

## CHAPTER 7: FINDINGS ABOUT EDUCATION AND TRAINING OPPORTUNITIES

### B. 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 and technicians who support them. The New York State Education Department licenses architects, landscape architects, professional engineers and land surveyors. To qualify, individuals must meet educational and experience requirements and pass an examination. According to the New York State Department of Labor, most architects and engineers are employed by architectural and engineering firms; others work for city and state governments or for construction firms.

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*.<sup>1</sup>

#### Non-Degree/Non-Credit Bearing Programs

Architecture and engineering occupations generally require at least a Bachelor's degree and often a Master's Degree in the relevant field (i.e., mechanical engineering, electrical engineering, 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 retro-commissioning 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). 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.

The courses or programs may prepare individuals for credentials from the following 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)
- **LEED** (Leadership in Energy and Environmental Design)

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<sup>1</sup> 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 Table "G" 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.

- **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)

The LEED credentials, in particular, are gaining a lot of ground in New York City and across the state especially in the construction, architecture and engineering industries. LEED is a rating and certification system for sustainable buildings as well as an accreditation system for professionals. LEED is a registered trademark of the U.S. Green Building Council (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. According to employer reports in the focus groups conducted for this study, some firms hire individuals without the LEED credential but 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 table below shows the 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 : <a href="http://www.usgbc.org">www.usgbc.org</a>	

The table below displays the distribution of non-degree providers and programs in New York State for architecture and engineering occupations. It also shows the number enrolled and the number of completers in 2010-11.

New York City 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. Also, many of these programs prepare people for the LEED accreditation exams.

Architecture and Engineering Occupations - <i>Green</i> Non-Degree Programs /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
<b>Total</b>	<b>37</b>	<b>141</b>	<b>3136</b>	<b>2588</b>

\* 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 within the 6 LMI Regions.

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, non-degree program programs found in New York State include such course names as:

- 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

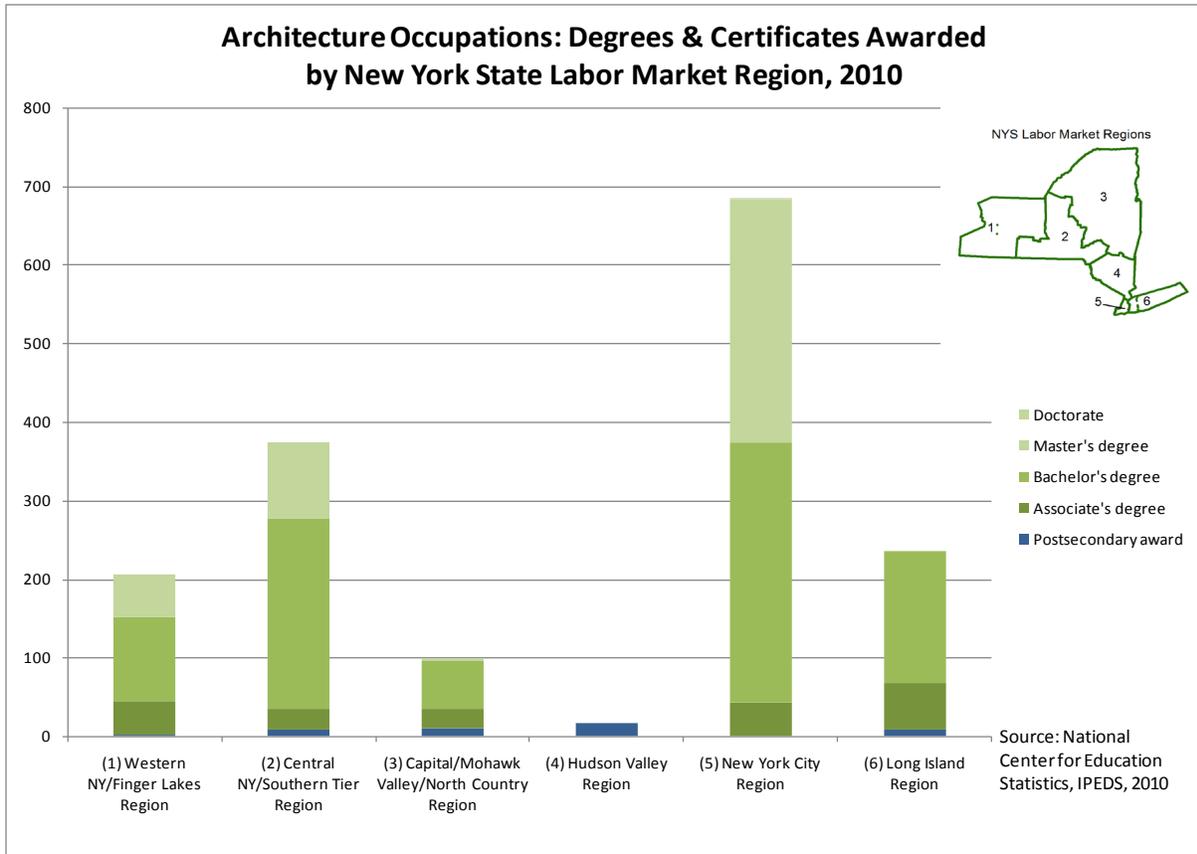
- Sustainability Approach to Engineering Design

### Degree and Credit-Bearing Certificate Programs

As explained more fully in the *Research Methods* section of this report (Chapter 1), the research partners looked at awards (certificates and degrees) conferred by colleges, universities, technical and vocational institutions in fields associated with green employment. The data source was the U.S. Department of Education’s Integrated Postsecondary Education Data System (IPEDS), which contained information on the number of certificates and degrees conferred by instruction area. These instructional programs were linked to occupations using the U.S. Departments of Education and Labor’s “CIP-SOC” crosswalk.

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

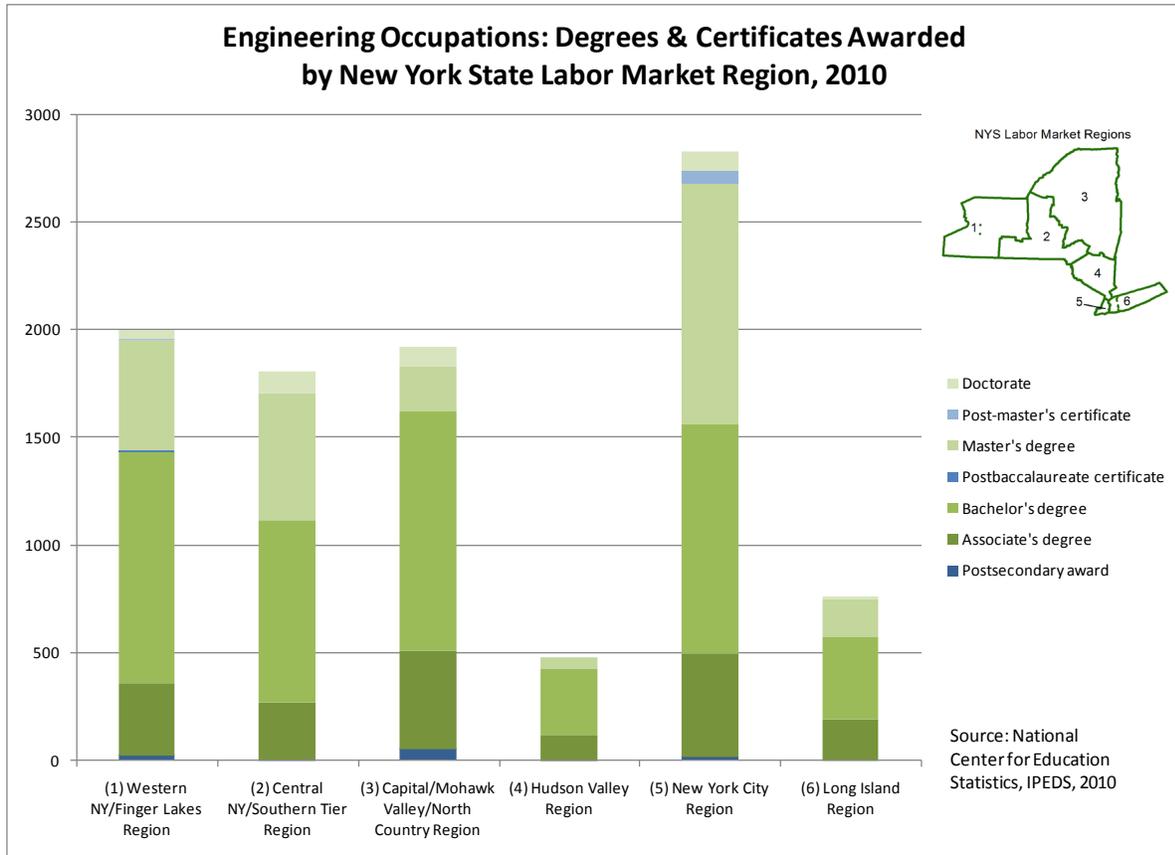
*Architecture.* In 2010 1,617 people in New York State received degrees or certificates that prepared them for work as architects or drafters. Approximately 56 percent of the degrees awarded were at the Bachelor’s level and 29 percent are at the Master’s level. The chart below shows the number and types of awards granted by region.



New York City has the highest number of degrees awarded in this area 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’s College of Architecture, Art and Planning 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 Associate Degrees awarded.

**Engineering.** In 2010, 9,788 awards were conferred preparing individuals for work as engineers or technicians. 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 Associate, Bachelor’s and Master’s Degree level in this occupational area (2,653 or 27% of all awards), with large programs at Columbia University, CUNY’s City College, and NYU’s Polytechnic Institute, among others. The Western NY/Finger Lakes region ranked second with 1,998 (20%) because of engineering programs at Rochester Institute of Technology (RIT), University of Rochester, SUNY Binghamton, the University at Buffalo, and others. 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.

In addition to identifying architecture and engineering degree programs associated with green occupations through IPEDS, the researchers conducted a survey of higher education institutions to find any specifically green programs. The table below summarizes the number of green degree and credit bearing programs found in this way.

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

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

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

Illustrative higher education institutions' *green* degree programs include:

### Architecture

- Tompkins Cortland Community College: Construction and Environmental Technology (A.A.S.)
- SUNY College of Environmental Science & Forestry: Construction Management B.S. (Concentration in Sustainable Construction and Renewable Materials)
- Rensselaer Polytechnic Institute: Built Ecologies (Architecture - M.S.)
- New York Institute of Technology: Combined B.S. in Architectural Technology and M.S. in Energy Management Program
- New York School of Interior Design: Master of Professional Studies in Sustainable Interior Environments (M.P.S.)
- Pratt Institute: Programs for Sustainable Planning & Development: Urban Environmental Systems Management M.S.

## Engineering

- Clarkson University: Bachelor's, Master's and Ph.D. degrees in Environmental Science & Engineering
- SUNY Canton: Civil & Environmental Technology B-Tech (Bachelor of Technology)
- Rochester Institute of Technology: Sustainable Engineering (M.E. and M.S Degrees)

### Program Focus

The table below displays particular program focus areas for architecture and engineering occupations. As shown, a large number of programs are focused on green construction and sustainable design, and on energy efficiency.

Architecture and Engineering Occupations	Degree/ Credit Program s	Non Degree/No n-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

Of all of the industry clusters studied as part of this research, the greenest one was professional services, consisting of architecture, engineering and consulting. It is no surprise, therefore, that there are many programs – both degree and non-degree – that prepare people in architecture and engineering occupations to work in the green economy. With 98 degree programs and 142 non-degree programs located throughout New York State, students may take advantage of the many green programs, 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, preparation for LEED or other credentialing exams, or merely wish to become more knowledgeable as these occupations are evolving in the green economy.