Go Green in New York

NEW YORK STATE GREEN JOBS RESEARCH REPORT

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INTRODUCTION

Where are New York's green jobs and what training and skills do people need?

The New York State Department of Labor and its research partners -- the New York City Labor Market Information Service (NYCLMIS) at the CUNY Graduate Center, the Advanced Energy Research and Technology Center (AEC) at Stony Brook University and the Energy and Environmental Technical Applications Center (E2TAC) at the University at Albany – conducted a groundbreaking study to answer these questions. NYCLMIS and AEC present this report, which brings together the findings from all of the research activities of the New York State Green Jobs Study including assessments of employer demand for green workers, the supply education and training opportunities, and the adequacy of those opportunities to meet employer demand.

The New York State Green Jobs Study is an important component of the State's commitment to increasing energy efficiency and maximizing growth in its clean energy sector. This introduction:

- ✓ Situates the New York State Green Jobs Study in the context of a larger national effort to understand the emerging green economy and its workforce implications;
- ✓ Presents an overview of New York State and New York City energy efficiency and renewable policies;
- ✓ Provides an overview of the study, the research questions, and the methods; and
- ✓ Describes the organization of the full report.

Understanding the Green Economy and Its Workforce Implications

Today's green movement started decades ago, evolving from grass roots activism to protect the environment into a broad campaign to diversify energy sources, reduce carbon emissions and improve the quality of life. The movement has brought about real change in the way that many good and services are produced, distributed and consumed. In general, the term *green economy* refers to these changes within and across industries and *green jobs* describes occupations that have been the most affected by the emerging green economy.

For the last several years, many people have been excited about the prospects represented by green jobs and have wanted more concrete information to navigate this new and evolving field. Many non-profit organizations, industry groups, institutions of higher education, state and local governments and federal agencies have conducted some form of green jobs-related research. The main goals of this study and others across the country are to measure the number of green jobs over time and develop information on the industries, occupations, preparation required and geographic distribution of these jobs.

USDOL and O*NET. The U.S. Department of Labor's Employment and Training Administration, in its February 2009 research report entitled *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* defined green jobs by identifying 12 green economic sectors that cut across existing North American Industry Classification System (NAICS) categories and identifying which occupations are likely to undergo some transformation because of the emergence of a green economy.

The O*NET report, *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* defines green jobs as "occupations that are affected by green economic activity" in one of the following ways:

- ✓ Existing occupations that require a substantial set of additional skills;

- ✓ Existing occupations that are in greater demand; or
- ✓ Entirely new and emerging occupations.

Enhanced Skills. Green economy activities actually change the work and worker requirements of an existing occupation. The purpose of the occupation stays the same, but tasks, skills, knowledge, and requirements such as licensure have changed. Construction Manager and Maintenance and Repair Workers are examples of enhanced skills occupations. O*NET has identified 62 Enhanced Skills occupations.

Increased Demand. The green economy increases the demand for these existing occupations. The increased demand does not entail changes in the work or worker requirements for the occupation although the work context may change. Carpenters and Bus Drivers are examples of increased demand occupations. O*NET has identified 64 Increased Demand occupations.

New and Emerging. Green economy activities generate new occupations with unique work and worker requirements. Examples of this are Sustainability Specialist and Carbon Credit Trader. O*NET has identified 91 New and Emerging occupations.

State Governments. The first states to conduct large-scale research, including on-line, paper and telephone employer surveys, were California, Michigan, Oregon and Washington. These studies were completed in 2008 and 2009, with results available in 2009 and 2010. Although the definitions of "green" varied across the states, they all attempted to benchmark green employment and understand the nature and extent of industry involvement in green economic activity. New York State and Connecticut also engaged in green-jobs research in 2009, although their efforts were less comprehensive.

The experiences of these six states were analyzed by the Workforce Information Council (WIC), which shared the lessons learned and offered advice to future green jobs researchers in a 2009 report entitled, *Measurement and Analysis of Employment in the Green Economy.* The main lessons learned from the earlier research, especially employer surveys, and shared in the Workforce Information Council's final report were:

- ✓ Define green jobs in the context of green economic activity. As the WIC report states, "These categories are fundamental and crucial to measurement as they are used to define the scope of what is considered green, provide guidance to a survey respondent, and serve as one level of analysis of results." The WIC report suggested that, "*A green job is one in which the **work is essential** to products or services that improve energy efficiency, expand the use of renewable energy, or support environmental sustainability."*
- ✓ Specify economic activity categories. These could include such categories as: renewable energy and energy conservation, among others.
- ✓ Make sure the employer survey questionnaire provides clear examples of what would be considered green for each of the economic activities selected.
- ✓ Specify a time period in the survey questionnaire for which employment estimates are requested from employers.
- ✓ Be clear on the purpose of the study. Is it focused on the entire economy or segments that might be considered part of the greening economy? What are the key questions to be answered?

- ✓ Pay attention to survey planning, response modes, instrument design, testing the survey instrument, sampling, follow-up procedures, data capture and editing, estimation, and data analysis and dissemination. The report noted that surveying green jobs, by its very nature, introduces several issues that are different from traditional industry and occupational surveys, so the lessons from the existing state surveys are particularly instructive and useful to future studies.

Bureau of Labor Statistics. The Bureau of Labor Statistics (BLS), the federal government's key agency charged with providing statistical information on industries and occupations, also conducted an extensive research and consultation process to define green jobs. As BLS expressed its findings in March 2010, "The common thread through the studies and discussions is that green jobs are jobs related to preserving or restoring the environment. Several categories of green activity are nearly universally cited: producing energy from renewable sources, improving energy efficiency, preventing and cleaning up pollution and greenhouse gases, and conserving natural resources." At the same time, neither of the standard classification systems used in BLS data, the North American Industry Classification System (NAICS) and the Standard Occupational Classification (SOC), identifies a green or environmental grouping of industries or occupations.

The primary approach adopted by BLS in 2010 (and used in New York State's study) is to measure jobs associated with producing green goods and services. BLS identified 333 detailed (6-digit NAICS) industries from which it will draw a sample for its national survey. BLS is also testing the feasibility of a secondary approach, which would try to measure the number of jobs related to environmentally friendly production processes. This might include "green" practices such as the use of more energy efficient machines and lighting, waste reduction, pollution prevention, energy conservation and use of renewable energy sources for production needs. This aspect of green jobs research was not attempted in the current New York State study.

State and City Policy Context

Both New York State and City are recognized as leaders for their focus on renewable energy, energy efficiency and clean technology industries. The major forces promoting a green economy in New York State are described below.

New York State's Energy Goals. New York State's Energy Plan was first developed in 2002 and was revised in 2009. The plan includes many initiatives related to energy efficiency and renewable energy.

- ✓ *Energy Efficiency Portfolio Standard (EEPS)*. On June 23, 2008, the Public Service Commission (PSC) issued a decision establishing New York's EEPS. As part of a statewide program to reduce New Yorkers' electricity usage by 15 percent below previously forecasted levels by 2015, the PSC established interim targets and funding for energy efficiency program activity through the year 2011.

- ✓ *Renewable Portfolio Standard (RPS)*. This is a policy that seeks to increase the proportion of retail electricity consumption derived from renewable sources to 30 percent by 2015. The base level was 19.3 percent in 2004, primarily from hydropower resources, mostly connected to Niagara Falls.

- ✓ *45 x 15*. In his State of the State address in 2009, former Governor David Patterson combined the EEPS and RPS goals into a new goal of "45 x 15" meaning that 45 percent of the state's energy would be from the combination of renewable energy sources and energy efficiency improvements by 2015. He also issued an executive order (Number 24) to reduce greenhouse gas emissions by 80 percent below 1990 levels by 2050 and required the state to draft a climate action plan.

- ✓ *Green Jobs/Green New York.* New York State enacted the ***Green Jobs/Green New York*** law in 2009, which earmarked $112 million in revenue from carbon credits sold through the Regional Greenhouse Gas Initiative (RGGI) to establish a revolving loan fund to support home energy audits and energy-efficiency building retrofits.

- ✓ *On-bill recovery.* In June 2011, Governor Andrew Cuomo and the state legislature enacted a law that allows for "on-bill recovery," which is designed to help consumers who cannot afford to have their homes or businesses retrofitted to reduce energy consumption. Utilities would lend those customers the money for the work, and their savings on future bills would be used to repay the loans. The limits are $13,000 for residences and $26,000 for businesses, at interest rates to be decided.

New York State Energy Research and Development Authority (NYSERDA). NYSERDA*, a public benefit corporation, has a unique role in New York State. Its aim is to help New York meet its energy goals: reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment.* The organization supports energy efficiency and renewable energy projects, research and development, education, and low-income energy assistance. NYSERDA programs are funded through multiple sources, among which are the Systems Benefit Charge (SBC), the Energy Efficiency Portfolio Standard (EEPS), the Renewable Portfolio Standard (RPS), and the Regional Greenhouse Gas Initiative (RGGI). The revenue basis for NYSERDA has allowed it to play a significant role in the growth of clean energy and in clean energy business development. NYSERDA also funds a number of Workforce Development initiatives that support green career preparation in New York State.

Green Buildings Policy. Since 2000, the state has offered a green building tax credit for energy efficiency and other building improvements. Guidelines under the 2001 Executive Order Number 111, also known as the Green and Clean State Buildings and Vehicles Order, call for a 35 percent reduction in energy consumption from 1990 in state government buildings, 20 percent renewable energy for electricity consumption for state buildings; and procurement of energy-efficient products.

The Dormitory Authority of the State of New York, which provides financing and construction services to public and private universities, not-for-profit healthcare facilities and other institutions which serve the public good released a sustainability policy in 2008 that promotes and supports sustainable design approaches and construction practices in every project, *regardless of size or complexity*. As of January 1, 2008, all projects that are *new construction, addition, or significant renovation* must include a goal of LEED Silver and are required to be fully submitted to the US Green Building Council (USGBC) for a rating review.

New York City. Similar legislation enacted in New York City requires that many New York City-funded construction projects achieve certification under LEED or LEED-equivalent green building standards, and meet energy and water efficiency targets. Further, in December of 2009, New York City enacted the *Greener, Greater Buildings Plan*, which includes four pieces of legislation that require, for 24,000 of the city's largest buildings (50,000 square feet and larger), energy audits and retro-commissioning, benchmarking of energy and water use, and lighting upgrades and sub-metering to measure the flow of electricity in tenant spaces.

New York State's Green Jobs Study

While it is clear that the economy is "greening" to some extent, much remains to be known about the shape of the green economy, and especially about the prospects for green jobs. We still need to know just how many green jobs there are and which types of firms and industries employ people in these jobs.

We need to know what skills and credentials employers are looking for and how people acquire the skills they need to perform green jobs. Currently, it is difficult to precisely estimate green employment activity because official government occupational and industry classification systems do not differentiate between green and traditional jobs.

In November 2009, the U.S. Department of Labor-Employment and Training Administration awarded $48.8 million in American Recovery and Reinvestment Act (ARRA) funds in the form of 24 individual state grants and six grants to consortia of states to "collect, analyze, and disseminate labor market information, and to enhance the labor exchange infrastructure for careers within the energy efficiency and renewable energy industries." The New York State Department of Labor received a $1.1 million individual state grant and is also part of two multi-state consortia.

Major research questions on employer demand. Policy makers, researchers and the public have a variety of questions about the green labor market in New York State. To find answers, the research partners sought out companies within selected industries that produce goods or services that increase energy efficiency or generate renewable energy. The key questions for employer research fell into four categories, as shown in the **New York State Green Jobs Study Research Questions** textbox below.

Industry selection. In order to align with the New York State Energy Plan's priority areas of renewable energy and energy efficiency, the research partners identified industries within NAICS categories that were likely to have employment related to these areas. Six primary industry clusters were selected and the appropriate 6-digit NAICS codes were identified. The industry clusters selected were:

- ✓ *Construction*, predominantly related to residential, industrial, commercial and power system construction.
- ✓ *Professional Services,* which includes architectural and engineering services, computer systems design, and research and development, all of which are especially important to New York City's economy. Because "Offices of Lawyers" comprise nearly half of the employment in Professional Services, these were surveyed and otherwise researched as a separate group.
- ✓ *Building Services*, which includes portions of the real estate and services to buildings industries. This cluster was selected because of its heavy concentration in New York City and its alignment with energy efficiency activity.
- ✓ *Component manufacturing*, which includes segments related to energy efficiency components and renewable energy only. This selection was made because of the state's efforts to refocus its manufacturing sector towards the production of advanced energy technologies and their component parts.
- ✓ *Electric Power Generation, Transmission, and Distribution*, which, although small in terms of employment, is integral to energy policy.
- ✓ *Financial Services*, which was defined to include investment banking and securities brokerage but excluded commercial banking. This industry was selected because of its importance, especially in New York City, and to better understand private financing for energy efficiency and renewable energy.

New York State Green Jobs Study Research Questions
Industry information
What are examples of green business activities that employers are engaged in?
How many firms in New York have green jobs?
How many workers in New York have green jobs?
Do firms expect their green employment to change in the next year?
What are the geographic concentrations of green industries and employment?
What factors influence firm and industry decisions about investment and growth? How does this affect employer decisions to increase or reduce the workforce?
What are the characteristics of the current workforce in selected industries?
To what extent is the green workforce existing workers vs. the need to hire new employees with green skills or credentials?
Occupational Information
Which occupations are green, or greening?
What are the skill and knowledge requirements for key occupations?
What are the employer's education and experience preferences for key occupations?
What green credentials are employers looking for?
Which green jobs are in demand?
Recruitment/Retention Information
Are employers having difficulty finding qualified applicants for key green occupations?
What are the major sources of recruitment for new employees?
What recruitment methods are effective and why?
What are employers' recruitment/hiring/retention challenges, if any?
Education and Training Information
Is additional education or training needed for occupations employers identify as green?
What are the methods and sources of education and training for green skills?
What advice would employers give to education and training providers on preparing the green

Objectives of research on the supply of training and education programs. As a companion to research on the demand for green employment, the researchers assessed the capacity of education and training providers to serve employers' needs in high growth, enhanced skills, and new and emerging occupations in the relevant sectors of the green economy. The methodology for identifying and presenting the programs and offerings that prepare individuals for jobs in the green economy is discussed in the Research Methods section below.

Research Methods: Employer Demand

Employer Survey. A key element of this green jobs research project was a large-scale survey of employers in the selected industry clusters.

Instrument development. A decision was made early on to offer the employer survey in both online and paper formats. The development of the actual survey took several months and was a collaborative effort among the research partners, with the New York State Department of Labor as the lead partner in this effort. The seven industry clusters -- Building Services; Component Manufacturing, Construction Trades;

Professional Services (ex. Legal Services); Electric Power Generation, Transmission, Distribution; Financial Services; and Legal Services -- were defined by 6-digit North American Industry Classification System (NAICS) codes. (See appendix for a list of 6-digist NAICS codes included in selected industry clusters and copies of the surveys developed for each industry cluster.)

Each employer survey was tailored to the particular industry and was a different color, in both the paper and online versions. Surveys targeted to larger firms included a pre-populated listing of the most common occupations in the industry, based on New York State's staffing patterns matrix, for employers to respond to. Surveys sent to small firms were designed so that the occupations could be filled in by the employer.

In designing the employer survey, the research team used its own experience with other labor market surveys, especially the Occupational Employment Survey (OES), and also followed the advice offered by the Workforce Information Council in its October 2009 report, *Measurement and Analysis of Employment in the Green Economy,* which looked at the experiences of four states that had already conducted green jobs employer surveys. Specifically:

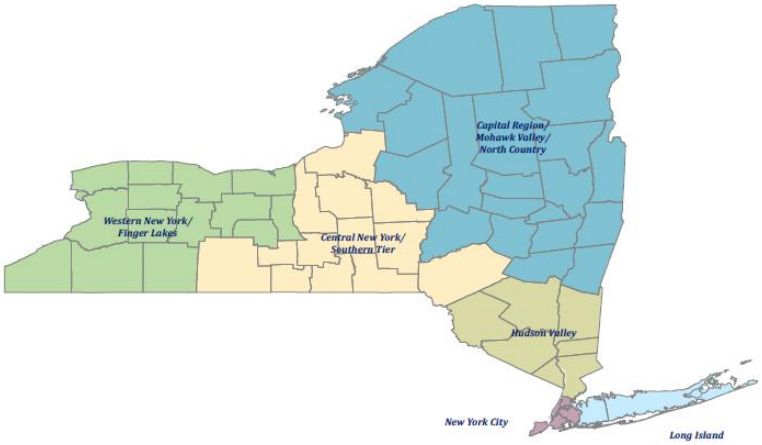
- ✓ The team established a working definition of a green job that was tied to the green economic activity categories of energy efficiency and renewable energy.
- ✓ Each questionnaire provided clear examples of what would be considered green.
- ✓ The examples were tailored to each industry cluster.
- ✓ The purpose of the study was clear as were the key questions to be answered.

Example: Definition of green used in the New York State Green Jobs Study Construction Industry Cluster Survey
What is a "Green" economic activity?
"Green" economic activity involves goods or services that increase **energy efficiency** or produce **renewable energy**
This includes:
- *Design and/or construction of new buildings or residences*
- *Energy Retrofitting, improving energy and resource efficiency in existing homes*
- *Retro-commissioning of existing buildings or improving energy efficiency in buildings or facilities*
- *Renewable Energy (solar, wind, biomass, geothermal, hydro) generation, system installation or storage*

Sampling. The sample was drawn from the fourth quarter of 2010 Quarterly Census of Employment and Wages (QCEW) Program. A stratified random sample of approximately 20,000 employers was selected in order to allow for analysis by three areas of interest: geographic region, industry cluster, and firm size.

The state was partitioned into 6 geographic regions: Capital District/North Country/Mohawk Valley, Central New York/Southern Tier, Hudson Valley, Long Island, New York City, and Western New York/Finger Lakes. (See map below.) Employers were grouped into three size classes by employment: small (1-25 employees), medium (26-100) and large (more than 100). All employers in the large and medium size classes and approximately 20 percent of employers in the small size class were sampled.

New York State Green Jobs Survey Regions



Address refinement. Prior to the actual conduct of the employer survey, the New York State Department of Labor spent considerable staff time refining contacts and addresses. Of the total of nearly 20,000 targeted firms, address refinement was done on 16,000. It is believed that this process contributed to the relatively high response rate ultimately achieved.

Administration. Data was collected through various modes (mail, online, phone, email and fax) from December 2010 through February 2011. Employers were mailed letters that requested participation in an online version of the survey accessible by a unique survey ID code. In order to increase response rates, two subsequent mailings were sent, each with a print version of the survey enclosed. After all of the mailings were sent, critical non-respondents were identified and called for phone interviews. There additional efforts results in a robust 42 percent response rate, with more than 8,000 firms participating statewide. The research partners were assisted by a professional survey research firm which programmed the online version of the survey and conducted much of the telephone follow-up to non-respondents.

Response rates were high enough in four industry clusters to provide reliable findings. The four industries were: Construction, Building Services, Professional Services (ex. Legal) and Manufacturing. For these industry clusters, the NYSDOL prepared a series of statewide and regional research findings and the NYCLMIS prepared the statewide industry profiles found within this report.

Data Limitations. As with many surveys, there were limitations. The New York State economy is very large, and it was necessary to focus research efforts in the most efficient manner. The New York State Green Jobs Survey focused only on activities involving energy efficiency and generating renewable energy, plus building services. It deliberately excluded other green practices, such as pollution abatement or recycling, leaving those activities for later research. Only companies in industries thought to have higher incidences of green economic activity, as defined above, were selected for the survey. Companies in other industries were not surveyed or assessed at this time.

While the survey sample was stratified by three different areas of interest (geographic region, industry cluster, and firm size), analysis was only conducted on groupings where the response was robust enough. Firms self-identified as green; the criteria for self identification was that one or more of their employee(s) be 'primarily engaged' in green economic activities as defined above.

There was a delay between when the survey sample was drawn (3rd Qtr of 2009) and when the survey was administered (4th Qtr of 2010). Estimates were subsequently benchmarked to the 2010 employment records, but some information may have been lost. Seasonal or cyclical change was not captured in the survey – the estimates reflect a 'snapshot' of the green economy at a particular time. Research was conducted during a recessionary period, which likely influenced results.

Focus Groups and Expert Interviews. In addition to the large-scale employer survey, researchers conducted 18 focus groups with employers in the selected industries. There were 9 focus groups conducted by the NYCLMIS CUNY Graduate Center in New York City, 5 conducted by AEC Stony Brook University on Long Island, and 4 conducted by E2TAC University of Albany in upstate New York. All of the groups conducted by NYCLMIS, and most of those conducted by the other partners were co-sponsored by industry organizations or others playing an instrumental role in the green economy, such as NYSERDA, the NYC Building Trades Employers' Association, and the CUNY Center for Sustainable Energy and the Building Performance Lab at Baruch College. A full list of focus group dates, co-hosts, and target industries can be found in the appendix . In addition, the research partners interviewed approximately 50 industry experts to gather additional information about the selected industry clusters.

Instrument development. The NYCLMIS took the lead on developing the protocols for both the focus groups and expert interviews and trained the research partners to conduct focus groups and utilize the protocols. The CUNY Graduate Center required approval of the Institutional Review Board (IRB) for the conduct of the focus groups and interviews in New York City. Stony Brook University and the University at Albany received IRB waivers from their institutions. The focus group and expert interview protocols can be found in the appendix.

The focus group and interview protocols included questions that addressed all four key research areas connected with employer demand: green industry background information, occupational information, recruitment/retention information, and education and training information, and were designed to find out qualitative information, complementing rather than duplicating the statistical information secured through the employer survey. The focus groups conducted by the NYCLMIS and Stony Brook University were recorded (with written consent from the participants) and were transcribed to facilitate analysis.

Respondent selection. One-on-one semi-structured interviews were conducted with "peak" experts in their respective fields identified through informal conversations with co-hosts and through a journalistic literature review. The intent of the focus groups was to learn about the industries and hiring and training needs from employers at the leading edge of green economic activity. As such, the research partners derived participant lists from two sources. Primarily, respondent firms and names were identified by the focus group co-hosts; additional names were culled from survey respondents who a) indicated that they had at least one green employee; and b) gave express permission to the research partners to be contacted for additional questions about their green businesses.

Analysis. As the lead partner in preparing industry profiles, the NYCLMIS read and analyzed all focus group and expert interview transcripts and notes to provide additional depth and nuance to the four industry cluster profiles that were prepared.

Research Methods: Education and Training

Aside from identifying employer demand for green skills in the workplace, the other major purpose of the research was to assess the capacity of those who prepare the workforce to serve employers' needs in high growth, enhanced skills, and new and emerging occupations in the relevant sectors.

The research on education and training included in this study encompassed degree and non-degree programs, in-person and virtual methods of instruction, offerings of community colleges and universities as well as other types of training providers, such as community-based organizations, BOCES and Career & Technical Education high schools, labor unions, credentialing organizations and private entities. The goal was to identify as many programs and offerings as possible in New York State that prepare individuals for green jobs.

The method of collection was designed to allow comparison by industry and job family with the information collected about employer demand. It was also designed to organize information that could be presented in user-friendly formats for use by:

- ✓ Job seekers
- ✓ Students
- ✓ Workforce members who want to enhance their skills or retrain
- ✓ Staff who assist any of the above groups with job search or career development
- ✓ Employers looking to find skilled or trained individuals
- ✓ Policy-makers and researchers

The research used slightly different approaches for non-degree programs and degree programs; also, methods of data collection were different for New York City vs. other parts of New York State.

The New York City Labor Market Information Service (NYCLMIS) at the City University of New York (CUNY) Graduate Center collected information on non-degree programs in New York City offered by any type of provider and degree programs offered by the 23 campuses in the CUNY system. The Advanced Energy Research and Technology Center (AEC) at Stony Brook University collected information on non-degree programs in New York State outside of New York City and on degree-granting programs throughout the state.

Non-degree program data collection**.** In New York City the local research partner collected data on a range of characteristics listed in the **Data items collected by NYCLMIS for Non-credit Education/Training Programs** text box below. These data were collected through the following methods:

- ✓ A Survey Monkey data collection instrument (see appendix) to collect information for all non-degree programs that could be identified.
- ✓ NYCLMIS worked through knowledgeable intermediaries to communicate with non-degree training and education program providers to encourage their participation in completing the Survey Monkey data collection instrument. These intermediaries included:
  - The Director of Green Education and Training Programs at the CUNY Central Office, who communicated with all campuses in the CUNY system and compiled a list of all "green" CUNY-offered adult and continuing education programs and degree programs.
  - The New York State Energy Research and Development Authority (NYSERDA), which communicated with all of its training grantees and contractors in New York State.
  - The New York City Employment & Training Coalition (NYCETC), a membership organization of 200 education and training providers, including non-profit and community organizations, private proprietary schools, labor unions and others, which listed the Survey Monkey instrument in its weekly newsletter for several months and followed up by phone with all members known to offer "green" education and training programs. NYCETC members included two U.S. Department of Labor "Pathways out of Poverty" grantee programs -- the Consortium for Worker Education (CWE) and STRIVE.

  - The New York City Department of Education's Career and Technical Education Division, which communicated with all of its career and technical education high schools and programs.

- ✓ NYCLMIS directly contacted a number of training programs operated by labor organizations or joint apprenticeship committees to gather information on their "green" training activities. These included SEIU Local 32BJ's Thomas Shortman Training Fund, the International Union of Operating Engineers Local 94, and several construction trade unions including the New York City District Council of Carpenters, the International Brotherhood of Electrical Workers (IBEW) Local 3, the Laborers' Mason Tenders Training Fund, the Painters and Allied Trades, and the Plumbers' Local 1.
- ✓ NYCLMIS compiled information on programs operated or authorized by credentialing organizations such as the Building Performance Institute (BPI), U.S. Green Building Council (LEED), and the North American Board of Certified Energy Practitioners (NABCEP).

Data items collected by NYCLMIS and AEC for "Green" Education/Training Programs

- ✓ *Name and contact information for each education/training provider*
- ✓ *Type of provider*
- ✓ *Name and contact information for each "green" education/training program*
- ✓ *Location(s) of education/training*
- ✓ *Major funding source(s)*
- ✓ *Industry sector(s) for which education/training program prepares students*
- ✓ *Job family (ies) for which education/training program prepares students*
- ✓ *Training type and length*
- ✓ *Estimated tuition/fee per student*
- ✓ *Credentials for which students are prepared*
- ✓ *Program entry requirements*
- ✓ *Target groups, if any*
- ✓ *Capacity and measures of effectiveness*
- ✓ *Inquiry about entrepreneurial programs, clean tech internships, career centers and assistance for displaced workers (AEC only)*
- ✓ *Degree type (for credit based/degree programs only) (AEC only)*

A relational database was created containing the fields in the Survey Monkey instrument. It should be noted that some of the items, such as capacity and measures of effectiveness, were requested but not required of education and training providers.

For *New York State, outside of New York City*, the AEC at Stony Brook University searched New York State's Eligible Training Provider database for all green-related training and education programs and performed a wider web search that included identification of education and training providers for green-related degree and non-degree, credit and non-credit programs offered throughout the State. This

information was organized into the same categories as those used by the NYCLMIS. In addition, AEC collected information about entrepreneurial programs, clean tech internships, career centers and assistance for displaced workers, especially as it applied to degree granting institutions.

To validate the information collected through the web search, the AEC developed a survey tool with a public portal, which was sent to the contact people for all green programs identified. The survey tool allowed for the addition of new programs as well as validation or updating of known programs (see appendix).

Data Collection on Degree and Certificate Programs. For degree programs, the research had two primary goals:

- ✓ Identify the ***general types of certificate and degree programs*** in the state that prepare individuals for the green jobs identified in the employer survey.
- ✓ Identify ***new and specialized green-related degree programs*** in the state, including those in "green" industries not covered in the employer demand analysis, such as waste removal and remediation, transportation, environmental science and others.

As part of the research on employer demand, the study identified the key occupations employers identify as "green." Wherever possible, these occupations were given codes using the O*NET-SOC categorization, the nation's primary source of occupational information, which is updated and maintained by the U.S. Department of Labor.

To identify the *general types of certificate and degree programs* related to the key "green" occupations, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, technical and vocational institutions related to green occupations. The main data source for this examination was the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS). The IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. Among the data collected through IPEDS is information on the number of certificates and degrees conferred, by instructional area. The instructional areas are organized according to the Classification of Instructional Programs (CIP).

The generally accepted system for organizing occupations is the Standard Occupation Classification (SOC) system. This system organizes occupations into 23 major groups (job families), within which there are 461 broad occupational categories. The research partners employed the U.S. Departments of Education and Labor's "CIP–SOC Crosswalk" to link instructional programs to occupations. Using this crosswalk, it is possible for an instructional program to be associated with multiple occupations; an occupation may also be associated with multiple instructional programs. In the research that follows, we include both types of multiple associations.

Finally, it should be noted that IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with a particular occupation. Some people in an occupation may work in the green economy and some may not. For example, an architecture degree may be used in green or non-green design.

To identify *new and specialized green-related degree programs* in the state, the AEC at Stony Brook University performed a broad Internet search for green-related degree-granting and certificate programs. These programs could be included in the IPEDS database or might be very new programs, or of a type for which no IPEDS code yet exists. The providers of these specialized green-related programs were asked to validate or update the information collected through the web search, and to add any new

green-related programs being offered. The NYCLMIS also searched for CUNY degree-granting programs in specific "green" fields that might not have been identified through the IPEDS analysis.

In addition to the data collection methods already mentioned, both the NYCLMIS at the CUNY Graduate Center and the AEC at Stony Brook University conducted selected focus groups and interviews with education and training providers to gather qualitative information. NYCLMIS, in partnership with the New York City Employment & Training Coalition, conducted a focus group of 20 non-credit green training providers in New York City. AEC conducted a focus group of labor union training providers, primarily in the construction trades, and also conducted expert interviews with BOCES and Green Training Academies.

The Education and Training Research Findings section of this report presents the results of the research on "green" education and training programs organized by occupational family.

Organization of this Report

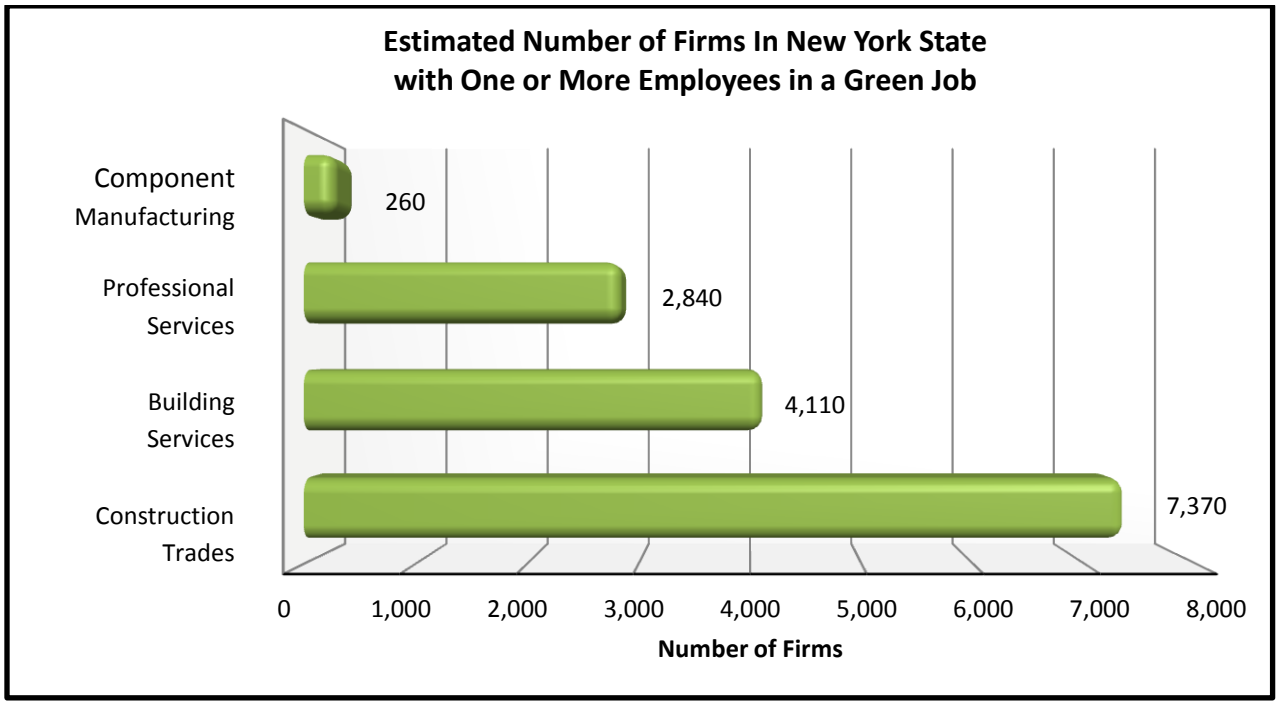
The first section of this report includes two overarching statewide findings about green jobs from the New York State Green Jobs Study.

This is followed by four employer demand-side industry cluster profiles, and then by the research findings about education and training opportunities organized into the six occupational families that most closely align with the green economic activity in renewable energy and energy efficiency and a seventh category for green occupations that do not fit neatly into the first six occupational families. The report concludes with an assessment of the match between the supply of education and training and current employer demand in the four industry clusters.

Chapter 2: TWO OVERARCHING FINDINGS ABOUT GREEN JOBS IN NEW YORK

This summary profiles statewide information drawn from the employer survey conducted from December 2010 through February 2011 on the number of firms in New York that have green jobs and the number of workers with green jobs in the four industry clusters for which the survey generated valid information. This information sets the stage for the more detailed industry profiles that follow.

Statewide Finding 1: How Many Firms in New York Have Employees with Green Jobs?



Firms Statewide	Component Manufacturing	Professional Services[1]	Building Services	Construction Trades
Number with Green Jobs	260	2,840	4,110	7,370
Total Number in Cluster	1,660	10,300	25,540	26,980
Percent with Green Employees[2]	**15%**	**28%**	**16%**	**27%**

In these four industry clusters, there are over 14,500 firms that have one or more employees primarily engaged in producing goods or delivering services that increase energy efficiency or generate renewable energy.

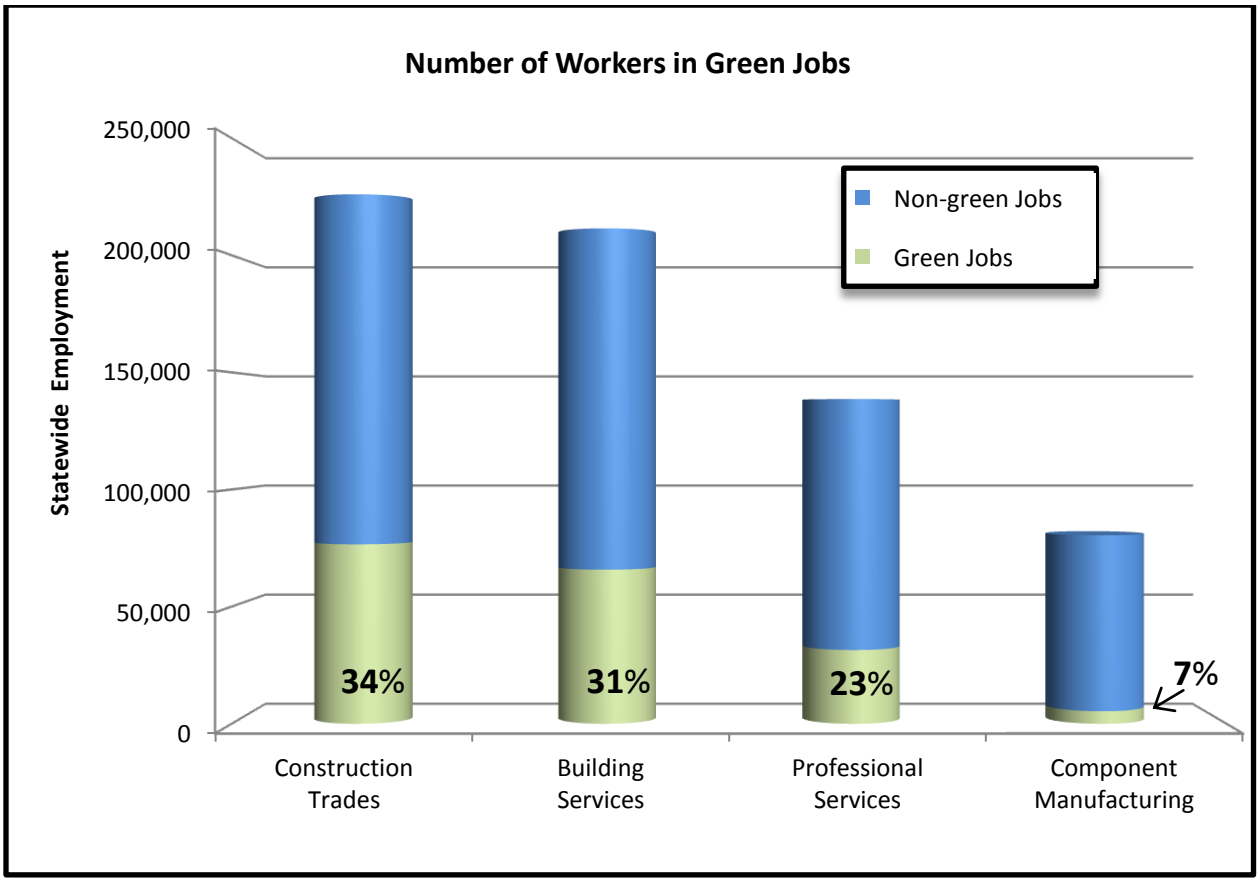
The smallest industry cluster listed above – Component Manufacturing – has the fewest firms with green employment whereas the largest – Construction Trades – has the most. Building Services is the second largest cluster and has the second highest number of firms with green employment, while Professional Services ranks third on both measures.

A different picture emerges when clusters are ranked by share of firms with green employment. Professional Services tops the list with 28% of its firms having green employment. Construction Trades

[1] The Professional Services industry cluster excludes legal services.
[2] Percentages are based on unrounded figures.

is a close second with 27%, Building Services is third at 16% and Component Manufacturing is fourth at 15%.

Statewide Finding 2: How Many Workers in New York State Have Green Jobs?



Statewide	Construction Trades	Building Services	Professional Services	Component Manufacturing
Green Employment	76,600	65,770	31,490	5,360
Cluster Employment	226,020	211,460	138,600	80,450

Statewide, in these four clusters nearly 180,000 workers are employed in green jobs.

Among selected industry clusters, Construction Trades not only has the greatest number of workers (226,020), but also the greatest number of workers with green jobs (76,600). It also has the highest incidence of green employment (34%).

Workers engaged in green economic activity make up 31 % (65,770) of Building Services' total employment of 211,460 and 23% (31,490) of Professional Services' total employment of 138,600.

Component Manufacturing is the smallest of the four clusters, with only 80,450 workers. This cluster also has the fewest workers employed in green jobs (5,360) and has the lowest incidence of green employment (7%).

Detailed Industry Profiles

The chapters that follow provide detailed industry and regional information on four industry clusters for which sufficient and valid information was collected: Construction; Professional Services; Building Services; and Component Manufacturing.

Each industry cluster profile includes information on:

- The industry cluster in general, including:
  - ✓ Background and historical information
  - ✓ Distribution of firms and employment by region of New York State
  - ✓ Concentration of employment by region of New York State
  - ✓ Size distribution of firms
  - ✓ Industry market drivers
  - ✓ Recent developments
  - ✓ Wages, employment projections and demographic trend of the workforce
- Green economic activity in the industry cluster, including:
  - ✓ Definition of green economic activity for that cluster
  - ✓ Examples of green economic activity
  - ✓ How green firms differ from non-green firms
  - ✓ Green market drivers
  - ✓ Regulatory and statutory drivers of demand
- Green employment
  - ✓ Firms and employment: employer survey results
  - ✓ Composition of the green workforce and credentials preferred by employers
  - ✓ Key occupations
  - ✓ Career pathways
  - ✓ Recruitment, retention and turnover
  - ✓ Education and training
  - ✓ Employer recommendations for education and training providers

Together, these profiles provide detailed, current and comprehensive information on some of the key green industry clusters in New York State.

CHAPTER 3: EMPLOYER DEMAND IN THE CONSTRUCTION INDUSTRY CLUSTER

Highlights

- *The Construction industry cluster has the largest number of "green" jobs of the industries studied. There are 76,600 "green" employees, or 34 percent of total construction industry cluster employment in New York State. More than a quarter of firms report having "green" employees.*
- *The proportion of green employment is highest in the Western NY/Finger Lakes Region (52%) and Capital Region/Mohawk Valley/North Country Region (50%). Because of its sheer size, New York City has the largest number of "green" employees, although they make up just 27 percent of its construction workforce.*
- *New York's largest commercial construction firms say that energy efficient and sustainably-designed construction is firmly in place, and not a trend waiting to happen at some time in the future. It is being driven both by customer preference and leadership from the public sector, both regulatory and role modeling. Virtually all new major publicly-financed construction projects are being built "green."*
- *The top "green" occupations, which account for more than half of the state's "green" jobs in Construction are: Heating and Air Conditioning Mechanics and Installers; Carpenters; Plumbers, Pipefitters & Steamfitters; Electricians; and Supervisors of Construction Workers.*
- *The "green" occupation for which employers have had the most difficulty finding qualified employees is Plumber and Pipefitter Helpers (32 percent of firms), followed by Heating and Air Conditioning Mechanics and Installers (30 percent).*
- *More than three out of four employers with "green" jobs require enhanced skills for these jobs, which are mostly learned through on-the-job training, in-house training, suppliers, and professional or trade organizations.*
- *Employers want education and training institutions to offer training that emphasizes quality over speed. They also want more "hands-on" practical experience and more work-study, internship and co-op programs.*
- *Employers say that schools should emphasize teamwork and interpersonal skills and help students to be adaptable to meet employer and industry needs.*
- *Companies want schools to expose students to more interdisciplinary work, for example, between technical training and business/sales skills.*
- *Although demand for green construction has suffered during the recession along with the sector in general, the construction industry has continued to move toward green building even as the recession has persisted.*

Overview of the Industry Cluster

The construction industry builds New York: the firms in this sector build housing, commercial and industrial buildings, hospitals, schools and infrastructure. The construction industry includes firms that engage in constructing, repairing and renovating buildings and engineering works, and in subdividing and developing land. Establishments may operate on their own or under contract to other establishments or property owners. They produce new construction and undertake repairs and renovations to existing structures.

Many who work in the construction industry are very hands-on and take pride in their accomplishments. As one said in a focus group conducted for this research, "Look what you have. I think we all get excited when we walk through the city and everybody points to a structure and you say 'I built that'." Another said, "It's definitely a self-satisfaction. I think that's probably the biggest driver in this business – that you're really part of something."

Human capital and raw materials are the main inputs in construction. While for many the image of "construction" is the worker in a hard hat, it is important to distinguish construction as an industry or sector from construction as an occupation. Construction firms employ and contract with workers in a wide range of jobs: these include not only skilled and unskilled construction occupations such as plumbers, carpenters and laborers, but also professional service and white collar jobs, like architects and engineers, legal, clerical, and managerial occupations.

Within the construction sector, two important subdivisions should be made. Firms specializing in large-scale commercial and residential development, infrastructure, and public buildings tend to be somewhat different than the smaller residential construction firms. The large-scale commercial, residential and infrastructure segments are dominated by unionized labor (particularly in commercial buildings and public works), and are made up of somewhat larger firms. The smaller residential segment, which is dominated by very small firms of 4 to 10 employees, is largely non-union.

The construction sector is comprised of general contractors and trade-specific contractors. General contractors, who make up only a small portion of all construction firms, organize the overall building process. They work with engineers and architects as well as coordinating all of the various trade contractors that will be involved in a project. The trade contractors specialize in particular functions such as electrical, plumbing, roofing, heating/cooling, or drywall and insulation. It is the trade contractors that are the primary source of employment in construction trades occupations.

Green services in this sector are focused in activities related to constructing new green buildings, retrofitting residential and commercial buildings, and adding green technology to infrastructure. The residential sector includes many different types of contractors, including some that specialize in installation of renewable energy systems and others that perform weatherization of residences.

Distribution of Firms and Employment. In the fourth Quarter of 2010, there were 35,104 firms in the construction industry in New York State, employing 216,030 people. Almost 30 percent of the firms (and 38 percent of the state's employment) are located in New York City. Another 24 percent of the firms and 19 percent of the State's employment are located on Long Island.

DISTRIBUTION OF CONSTRUCTION FIRMS AND EMPLOYMENT BY REGION

	Firms		Employment	
	Number	Share of NYS	Number	Share of NYS
New York State	35,104	100%	216,030	100%
Capital/Mohawk/North Country	3,563	10%	20,569	10%
Central/Southern Tier	2,252	6%	14,571	7%
Hudson	5,902	17%	25,846	12%
Long Island	8,270	24%	41,118	19%
New York City	10,109	29%	82,221	38%
Western/Finger Lakes	3,846	11%	26,429	12%
Region Not Classified*	1,163	3%	5,276	2%

SOURCE | 4Q 2010, QCEW

**Note: Refers to firms that do not provide a specific location in New York State.*

Construction represents 3.1 percent of all employment statewide. As shown in the chart below, the share of area employment is highest on Long Island (4.1%) and lowest in New York City (2.7%). Nonetheless, several of the country's largest construction firms are headquartered in New York City, and these companies work on projects around the state and around the country.

CONCENTRATION OF CONSTRUCTION EMPLOYMENT BY REGION

New York State Region	% of Total Employment
Capital/Mohawk/North	3.3%
Central/Southern Tier	3.0%
Hudson Valley	3.7%
Long Island	4.1%
New York City	2.7%
Western/Finger Lakes	2.8%

SOURCE | 4Q 2010, QCEW

Of the 35,104 firms in the construction industry in New York State, roughly three-quarters were small businesses with five employees or less although these small firms employed only 19 percent of those working in the industry. On the other end, the largest 6 percent of employers have more than half (52%) of all employees in the industry.

SIZE DISTRIBUTION OF CONSTRUCTION FIRMS IN NEW YORK STATE

			Percent of Total	
Size Class	Firms	Employment	Firms	Employment
Total	35,077	219,929	100%	100%
0 to 5	26,854	42,645	77%	19%
6 to 10	3,745	28,333	11%	13%
11 to 20	2,370	34,046	7%	16%
21 to 50	1,478	46,036	4%	21%
51 to 100	428	29,193	1%	13%
101 to 250	165	24,395	1%	11%
251 or more	37	15,281	<1%	7%

SOURCE | 4Q 2010, QCEW.

Residential remodelers made up the largest group of companies, with 8,014 separate firms, or 23 percent of the total. However, since residential construction firms tend to be very small, these firms employed only 23,128 people, or just over 10 percent of total employees. The largest firm types by employment were electrical contractors (47,255 employees), plumbing, heating, and air-conditioning contractors (47,164 employees), and commercial/institutional building contractors (30,937 employees).

Industry Market Drivers. Demand in the construction industry is partly seasonal, highly cyclical and very sensitive to the business cycle, although different segments of the industry respond to the business cycle in different ways. Demand for residential construction is usually closely tied to the overall health of the economy, because it responds to the level of employment, which affects demand, and interest rates, which affect access to credit. Commercial construction responds to these same factors, but it is much less volatile, with large firms maintaining better access to credit. Historically, residential construction is a leading indicator of economic recoveries, while commercial construction lags the overall economy.

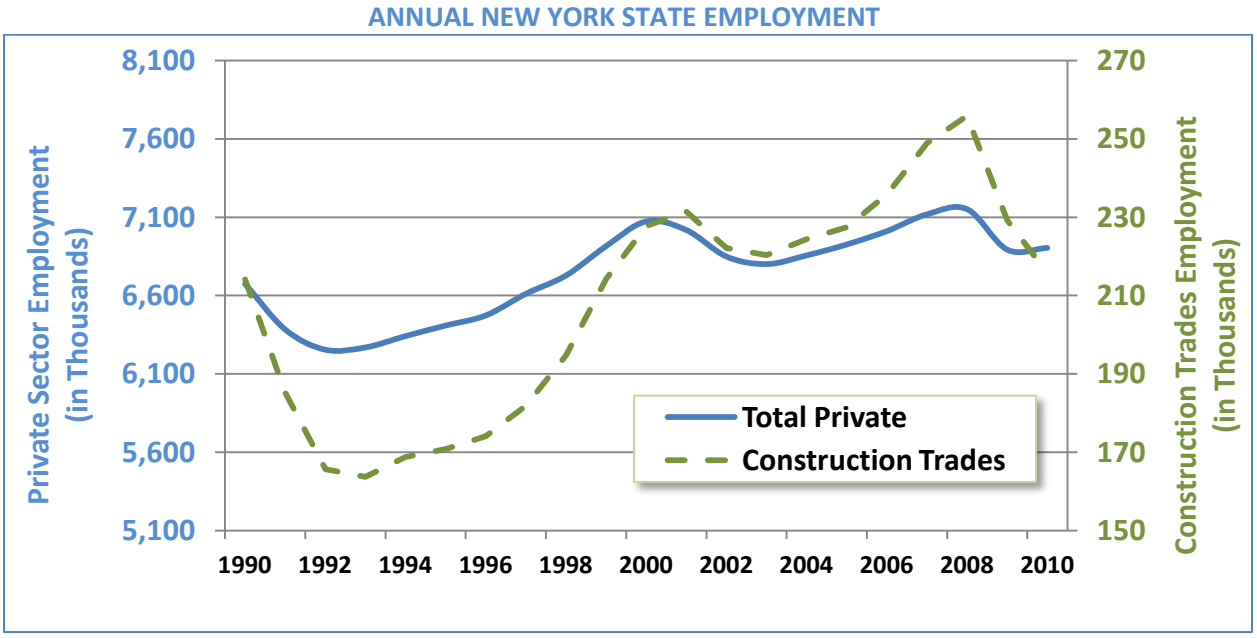
The aftermath of the recent (2008-2009) burst of the housing bubble has been something of an exception, however, as a large oversupply of existing residential housing and commercial office space has continued to depress demand for new construction even after the resumption of economic growth.

Thus, an unusually large share of current demand comes from infrastructure, school construction, and other publicly funded projects. Although public construction projects are usually less responsive to the business cycle, they are not immune, and state and local budgets suffered during this downturn.

Public sector investment accounted for 53 percent of the value of *all* construction starts in New York City in 2010-2011 (New York Building Congress). The biggest driver of construction starts is the New York City School Construction Authority, followed by the health and hospitals sector. Colleges and universities have also played a big part, including the City University of New York, the State University of New York, Columbia University, New York University, and Fordham.[3]

Recent Developments. As demonstrated in the chart below, statewide employment in this sector has been relatively flat (compared to the whole economy) since 1990.

The recent peak employment occurred in 2008, followed by significant declines in this sector's employment during the most recent recession. The housing bubble that peaked in 2006, and its subsequent collapse, has had a profound impact on the construction industry. Prior to the boom of 2002-2006, construction in New York City had been at a modest level for many years. In the 2000s, a huge volume of new commercial and residential construction projects were undertaken, swelling the ranks of construction employees.

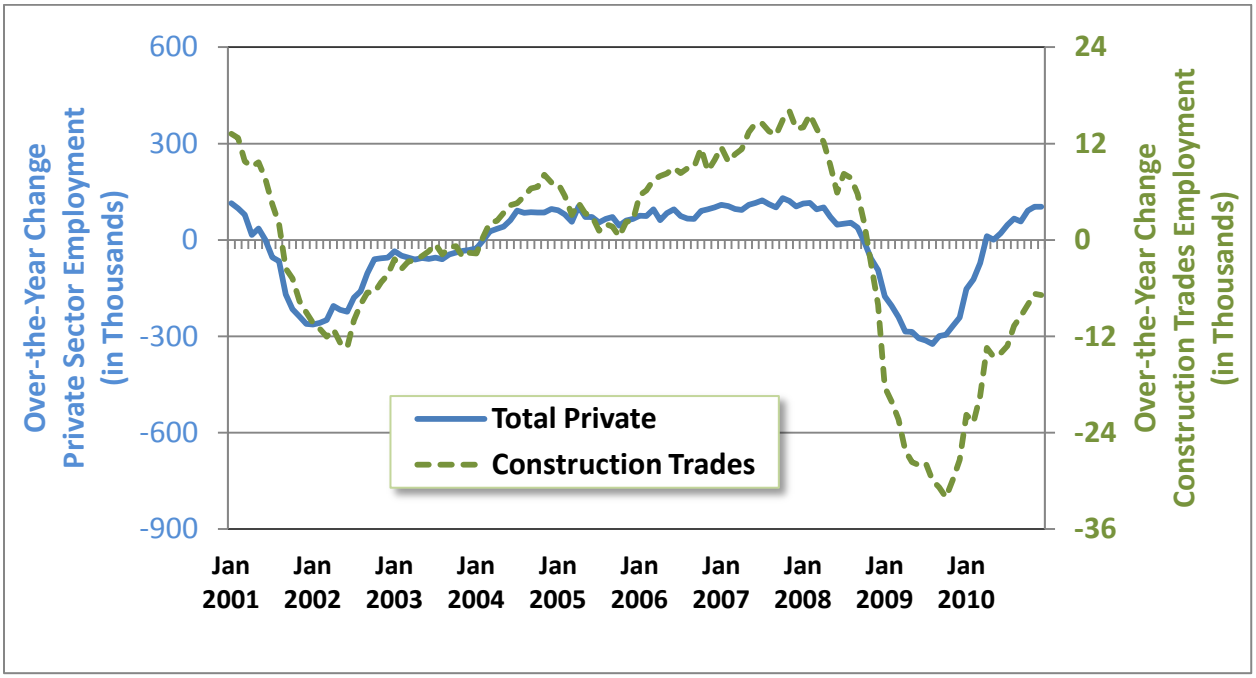


SOURCE | QCEW 1990 to 2010 Annual Average Employment

The collapse of the bubble has produced an enormous surplus of unemployed workers – the U.S. Bureau of Labor Statistics reported a national unemployment rate in construction of 21.8 percent in February 2011.[4] As the industry moves toward new green construction standards and practices, these unemployed workers are likely to be first in line to take advantage of newly created jobs and retraining opportunities.

[3] http://www.buildingcongress.com/outlook/, retrieved August 15, 2011.
[4] www.bls.gov/iag/tgs/iag23.htm, retrieved August 15, 2011.

YEAR-OVER-YEAR CHANGES IN MONTHLY PAYROLLS: TOTAL PRIVATE AND CONSTRUCTION



SOURCE | QCEW Monthly Over-the-Year Change

As the chart above illustrates, construction employment is more cyclical than overall private sector employment – gaining jobs by a higher percentage in good economic times and losing jobs by a higher percentage during more difficult economic times.

Wages. The chart below lists – in descending order by educational requirement – the median annual wages in New York State and typical preparation needed for occupations in the construction cluster. Note that this chart includes only occupations commonly found in the green economy, according to O*NET's *Greening of the World of Work.*[5]

WAGES AND TYPICAL PREPARATION FOR GREEN CONSTRUCTION OCCUPATIONS

Occupation	Median Pay	Typical Preparation
Chief Executives	>$187,200	Bachelor's or higher degree, plus work experience
Construction Managers	$117,710	Bachelor's degree
Electrical Engineers	$83,080	Bachelor's degree
Civil Engineers	$78,570	Bachelor's degree
Architects, Except Landscape and Naval	$78,370	Bachelor's degree
Mechanical Engineers	$74,800	Bachelor's degree
Cost Estimators	$66,190	Bachelor's degree
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	$51,060	Postsecondary vocational award
Structural Iron and Steel Workers	$77,540	Long-term on-the-job training

[5] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They

Occupation	Median Pay	Typical Preparation
Electrical Power-Line Installers and Repairers	$74,230	Long-term on-the-job training
Telecommunications Line Installers and Repairers	$69,110	Long-term on-the-job training
Electricians	$61,120	Long-term on-the-job training
Plumbers, Pipefitters, and Steamfitters	$56,730	Long-term on-the-job training
Millwrights	$50,800	Long-term on-the-job training
Carpenters	$48,520	Long-term on-the-job training
Sheet Metal Workers	$46,770	Long-term on-the-job training
Glaziers	$43,070	Long-term on-the-job training
Solar Photovoltaic Installers	$36,430	Long-term on-the-job training
Cement Masons and Concrete Finishers	$60,900	Moderate-term on-the-job training
Operating Engineers and Other Construction Equipment Operators	$57,360	Moderate-term on-the-job training
Insulation Workers, Mechanical	$52,860	Moderate-term on-the-job training
Hazardous Materials Removal Workers	$46,840	Moderate-term on-the-job training
Construction Laborers	$42,620	Moderate-term on-the-job training
Installation, Maintenance, and Repair Workers, All Other	$39,720	Moderate-term on-the-job training
Roofers	$37,270	Moderate-term on-the-job training
Insulation Workers, Floor, Ceiling, and Wall	$33,100	Moderate-term on-the-job training
Helpers – Electricians	$31,000	Short-term on-the-job training
Office Clerks, General	$27,530	Short-term on-the-job training
Helpers – Carpenters	$26,900	Short-term on-the-job training
Helpers – Pipelayers, Plumbers, Pipefitters, and Steamfitters	$26,700	Short-term on-the-job training
Supervisors of Construction and Extraction Workers	$71,310	Work experience in a related occupation
First-Line Supervisors of Mechanics, Installers, and Repairers	$69,430	Work experience in a related occupation
Sales Representatives, Services, All Other	$64,420	Work experience in a related occupation
Construction and Building Inspectors	$54,130	Work experience in a related occupation
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$53,840	Work experience in a related occupation

SOURCE | Occupational Employment Survey; O*NET Online

For workers with limited formal education, construction pays better than any other major industry in New York. One reason for this is that construction work is more highly unionized than the New York State average,[6] particularly in the commercial and infrastructure segments of the industry. In addition, New York State Labor Law requires that "prevailing wages" be paid on public works construction projects, and in practice the prevailing wage level is generally established according to the wages among unionized workers. In the segments of the industry dealing with large-scale construction, workers are generally trained through formal, State-approved apprenticeship programs, with built-in career ladders.

Employment Projections. Employment in the construction sector is projected to decline by.1 percent in New York State between 2008 and 2018. This compares to growth of.5 percent in total nonagricultural wage and salary jobs.

Demographic Trends. The following chart displays the demographic characteristics of the construction workforce from 2000 to 2007-2009. With the building boom, the construction workforce ballooned during the first decade of the century, increasing by 28 percent statewide and by 47 percent in New York City. A majority of those working in the industry have a high school education or more, with higher levels of education somewhat more prevalent outside of New York City. The industry has become more diverse ethnically and racially within the last decade, although employment in the construction trades remains overwhelmingly male.

DEMOGRAPHIC CHARACTERISTICS OF THE CONSTRUCTON CLUSTER WORKFORCE

	New York State		New York City	
	2000	**2007-09**	**2000**	**2007-09**
Total Cluster Workforce	433,643	554,490	168,423	247,257
New York State/City Residents	408,948	519,863	122,273	184,995
Non-New York State/City Residents*	24,695	34,627	46,150	62,262
New York City	32%	38%	*na*	*na*
Long Island	20%	18%	*na*	*na*
Hudson	15%	15%	*na*	*na*
Upstate	34%	30%	*na*	*na*
Bronx	*na*	*na*	13%	14%
Brooklyn	*na*	*na*	33%	34%
Manhattan	*na*	*na*	10%	7%
Queens	*na*	*na*	37%	37%
Staten Island	*na*	*na*	8%	8%
Male	91%	92%	90%	93%
Female	9%	8%	10%	7%
White	73%	64%	41%	33%
Black	8%	8%	18%	16%
Hispanic	13%	22%	28%	39%
Asian	3%	4%	8%	9%
Other	3%	2%	5%	2%
Age 18-34	34%	32%	37%	35%

[6] Blanchflower, D. and A. Bryson, The Union Wage Premium in the US and the UK," CEP Discussion Papers, London: Centre for Economic Performance, London School of Economics, 2004.

	New York State		New York City	
	2000	2007-09	2000	2007-09
35-44	31%	25%	28%	26%
44-54	24%	29%	25%	26%
55+	12%	14%	10%	12%
Less than high school or GED	22%	18%	33%	27%
High school or GED	39%	41%	34%	38%
Some college	28%	28%	22%	21%
College	11%	13%	11%	14%

SOURCE | U.S. 2000 Decennial Census and 2007, 2008, and 2009 American Community Surveys public use microdata (PUMS) files. *The remaining counts that appear in the table are of people who both live *and* work in New York State and New York City, respectively. **NOTE|** About 3 percent of employed persons do not have a place of work value and are not included in this analysis.

Green Economic Activity

For the purposes of this research, "green" economic activity in construction was defined as:

- Constructing energy efficient new buildings, including residential, commercial, institutional, and industrial buildings.
- Remodeling, retrofitting, or retro-commissioning of existing buildings to improve energy or resource efficiency.[7]
- Construction of structures related to generating or transmitting renewable energy, such as solar, wind, biomass, geothermal, and hydro-electric.
- Installation of renewable energy systems.

During focus group discussions, industry employers also mentioned construction of electric vehicle charging stations and construction of green roofs.

Within the last ten years or so, there has been significant movement in the direction of green practices throughout the construction industry, especially in large buildings and high-end commercial spaces. Some of New York City's largest commercial construction firms say that energy efficient building is firmly in place, and not a trend waiting to happen at some time in the future. It has been driven both by customer preference and leadership from the public sector, both regulatory and role modeling. The Related Companies, one of the largest property management companies in New York City, reports that tenants now expect energy efficiency and environmental sustainability in commercial office space, and that any building that does not have these features will be perceived as "obsolete."

There is movement toward green construction in the residential sector as well, particularly in low-income and affordable housing developments where public subsidies are involved. Increasing energy efficiency is seen as a way to maintain affordable rents for low-income tenants by controlling costs. New York City's Department of Housing Preservation and Development (HPD) has instituted green requirements for new construction and major rehabilitation projects in order for developers to qualify for low-income housing tax credits or HPD financing. As of the first quarter of 2011, HPD-funded

[7] This category includes weatherization, made up of a large network of non-profit organizations and their contractors that weatherize largely low-income residential properties. Typical weatherization activities include repair, upgrade and replacement of heating systems, water heater installation, wall insulation, window insulation and replacement, repair of minor roof leaks, pipe insulation, replacement of appliances, especially refrigeration, addressing health and safety issues, such as exit signs, mildew, asbestos, mold and poor indoor air quality. Energy audits are performed to determine the type of work needed.

projects must achieve Enterprise Green Communities Certification, a national certification designed especially for affordable housing.

The other major area of green investment in the residential sector is weatherization: many small companies and non-profit organizations are involved in performing energy-efficiency remodeling in existing residences of low-income individuals and families. Although some of these organizations have been involved in weatherization for many years, activity in this area has greatly increased since 2009 due to the weatherization grant funding included in the American Recovery and Reinvestment Act. Several grantees of this funding emphasized that they had been involved in weatherization well before the funding, noting "We were green before they invented the phrase."

EXAMPLES OF GREEN CONSTRUCTION PROJECTS

Four Times Square (Commercial). Completed in 1999, Four Times Square was a pioneer in green commercial construction. Developed by the Durst Organization, this 48-story building includes many energy efficiency and environmental improvement measures. Measures such as energy-efficient lighting and high-tech heating and cooling systems allow the building to save an estimated $1,760,000 per year in energy costs. Non-toxic, biodegradable and sustainable materials were used extensively in construction, and 65% of construction debris was recycled. Indoor air quality is improved by a high-elevation outside air intake system and special smoking rooms with dedicated exhaust shafts. The building benefited from the assistance of NYSERDA's Technical Assistance Services and New Construction Programs.

Solaire (Residential). Completed in 2003, this 27-story, 293-unit building is located in Battery Park City in lower Manhattan. It achieves a 35 percent reduction in energy demand by using automatic fluorescent lights, photovoltaic panels, high-performance windows and other methods. A roof garden covers 75 percent of the building roof, reducing heating and cooling costs. The building reduces water use by 50 percent by using recycled waste-water for cooling, toilets, and irrigation. 93 percent of the project's construction waste was recycled.

P.S./I.S. 276 (Public). The School Construction Authority's Green Schools Guide, first released in 2007, establishes green standards for school construction projects and ensures compliance with Local Law 86.One of the first schools built under these guidelines was this 8-story school in Battery Park City, which serves 950 K-8 students. Following the guidelines, the building includes such features as a highly insulated envelope, high performance glazing, a highly efficient mechanical plant, CO2 sensors, and enhanced indoor air quality with mold-resistant and low VOC emitting materials and sustainable materials. The building also goes beyond the guidelines with features such as a photovoltaic array, which supplies energy for one-half to one-third of the building's lighting. Creative design decisions, such as placing the cafeteria and library on the middle floors, save energy by reducing the need for elevators.

General Colin L . Powell Apartments, Morrisania Homes in the South Bronx **(Affordable Housing).** This 50-unit multi-family building was developed in a unique partnership with the City of New York, Blue Sea Development Company and Habitat for Humanity – New York City. The building has a green roof that insulates and reduces storm water runoff, a co-generation system that produces electricity and hot water, a healthy indoor environment through non-toxic materials and controlled filtered ventilation systems, and educational materials for residents on green, healthy lifestyles.[1]

The Family Residence and Essential Enterprise (FREE) Project. The FREE Project recently partnered with EmPower Solar and LIPA to install a large scale multi-site solar energy project at its commercial and residential group home properties across Long Island, NY. The arrays vary in size from a 2.07kW residential system in Patchogue to a 124kW system at their main facility in Old Bethpage. The 45 PV systems total almost 800 kilowatts (kW) and will produce approximately 1,018,000 kilowatt hours (kWh) of electricity annually reducing utility expenses by 27 percent per year that FREE will be reinvesting back into their programs. The project received the 2011 "Photovoltaic Project of Distinction Award" from the Solar Energy Industries Association (SEIA) and the Solar Electric Power Association (SEPA) at the PV America Conference in Philadelphia.

Glass Tower Hall at SUNY Cortland (Residential, Public). SUNY Cortland and the Dormitory Authority of the State of New York (DASNY) completed this LEED-certified building in 2005. In addition to energy-efficient HVAC, windows, and insulation, the building includes bike racks to encourage biking to class, wide sidewalks to encourage walking, and charging stations for renewable energy carts. The building houses 194 students.

Alongside the more general trend toward green construction, renewable energy technologies such as wind and solar are a specific green niche within the larger construction sector. Wind is not currently in major demand in New York City, primarily due to the difficulty of meeting building code requirements. Solar, however, has seen increased demand, due to subsidies and to Mayor Bloomberg's promotion of solar panels on city buildings under PlaNYC. Major funding for solar installations has also come from the

New York Power Authority (NYPA), which recently announced several new projects. In addition, the Long Island Power Authority (LIPA) and several towns on Long Island have incentives that strongly encourage solar installations.

Although demand for green construction has suffered during the recession, along with the sector in general, the construction industry has continued to move toward green building even as the recession has persisted. The U.S. Green Building Council (USGBC), which administers the Leadership in Energy Efficient Design (LEED) standard, reported that its membership grew between 2008 to 2009 contrary to expectations. The number of LEED-registered projects (the first step toward certification) continued to grow despite the collapse in new construction, as did the annual number of new certifications. One analyst speculates that this is due to a "lifeboat effect", in which builders attempt to protect themselves from a weak market by jumping on what is perceived to be a marketable trend.

How Green Firms Differ. As part of this research, several focus groups were held with industry employers. One of the strongest messages to emerge from a focus group of large New York City construction companies was that sustainable construction has become standard over the last several years for Class A office space, especially in New York City. As one company representative noted, "the big players in the [construction] industry" believe they must be involved in the green movement. At first, developers paid a premium for LEED, but "now, four years later, it's standard practice." The analogy was made to new technology – "the iPad, iPhone comes out, not everybody gets it and then all of a sudden it becomes standard."

Another company representative added that for Class A office construction projects, the cost of construction of a sustainable project is virtually the same as for a non-sustainable one, "unless you're going to [LEED] platinum, but to go for a silver rating, for that middle level, it's really no [additional] cost. If you want to go with co-generation and wind and things like that, that's where you start paying."

The large construction companies involved in LEED and other sustainable construction believe that what sets them apart from others is their knowledge and experience. One company representative said, "We're innovative, we want to push things forward…we're smart, we're curious, we want to know what's out there, where the movement is going…we're leading the charge that maybe some of our competitors are not." Several years ago, the largest construction companies began to see sustainable construction as a growing market and wanted to be "ahead of the curve on the trend." One large construction contractor said, "Everybody seems to be going with either a sustainable building or a LEED certification. The company has embraced it and they're just growing around that market."

For other segments of the construction market, the answers are different. For residential construction, including affordable housing, sustainable construction can be more expensive than standard construction, and one affordable housing developer said that what distinguishes his company from the competition is that, "They [standard developers] make more money – simple fact." Those developers that do become involved in LEED or other sustainable residential construction have a strong interest in undertaking this type of project and tend to work with city and/or state agencies and/or foundations. They generally take advantage of available public incentives.

In yet another segment of the market – weatherization contractors – one contractor said, "Well what I would say is that we benefit a lot by participating in all these programs…we have more work than we would have otherwise." This contractor believes that what sets his company apart is that his workers have been trained and have the experience, and that the work is done professionally "without any problems or consequences." Some weatherization contractors noted that the additional funds provided

under the American Recovery and Reinvestment Act (ARRA) have drawn what they believe are less-than-qualified contractors into the business.

Green Market Drivers. Buildings account for 48 percent of energy use and greenhouse gas emissions in the United States and 75 percent in New York City, so, in general, they are an important target for environmental initiatives. Green construction techniques become more attractive as the price of fossil-fuel energy rises – either due to global economic reasons or to government policies that place a price on carbon. To the extent that energy efficiency translates to cost savings, individuals and businesses will demand green construction. Other reasons individuals and businesses buy green construction include government incentives, philosophical commitments, image, cachet, and consonance with the organizational mission.

Green construction experts and focus group participants cited customer demand and public sector leadership as the main drivers of green construction activity, in addition to the laws, regulations and statutes discussed in the introduction to this report. The following are explanations of the "green" construction market offered by construction industry employers at one or more focus groups held as part of this research:

> ***Customer Demand***. Large construction companies and the trade contractors they utilize said that, at first, the sustainable building movement was led by certain committed developers, consultants and others who believed that sustainability was good for the environment and the future. The particular focus initially was on sustainable materials and energy conservation. Early on, construction companies were not sure whether this was a "fad" or whether it was "really going to catch on." As time went on, there was "a perception that a LEED certified building was a better place to live and to work. Commercial tenants wanted a better place for their employees." They wanted better indoor air quality and environmental benefits. "Even the [real estate] brokers are now driving the [LEED] certifications. It's a selling tool for higher rents. You've got the brokers pushing on one end, the owners benefiting from that and also benefiting from a more efficient building." A trade contractor observed that, "this is the thing to do today." One trade contractor commented, "This [LEED] is very much a religion as much as a business."
>
> ***Cost and return on investment***. One large New York City construction contractor noted that the gap between a LEED-certified building and standard construction in Class A office space is not that great because "You're already at a higher quality level." Also, it appears that high-end commercial and residential tenants want LEED certified space and are willing to pay a premium for it. He continued, "Here in New York, if you're going to build a Class A office building, it has to be a LEED silver or gold building to compete with the others."
>
> Cost issues impact different construction markets in different ways. Some companies that participated in focus groups felt that potential energy cost savings will drive greater demand for energy efficiency improvements in other commercial (Class B and below) and residential buildings.
>
> An affordable developer noted to researchers, "In affordable housing especially, you have income limitations and construction costs on the bottom side. And you're always between a rock and a hard place. You can't raise the rent or the price of the unit one penny. In the affordable housing realm, it's extremely difficult. So the incentives are key to us making things happen. In this case, incentives from NYSERDA and others allow the project to be feasible for developers. "
>
> Builders and building owners may still be reluctant to invest in energy-efficient building retrofits or technologies because their benefits often accrue over a very long time horizon, or accrue

primarily to tenants (in the case of leased commercial space), resulting in what is known in the trade as "split incentives." Getting tenants to pay attention to energy-efficiency can be difficult, as well – in Class A commercial office buildings, energy will typically only account for one to two percent of a tenant's costs. Ironically, however, it is the Class A tenants that appear to be demanding LEED-certified space, and building owners find they can charge a premium for rent for such spaces. On the other side of this issue, some developers are only interested in investments with a relatively short payback period. One company representative observed that some developers feel, "We have a 10 year lease, we're out of here, we're moving somewhere else in 10 years. We don't care. If the payback is not 24 months, we're not interested."

A solar company commented that, "At the end of the day, as much as people want to do green and to do renewable energy, the return on investment is kind of what directs them to go/no go." Another said, citing the difficulty of selling solar thermal systems, "Cash flow is an issue. For solar thermal, the ROI [return on investment] is a couple of years longer than PV [photovoltaic cells] to begin with."

Within the weatherization program, decisions are made on a cost-benefit basis, or as one focus group employer said, "What are you paying for the return on energy conservation?" There is "an iterative process to discover the most effective, cost-effective ways of doing those things."

Impact of financing issues. Financing issues impact different segments of the green construction industry differently. In the residential and small commercial markets, most private mortgage lenders will not finance the cost of efficiency upgrades or the greater cost of energy efficient materials in the case of new construction making it necessary to find financing through utilities or other public sector sources. Currently, New York State has several initiatives but no common solution to this problem, as described in greater detail in the introduction to this report.

Because weatherization is publicly funded and targeted, income eligibility of the tenants or homeowners is the major consideration. Weatherization industry employers feel that this type of construction has been constrained by its restriction to income-eligible property, and by a lack of incentives for owners and tenants in other than low-income properties.

Responsiveness of regulators. One construction industry representative noted that while financing is an issue in the construction market, the City and State can do more to streamline the bureaucracy and expedite the process, making it more conducive to job creation. An example was given of five separate sets of disclosure forms all asking exactly the same questions in slightly different ways. It was felt that the City of New York could do more within its own agencies to streamline the process. The feeling among many companies was that this message had been received "at the top" but that it disappears into the bureaucratic culture and "hasn't quite make it down to the street level."

On a related point, one company noted that "new technology is being developed, advanced and put in the market place faster than the [NYC] building department can analyze it and understand whether or not it's good for the city, good for the environment." This was one of a number of comments about how bureaucracy – or the lack of it – can have a major impact on the amount and type of green construction. There was praise both for the Con Edison solar representative, who has streamlined the ways in which solar companies interact with the utility, as well as the CUNY Center for Sustainable Energy, which, acting as ombudsman, helped to troubleshoot and resolve solar installation problems with the NYC Buildings Department. Yet even in this case, there were still a number of complaints about the multi-step process and amount of time it takes to get approval.

Conduciveness of space was cited by solar installation firms as a primary driver of their business. As one company observed, "Every market is a little different." For example, "you could have a million square foot building [in New York City] but it's got a 40,000 square foot roof with cooling towers, water towers and satellite dishes on them and there is no square footage for [solar]. If you go out to Long Island and do something in Melville where you've got a four story building that's a million square feet and you've got 10 acres of roof you can do a solar installation."

Regulatory and Statutory Drivers of Demand. As noted in the introduction to this report, regulatory mandates and incentives from the federal, state and New York City governments have played a very large role in driving "green" construction. These range from the federal Energy Policy Acts of 1992 and 2005 that mandated state energy codes for some buildings and provide tax incentives for building owners who increase efficiency, to the Energy Independence and Security Act of 2007, which established a block grant program which provides seed money for local green building and energy efficiency initiatives. Additionally, the American Recovery and Reinvestment Act of 2009 provided the Department of Energy with $16.8 billion for energy efficiency and renewable energy programs. This money was directed toward greening federal buildings, funding local block grants, and weatherizing the residences of low-income families.

In New York City, government initiatives have increased demand for green construction. The Green Building Law (Local Law 86), passed in 2005, requires that many city-funded construction projects achieve certification under the LEED or LEED-equivalent green building standards and meet energy and water efficiency targets.

Another set of laws encourages energy efficiency under the umbrella of the city's "Greener, Greater Buildings Plan". These laws require the creation of energy and water efficiency benchmarks for buildings (Local Law 84), more stringent energy efficiency standards for new construction and renovations (LL85), energy audits and retro-commissioning for large buildings (LL87) and upgrades to lighting systems (LL88). There are also a number of state programs that promote green building and retrofits, under the umbrella of the New York State Energy Research and Development Authority program (NYSERDA).

In the weatherization of the residences of low-income people, funds are often leveraged from more than one program. In New York City, since 1993, weatherization funds from the U.S. Department of Housing and Urban Development have been combined with Con Edison, National Grid, and NYSERDA programs to both accomplish a more comprehensive scope of work and perform work on more units. ARRA funds have been a boon to this industry, as they have been provided in addition to regular weatherization funds. There have also been changes in the industry over time – upgrades in appliance standards, technological changes in heating, such as the use of condensing boilers; even window technology has changed.

In the course of focus groups with construction industry employers, a number commented on their experience with laws, mandates and incentives:

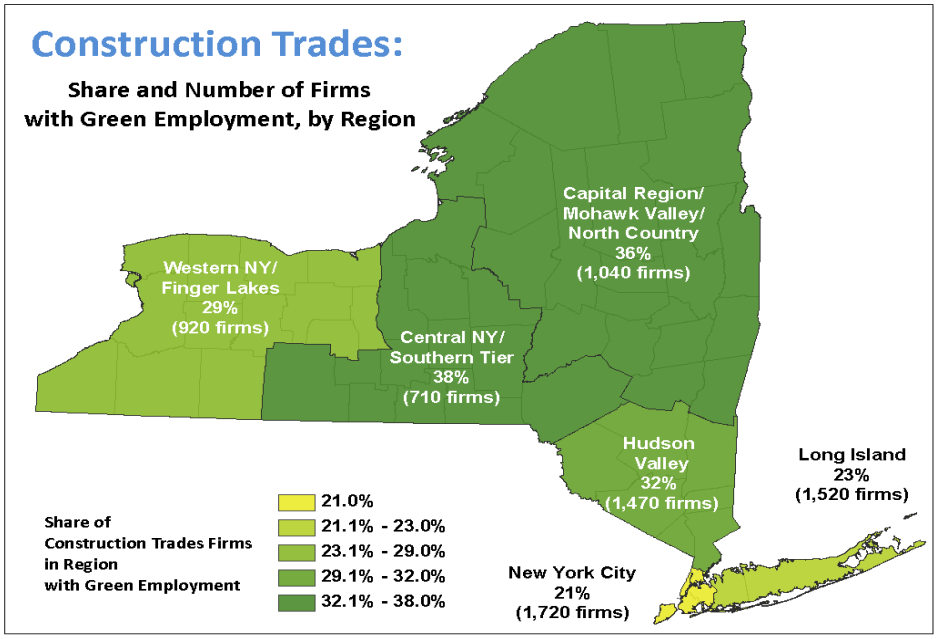
- "Subsidies and incentives and tax incentives are very important to our developers. When they're putting together a complete pro forma, every little bit helps the bottom line and I think most of the major developers are looking to those incentives at least to put a piece of their financing together."
- On NYSERDA incentives – "Sometimes it's easy, sometimes not so much."
- "The law says they're not going to make incandescent light bulbs anymore in a short amount of time so you're going to be compelled to make some of these changes. As you renovate spaces you must now comply with the latest energy codes."

- On utility incentives – "I know developers now putting in cogen[eration] plants that they wouldn't have if there wasn't an incentive there."
- On Con Edison's incentives – "65% of their incentives have to do with lighting retrofits."
- For solar, "Incentives are complicated and specific to the locations that you operate in. With commercial, you have the federal 30% tax credit grant. 100% depreciation the first year. And if you're in NYC, you've got a NYSERDA rebate, which is upfront. You've got a property tax abatement."
- "The weatherization program drove a lot of improvements in energy efficiency industry-wide in this country. We were kind of a testing ground for all these things, and I think we can take credit for that." The NYC Department of Housing and Community Renewal has been an innovator and leader, for example, in the use of energy efficient boilers.

Green Employment in Construction

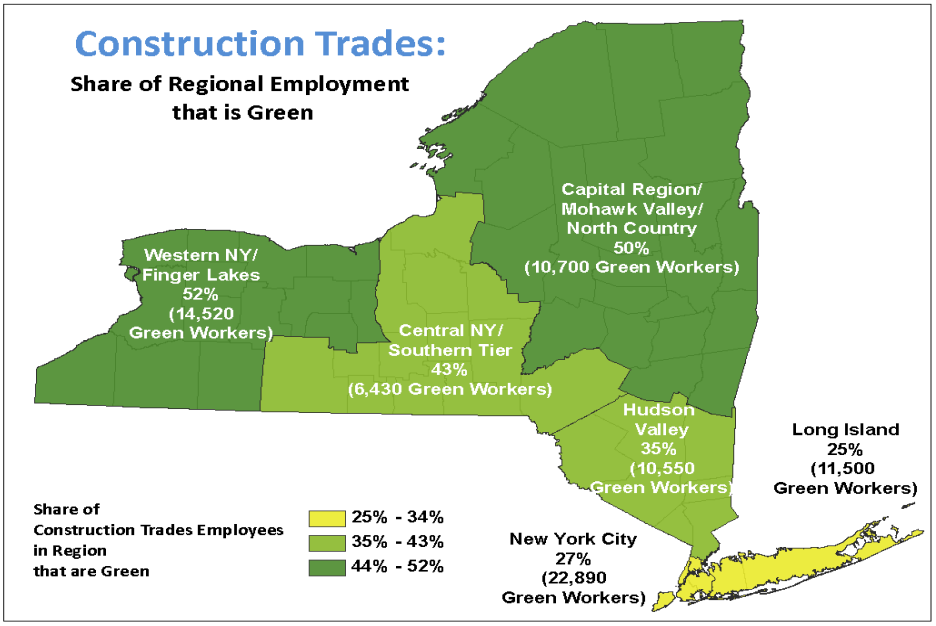
Firms and Employment: Survey Results

Statewide, 27 percent of firms in the construction industry cluster reported that they had one or more green employees. The map and chart below display the findings by region of New York State. The upstate areas had higher percentages of firms with green employment, but fewer construction companies.



Firms	New York State	New York City	Long Island	Hudson Valley	Capital Region/ Mohawk Valley/ North Country	Central NY/ Southern Tier	Western NY/ Finger Lakes
Number with Green Employees	7,370	1,720	1,520	1,470	1,040	710	920
Total Number in Cluster	26,980	8,020	6,510	4,570	2,850	1,850	3,170
Percent with Green Employees*	**27%**	**21%**	**23%**	**32%**	**36%**	**38%**	**29%**

As the next map and chart display, the survey results indicate that 34 percent of the total employment in the sector is green. The proportion of green employment in construction is highest in the Western NY/Finger Lakes Region (52%) and Capital Region/Mohawk Valley/North Country (50%) areas of the state. Because of its sheer size, New York City has the largest number of green employees, although they make up just 27 percent of its construction workforce.



	New York State	New York City	Capital Region/ Mohawk Valley/ North Country	Hudson Valley	Central NY/ Southern Tier	Long Island	Western NY/ Finger Lakes
Green Employment	76,600	22,890	10,700	10,550	6,430	11,500	14,520
Regional Employment	226,020	83,880	21,600	29,870	14,990	45,730	27,880
Percent Green*	**34%**	**27%**	**50%**	**35%**	**43%**	**25%**	**52%**

Firms with green employees were asked whether they expected their green employment to grow larger, smaller, or remain unchanged a year later. Of the 7,340 firms with green employment, 72 percent expected that their green employment would remain the same (42%) or grow larger (30%). Only seven percent of those with no green employees expected to have green employees a year later.

Composition of the Green Workforce. As of this writing, the green economy exists within a very slowly growing overall economy. The construction industry in particular has not recuperated from the recession to any great extent, and unemployment among construction workers remains high. In addition to the special incentives and calculus of constructing renewal energy and energy efficient projects, reviewed below, the green construction industry is also subject to the same economic pressures as the industry in general.

As one construction company representative noted, “I just think it’s the environment that we’re in right now, I don’t think anybody is overstaffing and bringing new people in. Everybody is doing more with less.” A developer said, “Personally I think it’s volume-driven. You look around New York City and

everything is for the most part, ground to a halt. And so the demand for new jobs in any construction field is extremely limited."

In general, employers in the focus groups felt that they were not hiring new employees as much as they were offering "retraining or continuous education to current employees." Another said, "It just becomes another fact of what our 'boots-on-the-ground guys' have to do. It's like safety…it's not like you're bringing an extra person in to do it." It is "more of a shifting and training our people." Trade contractors reported that they are retraining their own staff and are preparing union members to receive similar education "getting ready for the future green economy."

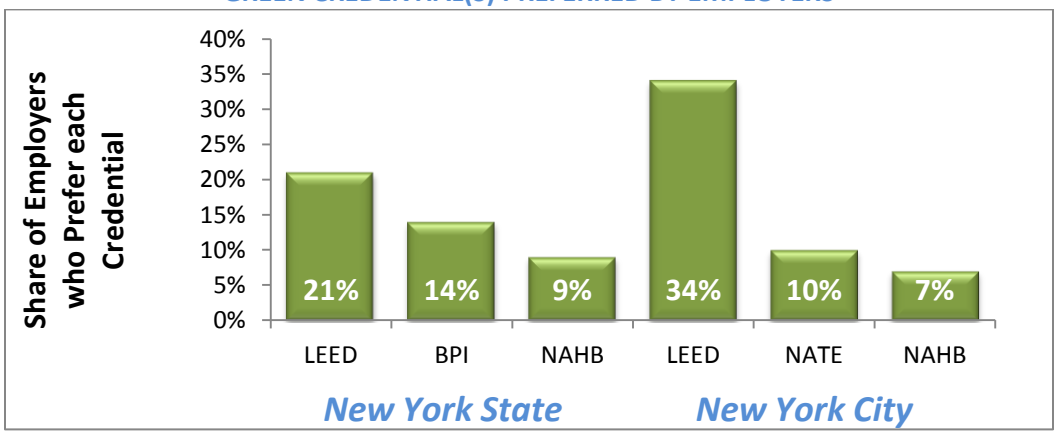
Construction companies noted that many college graduates have already learned about "green" and sustainability. They added, "the younger folks coming out of school, they know this already. This is already taught in your construction management program, it's taught in architecture programs, it's taught in engineering programs so it's really the people at our level that require the retraining."

However, some employers, especially those performing energy audits and installing energy efficiency products, including weatherization contractors, emphasized the need to hire people with specialized skills and experience. This was felt to be critical with energy auditors and quality assurance inspectors. One noted that, "The work must be done correctly." Several weatherization contractors agreed that, "You have to have somebody that has some construction experience to actually do this work properly."

Employers were asked in the survey what if any "green" credentials they preferred their employees to have. As shown in the chart below, 21 percent of Construction industry employers with green employees in New York State – and 34 percent in New York City – prefer that their employees have a Leadership in Energy and Environmental Design (LEED) credential, 14 percent prefer they have a Building Performance Institute (BPI) credential and 9 percent prefer a National Association of Home Builders (NAHB) credential.

The industry focus group discussions reinforced the survey findings. Both large construction contractors and the smaller trade contractors mentioned LEED accreditation for staff. Company representatives in the residential construction and weatherization focus groups mentioned BPI. Some of the companies in the solar focus group mentioned the North American Board of Certified Energy Practitioners (NABCEP) certification.

GREEN CREDENTIAL(S) PREFERRED BY EMPLOYERS

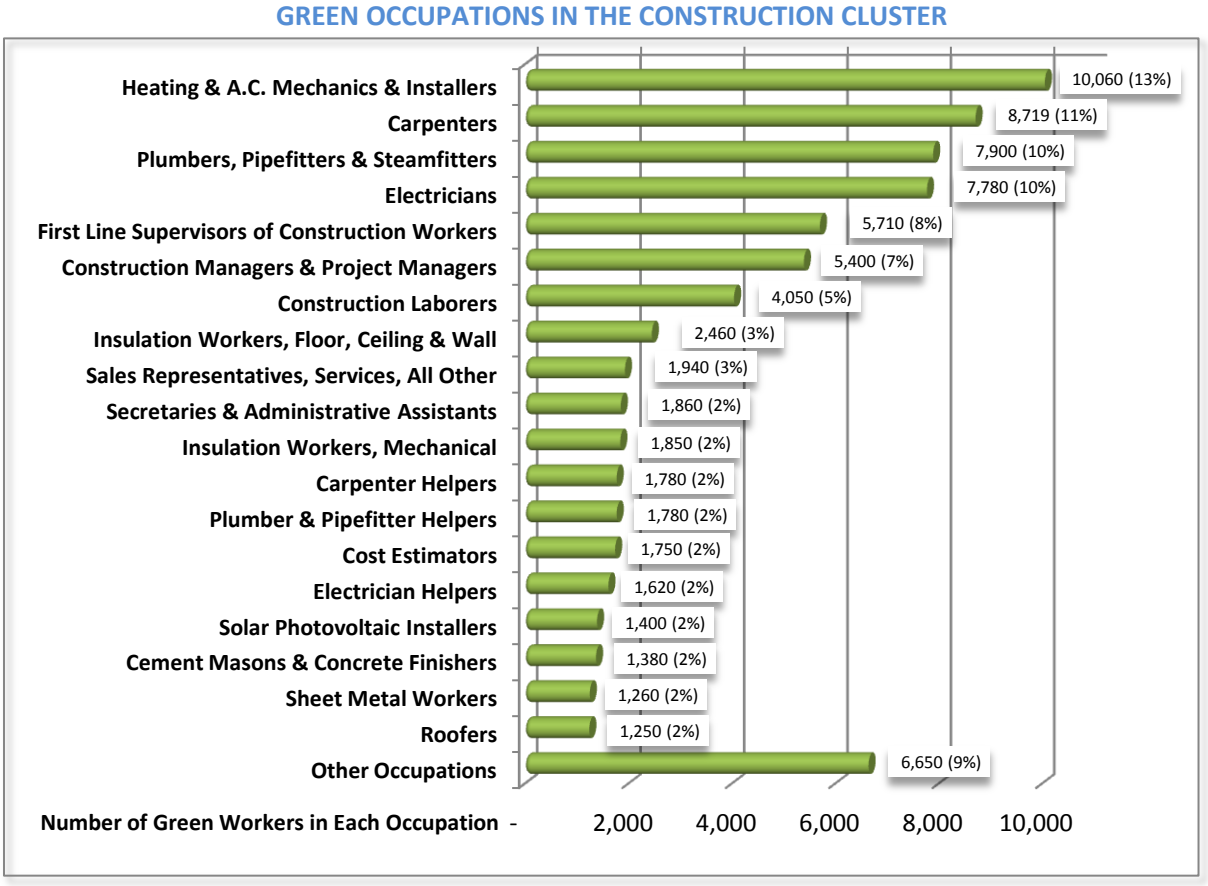


BPI	Building Performance Institute
LEED	Leadership in Energy and Environmental Design
NAHB	National Association of Home Builders
NATE	North American Technician Excellence

Occupational Information

Key Occupations. As shown in the chart below, the statewide employer survey found that five occupations provide over 50 percent of this industry's green employment. They are:

- Heating and Air Conditioning Mechanics and Installers
- Carpenters
- Plumbers, Pipefitters & Steamfitters
- Electricians
- Supervisors of Construction Workers



In the focus groups with construction employers, other jobs mentioned included:

- *LEED Supervisor or LEED Coordinator*. This would be someone who understands the requirements of LEED Certification in detail and serves as a point person. This person must be able share information and coordinate people across all disciplines, from consultants to project managers to trade contractors.
- *Job Estimators*. Some employers mentioned that they need people who have an understanding of the costs of a green versus traditional project.
- *BPI-certified Energy Auditor*. It was felt that energy auditor is a specialized occupation, usually but not always requiring a bachelor's degree and hands-on experience.
- *Field technicians*. These are generalist technicians or laborers who assist energy auditors in the field in the data collection process.

- *Weatherization "crew" members*. These are workers who can air seal; make heating distribution repairs; install weather-stripping, compact fluorescent light bulbs, carbon monoxide detectors and smoke alarms; repair doors and windows; and mix cement to patch up something in a courtyard or boiler room.
- *Expeditors.* These are individuals who shepherd solar installations through the regulatory process.

One industry employer said that, while many occupations have the same name as in the general construction industry, the job is done differently in the green economy: "It's just what equipment and to what level of detail and quality do they go in." He said that his company is paying much more attention to detail. "So it's really about how practices are done."

Another employer made the same point, saying that "green" practices require greater care: "It brings an awareness to the labor force that yes there is another source, yes there is another method, yes there is another way of doing things so that awareness by itself is going to be very valuable for a greener future."

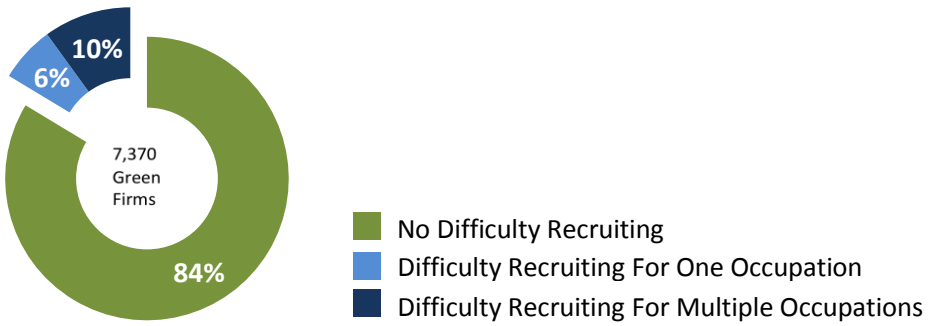
In one focus group, employers mentioned jurisdictional issues among unions, or "gray areas" that they believed needed to be "fought and figured out." These include such areas as the roles of roofers versus electricians installing solar photovoltaic panels, or the roles of roofers versus boilermakers installing solar thermal heating systems.

Another comment made by focus group members, especially those involved in smaller organizations that provider weatherization services was, "many of our staff wear multiple hats."

Career Pathways. The general feeling among industry experts and focus group participants was that people do well and move up based on their skills sets, their social and workplace skills and because they performed well in their jobs. One industry employer said, "Some project laborers have moved up to project supers, not because they got trained in green jobs or anything like that, but just because they excelled at what they were doing." Within the solar industry it was noted that people move from roofer to solar photovoltaic installer; from field to office or from office to field, and sometimes to supervision. Within the weatherization section of the industry, individuals can move from being a crew person to assisting an energy auditor, and occasionally to construction manager.

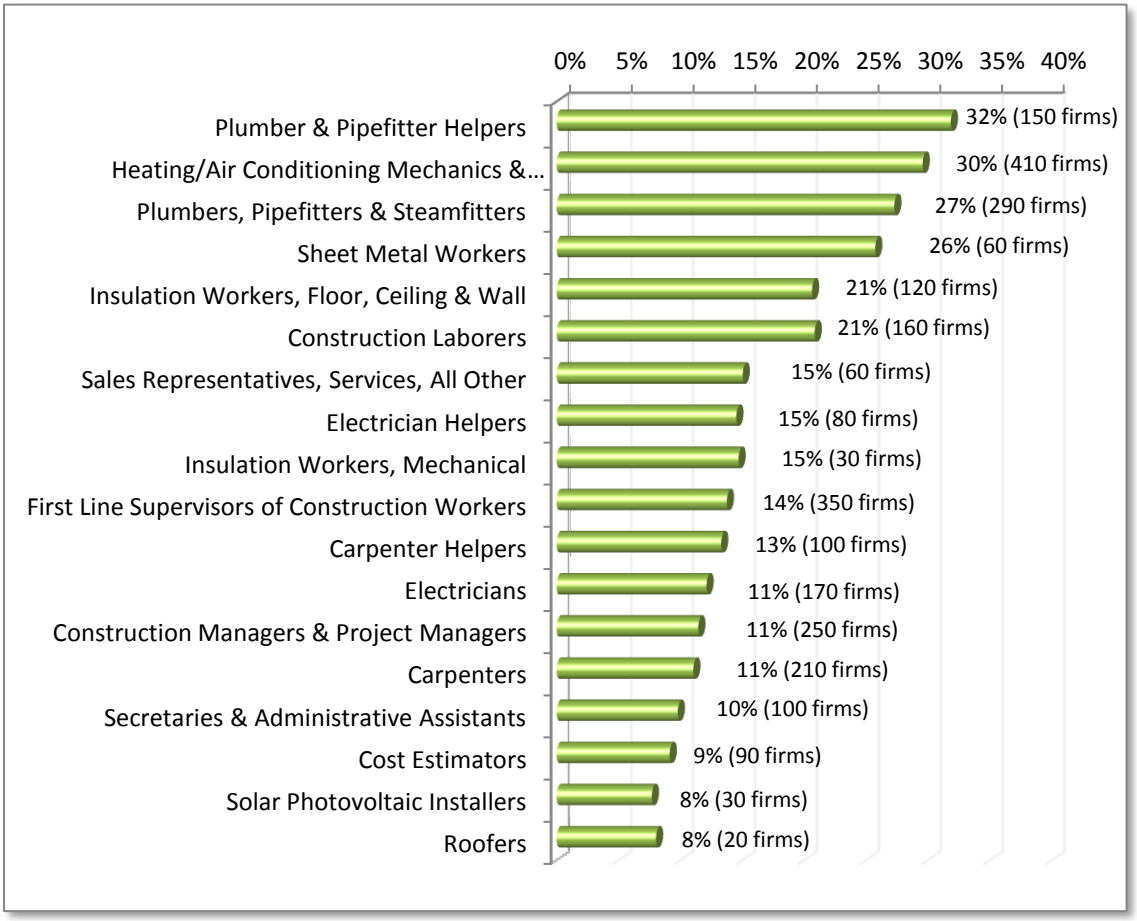
Recruitment, Retention, and Turnover. As part of the employer survey, "green" firms were asked if they have difficulty recruiting qualified workers. Of the 7,370 green firms in Construction Trades in New York State, 16 percent (1,210) had difficulty recruiting qualified green workers. Ten percent had difficulty recruiting for more than one occupation

PERCENT OF GREEN CONSTRUCTION FIRMS WITH RECRUITING DIFFICULTY



The occupation that employers had the most difficulty finding qualified employees was plumber and pipefitter helpers, with 32 percent of firms reporting this issue. The second most frequent occupation – with 30 percent reporting difficulty – was for Heating, Air Conditioning Mechanics and Installers.

DIFFICULT TO RECRUIT OCCUPATIONS IN GREEN CONSTRUCTION



Recruitment difficulties varied by region, however. The three most difficult to recruit occupations in each region were as follows:

- Capital District/ Mohawk Valley/North Country: Construction Managers, Secretaries and Administrative Assistants, and First-Line Supervisors of Construction Workers.[8]
- Central New York/Southern Tier: Construction Managers, Secretaries and Administrative Assistants, and First-Line Supervisors of Construction Workers
- Hudson Valley: Construction Managers, Cost Estimators, and Architects
- Long Island: Construction Managers, Cost Estimators, and First-Line Supervisors of Construction Workers
- New York City: Construction Managers, Cost Estimators, and Sales Representatives
- Western New York/Finger Lakes : Construction Managers, Cost Estimators, and Sales Representatives

[8] This was reinforced during a focus group with construction firms in the Albany area, where employers reported difficulty finding Purchasing Agents and Construction Managers hard to fill because they are looking for people with experience, not just a certification. They were also looking for Job Estimators who know how to project the costs of green construction.

In focus group discussions, all of the employers said that they were looking for the best people and, even with a high unemployment rate, perceived themselves to be in competition with one another for talent. The main retention issue mentioned across the board was "keeping enough business on the books to keep the people employed that we have identified as people that we want for the long term." Larger construction firms mentioned that they retained as many people as possible whom they regarded their "A team," laying less productive staff off when the economic downturn began. Of course, most agreed that individuals with poor work habits generally do not remain in a construction job for very long. On the other end, firms reported losing some of their better workers who leave construction to become more involved in the financing aspect of the industry.

Recruitment Practices. Focus groups revealed that different parts of the industry recruit new candidates differently although almost all companies post jobs on their websites. And many also attend job fairs, especially "green" jobs fairs. Another point made by several companies is that there are workforce ebbs and flows in construction depending on what is happening in different parts of the country. The construction workforce is highly mobile, moving to parts of the country where there is more construction work.

Employers in the unionized (generally commercial/infrastructure) sector of construction industry recruit two types of workers: management (highly technical people, generally college graduates) and trades people (trained through Joint Apprenticeship Committees). In recruiting managers, one employer in this sector noted, "We've got a lot of talent in the industry and I just think, when you look at the high school graduate versus the college graduate, the college graduate knows how to learn." The feeling was that the college graduate has "learned to solve problems and how to work in a team." Also, interpersonal skills were felt to be important, as "90 of business is dealing with people." One representative from a large construction company said that "someone without a college degree is maybe not going to hit a dead end but they're going to hit a cul de sac and just get stuck there. It's not like 50 years ago where a guy could drop his tool belt on the ground and become a supervisor and learn the trade and become a career senior manager. The industry has become too sophisticated and it needs to be learned in a classroom setting." Some employers mentioned that with the construction slowdown, there are a lot of qualified people available on the management side. Interestingly, unionized trade contractors reported that college-educated candidates are now interested in union apprenticeships, such as electrician, HVAC mechanic and roofer.

Employers in residential construction recruit through local colleges, at job fairs and from non-profit training providers. One employer said that his company has difficulty "all the time" finding qualified employees. He said that "it's not about any particular skill set because we'll train them to do what needs to be done. It's really about whether they come with the work skills. Getting to your job on time and being presentable, putting in a good day's work, not having to be reminded of things. "Some employers described: "These days every program has a workforce development requirement whether it's happening from the community or whether it's happening from an outside agency. So we're working most of the time with predefined or already structure organized programs."

Solar companies find that many people want to work for them, "It's an industry that everybody wants to be in. They're smart enough to get on the web and find companies and call them up. When I get the 10th email and the 12th call from the same person, that's usually when we meet, and hopefully at some point we have a position." They feel that there is no shortage of qualified people. People "like renewable energy and think it's more of a look to the future." Although it is still a small industry, employers report that the talent pool is growing.

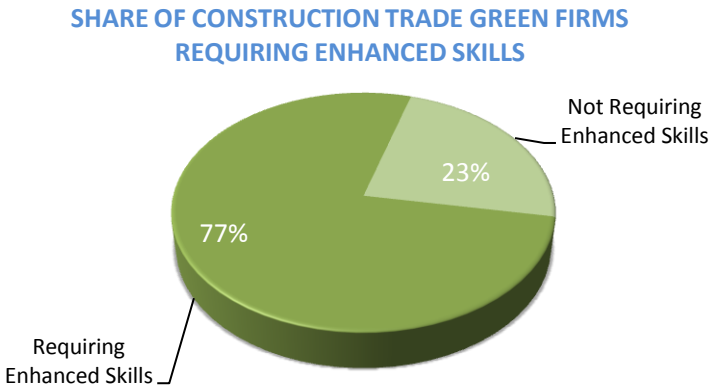
Weatherization grantees and subcontractors do a lot of hiring through word of mouth and through the local community. They also report that many of the best people in the industry have construction

experience." "They're either carpenters or masons or handymen or general contracting guys or whatever." When asked what they value and look for in employees, employers mentioned:

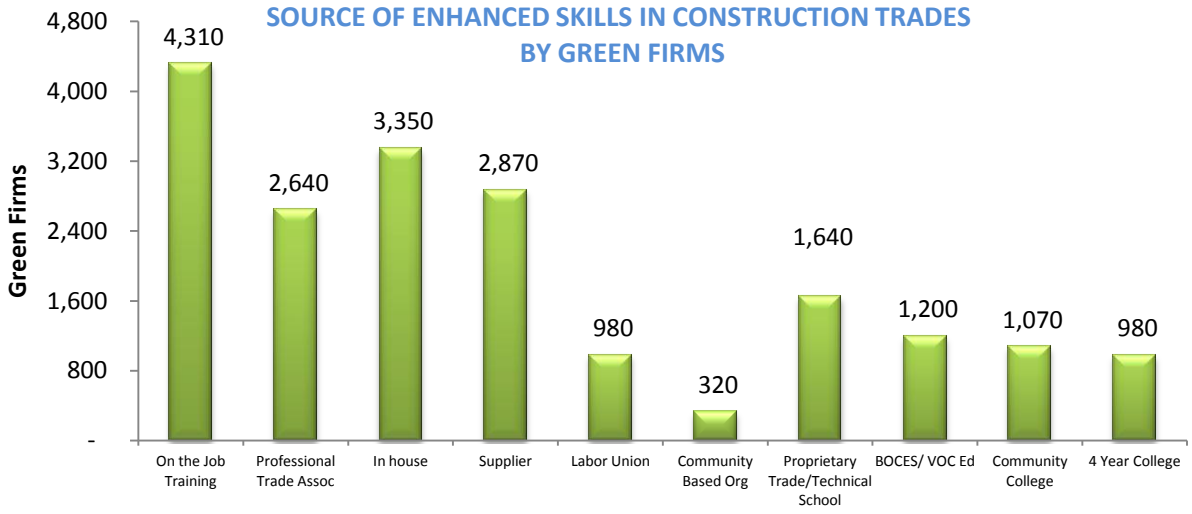
- Timeliness
- Loyalty
- Ambition
- Work ethic
- Integrity of character

They reported that their least effective employees are "the people that don't want to deal with change … the industry is constantly changing and if you don't adapt you get left behind."

Education and Training. As part of the statewide Employer Survey, firms were asked to indicate whether the occupations they indicated were "green" required enhanced skills, and if so, the source of training for these enhanced skills. As indicated in the chart below right, approximately 77 percent (5,660) of Green firms in Construction Trades indicated that their green occupations required enhanced skills.



The sources of enhanced skills can range from 'On-the-Job Training' to '4-Year College'. As shown in the bar graph below, the most common sources of training for enhanced skills are 'On-the-Job Training' (4,310) and 'In-house' (3,350). The least utilized sources are 'Community Based Organization' (320), 'Labor Union' (980), and '4-Year College' (980).



The focus group discussions reinforced and elaborated on the information collected in the survey:

- "A lot of it is OJT," and "It doesn't happen in a classroom – it's usually on-the-job training."
- People are trained by mentors or bosses. "They get out onto projects, cycle through different aspects of the business." One contractor said that, "the way to be trained is to be assigned next to an expert that is teaching day-by-day, step-by-step, until they get to that level. So they can start doing work themselves." A solar contractor said that "… people learn on the job and you have to have the right people supervising them and making sure everyone's safe. But this stuff isn't difficult, and if you find people with the right skills, they can easily transition."
- "There's not a lot of time for construction workers to go to training, so we bring training in-house if it's something they really need to know, such as safety. The whole training at night kind of stuff when you have a day job can be a real problem.**"**
- Training of electricians has changed – "they [the Electrical Workers unions] are incorporating training in solar photovoltaics, electrical vehicles, giving apprentices the chance to have hands on and play with it."
- "Roofers are just using different materials. We used to put gravel in, now we put pavers in and now we put a pedestal underneath so we can level it off … we are applying new technology, not creating it – we're installing it."
- "Unionized Trades are providing the training necessary. Unions have applied pressure to provide training for green initiatives. As the unions started to increase their awareness and demand they began to provide and generate LEED certified workers."
- "All of the big players in the industry have similar programs and also have commitment to education –tuition reimbursement or in-house training."
- There are a lot of "Lunch and learns" at smaller firms.
- "There are good training programs, accredited training programs, like NABCEP, but people need both – hands-on and NABCEP."
- Apprentice programs – combination of training and OJT.
- "There's a need to mix the type of training. Some people do well with web based on their own time. Some people thrive in an environment of a training room."
- "We rely on LEED training to some extent."
- "So there's a certain amount of retraining that generally happens with all of the trades. All our subcontractors – the ones that were not familiar with it, become familiar with it after they're told to do things over once or twice. They get the picture pretty quick." "Subcontractors really have been trained and they've taken what they've seen and it's really passing down."

Recommendations for Education and Training Providers. Focus group employers were asked what they would change about the way colleges, community colleges and training institutions are generally preparing students for the workforce. Their suggestions were:

- *Education and training need to be hands-on and practical*. Most employers agreed that getting people out into the field should be part of the curriculum. Both hands-on training and the opportunity to work in the field before course completion were seen as very important.
- *College internships and co-op programs* are very popular with employers. "Take college sophomores, juniors, bring them in for the summer (paid). It's a great opportunity to really put these young people to the test of what their capabilities are and then the best and the brightest of the interns will go back to college knowing that they have an opportunity to come to work for us upon graduation. It works out very well for both of us, particularly in a down market." Another praised the co-op program at Manhattan College and said," You just see such a

difference in these kids that have had real world application." A related suggestion was to have mentors for students.

- *Communication skills.* One employer said that "communication skills are a huge, huge, huge problem" and that in order to have teamwork, people must communicate well with each other. This issue was mentioned for both the non-college and college-educated populations. Education institutions should emphasize verbal and written communication on the job.
- *Soft skills are key*. In addition to communication skills, other soft skills mentioned were work ethic and willingness to learn. Employers want someone "who finishes a task and knows to go on to the next one, who doesn't stand around waiting for someone to tell them what to do next, that kind of self-starter mentality."
- *Combine technical training with sales skills*. Within training for solar occupations, there was praise for some training courses, for example, "There are great teachers, hands-on" but "you're not going to work if you can't sell the project. So sales could be another aspect of the training programs, you now, how to go out and sell a job."
- *Real world experience among the teaching staff in higher education*. This was felt to be critical – that educators have current real world knowledge, or as one employer said, "not academia since 1962."

Quality counts. One employer raised a concern about the "volume [of training] that's currently being done [related to weatherization]. There seems to be a mad rush to get people 'trained' to be green for whatever the capacity is.… I'm finding that the quality of their training isn't up to what I consider the value that it needs to be. And that gives me concern. Because we're doing work on people's houses, potentially we're talking about health and safety issues. We can do harm to these homes if we're not being careful how we're building and sending people to family buildings," and added "there needs to be some amount of experience that goes hand-in-hand with the traing."

CHAPTER 4: EMPLOYER DEMAND IN THE PROFESSIONAL SERVICES (EX-LEGAL SERVICES) CLUSTER

Highlights

- *Professional Services is one of the "greenest" industry clusters in New York State. Almost one-third of firms in this industry report having "green" employees.*
- *New York City has half of all green employment in the cluster, with 15,050 "green" employees out of 31,490 "green" employees statewide.*
- *The top "green" occupation is Architect, followed by Civil Engineer, Drafter, and Mechanical Engineer. Newer "green" occupations include Energy Auditor and Energy Engineer.*
- *Laws enacted and guidelines issued by New York State and City related to construction and building operations have also increased the demand for "green" professional services such as architecture, engineering and information systems.*
- *The demand for sustainable design has been driven over the last ten years by commercial customers, especially those involved in high-end Class A and B+ office space in New York City, who have been interested in building and retrofitting sustainably, usually with LEED certification.*[9]
- *More recently, demand for green design and engineering has come from colleges and universities, healthcare facilities and non-profit organizations, who all aspire to high levels of sustainability as part of their missions*
- *Nine in ten employers require enhanced skills for "green" jobs and 57 percent (74 percent in New York City) prefer that "green" employees have a Leadership in Energy and Environmental Design (LEED) credential.*
- *Employers want education and training institutions to offer more "hands-*on" practical *experience and more work-study and internship programs.*
- *Employers say that schools should emphasize teamwork and interpersonal skills more than they do now.*
- *Companies want schools to expose students to more interdisciplinary work, for example, between architects and engineers.*

Overview of the Industry Cluster

The professional services industry includes firms that specialize in performing professional, scientific, and technical activities for others. Human capital is the major input for these activities and requires a high degree of expertise and training. The establishments in this sector specialize according to expertise and provide these services to clients in a variety of industries and, in some cases, to households. They make available the knowledge and skills of their employees.

Activities performed include: accounting, bookkeeping, and payroll services; architectural, engineering, and specialized design services; computer services; consulting services; research services; advertising services; photographic services; translation and interpretation services; veterinary services; and other professional, scientific, and technical services.

Green services in this sector are focused in the architecture, engineering, management, scientific, and technical consulting services industry. Environmental consulting firms identify and evaluate environment problems and offer solutions. They may advise clients about controlling harmful emissions, cleaning up contaminated sites, establishing recycling programs, and complying with government environmental

[9] Commercial real estate practitioners determine Class A buildings based on prime location, full-service amenities, and other guidelinesand proceed to label other buildings relative to those results.

laws and regulations. Architect and engineers are involved in both the design of new construction projects and retrofits to existing buildings, including the design of electrical and heating/cooling systems. Engineering firms have been very involved in offering the energy audits and retro-commissioning plans required by the recent NYC Greener Greater Building Laws.

Also included in this industry, energy consultants may advise clients on how to reduce costs by utilizing energy-efficient machinery. Green chemists and chemical technicians are involved in the design, development, and implementation of chemical products and processes that reduce or eliminate substances hazardous to the environment.

Distribution of Firms and Employment. In the fourth Quarter of 2010, there were 14,416 firms in the professional services (ex-legal services) industry in New York State, employing 138,556 people. Thirty-five percent of the firms and 37 percent of the jobs are located in New York City, while another 31 percent of the firms and 27 percent of the jobs are located in the other downstate regions of Long Island and Hudson Valley.

DISTRIBUTION OF PROFESSIONAL SERVICES FIRMS AND EMPLOYMENT BY REGION

	Firms		Employment	
	Number	Share of NYS	Number	Share of NYS
New York State	14,416		138,556	
Capital / Mohawk Valley /North Country	1,100	8%	16,451	12%
Central/Southern Tier	710	5%	11,625	8%
Hudson Valley	1,922	13%	14,992	11%
Long Island	2,523	18%	21,542	16%
New York City	5,030	35%	50,794	37%
Region Not Classified*	1,790	12%	5,512	4%
Western NY/Finger Lakes	1,341	9%	17,639	13%

SOURCE | 4Q 2010, QCEW

**Note: Refers to firms that do not provide a specific location in New York State.*

Professional services comprises the largest share of private employment in the North Country (10%) followed by New York City (8%). It factors less prominently in the other regions of the state, with shares of six percent or less. There is a strong regional concentration of architecture, engineering and consulting jobs in New York City, and firms that are located in the City work on projects around the state and around the world. New York City is the headquarters of several top-50 design firms, and six of the top 50 green design firms (McGraw-Hill Construction).

In 2010, there were 14,509 firms in the professional services (ex-legal services) industry in New York State, employing 141,102 people. Roughly three-quarters of the firms in this industry are small businesses with five employees or less. Computer systems design services made up the largest group, with 5,251 separate firms, followed closely by administrative management and general management consulting services (4,817 firms) and custom computer programming services (4,798). These firms are generally smaller in size, averaging six employees by firm, and employ 93,254 people. The largest firm types by employment were offices of CPAs (42,323 employees), custom computer programming services (37,563 employees), and advertising agencies (36,597 employees).

While there are many small firms employing architects, engineers, and consultants, billings are dominated by a smaller number of large firms. In architecture, for example, the two percent of firms with 100 or more employees account for 36 percent of total billings (American Institute of Architects). Likewise, although there are 60,000 engineering services firms in the United States (including the engineering divisions of major construction companies), the 50 largest firms account for 35 percent of industry revenue (First Research). In the New York City region, there are 2,595 engineering services firms; those with over 100 employees make up 3 percent of the total number of firms but 36 percent of employees and 54 percent of total sales (C. Barnes and Co.).

DISTRIBUTION OF PROFESSIONAL SERVICE FIRMS (EX-LEGAL SERVICES) IN NEW YORK STATE

			Percent of total	
	Firms	**Employees**	**Firms**	**Employees**
ALL EMPLOYEES	14,509	141,102		
0-5 EMPLOYEES	11,062	16,323	76%	12%
6-10 EMPLOYEES	1,359	10,289	9%	7%
11-20 EMPLOYEES	958	13,844	7%	10%
21-50 EMPLOYEES	694	21,706	5%	15%
51-100 EMPLOYEES	243	17,357	2%	12%
101-250 EMPLOYEES	140	21,390	1%	15%
250+ EMPLOYEES	53	40,193	0%	28%

SOURCE | QCEW, 4Q 2010.

Industry Market Drivers. Architecture and engineering firms are typically hired by general contractors in the context of a construction or remodeling project. For this reason, demand for their services is tied to the cyclical factors affecting construction demand, and employment in the sector tends to suffer when investment in new construction declines, as it did in the early 1990's and again since 2008. (American Institute of Architects) (Dunlop). Consulting firms advise businesses on a wider range of practices, so demand for them is less tied to business cycle dynamics.

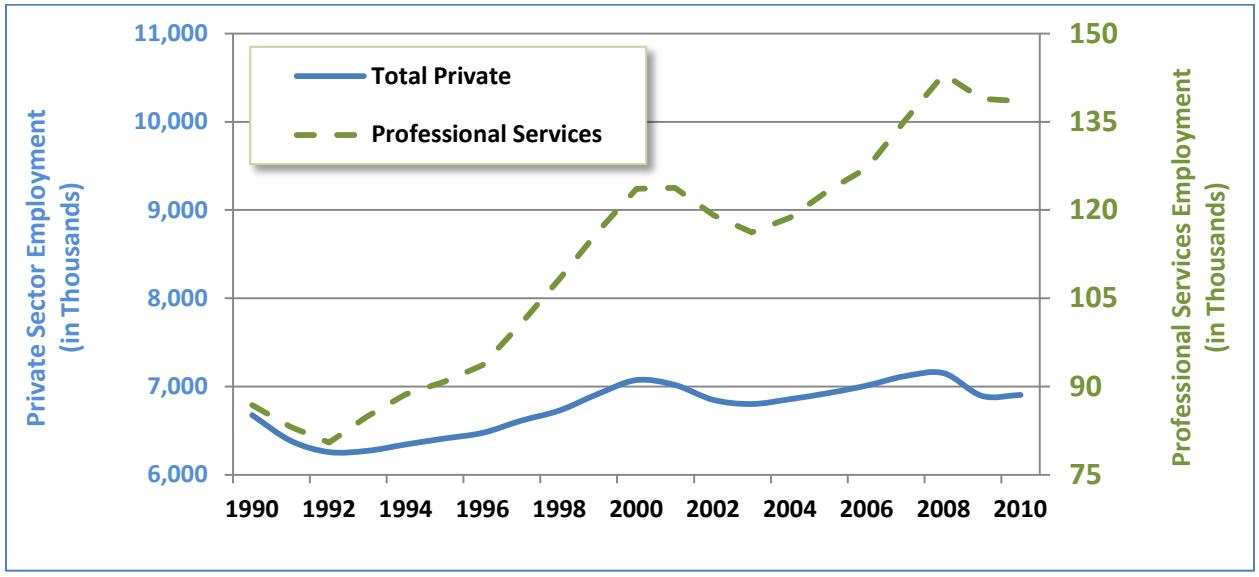
Architects are particularly important on non-residential construction projects. Architects design about 75 percent of such projects, and are involved in reviewing or approving a larger share beyond that. Because the architect is involved at the very beginning of a project, architectural billings are a leading indicator for the construction market: the architectural phase precedes the beginning of construction by around a year (Saltes).

Because demand for architects and engineers is tied to demand for construction, employment in the sector was strongly affected by the recent housing boom and the subsequent recession. Between 2005 and 2008, gross billings at architecture firms rose more than 50 percent, according to the American Institute of Architects. The industry then suffered due to the recession and the decline in construction, although declines in employment lagged declines in the construction sector. After peaking in 2008, payrolls at architecture firms declined by over 12 percent. Although residential activity increased dramatically during the housing boom, by 2008 it had declined substantially even as commercial and institutional activity increased. In 2008, institutional projects as a share of billings were at the highest level in 15 years. This share may have increased further since then, as government spending on infrastructure remains one of the major drivers of demand for construction. (American Institute of Architects).

The downturn in construction has been felt strongly. Many projects have been put on hold or stopped; new commissions have not been plentiful. Many architecture firms have downsized and new architects are not being hired as readily. (AIA)

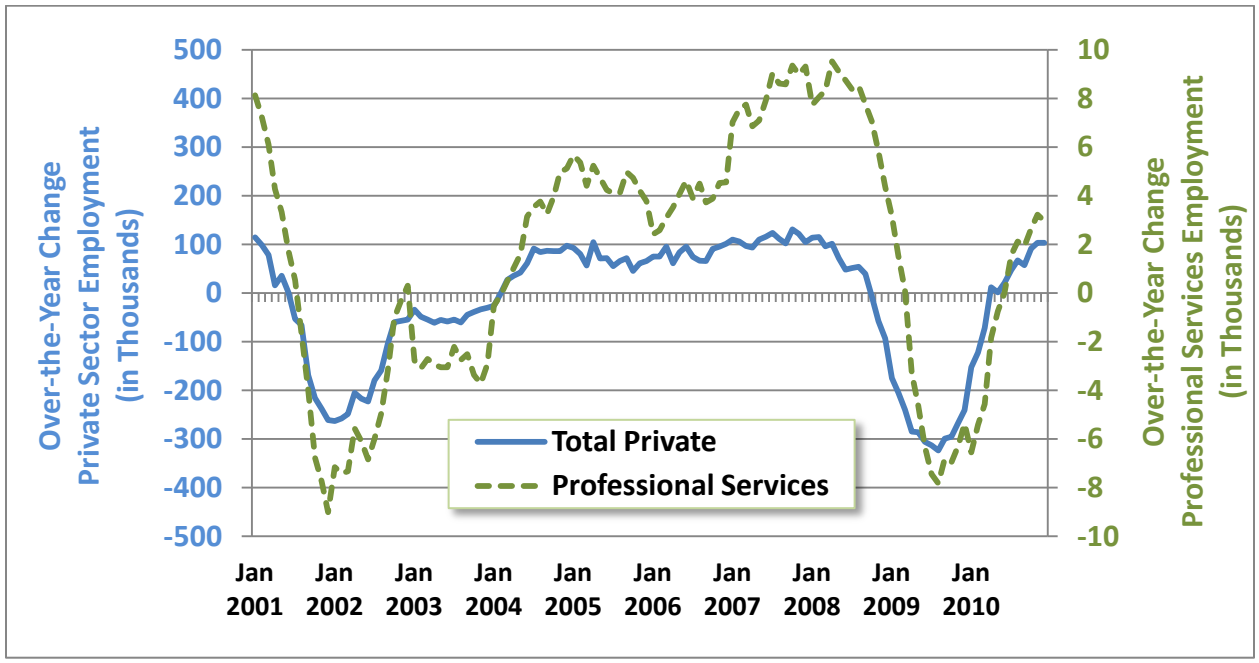
Recent Developments. As demonstrated in the charts below, employment in this sector is generally cyclical but has grown more quickly than private sector employment overall. During the most recent recession — and the prior two — there were significant declines in this sector's employment.

ANNUAL PAYROLLS IN NEW YORK STATE



SOURCE | QCEW 1990 to 2010 Annual Average Employment

YEAR-OVER-YEAR CHANGES IN MONTHLY PAYROLLS: TOTAL PRIVATE AND PROFESSIONAL SERVICES



SOURCE | QCEW Monthly Over-the-Year Change

Wages. The chart below lists – in descending order by educational requirement – the median annual wages in New York State and typical preparation needed for occupations in the professional services cluster. Note that this chart includes only occupations commonly found in the green economy, according to O*NET's *Greening of the World of Work.*[10]

WAGES AND TYPICAL PREPARATION FOR GREEN PROFESSIONAL SERVICES OCCUPATIONS

Occupation	Median Pay	Typical Preparation
Environmental Scientists and Specialists, Including Health (Climate Change Analysts, Environmental Restoration Planners, Industrial Ecologists)	$68,100	Master's degree
Social Scientists and Related Workers, All Other (Transportation. Planners)	$68,040	Master's degree
Advertising and Promotions Managers (Green Marketers)	$129,520	Bachelor's or higher degree, plus work experience
Engineering Managers	$124,290	Bachelor's or higher degree, plus work experience
Natural Sciences Managers	$116,220	Bachelor's or higher degree, plus work experience
Computer Software Engineers, Systems Software	$93,350	Bachelor's degree
Financial Analysts	$90,500	Bachelor's degree
Electrical Engineers	$80,440	Bachelor's degree
Architects, Except Landscape and Naval	$79,280	Bachelor's degree
Environmental Engineers	$78,580	Bachelor's degree
Civil Engineers	$76,920	Bachelor's degree
Mechanical Engineers (Fuel Cell Engineers)	$73,250	Bachelor's degree
Chemists	$70,580	Bachelor's degree
Business Operations Specialists, All Other (Energy Auditors, Sustainability Specialists)	$67,400	Bachelor's degree
Public Relations Specialists	$61,660	Bachelor's degree
Commercial and Industrial Designers	$58,190	Bachelor's degree
Life, Physical, and Social Science Technicians, All Other (Precision Agriculture Technicians)	$42,960	Bachelor's Degree
Chemical Technicians	$42,450	Associate degree
Production, Planning, and Expediting Clerks	$45,050	Moderate-term on-the-job training
Customer Service Representatives	$33,190	Moderate-term on-the-job training
Laborers and Freight and Material Movers, Hand	$24,460	Short-term on-the-job training
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products (Solar Sales Representatives and Assessors)	$79,320	Work experience in a related occupation
Sales Representatives, Services, All Other (Energy Brokers)	$61,340	Work experience in a related occupation
Construction and Building Inspectors	$53,230	Work experience in a related occupation

SOURCE | Occupational Employment Survey; O*NET Online

[10] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They

Employment Projections. Employment in the professional services cluster is projected to grow by 2.6 percent in New York State between the years of 2008 and 2018. This compares to growth of 0.5 percent in total nonagricultural wage and salary jobs.

Demographic Trends. The following chart displays the demographic characteristics of the professional services (ex-legal services) workforce from 2000 to 2007-2009.

DEMOGRAPHIC CHARACTERISTICS OF THE PROFESSIONAL SERVICES CLUSTER WORKFORCE

	New York State		New York City	
	2000	2007-09	2000	2007-09
Total Workforce	**137,895**	**163,340**	**71,951**	**88,025**
New York State/City Residents	121,276	144,542	48,832	60,942
Non-New York State/City Residents*	16,619	18,798	23,119	27,083
New York City	42%	44%	*na*	*na*
Long Island	16%	16%	*na*	*na*
Hudson Valley	13%	12%	*na*	*na*
Upstate	28%	27%	*na*	*na*
Bronx	*na*	*na*	6%	6%
Kings	*na*	*na*	24%	26%
New York	*na*	*na*	45%	46%
Queens	*na*	*na*	21%	17%
Richmond	*na*	*na*	5%	5%
Male	64%	64%	50%	53%
Female	36%	36%	50%	47%
White	79%	78%	65%	64%
Black	6%	6%	12%	11%
Hispanic	6%	7%	11%	13%
Asian	7%	8%	9%	10%
Other	2%	1%	3%	2%
Age 18-34	35%	31%	44%	38%
35-44	25%	22%	23%	24%
44-54	23%	26%	20%	21%
55+	16%	21%	13%	16%
Less than high school or GED	2%	1%	2%	2%
High school or GED	8%	7%	9%	8%
Some college	22%	19%	18%	14%
College or More	69%	73%	71%	76%

SOURCE | U.S. 2000 Decennial Census and 2007, 2008, and 2009 American Community Surveys public use microdata (PUMS) files. *The remaining counts that appear in the table are of people who both live *and* work in New York State and City, respectively.

New York State cluster employment grew by 18 percent to over 160,000 workers in 2007-2009; employment grew at an even faster pace in New York City, by 22 percent during the same time period. In 2007-2009, New York City represented more than half of the total cluster employment in the State. About two out of five professional services workers in New York City commuted in 2007-2009. That year, four out of five of the State's professional services workers lived within state borders.

In both years, females were better represented in the cluster in New York City than in the State as a whole, as were Black, Hispanic, and younger workers. A large majority of the workers held a four-year college degree and slightly more did so in 2007-2009 than in 2000.

Green Economic Activity

For the purposes of the focus groups, "green" economic activities in Professional Services were defined as those associated with energy efficiency and renewable energy, such as**:**

- consultation
- design
- production
- distribution
- construction
- installation
- assessment services

During focus group discussions, industry employers refined the concept of consultation to include energy management consulting and green building consulting, which included assisting clients to secure LEED or other green building certification. Employers also suggested that green economic activity in the industry includes evaluation, such as quality assurance and quality control, and marketing, construction management, planning, and commissioning. Commissioning generally means validating that building systems are functioning optimally according to design. Additional areas of professional services mentioned by focus group participants included project management, software development and research and development.

Architecture firms report that until recently, green design was being pioneered by a small number of firms that were early advocates of environmental responsibility in architecture. Today, however, green design has become more mainstream, especially as new laws and government initiatives create incentives for green design. According to industry experts, architectural services in New York City have moved quickly in the direction of sustainability. The first green skyscraper in New York City – 4 Times Square – was completed only 10 years ago. Since that time, the industry in New York and other major cities has "greened up significantly." In the last five years, almost all major commercial construction projects in New York City have been designed to be LEED-certified or to an equivalently sustainable standard.

How Green Firms Differ. Many professional services firms believe that they are sought after because of their particular expertise in green or sustainability and their access to people who are trained to design sustainable spaces.

Although sustainability may now be the norm for many architecture firms, some have more of a track record than others. Engineering and consulting firms believe that they have attributes that set them apart from others in the industry. They report that clients hire them because they have a different perspective – they look at buildings in a different way. Firms may also have sub-specializations within sustainable architecture and engineering. For example, some are experts in photovoltaics, others in computerized energy modeling, commissioning, project management or particular software, such as

high performance building management systems. In many cases, these firms are building on prior expertise garnered over a period of time. For example, engineering firms that previously specialized in heating, ventilation and air conditioning (HVAC) systems are more likely to specialize in energy efficient HVAC management systems.

The following are direct quotes from representatives of professional services firms on the topic of what sets them apart from other firms:

- "I think that part of our *modus operandi* is the sustainable term … we're carbon-neutral and we practice green, sustainable activities within the firm and within our parent firm. That promotes what we believe in and with virtually all of our clients…. One of the reasons they come to us is because of our sustainable expertise is a value-added. The corporate image now is to be green. So our firm provides consulting and design services to help our clients become greener and more sustainable."
- "We also try to be practical because it … should also make practical economic sense to provide the best value to the customer…. You need to look at what the capital budget is for the client and make sure that what you're promoting makes economic sense. But you also want to make sure that if they want to promote a new technology, that you have the expertise to design it and have it implemented."
- "I would say that most engineering firms in our business are familiar with the products and are familiar with energy conservation as a concept and practice it every day. I think the distinction that can be made is the expertise in-house to conduct special studies and evaluations…. Computerized energy modeling is a specialty. It takes a long time to train somebody to do that. Not all firms have that capability."
- "Commissioning is another thing that people offer, but to do it over a long term, you have to develop an expertise in it and you have to train people. I think the distinction between firms is a question of expertise. Having done something over and over again, it becomes not a unique service but something that you do every day."

Some focus group participants noted that some firms have been drawn into the sustainable building design field that have less than adequate experience in their fields. One business person went so far as to say that "garbage firms" and "schlockmeisters" have been attracted because of public funding and utility funding, and that these firms may sometimes "low-ball" their competitive bids. In general, however, it was felt that firms that already have the expertise are poised to take advantage of new, green professional service opportunities.

In addition to the laws, regulations and statutes driving the green economy discussed in the introduction to this report, experts and focus group participants cited the following supply and demand dynamics as distinct to green professional services:

- ***Market forces***. Over the last ten years, many commercial customers, especially those involved in high-end Class A and B+ office space in New York City, have been interested in building and retrofitting sustainably, usually with LEED certification. High-end Class A and B+ tenants appear to be demanding LEED-certified space, and building owners find they can charge a premium for rent for such spaces. However, the general economy and downturn in construction have slowed the pace of design activity in this portion of the industry.
- ***Demand from colleges and universities***. Many college and university presidents have signed a "climate commitment." Some have set the goal of "carbon neutrality" by 2030. This commitment is having an impact on all major new building projects. One firm that participated in a focus group

noted that it has many clients in the university and non-profit sectors that were interested in sustainability, and commented that the movement is in part student-driven.

- ***Demand from healthcare facilities***. Because hospitals and health centers are big energy and water users as well as waste producers, they stand to gain a great deal from sustainability. This sector is currently offering a major opportunity for energy savings and sustainable design. The nature of the healthcare industry influences its commitment to a healthier environment and lifestyle.
- ***Demand from non-profit organizations that aspire to high levels of sustainability as part of their missions***. An example of this is the Audubon Society, which redesigned and renovated its World Headquarters' rental space at 225 Varick Street in Manhattan. (National Audubon Society)
- ***Cost of energy***. Several industry experts reported that if and when the price of conventional fuel increases, there will be more incentive to save on energy costs. One said that "we may not be able to count on a passion for green, but we can count on the economics, on the payback of energy efficiency improvements."

In focus group discussions conducted as part of this research, many firms discussed how regulatory forces either have had or are expected to have an impact on demand for their services. In New York City, many felt that the new local law mandating benchmarking in large buildings 50,000 square feet and over would stimulate the green architecture and engineering industries.

An industry expert noted that incentives can "sweeten the pot" but are not "make or break." The same expert said that incentives sometimes require a fair amount of effort in the application process, and that organizations/companies sometimes use up a good portion of the value of the incentive in the time it takes to apply for them. . On a similar note, another focus group participant said that his firm helps clients "wade though" the complex requirements and procedures involved in obtaining public sector incentives.

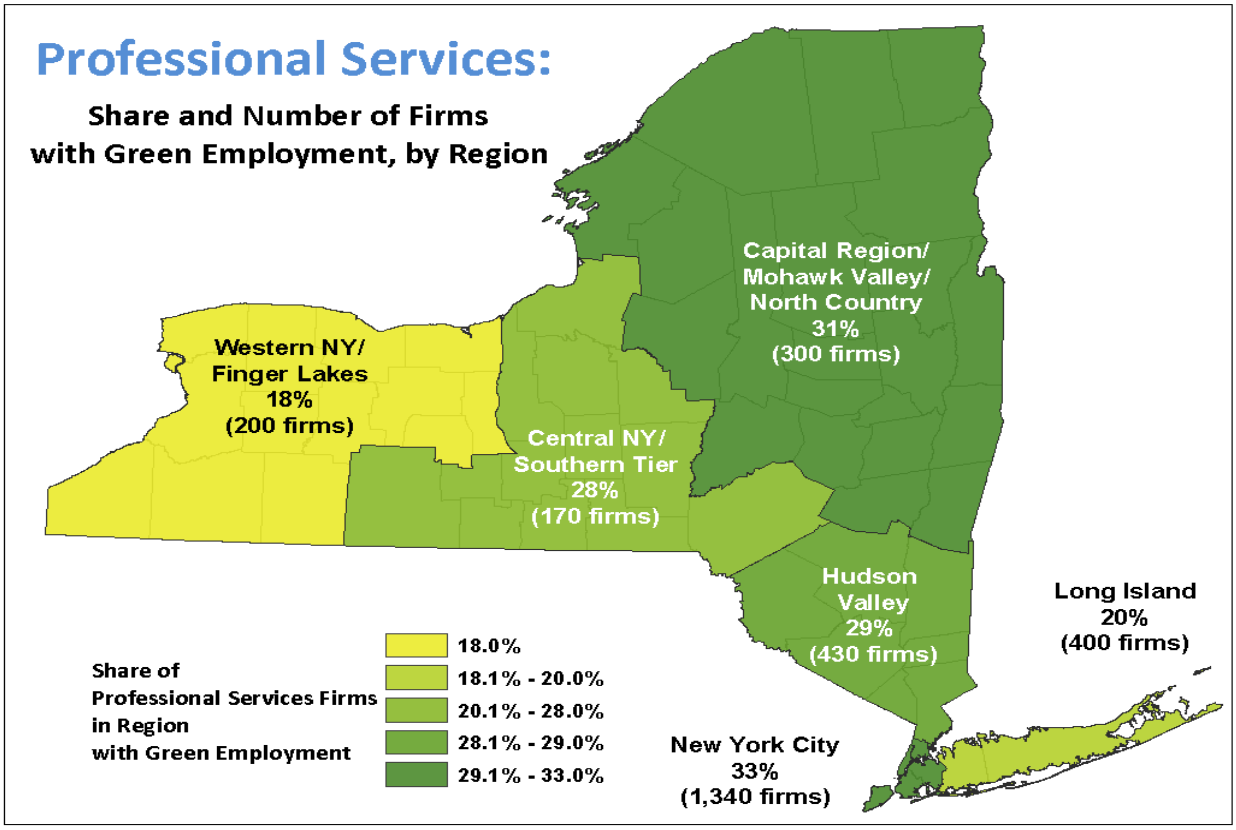
Green Employment in Professional Services

Firms and Employment: Survey Results

Statewide, 28 percent of firms in the professional services industry cluster report that they have one or more "green" employees. The map and chart below display the findings by region.

In professional services, firms in the five boroughs of New York City dominate the green labor market in New York State. One-third of all professional services firms in New York City have green employment – the highest regional share. Also, green New York City firms account for nearly half of all green firms in the industry cluster statewide.

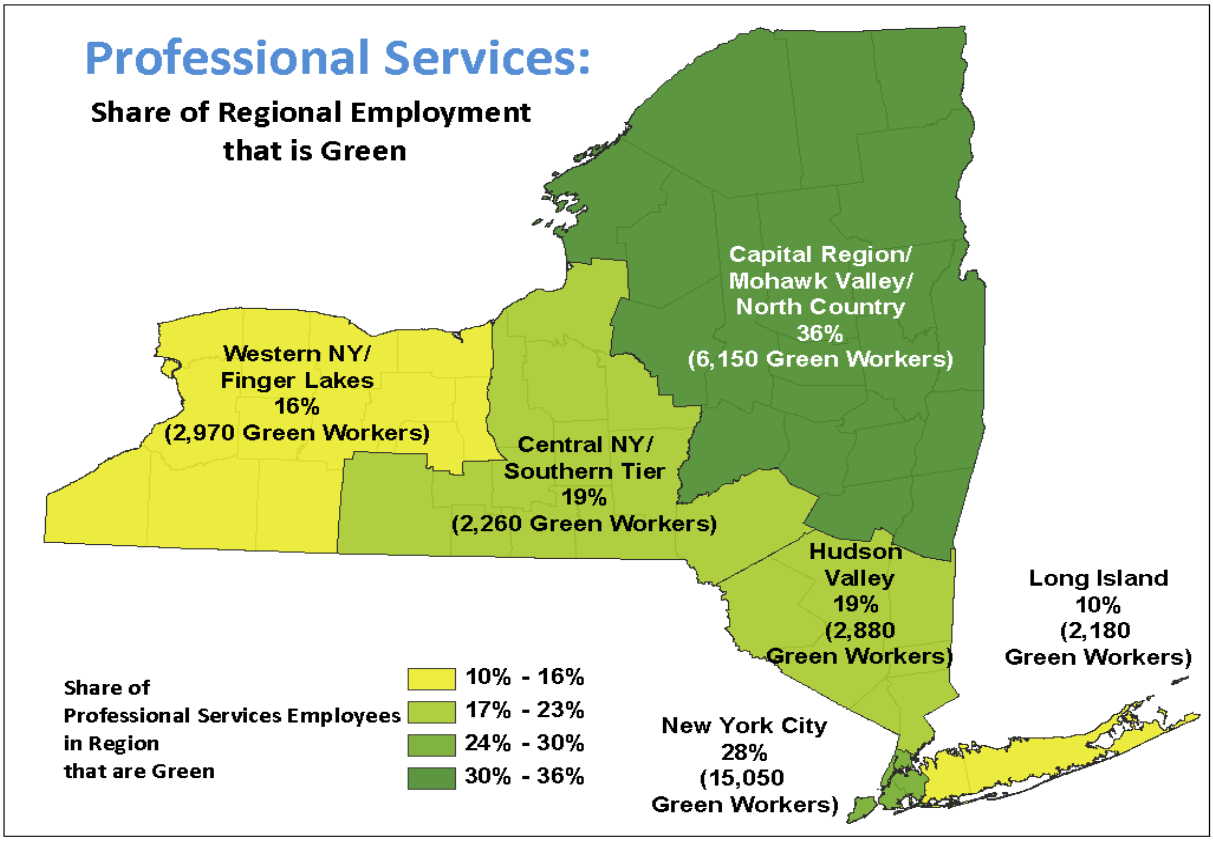
In regions outside New York City, there are fewer professional services firms with green employment but some regional shares are high. For instance, 300 green professional services firms are located in the Capital Region/Mohawk Valley/North County, and comprise 31percent of all professional services firms in the region.



Firms	New York State	New York City	Long Island	Hudson Valley	Capital Region/ Mohawk Valley/ North Country	Central NY/ Southern Tier	Western NY/ Finger Lakes
Number with Green Employees	2,840	1,340	400	430	300	170	200
Total Number in Cluster	10,300	4,080	2,060	1,510	950	610	1,100
Percent with Green Employees*	**28%**	**33%**	**20%**	**29%**	**31%**	**28%**	**18%**

In terms of the "green" share of total professional services employment in the state, survey results indicate that 23 percent of the total employment in the sector is "green."

As the chart below indicates, green employment in the professional services cluster is heavily concentrated in two regions. New York City has 15,500 green professional services workers – 28 percent of all workers in the cluster – and Capital region/Mohawk Valley/North Country has 6,150 – 36 percent of all workers in the region. Green professional services workers in these two regions combined account for over two-thirds of statewide green employment in the cluster.



	New York State	New York City	Capital Region/ Mohawk Valley/ North Country	Hudson Valley	Central NY/ Southern Tier	Long Island	Western NY/ Finger Lakes
Green Employment	31,490	15,050	6,150	2,880	2,260	2,180	2,970
Regional Employment	138,600	52,910	16,900	15,240	11,620	22,200	18,040
Percent Green*	**23%**	**28%**	**36%**	**19%**	**19%**	**10%**	**16%**

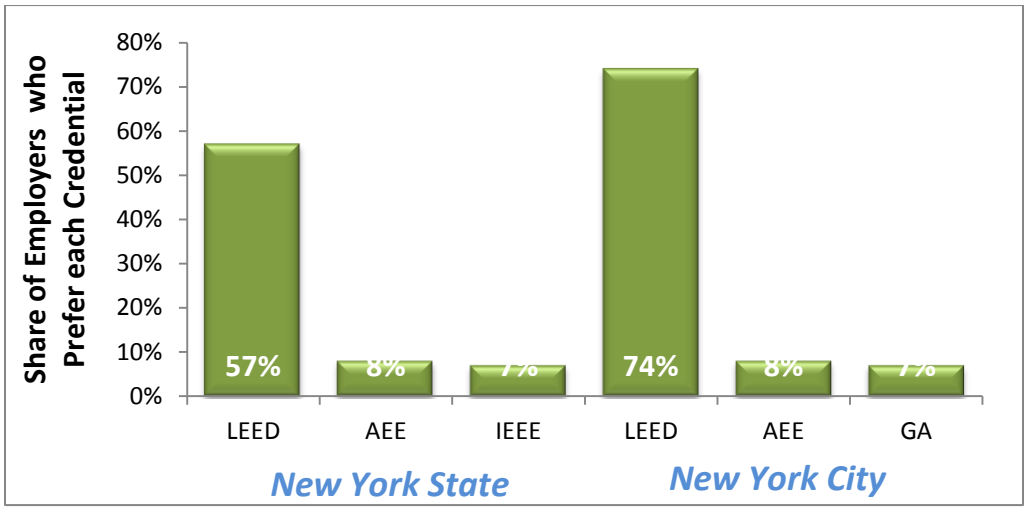
Firms with green employees were asked whether they expected their green employment to be larger, smaller or unchanged a year later. Of the 2,840 Professional Services firms with green employment, 83 percent expected their green employment to grow larger (38%) or remain unchanged (45%).
Firms without green employees were asked whether they expected to have green employment a year later. In answer to this question, 74 percent of the 74,600 without green employment said they did not expect any change, 4 percent expected to have green employees a year later, and 22 percent were not sure.

Composition of Green Workforce. The "green" economy, while sizable, exists within the larger economy, which is growing very slowly. Employment in the construction industry, in particular, has not yet recuperated from the recession, and this has affected the hiring of architects and some types of engineers. Industry experts report very little hiring of architects at present, and many architecture firms have reduced staff in the last few years.

In general, employers in the focus groups did not view their "green" workforce as separate from their regular workforce. Although many view a commitment to green or sustainability as an asset in hiring, most provide training on-the-job to make sure that employees have the green skills they need to perform effectively.

Employers were asked in the survey what if any green credentials they prefer their employees to have. As shown in the chart below, 57 percent of the employers with green employees in New York State – and 74 percent in New York City – preferred a Leadership in Energy and Environmental Design (LEED) credential, eight percent prefer an Association of Energy Engineers (AEE) credential, and seven percent prefer an Institute of Electrical and Electronics Engineers (IEEE) credential.

GREEN CREDENTIAL(S) PREFERRED BY EMPLOYERS



AEE	Association of Energy Engineers
GA	Green Advantage
IEEE	Institute of Electrical and Electronics Engineers
LEED	Leadership in Energy and Environmental Design

Expert interviews with architects and engineers indicated that LEED credentials are desirable because the firms work on LEED projects. As noted above, some engineering firms also prefer a Master's degree in Energy Management; others considered an energy degree a "plus," but not necessary. Some architecture firms hire individuals without the LEED credential but expect new employees to earn the credential within 6 months.

WHAT IS LEED?

Leadership in Energy and Environmental Design (LEED) is a certification system for green buildings. LEED is administered by the U.S. Green Building Council (USGBC), a non-profit trade association made up of over 18,500 member organizations from the building industry. LEED was introduced in 1998 and has been revised several times since then. The most recent version is LEED version 3, launched in 2009.

LEED offers both certification for buildings and credentials for individuals. For buildings, the LEED 2009 standard consists of many different certifications covering new construction, renovations, and building operations. In order to qualify for certification, a building must receive a certain number of points for improving performance in areas such as energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. Depending on the number of points received, there are four levels of certification: Certified, Silver, Gold, and Platinum.

Through the Green Building Certification Institute (GBCI), professionals can obtain LEED credentials. LEED courses provide training in design and construction, operations and maintenance, and neighborhood development.

SOURCE | www.usgbc.org

Occupational Information

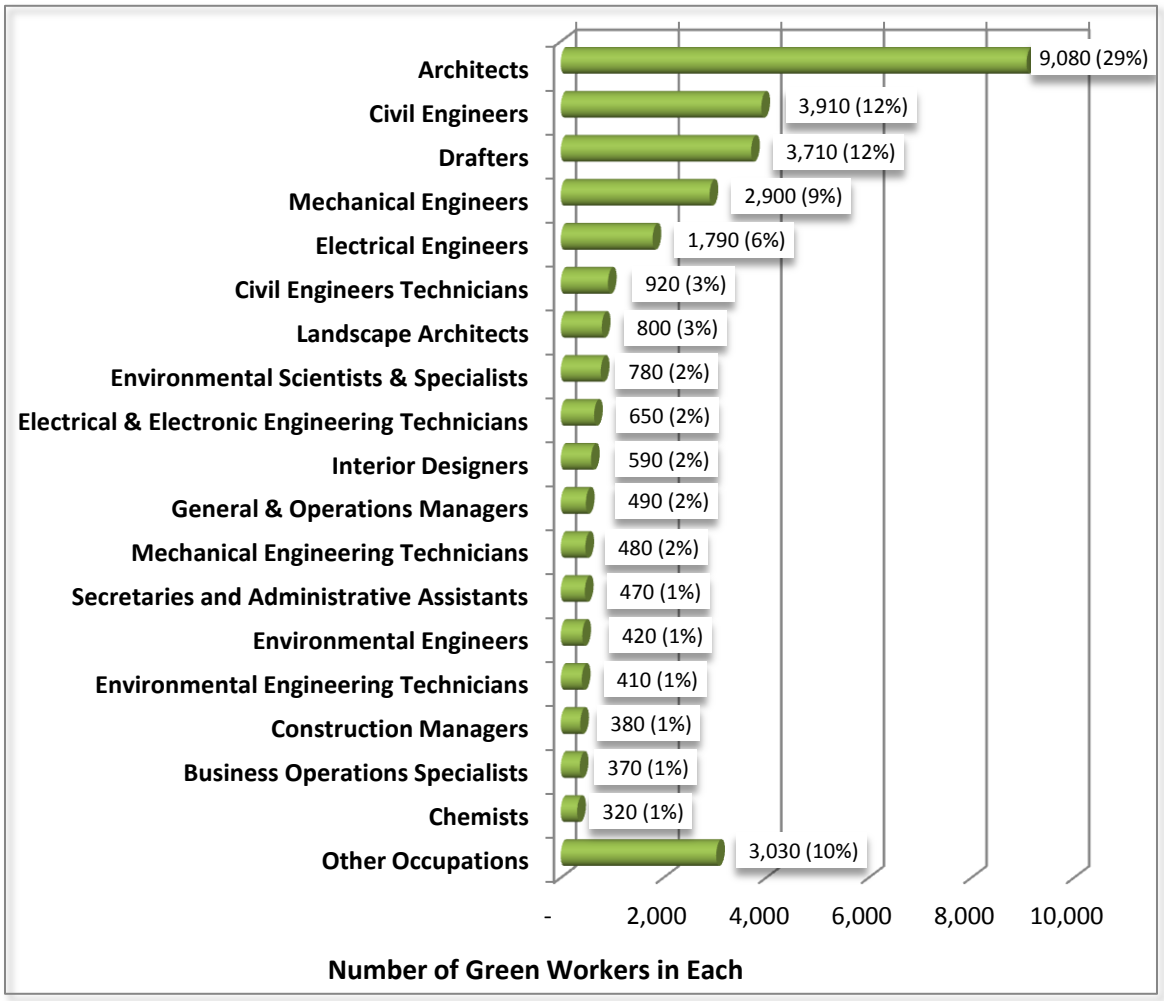
Key Occupations. As shown in the chart below, the statewide employer survey found that green employment in professional services is concentrated in a few occupations – Architects, Civil Engineers, Drafters, Mechanical Engineers and Electrical Engineers. Together, these five titles account for over two-thirds of the cluster's green employment. All of these occupations are involved in delivering energy efficiency products and services.

'Other Occupations' make up 10 percent of the cluster's green employment. 'Other Occupations' includes job titles with low green employment, such as Occupational Health and Safety Specialists, Commercial and Industrial Designers, and Urban and Regional Planners. By itself, each occupation comprises less than 1% of the cluster's total green employment.

The jobs mentioned most often by engineering firms represented in our focus groups were *energy engineer, design engineer, mechanical engineer, electrical engineer* and *operating enginee*r. One participant pointed out that most energy auditors are mechanical engineers. Interviews with architects mentioned both architects and mechanical engineers as critical to green design. In describing some of these jobs, focus group participants added:

- *Design engineers* need to have the expertise to design and implement energy saving building systems such as lighting systems, plumbing systems, electrical systems, and heating and cooling systems.
- *Energy engineers* look at the entire building—the envelope, the systems, the electrical systems, lighting systems and model the building – so they can evaluate independent energy conservation measures as well as looking at how they interact with each other. Focus group participants noted that a great deal of sophistication is needed and that it requires a substantial amount of training. These firms utilize computer-assisted energy modeling, but the right information must be inputted, because if it is not modeled correctly, "you'll get bad information." As one employer said, "These are specialists—I call them energy specialists."

GREEN OCCUPATIONS IN THE PROFESSIONAL SERVICES CLUSTER



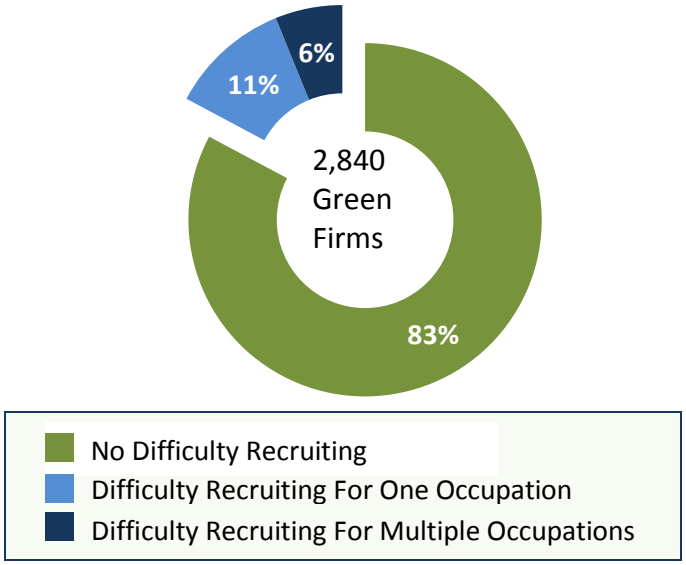
- Representatives of consulting firms mentioned the need for *financial analysts* who understand the relationship of energy to total energy cost.
- Some engineering firms design, manage and run energy efficiency programs and have a need for *program evaluators, measurement and verification professionals* and *inspectors.*
- Another skill shortage area often mentioned in the employer focus groups was *Heating, Ventilation and Air Conditioning* (HVAC), where companies reported that additional training is needed for HVAC technicians to "take them to the next (green) step."

New York City engineering firms, in particular, indicated that there are opportunities for less-skilled people in the energy audit business, but not in engineering tasks. Citing the huge local building stock, they believed that less skilled people, including returning service people, could carry out a circumscribed auditing regime.

The general feeling among industry experts and focus group participants was that people become more valuable with hands-one experience and that there is no substitute for this. Another observation was that people with commitment to sustainability and broad interest in the field are valued.

Recruitment, Retention and Turnover. As part of the employer survey, "green" firms were asked whether they have difficulty recruiting qualified workers. Of the 2,840 green firms in this cluster, 17 percent (490) had difficulty recruiting qualified green workers. Six had difficulty recruiting for more than one occupation.

PERCENT OF PROFESSIONAL SERVICES FIRMS WITH RECRUITING DIFFICULTIES



The occupation that employers have the most difficulty finding qualified employees is chemist, where 53 percent of firms report this issue. The second most frequent occupation with recruiting difficulties was Business Operations Specialist, which is the O*NET title that includes Energy Auditor. Occupational recruiting difficulties varied by region, however. The three most difficult to recruit occupations in each region were as follows:

- Capital Region/Mohawk Valley/North Country: Computer Programmers, Application Software Developers, and Chemical Engineers
- Central New York/Southern Tier: Architects, Civil Engineers, and Electrical Engineers
- Hudson Valley: Architects, Electrical Engineers and Mechanical Engineers
- Long Island: Chemists, Chemical Technicians (no other occupation cited)
- New York City: General and Operations Managers, Architects, and Civil Engineers
- Western New York/Finger Lakes: Construction Managers, Architects, and Civil Engineers

Focus group participants from engineering firms said they had difficulty both recruiting and retaining engineers in general. Several suggested that more marketing and outreach is needed to make this field attractive. Some felt that the pay may not be competitive enough to attract the qualified candidates to engineering work.

One downstate employer mentioned that geography is key, and that Long Island firms have a harder time finding and retaining engineers than do those in Manhattan. Some suggested that higher salaries are needed because of the high cost of living in the New York City metropolitan area. One person believed that engineering salaries would increase in the near term, citing the shortage of talent in the field.

According to our focus group participants, because engineering is lower-paid than other occupations that require similar education and skills, many people leave to enter higher paying fields such as financial services. There was general agreement that turnover is high in engineering.

Although not typically considered a professional service occupation, focus group employers cited a shortage of Operating Engineers. They said that many existing operating engineers are older and that it is hard to "change old-timers' minds about new ways of doing things." Some said that there are "no young people coming into this field." Also, it was felt that some of the new technology is too complex for the older workforce, drawing an analogy to auto mechanics that needed to learn how to work with computerized equipment when automotive technology changed. Operating engineers play key roles in both commissioning and retro-commissioning buildings. Employers suggested that there should be courses to improve the skill sets of existing Operating Engineers.

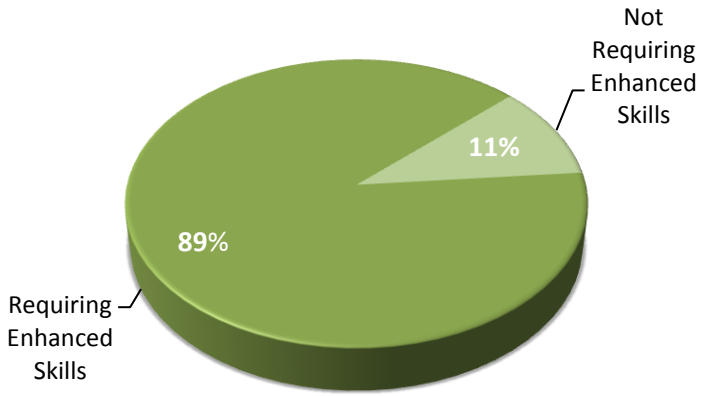
The major sources of recruitment reported by employers in focus groups and interviews were referrals from people within the company and word of mouth, hiring directly from colleges, and online job boards, such as Monster. Among these sources, however, job boards were seen as the least useful.

In New York City, some engineering firms reported recruiting employees from City agencies. In fact, one focus group participant had previously worked for the City. In addition, some large non-profit organizations involved in energy efficiency and weatherization employ similar types of employees to engineering firms that specialize in these same areas.

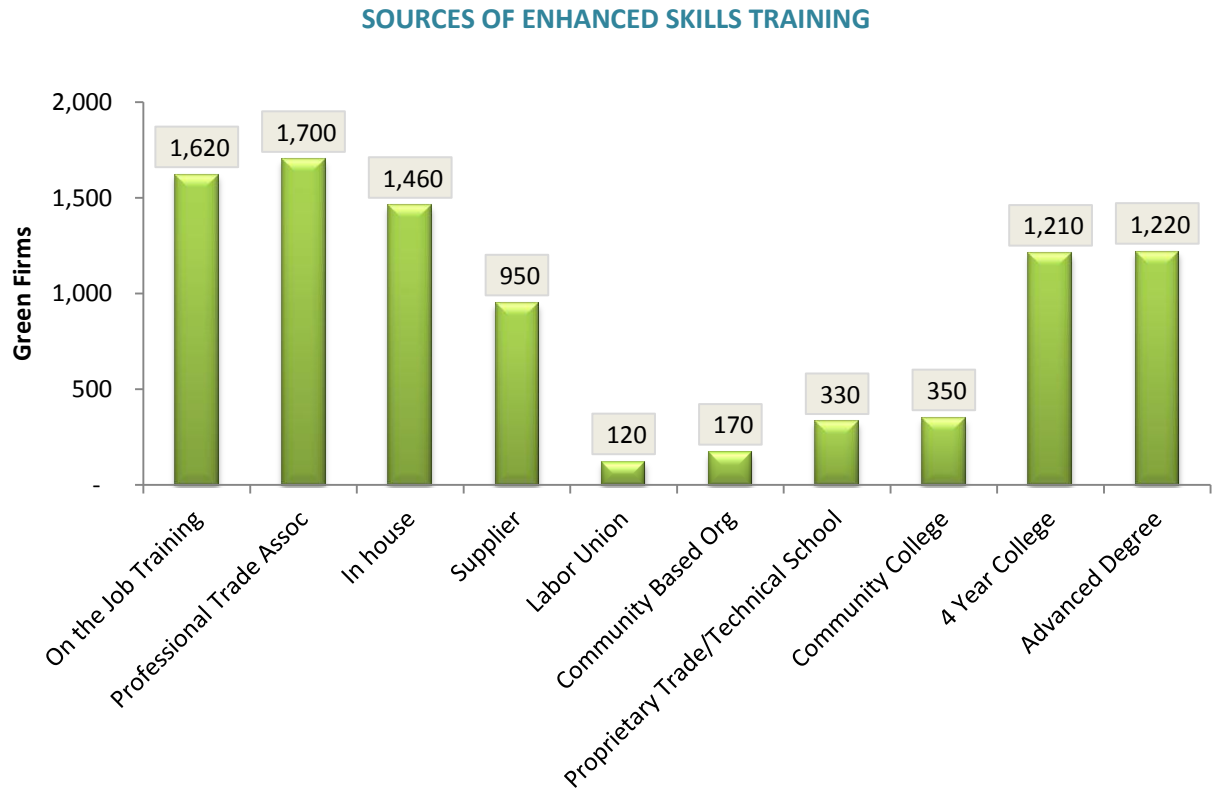
Colleges mentioned as sources of recruitment included Manhattan College, SUNY schools, Penn State, Rochester Institute of Technology, Northeastern, Rutgers, Columbia, New York Institute of Technology, Stevens Institute of Technology, Massachusetts Institute of Technology, and New York University. There was general agreement that schools that offered degrees in both Architecture and Engineering were ideal. They indicated that the reputation of the school was not as important to them as the degree itself. They also emphasized – as did employers in other industries included in this study – that they value co-op and internship programs operated in partnership with colleges and universities. Focus group participants said that their criteria for hiring includes motivation, hard work, "smarts," commitment, capacity and willingness to learn, and imagination.

Educational Preparation. Employers were asked in our statewide survey how many of their employees required new skills to be able to perform their work in a green economy, and of those that required skills, where they were acquired. A strong majority, almost nine out of 10 green employers in the cluster required employees to have enhanced skills to produce green products or services.

PERCENTAGE OF EMPLOYERS REQUIRING ENHANCED SKILLS FOR GREEN WORKERS



As the chart below shows, sources of enhanced skills used by an employee ranged from the most informal ('On-the-Job Training') to the most rigorous and formal, an 'Advanced Degree'. The most common sources were 'Professional Trade Association' – most likely LEED accreditation from the United States Green Business Council, discussed in greater detail above – and 'On-the-Job Training.' The least utilized sources of enhanced skills training were 'Labor Union' (120) and 'Community Based Organization' (170).



Employers that took part in focus groups reported that most training for green "enhanced" skills is on-the-job, with senior people teaching junior people. According to them, college graduates come prepared with the "basics," but they need to learn "nuances" to be of key value to the firms.

A key finding of the focus groups is that employers would like help with the cost of training people in new skills. Firms indicated that training can be a huge burden, as it takes time to train junior people who may take their new skills with them to earn more in another firm or another industry altogether.

Specific training needed included energy modeling for energy specialists and LEED EB training in commissioning for Operating Engineers. A number of employers are having trouble finding qualified individuals for energy modeling, and believe that courses in energy modeling should be created by schools.

Commissioning is not easily trained, however, as it requires extensive experience usually gained over a long period of time. Employers added that there is also a special type of training in commissioning or retro-commissioning for LEED, existing buildings. As one focus group participant explained, "The building management system is much more sophisticated. So you need to have the ability to look at operating the systems as efficiently as possible, training the operating engineers who are going to take over the systems."

One focus group participant mentioned that there are energy efficiency programs overseas, but that in the U.S., there are no programs for energy efficiency and that they are needed, especially at the undergraduate level.

Recommendations for Education and Training Providers. Focus group employers were asked what they would change about the way colleges, community colleges and training institutions are preparing students for the workforce. Their suggestions were:

- *Offer specific courses* in such topics as cogeneration, photovoltaic, geothermal, energy efficiency
- *Offer more hands-on practical experience* and more work-study or internship programs
- *"Green" needs to be woven into standard engineering courses*, e.g. energy auditors should be trained to do field surveys; mechanical engineers should be taught computer energy modeling. Need to teach energy efficiency to undergraduates.
- *Schools should emphasize teamwork and interpersonal skills more than they do*. Several employers noted that technical people need to be able to "sell" additional services and products, and need to be tuned into their customers when they are performing work. Also, teamwork is needed to get LEED certification, because professionals from different disciplines must work together.
- *Schools should expose students to more interdisciplinary work, especially between architects and engineers*. No longer are architects responsible for the way things look and engineers for the way they work. Both disciplines need to work together and understand each other's disciplines. Both architecture and engineering firms said that there is a need for greater integration between the two professions. Both believe that having an integrated design is critical. Architects are focused on the environmental level; engineers on the technical level, but everything is interwoven. The key is to have people who are "integrators," who can translate performance requirements into design solutions.

CHAPTER 5: EMPLOYER DEMAND IN THE BUILDING SERVICES CLUSTER

Highlights

- *The Building Services cluster has a substantial amount of "green" employment. A total of 65,770 or almost one-third of employees in this cluster are considered "green" by their employers.*
- *Fifty-eight percent of the state's green labor force is in New York City; 14 percent is on Long Island.*
- *The industry's greening trend is most pronounced in high-end commercial office buildings and very large residential buildings, where tenants increasingly demand sustainable and efficient spaces. There has been rapid growth in the use of advanced Building Management Systems (BMS) or Energy Management Systems (EMS).*
- *Increasingly, businesses are recognizing the importance of integrating sustainability into their normal operating practices as a means of decreasing operating costs and protecting the environment. The owners of large buildings recognize the long-term cost savings possible with high-tech systems, and are therefore willing to invest in large-scale automation of heating, cooling, lighting, and other buildings systems.*
- *The most common occupation with "green" employment is Janitors and Cleaners, who are responsible for green cleaning and recycling. The other common occupations in this industry cluster are: First-Line Supervisors of Building and Grounds Cleaning and Maintenance Workers, Maintenance and Repair Workers, General and Operations Managers, Stationary Engineers and Boiler Operators, Landscaping and Groundskeeping Workers and Property, Real Estate and Community Association Managers.*
- *Industry employers report that some of their most critical "green" employees are Operating Engineers (the common title for Stationary Engineers and Boiler Operators in New York City) and professionals in new energy and sustainable services departments. These professionals might include engineers and architects as well as people who procure energy and those who handle retro-commissioning.*
- *Employers want education and training institutions to offer more "nuts and bolts" practical experience, including more mentoring, co-op and internship programs.*
- *Employers, especially in New York City, would like more attention paid by higher education institutions to career paths in the real estate/building operations industry.*
- *Companies would like a way to share information about what techniques and products work well, and would like case studies about how different "shops" within companies work together to achieve energy efficiency*.

Overview of the Industry Cluster

The "built environment" is a term that suggests the man-made surroundings that provide the setting for human activity, ranging from personal shelter to neighborhoods to office buildings to large-scale civic surroundings. By this definition, many parts of New York State, but especially New York City, is predominantly a built environment. As noted in PlaNYC 2030, New York City's plan for the sustainable future, "Buildings dominate New York City's carbon footprint. Approximately 75 percent of New York City's carbon emissions stem from energy used in buildings, and today's existing buildings will make up 85 percent of all real estate in 2030" (PlANYC).

The building services sector examined in this research includes major portions of the State's real estate industry -- firms and workers involved in leasing, managing, and maintaining both residential and

commercial properties. It includes both owners who lease and manage their own buildings as well as firms that manage buildings for others. Building services firms handle everything from leasing buildings to tenants, to providing day-to-day upkeep of buildings, to providing building security. It also includes services provided to buildings, such as janitorial, landscaping, pest control, and waste disposal. Some buildings employ workers directly; others hire maintenance contractors.

Green services in this sector are focused on activities that help buildings and facilities achieve greater energy efficiency, utilize new energy technologies, reduce waste or achieve other environmental sustainability goals.

Distribution of Firms and Employment. In the fourth Quarter of 2010, there were 27,552 firms in the Building Services industry cluster in New York State, employing 194,691 people. New York City dominates this cluster, with 62 percent of the firms and 64 percent of the jobs.

DISTRIBUTION OF BUILDING SERVICES FIRMS AND EMPLOYMENT BY REGION

	Firms		Employment	
	Number	Share of NYS	Number	Share of NYS
New York State	27,552		194,691	
Capital / Mohawk Valley /North Country	1,319	5%	8,511	4%
Central/Southern Tier	964	3%	6,875	4%
Hudson Valley	3,015	11%	16,633	9%
Long Island	3,094	11%	20,137	10%
New York City	17,207	62%	124,791	64%
Region Not Classified*	326	1%	4,174	2%
Western NY/Finger Lakes	1,846	7%	14,122	7%

SOURCE | 4Q 2010, QCEW

**Note: Refers to firms that do not provide a specific location in New York State.*

Within New York City, slightly more than 25 percent of the Building Services workforce resides in each of the boroughs of Queens, Manhattan and Brooklyn, 17 percent reside in the Bronx and 5 percent in Staten Island. (Source: U.S. 2000 Decennial Census and 2007, 2008, and 2009 American Community Surveys public use microdata (PUMS) files.)

Building Services represents 2.8 percent of all employment statewide. As shown in the chart below, the share of area employment is highest in New York City (4.1%) and lowest in the upstate areas.

CONCENTRATION OF BUILDING SERVICES EMPLOYMENT BY REGION

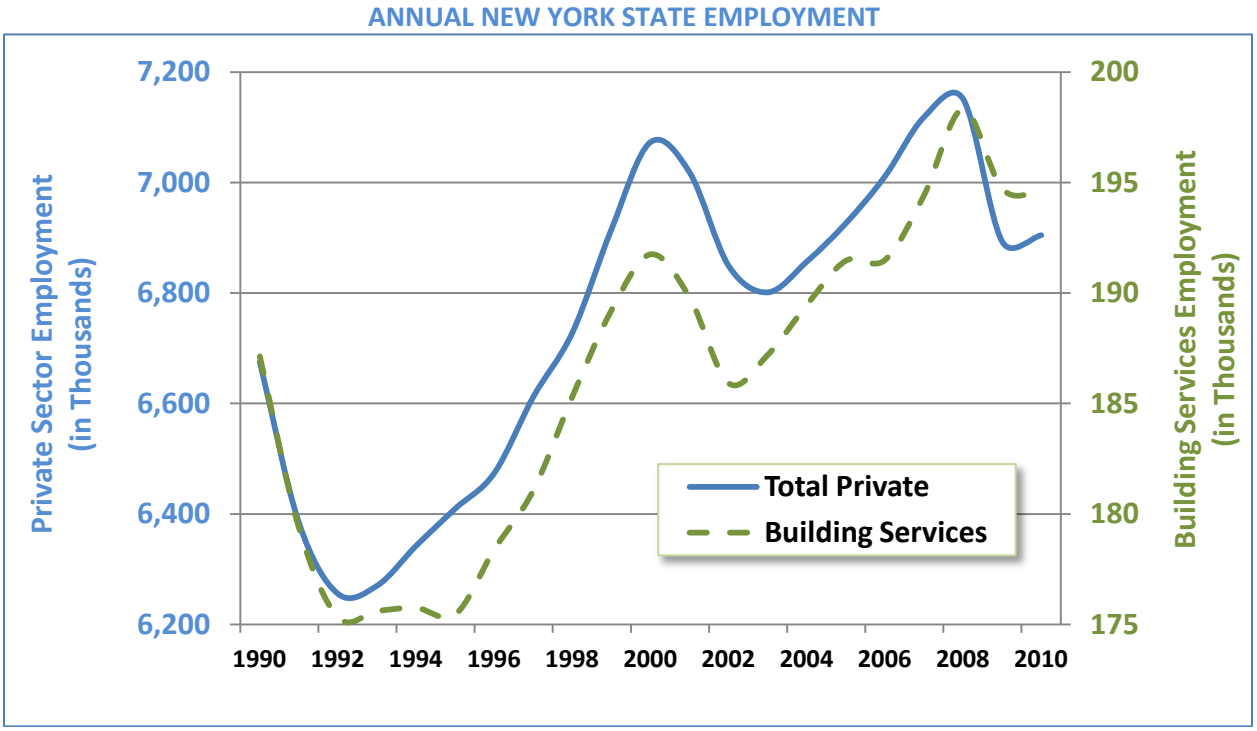
New York State Region	% of Total Employment
Capital/Mohawk/North	1.4%
Central/Southern Tier	1.4%
Hudson Valley	2.4%
Long Island	2.0%
New York City	4.1%
Western/Finger Lakes	1.5%

SOURCE | 4Q 2010, QCEW

Lessors of residential buildings made up the largest group of companies, with 13,740 separate firms, or nearly half of the total, which employed 63,595 people (one-third of total employees), or more than any other type of business in this cluster. This category includes operators of residential buildings, including apartment buildings, retirement housing and other types of housing. These firms average less than five employees each. Janitorial service companies are also a major source of employment, and tend to be larger, with an average employment of 20 per firm and total employment of 58,765, or 30 percent of the total. There is also significant employment with operators of commercial buildings and with residential property management firms. These firms typically contract with building owners or managers. Within New York City, the greatest concentration of building services employment is in Manhattan.

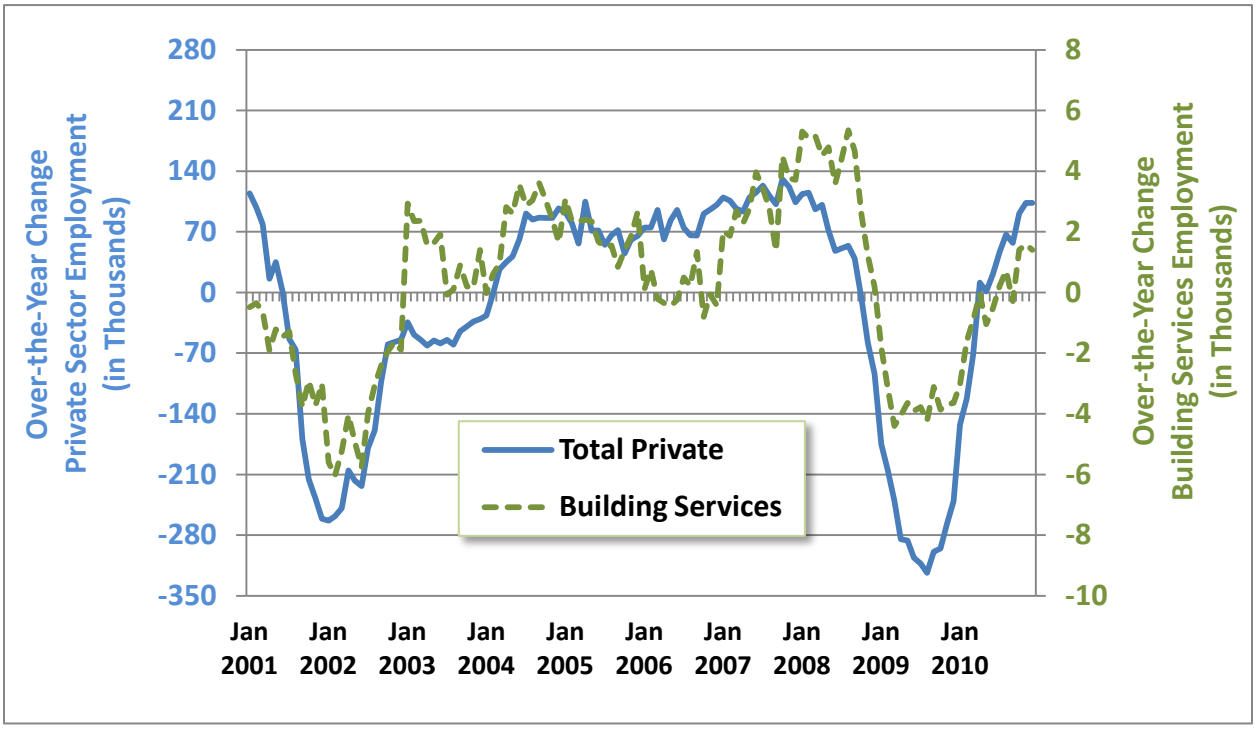
Industry Market Drivers. Since much of the work in building services is related to managing and maintaining rental properties, demand in the sector tends to fluctuate less than the economy overall. However, there is some responsiveness to the economy: changes in rental vacancy rates and in the volume of new construction - both effects of economy downturns – also tend to affect the demand for building services. With the downturn in the real estate market over the last two or three years, and the tightness of credit, financing for energy efficiency still represents a barrier for building owners seeking to retrofit their properties – especially in the residential sector.

Recent Developments. As demonstrated in the charts on the next page, employment in this sector is generally cyclical. During the most recent recession, employment in this sector performed better than the average for private sector employment.



SOURCE | QCEW 1990 to 2010 Annual Average Employment

YEAR-OVER-YEAR CHANGES: TOTAL PRIVATE AND PROFESSIONAL SERVICES



SOURCE | QCEW Monthly Over-the-Year Change

Wages. The chart below lists – in descending order by educational requirement – the median annual wages in New York State and typical preparation needed for occupations in the Building Services cluster. Note that this chart includes only occupations commonly found in the green economy, according to O*NET's *Greening of the World of Work*[11] and jobs mentioned by employers in response to the green jobs employer survey conducted in late 2010-early 2011.

WAGES AND TYPICAL PREPARATION FOR GREEN BUILDING SERVICES OCCUPATIONS

Occupation	Median Pay	Typical Preparation
General and Operations Managers	$116,950	Bachelor's or higher degree, plus work experience
Accountants and Auditors	$76,110	Bachelor's degree
Property, Real Estate, and Community Association Managers	$79,420	Bachelor's degree
Appraisers and Assessors of Real Estate	$57,960	Associate degree
Real Estate Sales Agents	$57,550	Postsecondary vocational award
Stationary Engineers and Boiler Operators	$58,690	Long-term on-the-job training
Installation, Maintenance, and Repair Workers, All Other	$39,720	Moderate-term on-the-job training
Maintenance and Repair Workers, General	$39,510	Moderate-term on-the-job training
First-Line Supervisors of Building and Grounds	$47,230	Work experience in a related

[11] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They

Occupation	Median Pay	Typical Preparation
Cleaning and Maintenance Workers		occupation
First-Line Supervisors of Mechanics, Installers, and Repairers	$69,430	Work experience in a related occupation
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	$27,250	Short-term on-the-job training
Landscaping and Groundskeeping Workers	$27,040	Short-term on-the-job training

SOURCE | Occupational Employment Survey; O*NET Online

The industry includes employment in many different types of occupations, from low-skilled jobs, such as janitors and cleaners, to technical jobs, such as stationary engineers (called operating engineers in New York City), to professional jobs, such as property managers, as well as highly skilled jobs in energy management. Building services is an important source of employment for workers with limited English, particularly in janitorial jobs. Over half of the building services workers in New York City is unionized, and pay and benefits in this sector are high relative to workers of similar educational levels in other industries. SEIU Local 32BJ, which represents employees in many residential and some commercial buildings, has 80,000 members in New York City. Local 94 of the International Union of Operating Engineers represents more than 5,800 employees, primarily in commercial buildings.

Employment Projections. Employment in the Building Services cluster is projected to increase by 0.2 percent in New York State between 2008 and 2018. This compares to growth of 0.5 percent in total nonagricultural wage and salary jobs.

Demographic Trends. The following chart displays the demographic characteristics of the Building Services workforce from 2000 to 2007-2009. The New York State Building Services workforce grew by almost 30 percent to almost 200,000 workers in 2007-2009; employment grew at a slightly faster pace in New York City during the same time period. The workforce is ethnically diverse, especially in New York City, and most workers are male. The workforce appears to be aging, as 60 percent are 45 years of age or older and almost 30 percent are 55 or older. Although this is still an industry where many people have a high school diploma or less, the educational attainment of the industry's workforce increased between 2000 and 2009. The vast majority of those who work in this industry cluster in New York State (95%) live in the state. More than 80 percent of those who work in the sector in New York City live in the City.

DEMOGRAPHIC CHARACTERISTICS OF THE BUILDING SERVICES CLUSTER WORKFORCE

	New York State		New York City	
	2000	2007-09	2000	2007-09
Total Workforce	**154,654**	**199,133**	**96,409**	**127,159**
New York State/City Residents	147,284	188,152	79,521	105,164
Non-New York State/City Residents*	7,370	10,981	16,888	21,995
New York City	56%	58%	*na*	*na*
Long Island	14%	14%	*na*	*na*
Hudson Valley	12%	12%	*na*	*na*
Upstate	18%	77%	*na*	*na*
Bronx	*na*	*na*	17%	17%
Kings	*na*	*na*	26%	25%

	New York State		New York City	
	2000	2007-09	2000	2007-09
New York	*na*	*na*	28%	26%
Queens	*na*	*na*	25%	26%
Richmond	*na*	*na*	5%	5%
Male	61%	62%	68%	68%
Female	39%	38%	32%	32%
White	62%	58%	44%	42%
Black	13%	13%	19%	17%
Hispanic	19%	21%	29%	31%
Asian	4%	6%	5%	8%
Other	2%	2%	3%	2%
Age 18-34	23%	20%	25%	22%
35-44	25%	21%	24%	22%
45-54	28%	31%	28%	31%
55+	25%	29%	23%	26%
Less than high school or GED	16%	11%	22%	15%
High school or GED	25%	27%	26%	29%
Some college	29%	28%	26%	24%
College or More	29%	34%	26%	33%

SOURCE | U.S. 2000 Decennial Census and 2007, 2008, and 2009 American Community Surveys public use microdata (PUMS) files.

*The remaining counts that appear in the table are of people who both live *and* work in New York State and City, respectively.

Green Economic Activity

For the purposes of the focus groups, "green" economic activity in Building Services was defined to include activities that help buildings and facilities achieve greater energy efficiency, utilize new energy technologies, reduce waste or achieve other environmental sustainability goals. These include:

- Operations, such as meter reading/reporting, performance monitoring/optimization, retro-commissioning, and utilization of energy efficient new technologies
- Maintenance, such as maintaining renewable energy systems, green roofs/landscaping and indoor air quality
- Other green activities, such as green cleaning and recycling

Companies involved in Building Services report that there is a greening trend throughout the industry. Increasingly, businesses are recognizing the importance of integrating sustainability into their normal operating practices as a means of decreasing operating costs and protecting the environment. This is most pronounced in high-end (i.e., Class A[12]) commercial office buildings and very large residential

[12] Commercial real estate practitioners determine Class A+/A buildings based on prime location, full-service amenities, and other guidelines and label other buildings relative to those results.

buildings. Office tenants increasingly demand sustainable and efficient spaces. The owners of large buildings recognize the long-term cost savings possible with high-tech systems, and are therefore willing to invest in large-scale automation of heating, cooling, lighting, and other buildings systems. Firms that manage smaller buildings, such as residential buildings of fewer than 150 units, tend to lag behind in the move to green. This is often because owners are unwilling or unable to make large investments that may take many years to pay for themselves. However, even in this subsector, firms are making small-scale improvements such as upgraded hallway lighting or non-carbon-based roofing materials.

The growth of LEED- and LEED-equivalent construction and renovation in recent years has had an impact on Building Services as well. There has been rapid growth in the use of advanced Building Management Systems (BMS) or Energy Management Systems (EMS). A BMS uses computers to collect "real-time" data on buildings and automatically manages the building's electrical and heating/cooling systems to optimize energy efficiency. Operating such systems requires building staff to possess more sophisticated skills, such as computing and quantitative analytical skills that were not needed in the past. The U.S. market for these systems generated $900 million in revenue in 2010, and is forecast to grow to $2.4 billion by 2018, according to a 2010 report by a private research firm (Pike Research). Health care, university, and high-rise commercial office buildings are the leading source of demand. Industry experts in New York City note that full automation of energy systems in commercial buildings is increasing. Full BMS is still very rare in residential buildings. There is also a trend towards more centralized control and remote monitoring of building management systems.

According to industry experts, the most common types of retrofits in New York City have been lighting technology, heating, ventilation and air conditioning (HVAC)-related systems and technologies for building management systems. Building owners and managers have also invested in co-generation. Many try to do as much as possible in-house, and if this is not possible, they contract out to the trades or other vendors with expertise.

How Green Firms Differ. As many have noted, buildings account for a large share of energy use and greenhouse gas emissions in the United States and an even greater share in New York City, so, in general, they are an important target for environmental initiatives. Companies heavily involved in "green" Business Services believe they differ from others in the following ways:

> ***Involvement in data collection on energy use***. As noted in the profile on Vornado's Energy Information Portal, Vornado has been involved in a vast amount of installed sub-metering of commercial tenant spaces. This large base of meters has allowed Vornado and others to measure and document energy usage and identify waste. One company representative in a focus group said, "There is a tremendous amount of waste. You can see it in high usage when they [commercial tenants] leave for the day."
>
> ***Expertise with achieving energy efficiency***. Some building services firms have built an expertise in improving the energy efficiency of their own or clients' spaces. One large firm has a dedicated energy services group. Others manage buildings that are applying for LEED EB status, which requires more attention to energy management.

VORNADO'S ENERGY INFORMATION PORTAL[13]

Vornado Realty Trust, a publicly traded real estate investment trust with over 20 million square feet of space in New York City, employs a dedicated team of professionals in energy management and sustainability.

After the deregulation of NY electricity markets in 1998 and the ensuing competition among utility generation companies, Vornado and other landlords became increasingly aware of the market cost of the energy supplying their properties. Vornado transitioned its tenants' electricity submeters to "smart" meters with funding from NYSERDA. This type of submetering enables Vornado to accurately measure and determine each tenant's portion of electrical costs for the building in which it is located. The smart meters allow energy information to be read on a constant "real time" basis.

In 2009, Vornado contracted with Syntonic Data Management (SDM), Inc, to develop a user-friendly Energy Information Portal (EIP) that would allow tenants to see their energy usage on an hourly, daily, weekly and monthly basis. The EIP has enabled tenants to implement ways to conserve energy and immediately translate their efforts into money saved.

Building managers can monitor their building equipment and see how slight adjustments in the scheduling, heating or cooling of the machinery can yield dramatic results in conservation. Anthony Campbell, VP of Energy and Sustainability at Vornado, described the EIP as a "convergence of IT, telecommunications and energy data management, meeting a world with a need for lower carbon footprints and higher energy efficiency standards." The EIP is a significant development in transforming "green" aspirations into real change.

Understanding of how to change behavior to achieve energy savings. One industry expert said that "Conservation is behavioral change" and that her company has found that they "need a total concept program to engage the tenants."

Commitment to the cause. Several focus group participants noted their commitment to energy efficiency and/or their organizations' mission-related reasons for being involved in this area. One energy contractor expressed the belief that "going green" is not only the right thing to do but promises better quality craftsmanship in the work. One industry expert mentioned that corporate social responsibility also plays a role.

Access to capital. A number of industry experts have noted that the industry is currently in a "capital-constricted market" with a general shortage of investment dollars. The Empire State Building (ESB) energy efficiency retrofit, which is profiled in this section, was self-funded by the building owner, who noted that not many buildings have the ongoing source of revenue of the ESB's observation deck. Several experts have observed that the industry needs to document energy efficiency savings from retrofits, proving a return on investment, in order to spur investment. Another industry expert said that "financial markets will get on board when there is enough volume."

[13] Based on a report published by the Steven L Newman Real Estate Institute at Baruch College

EMPIRE STATE BUILDING SUSTAINABILITY RETROFIT

The Empire State Building is currently undergoing a well-publicized $110 million sustainability retrofit that is part of a $550 million renovation of the building. Consulting, design, and construction partners **Clinton Climate Initiative**, **Johnson Controls Inc**., **Jones Lang LaSalle**, **NYSERDA**, and **Rocky Mountain Institute** recently completed an eight-month modeling and analysis project which will save 38 percent of the building's energy and $4.4 million annually.

There are several parts to the sustainability retrofit, including:

1. *Windows* -- All 6,514 windows were remanufactured within the building into insulated glass units. This facet was completed by October 2010, ahead of schedule.
2. *Radiative barrier* – The project installed insulation behind 6,514 radiator units located on the perimeter of the building. This was also completed by October 2010.
3. *Chiller plant retrofit – Because of the energy savings generated by the new windows, the building needed a smaller chiller plant than originally thought. This was completed by April 2010*
4. *The Building Management System (BMS) (building automation and controls) was upgraded and submeters were installed on each floor and completed by December 2010.*
5. *Tenant energy management* -- The Tenant Energy Management Program was completed in December 2010. This program gives tenant information on a variety of energy measures.

There are additional parts to the retrofitting plan, including, among others, reduced lighting power density in tenant spaces, addressing the variable heating/cooling problems in different parts of the building, and improving air quality in the building by introducing outside air into the building. The plan also includes 24/7 “real-time” commissioning, which is monitored from outside the building by Johnson Controls, which contacts managers in the building when something needs adjustment or attending to.
One goal of this project was to create an example for the design of commercial retrofits. In the process of developing specific project recommendations, the team uncovered several key lessons for the retrofit of large multi-tenant commercial office buildings.

Green Market Drivers. There have been a number of initiatives that have had an impact on the Building Services industry, particularly in New York City, where the employment in this industry is concentrated. New York City began a voluntary recycling program in 1986 and in July 1989, with the passage of Local Law 19, recycling became mandatory. Collection of required materials was phased in, district by district, and by 1997, all 59 districts in the five boroughs were recycling the same materials. In addition to recycling, a number of laws have revised New York City’s energy code and have required energy-conservation-related activities for buildings over a certain size. For 24,000 of the City’s largest buildings, these laws require energy audits and retro-commissioning, benchmarking of energy and water use, and lighting upgrades and sub-metering to measure the flow of electricity in tenant spaces. This represents a major shift because the laws impose significant obligations on existing buildings, which had previously been grandfathered or exempt under the New York State Energy Code and prior amendments to New York City’s codes.

In 2010, the New York City Green Codes Taskforce issued a lengthy report to the Mayor making 111 recommendations for "green" changes to existing New York City Building Codes. These related to such areas as air quality, emissions, water efficiency and construction standards. Several of these recommendations have already been enacted into law or included in regulation and others are pending.

In addition to the New York City laws, there are a number of public sector incentive programs that have an impact on this industry. These include:

- Federal tax credits. There is a federal tax deduction available for envelope, lighting, and mechanical system upgrades.
- ARRA Stimulus Funding. The Recovery Act made funding available for energy efficiency improvements includes the Energy Efficiency & Conservation Block Grants which is intended to finance energy efficiency upgrades in buildings 50,000 square feet or larger that have completed an energy audit, but are either financially distressed or unable to finance energy efficiency projects in traditional ways.
- NYSERDA Incentive Programs for energy efficiency upgrades.
- Utility Incentive Programs from Con Ed and National Grid for electricity and gas efficiency measures

The U.S. Department of Energy and the U.S. Environmental Protection Agency jointly operate the Energy Star program, which encourages energy efficient choices for homes and offers businesses an energy performance measurement and tracking system.

Green building services experts and focus group participants mentioned these and other drivers for the green Building Services market. One real estate company representative made the point that there are many different types of owners: individuals, companies, Real Estate Investment Trusts (REIT's) and others. He observed that "different reasons appeal to different people." Some respond to the "carbon footprint" argument, while financial people tend to respond to increased operational savings. "Income tax incentives do not work if you're not paying taxes, which is the case with REIT's." Each audience needs to be approached in a different way. Some of the major drivers mentioned by industry experts and companies that participated in focus groups conducted for this research include:

> ***Tenant Interest.*** Company representatives said that in the Class A commercial market in New York City, tenants demand sustainability and feel that buildings or spaces that are not green will be "obsolete." Tenants and tenant employees want to live in healthier buildings. One industry expert noted that the appraisal community has found that energy efficiency adds value. In this market, a company's commitment to sustainability is a "driver of value in the asset." It is a "value enhancement." This is true in a number of areas of the county, including Boston, Chicago, Dallas, San Francisco and New York. They noted that Class B tenants are beginning to expect amenities associated with environmental sustainability, such as bicycle access.
>
> ***Cost and return on investment***. As one focus group participant summarized this issue, "economics need to drive." Companies that participated in focus groups for this research made such statements as:
>
> - "People want to see a return." A main difficulty is selling building owners on the monetary return to retrofitting their buildings. "They look at the easy things first," which generally includes lighting retrofits and retro-commissioning (essentially a facility "tune-up" that restores and optimizes the building's energy-using equipment back to its peak performance). Many smaller residential buildings, such as co-ops and condos, respond to real estate (not income) tax incentives. In many cases, solar power has not been found to make sense in residential buildings because most electricity use is at night.

- "Landlords are looking to recover the costs of investing in green technology." A commercial real estate person reported that because "More than 60 percent of energy use in buildings is by tenants, it's important to find a way to incentivize them to save energy." He said that this can be difficult because electricity is a small proportion of overall tenant costs, especially in high-end commercial buildings.
- "Cost-effectiveness is the issue." Another industry representative said that cost-effectiveness is the main selling point for "green." His company primarily manages many buildings constructed before World War II.
- "It is difficult to sell smaller (40-60 unit) buildings on the cost of major retrofits. As an alternative, they pursue smaller programs such as upgrading hallway lighting, which have shorter (1-3 year) payback times. They look for simple paybacks."
- "The savings-to-income ratios aren't significant enough for the end users." There was the feeling that many homeowners, especially upstate, are not reaping the financial rewards they expected.
- "The payback is huge for hospitals and health centers, which often have huge campuses."

One industry expert observed that there are different levels of sophistication in understanding the cost and return on investment issue. He said that owners of small buildings often do not want to spend the money, while institutional investors and other owners of large buildings are often more sophisticated and understand "present value" and other calculations. A related issue is how long owners/investors plan to keep a property (the "hold period"), which has an impact on the length of their time horizon for recouping costs. Another related issue is the "end-of-life" scenario for major building systems, meaning whether the system is at or near the end of its useful life and needs to be replaced soon anyway. Still another is whether there are vacancies or whether the property is being refinanced. All of these issues – and more -- have an impact on the cost vs. return on investment issue.

One challenge mentioned is that of convincing owners that energy efficient technologies can increase a property's value in addition to reducing operating costs. Often, finance departments "are an obstacle because they are ignorant of the benefits of newer technologies. It is hard to convey the message to finance departments."

Several company representatives said that it is good that appraisers are "beginning to get it." Others mentioned that, with a new tenant of lease, the owner can finance energy improvement financing with the new lease. There is a new movement towards "green" leases which provide a "split incentive" for both building owners/managers and tenants to save on energy costs.

Technology. Industry employers said that there is a huge demand for building automation systems, or "actionable energy overlay systems." One industry representative explained that technology, including high speed Internet and other IT capabilities have set the environment to use information technology to collect efficiency data. There are new energy dashboards that owners/managers want to fully utilize. Another industry representative said that there are a number of "small, smart firms' developing building management software.

Laws and Incentives. A number of industry representatives in focus groups said that the NYC Greater Greener Building laws "are having a huge impact" and provide credibility when selling products to building owners, who are often reluctant to make investments when they are not mandatory. These laws require, among other things, benchmarking energy use. This

representative believes that “data helps identify problem areas.” Several New York City real estate management companies, especially those that work with smaller buildings, have had positive experiences with Con Ed’s incentives. One is considering the use of Con Ed’s incentive to switch from #6 heating oil (which will soon be outlawed) to gas. Another mentioned Con Ed’s lighting incentives.

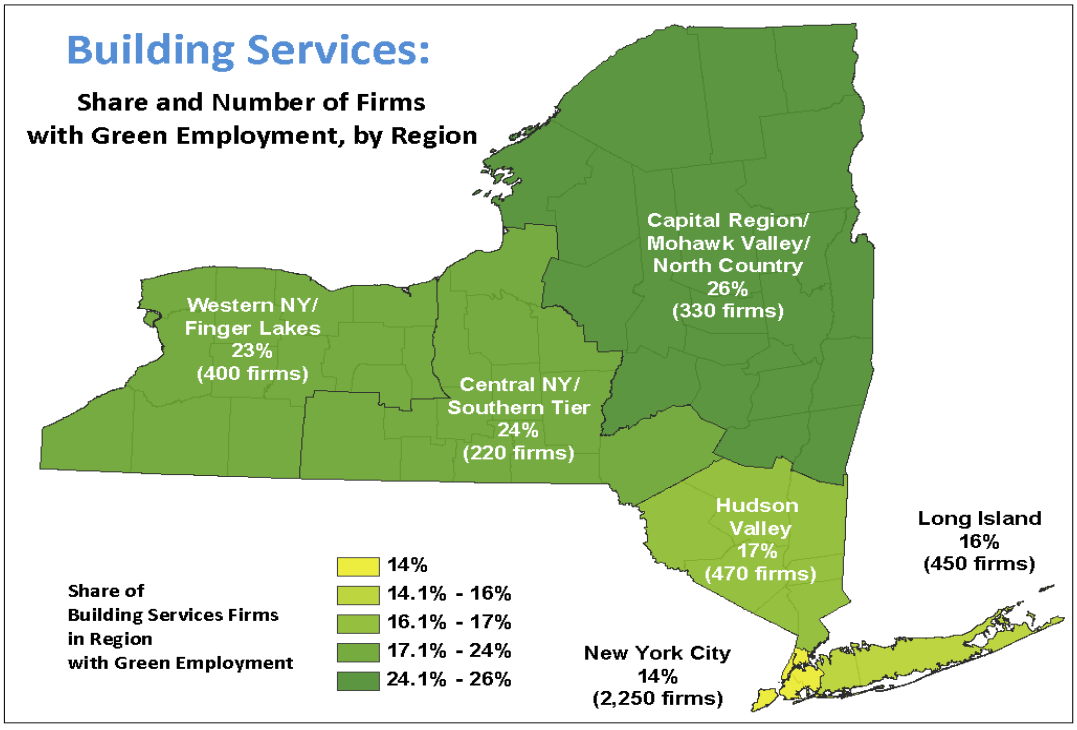
Industry representatives in upstate New York expressed the opinion that there should be more incentives, especially from NYSERDA, for customers to go green. They reported that the funds available through the American Recovery and Reinvestment Act (ARRA) had provided a tremendous boon to their businesses, and were concerned about what will happen to their businesses when that source ends.

To promote economic growth in New York City's clean technology and real estate sectors, the City has partnered with Columbia University, the Polytechnic Institute of New York University, and City University of New York to create the New York City Urban Technology Innovation Center (NYC UTIC). One of the key goals of this partnership, established in January 2011, is to promote best-practices sharing among building management stakeholders.

Green Employment in Building Services

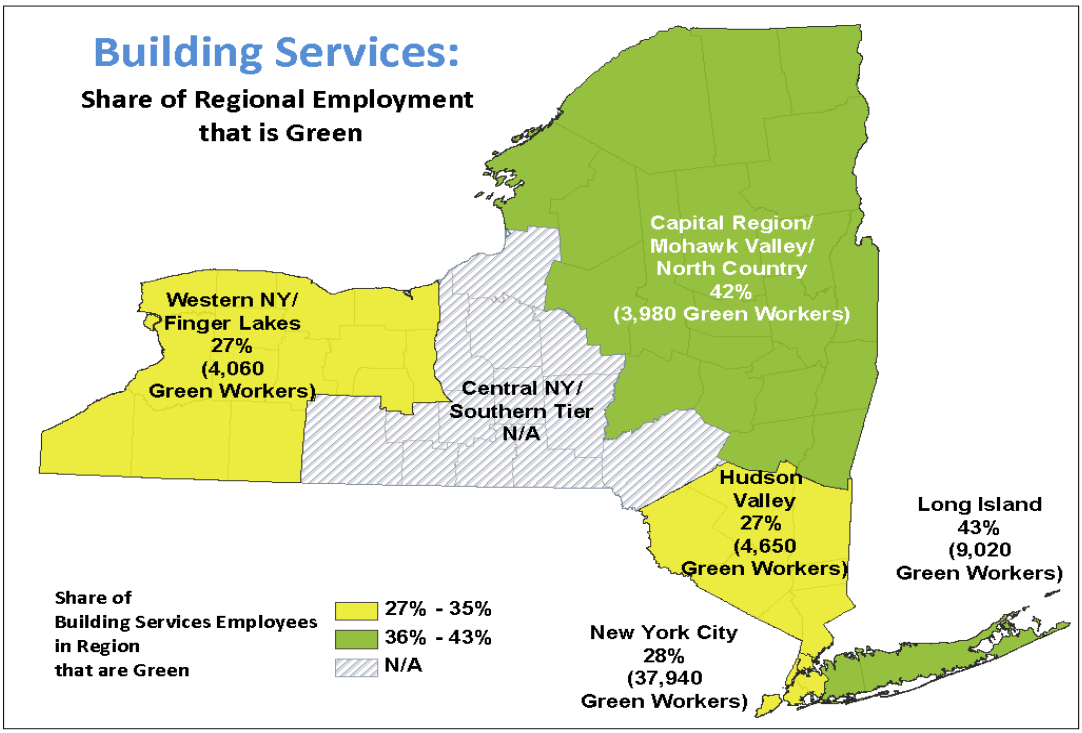
Firms and Employment: Survey Results

Statewide, 16 percent of firms in the Building Services industry cluster report that they have one or more “green” employees. The map and chart below display the findings by region. As shown, the proportions of “green” firms in the industry cluster are higher in the upstate regions, but New York City firms account for more than half of all green firms in the cluster statewide.



Firms	New York State	New York City	Long Island	Hudson Valley	Capital Region/ Mohawk Valley/ North Country	Central NY/ Southern Tier	Western NY/ Finger Lakes
Number with Green Employees	4,110	2,250	450	470	330	220	400
Total Number in Cluster	25,540	16,190	2,740	2,750	1,250	910	1,710
Percent with Green Employees*	**16%**	**14%**	**16%**	**17%**	**26%**	**24%**	**23%**

In terms of the "green" share of total Building Services employment in the state, survey results indicate that 31 percent of total employment in the sector is "green." As the map and chart below indicate, green employment in the Building Services cluster is heavily concentrated in two regions. New York City has 37,941 green business services workers – 58 percent of all workers in the cluster -- and Long Island has 9,016 green Building Services workers. Green Building Services workers in these two regions combined account for more than 70 percent of statewide green employment in the cluster.

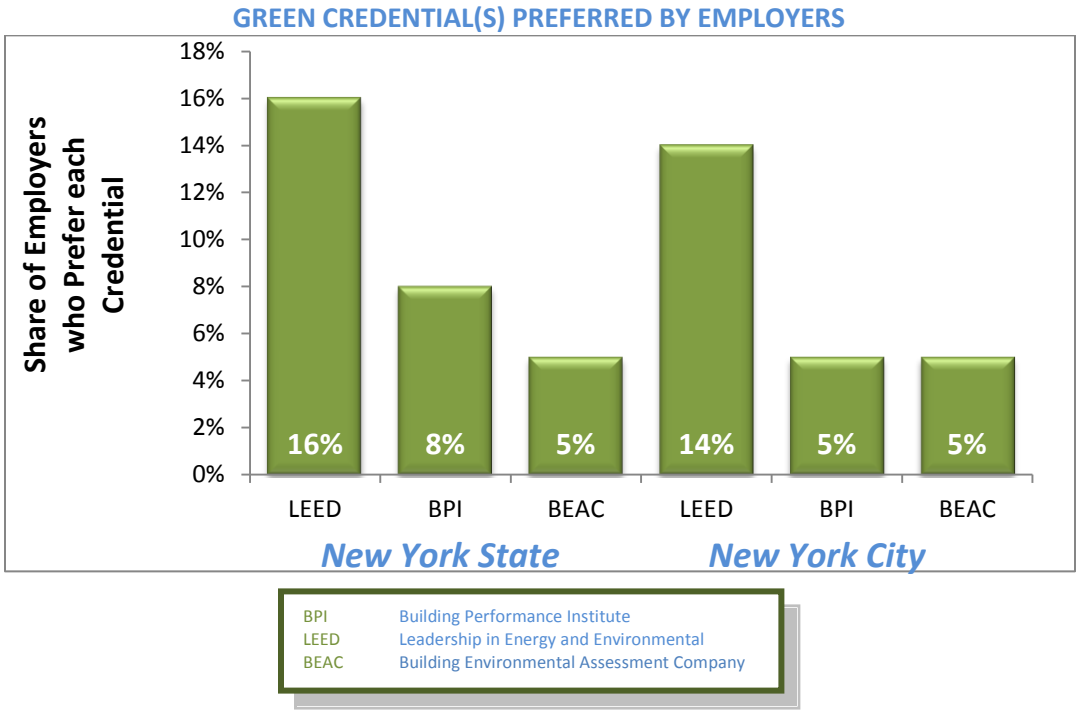


	New York State	New York City	Capital Region/ Mohawk Valley/ North Country	Hudson Valley	Central NY/ Southern Tier	Long Island	Western NY/ Finger Lakes
Green Employment	65,770	37,940	3,980	4,650	N/A	9,020	4,060
Regional Employment	211,460	137,840	9,430	17,420	7,420	21,050	15,260
Percent Green*	**31%**	**28%**	**42%**	**27%**	**N/A**	**43%**	**27%**

Firms *with* green employees were asked whether they expected their green employment to be larger, smaller or unchanged a year later. Of the 4,112 Building Services firms with green employment, 76 percent expected their green employment to grow larger (26%) or remain unchanged (50%).
Firms *without* green employees were asked whether they expected to have green employment a year later. In answer to this question, 71 percent of the 21,430 without green employment said they did not expect any change, 4 percent expected to have green employees a year later, and 25 percent were not sure.

Credential Preferences. In general, employers in the focus groups viewed their "green" workforce as part of their regular workforce. As discussed further on, employers are training their workforces to adopt "green" practices. In some cases, new types of positions are needed, many of which are involved in installing or utilizing building performance technology that increases energy efficiency. Most provide training on-the-job to make sure that employees have the green skills they need to perform effectively although some take advantage of specialized formal programs to upgrade the skills of employees.

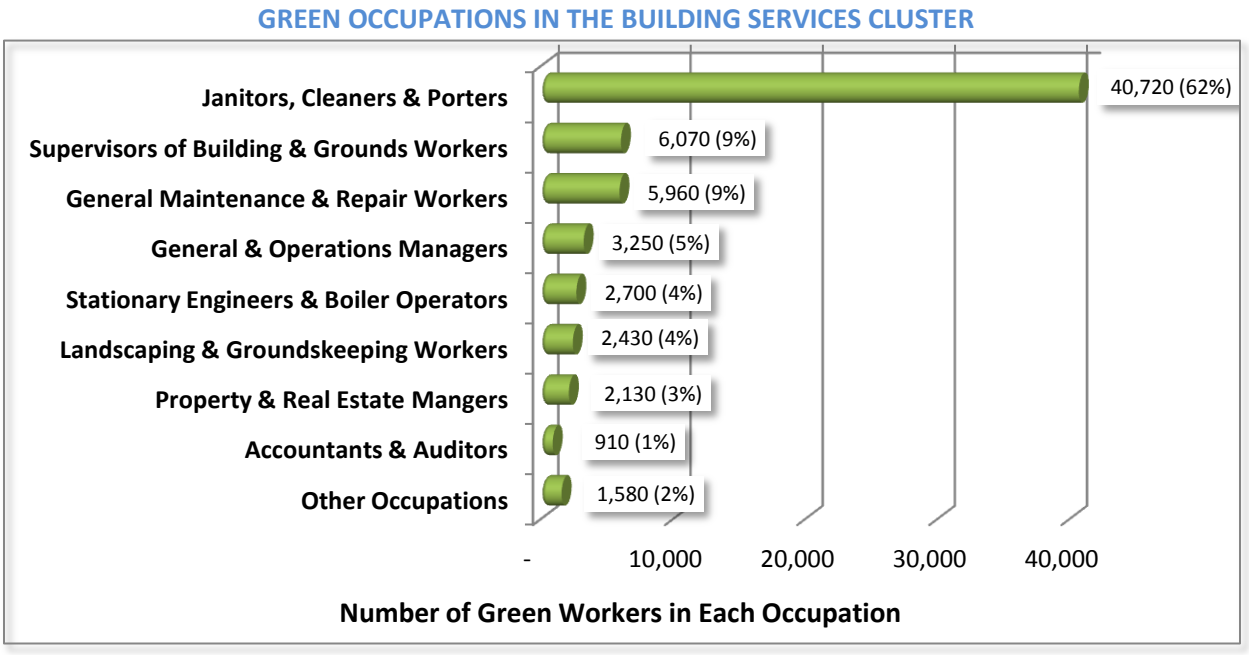
Employers were asked in the survey what if any green credentials they prefer their employees to have. As shown in the chart below, 16 percent of the employers with green employees in New York State preferred a Leadership in Energy and Environmental Design (LEED) credential, eight percent preferred a Building Performance Institute (BPI) credential, and five percent prefer a Board of Environmental, Health and Safety Auditors (BEAC) credential. The proportions are similar for New York City.



Industry employers indicated that LEED credentialing is desirable for managers and engineers so that they can sharpen their skills. There was also praise of training conducted by SEIU Local 32BJ for building superintendents and other building staff, by Local 94 for Operating Engineers, and by Baruch's Building Performance Lab. These training programs prepare individuals for the Building Operator Certification (BOC) credential and/or the BPI credential, both of which are supported by the New York State Energy Research and Development Authority (NYSERDA).

Occupational Information

Key Occupations. As shown in the chart below, the statewide employer survey found that the most common occupation with green employment in Building Services is Janitors and Cleaners, who are responsible for green cleaning and recycling. The other common occupations in this industry cluster are: First-Line Supervisors of Building and Grounds Cleaning and Maintenance Workers, Maintenance and Repair Workers, General and Operations Managers, Stationary Engineers and Boiler Operators, Landscaping and Groundskeeping Workers and Property, Real Estate and Community Association Managers. Together, these seven occupations account for 97 percent of the cluster's green employment. All of these occupations are involved in helping buildings and facilities achieve greater energy efficiency, utilize new energy technologies, reduce waste or achieve other environmental sustainability goals.



While building superintendents and porters (this is a common job title used in New York City buildings for cleaners) were mentioned by industry employers in focus groups held for this research, they felt that some of their most critical "green" employees were Operating Engineers (the common title for Stationary Engineers and Boiler Operators in New York City) and professionals in new energy and sustainable services departments. These professionals might include engineers and architects as well as people who procure energy and those who handle retro-commissioning.

- *Operating Engineers* need to have the skills to operate high tech building performance systems. There is a demand for data and technical skills among these staff. The analogy was made to skills needed in the automotive industry – mechanics now need to know how to use computerized diagnostic systems.
- *New types of positions are being created – new opportunities in energy and sustainability services, and in areas such as engineering, architecture, procurement of energy and retro-commissioning.* The overall scope of "building performance" goes beyond energy efficiency to include financial analysis,

broader benchmarking and related areas. As one industry representative reported, "The field has gone from non-professional to professional to sophisticated – it didn't used to be that way." Some property management companies have hired professionals that specialize in energy efficiency and renewable energy to oversee projects in buildings. One real estate management company hired someone "to keep on top of things" because "the world is changing." This company said that substantial work is needed to find suitable solutions and reliable contractors for greater energy efficiency or renewable energy undertakings.

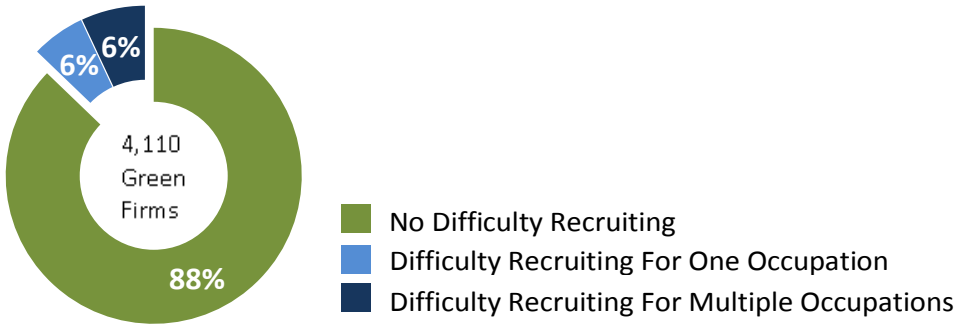
- *There is increased accountability for upper management.* In the past, managers may have had an energy budget, whereas now their actual energy use is monitored. This has created a new culture.

Career pathways. Within residential buildings, many of which are covered by SEIU Local 32BJ, there are career pathways from porter to doorman or handyman, and then potentially to building superintendent. Building staff are able to move up, but need additional technical, language and interpersonal skills in order to make these transitions. There is no formal apprenticeship program, but after individuals have worked for 30 days in a building that is covered by a labor management agreement, they are covered by Local 32BJ and are generally eligible to take training courses offered through the Thomas Shortman Training Fund. Employers say that "finding someone with a good work attitude is most important; they can then get the necessary schooling or training for jobs. The most important thing is to want to learn."

Within the commercial real estate industry, entry into the field and progress within it varies considerably. People come from a diversity of educational backgrounds. One focus group participant studied architecture for two years, then worked as an intern for a real estate management company and was hired by the company. Another had been an electrician, then a City inspector. Others have trade or technical backgrounds. Individuals can move from mechanical areas such as electrical, plumbing, heating, refrigeration or elevator maintenance to managerial positions in energy and sustainability. On the professional level, there are very few specific degrees for property management, although both Baruch and NYU were mentioned. Employers said that "there is a need for constant learning on the job" and "There are still a lot of things that can't be taught, they must be shown."

Recruitment, Retention and Turnover. As part of the employer survey, "green" firms were asked whether they have difficulty recruiting qualified workers. Of the 4,112 green firms in this cluster, 12 percent (227) had difficulty finding qualified green workers. Six percent had difficulty recruiting for more than one occupation. This varied significantly by region of the state. In the Central NY/Southern Tier area, 23 percent of employers had difficulty finding qualified green workers, while in the Capital Region/Mohawk Valley/North Country, New York City and Western NY/Finger Lakes regions, this proportion was under 10%.

PERCENT OF BUILDING SERVICES FIRMS WITH RECRUITING DIFFICULTIES



- The occupation for which employers have the most difficulty finding qualified candidates is Stationary Engineers and Boiler Operators (known as Operating Engineers in NYC), where 17 percent of firms report this issue. The second most frequent occupation with recruiting difficulties was Janitors and Cleaners, where 10 percent report this difficulty. Occupational recruiting difficulties varied by region, however. The occupations where 15% or more of employers had difficulty finding qualified "green" workers were:

- Capital Region/Mohawk Valley/North Country: Landscaping and Groundskeeping Workers (17%) and Janitors and Cleaners (15%)
- Central New York/Southern Tier: Landscaping and Groundskeeping Workers (25%), Property, Real Estate, and Community Association Managers (19%), Maintenance and Repair Workers, General (17%), Stationary Engineers and Boiler Operators (16%), First-Line Supervisors of Building and Grounds Cleaning and Maintenance Workers (16%) and General and Operations Managers (16%).
- Hudson Valley: Janitors and Cleaners (20%)
- Long Island: Installation, Maintenance and Repair Workers (67%) and Stationary Engineers and Boiler Operators (28%)
- New York City: Appraisers and Assessors of Real Estate (41%), Stationary Engineers and Boiler Operators (16%), Real Estate Sales Agents (15%)
- Western New York/Finger Lakes: none over 15%

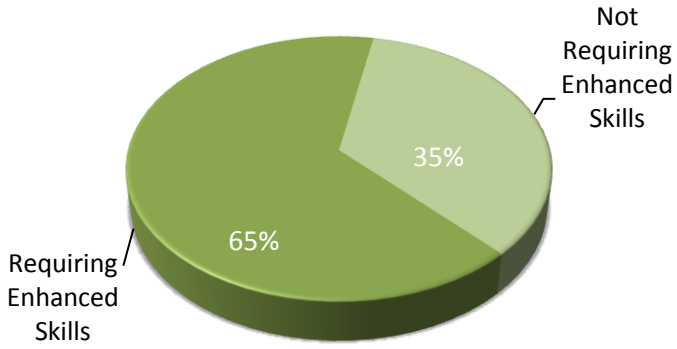
Many employers that participated in focus groups mentioned the Stationary Engineers and Boiler Operators, which in New York City are commonly called Operating Engineers, possibly because many are represented by the International Union of Operating Engineers. One company representative said that "there is a perception among Operating Engineers that they will not be needed, but this is not the case…. External diagnostic software (remote) systems management is increasingly important, but is not replacing building staff." Another made the same point, "Operating Engineers worry that new technologies will make them obsolete, and worry about how many will be needed. They perceive this as a threat, but this is not the case. Personnel are still necessary in the buildings – they just require new skills to operate high-tech systems."

The major sources of recruitment reported by employers in focus groups and interviews were word of mouth ("least expensive and safest recruitment effort"), "cross recruits from other companies" and recruitment through the Building Operators and Managers Association (BOMA) and universities. They also "poach" from engineering companies, retro-commissioning agents and contractors. Some larger management companies now have a team – with people who specialize in such area as HVAC, utilities, compliance, etc.

Employers noted that flexibility and adaptability skills are "key" and that "a lack of adapting to change is fatal."

Training and Educational Preparation. Employers were asked in the statewide survey how many of their employees required new skills to be able to perform their work in a green economy, and of those that required skills, where they were acquired. A strong majority, almost two out of three green employers in the cluster required employees to have enhanced skills to produce green products or services.

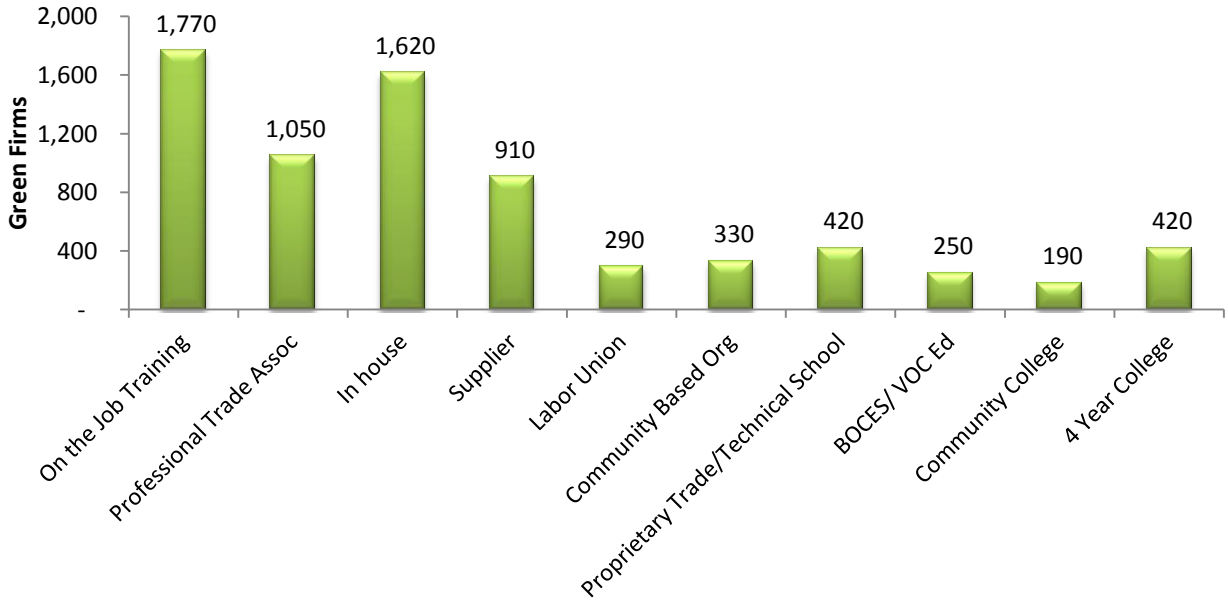
PERCENTAGE OF EMPLOYERS REQUIRING ENHANCED SKILLS FOR GREEN WORKERS



Employers that took part in focus groups believe that the entire building workforce needs training – "every single part" – cleaners, electricians, lighting, maintenance, managers, engineers and that "everyone needs to "sharpen their skills." They said that "green" practices are affecting all types of jobs – "top to bottom," and that the entire hierarchy of occupations needs skill upgrades. One said, "This goes from owners to contractors to operating engineers and even down to cleaners, who must be trained, for example, on using green cleaning products correctly." One employer encourages LEED credentialing for people in management and engineering positions. Some expressed the opinion that training the older workforce on new technologies can be a problem and conversely that newer workers are not familiar with the old technologies, and that this knowledge is necessary for making the transition. There is a potential problem and "gap" between new employees who are more technically savvy, and older employees who know the building systems very well, including all of the adjustments that have been made over the years.

As the chart below shows, the most common sources were On-the-Job Training, In-house Training, Professional Trade Association, and Supplier. The least utilized sources of enhanced skills training were Community College and BOCES/Vocational Education.

SOURCES OF ENHANCED SKILLS TRAINING



This information was validated by focus group discussions and expert interviews with industry employers, who emphasized the importance of learning on the job. One said that on-the-job learning is important because many of the older building systems have idiosyncrasies that need to be learned.

Companies in upstate New York reported utilizing NYSERDA-funded training programs. Companies in New York City said that some labor unions in New York City, such as Operating Engineers Local 94 and SEIU Local 32BJ are "highly sophisticated" and work closely with management to make sure their workers are trained on the new technologies. One said that Local 32BJ has been "exceptionally active." Another commented that the "bigger [training] problem is in residential non-union buildings in NYC and buildings outside of New York City."

Some companies mentioned the Building Performance Toolkit developed by Baruch's Building Performance Lab, which offers on-line training for building operators, building managers, property owners and other real estate professionals as a guide to reducing energy costs and energy consumption. It is primarily geared toward large commercial property owners in New York City but can also be helpful to other sustainability professionals

One company reported that it brings in trainers to provide some of the training for building staff, and that they need to supplement the training provided by the union. Another commented that products and equipment are constantly changing, and that staff training is very important. Another company said that after the installation of building performance software, the software contractors trained the building staff.

Recommendations for Education and Training Providers. Employers that took part in focus groups were asked what they would change about the way colleges, community colleges and training institutions are preparing students for the workforce. Their suggestions were:

- *More hands-on training and mentoring.* One employer praised the training done by SEIU Local 32BJ, saying that "hands-on is the way to go," and "mentoring is the key." However, this "hands-on" experience also applies to engineering students. One employer said that students should get hands-on experience with building systems, e.g. mechanical engineers need to see more "nuts and bolts."
- *More experience in the field before graduation.* Employers suggested that colleges should institute co-op and internship programs that "put people in the field getting work experience for part of their training." At the same time, one employer has had experience with college interns who felt that some of the tasks they were asked to perform were "beneath them" and were unwilling to do "grunt work." In the property management field, it was felt that it is a team effort with everyone pitching in. Employers also suggested that BOCES programs should implement internships at the high school level to create a more valuable workforce.
- *More attention to career paths in the real estate/building operations industry.* Several employers thought that students need to get a better understanding of the different career paths in the industry and how different educational programs can lead to careers, such as in property management. Another mentioned that there are very few schools with real estate programs. Still another said that there is no good alternative to the unions as far as paths into the mechanical jobs in the industry are concerned.
- *More information sharing and a more unified avenue* so that building operators could share knowledge about what techniques and products work well. They would like case studies about how different "shops" within companies work together to achieve energy efficiency.

- *Less fragmentation among educational institutions.* Several employers complained that institutions of higher education are “doing their own thing,” “wasting a lot of time,” and “not helping me.” Others said that certification programs and degrees are “highly fragmented and incoherent.” They suggested that the industry would be more willing to support them if the different educational institutions could get together and come up with something more unified to meet the staffing needs of the industry.

CHAPTER 6: EMPLOYER DEMAND IN COMPONENT MANUFACTURING CLUSTER

Highlights

- *The Component Manufacturing cluster is the smallest of those included in the green jobs study and, with 5,360 green jobs, or 7 percent of the total employment in this cluster, has the least green employment.*
- *The Western NY/ Finger Lakes region has 1,580 green Component Manufacturing workers, the highest regional number by far. Long Island was second with 980 green jobs. While New York City has only 760 green jobs in this cluster, the proportion of total jobs that are green, at 13 percent, is nearly twice the average for the state.*
- *The manufacturing workforce in general is older, with nearly 60 percent of the workforce 45 year of age or older.*
- *There are a number of positive developments related to green Component Manufacturing in upstate New York. Some examples include the Solar Energy Consortium based in Kingston, the General Electric Schenectady-based global renewable energy headquarters and manufacturing plant making advanced storage batteries, Global Foundries' new semi-conductor plant in Malta, The Tech Garden in Syracuse, and the Globe Specialty Metals purified silicon plant in Niagara Falls.*
- *Of the 260 firms in Component Manufacturing with "green" employment, 34 percent of the total (90 firms), have difficulty recruiting qualified green workers. Employers upstate reported more difficulty than those downstate.*
- *Employers would like education and training institutions to educate with more cross-functionality. For example, employers say they need "engineers with stronger people skills and sales and marketing employees with stronger critical and analytical reasoning skills." They say "this is necessary in order for companies to be able to grow, innovate and meet the demands of a market."*

Overview of the Industry Cluster

For much of its history, New York State was a powerhouse of manufacturing activity. New York City was its largest manufacturing center, particularly known for its garment district ("the densest clothing manufacturing zone in the world") but also prominent in many other manufacturing areas, from printing and publishing to fabricated metals. Manufacturing jobs were also a source of economic prosperity for upstate communities that hosted large manufacturing plants, such as Kodak in Rochester, General Motors and the auto industry in Buffalo, and General Electric in Schenectady. Other upstate cities, such as Binghamton, Elmira, Syracuse, Utica and the Albany-Troy-Rensselaer area have produced everything from shoes to computer and electrical products.

In the last 50 years New York State and City have endured a well-documented steady erosion of employment in the sector. Employment in manufacturing has declined by over 60 percent since the 1940s. In the last ten years, between 2000 and 2010, overall manufacturing employment in New York State fell from 752,300 to 457,800, and now represents a little more than 5 percent of the state's jobs (NYSDOL). Manufacturing employment in New York City peaked at one million in the 1950's, with a third of these jobs in the apparel industry. As of February 2011 the number of people employed in manufacturing in New York City had dwindled to 73,600 (NYSDOL) and comprised approximately two percent of the New York City workforce.
By definition, the manufacturing sector is involved in the production of goods, involving the conversion of raw materials, components or parts into finished goods. These finished goods may be used for

manufacturing other, more complex products, such as aircraft, household appliances or automobiles, or sold to wholesalers, who in turn sell them to retailers, who then sell them to end users – the consumers. Manufacturing may be handicraft, high tech, or mass production on a large scale. The North American Industrial Classification System (NAICS) identifies 20 major industries within the manufacturing sector. **For purposes of this green jobs research, *green manufacturing* was limited to manufacturing related to green technology, renewable energy and energy efficiency.[14] Together, these industries are referred to throughout this report as "Component Manufacturing."**

Distribution of Firms and Employment. In the fourth Quarter of 2010, there were 1,854 firms in the Component Manufacturing cluster in New York State, employing 80,458 people. The largest share of employment was in the Western New York/Finger Lakes region, with 22 percent of the firms and 30 percent of the employment in the State.

DISTRIBUTION OF COMPONENT MANUFACTURING FIRMS AND EMPLOYMENT BY REGION

	Firms		Employment	
	Number	Share of NYS	Number	Share of NYS
New York State	1,854		80,458	
Capital / Mohawk Valley /North Country	211	11%	10,819	13%
Central/Southern Tier	217	12%	17,026	21%
Hudson Valley	186	10%	8,847	11%
Long Island	442	24%	13,766	17%
New York City	326	18%	5,891	7%
Region Not Classified*	408	22%	23,978	30%
Western NY/Finger Lakes	64	4%	131	0%

SOURCE | 4Q 2010, QCEW

**Note: Refers to firms that do not provide a specific location in New York State.*

Component Manufacturing represents 1.2 percent of all employment statewide. As shown in the chart below, the share of area employment is highest in the upstate areas of Central NY/Southern Tier (3.5%) and Western NY/Finger Lakes (2.5%) and lowest in New York City (0.2%).

CONCENTRATION OF COMPONENT MANUFACTURING EMPLOYMENT BY REGION

New York State Region	% of Total Employment
Capital/Mohawk/North	1.7%
Central/Southern Tier	3.5%
Hudson Valley	1.3%
Long Island	1.4%
New York City	0.2%
Western/Finger Lakes	2.5%

SOURCE | 4Q 2010, QCEW

[14] This included such areas as window and door manufacturing, plastic material, glass products, copper wire, fabricated metal, air conditioning and heating equipment, general purpose machinery, semiconductors, other electric components, measuring devices, lighting fixtures, electronic equipment and components, motor vehicle and railroad stock, among others.

Of the 1,837 Component Manufacturing firms in New York State, more than three in five (62%) had 20 or fewer employees, with 35 percent of the firms having five employees or less.

SIZE DISTRIBUTION OF COMPONENT MANUFACTURING FIRMS IN NEW YORK STATE

Size Class	Firms	Employment	Firms	Percent of Total Employment
Total	1,837	80,801	100%	100%
0 to 5	652	1,277	35%	19%
6 to 10	237	1,870	13%	13%
11 to 20	266	3,947	14%	16%
21 to 50	334	10,862	18%	21%
51 to 100	172	12,185	9%	13%
101 to 250	123	19,181	7%	11%
251 or more	53	31,479	3%	7%

SOURCE | 4Q 2010, QCEW

The largest number of firms and the largest number of Component Manufacturing jobs were with firms that manufacture all other plastic products, with 17 percent of the total firms and 14 percent of the total employment (11,267 employees). Other types of firms with a significant share of employment were semiconductor manufacturers (6,973 employees), sheet metal work (5,492 employees) and motor vehicle electrical/electronic equipment manufacturers (4,901 employees).

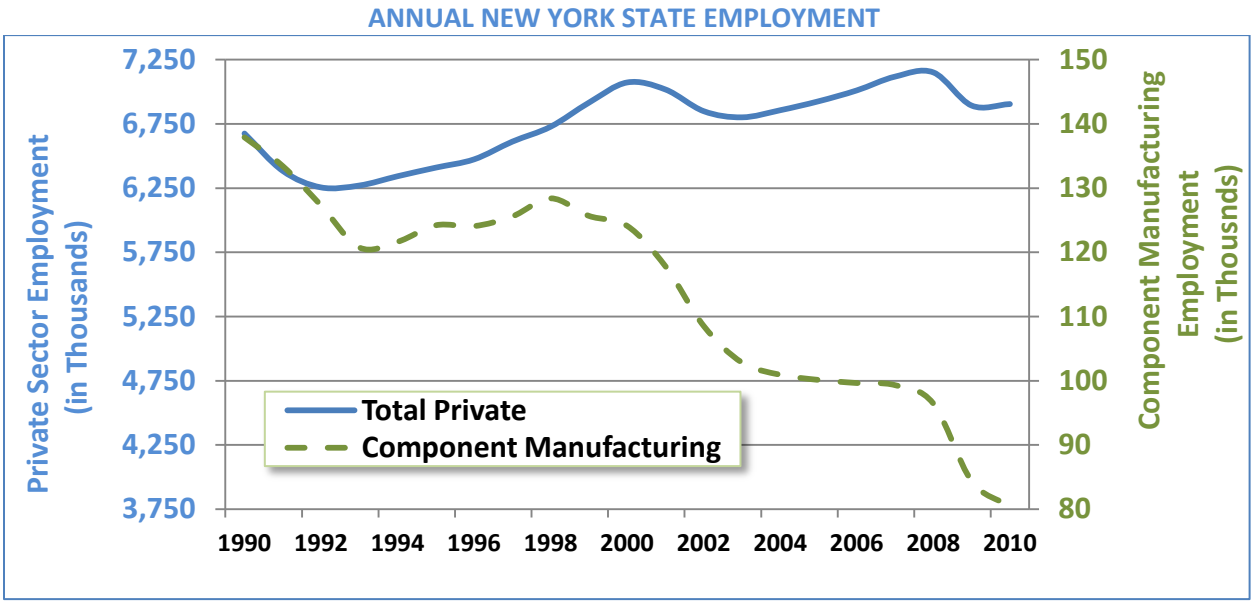
Industry Situation. As one recent report states, "With the emergence of the global economy, many policy makers assume that these once plentiful and high-paying manufacturing jobs will not be returning to New York State." (Office of the State Comptroller) However, the same report notes that, despite job losses, manufacturing remains an important component of the economy, particularly the upstate economy. Many national and state experts believe that the manufacturing decline may have reached a plateau.

Now in upstate New York, manufacturing firms and the jobs within them tend to be more highly technical and higher paying. In a study of skill-upgrading within the manufacturing workforce nationwide, researchers at the Federal Reserve Bank found that practically all manufacturing industries have become higher-skilled industries. The recently formed (2011) Regional Economic Development Councils in New York State are trying to bring academic institutions and industry leaders together to further key industries in each region of the state. In some regions, these Councils will focus on manufacturing, especially high-tech or advanced manufacturing, which require a skilled and educated workforce.

According to a report issued by the New York Industrial Retention Network in 2009, New York City's remaining manufacturers say that they want to be in close proximity to clients and supply chain, appreciate the availability of skilled/semi-skilled labor and feel they can provide better supplier customer service by being in the City (NYIRN, 2009). Surveyed by Halcrow in 2009, New York City manufacturers listed real estate and facility costs, energy utilities costs and insurance costs as the greatest challenges to doing business in NYC (NYIRN, 2009).

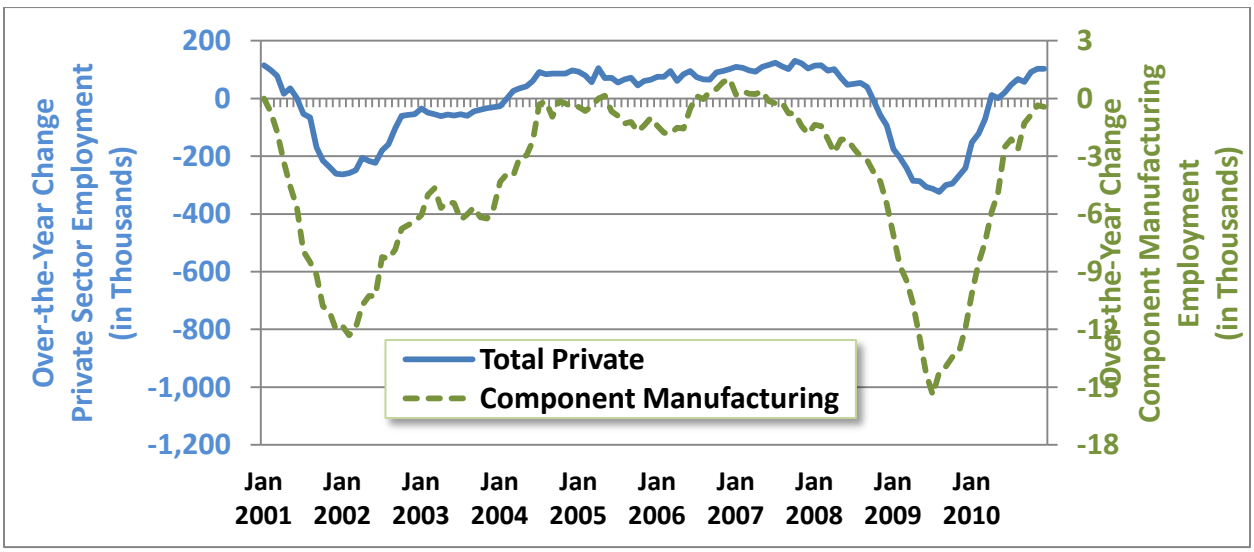
Recent Developments. As demonstrated in the chart below, employment in the Component Manufacturing cluster has generally declined over the last 20 years and has declined by about 60,000

jobs since 1990. The reduction in manufacturing employment in New York State and City has mirrored national trends, and is similar to other states with urban centers in the northeast, Midwest and on the west coast. New York City, in particular, has transitioned from an industrial to a post-industrial economy. The reasons are many and include broad technological changes, improvements in transportation, changes in mass production technology, and movement of production to areas with lower business costs, including land, utility and labor costs, and, in some cases, less environmental regulation or lower tax rates.



SOURCE | QCEW 1990 to 2010 Annual Average Employment

As the chart below illustrates, component manufacturing employment is more cyclical than overall private sector employment but has tended to lose jobs in all economic cycles.



SOURCE | QCEW Monthly Over-the-Year Change

Wages. The chart below lists the median annual wages in New York State and typical preparation needed for occupations in the Component Manufacturing cluster. Note that this chart includes only occupations commonly found in the green economy, according to O*NET's *Greening of the World of Work.*[15]

WAGES AND TYPICAL PREPARATION FOR GREEN COMPONENT MANUFACTURING OCCUPATIONS

Occupation	Median Pay	Typical Preparation
Electrical Engineers	$83,080	Bachelor's degree
Electronics Engineers, Except Computer	$89,300	Bachelor's degree
Environmental Engineers	$81,230	Bachelor's degree
Industrial Engineers	$77,550	Bachelor's degree
Mechanical Engineers	$74,,800	Bachelor's degree
Sales Engineers	$90,180	Bachelor's degree
Software Developers, Applications	$92,470	Bachelor's degree
Electrical and Electronic Engineering Technicians	$58.09	Associate degree
Environmental Engineering Technicians	$41.88	Associate degree
Mechanical Engineering Technicians	$48,960	Associate degree
Civil Engineers	$78,570	Bachelor's degree
First-Line Supervisors of Building and Grounds Cleaning and Maintenance	$27,250	Work experience in a related occupation
First-Line Supervisors of Production and Operating Workers	$58,090	Work experience in a related occupation
Industrial Production Managers	$92,840	Work experience in a related occupation
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	$59,850	Work experience in a related occupation
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$81,520	Work experience in a related occupation
Drafters	$51,500	Postsecondary vocational award
Heating, Air Conditioning and Refrigeration Mechanics and Installers	$51,060	Postsecondary vocational award
Welders, Cutters, Solderers, and Brazers	$36,090	Postsecondary vocational award
Assemblers and Fabricators, All Other	$24,520	Moderate term on-the-job training
Customer Service Representatives	$33,900	Moderate term on-the-job training
Insulation Workers, Floor, Ceiling and Wall	$33,100	Moderate term on-the-job training
Production, Planning and Expediting Clerks	$46,470	Moderate term on-the-job training
Computer-Controlled Machine Tool Operators, Metal and Plastic	$33,610	Moderate-term on-the-job training
Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	$28,750	Moderate-term on-the-job training
Inspectors, Testers, Sorters, Samplers, and Weighers	$34,470	Moderate-term on-the-job training
Installation, Maintenance, and Repair Workers, All Other	$39,720	Moderate-term on-the-job training

[15] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They

Team Assemblers	$25,510	Moderate-term on-the-job training
Machinists	$40,440	Long-term on-the-job training
Sheet Metal Workers	$46,770	Long-term on-the-job training
Structural Iron and Steel Workers	$77,540	Long-term on-the-job training
Tool and Die Makers	$49,160	Long-term on-the-job training
Electrical and Electronic Equipment Assemblers	$29,070	Short-term on-the-job training
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	$27,250	Short-term on-the-job training
Packaging and Filling Machine Operators and Tenders	$23,840	Short-term on-the-job training

SOURCE | Occupational Employment Survey; O*NET Online.

Manufacturing offers jobs at all skills levels – low, moderate and highly technical. The median wage in manufacturing in New York City is 30 percent to 50 percent greater than wages for retail or service workers. (NYIRN, 2009) In upstate New York, the pay scale is 40 percent above the average wage. (NYSDOL)

Employment Projections. Employment in Component Manufacturing is projected to shrink by 0.9% in New York State between the years of 2008 and 2018. This compares to growth of 0.5% in total nonagricultural wage and salary jobs.

Demographic Trends. The following chart displays the demographic characteristics of the Component Manufacturing workforce from 2000 to 2007-2009. Statewide, the Component Manufacturing workforce contracted by 16 percent; employment in New York City declined by 5 percent during the same time period. The vast majority of the Component Manufacturing workforce lives upstate. The statewide workforce is predominantly male and white; the workforce in New York City is mostly male but is racially and ethnically diverse. Throughout the state, the manufacturing workforce is aging, as almost 60 percent are 45 years of age or older. On a statewide basis, a small proportion of the workforce (14%) has less than a high school degree, although this percentage is much higher in New York City (25%). Almost all of those who work in the industry (96%) in New York State also live in the state. Four in five people who work in the sector in New York City live in the City.

DEMOGRAPHIC CHARACTERISTICS OF THE COMPONENT MANUFACTURING WORKFORCE

	New York State		New York City	
	2000	**2007-09**	**2000**	**2007-09**
Total Workforce	**98,784**	**84,130**	**14,185**	**13,101**
New York State/City Residents	95,278	80,413	10,960	10,337
Non-New York State/City Residents*	3,506	3,717	3,225	2,764
New York City	14%	16%	*na*	*na*
Long Island	12%	13%	*na*	*na*
Hudson Valley	9%	7%	*na*	*na*
Upstate	65%	63%	*na*	*na*
Bronx	*na*	*na*	18%	13%
Kings	*na*	*na*	32%	37%
New York	*na*	*na*	11%	9%
Queens	*na*	*na*	36%	38%

	New York State		New York City	
	2000	2007-09	2000	2007-09
Richmond	*na*	*na*	3%	4%
Male	71%	72%	73%	72%
Female	29%	28%	27%	28%
White	78%	77%	31%	38%
Black	6%	5%	15%	13%
Hispanic	11%	12%	41%	30%
Asian	3%	5%	8%	17%
Other	2%	1%	5%	3%
Age 18-34	30%	22%	33%	24%
35-44	28%	19%	25%	18%
45-54	27%	37%	25%	33%
55+	15%	22%	18%	26%
Less than high school or GED	16%	14%	34%	25%
High school or GED	35%	34%	28%	32%
Some college	30%	29%	23%	25%
College or More	19%	23%	15%	18%

SOURCE | U.S. 2000 Decennial Census and 2007, 2008, and 2009 American Community Surveys public use microdata (PUMS) files.
*The remaining counts that appear in the table are of people who both live *and* work in New York State and City, respectively.

Green Economic Activity in Component Manufacturing

For the purposes of the current green jobs research, "green" economic activity in Component Manufacturing has been defined to mean the production of goods that contribute to increasing energy efficiency or producing renewable energy. Examples include:

- Manufacturing components or equipment for renewable energy generation and distribution, e.g. wind turbines, solar panel components, controls and devices
- Manufacturing energy efficiency products, e.g. boilers, furnaces, windows, doors, insulation, electrical devices
- Manufacturing products for retrofitting or improving energy efficiency in buildings or facilities
- Manufacturing motor vehicle equipment, including batteries, and railroad rolling stock

While not within the scope of this green jobs study, the researchers are aware that within the context of New York City manufacturing and elsewhere in the state, "green" manufacturing refers to both "green" practices such as the use of more energy efficient machines and lighting, waste reduction, pollution prevention, energy conservation and use of renewable energy sources for production needs, as well as the production of "green" products, such as those made from recycled materials (glass, cardboard, paper) or from sustainably-sourced materials (wood used in furniture, organic cotton) or environmentally-friendly materials, i.e. varnishes used in furniture. It is also taken to include organic produce and food.

THE BROOKLYN NAVY YARD

The Brooklyn Navy Yard, is one of New York City's 16 Industrial Business Zones. The Brooklyn Navy Yard Development Corporation (BNYDC), a not-for-profit corporation, manages the Yard under a contract with the City of New York, which owns the property. BNYDC is responsible for leasing space in the Yard, developing the underutilized areas of the Yard, and overseeing the ongoing modernization of the Yard's infrastructure. BNYDC is pursuing its mission to create and retain industrial jobs in New York City with a strong commitment to environmental sustainability.

It explicitly wants to be the destination of choice for green manufacturers and businesses, and illustrates an approach to "green" or sustainability that includes both products and practices. The BNYDC has set goals to develop a coordinated green strategy to stabilize and reduce the Yard's carbon footprint, position the Yard to be a national model for sustainable industrial parks, and establish the Yard as an attractive location for green manufacturers and businesses (Brooklyn Navy Yard).

Key initiatives include:

- Requiring new buildings and major renovations to be certified LEED Silver or better
- Constructing the first multi-tenant industrial LEED Silver buildings in the US, including NYC's first wind turbines
- Reusing Navy-built buildings for their original industrial intent; a new museum will have a geothermal heating system
- Using green technologies for renovations and maintenance, i.e. Energy Star roofs, experimenting with "green" roofs, energy efficient windows and light bulbs
- Undertaking a major infrastructure project involving a major water/sewer upgrade, improving water conservation, and rebuilding the road system with improved stormwater management systems, expanding landscaping with water-loving plants, and using permeable asphalt
- Purchasing hybrid and low-emission vehicles for the Yard's fleet; operating a shuttle system to the subway station using diesel-powered buses
- Installing solar-powered trash compactors and exploring use of solar-powered street lamps
- Using eco-friendly cleaning products
- Installing bicycle racks (designed in the shape of ships by one of the Yard's tenants and made from recycled material) and lanes
- Providing setbacks along the perimeter of the Yard to enable the first phase of the Brooklyn Waterfront Greenway for bicyclists and pedestrians
- Submetering all tenants and billing them for electricity use
- Establishing a tenant sustainability committee
- Developing a new waste management system, including the re-use of some industrial waste

One large building (Building 128) is being renovated and positioned as a "Green" manufacturing center. As evidenced by the Yard's "Green Business Directory"(Brooklyn Navy Yard), there is already a clustering of green companies. The hope is that the entrepreneurs will be attracted there and create new jobs.

There are a number of positive developments related to green Component Manufacturing in upstate New York State.

- The Solar Energy Consortium was founded in 2007 and is based in Kingston, NY in the Hudson Valley region of the state. In addition to advancing solar installation, the organization has as one

of its main goals to create a solar R&D and manufacturing cluster in New York State. It has brought together industry, academic, and economic development partners to try to accomplish this. There is now a cluster of solar businesses, including manufacturers, in the Kingston area with high-skill R&D and manufacturing jobs.

- General Electric (GE) has established its global renewable energy headquarters in Schenectady, and will monitor wind turbines across the country from this facility. In addition, GE Transportation, a business unit of GE, is building a manufacturing plant in the Albany area that will make advanced storage batteries using sodium-metal halide technology. These batteries are for use in hybrid-electric applications such as mining trucks, tugboats and hybrid locomotives. Other applications include backup storage and load leveling for smart grid.
- Global Foundries is building a new semi-conductor manufacturing facility in Malta, NY, in Saratoga County. Global Foundries is one of the largest computer chip manufacturers in the world.
- The Tech Garden in Syracuse, NY area is a multipurpose organization trying to bring clean tech and other technology businesses to central New York. Recently, the Canadian company ProTerra (an LED lighting manufacturer) announced that it will locate a sales and marketing workforce, and possibly later an engineering, assembly and testing center in Tech Garden in downtown Syracuse. A German company, Sun Energy Europe will locate the headquarters of Sun Energy Americas in Syracuse.
- SunMaxx Solar, headquartered near Binghamton, NY, designs and manufactures solar thermal hot water and heating systems. It has a large thermal logistics center in Binghamton.
- Globe Specialty Metals re-opened its plant in Niagara Falls to make purified silicon for solar panels. It is hoped that this will attract solar panel manufacturers to the region.

Green Market Drivers

As one representative of a Long Island manufacturer that participated in a focus group for this research expressed it, “Before we can have occupations [in the energy industry] we need companies that can hire people, and before companies can hire people, there has to be a need for that company’s services and products in a demand driven market.” A New York City industry expert made the same point, that in order to have “green job creation” there must be entrepreneurs creating the jobs. Some experts believe that it is a challenge to attract that type of firm. A number of New York State entities have made efforts to support green manufacturing in the state. Several companies have received financing from the Empire State Development Corporation. Others have been assisted by the New York Power Authority, NYSERDA, the New York State Department of Labor and the cities or counties in which they are located.

Manufacturing employers that participated in a focus group conducted as part of this research also mentioned the following factors:

- “It all comes down to economics.” Some mentioned that high energy costs drive demand for their products and services. One company that is involved in converting vehicles to hybrid electric power said, “People must understand that they [fleet operators] are spending a huge portion of their operating capital on fuel.” Another example of “economics” is the cost to the consumer of switching to renewable energy sources. The cost of renewable energy (e.g. solar) must be competitive. Another company representative said, “High energy costs drive demand for services in this industry.” Another said, “You don’t sell the ‘green,’ you sell the technology and the benefit.”

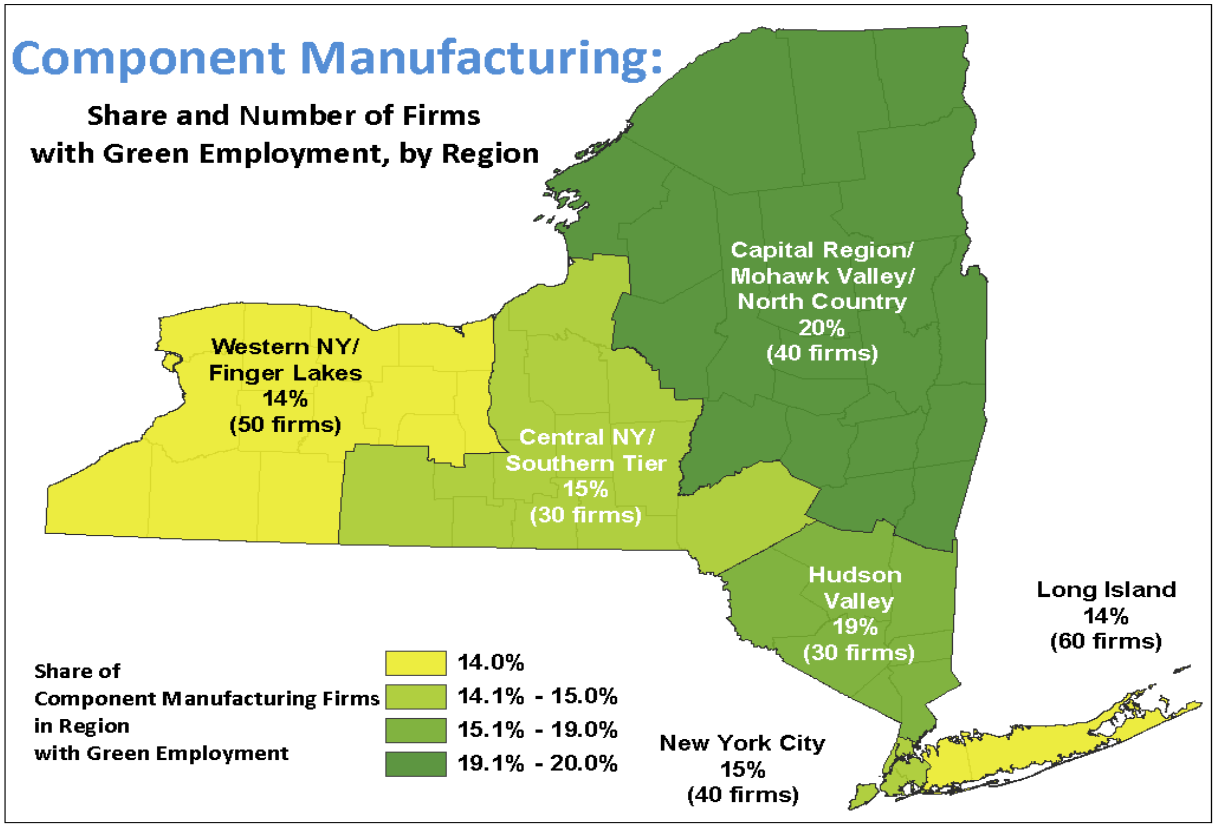
- "Present financing options are virtually non-existent." One company representative said that financing is critical to moving energy management projects forward. Another added "if the credit is there to do these kinds of projects then businesses will grow and hire people."
- Need for greater consistency in rules and legislation. One Long Island manufacturer pointed out that there are nearly 150 local municipalities on Long Island, each with its own set of rules for renewable energy installations, and that "permitting is unclear." These inconsistencies "slow things down and create other hurdles that are impediments to business, which makes rolling out a technology very difficult…and leads to all sorts of extra cost and resistance." This same general point has been made in New York City.
- Need for stronger fuel economy and air quality laws. Stricter standards would create a demand for technologies and products to address these issues.
- Workforce quality. A business that recently moved to the Syracuse area said that the area's well-educated workforce and commitment to business growth were pivotal in the company's decision to base U.S. operations in the area.

Whatever the drivers of green manufacturing, the sector still exists within the overall economy, which is experiencing a weak economic recovery and limited job growth.

Green Employment in Component Manufacturing

Cluster Employment: Survey Results

Statewide, 16 percent of firms in the Component Manufacturing cluster report that they have one or more "green" employees. The map and chart below display the findings by region.



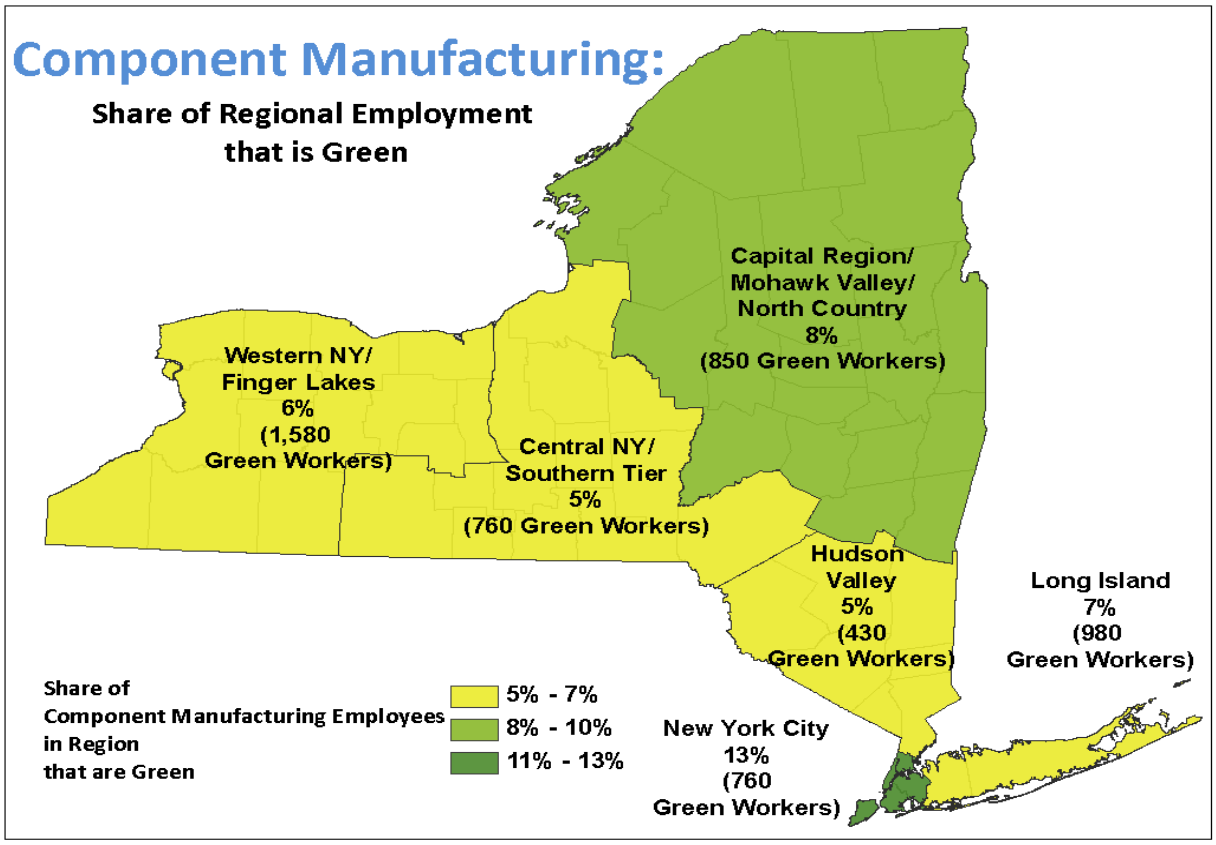
Firms	New York State	New York City	Long Island	Hudson Valley	Capital Region/ Mohawk Valley/ North Country	Central NY/ Southern Tier	Western NY/ Finger Lakes
Number with Green Employees	260	40	60	30	40	30	50
Total Number in Cluster	1,660	280	410	170	200	210	170
Percent with Green Employees*	**16%**	**15%**	**14%**	**19%**	**20%**	**15%**	**14%**

In Component Manufacturing, due in large part to the small number of green firms statewide, very few significant regional differences arise. Generally, firms with green employment are fairly evenly distributed across the six regions.

Regional shares of Component Manufacturing firms with green employment have a narrow spread. However, Component Manufacturing firms in Hudson Valley and Capital Region/Mohawk Valley/North Country are slightly more likely to be green than similar firms in other regions.

Across the state, the shares of Component Manufacturing workers in each region that are green do not vary widely. However, as shown in the map and chart below, Component Manufacturing workers in New York City are slightly more likely to be green than similar workers in regions outside the city.

Western NY/ Finger Lakes region has 1,580 green Component Manufacturing workers, the highest regional number by far. But these green workers account for only 6% of all workers in the cluster in that region.



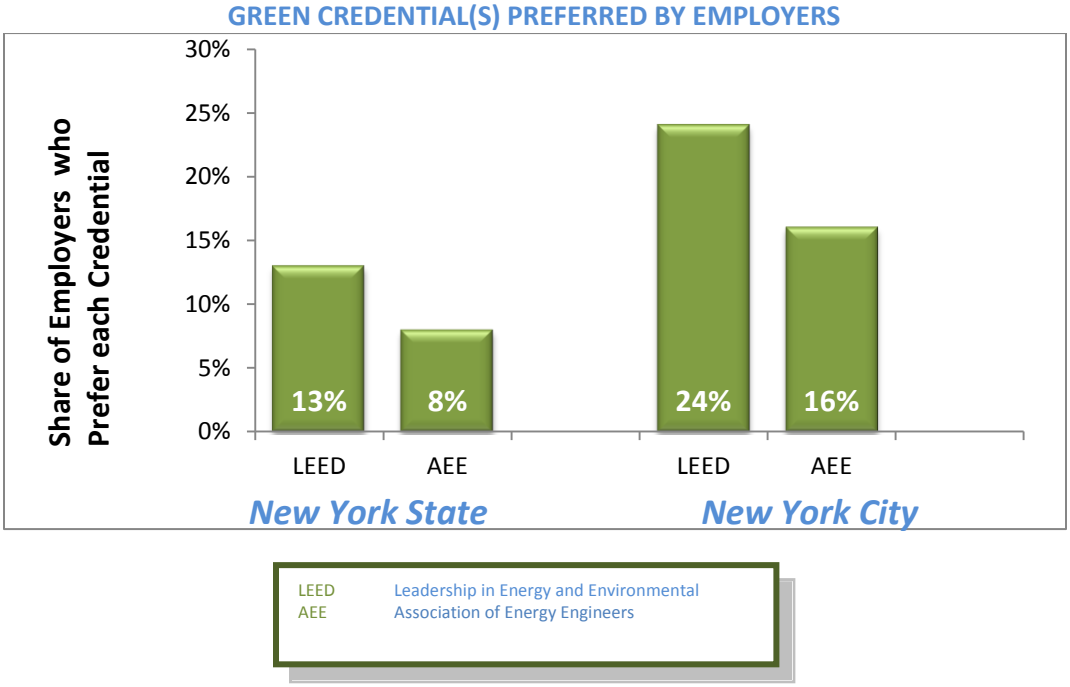
	New York State	New York City	Capital Region/ Mohawk Valley/ North Country	Hudson Valley	Central NY/ Southern Tier	Long Island	Western NY/ Finger Lakes
Green Employment	5,360	760	850	430	760	980	1,580
Regional Employment	80,450	5,750	11,040	8,820	16,820	13,700	24,280
Percent Green*	**7%**	**13%**	**8%**	**5%**	**5%**	**7%**	**6%**

Firms with green employees were asked whether they expected their green employment to be larger, smaller or unchanged a year later. Of the 260 Component Manufacturing firms with green employment, 81 percent expected their green employment to grow larger (42%) or remain unchanged (39%).

*Percentages are calculated from unrounded data.

Firms without green employees were asked whether they expected to have green employment a year later. In answer to this question, 70 percent of the 1,660 without green employment said they did not expect any change, 3 percent expected to have green employees a year later, and 27 percent were not sure.

Preferred Credentials for the Green Workforce. Employers who responded to the survey were asked what, if any, green credentials they prefer their "green" employees to have. As shown in the bar graphs below, 13 percent of the employers with green employees in New York State preferred a Leadership in Energy and Environmental Design (LEED) credential, and eight percent preferred an Association of Energy Engineers (AEE) credential. For New York City, the proportions were higher, with 24 percent preferring LEED and 18 percent preferring AEE.

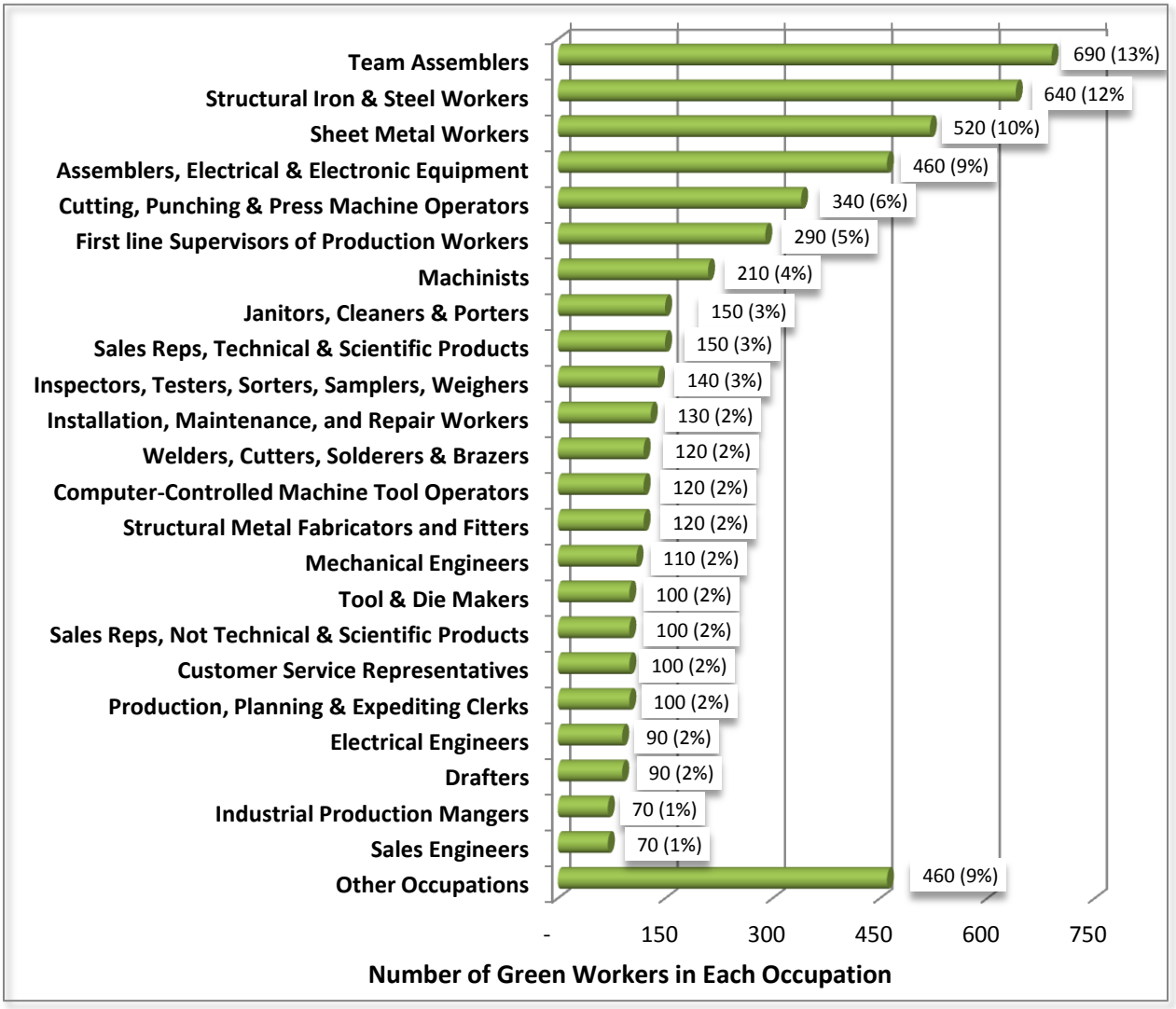


Focus groups and interviews with industry employers validated this response. Several indicated that being conversant in LEED helps, especially in understanding what types of products earn LEED points in building construction and retrofits. One company representative said that his company's acoustical noise reduction applications have earned LEED points because they improved the environment of the space. Another company mentioned that AEE credentials are recognized for Energy Engineers, an example being the Certified Energy Manager (CEM).

Occupational Information

Key Occupations. As shown in the chart below, the statewide employer survey found that the five most common occupations with green employment in Component Manufacturing are: Team Assemblers; Structural Iron and Steel Workers; Sheet Metal Workers; Electrical and Electronic Equipment Assemblers; and Cutting, Punching and Press Machine Operators (Metal and Plastic). These five occupations account for half of the cluster's green employment.

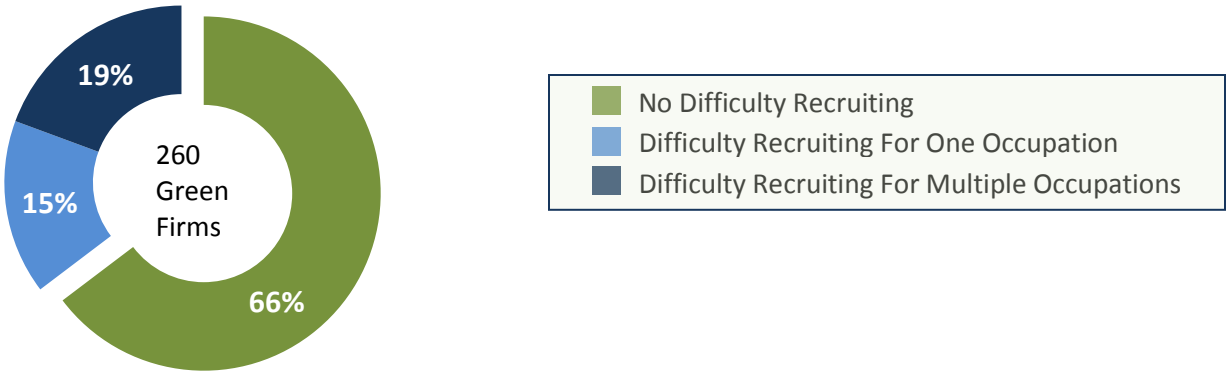
GREEN OCCUPATIONS IN THE COMPONENT MANUFACTURING CLUSTER



'Other Occupations' includes job titles that individually account for less than 1% of the total green employment in Component Manufacturing. These occupations, such as Civil Engineers, Electricians, and Environmental Engineers, together make up 9% of green employment in this industry cluster.

Career Pathways. One employer explained that his business needs a team effort from people with different disciplines, from technicians to electrical engineers, energy engineers and systems engineers. People in all of these disciplines need to be able to demonstrate the benefit of his company's devices (control and monitoring applications) to the customer and be successful in creating a project. Another company in the geothermal business takes its installation workforce from those with classic HVAC installer experience and gives them training in the new technology that it produces.

Recruitment, Retention and Turnover. As part of the employer survey, "green" firms were asked whether they have difficulty recruiting qualified workers. Of the 260 green firms in Component Manufacturing in New York State, 34% (90) have difficulty recruiting qualified green workers. 19% have difficulty recruiting for more than one occupation.



- The occupation for which employers have the most difficulty finding qualified candidates is Structural Metal Fabricators and Fitters, where 58 percent of firms (10 firms) report this issue. The second most frequent occupation with recruiting difficulties was Mechanical Engineers, where 52 percent, or 20 firms, percent report this difficulty. Occupational recruiting difficulties varied by region, however. The occupations where 15% or more of employer had difficulty finding qualified "green" workers were:

- Albany/Mohawk/North Country: Electrical Engineers (64%), Mechanical Engineers (81%) and Sales Reps, Technical & Scientific Products (36%)
- Central Region: no recruiting difficulties
- Hudson Valley: no recruiting difficulties
- Long Island: Mechanical Engineers (77%), Sales Engineers (68%, Assemblers, Electrical & Electronic Equipment (31%)
- New York City: First line Supervisors of Production Workers (29%)
- Western NY/Finger Lakes: Sales Reps, Not Technical & Scientific (100%), First-line Supervisors of Production Workers (19%), Computer-Controlled Machine Tool Operators

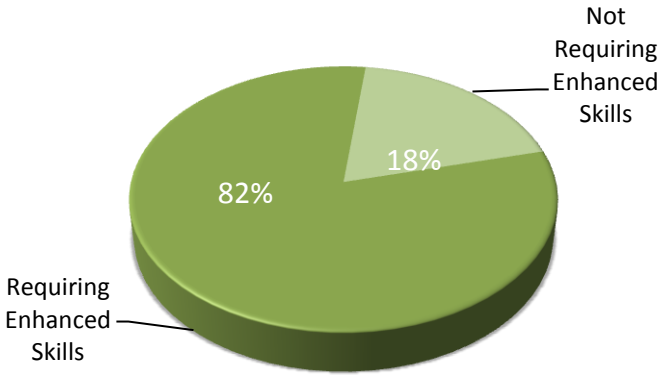
Component manufacturers that attended a focus group for this research on Long Island noted difficulty recruiting Power Engineers. One said that "the few we work with have been in the industry for 40 to 50 years and won't be around much longer; they want to retire." Another mentioned that the New York area is lacking in electrical engineering staff, both power and analog.

Another Long Island manufacturer of wireless web-enable communication technologies stated that they need Energy Engineers who really understand the incentive programs that are run by the State and who also have an in-depth understanding of the hearing systems in buildings.

In terms of general recruitment of new employees, several firms say that their web pages are recruiting tools at all levels. They note that because they are green companies, people want to work for them because they are seen as innovators. One employer recruits through one of the local community colleges and finds this is a good fit for this company. Most manufacturers are small companies.

Training and Educational Preparation. Employers were asked in the statewide survey how many of their employees required new skills to be able to perform their work in a green economy, and of those that required skills, where they were acquired. A very strong majority, more than four in five green employers in the Component Manufacturing cluster required employees to have enhanced skills to produce green products.

PERCENTAGE OF EMPLOYERS REQUIRING ENHANCED SKILLS FOR GREEN WORKERS

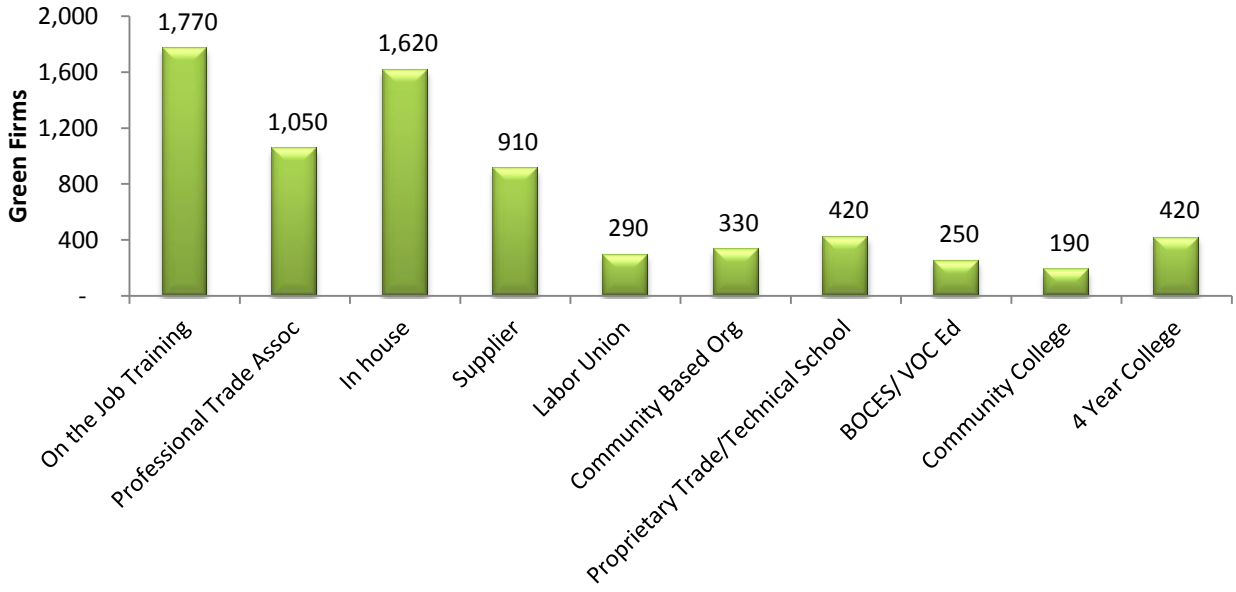


As the chart below shows, the sources of enhanced skills used by employer ranges from 'On-the-Job Training' to 'Four Year College'.

Common sources of training include 'On-the-Job Training' (160) and 'In- house' (130) in Component Manufacturing. The least utilized sources are community-based organizations (10) and labor unions (10).

Companies that participated in focus groups mentioned both on-the-job training and training from industry trade associations. Manufacturers work with dealers and installers, who often have the responsibility for making sure that its employees have the training, whether on their own or through their employers.

SOURCES OF ENHANCED SKILLS TRAINING



Recommendations for Education and Training Providers. Employers that took part in focus groups were asked what they would change about the way colleges, community colleges and training institutions are preparing students for the workforce. Their suggestions were:

- *More cross-functionality.* Employers say they need "engineers with stronger people skills and sales and marketing employees with stronger critical and analytical reasoning skills." They say

that “this is necessary in order for companies to be able to grow, innovate and meet the demands of a market without impacting with quality or reputation when it comes to development and being able to push the market forward.”

- *Prepare people for the workforce as well as educating them in the subject matter.* Employers believe that universities need to incorporate business practices and input into the university structures. They feel that students at all levels – including PhD level students – know their subject matter but are not prepared for the workforce. As one company representative said, “Once they’re in the workforce they see what they are lacking. There is definitely a flaw in the system.”
- *More hands-on learning.* As one employer said, “the next best thing to a project that can be started is a project that has already been performed. Taking all the parts involved, knowing exactly how they went in and what was required, is probably the easiest way to structure a curriculum for a building.”

Chapter 7: GREEN EDUCATION AND TRAINING PROGRAMS

An important component of the Green Jobs research in New York State is to identify and present the programs and offerings that prepare individuals for jobs in the green economy. The research identified all types of education and training -- degree and non-degree programs; credit and non-credit courses; in-person, online, and blended learning. These programs and courses are offered by community colleges, universities, community-based organizations, BOCES and Career & Technical Education high schools, labor unions, credentialing organizations and private entities. The goal of the research was to identify as many programs and offerings as possible in New York State that prepare individuals for green jobs or upgrade their existing skills sets so they are able to move in a green or sustainability direction.

The primary focus of the research was on training and education that prepares people for the occupations found in the four industry clusters that are the main subject of the research on employer demand (construction, professional services, building services and manufacturing), although information on additional fields was collected.

The findings on green education and training programs are organized into the major job families that appear to have the greatest presence in the green economy. Utilizing the O*NET-SOC categories, the six job families are:

- Construction and Extraction Occupations
- Architecture and Engineering Occupations
- Installation, Maintenance and Repair Occupations
- Building and Grounds Cleaning and Maintenance Occupations
- Life, Physical and Social Science Occupations
- Production Occupations

There is also a seventh category of “Miscellaneous Green Occupations” for selected occupations in the green economy that fall outside these six job families.

Details on the research methods used to collect data can be found in the “Research Methods” section of this report.

A. INFORMATION COLLECTION AND DEFINITION OF “GREEN” TRAINING/EDUCATION

For the most part, information was collected directly from education and training providers throughout New York State, who were invited to submit or verify information on their “green” education and training offerings. Institutions that responded were told that their “green” offerings would be included in the State’s research and listed on New York State’s green careers portal, www.greencareersny.com. It was the responsibility of the education and training providers to indicate whether any of their offerings were “green.” In general, courses and programs having to do with energy efficiency, sustainability, and renewable energy were considered “green.”

In order to be able to align information on employer demand with information on education and training, providers were asked to designate which industries (primary and secondary) and job families they believed they were preparing their students/trainees to work in. Industry categories used the North American Industry Classification System (NAICS categorization); job family categories followed the O*NET-SOC system.

In analyzing the data, the researchers also assigned a green "program focus" to the responses. Where possible, these "program focus" categories are intended to align with categories of economic activity included in the employer survey, such as energy efficiency and renewable energy (e.g. solar PV, solar thermal, wind, biomass, geothermal, hydro). In other cases, they are descriptive identifiers used to group similar programs together. Eleven "program focus" categories and an "other" program focus are shown in the table below. A complete listing of all programs by "program focus" may be found in the appendix.

Program Focus	Includes
Background Skills / General	Basic construction skills, math, computer, electrical theory to support energy efficiency, PV and renewables
Energy Efficiency	Energy efficiency, weatherization, Building Performance Institute (BPI), Heating, Ventilation and Air Conditioning (HVAC), Home Energy Rating Score (HERS) Rater
Renewable / Alternative Energy	Biomass, biofuels, bioenergy
	Fuel cells, battery technology
	Geothermal
	Solar PV
	Solar thermal
	Wind
	Multifocal programs or other renewable/alternative energy
Green Construction / Sustainable Building, Materials and Design	Green Construction, Architecture, Design, Sustainable/Green Building non-LEED
	LEED Programs
Energy Mgmt / Environmental Mgmt / Sustainability Mgmt / Facilities Mgmt	Energy Management, Environmental Management, Sustainability Management, Facilities Management
Waste Management / Environmental Remediation	Waste and waste water management
Engineering	Civil, electrical, environmental, mechanical, Nanoscale and nuclear engineering, engineering technology
Electrical / Power / Lighting	Electrical, Power and Lighting
Environmental Science	Environmental Science
	Environmental Biology, Chemistry, Geology, Natural and other Sciences
Environmental Studies	Environmental Studies
	Climate, policy, politics, law, economics, social aspects and planning.
Conservation Natural Resources / Forestry /Agriculture	Conservation Natural Resources, Forestry, Agriculture
Other / Miscellaneous	Other focuses not represented by the above focus groups

In addition to collecting and validating data directly with education and training providers, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, and technical and vocational institutions *related to* green jobs. The main data source for this examination was the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS). The IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with occupations in a job family. Details about the IPEDS data and how it was utilized is provided in the Research Methods section of this report.

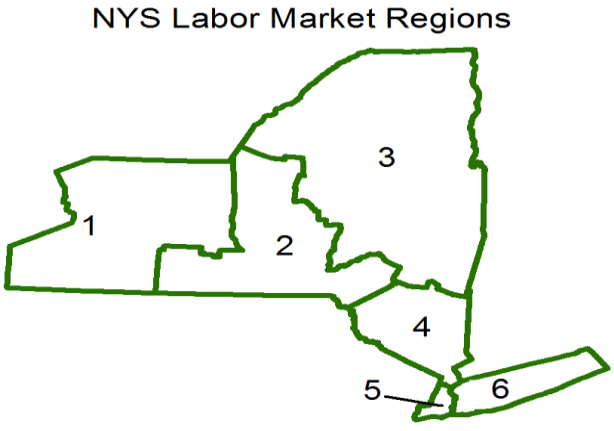
The analysis of degrees and certificates conferred, using the IPEDS data source, is presented along with the findings on green education and training programs for each of the six occupational job families.

B. SUMMARY FINDINGS

This section includes summary findings for:

- ✓ The number of "green" education and training programs identified by the researchers through direct contact with education and training institutions;
- ✓ "Green" education and training programs by job family;
- ✓ Types of organizations that provide "green" education and training;
- ✓ Sources of funding for "green" education and training;
- ✓ Industry-recognized credentials for which education and training programs prepare students;
- ✓ Program entry requirements;
- ✓ Target groups;
- ✓ Measures of program effectiveness; and
- ✓ Information on Entrepreneurial Programs, Programs for Displaced Workers, and Career Center Assistance

1. **Number of Green Education and Training Programs –** The information presented below is displayed for six Labor Market Regions of New York State. These regions are: (1) Western NY/Finger Lakes, (2) Central NY/Southern Tier, (3) Capital Region/Mohawk Valley/North Country, (4) Hudson Valley, (5) New York City, and (6) Long Island. The chart below shows the location of these six regions:



The table below displays the number of green degree/credit bearing programs and the number of non-degree/non-credit bearing programs in each labor market region of the state. On-line courses are listed separately as they can be accessed from any location. For the state as a whole, 802 green educational and training programs and courses were identified.

Region	Number of Degree/Credit Bearing Programs	Number of Non-Degree/Non-credit Bearing Programs	Total Programs
New York City	41	145	186
Hudson Valley	16	130	146
Central NY/Southern Tier	41	69	110
Capital District/North Country/Mohawk Valley	80	29	109
Western NY/Finger Lakes	56	50	106
Long Island	48	39	87
Online*	3	55	58
Totals:	**285**	**517**	**802**

***Online designation is for web based programs and is not one of the LMI Regions.**
***Blended format programs are included in 6 LMI Region totals.**

With 80 green degree or credit bearing programs, the Capital District/North Country/Mohawk Valley region has the highest share representing 28 percent of all degree/credit programs. The Western NY/Finger Lakes region has the second highest number of degree/credit programs with 56 or just fewer than 20 percent.

New York City has the largest number of green non-degree/non-credit bearing programs, with 145. The Hudson Valley region is second, with 130.

Of the 802 programs identified by the research 722 are delivered in person, 58 are online and 22 are by blended format.

2. **Green Education and Training by Job Family -** The table below presents the number of education and training programs by "Job Family," as defined in the U.S. Department of Labor's O*NET-SOC categories. Program totals for the six job families are represented below in order of prevalence:

Job Family*	Number of Degree Programs	Number of Non-Degree Programs	Total Degree and Non-Degree
Construction and Extraction Occupations	14	359	**373**
Architecture and Engineering Occupations	98	141	**239**
Installation, Maintenance, and Repair Occupations	26	196	**222**
Life, Physical, and Social Science Occupations	132	3	**135**
Building and Grounds Cleaning and Maintenance Occupations	7	68	**75**
Production Occupations	4	13	**17**

*** Totals do not add to 100% since programs may be counted more than once.**

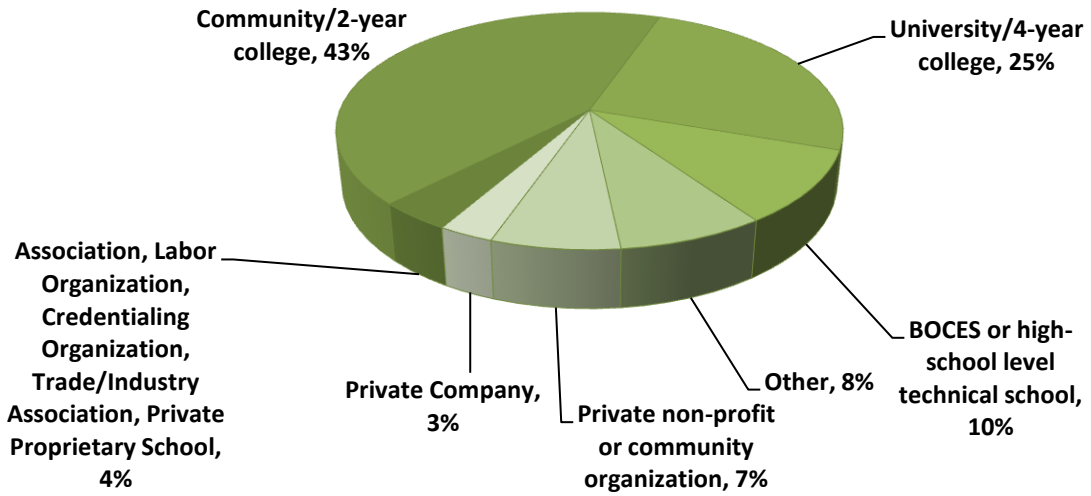
Further detail on each of these can be found in sections of this report devoted to each job family.

3. **Types of Organizations that Provide Green Training –** The research found that green-related education and training programs are offered by all of the following types of organizations:

- University/4-year Colleges
- Community Colleges
- BOCES or High School level technical schools
- Adult vocational training centers
- Private non-profit or community organizations
- Labor organizations or Joint Apprenticeship Committees
- Private proprietary schools
- Private companies
- Credentialing organizations
- Trade/industry associations
- Public/private partnerships

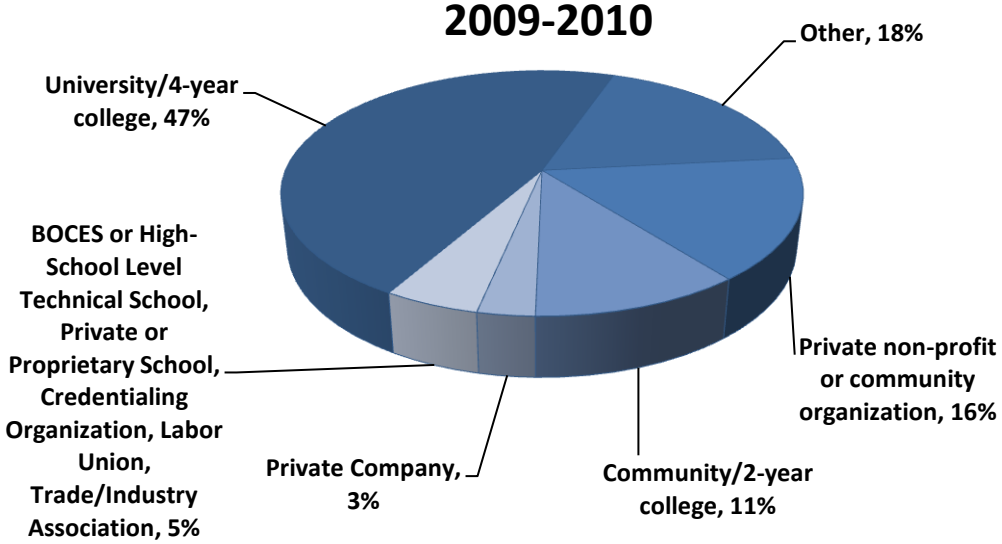
A total of 165 education and training providers were identified throughout New York State. Of these providers, 111 offer training in non-degree programs and 80 offer educational programs that lead to a degree or are credit bearing. The following graph shows the breakout of the types of institutions offering green non-degree programs and courses throughout NYS.

Non-degree/Non Credit Programs
New York State
2009-2010



While universities and community colleges offer the majority of non-degree programs, private, non-profit and community organizations play a much larger role in offering such training in New York City.

Non-degree/Non Credit Programs
New York City
2009-2010



It is known that labor organizations and Joint Apprenticeship Committees play a significant role in green skills training, especially in the construction trades. Due to a low response from these organizations, the information presented may under-represent their role in preparing the green workforce.

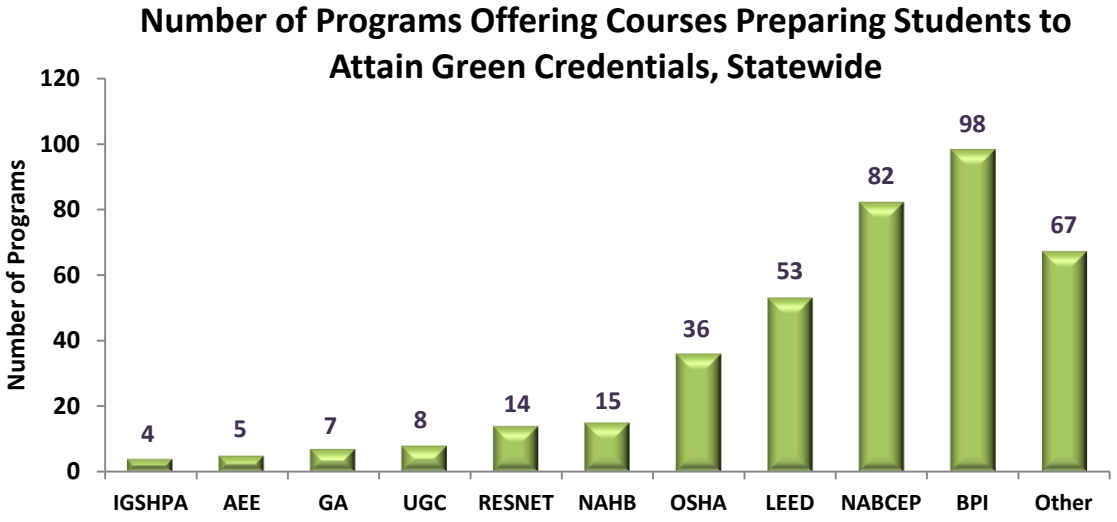
The role of "partnering" among education and training providers in providing "green" training. In a number of instances, providers partner with each other, often to take advantage of expertise or geographic location. The research identified 13 providers, with 25 programs, who partner with other organizations to deliver "green" training to students. These providers are in all six regions and include online training providers as well.

4. **Sources of Funding for "Green" Training/Education** – The research indicates that green education and training may be funded or financed in any number of ways and in many cases have multiple sources. The most commonly mentioned funding sources, in order of frequency, are:

    - Tuition/student funded
    - NYSERDA
    - State (non-NYSERDA)
    - Federal
    - Foundation
    - City

As indicated above, NYSERDA is the largest source of funding after tuition/student funding. Please see the sidebar about the importance of NYSERDA to financing "green" education and training.
Some training providers that receive funding through the federal American Recovery and Reinvestment Act (ARRA) are concerned about the loss of this source of revenue by the end of 2011.

5. **Industry-recognized "Green" Credentials for which programs and courses prepare students –** Providers were asked to indicate the specific credentials for which their programs prepare students. Some of the most common credentials for the energy efficiency, renewable energy, green building/construction and other industries are represented below. Providers indicated that 342 non-degree/non-credit based programs prepare students for these "green" credentials. Some of these programs prepare students for more than one credential. The chart below indicates the prevalence of each.

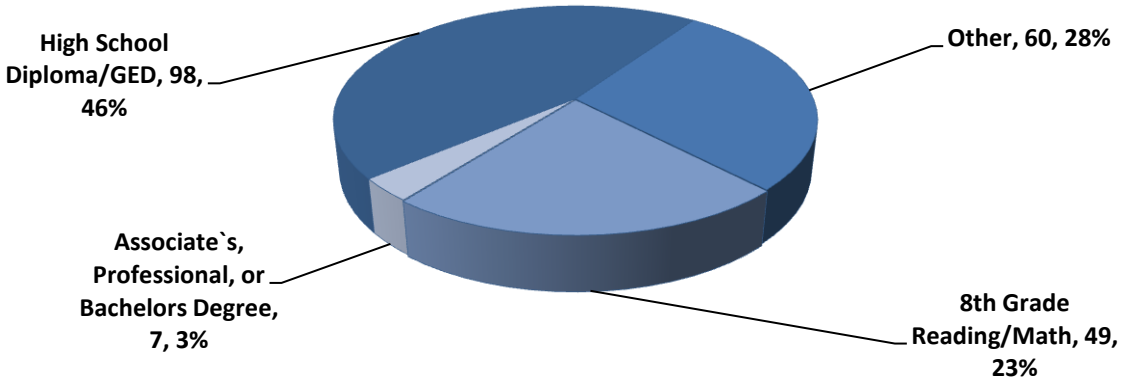


***Other category Includes credentials such as NYWEA and BEA**

6. **Program Entry Requirements –** Providers were asked if there were any program entry requirements beyond student interest in the subject matter. They were asked specifically about any required level of education, previous work experience, or prerequisite credential or degree.

    - ***Education Requirement*** Because degree and credit-bearing programs always require at least a HS Diploma/GED or other degree, they are not included in the graph below, which details the responses for non-degree/non-credit program.

Non-Degree and Non-Credit Bearing Programs: Entrance Requirements



Of the 517 programs, 214 indicated that they had some form of educational requirement. The graph above is broken down based on the 214 responses to this question. Almost 23% indicated that their programs required an 8th grade level of reading or math proficiency for entry into their program. Approximately 46% require a High School Diploma or GED. Post secondary degree requirements account for only about 3% collectively.

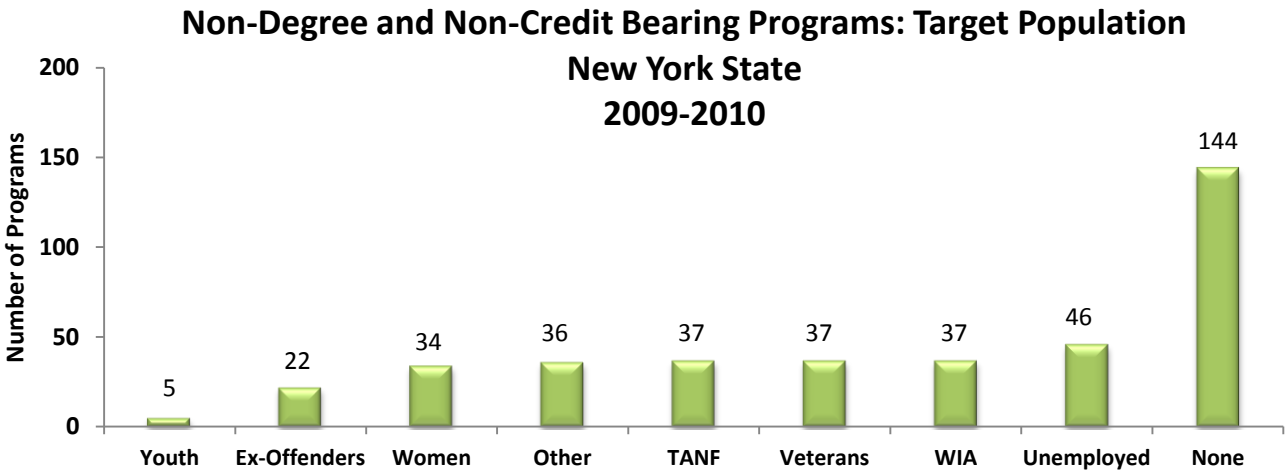
- ***Work Experience Requirement*** A total of 47 responders indicated that there is a work experience requirement to enter their program. Some examples include:

    - 1 year of sales experience
    - Basic building, design, construction knowledge or industry related experience
    - Electrical experience or an electrician's license
    - Plumbing or heating contractor, experience in cooling
    - Experience with HVAC systems or HVAC technician
    - Bachelor's degree equivalent work experience
    - Internship experience with a local business
    - Air sealing, weatherization, health and safety experience
    - Experience in the field of architecture, construction, or design
    - Participants should be a porter, handyperson or superintendant

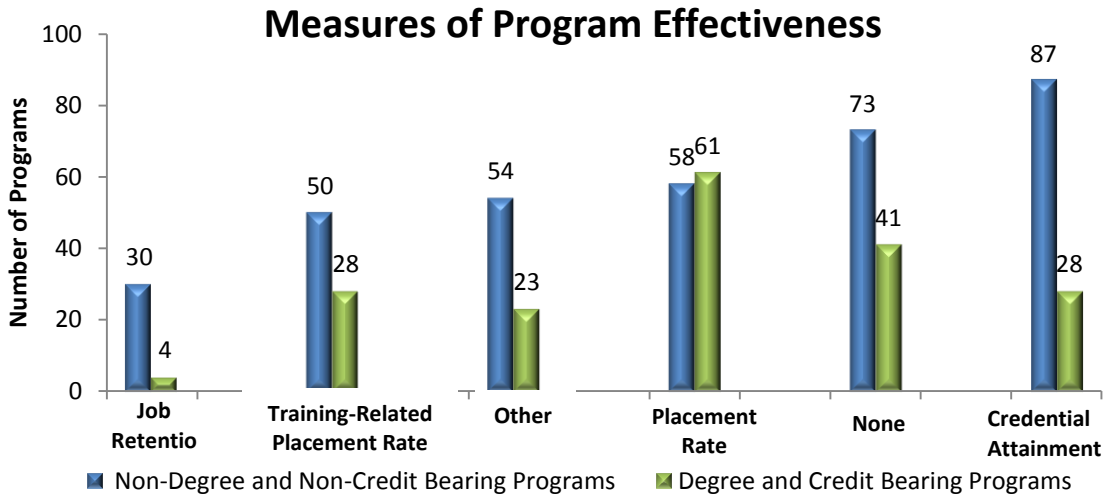
- ***Specific Credential or Degree Requirement*** Seventeen respondents indicated that there is a credential requirement to enter their programs. Some examples of these credentials are the LEED Green Associate credential, BPI Building Analyst Certification, NABCEP 40-hour

introductory PV class or certification as an entry level installer, OSHA 10-hr construction certification, EPA Section 608 certification type II or Universal Recovery Certificate, amongst others. No specific degree requirements were mentioned.

7. **Target Groups –** Providers were asked if their programs are directed toward specific target groups. Target group data was gathered for women, ex-offenders, unemployed, veterans or veteran's spouses, Workforce Investment Act (WIA) eligible, Temporary Assistance for Needy Families (TANF), "no specific target group" and "other" groups. A total of 217 respondents for non-degree and non-credit bearing programs indicated one or more target groups for their programs. A negligible number of providers responded for degree and credit based programs and this data is not included in the analysis. The distribution of target groups for non-degree and non-credit bearing programs are shown in the following chart:



8. **Measures of Program Effectiveness –** Providers were asked whether there are any measures of effectiveness used to evaluate their programs. They were asked specifically about job placement rate, placement in training-related jobs, job retention rate, and credentials obtained. "None" and "other" choices were also provided. Respondents were asked to check off as many as apply for any given program. Provider response distribution is indicated below for both degree/credit and non-degree/non-credit programs:



A total of 245 respondents provided measures of effectiveness data for non-degree and non-credit bearing programs and 114 respondents provided measures of effectiveness data for degree and credit bearing programs respectively. The most utilized measure of effectiveness for non- credit bearing programs was credential attainment. For degree and credit bearing programs, the most used measure was placement rate.

9. **Information on Entrepreneurial Programs, Programs for Displaced Workers, and Career Center Assistance –** Providers were asked whether their institution or organization includes or provides the following:

    - Entrepreneurial Programs for students
    - College and/or Federal/State programs that support displaced workers, underemployed and/or part-time workers interested in Green/CleanTech jobs
    - A College Career Placement Center that supports displaced workers
    - Affiliation with any Companies and/or Organizations that offer paid and/or unpaid Green/CleanTech Internship or Volunteer Programs
    - Affiliations with any Organizations that provide, or could provide, Green/CleanTech Scholarships at their institution

Thirty-one providers indicated that they have entrepreneurial programs for students; 31 providers indicated that they have programs to support displaced workers; 30 indicated that they have Career Placement centers; and 9 providers indicated affiliations with companies or organizations that offer internships. No information was provided regarding clean tech scholarships.

Green Jobs Training and the New York State Energy Research and Development Authority (NYSERDA)

NYSERDA*, a public benefit corporation, has a unique role in New York State. Its aim is to help New York meet its energy goals: reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment.* NYSERDA has a number of Workforce Development initiatives that support green career preparation in New York State. These initiatives are described below.

Career Pathways (Basic Skills) and Worker Readiness Training offer "worker readiness skills" training, which includes workplace preparation, teamwork, problem solving, time management, conflict resolution, and basic vocational/technical skills training with a specific vocational objective. Career Pathways training assists workers with the transition to next steps in career development, and seeks to increase student access to postsecondary programs, credential programs, and employment.

The Center for Energy Efficiency and Building Science (CEEBS.), headquartered at Hudson Valley Community College (HVCC), provides building science/energy efficiency training across most of New York State. Administered by HVCC, there are currently 13 learning centers in the CEEBS network teaching classes at 18 different locations across the state.

NYSERDA's Clean Energy Training Program provides training through thirty-six training centers including community colleges, four-year colleges, building trades, and BOCES throughout the state. Clean energy technology areas include: solar water heating, small and large wind, geothermal, fuel cells, and solar PV. NYSERDA assists participating PV installers to obtain certification by the North American Board of Certified Energy Practitioners (NABCEP).

TEC-SMART, the Training and Education Center for Semiconductor Manufacturing and Alternative and Renewable Technologies, developed by Hudson Valley Community College and NYSERDA, is located at the Saratoga Technology and Energy Park (STEP), in Malta, NY. The center prepares skilled technicians to meet the demands in growing industrial sectors that develop and manufacture semiconductors, photovoltaics, wind turbines, geothermal products, alternative fuels, and energy-efficient buildings.

Funding is available through NYSERDA to add energy efficiency elements to an existing **Apprenticeship** or building trades program. Apprenticeship programs must first be registered with the New York State Department of Labor and building trades programs must be accredited by a third party.

Internships are supported by NYSERDA in order to link academic learning with real work experiences and On-the-Job Training to provide incentives to develop job skills related to energy efficiency, weatherization, green building principles, and solar water heating installations.

NYSERDA funding is available for **Professional Certification Reimbursements** relevant to energy efficiency skills and competencies. Reimbursable expenses may include certification-related expenses, such as written examination fees, field exam fees, certification preparation course fees, and contractor accreditation fees.

NYSERDA has partnered with the Northwest Energy Efficiency Council to deliver the nationally-recognized **Building Operator Certification training** for building engineers and facility operators. Participants receive instruction in energy conservation techniques, facility electrical systems, indoor environmental quality, HVAC systems and controls, energy efficient lighting, and operations and maintenance practices for building systems.

New York State is committed to ensuring that at least 90% of residential and commercial buildings comply with the 2010 Energy Conservation Code of New York State (ECCNYS) by 2017. NYSERDA's Energy Codes Training and Support initiative will support the design and construction communities in this transition to a more energy efficient built environment.

C. GREEN TRAINING AND EDUCATIONAL FINDINGS BY JOB FAMILY

#1. Construction and Extraction Occupations – O*NET-SOC Code 47

Overview

This job family includes construction trades workers, construction trades helpers, first-line supervisors of construction trades workers, and closely related occupations. “Green” occupations such as solar photovoltaic installers, solar thermal installers and technicians, and weatherization installers and technicians are also included in this job family. Many people in the trades maintain that the difference between a “green” tradesperson and a tradesperson in general depends on the construction project, and that the basic preparation is the same (i.e. carpentry training for a carpenter, regardless of the application of these skills).

Skills for construction trades occupations are normally learned through pre-apprenticeship training, apprenticeship training, post-secondary education or on-the-job training. The research conducted under this grant focused on the 22 green occupations in the construction trades job family in O*NET’s

Greening of the World of Work[16] as well as occupations that were reported by New York State employers in the large employer survey conducted in late 2010 - early 2011.

Non-Degree/Non-Credit Bearing Programs

Green training in construction trades occupations is unique compared to other job families in that much training for the construction trades in New York State is provided by Joint Apprenticeship & Training Committees. As expressed by a union representative during a focus group discussion conducted as part of this green jobs research, "This new-labeled 'green' collar job is really a blue-collar worker coming back for some enhancement training. It's the work that we have always been doing. This isn't a new occupation. "The same representative continued, "All of our [Joint Apprenticeship & Training] programs are constantly evolving. They change based on market conditions, based on technology changes, this one [green] being a tremendous one. Green technology…was a door opened to us a few years ago that, you know, suddenly we all had to get reeducated in how to train for it."

As noted in the Research Methods section of this report, the researchers reached out to Joint Apprenticeship and Training Committees (JATCs) as well as other types of education and training entities to gather information for this report. The response rate from the JATC's was very low. We have presented narrative information on both pre-apprenticeship and apprenticeship programs in the construction trades, but because of the low survey response rate there is little statistical information in the table below for JATC programs and the information presented on the chart under-represents their role in training the "green" construction trades workforce.

The non-degree and non-credit bearing programs and courses identified for this job family may focus in such areas as background skills and general information; energy efficiency; electrical power and lighting; energy, environmental, sustainability or facilities management; renewable or alternative energy technologies; green construction and sustainable building, materials and design; and waste management and environmental remediation amongst others.

They may also include "green" education and training that prepare individuals for credentials from the following credentialing bodies:

- **AEE** (Association of Energy Engineers)
- **BEAC/CESB** (Board of Environmental, Health & Safety Auditor Certifications/Council of Engineering and Scientific Specialty Boards)
- **BPI** (Building Performance Institute)
- **GA** (Green Advantage)
- **UGC's GPro** (Urban Green Council)
- **LEED** (Leadership in Energy and Environmental Design)
- **NABCEP** (North American Board of Certified Energy Practitioners)
- **NAHB** (National Association of Home Builders)
- **OSHA** (Occupational Safety and Health Administration)
- **RESNET** (Residential Energy Services Network)

[16] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They are listed in the appendix.

Additional examples of credentials for which students are prepared in this job family include Certified Green Professional (CGP), certification for 40-hour HAZWOPER (Hazardous Waste Operations and Emergency Response); International Ground Source Heat Pump Association (IGSHPA) installer certification; BPI Cooling Professional, Envelope Professional and Heating Professional; Environmental Protection Agency (EPA) Renovation, Repair and Painting certification; 8-hour Lead Renovator certification; Pre-Apprenticeship Certificate Training (PACT) Certification; and preparation for the LEED Green Associate among many others.

Examples of "Green" Non-Degree Training:

The chart below displays the number of specifically "green" non-degree programs or non-credit bearing courses identified in the Construction and Extraction occupations by labor market region of New York State. Examples of these courses and programs include:

- Building Maintenance and Weatherization
- Construction Management for Green Building
- Electrical Installation
- Fundamentals of Building Green
- GPRO
- Green Building for Contractors
- Green Roofs and Living Walls
- Introduction to Photovoltaic Design and Installation
- LEED AP Building Design and Construction
- Solar Hot Water Systems
- YouthBuild program

The specific providers and programs can be found in the appendix to this report.

Construction and Extraction Occupations – *Green* Non-Degree Programs and non-Credit Bearing Courses				
Region	**Number of Providers**	**Number of Programs**	**Students Enrolled***	**Student Completers***
Hudson Valley	12	93	753	738
New York City	31	90	4096	3353
Central NY/Southern Tier	11	59	66	45
Long Island	9	34	566	546
Western NY/Finger Lakes	9	33	1585	1282
Capital District/North Country/Mohawk Valley	10	25	602	536
Online**	11	25	43	41
Total	**93**	**359**	**7711**	**6541**

*** Enrollment and completion data were not reported by all training/education providers.**
****Online designation is for web based programs and is not one of the LMI Regions.**
****Blended format programs are included in 6 LMI Region totals.**

The Hudson Valley region offers the largest number of non-degree programs in the Construction and Extraction Job Family and represents almost 26 percent of the training programs offered. Within the Hudson Valley region, SUNY Ulster County Community College accounts for 34 programs in this job family and is one of the partner organizations with the Hudson Valley Community College (HVCC) Center for Energy Efficiency and Building Science (CEEBS) programs, which has other partners in this region as well. New York City has the second largest number of programs and represents about 25 percent of the total.

The New York City region has the highest reported enrollment and completion rates for all regions representing just over one-half of all enrollees (53%) and completers (51%) for the state. Solar One and Forever Green Training and Design are the largest contributors accounting for more than half of the total enrollment and completion reported for the New York City region. The Western NY/Finger Lakes region has the second highest reported enrollments and completions, representing about 21% and 20% respectively. Alfred State College and Erie Community College account for approximately two-thirds of the enrollment and completion in this region. The Central NY/Southern Tier region has the lowest reported enrollment with 66 enrollees and 45 completers, representing less than one percent of the statewide total for both.

Twenty-five "green" Online training programs were found for this job family.

Spotlight on Green Professional Building Skills (GPRO) Training

Many construction trade unions have participated actively with the Urban Green Council (the New York City affiliate of the US Green Building Council) to develop the Green Professional Building Skills (GPRO) program, which is intended to teach experienced construction workers the principles of sustainability as well as trade specific green construction knowledge.

The program helps these workers incorporate green practices into the core knowledge of their trade.

The GPRO training program includes:

- ***Fundamentals of Building Green***: 4-hour course intended to cover the "green gap" between standard trade skills and the new awareness and skills required to successfully implement green building. This course is prerequisite to all other GPRO courses.
- ***GPRO Construction Management***: 6-hour course that fills the "green gap" for individuals with construction experience such as: CM or GC Site Superintendent, Project Manager, Executive Project Manager, Project Engineer/Clerk, Sustainability Manager, experienced tradesman with five years of experience, tradesperson with site supervision or management responsibility, facilities manager or building owner, owner's representative or project manager, project architect, professional engineer, or commissioning agent.
- ***Electrical Systems***: 6-hour course designed for electricians and workers in the electrical industry.
- ***Plumbing***: 6-hour course designed for plumbers and workers in the plumbing industry.
- ***Mechanical Air*****:** 6-hour course in sustainable construction practices for HVAC mechanics and workers in the heating and air conditioning industry.
- ***GPRO Operations & Maintenance Essential:*** *8-hour course* intended for a wide variety of professionals who work on-site in building operations and maintenance.

In New York City, GPRO courses are currently being delivered through three partner colleges: City Tech in Brooklyn, Hostos Community College in the Bronx, and LaGuardia Community College in Queens.

Students who live or work in New York City are eligible to apply for a 50% reimbursement for course and exam fees through NYSERDA. Several construction trade unions are actively promoting GPRO to their memberships.

Pre-Apprenticeship Training Programs:

Several areas of the state have either pre-apprenticeship programs or transition programs that prepare individuals for entry into any of the construction trades. Some work with under-represented populations, others with high school students, and others with returning military personnel. Some pre-apprenticeship programs operated in New York City and Long Island include:

- Building & Construction Trades Council of Nassau and Suffolk County Workforce Development Program
- Edward J. Molloy Institute for Construction Skills (New York City)
- Non-traditional Employment for Women (New York City)
- Helmets-to-Hardhats (nationwide program for returning military personnel, with locations in New York City and elsewhere in New York State)

Construction Trade Apprenticeships and Training Programs

Within the construction trades in New York State, there are many different union locals, of varying sizes and covering different geographic areas. The following chart is not a complete list, but displays some of the construction unions most involved in green construction in the downstate areas of New York. More information on apprenticeship programs and apprenticeship occupations can be found on www.labor.ny.gov/apprenticeship/appindex.shtm.

Type of Labor Organization	Area of Coverage	Nature of Trade	Involvement in Green Construction	Apprenticeship Duration
Boilermakers Local 5	NYC, Long Island, lower Hudson Valley	Construction boilermakers	Several areas	4 years
Northeast Regional Council of Carpenters	New York State	Carpenters, cabinetmakers, millwright, pile drivers, construction divers	Carpentry, cabinetry	4 years; 5 years for cabinetmakers
Electrical Workers – IBEW Local 25	Nassau & Suffolk	Electrical, Construction, Maintenance, Communication	Several areas	5 years
Electrical Workers – IBEW Local 3	New York City & Westchester County	Electrical, Construction, Maintenance, Communication	Several areas	5½ years
Laborers:	NYC & Long	All aspects of	Weatherization	3 years for Locals

Locals 79 (Building Construction Laborers), 78 (Environmental Remediation Laborers) and 10 Home Performance Laborers); training handled by the Mason Tenders Training Fund	Island	construction: masonry, plastering, scaffolding; Environmental remediation; Home performance laborers	of residential homes; Remediation of hazardous materials	78 and 79
Steamfitters Local 638	NYC, Nassau, Suffolk	Installation of Steam or Hot Water Piping	Heating, air conditioning, ventilation, air conditioning and refrigeration (HVAC/R)	5 years.
Plumbers Local 1	New York City	Installation, repair and maintenance of piping systems	Several areas	5 years

Some construction trade apprenticeships now offer an Associate's Degree as part of the apprenticeship, through articulation agreements with colleges. One example of this is Local 3 of the International Brotherhood of Electrical Workers, based in New York City, which has an articulation agreement with Empire State College.

Pathways out of Poverty "Green" Training Grants

Pathways out of Poverty Grants, funded through the American Recovery and Reinvestment Act of 2009, were awarded by the U.S Department of Labor's Employment and Training Administration through a competitive procurement process. The purpose of these grants is to teach workers the skills required in high growth and emerging industries, including energy efficiency and renewable energy. The programs are designed to help individuals to learn new skills and competencies, gain employment, and advance along career pathways.

Focused on Public Micro Data Areas (PUMAs) where poverty rates were 15% or higher, the grants are targeted to individuals who may lack basic literacy and job readiness skills, and may also face other barriers to employment.

There are four Pathways out of Poverty grants operating in New York State:

- **The Consortium for Worker Education** (www.cwe.org), along with service partners SoBRO, Sustainable South Bronx, the Osborne Association, the Association for Energy Affordability and Nontraditional Employment for Women, is establishing the **Center for Environmental Workforce Training (CEWT)** to recruit, train and identify employment opportunities for Bronx residents in city-wide emerging Green industries and transitioning sectors. These include Green

Building Construction and Retrofit, Energy Efficiency Assessment, Deconstruction and Materials Use, and Sustainable Manufacturing.

- **STRIVE (**www.striveny.org**) in East Harlem operates a Green** Construction Program that trains students in carpentry, electrical, and plumbing and prepares them for handling hazardous materials and energy efficient building and retrofitting techniques. The program includes instruction in four Brownfield Remediation certifications that are industry-recognized within New York State. In addition, the program includes classes in weatherization, energy auditing and solar panel installation.
- **Pathstone Corporation** (www.pathstone.org) runs the **"Green for Gold"** program in Rochester, New York, which focuses on deconstruction, specifically on city properties slated for demolition in Rochester.
- **Central New York (CNY) Works** (www.cnyworks.com) is coordinating the **"eCUSE"** grant which provides low-income jobseekers living in the City of Syracuse with access to green employment and training assistance.

For more information about Pathways out of Poverty grants visit http://www.doleta.gov/pdf/Pathways_Poverty_grants.pdf.

Degree and Credit-Bearing Certificate Programs

General Degree and Credit-Bearing Certificate Programs

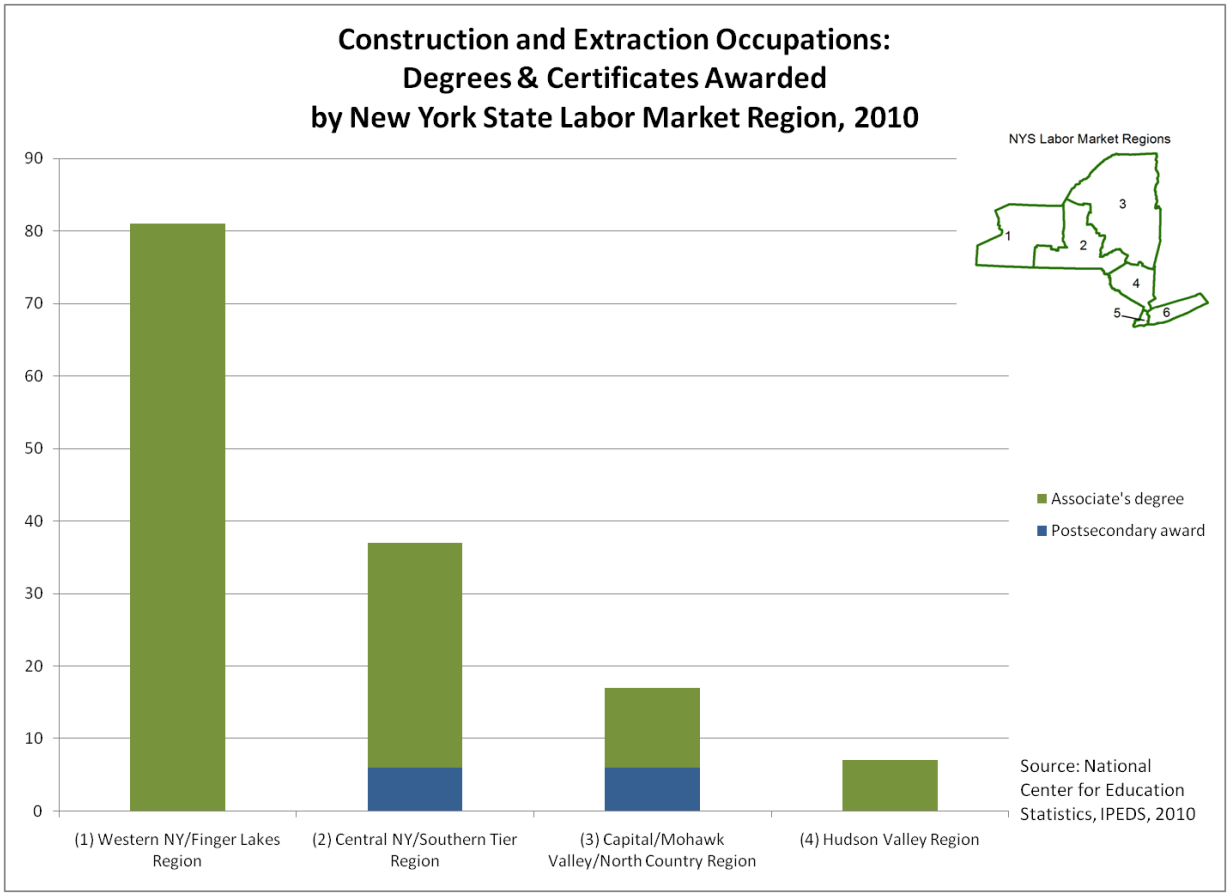
As explained more fully in the "Research Methods" section of this report, as part of its research on "green" jobs, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, technical and vocational institutions related to green jobs.

The information below was derived from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), which gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. IPEDS data, which is organized by instructional program ("CIP" codes) was "crosswalked" to occupations using the U.S. Departments of Education and Labor's "CIP–SOC "crosswalk" to link instructional programs to occupations.

It should be noted that IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with a job family but may not pertain to the occupation as it relates to the green economy.

IPEDS data indicates that in 2010, 142 awards were conferred related to the Construction Trades job family.

Only four of the six NYS LMI Regions have awards in this Job Family. These regions include the Western NY/Finger Lakes, Capital District/Mohawk Valley/North Country, Central NY/Southern Tier and Hudson Valley regions.



130 awards conferred were at the Associates degree level, with 81 Associates degrees or 57% of awards in the Western New York/Finger Lakes region, followed by 31 or 26% in the Central NY/Southern Tier Region. The Associate's degree is the highest award level for this Job Family.

Green Degree and Credit-Bearing Certificate Programs

The chart below summarizes the number of *specialized* green-related degree and credit bearing programs in Construction Trades that the research partners identified through original research, which was then validated by the postsecondary institutions. A list of institutions and programs can be found in the appendix of this report.

Relatively few degree and credit based programs were found for this job family, as the skills required for Construction Trades occupations are learned predominantly through pre-apprenticeships, apprenticeships, post-secondary non-credit courses and on the job training.

Construction and Extraction Occupations – *Green* Degree Programs and Credit Bearing Courses				
Region	**Number of Providers**	**Number of Programs**	**Students Enrolled**	**Student Completers**
Long Island	3	4	275	104
Western NY/Finger Lakes	2	4	99	97
Capital District/North Country/Mohawk Valley	3	3	n/a	n/a
Central NY/Southern Tier	2	2	66	14
New York City	1	1	n/a	n/a
Totals:	**11**	**14**	**440**	**215**

***Enrollment and completion data were not reported by all training/education providers.**

Three providers were identified on Long Island offering four programs, which represents 29% of all programs in the identified regions. The Western New York/Finger Lakes region also has four programs, which are offered by two providers.

The Long Island region has the highest number of students enrolled and completed, representing 63% and 48% respectively of enrollees and completers in the state.

Illustrative "green" degree program names include:

- Building Trades-Building Construction AOS (Associate of Occupational Studies)
- Construction and Environmental Technology AAS
- Construction Management Engineering Technology BS
- Green Building Technology – One year credit certificate
- Sustainable Urban Environments BS
- Alternative and Renewable Energy Systems B-Tech (Bachelor of Technology)

Program Focus

The following chart displays particular program focus areas for Construction and Extraction programs. "Program focus" categories are assigned with the intention to align programs with categories of economic activity included in the employer survey, such as energy efficiency and renewable energy (e.g. solar PV, solar thermal, wind, biomass, geothermal, hydro). In other cases, they are descriptive identifiers used to group similar programs together.

In construction and extraction occupations, a large number of "green" programs identified are focused on energy efficiency, green construction/sustainable building, materials and design, and renewable energy. Of note is the significant number of LEED programs offered. In addition, solar programs comprise a large percentage of the programs in renewable energy offered across the state.

A complete list of program focus areas for all programs can be found in the appendix to this report.

Construction and Extraction Occupations – Program Focuses	Degree/ Credit Programs	Non Degree/ Non-Credit Programs
Background Skills / General	n/a	16
Electrical / Power / Lighting	n/a	5
Energy Efficiency	n/a	107
Green Construction / Sustainable Building, Materials and Design:		
Green Construction, Architecture, Design, Sustainable/Green Building (non-LEED)	5	55
LEED Programs	n/a	23
Other / Miscellaneous	3	35
Renewable / Alternative Energy:		
Biomass / Biofuels / Bioenergy	n/a	1
Fuel Cells / Battery Technology	n/a	1
Geothermal	n/a	10
Multifocus or Other Renewable / Alternative Energy	2	9
Solar PV	2	63
Solar Thermal	n/a	16
Wind	1	9
Waste Management / Environmental Remediation	1	9

*Programs may be counted toward multiple job families

Conclusion

Green training in the construction trades job family is unique compared to other job families. Construction skills are learned predominantly through on the job, pre-apprenticeship or apprenticeship types of training. Basic training for a "green" tradesperson is largely the same as for the trade in general. This is reflected in the relatively low occurrence of "green" degree or credit related educational and training programs found for this job family. In many cases, pre-apprenticeship, apprenticeship and training for union workers has been updated to include content required for green or sustainable construction.

Many "green" non-degree and non-credit based programs have been identified by the research for Construction and Extraction occupations. A large number of these programs provide specific credentials that are recognized by credentialing bodies such as the Green Building Certification Institute (GBCI), which administers the LEED credential, Building Performance Institute (BPI), the North American Board of Certified Energy Practitioners (NABCEP) and many others to provide the "green" skills and training workers may need to enhance existing skills or to provide new skills, training and specializations within their occupations. These programs are focused in multiple areas including energy efficiency, renewable energy, green construction and sustainable building, amongst many others.

Overall enrollment and completion data for Construction and Extraction occupations is the highest of the six job families analyzed. The Hudson Valley region has the largest number of "green" training programs, while New York City and the Western NY/Finger Lakes region account for approximately two-thirds of the enrollment and completion for the state.

#2. Architecture and Engineering Occupations - O*NET-SOC Code 17:

Overview

The architecture and engineering occupational family includes architects, surveyors, cartographers, and engineers of all types as well as the drafters, cartographers, and technicians who support them. Architects, engineers and surveyors are licensed by New York State; in addition to passing an examination, they must meet the educational requirements for licensure. Employment as a drafter, cartographer, or technician typically requires a Bachelor's Degree. According to the New York State Department of Labor, many people in these occupations are employed in architecture, engineering and construction firms; others work for city and state governments.

The research conducted under this grant focused on the 28 green occupations in the architecture and engineering job family in O*NET's *Greening of the World of Work.*[17]

Non-Degree/Non-Credit Bearing Programs

Employers of the professional occupations within this job family – architects and engineers - generally require at least a four-year degree and often a Master's Degree in the relevant field (i.e., mechanical engineering for mechanical engineers; electrical engineering for electrical engineers, etc.). Drafters and technicians may obtain employment with a four-year degree or less. Although on-the-job experience with energy efficiency building design and retrocommissioning is useful, employers also recognize other "green" credentials.

Non-degree and non-credit bearing programs and courses for this job family include "green" continuing education courses recognized by credentialing bodies such as the Green Building Certification Institute (GBCI) for LEED programs, the American Institute of Architects (AIA), and the Association of Energy Engineers (AEE). Credentials from these sources are considered useful in occupations in construction and other job families. Courses focus on energy efficiency; electrical, power and lighting; energy, environmental, sustainability or facilities management; renewable or alternative energy technologies; green construction and sustainable building, materials and design; LEED programs, and waste management and environmental remediation amongst others.

[17] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They are listed in the appendix, along with statistical information about projected growth and openings in the State of New York. O*NET also classifies green occupations into three categories: increased demand, enhanced skills, and new and emerging. *Increased demand* occupations are expected to grow as the green economy grows without undergoing any substantial change in the nature of the work; *enhanced skills* occupations require new skills in order to operate in the green economy (and may or may not be expected to grow); finally, *new and emerging* occupations are entirely new jobs that do not exist outside of the green economy.

Credentials. The major credentialing organizations associated with green employment within the Architecture and Engineering job family include:

- **AEE** (Association of Energy Engineers)
- **BEAC/CESB** (Board of Environmental, Health & Safety Auditor Certifications/Council of Engineering and Scientific Specialty Boards)
- **BPI** (Building Performance Institute)
- **GA** (Green Advantage)
- **LEED** (Leadership in Energy and Environmental Design)
- **NABCEP** (North American Board of Certified Energy Practitioners)
- **NAHB** (National Association of Home Builders)
- **OSHA** (Occupational Safety and Health Administration)
- **RESNET** (Residential Energy Services Network)

Other recognized credentials are Certified Green Professional (CGP), Certified Sustainable Building Advisor (CSBA), EPA Universal Recovery Certification, International Ground Source Heat Pump Association (IGSHPA), Interstate Renewable Energy Council **(**IREC) accreditation, NAPCEP II Instructor and others.

Major LEED Accreditations

Credential	Description
LEED Green Associate	Intended for professionals who want to demonstrate green building expertise in non-technical fields of practice and denotes basic knowledge of green design, construction and operations.
LEED AP BD+C	A standard for professionals participating in the design and construction phases of high-performance, affordable and environmentally sound commercial, institutional, and high-rise residential buildings. The credential denotes practical knowledge of the Green Building Design + Construction LEED rating systems: LEED for New Construction, LEED for Schools and LEED for Core & Shell.
LEED AP ID+C	A standard for professionals participating in the design and construction of environmentally responsible, high-performance commercial spaces and tenant improvements. This credential denotes practical knowledge of the Green Interior Design + Construction LEED rating system: LEED for Commercial Interiors.
LEED AP Homes	A standard for professionals participating in design and construction of high-performance green homes. This credential denotes practical knowledge of the LEED for Homes rating system.
LEED AP O+M	A standard for professionals participating in the operation and maintenance of existing buildings that implement sustainable practices and reduce the environmental impact of a building over its functional life cycle. This credential denotes practical knowledge of the Green Building Operations + Maintenance LEED rating system: LEED for Existing Buildings: Operations & Maintenance.

LEED AP ND	A standard for professionals participating in the design and development of neighborhoods that meet accepted high levels of environmentally responsible, sustainable development. This credential denotes practical knowledge of the LEED for Neighborhood Development rating system.
SOURCE :	www.usgbc.org

The table below shows the distribution of non-degree providers and programs in New York State for this job family, along with the number enrolled and the number of completers in the most current year of program operation (2010-11).

The New York City Region has 63 non-degree programs for architecture and engineering occupations operated by 16 providers (45% of all programs in the state). New York City's completion rates are also the highest in the State. Two providers located in New York City --Solar One and Forever Green Training and Sustainable Design -- are the largest contributors for this region.

Spotlight on LEED (Leadership in Energy and Environmental Design)

LEED Building and LEED credentials are gaining a lot of ground in NYC and across New York State especially in the construction, architecture and engineering industries.

LEED, or Leadership in Energy and Environmental Design, is an internationally recognized green building certification system. Initially developed by the U.S. Green Building Council (USGBC) in March 2000, and modified several times since, LEED provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions. (USGBC)

Professionals may take an exam to become accredited in the practices of LEED building. Many architectural and engineering firms prefer that their employees have LEED credentials because their firms work on LEED projects. Some firms hire individuals without the LEED credential but may expect their new employees to earn the credential within a short time after they are hired.

Professionals may receive a particular credential in their area of interest by taking a special accreditation exam. The text box shows the major LEED accreditations.

Architecture and Engineering Occupations - *Green* Non-Degree Programs and Non-Credit Bearing Courses				
Region	**Number of Providers**	**Number of Programs**	**Students enrolled***	**Student completers***
New York City	16	63	1855	1582
Long Island	5	16	246	234
Hudson Valley	4	15	194	184
Capital District/North Country/Mohawk Valley	2	10	372	355
Western NY/Finger Lakes	2	10	435	201
Central NY/Southern Tier	2	7	n/a	n/a
Online**	6	20	34	32
Total	**37**	**141**	**3136**	**2588**

*** Enrollment and completion data were not reported by all training/education providers.**
****Online designation is for web based programs and is not one of the LMI Regions.**
****Blended format programs are included in 6 LMI Region totals.**

The Long Island Region has the second highest number of programs, with 16. The Capital District/North Country/Mohawk Valley has the second highest completion rate; its completers comprise 14 percent of all completers in the state. Central New York/Southern Tier has the fewest programs with only five percent of the total in the State.

In addition to LEED and other credential-associated programs, illustrative non-degree program names found in New York State include:

- Leading Sustainability Initiative: Green Change Management
- Energy-Efficient Design for Architects
- Environmental Site Investigation and Remediation
- Fundamentals of Sustainable Buildings and High Performance Systems Design
- Green Roofs and Living Walls
- New Technologies - Smart Grid and Smart Buildings
- Photovoltaic Systems
- Sustainability Approach to Engineering Design

Degree and Credit-Bearing Certificate Programs

As part of its research on "green" jobs, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, technical and vocational institutions on workers to prepare them for green jobs. The main data source for this examination was the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS). The IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. Among the data collected

through IPEDS is information on the number of certificates and degrees conferred, by instructional area. The instructional areas are organized according to the Classification of Instructional Programs (CIP).

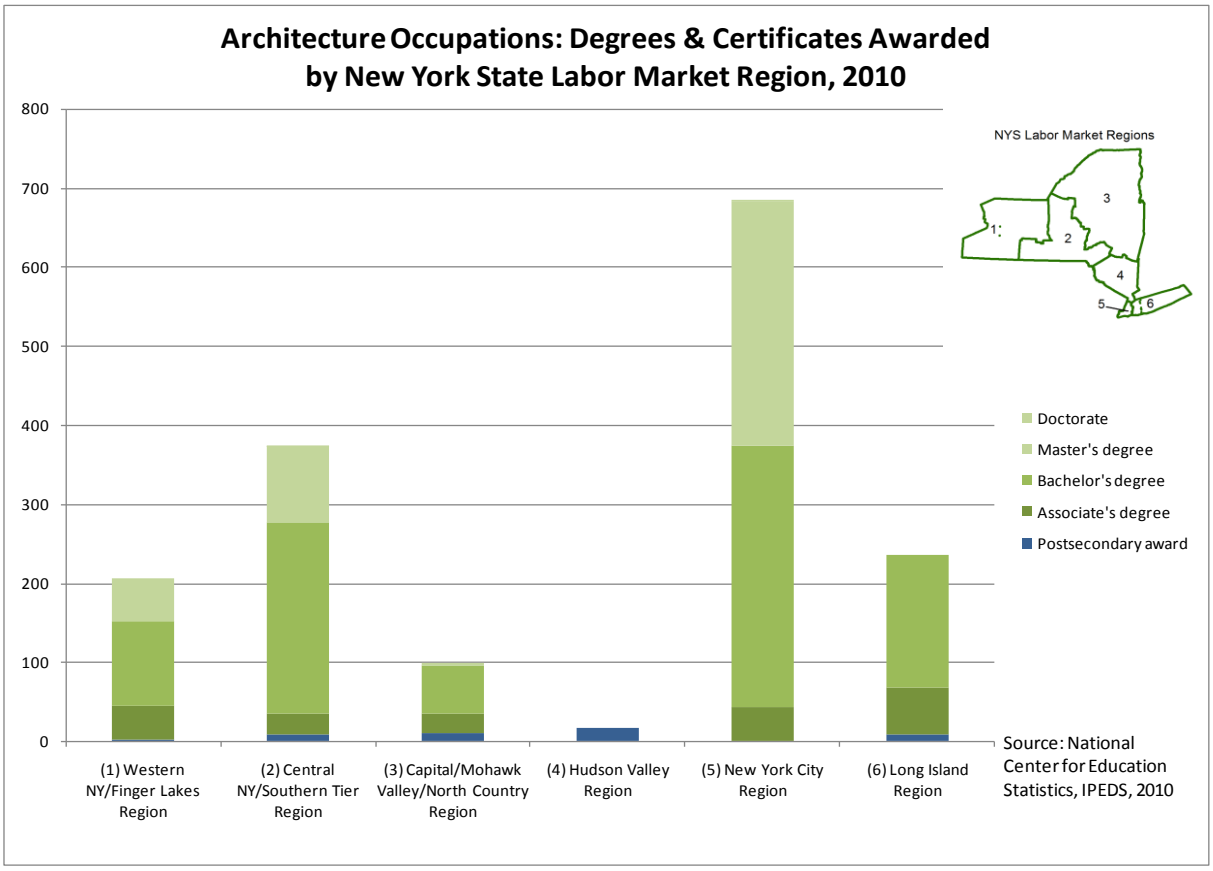
The generally accepted system for organizing occupations is the Standard Occupation Classification (SOC) system. This system organizes occupations into 23 major groups (job families), within which there are 461 broad occupational categories. The research partners employed the U.S. Departments of Education and Labor's "CIP–SOC "crosswalk" in order to link instructional programs to occupations. Using this crosswalk, it is possible for an instructional program to be associated with multiple occupations; an occupation may also be associated with multiple instructional programs. In the research that follows, we include both types of multiple associations.

Finally, it should be noted that IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with a job family. In other words, many programs may not pertain to the occupation as it relates to the green economy. For this information, the research partners collected original data from several online and expert sources; data on green-related degrees and credited certificates were validated by the research partners with an online data collection instrument that was completed by invited institutions.

General Degree and Credit-Bearing Certificate Programs

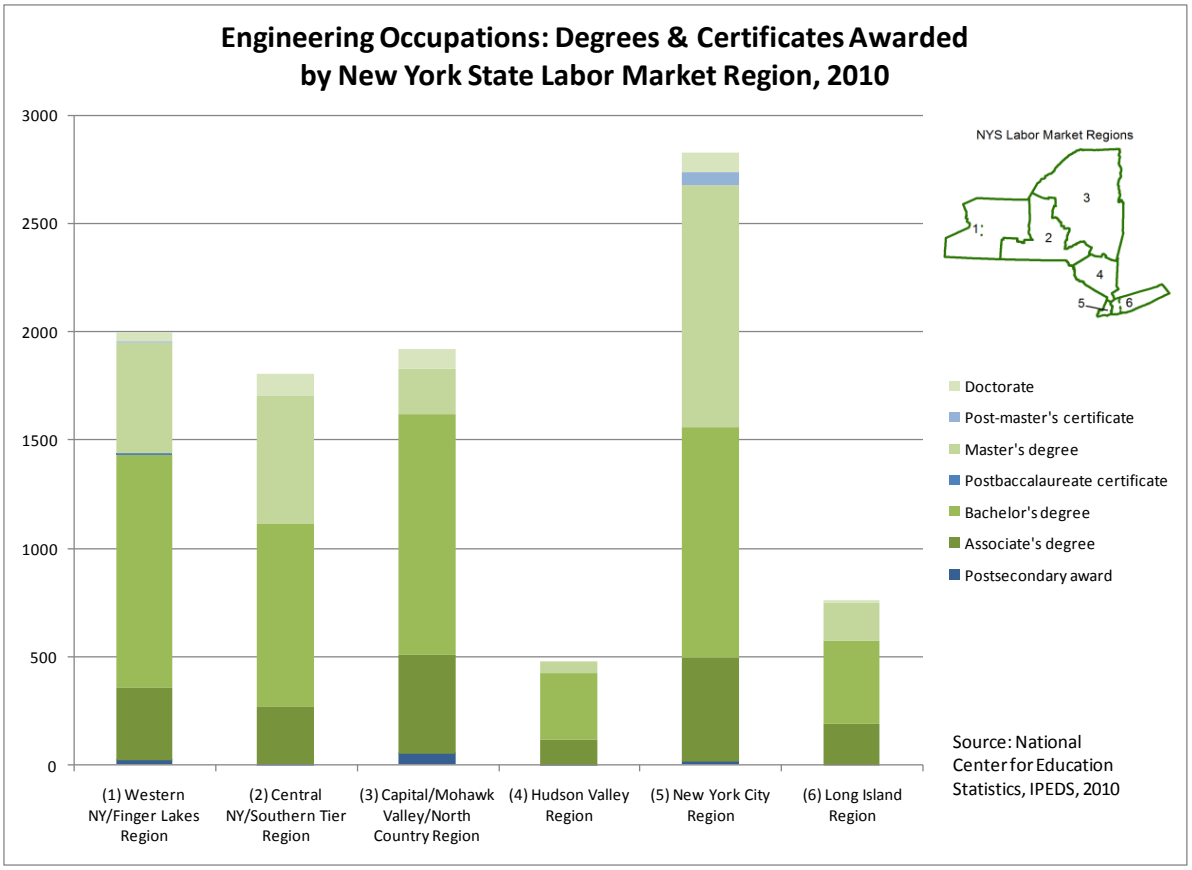
The research partners analyzed degree programs for the architecture subfamily separately from the engineering subfamily.

Architecture Subfamily. In 2010 1,617 people received degrees or certificates that prepare them for work within the architecture and drafters subfamily. Approximately 56 percent of the degrees awarded are at the Bachelor's level and 29 percent are at the Master's level. The chart below shows the number and types of awards granted by region.



New York City has the highest number of degrees awarded in this Job subfamily with 685 awards. Of these, 331 (48%) are at the Bachelor's level and 309 (49%) are at the Master's level. The Central NY/Southern Tier Region – where Cornell University is located – ranks second overall with 372 graduates in architecture. The Hudson Valley Region comprises the smallest share of awards with 17; the highest award in this region is a postsecondary certificate. Long Island ranks highest in Associates Degrees awarded.

Engineering Subfamily. In 2010, 9,788 awards were conferred preparing individuals for the Engineering and Technician Occupations Job subfamily. Nearly one-half of all awards (49%) are at the Bachelor's Degree level. The Master's Degree level represents 27 percent of the awards. The chart below shows the number and types of engineering-related awards granted by region.



New York City educational institutions have the highest number of total degrees awarded at the Associates, Bachelor's and Master's Degree level in this Job subfamily (2,653 or 27% of all awards), with large programs at Columbia University and CUNY City College, among others. The Western NY/Finger Lakes region ranked second with 1,998 (20%) because of large engineering programs at Cornell and SUNY Binghamton. The Capital District/Mohawk Valley/North Country Region was a close third with 1,918 awards largely due to the number of engineering degrees conferred by Rensselaer Polytechnic Institute (RPI). The Hudson Valley Region represents the smallest number of programs (478), with the highest award at the Master's Degree level.

Green Degree and Credit-Bearing Certificate Programs

As noted in the Methods Section of this report, the data reported above on awards granted does not distinguish between standard degree programs and those that have a special focus on the green economy. The chart below summarizes the number of "green" degree and credit bearing institutions and programs in Architecture and Engineering that the research partners identified through original research validated by the postsecondary institutions. A list of institutions and programs can be found in the appendix of this report.

Architecture and Engineering – *Green* Degree Programs and Credit Bearing Courses				
Region	**Number of Providers**	**Number of Programs**	**Students enrolled***	**Student completers***
Capital District/North Country/Mohawk Valley	7	36	602	148
Western NY/Finger Lakes	4	18	48	30
Central NY/Southern Tier	8	16	148	52
New York City	5	14	342	129
Long Island	4	12	361	94
Hudson Valley	2	2	95	45
Totals:	**30**	**98**	**1596**	**498**

*** Enrollment and completion data were not reported by all training/education providers.**

The Capital District/North Country/Mohawk Valley Region has the greatest number of programs and represents 36 of all programs offered. The Western NY/Finger Lakes Region has the second largest number of programs with 18, or about 19 percent of all programs identified. The Hudson Valley Region has the fewest programs, offering only 2 of the 98 degree or *green* credit bearing programs for this job family.

Reported enrollment and completion was highest for the Capital District/North Country/Mohawk Valley region, representing almost 30 percent of all completers for "green" degree programs in this job family, followed by the New York City region with 26 percent.

Illustrative *green* degree program names include:

Architecture

- Construction and Environmental Technology (A.A.S.)
- Construction Management B.S. (Concentration in Sustainable Construction and Renewable Materials)
- Master of Science in Built Ecologies (Architecture - M.S.)
- Combined B.S. in Architectural Technology and M.S. in Energy Management Program
- Master of Professional Studies in Sustainable Interior Environments (M.P.S.)
- Urban Environmental Systems Management M.S.

Engineering

- Bachelor's, Master's and Ph.D. degrees in Environmental Engineering
- Civil & Environmental Technology B-Tech (Bachelor of Technology)
- Sustainable Engineering (M.E. and M.S Degrees)

Program Focus

The following chart displays particular program focus areas for Architecture and Engineering programs. "Program focus" categories are assigned with the intention to align programs with categories of economic activity included in the employer survey, such as energy efficiency and renewable energy (e.g. solar PV, solar thermal, wind, biomass, geothermal, hydro). In other cases, they are descriptive identifiers used to group similar programs together. A complete list of program focuses for all programs can be found in the appendix of this report.

Architecture and Engineering Occupations	Degree/Credit Programs	Non Degree/Non-Credit Programs
Background Skills / General	n/a	2
Electrical / Power / Lighting	3	4
Energy Efficiency	n/a	29
Energy Mgmt / Environmental Mgmt / Sustainability Mgmt / Facilities Mgmt	6	1
Engineering	38	n/a
Environmental Science	5	n/a
Green Construction / Sustainable Building, Materials and Design:		
Green Construction, Architecture, Design, Sustainable/Green Building (non-LEED)	25	41
LEED Programs	n/a	23
Other / Miscellaneous	2	22
Renewable / Alternative Energy:		
Biomass / Biofuels / Bioenergy	n/a	1
Fuel Cells / Battery Technology	1	n/a
Geothermal	n/a	1
Multifocus or Other Renewable / Alternative Energy	12	3
Solar PV	3	7
Solar Thermal	n/a	1
Wind	n/a	2
Waste Management / Environmental Remediation	3	4

*Programs may be counted toward multiple job families.

Conclusion

The Architecture and Engineering Occupational job family has the second largest number of programs within the six job families. With a total of 98 degree programs or credit bearing courses, and 142 non-degree programs or non-credit bearing courses located throughout New York State, students may take advantage of the many "green" programs available, whether they are seeking a degree in Architecture or Engineering, non-credit classes to provide the "green" skills and training they may need to enhance

skills within their occupations, or merely wish to become more knowledgeable as these occupations are evolving in the "green economy".

#3. Installation, Maintenance and Repair Occupations – O*NET-SOC Code 49

Overview

This job family includes electrical and electronics repairers, mechanics, technicians and installers, and first-line supervisors for these occupations. "Green" occupations such as wind turbine technicians, geothermal technicians, and air conditioning mechanics and installers are included in this job family.

Skills for these occupations are typically learned through post-secondary training and on the job training.

The research conducted under this grant focused on the 16 green occupations in the Installation, Maintenance and Repair job family in O*NET's *Greening of the World of Work,*[18] as well as occupations that were reported by New York State employers in the large employer survey conducted in late 2010-early 2011.

Non-Degree/Non-Credit Bearing Programs

Non-degree and non-credit bearing programs and courses for this job family may focus in such areas as background skills and general information; energy efficiency; electrical power and lighting; energy, environmental, sustainability or facilities management; renewable or alternative energy technologies; green construction and sustainable building, materials and design; and waste management and environmental remediation amongst others.

They may also include "green" education and training that prepares individuals for credentials from the following credentialing bodies:

- **BPI** (Building Performance Institute)
- **IGSHPA** (International Ground Source Heat Pump Association)
- **NATE (**North American Technician Excellence)
- **GA** (Green Advantage)
- **LEED** (Leadership in Energy and Environmental Design)
- **NABCEP** (North American Board of Certified Energy Practitioners)
- **RESNET** (Residential Energy Services Network)

Other examples of credentials for which students are prepared in this job family are the 40 Hour Hazardous Waste Operations and Emergency Response Standard (HAZWOPER), EPA Renovation, Repair and Painting and EPA Universal Recovery Certificate, Lead Renovator & OSHA 10 certification, the Midwest Renewable Energy Association (MREA) certification, Pre-Apprenticeship Certificate Training (PACT) certification and others.

The charts that follow display the "green" education and training programs, identified by the research, that are available in New York State to prepare individuals for these occupations.

[18] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They are listed in the appendix

Spotlight on Energy Efficiency Programs – The Center for Energy Efficiency and Building Science (CEEBS)

Installation, Maintenance and Repair occupations are closely tied to energy efficiency, which is a critical component of the "green economy". There are many programs that prepare workers in areas such as basic energy efficiency and weatherization as well as advanced programs in building performance and analysis.

The Building Performance Institute (BPI) is a well-known developer of technical standards for home performance and weatherization retrofit work. BPI has implemented a suite of training programs to address the different aspects of residential energy efficiency.

The Center for Energy Efficiency and Building Science (CEEBS), a division of the Workforce Development Institute at Hudson Valley Community College, delivers BPI's energy efficiency and building science courses through a network of 13 regional learning centers throughout New York State.

Building Performance Institute (BPI) Credential Preparation Courses offered by the Center for Energy Efficiency and Building Science (CEEBS) throughout New York State*

Basic Air Sealing and Insulation - Students are introduced to the skills and principles necessary for working in the field of home weatherization. They learn how to install air sealing and insulation treatments that increase a home's energy efficiency. This course teaches the basic skills necessary for weatherizing a building and provides the background necessary to become a qualified entry–level installer.

Basics of Building Science - This course provides an introduction to the field of Building Science. Students learn how to analyze the components of a home and how they work as a system. This course teaches the basics of building science and how interacting relationships affect the performance of a home to give the student a foundation upon which to build. The topics covered in this course are a good prerequisite for the advanced Building Analyst certification training course.

Building Analyst - This training program helps prepare the student for the Building Analyst online and field tests. Students come to understand how the house works as a system, why some homes fail, and how to use the latest building science technology to help resolve residential heating, cooling, and base load air leakage problems. By using a "whole house" performance-based approach, students address a comprehensive range of interrelated building issues and are able to provide clients with a more comfortable, safe, durable, and energy efficient home.

Envelope Professional - Using a "whole house" performance-based approach, this training covers advanced building envelope diagnostic, evaluation, and repair skills to help students prepare for Envelope Professional on-line and field exams.

Heating Professional - Using a "whole house" performance-based approach, this training covers advanced heating system diagnostics, evaluation, and repair skills to help students prepare for the Heating Professional on-line and field exams.

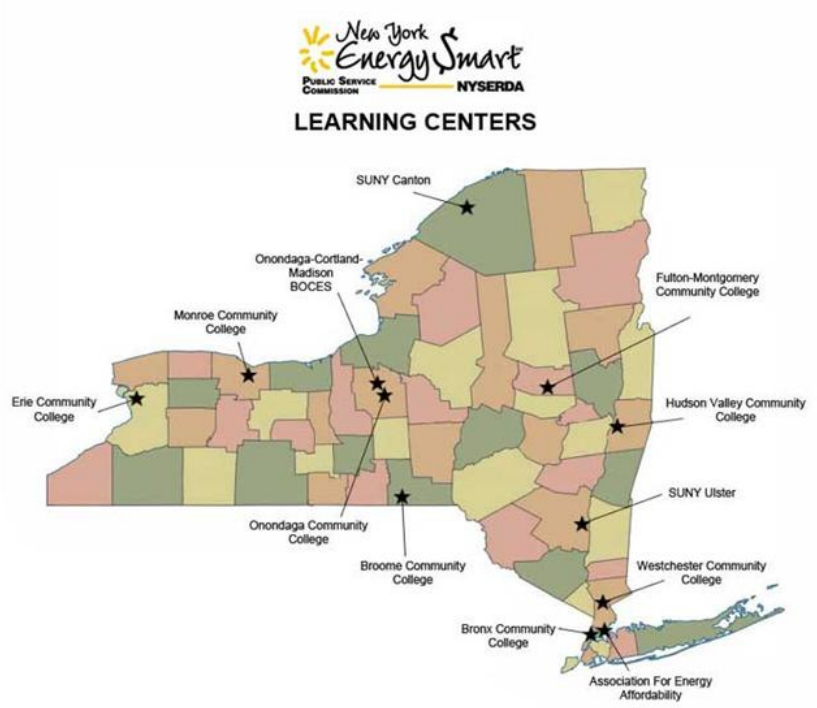
Cooling Professional - This is a two-day course designed for experienced heating contractors. The training consists of both classroom and field experience and helps to prepare students for the Cooling Professional on-line and field exams. The BPI Cooling Professional designation was developed in collaboration with North American Technician Excellence (NATE).

Multifamily Building Analyst Training - This course applies building-as-a-system fundamentals to diagnose problems and improve the performance of larger, more complex residential structures.

*information taken from the Building Performance Institute website – www.bpi.org.

The 13 participating learning centers include the Association for Energy Affordability (New York City), Bronx Community College, Broome County Community College, Clinton Community College, Erie Community College, Fulton-Montgomery Community College, Hudson Valley Community College (HVCC), Monroe Community College, Onondaga Community College, Onondaga-Cortland-Madison BOCES, SUNY Canton, SUNY Ulster Community College and Westchester Community College.

Not all programs are offered at each of the learning centers, but a schedule of classes for all programs can be found on the HVCC website at www.hvcc.edu/ceebs. More than 90 courses are presently offered at these learning centers. A map showing the location of these training centers is shown below.



CEEBS, which is housed at Hudson Valley Community College in Troy, receives funding from the New York State Energy Research and Development Authority (NYSERDA) and from the U.S. Department of Labor through a Community-Based Job Training grant.

Building Operator Certification: Spotlight on the Baruch College Building Performance Lab

The Building Performance Lab at CUNY's Baruch College, supported in part by the New York State Energy Research and Development Authority (NYSERDA), is focused on increasing energy efficiency in public and commercial buildings in New York City. Among its activities, it promotes workforce development, which it pursues though curriculum development, internships and other technology training.

The Building Performance Lab is part of a team, along with the CUNY School of Professional Studies and the New York City Department of Citywide Administrative Services, which is offering the nationally-recognized **Building Operator Certification** training to all public school custodians as part of the city's efforts to reduce energy use. The Lab is also partnering with the International Union of Operating Engineers Local 94 to offer a class for union members at the union's training center. The curriculum introduces the concepts of energy management and green building practices at the facilities level; students will have the option of pursuing the Building Operator Certification.

Findings. The table below shows the distribution of non-degree providers and programs in New York State for this job family, along with the number enrolled and the number of completers in the most current year of program operation (2010-11).

The Hudson Valley Region has the greatest number of "green" non-degree and non-credit bearing programs with 62, or 32 percent of total programs. New York City has the second largest number of training programs with 48 programs or 24 percent of total programs identified by the research. The Capital District/North Country/Mohawk Valley has the smallest number of programs, offering 6 programs, which represents about 3 percent of total programs identified.

Installation, Maintenance, and Repair Occupations – *Green* Non-Degree Programs and Non-credit Bearing Courses

Region	Number of Providers	Number of Programs	Students Enrolled*	Student Completers*
Hudson Valley	9	62	594	584
New York City	21	48	3760	3271
Western NY/Finger Lakes	7	37	1532	1254
Central NY/Southern Tier	8	24	66	45
Long Island	6	12	346	338
Capital District/North Country/Mohawk Valley	3	6	50	37
Online**	4	7	6	6
Total	**58**	**196**	**6354**	**5535**

*** Enrollment and completion data were not reported by all training/education providers.**
****Online designation is for web based programs and is not one of the LMI Regions.**
****Blended format programs are included in 6 LMI Region totals.**

Reported enrollment data was high for Installation, Maintenance and Repair programs. The New York City region reports the greatest student enrollment at 3,760 which represents 59% of all reported enrollment for this job family. Solar One and Forever Green Training and Sustainable Design are the largest contributors, accounting for more than half of the total enrollment and completion reported for this region. The Western NY/Finger Lakes region reported 1,254 or 23 percent of all completion rates. Erie Community College and Monroe Community College programs account for nearly 82% of completers in this region.

New York City also has the highest number of completers at 3,271, with an 87 percent completion rate overall. The Long Island Region, which has 12 programs, has the second smallest number of programs and has a 98 percent reported completion rate for all enrollees, which is the highest completion rate amongst the six regions. The Capital District/North Country/Mohawk Valley has both the lowest reported enrollment and completion rates, representing less than 1 percent for both.

Online programs accounted for only 5 programs with a reported enrollment and completion of 6 students.

In addition to BPI and other credential-associated programs, illustrative non-degree program names found in New York State include:

- BPI Building Analyst Training
- Electricity for HVAC/R Technician (Offered in 2 parts)
- Entry Level Weatherization Installer 4-day Boot Camp
- Heating Systems and Chimney Fundamentals
- Residential Electrical Systems and How To Evaluate Them Holistically
- Weatherization Technician
- Fundamentals of Sustainable Buildings and High Performance Systems Design
- IGSHPA Accredited Geothermal Installation/NATE Certification
- Solar Hot Water Installation & Design
- Wind Turbine Installation

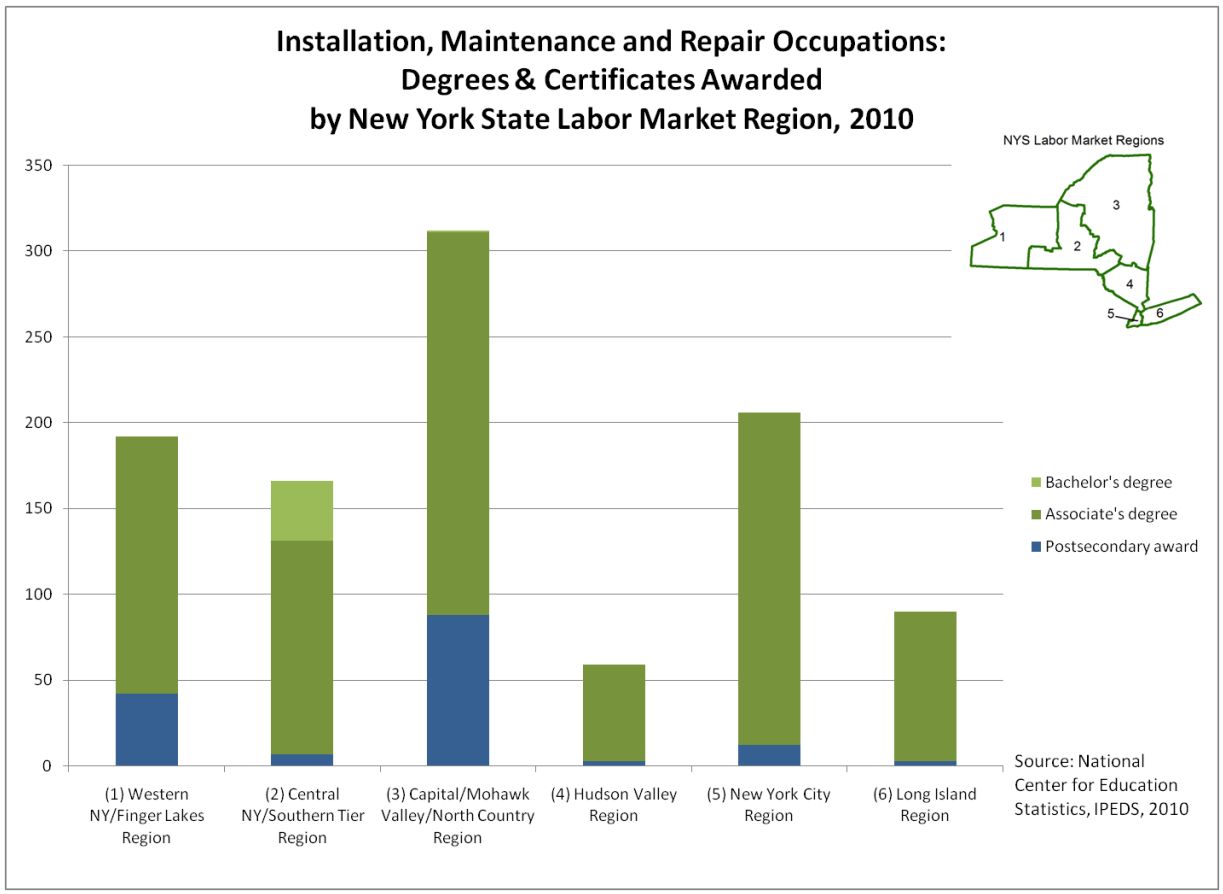
Degree and Credit-Bearing Certificate Programs

General Degree and Credit-Bearing Certificate Programs

As explained more fully in the "Research Methods" section of this report, as part of its research on "green" jobs, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, technical and vocational institutions related to green jobs. The information below was derived from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), which gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. IPEDS data was "crosswalked" to occupations using U.S. Departments of Education and Labor's "CIP–SOC "crosswalk" to link instructional programs to occupations. It should be noted that IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with a job family but may not pertain to the occupation as it relates to the green economy.

IPEDS data indicates that in 2010, 1,025 awards were conferred related to the Installation, Maintenance and Repair Occupations job family.

Almost all -- 96 percent, or 989 awards -- in this job family are Post Secondary Certificate or Associates Degree awards. The Associates Degree level represents the largest number of degrees at 834 total awards, or 81 percent of the total.



The Capital District/Mohawk Valley/North Country Region represents the largest number of overall awards conferred at 312 or 30 per cent of the total, followed by New York City, which represents 20 percent of all awards conferred. All but one of the 36 Bachelor's awards was conferred by institutions in the Central NY/Southern Tier Region. The Hudson Valley Region represents the lowest amount of overall awards at 59 awards, or just less than 6 percent of the total.

Green Degree and Credit-Bearing Certificate Programs

As noted in the Methods Section of this report, the data reported above on awards granted does not distinguish between standard degree programs and those that have a special focus on the green economy. The chart below summarizes the number of specialized green-related degree and credit bearing programs in Installation, Maintenance and Repair that the research partners identified through original research validated by the postsecondary institutions. A list of institutions and programs can be found the appendix of this report.

Relatively few degree and credit based programs were found for this job family, as the skills required for installation, maintenance and repair occupations are learned predominantly through post-secondary non-credit courses and on the job training.

Twenty-six (26) degree and credit-bearing programs were identified for the six labor market information (LMI) regions. The Western NY/Finger Lakes region has nearly one-third of all degree programs or credit bearing courses in the State. The Capital District/North Country/Mohawk Valley region offers 7 programs and is a close second at 27 percent of the total. Central NY/Southern Tier and the New York City region have the least number of programs with one program each for degree-granting green programs.

Installation, Maintenance, and Repair Occupations – *Green* Degree Programs and Credit Bearing Courses

Region	Number of Providers	Number of Programs	Students Enrolled*	Student Completers*
Western NY/Finger Lakes	3	8	516	173
Capital District/North Country/Mohawk Valley	2	7	15	14
Long Island	2	6	40	28
Hudson Valley	2	3	20	20
Central NY/Southern Tier	1	1	36	8
New York City	1	1	n/a	n/a
Totals:	**11**	**26**	**627**	**243**

*** Enrollment and completion data were not reported by all training/education providers.**

The Western NY/Finger Lakes region has the highest enrollment at 516 students or 82 percent of total enrollment in the State. This region also has the highest number of student completers reported, at 173 or 71 percent of the total. No enrollment or completion statistics were reported for New York City.

Illustrative "green" degree program names include:

- Advanced Certificate in Facilities Management - credit certificate
- Electrical Construction and Maintenance Electrician AOS (Associate of Occupational Studies)
- Air Conditioning Technology: Heating and Ventilation (AOS and AAS)
- Heating, Ventilation, Air Conditioning and Refrigeration (HVAC/R) AAS
- Wind Energy & Turbine Technology AAS
- Energy Utility Technology Credit Certificate B-Tech (Bachelor of Technology)

Program Focus

The following chart displays particular program focus areas for Installation, Maintenance and Repair programs. As shown, a large number of programs are focused on energy efficiency training. Solar PV and solar thermal installation training are also significant for this job family. A complete list of program focus areas for all programs can be found in the appendix of this report.

Installation, Maintenance, and Repair Occupations	Degree/ Credit Programs	Non Degree/Non-Credit Programs
Background Skills / General	n/a	6
Electrical / Power / Lighting	3	3
Energy Efficiency	6	66
Energy Mgmt / Environmental Mgmt / Sustainability Mgmt / Facilities Mgmt	3	n/a
Green Construction, Architecture, Design, Sustainable/Green Building (non-LEED)	1	12
Other / Miscellaneous	n/a	20
Renewable / Alternative Energy:		
Fuel Cells / Battery Technology	n/a	1
Geothermal	n/a	10
Multifocus or Other Renewable / Alternative Energy	5	5
Solar PV	3	43
Solar Thermal	n/a	17
Wind	5	12
Waste Management / Environmental Remediation	n/a	1

*Programs may be counted toward multiple job families.

Conclusion

Energy Efficiency is an important component of the "green economy". Within this category and others, there are a host of programs that prepare workers for Installation, Maintenance and Repair occupations.

A total of more than 200 "green" programs have been identified by the research, located throughout all 6 NYS LMI Regions. Students may take advantage of the many programs available, whether they are seeking a degree in Heating, Ventilation, Air Conditioning and Refrigeration (HVAC/R), or specialized training and certification through one of many programs and courses in energy efficiency.

Nearly 6,000 students are already trained through these programs, making the Installation, Maintenance and Repair occupations job family the second highest overall in the number of student completers of the six job families selected for analysis by the research.

#4. Building and Grounds Cleaning and Maintenance Occupations - O*NET-SOC Code 37

Overview

This job family includes janitors and cleaners as well as first-line supervisors of landscaping, lawn service, and grounds keeping workers. Skills for these occupations are typically learned through on the job training.

The research conducted under this grant focused on the green occupations in the Building and Grounds Cleaning and Maintenance job family in O*NET's *Greening of the World of Work,*[19] and also occupations that were reported by New York State employers in the large employer survey conducted in late 2010-early 2011.

Non-Degree and Non-Credit Bearing Programs

Non-degree and non-credit bearing programs and courses for this job family may focus on basic maintenance skills that contribute to energy efficiency, facilities management, and waste disposal and recycling amongst others.

They may also include "green" education and training that prepare individuals for credentials from the following credentialing bodies:

- **BPI** (Building Performance Institute)
- **BOC** (Building Operator Certification)
- **Urban Green Council's G-PRO**
- **HAZWOPER** (Hazardous Waste Operations and Emergency Response Standard)
- **OSHA** (Occupational Safety and Health Administration)
- **LEED** (Leadership in Energy and Environmental Design)

Other examples of credentials for which students are prepared in this job family include the Building Performance Institute (BPI) Multi-Family Building Analyst certification; integrated Pest Management, Pruning, Weed Identification, and Soil remediation; OSHA 1 - Construction, Asbestos Awareness, and Intro to Green products; North American Board of Certified Energy Practitioners (NABCEP); Green Advantage (GA), EPA Universal Recovery Certificate; Green Leadership Certification; and the Residential Energy Services Network (RESNET) certification, amongst others.

Spotlight on SEIU Local 32 BJ Thomas Shortman Training Fund: "Helping to make NYC Buildings Green – 1,000 Supers at a time"

The Thomas Shortman Training Fund is a joint labor-management organization, co-sponsored by the Service Employees International Union (SEUI) Local 32BJ and the Realty Advisory Board on Labor Relations. Since 2005, this joint labor-management training fund has been greening New York City's buildings by training building service professionals who are members of 32BJ, the largest property service workers union in the country. Local 32BJ members work in residential apartment buildings, commercial office buildings, area theaters and stadiums and office space in New York City.

[19] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They are listed in the appendix.

In January 2010, the U.S. Department of Labor awarded a $2.8 million Energy Training Partnership grant to the Thomas Shortman Training Fund under the American Recovery and Reinvestment Act (ARRA). The grant's goal is to help train New York City building superintendents in energy efficiency through better operations & maintenance. The Shortman Fund aims to train 1,000 superintendents in one year to help foster a greener New York City. Upon satisfactorily completing the certification tests, each super is awarded green building operator certifications by the Building Performance Institute and the U.S. Green Building Council (USGBC).(www.1000supers.com)

The Thomas Shortman Training Fund's 1,000 Green Supers Program Curriculum: 40-Hour Course*

1. Building Science & Building Envelope — includes the fundamentals of building science and examines a 'whole-building' approach to operations and maintenance. Topics include air movement, heat transfer, and relative humidity. It also covers the core area of the building's envelope and explores ways to keep conditioned air from escaping to the outside environment. Topics include air barriers, vapor barriers, thermal barriers, air sealing, insulation, pressure boundaries, and compartmentalization.

2. Lighting — includes all aspects of lighting. Topics include lighting types, quality, efficiency and controls. The unit also discusses appliance efficiency ratings.

3. Heating, Ventilation & Air Conditioning (HVAC) — includes the essentials of running a building's heating, ventilation, and air conditioning system. Topics include combustion science, combustion efficiency, boilers, controls and distribution as well as efficiency strategies for each of these areas.

4. Field Exercise (HVAC): Mechanical Room and Roof — Onsite visit to a building's machine room and roof where instructors will teach supers how to perform steady state efficiency tests, maintain rooftop ventilation equipment, and apply efficiency strategies and best practices.

5. Sustainability/Indoor Environmental Quality — describes the phenomenon of global warming and how energy use and waste generated from buildings contribute to global warming. Students learn that the manner in which they perform their jobs has a direct impact on the environment. Also covers the indoor atmosphere of a building, strategies to avoid and limit indoor pollutants, an introduction to green cleaning and the concept of green purchasing.

6. Water Conservation — includes the essentials of water use and water conservation strategies. Topics include understanding water use, low flow appliances, leak detection, and leak repair.

7. Field Exercise: Hallway, Lobby, Apartment — onsite exercise where supers learn how to inspect an apartment, evaluate hallways and common areas, and inspect the building's envelope.

8. Utilities & Energy Benchmarking — includes measuring and managing energy use by understanding and working with utility bills (fuel, gas, electricity, and water). Topics include reading and understanding bills, energy benchmarking, recognizing unusual energy use (trends), and identifying opportunities for savings.

9. Green Building Work Plan — students develop a basic action plan for improving their buildings based on concepts and strategies taught in earlier units. In addition, the class also discusses strategies and techniques to communicate effectively with building owners, tenants, and staff on their action plan, including payback and incentives for improvements.

10. Review & Practice Exam — a review and a practice test are given to help prepare for the BPI certification exam.

*Information taken from the www.1000supers.com website.

The table below shows the distribution of non-degree providers and programs in New York State for this job family, along with the number enrolled and the number of completers in the most current year of program operation (2010-11).

New York City has the largest number of programs for this job family, with 39 programs, or 57 percent of the total. The Hudson Valley region is the second largest, with 6 programs representing about 9 percent of all "green" non-degree training identified by the research. The Central NY/Southern Tier region has the smallest number of programs with only one program identified for this region.

Building and Grounds Cleaning and Maintenance Occupations – *Green* Non-Degree Programs and Non-Credit Bearing Courses				
Region	**Number of Providers**	**Number of Programs**	**Students Enrolled***	**Student Completers***
New York City	21	39	3933	2901
Hudson Valley	3	6	117	117
Western NY/Finger Lakes	4	4	415	180
Capital District/North Country/Mohawk Valley	3	3	150	126
Long Island	1	2	24	24
Central NY/Southern Tier	1	1	n/a	n/a
Online**	3	13	5	5
Total	**36**	**68**	**4644**	**3353**

*** Enrollment and completion data were not reported by all training/education providers.**
****Online designation is for web based programs and is not one of the LMI Regions.**
****Blended format programs are included in 6 LMI Region totals.**

Representing approximately 85 percent of reported enrollment and completion, New York City reports both the largest number of student enrollments and student completers with 3,933 and 2,901 respectively. The "1,000 Green Supers" Program offered by the Thomas Shortman Training Fund in New York City, reports 1,000 enrollees and 800 completers for their programs and accounts for almost 25% of all reported enrollment for programs in New York City. It is important to note that only members of SEIU Local 32BJ are eligible for this training. Reported enrollment is the lowest for the Long Island region, with 24 students enrolled and completed. Enrollment information is not available for the Central NY/Southern Tier region.

Online programs represent the third largest contributor of "green" non-degree training according to the findings. Thirteen programs were identified for online training.

In addition to the credential-associated programs, illustrative non-degree program names found in New York State include:

- 1,000 Green Supers Program
- BPI Multi-Family Building Analyst Certification
- Building Operator Certification
- GreenWorks-Building Maintenance Training
- Heating Ventilation & Air Conditioning (HVAC) Excellence
- Green Handyman and Weatherization Specialist
- Plumbing and Electricity Basics for Green Jobs
- Basic Property Management
- Facilities 101 Anatomy of a Building
- Water Treatment Grade B & C

Degree and Credit-Bearing Certificate Programs

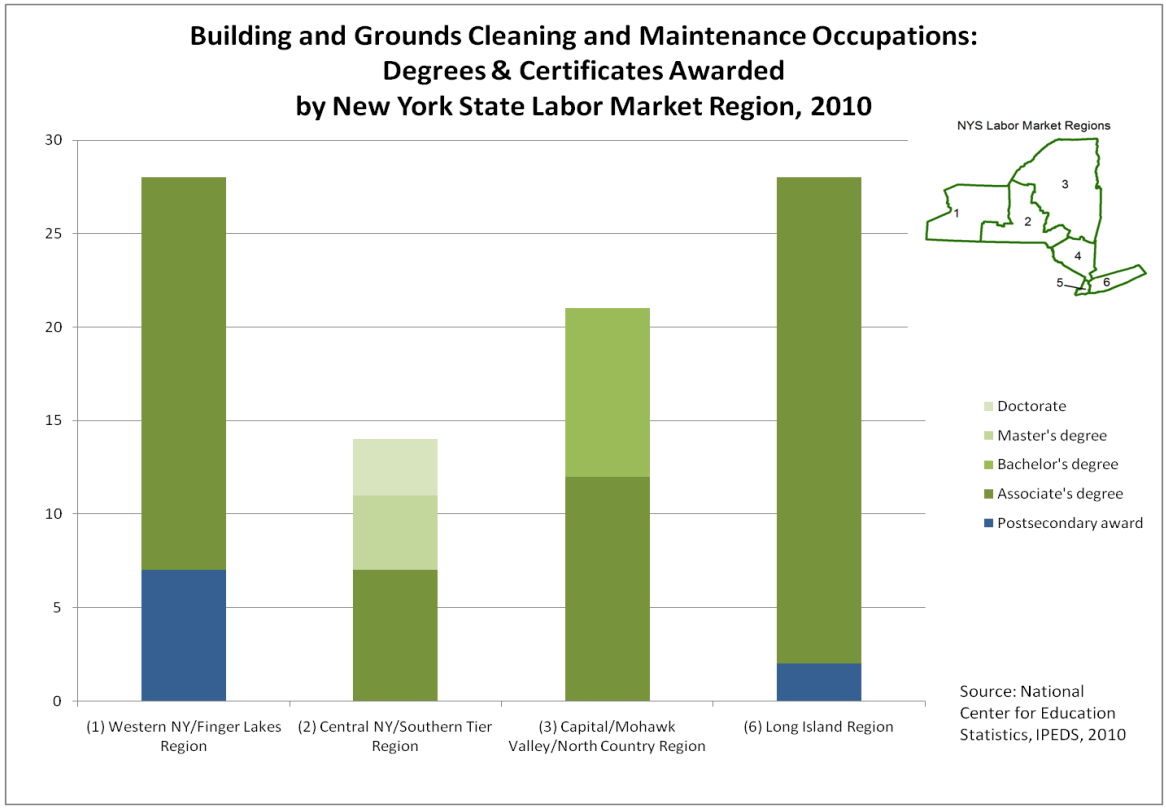
General Degree and Credit-Bearing Certificate Programs

As part of its research on "green" jobs, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, and technical and vocational institutions to prepare workers for green jobs. The information below was derived from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), which gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. IPEDS data was "crosswalked" to occupations using U.S. Departments of Education and Labor's "CIP–SOC "crosswalk" in to link instructional programs to occupations. It should be noted that the IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with a job family but may not pertain to the occupation as it relates to the green economy.

Because skills for building and grounds cleaning and maintenance are learned primarily on the job or through non-credit training or coursework, relatively few degree and credit based programs were identified for this job family.

In 2010, 91 people received degrees or certificates that prepared them for work within the Building and Grounds Cleaning and Maintenance job family.

Only four of the six NYS LMI Regions have awards in this Job Family. These regions include the Western NY/Finger Lakes, Capital District/Mohawk Valley/North Country, Central NY/Southern Tier and Long Island regions.



Long Island and the Western NY/Finger Lakes Regions conferred the highest number of total awards, with 28 each, representing 62 percent of total awards for both regions. A total of 66 awards, or 73 percent are at the Associate's Degree Level. The Long Island Region has the highest proportion, with 39 percent of total Associate's Degree awards. Slightly less than 10 percent, or 9 awards, are at the Bachelor's Degree level. The Capital District/Mohawk Valley/North Country region is the only region with Bachelor's Degree awards for this Job Family.

Green Degree and Credit-Bearing Certificate Programs

As noted above and in the Methods section of this report, the data reported above on degree and certificate awards granted does not distinguish between standard degree programs and those that have a special focus on the green economy. The chart below summarizes the number of specialized green-related degree and credit bearing programs in Building and Grounds Cleaning and Maintenance that the research partners identified through original research validated by the postsecondary institutions. A list of institutions and programs can be found in the appendix of this report.

Building and Grounds Cleaning and Maintenance Occupations – *Green* Degree and Credit Bearing Programs				
Region	**Number of Providers**	**Number of Programs**	**Students Enrolled***	**Student Completers***
Long Island	3	4	270	220
Hudson Valley	1	1	75	25
Online	1	2	n/a	n/a
Total	**5**	**7**	**345**	**245**

*** Enrollment and completion data were not reported by all training/education providers.**
****Online designation is for web based programs and is not one of the LMI Regions.**
****Blended format programs are included in 6 LMI Region totals.**

With four programs offered, the Long Island Region has the greatest number of "green" degree and credit bearing programs for this job family, representing 57 percent of total programs for all regions shown. The Hudson Valley region offers one program.

Illustrative "green" degree program names include:

- Green Building Maintenance and Management AAS
- School Facilities Management AAS
- Industrial Technology - Facility Management Technology BS
- Fundamentals of Environmental Safety and Health - 3 credit course

Program Focus

The following chart displays particular program focus areas for Building and Grounds Cleaning and Maintenance programs. "Program focus" categories are assigned with the intention to align programs with categories of economic activity included in the employer survey, such as energy efficiency and renewable energy (e.g. solar PV, solar thermal, wind, biomass, geothermal, hydro). In other cases, they are descriptive identifiers used to group similar programs together. A complete list of program focuses for all programs can be found in the appendix at the end of this report.

Building and Grounds Cleaning and Maintenance Occupations	Degree/Credit Programs	Non Degree/Non-Credit Programs
Background Skills / General	n/a	1
Electrical / Power / Lighting	n/a	1
Energy Efficiency	n/a	21
Energy Mgmt / Environmental Mgmt / Sustainability Mgmt / Facilities Mgmt	5	1
Green Construction / Sustainable Building, Materials and Design:		
Green Construction, Architecture, Design, Sustainable/Green Building (non-LEED)	n/a	13
LEED Program	n/a	1
Other / Miscellaneous	1	22
Renewable / Alternative Energy:		
Multifocus or Other Renewable / Alternative Energy	n/a	1
Solar PV	n/a	2
Solar Thermal	n/a	1
Waste Management / Environmental Remediation	1	4

*Programs may be counted toward multiple job families.

Conclusion

Programs identified in the Building and Grounds Cleaning and Maintenance occupations job family prepare students to perform this type of work. Several also prepare students for many different credentials in the industry including those from BPI (Building Performance Institute), BOC (Building Operator Certification), UGC (Urban Green Council), HAZWOPER (Hazardous Waste Operations and Emergency Response Standard), OSHA (Occupational Safety and Health Administration), and LEED (Leadership in Energy and Environmental Design), amongst others.

Skills for Building and Grounds Cleaning and Maintenance occupations are learned predominantly through on the job training and non-credit training. This is reflected in the relatively low occurrence of "green" degree and credit-bearing educational and training programs found for this job family.

Building and Grounds Cleaning and Maintenance occupations account for a high level of employment in the New York City region. "Green" non-degree programs and non-credit bearing certificates and courses that are offered in this region give testament to the importance of these occupations in New York City. The 1,000 Green Supers Program has graduated a large number of students and is an important program that has been implemented in NYC.

#5. Life, Physical and Social Sciences Occupations - O*NET-SOC Code 19:

Overview

This job family includes scientists and environmental scientists, conservationists and conservation technicians, urban regional planners and agricultural technicians. Other "green" occupations such as environmental economists, environmental restoration planners, and climate change analysts are also included in this job family.

The research conducted under this grant focused on the green occupations in the Life, Physical and Social Sciences job family in O*NET's *Greening of the World of Work*[20] as well as occupations that were listed by employers in New York State as "green" in the large employer survey conducted in late 2010-early 2011.

Non-Degree/Non-Credit Bearing Programs

Employers of the professional occupations within this job family – scientists and environmental scientists, urban regional planners, environmental economists and the like - generally require at least a four-year degree and often a Master's Degree in the relevant field. Technicians may obtain employment with a four-year degree or less. No non-degree/non-credit programs were identified that were specifically targeted to this job family.

Spotlight on "Green" Energy and Environmental Research Centers:

There are many leading research centers in both public and private universities around New York State that focus on exploring ways of producing and promoting clean energy. Their goals include delivering technology solutions and cultivating an environment of innovation and cooperation to produce highly qualified professionals at the baccalaureate, masters and doctoral levels. Researchers, faculty and graduate students are typically involved in many research areas including:

- Bioenergy
- Battery Storage
- Energy Efficiency
- Environmental Impacts
- Geothermal Energy
- Fuel Cell & Hydrogen Technologies
- Energy and Environmental Policy
- Power Systems
- Nanoscience and Nanotechnology
- Solar Energy
- Transportation Systems
- Wind Energy

It is hoped that many graduates of New York State institutions will be instrumental in developing cutting-edge technologies and innovative solutions within these and other areas of "green" technology to overcome critical barriers to providing more efficient and cost-effective solutions for growth. Below are some examples of leading energy and environmental research centers in New York State. Website URLS are included to provide more information on each research center.

[20] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They are listed in the appendix.

- **Advanced Energy Center (AERTC) at Stony Brook University:** The AERTC works with energy-based institutes, laboratories, and programs throughout the country and includes within it five major research and training centers: New York Energy Policy Institute (NYEPI), the Center for BioEnergy Research and Development (CBERD), Northeastern Center for Chemical Energy Storage (NECCES), Long Island Clean Energy Business Incubation Program (CEBIP), and the Advanced Energy Training Institute (AETI). The Advanced Energy Center is also a collaborator with the Center for Emergent Superconductivity (CES) at Brookhaven National Labs on Long Island. Areas of research for these centers include energy policy, bioenergy, chemical energy and battery storage, and superconductors, amongst others. The Advanced Energy Center is a founding organization of the New York State Smart Grid Consortium (NYSSGC). www.aertc.org
- **Center for Energy, Environment and Economics, New York Institute of Technology (NYIT):** Center activities include conducting research, evaluating policy options, and advancing environmentally friendly technology in the areas of energy generation, air pollution, water resources, solid waste management, and transportation. Personnel conduct research and perform analyses for the public and private sectors. Activities also include public education, major conferences, and demonstration of cutting-edge sustainable energy technologies. In concert with the School of Engineering and Computing Sciences, the center serves as a demonstration site for new, energy-efficient, alternative, renewable resource technologies. http://www.nyit.edu/engineering/centers/centers_energy_environment_economics/
- **Center for Future Energy Systems (CFES) at Rensselaer Polytechnic Institute (RPI):** CFES conducts fundamental and applied research to accelerate the development of energy efficient and renewable energy technologies. The center is focused on project areas including low cost, high efficiency photovoltaic solar cells, wind turbine blade performance enhancement, advanced lighting sources, fuel cell testing and characterization, smart buildings, energy storage technologies, renewable energy grid integration, microgrid, and smart grid. Activities include research and development, technology transfer, and workforce development/training. CFES collaborative partners include Cornell University (Ithaca) and Brookhaven National Laboratory (Long Island). http://www.rpi.edu/cfes/
- **Clarkson University Center for Sustainable Energy Systems:** The research interests at Clarkson cover a wide spectrum of energy related areas including bioenergy, energy efficiency, fuel cell and hydrogen technologies, energy policy, solar and wind energy, amongst others. The center also supports the current efforts of the Institute for a Sustainable Environment (ISE) and the Center for Advanced Materials Processing (CAMP) and provides a vehicle to exchange ideas and generate new concepts for innovative, sustainable, collaborative projects at local, national and international levels. www.clarkson.edu/cses/index.html
- **Cornell Fuel Cell Institute at Cornell University:** A collaborative center including Materials Science and Engineering, Chemical Engineering, and Chemistry and Chemical Biology departments focusing on developing materials to enable advanced fuel cell technologies in automobiles, stationary applications, and portable power. http://cfci.ccmr.cornell.edu/index.html
- **Golisano Institute for Sustainability, Center for Sustainable Energy Systems (CSES) at Rochester Institute of Technology (RIT)**: The center is focused on evaluating the economic and environmental impacts of alternative fuel and propulsion technologies, including: biodiesel, ethanol, fuel cells, and hydrogen. CSES' multidisciplinary academic unit focuses on

education and research programs in sustainability including sustainable production, sustainable energy, sustainable mobility and ecologically friendly information technology systems. http://www.rit.edu/gis/cses.html

- **Center of Excellence in Environmental and Energy Systems (CoE) at Syracuse University:** The center is focused on conducting research in environmental and energy-related technologies for built environments including clean and renewable energy, water resources, and indoor environmental quality. Activities include research, product development, commercialization assistance, and education. The CoE academic partners include Alfred University, Clarkson University, Cornell University, Rensselaer Polytechnic Institute, SUNY Albany, SUNY Buffalo, and University of Rochester. http://www.syracusecoe.org/coe/index.html

- **Energy and Environmental Technology Applications Center (E2TAC), SUNY University at Albany:** The center focuses on renewable and alternative energy and environmental technologies, microelectronics and nanotechnology for energy and environmental applications, technology development, and training and education. Research is being conducted in the areas of energy efficiency, power electronics, electric double layer capacitors, photovoltaics, thermoelectric devices, environmental sensors, high-temperature superconductors and fuel cells. Education and outreach programs include New Energy New York and the New Energy Symposium amongst others. http://www.e2tac.org/about.html

- **Center for Sustainable and Renewable Energy at SUNY College of Environmental Science and Forestry (SUNY-ESF)**: SUNY ESF is the host campus of the 64-campus research and development clearinghouse for renewable energy, energy efficiency and sustainable energy use. The center has conducted research on: renewable carbonate fuel cell operations, photovoltaic power generation, solar-fueled hydrogen generation, biomass energy feedstock agroforestry production, biomass feedstock production from New York's forest-products industry, and hydrogen extraction and biotechnical hydrogen production from biomass, amongst others. The Center also functions as scientific and policy advisor to the American Bioenergy Association. http://www.esf.edu/energycenter/about.htm.

- **City University of New York (CUNY) Energy Institute, housed at the City College of New York.** This institute draws upon all the resources of all CUNY campuses to develop sustainable and low-carbon energy technologies. The Institute also works on thermal storage and megacapacators. The institute is connected with the interdisciplinary CUNY Institute for Urban Systems and the CUNY Center for Sustainable Energy. Much of the research conducted at the Energy Institute deals directly with New York City specific issues.

Degree and Credit-Bearing Certificate Programs

General Degree and Credit-Bearing Certificate Programs

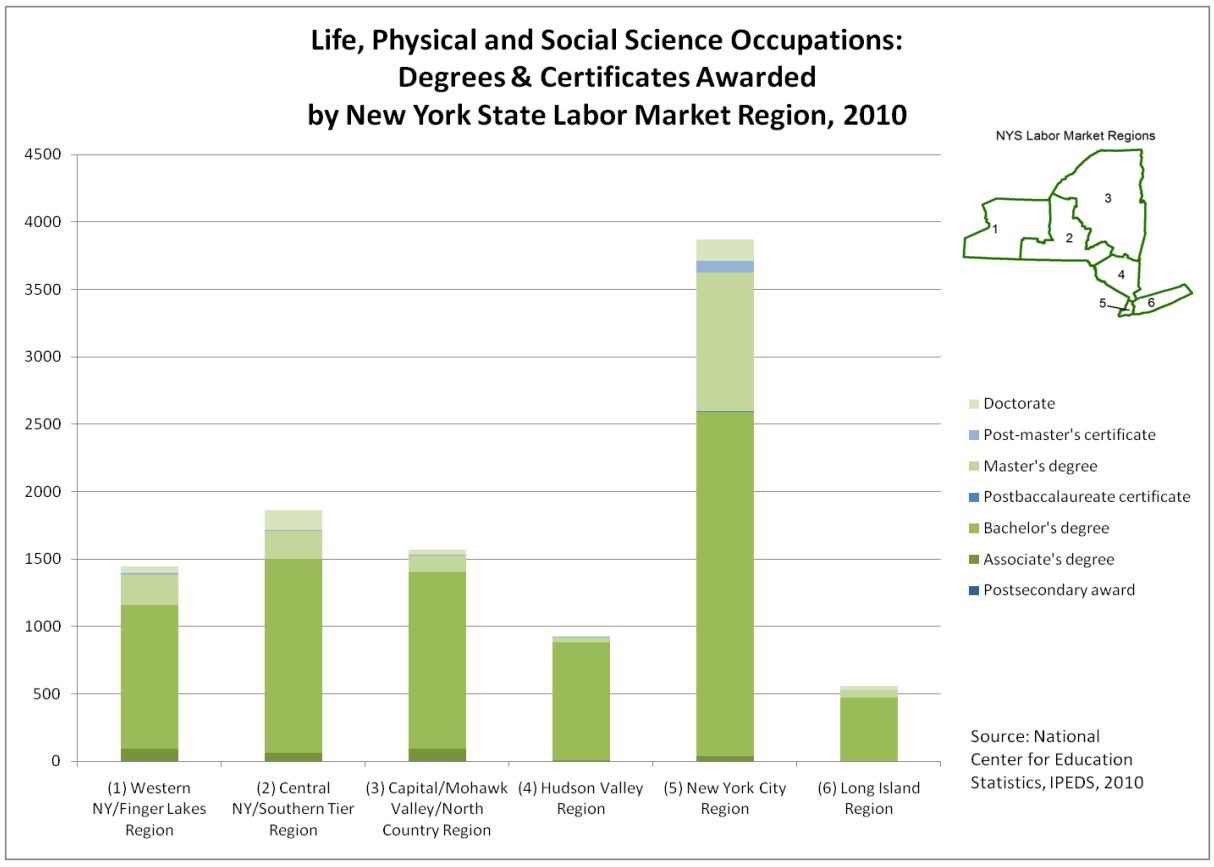
As explained more fully in the "Research Methods" section of this report, as part of its research on "green" jobs, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, and technical and vocational institutions related to green jobs. The information below was derived from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), which gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. IPEDS data was "crosswalked" to occupations using the U.S. Departments of Education and

Labor's "CIP–SOC "crosswalk" to link instructional programs to occupations. It should be noted that IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with a job family but may not pertain to the occupation as it relates to the green economy.

In 2010, a total of 10,223 awards were conferred for the Life, Physical and Social Sciences Occupations.

Approximately three in four of the awards are at the Bachelor's Degree level followed by 16 percent at the Master's Degree level and 4 percent at the Doctoral Degree level.

Educational institutions in New York City conferred the largest number, at 3,869 awards or 38 percent of the total. The Central NY/Southern Tier Region conferred the second highest number of awards at 1,861 or 18 percent. The Long Island Region represents the lowest number of awards at 558, or 5 percent of the total for the State in this job family.



For the job families considered in this study, Life, Physical and Social Sciences is the only job family other than Legal Occupations to have more professional/doctoral degrees (419 awards) than Associates Degrees (279 awards) for 2010.

Green Degree and Credit-Bearing Certificate Programs

As noted in the Methods Section of this report, the data reported above on awards granted does not distinguish between standard degree programs and those that have a special focus on the "green economy". The chart below summarizes the number of specialized green-related degree and credit-

bearing programs in Life, Physical and Social Sciences that the research partners identified through original research validated by the postsecondary institutions.

The Life, Physical and Social Science Occupations job family has the greatest number of "green" degree programs and credit bearing certificates and courses of the six job families selected for analysis. Programs and courses may focus in such areas as environmental science; environmental biology, chemistry, geology and natural science; conservation of natural resources, forestry and agriculture; climate, environmental policy, politics, law, economics, social aspects and planning; environmental studies; energy, environmental, sustainability or facilities management; and waste management and environmental remediation amongst others. Details about the institutions and programs can be found in the appendix of this report.

Life, Physical, and Social Science Occupations - *Green* Degree Programs and Credit Bearing Courses				
Region	**Number of Providers**	**Number of Programs**	**Students Enrolled***	**Student Completers***
Capital District/North Country/Mohawk Valley	17	37	415	108
New York City	9	24	299	81
Western NY/Finger Lakes	15	22	363	90
Long Island	6	21	427	99
Central NY/Southern Tier	11	20	334	90
Hudson Valley	4	8	60	60
Totals:	**62**	**132**	**1898**	**528**

*** Enrollment and completion data were not reported by all training/education providers.**

The Capital District/North Country/Mohawk Valley region has the largest number of "green" degree and credit bearing programs for all regions, representing 28 percent of all programs in the state. New York City has the second greatest number of programs at 18 percent. The Hudson Valley region has the smallest number of programs with just 6 percent of all programs.

Reported enrollment and completion rates are highest in the Capital District/North Country/Mohawk Valley region, representing 22 percent and 20 percent respectively. New York City is second with 16 percent enrollment and 15 percent completion reported for the state. Enrollment and completion data was not reported to the researchers by all educational institutions.

Illustrative "green" degree programs include:

- Environmental and Energy Technologies B-Tech (Bachelor of Technology)
- Sustainability Studies BA
- Environmental Design, Policy, and Planning (EDP) BA
- Biology with Environmental Studies Specialization BS
- Environmental Health Science (EHS) BS
- Natural Resources Sustainability BS
- Environmental Resources Major BS
- Environmental Management MPS (Master of Professional Studies)
- Environmental Policy and Sustainability Management MS

- Climate Science and Policy MS

For this particular job family, certain degree programs include preparation for "green" industry credentials, such as those conferred by the Occupational Safety and Health Administration (OSHA). Other examples of credentials geared to occupations in this job family include the 40-Hour HAZWOPER (Hazardous Waste Operations and Emergency Response) certification; NYS Dept. of Labor Asbestos Inspector; and DEC (Department of Environmental Conservation) Environmental Analyst certification amongst others.

Program Focus

The following chart displays particular program focus areas for Life, Physical and Social Sciences programs. As shown, a large number of programs are focused on environmental science and environmental studies. Thirteen "green" degree programs were also identified in the energy management, environmental management, sustainability management and facilities management group. A complete list of program focus areas for all programs can be found in The appendix at the end of this report.

Life, Physical, and Social Science Occupations	Degree/ Credit Programs	Non Degree/Non-Credit Programs
Conservation Natural Resources / Forestry / Agriculture	6	n/a
Energy Mgmt / Environmental Mgmt / Sustainability Mgmt / Facilities Mgmt	11	n/a
Environmental Science:		
Environmental Science	38	n/a
Environmental Biology / Chemistry / Geology / Natural Science	14	n/a
Environmental Studies:		
Environmental Studies	32	n/a
Environment / Climate / Policy / Politics / Law / Economics / Social Aspects / Planning	21	n/a
Other / Miscellaneous	8	3
Waste Management / Environmental Remediation	2	n/a

*Programs may be counted toward multiple job families.

Conclusion

Educational offerings for the Life, Physical and Social Sciences occupations were almost exclusively degree and credit bearing programs. "Green" programs identified for this occupational family are largely focused in environmental science; environmental biology, chemistry, geology and natural science; conservation of natural resources, forestry and agriculture; climate, environmental policy, politics, law, economics, social aspects and planning; environmental studies; energy, environmental, sustainability or facilities management; and waste management and environmental remediation.

The Life, Physical and Social Sciences occupations job family has the highest number of "green" credit bearing programs identified for any of the six job families analyzed. The Capital District/North Country/Mohawk Valley region has the largest number of "green" degree and credit bearing programs for all regions, followed by New York City. Reported enrollment and completion rates were also the highest for these two regions.

With a total of 132 degree programs and credit bearing courses located throughout New York State, students may take advantage of the many "green" programs available. New York State is rich in energy and environmental research centers focused on exploring ways of producing and promoting clean energy. Students who are pursuing graduate degrees may have the opportunity to participate in research activities conducted at these centers.

#6. Production Occupations – O*NET-SOC Code 51

Overview

This job family includes production occupations such as assemblers, machine tool operators, setters and tenders, welders, cutters, solderers and braziers, inspectors, testers, sorters, samplers, and weighers, as well as first-line supervisors of production and operating workers. "Green" occupations such as biofuels processing technicians, biomass plant technicians and hydroelectric plant technicians are also included in production occupations. Skills for these occupations are learned mostly through on the job type training.

The research conducted under this grant focused on the 24 green occupations in the Production occupations job family in O*NET's *Greening of the World of Work*[21] as well as occupations that were listed by employers in New York State as "green" in the large employer survey conducted in late 2010/early 2011.

Non-Degree/Non-Credit Bearing Programs

Non-degree and non-credit bearing programs and courses for this job family may include "green" training and education recognized by credentialing bodies such as the Building Performance Institute (BPI), the North American Board of Certified Energy Practitioners (NABCEP), the Occupational Safety and Health Administration (OSHA) and others. These courses may focus in such areas as background skills and general information, energy efficiency; energy, environmental, sustainability or facilities management; renewable or alternative energy technologies; and green construction and sustainable building, materials and design amongst others. It is important to point out that production occupations are predominantly involved with *manufacturing* of products that are used to support industries whose focus may include those mentioned above. In addition, the production occupations job family may not be the only, or even primary, job family for many of these "green" programs.

Credentials. The major credentialing organizations associated with green employment within the Production Occupations job family include:

- **LEED** (Leadership in Energy and Environmental Design)
- **BPI** (Building Performance Institute)
- **NABCEP** (North American Board of Certified Energy Practitioners)

[21] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They are listed in the appendix.

- **RESNET** (Residential Energy Services Network)
- **NYWEA** (New York Water Environment Association)

Other examples of credentials for which students in this job family are prepared are the 40 Hour Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) and OSHA 10 certification, among others.

Spotlight on TEC-SMART (Training and Education Center for Semiconductor Manufacturing and Alternative and Renewable Technologies) at HVCC*

Hudson Valley Community College's newest facility, TEC-SMART (Training and Education Center for Semiconductor Manufacturing and Alternative and Renewable Technologies), opened in January 2010 in Malta, NY. The facility features more than a dozen classrooms and laboratories that will be used to train the workforce in semiconductor manufacturing and green technologies, including alternative fuels and the installation and maintenance of photovoltaic, geothermal and wind energy systems. TEC-SMART's goal is to produce a skilled workforce to serve major employers including GlobalFoundries, General Electric, SunPower, Inc. and Alteris Renewables.

TEC-SMART is a joint project between Hudson Valley Community College and the New York State Energy Research and Development Authority (NYSERDA). The facility is located in NYSERDA's Saratoga Technology + Energy Park ® (STEP ®), a destination for clean-energy and environmental technology companies in New York's Tech Valley. TEC-SMART will provide skilled technicians for these plants as well as the renewable energies field. The mission of TEC-SMART is to serve as a premier resource for clean energy technologies and semiconductor manufacturing training and education.

Saratoga Technology + Energy Park® (STEP®)*

NYSERDA's Saratoga Technology + Energy Park (STEP) is a 280-acre site located in Malta, New York, master-planned for 1.25 million square feet of office, lab, and light manufacturing. STEP is the home of Hudson Valley Community College's TEC-SMART facility and the administrative offices of GLOBALFOUNDRIES. GLOBALFOUNDRIES semiconductor manufacturing facility is currently the largest economic development project in the country.

STEP also provides resources for clean-energy and environmental companies looking for strategic locations to build and grow in the heart of New York's Tech Valley. In addition, STEP offers programs, services, partnerships, and amenities to support the success of companies and their employees.

STEP is owned and sponsored by the New York State Energy Research and Development Authority (NYSERDA), a public benefit corporation of the State of New York.

*For more information about TEC-SMART® and STEP® visit www.hvcc.edu/tecsmart.

Findings. The table below shows the distribution of non-degree providers and programs in New York State for Production occupations, along with the number enrolled and the number of completers in the most current year of program operation (2010-11).

Only three of the six NYS LMI regions have "green" non-degree and non-credit bearing programs for this job family. With 6 of the 13 programs, the New York City region has the greatest number of programs representing 46%. New York City also reports the highest enrollment and completion rates for this job family with 91% and 90% respectively.

Production Occupations – *Green* Non-Degree and Non-Credit Bearing Programs				
Region	**Number of Providers**	**Number of Programs**	**Students Enrolled***	**Student Completers***
New York City	6	6	177	128
Hudson Valley	3	3	n/a	n/a
Western NY/Finger Lakes	1	1	18	15
Online**	1	3	n/a	n/a
Totals:	**11**	**13**	**195**	**143**

*** Enrollment and completion data were not reported by all training/education providers.**
****Online designation is for web based programs and is not one of the LMI Regions.**
****Blended format programs are included in 6 LMI Region totals.**

Three online programs were identified for "green" production for non-degree training. No enrollment data was provided for either the Hudson Valley region or for online training programs.

In addition to LEED and other credential-associated programs, illustrative non-degree program names found in New York State include:

- Green Advanced Manufacturing Collaborative
- Introduction to Solar Panel Manufacturing
- Intro to the Sustainable Organization /Company

Degree and Credit-Bearing Certificate Programs

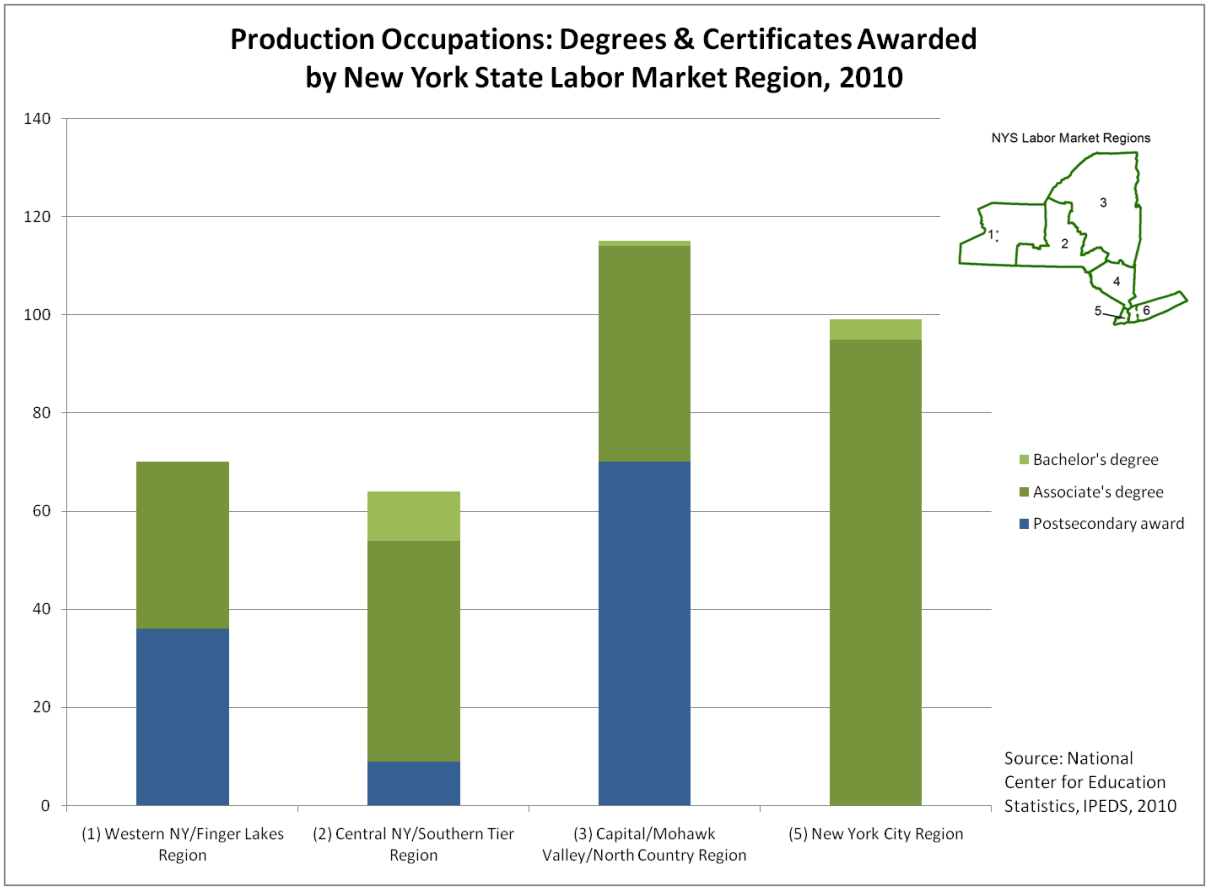
General Degree and Credit-Bearing Certificate Programs

As explained more fully in the "Research Methods" section of this report, as part of its research on "green" jobs, the New York State Department of Labor and its research partners looked at awards (certificates and degrees) conferred by colleges, universities, technical and vocational institutions related to green jobs. The information below was derived from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), which gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. IPEDS data was "crosswalked" to occupations using U.S. Departments of Education and Labor's "CIP–SOC "crosswalk" in to link instructional programs to occupations. It should be noted that IPEDS provides information that allows the identification of *all* degrees and credited certificates that align with a job family but may not pertain to the occupation as it relates to the green economy.

IPEDS data reveals that a total of 348 awards were conferred in the Production Occupations Job Family in New York State in 2010.

Only four of the six NYS LMI Regions have awards in this Job Family. These regions include the Western NY/Finger Lakes, Capital District/Mohawk Valley/North Country, Central NY/Southern Tier and New York City Regions.

Almost all -- 96 percent -- of the total awards in this Job Family are Post Secondary Certificate or Associate's Degree awards. The Associates Degree level represents the largest number of degrees at 63 percent, or 218 total awards. Bachelor's Degrees represent less than 5 percent of all awards in this Job Family.



The Capital District/Mohawk Valley/North Country Region represents the highest number of overall awards in this Job Family at 33% or 115 awards. New York City ranks second with 28% or 99 awards. Ten of the 15 Bachelor's Degree awards (67%) are in the Central NY/Southern Tier Region. The Central NY/Southern Tier Region represents the lowest amount of overall awards at 18% or 64 total awards for Production Occupations.

Green Degree and Credit-Bearing Certificate Programs

As noted in the Methods Section of this report, the data reported above on awards granted does not distinguish between standard degree programs and those that have a special focus on the green economy. The chart below summarizes the number of specialized green-related degree programs in

Production occupations that the research partners identified through original research validated by the postsecondary institutions.

Production skills are learned predominantly through on the job training, so relatively few degree and credit based programs were identified for this job family. The four credit based programs that were identified by the research are presented in the chart below. Programs were identified for only three of the six LMI regions. Details about the institutions and programs can be found in the appendix of this report.

Production Occupations – *Green* Degree and Credit Bearing Programs		
Region	**Number of Providers**	**Number of Programs**
Western NY/Finger Lakes	1	2
Capital District/North Country/Mohawk Valley	1	1
Hudson Valley	1	1
Totals:	**3**	**4**

*** Enrollment and completion data were not reported by all training/education providers.**

Illustrative "green" degree program names include:

- Energy Systems AAS
- Environmental and Energy Technologies, B-Tech (Bachelor's of Technology)
- BS in Industrial Systems & Engineering/MS in Sustainable Engineering (combo BSISE/MSSE)
- BS in Industrial Systems & Engineering/M. Eng in Sustainable Engineering (combo BSISE/MESE)

Program Focus

The following chart displays particular program focus areas for Production programs. As mentioned above, production occupations are predominantly involved with *manufacturing* of products that are used to support industries whose focus may include those listed. In addition, the production occupations job family may not be the primary job family for many of these "green" programs. A complete list of program focus areas for all programs can be found in the appendix at the end of this report.

Production Occupations	Degree/Credit Programs	Non Degree/ Non-Credit Programs
Energy Efficiency	n/a	1
Energy Mgmt / Environmental Mgmt / Sustainability Mgmt / Facilities Mgmt	2	n/a
Engineering	2	n/a
Green Construction, Architecture, Design, Sustainable/Green Building (non-LEED)	n/a	2
Other / Miscellaneous	n/a	8
Renewable / Alternative Energy:		
Solar PV	n/a	2

*Programs may be counted toward multiple job families.

Conclusion

Relatively few "green" non-degree or degree programs and courses were identified for the production occupations job family in New York State. The New York City region is the largest provider of "green" non-degree/non-training programs found for production occupations.

#7. Miscellaneous "Green" Occupations and Job Families

Overview

The research findings on "green" education and training programs focused primarily on occupations aligned with the industry clusters that were the main subject of the green jobs research in New York State. The researchers were able to accommodate most of these occupations within the six job families described in detail.

However, there were several important occupations that did not fit neatly into these six job families. These include "Management" occupations such as Construction Manager, Property Manager, and Managers of renewable energy operations. The "Business and Financial Operations" job family includes such occupations as Energy Auditor and Sustainability Specialist.

In addition, the research identified education and training for other occupations considered "green" that fall outside of the industry clusters under study in this research. These include occupations in transportation, farming and education, amongst others.

A summary of the other 10 job families in which "green" educational and training programs were identified is listed below. A complete listing of "green" occupations by job family can be found in the appendix of this report. [22]

Job Family*	O*NET SOC Code	Number of "Green" Degree Programs	Number of "Green" Non-Degree Programs	Total "Green" Degree and Non-Degree Programs
Management Occupations	11	44	29	**73**
Business and Financial Operations Occupations	13	2	29	**31**
Education, Training, and Library Occupations	25	23	5	**28**
Farming, Fishing, and Forestry Occupations	45	19	7	**26**
Legal Occupations	23	14	2	**16**
Sales and Related Occupations	41	3	11	**14**
Community and Social Services Occupations	21	8	4	**12**
Transportation and Material Moving Occupations	53	2	9	**11**
Office and Administrative Support Occupations	43	1	9	**10**
Computer and Mathematical Occupations	15	2	3	**5**

* Totals do not add to 100% since programs may be counted more than once.

[22] Dierdoff, E., J. Norton, D. Drewes, et al., *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations,* National Center for O*NET Development, *2009.* They are listed in Appendix.

Collectively, these job families have programs in all eleven program focus areas including background skills and general information; energy efficiency; renewable and alternative energy; green construction/sustainable building, materials and design; energy management, environmental management, sustainability management or facilities management; waste management and environmental remediation; engineering; electrical, power and lighting; environmental science; environmental studies; and conservation natural resources , forestry, and agriculture.

Credentials - Many programs identified prepare people for "green" credentials within the 10 job families from the chart above. The major credentialing organizations associated with green employment within these job families include:

- **BPI** (Building Performance Institute)
- **BOC** (Building Operator Certification)
- **GA** (Green Advantage)
- **LEED** (Leadership in Energy and Environmental Design)
- **NABCEP** (North American Board of Certified Energy Practitioners)
- **NAHB** (National Association of Home Builders)
- **OSHA** (Occupational Safety and Health Administration)
- **RESNET** (Residential Energy Services Network)
- **UGC's G-PRO** (Urban Green Council)

Other recognized credentials are Green Seal Certification, 40-hour HAZWOPER (Hazardous Waste Operations and Emergency Response Standard), Integrated Pest Management, Pruning, Weed Identification, and Soil remediation, and EPA Universal Recovery Certificate, amongst others.

Occupational Job Families

1. ***Management Occupations*** – The Management Occupations job family includes chief sustainability officers and manager occupations. Some of the "green" occupations in this job family include green marketers, geothermal, biofuels and biomass production managers, regulatory affairs, compliance and supply chain managers, construction managers, property managers and wind energy operations and project managers. The research identified 73 "green" programs for this job family. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (29 programs):

   - Green Project Management
   - Training for Sustainability Directors and Green Team Leaders (Green Management II)
   - Construction Management for Green Building
   - Green Facilities Management Certificate Program
   - Environmental & Energy Management ISO 14001/ISO 50001

   Degree/Credit Programs (44 programs):

   - Field Operations for Energy Utilities - Credit Certificate
   - School facilities Management Certificate

- Construction Management (Concentration in Sustainable Construction and Renewable Materials) BS
- Industrial Technology - Facility Management Technology BS
- Energy Management MS
- Environmental Policy and Sustainability Management MS
- Sustainable Construction Management and Wood Science MS/PhD

2. ***Business and Financial Operations Occupations*** – The Business and Financial Operations Occupations job family includes selected analysts, advisors and specialists. "Green" occupations in this job family include Energy Auditor and Sustainability Specialist,. Other "green" occupations include logistics engineers and analysts, training and development specialists, financial analysts, and purchasing agents and buyers of farm products. The research identified 32 "green" programs for this job family. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (29 programs):

   - BPI: Building Analyst
   - BPI: Multifamily Building Analyst
   - Environmentally Preferable Purchasing (EPP) Orientation and Workshop
   - Green Event Planning

   Degree/Credit Programs (2 programs):

   - Environmental Policy Major (Bachelor's)
   - Fast Track BS/BA-MBA Program (5 years) (Concentration in Sustainability*)*

3. ***Education, Training, and Library Occupations*** – The Education, Training and Library Occupations job family includes Farm and Home Management Advisors. The research identified 28 "green" programs for this job family. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (5 programs):

   - Intro to the Sustainable Organization/Company
   - Forever Green Training & Sustainable Design

   Degree/Credit Programs (23 programs):

   - Interdisciplinary Studies with a concentration in Earth System Science BS
   - Environmental Engineering BS, MS or PhD programs
   - Ecological Economics PhD
   - Environmental and Natural Resources Policy PhD

4. ***Farming, Fishing, and Forestry Occupations*** - The Farming, Fishing, and Forestry Occupations job family includes first-line supervisors/managers of agricultural crop and horticultural workers, agricultural inspectors, and forest and conservation workers. The research identified 26 "green" programs for this job family. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (7 programs):

   - Green Training Landscaping & Urban Ecology
   - Certificate in Sustainable Vegetable Production
   - Southwest Community Farm Project

   Degree/Credit Programs (19 programs):

   - Agricultural Business or Agricultural Technology AAS
   - Pre-Environmental Science and Forestry AA
   - Environmental Science (Study Option in Environmental Planning and Management) BA
   - Environmental Technology MS
   - Sustainable Enterprise Partnership CASSE (Certificate of Advanced Study in Sustainable Enterprise) graduate certificate

5. ***Legal Occupations*** – The Legal Occupations job family includes arbitrators, mediators and conciliators, lawyers, paralegals and legal assistants. The research identified 17 "green" programs for this job family. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (2 programs):

   - Intro to the Sustainable Organization /Company

   Degree/Credit Programs (14 programs):

   - Environmental Studies: Economic and Political Science Track BA/BS
   - History & Government, Environmental Studies Specialization BA
   - Environmental Policy (Environmental Law and Management Track) BA
   - Climate Science and Policy MS
   - Environmental Policy MS
   - The Dual Degree with Pace Law School (M.S./J.D.)

6. ***Sales and Related Occupations*** – the Sales and Related occupations job family includes securities, commodities and financial services sales agents, sales representatives, sales engineers and real estate sales agents, amongst others. Some "green" occupations in this job family include energy brokers, sales representatives of wholesale and manufacturing for technical and scientific products, and solar sales representatives and assessors amongst others.

The research identified 14 “green” programs for this job family; however they may not be the primary job family indicated for the programs. Some examples of non-degree/non-credit and degree/credit programs are as follows:
Non-Degree/Non-Credit Programs (11 programs):

- PV Technical Sales & Marketing
- Green Certificate (Real Estate)
- Solar Sales Training

Degree/Credit Programs (3 programs):

- Certificate in Renewable Energy Technology
- Renewable Energy Technologies A.A.S.

7. ***Community and Social Services Occupations*** – no “green” occupations were listed in the O*NET reference for this job family. The research identified 12 “green” programs for this job family; however they may not be the primary job family indicated for the programs. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (4 programs):

   - Southwest Community Farm Project
   - Forever Green Training & Sustainable Design

   Degree/Credit Programs (8 programs):

   - Global and Local Sustainability BA
   - City and Regional Planning MS
   - Urban Environmental Systems Management MS

8. ***Transportation and Material Moving Occupations*** – the Transportation and Material Moving Occupations job family includes “green” occupations such as recycling and reclamation workers and coordinators, refuse and recyclable materials collectors, and transportation vehicle, equipment and systems inspectors, amongst other occupations. The research identified 11 “green” programs for this job family. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (9 programs):

   - Certified Green Supply Chain Professional
   - Sustainable Transportation
   - Biofuel Production Operations

   Degree/Credit Programs (2 programs):

- Environmental Issues of Metropolitan New York - 4 credit course
- BS in Industrial and Systems Engineering/MS in Sustainable Engineering (combo BSISE/MSSE)

9. ***Office and Administrative Support Occupations*** – the Office and Administrative Support Occupations job family includes customer service representatives, freight forwarders, production, planning and expediting clerks, and shipping, receiving and traffic clerks, amongst other occupations. The research identified 10 "green" programs for this job family; however they may not be the primary job family indicated for the programs. Some examples of non-degree/non-credit and degree/credit programs are as follows:

   Non-Degree/Non-Credit Programs (9 programs):

   - Preparing Energy Audit Reports
   - Conquering the Forms and Regulations of Solar Incentives
   - Environmentally Preferable Purchasing (EPP) Orientation and Workshop

   Degree/Credit Programs (1 program):

   - Sustainability Studies (minor)

10. **Computer and Mathematical Occupations –** the Computer and Mathematical Occupations job family includes computer systems analysts and programmers, software developers and database administrators, amongst other occupations. Some of the "green" occupations in this job family include computer software engineers, geospatial information scientists and technologists, and geographic information systems technicians. The research identified 5 "green" programs. Some examples of non-degree/non-credit and degree/credit programs are as follows:

    Non-Degree/Non-Credit Programs (3 programs):

    - Intro To The Sustainable Organization /Company

    Degree/Credit Programs (2 programs):

    - Energy in Electronics and Computer Systems - 3 credit course
    - Environmental Technology with a concentration in Infrastructure Security MS

Conclusion

"Green" educational and training programs for non-degree/non-credit and degree/credit programs and courses were identified by the research for 10 additional job families which include occupations that fall outside of the six job families that were selected for primary analysis. In addition, the research identified education and training for occupations considered "green" that may fall outside the industry clusters of construction, building services, professional services and manufacturing which are the subject of this research.

Summary for Green Educational and Training Programs

A significant amount of "green" training exists for both non-degree/non-credit, and degree/credit programs, certificates and courses throughout New York State. A total of 915 "green" educational and training programs were identified by the research for 165 training providers. As existing occupations evolve to necessitate increased knowledge and skill sets in areas such as energy efficiency and renewable energy, and as new occupations are also created to satisfy the demand for these services and products, workers may be required to avail themselves of programs to upgrade their existing skills or to provide new training, credentials or degrees in industries such as construction, building services, professional services, manufacturing and other industries.

Many credentialing bodies have partnered with not-for-profit or community based organizations, and private companies as well as educational institutions or other organizations to provide industry recognized training and credentialing programs in green and sustainable building and construction (LEED accreditation), energy efficiency, weatherization, building operations and building science (BPI, UGC's G-PRO, NAHB, RESNET, BOC, etc), renewable energy such as solar and wind programs (NABCEP), geothermal programs (IGSHPA) and others. Some non-degree programs may have entrance requirements including work experience or other credentials, and some may be targeted to workers in specific industries, or to particular populations. Programs may be paid for by students or may receive funding through NYSERDA or other state entities; or programs may receive federal, foundation, city or other sources of funding.

In response to increased demand for "green" skills, educational institutions have incorporated "green" elements and environmentally relevant courses into existing and new degree or credit programs to supply this demand. A number of community colleges are also offering degree programs in the areas of energy efficiency, including, for example, Heating, Ventilation and Air Conditioning (HVAC) programs, and renewable energy, including wind energy degree programs. Many New York State colleges and universities have developed energy and environmental research centers which are focused on exploring ways of producing and promoting clean energy. Utilizing cutting-edge technologies and innovative solutions within "green" technology, these research centers may provide opportunities for students who are pursuing graduate degrees to participate in research activities conducted at these centers.

Unions and other labor organizations are including "green" skills and even credential preparation training (such as NABCEP for IBEW workers) in their apprenticeship and pre-apprenticeship programs to meet the demand for "green" knowledge and skill sets. Some construction trade apprenticeships even offer an Associate's Degree as part of the apprenticeship, through articulation agreements with colleges.

NYSERDA provides a number of Workforce Development initiatives that support green career preparation in New York State, including the Center for Energy Efficiency and Building Science (CEEBS), and their Clean Energy Training Program, which are energy efficiency and renewable energy training and credentialing programs provided with partner organizations and educational institutions throughout

New York State. NYSERDA also supports apprenticeships, internships, and on-the-job training to provide incentives to develop job skills related to energy efficiency, weatherization, and green building principles amongst other areas.

Finally, American Recovery and Reinvestment Act (ARRA) funding has supported programs such as Pathways out of Poverty green training programs and the Thomas Shortman Fund's "1000 Supers" program.