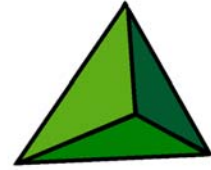




**ECONOMIC &
WORKFORCE
DEVELOPMENT**
through the
CALIFORNIA
COMMUNITY
COLLEGES

**BUSINESS AND WORKFORCE
PERFORMANCE IMPROVEMENT INITIATIVE**



Environmental Scan Report Los Angeles County

Green Building



Center of Excellence

Los Angeles Community College District

November 2007



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Environmental Scan for Los Angeles Community Colleges

Green Building and Construction

November 2007

Prepared By:

Center of Excellence, EWD Region 7
Los Angeles County
Los Angeles Community College District
770 Wilshire Blvd, Los Angeles, CA 90017
Phone: (213) 891-2162 Fax: (213) 891-2055
lewenble@laccd.edu
www.cccewd.net

In collaboration with:

BW Research
2541 State Street, suite 108, Carlsbad, CA 92008
Phone: (760) 730-9325 Fax: (760) 730-9688
www.bwresearch.com

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OUR MISSION IS TO STRENGTHEN CALIFORNIA'S WORKFORCE AND ADVANCE ECONOMIC GROWTH THROUGH EDUCATION, TRAINING AND JOB DEVELOPMENT.

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INCENTIVES FOR ENERGY EFFICIENCY CREATE SUBSTANTIAL NEW CONSTRUCTION INVESTMENT AND GOOD JOBS RETRO-FITTING BUILDINGS...21.5 JOBS FOR EVERY \$1 MILLION INVESTED, COMPARED TO 11.5 JOBS FOR NEW NATURAL GAS GENERATION.

– Source: New Energy for America: Apollo Jobs Report

Executive Summary

Incentives for energy efficiency are one of a plethora of indicators supporting the growth potential for the area of green technologies. The community colleges are strategically positioned to assist in developing this innovative economic cluster in Los Angeles. Green Technologies encompass multiple industries including energy (solar, wind, geothermal), transportation (biofuels), manufacturing (building materials), and construction (green building). In order to reach their full potential, a skilled workforce is needed. "Across the country, our companies experience workforce shortages as one of the key barriers to growth," cited a 2006 study by the National Renewable Energy Lab (NREL) identifying "the shortage of training and skills as a leading non-technical barrier to renewable energy and energy efficiency growth."

This cluster is interconnected and this report focuses on the emerging area of "green building". Multiple factors suggest that the area of green building provides a strong opportunity for colleges to adapt and create programs to assist in the development of a skilled workforce.

One such indicator is the array of recent studies highlighting opportunities in this area. "Jobs in LA's Green Technology Sector", reported that six of the city's top 20 green occupations are in construction, accounting for 25% of jobs. It also noted that several of these construction occupations have significant wage increases between their typical entry-level and overall occupational average. In 2005, the average wage in Los Angeles for construction was approximately \$45,000 annually with relatively low educational requirements.

The overall demand for construction occupations in Los Angeles is substantial, with over 150,000 employed in the industry within the county. According to economy.com, that number will grow by another 12,000 jobs by 2009.

Construction continues to be a strong industry in Los Angeles County and new regulations are mandating that growth be sustainable; most public agencies are requiring new buildings to be Leadership in Energy and Environmental Design (LEED) certified. Over \$15 billion in local construction is expected to integrate sustainable principles over the next few years. A recent survey of construction companies reported that approximately 25% have worked on a "green" project; this number is expected to increase to 50% within the next several years.

All of these factors combine to make this an excellent opportunity for community colleges in Los Angeles to assist in developing a skilled workforce for this cluster.

This report attempts to define the area of green construction, provide an overview of the industry, identify existing construction occupations that will require new skill sets, describe new occupations emerging in response to this transition to greener practices, and provide additional resources and recommendations for further exploration.

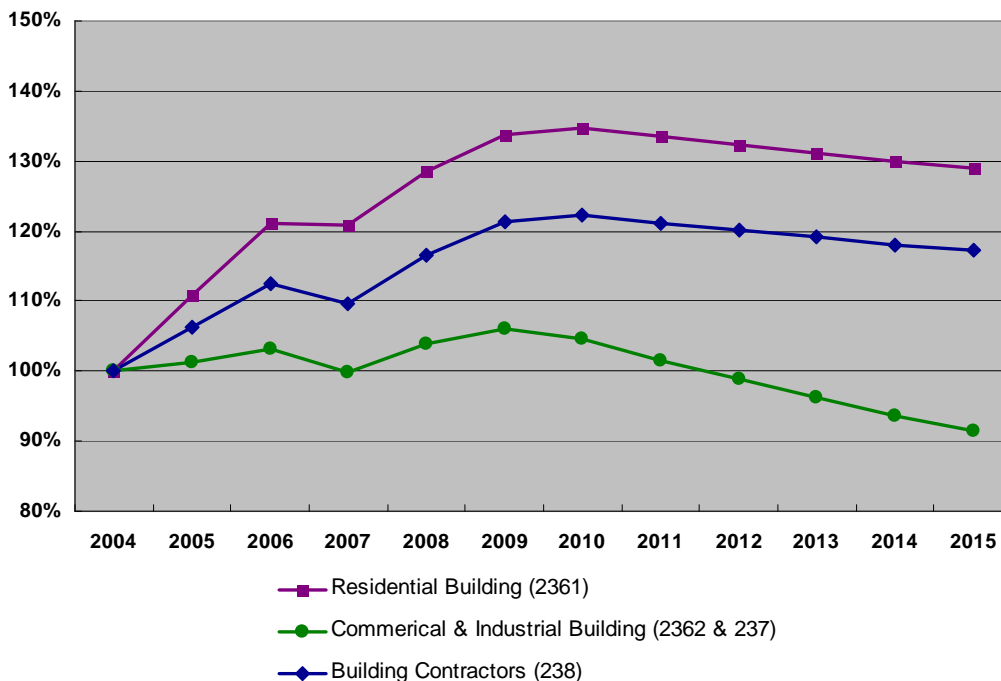
Industry Overview – Los Angeles Construction Trends

The building and construction industry in Los Angeles is usually discussed in terms of residential, commercial and industrial development. However, the largest employers within the building industry are the specialty trade contractors or subcontractors that are involved in any construction project regardless of the type of building. These include green retrofits and renovations of pre-existing buildings. The sectors within the construction industry include:

- Residential building, 16% of employment in 2005
- Commercial and industrial building, 16% of employment in 2005
- Specialty trade contractors, 68% of employment in 2005

The figure below shows the overall change in employment among the three general sectors of the building and construction industry in Los Angeles (source, economy.com). Regional forecasts of the Los Angeles economy¹ indicate the building industry is generally going in two different directions. In the short term, as residential building and housing recede, commercial and industrial building will grow and increase employment. However, longer term employment forecasts, such as those found on economy.com, have very different forecasts, with residential building employment expected to outpace employment in commercial and industrial construction as well as employment opportunities with building contractors.

Figure 1 Expected Change in Employment in Construction sectors



¹ Source - LAEDC's (Los Angeles Economic Development Corporation) 2007-08 Economic Forecast and Industry Outlook

Green Building can be defined as an organized effort to design, construct, and maintain buildings and facilities using processes and materials that promote environmental sustainability. Green building firms are found in all sectors of construction including commercial and industrial facilities, residential buildings, and among specialty trade contractors.

The move to greener more sustainable buildings and building practices is being driven by four major forces:

1. the response to local and state legislative requirements,
2. increased energy and commodity costs,
3. increased demand for minimal environmental impacts, and
4. a desire to build the economic cluster.

Appendix B presents the case for each of these factors and its influence on green building practices and demand.

The overall demand for construction occupations in Los Angeles is substantial, with over 150,000 employed in the industry within the County. According to economy.com, that number will grow by another 12,000 jobs by 2009. Employment in the construction industry pays well, particularly given the comparatively low educational requirements. In 2005, the average wage in Los Angeles for the entire construction industry was approximately \$45,000 annually. In addition, demand is expected to rise as current employers in the region expect to increase total employment by four and half percent over the next 12 months. Based on the recent survey of local construction companies, feedback suggests that of the approximately 3,000 construction firms in Los Angeles with 10 employees or more, about 720 have experience working on green construction projects.

For this study, firms that have experience building or working on projects that create green buildings are considered “green construction” firms while those businesses in the building industry that do not have experience working on a green building are considered “traditional construction” firms. Based on the employer survey and current employment in the construction industry, approximately 35,000 employees work for green construction firms, and by 2010 that number will nearly double with approximately 70,000² employees working for green construction firms. Wages for green construction employees are expected to be at least as high, if not higher, than the overall construction industry average, and green construction employees require more training and education than their traditional counterparts. Green construction firms also indicated more difficulty recruiting entry and non-entry level employees.

*Based on the survey results, **green construction firms** make up about 28% of the building industry, but they **are expecting to increase employment at more than twice the rate (9.7 percent)** over the next 12 months in comparison to traditional construction (4.6 percent) firms in Los Angeles County.*

² This figure is derived based on Economy.com’s Los Angeles forecast for the construction industry and survey data which showed an annual increase of approximately 6% of firms moving into green construction that previously had no experience.

Green Building ratings, particularly the LEED (Leadership in Energy and Environmental Design) rating system implemented by the USGBC (United States Green Building Council)³, play an important role in both providing a gold standard for builders to aim for, as well as certifying that a building or facility is as 'green' as it says it is. LEED has a relatively high level of awareness among Los Angeles construction employers (25%) and is most often cited among policy makers as the goal to which a given region should strive. Currently, LEED applies largely to commercial and industrial buildings, but a new rating system for residential homes is very close to being finalized after being in a pilot program for several years. Another green rating system is CHPS (Collaborative for High Performance Schools) which is designed for rating new schools or schools that are being renovated. CHPS presently has a relatively low awareness level among construction firms in Los Angeles (8%).

California and the City of Los Angeles are leading the country in legislation and incentives that will increase the number of green buildings in the region. Legislation such as Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006, Senate Bill (SB) 1, the Million Solar Roofs Bill, and Mayor Villaraigosa's commitment to reducing greenhouse gas emissions beyond the requirements of AB 32 will have a substantial impact on the demand for the green construction workforce. Another interesting bill to watch is AB 118 which is designed to provide resources to develop a more efficient transportation infrastructure.

Academics, the building industry, and even policy makers have begun to recognize the economic development opportunities for Green Building in Los Angeles. By developing an innovative, burgeoning economic cluster, the region will reap the benefits of increased employment and job opportunities while supporting an industry that is inherently focused on bettering the region's quality of life for its residents. Elected officials of almost any persuasion are supportive of policies that support the region's economic and environmental health.

Workforce Challenges and Opportunities

Training is a central element in the success of individuals in construction and building occupations. Green construction occupations typically require more education than traditional construction occupations; however, the building industry is still focused on work experience and does not emphasize academic degrees as often in its employment requirements. Currently, about ten percent of construction employers hire individuals with an understanding of, or training in green or sustainable building. Given the growth expectations of green construction, that figure is expected to rise in the future.

In our survey and follow-up interviews, construction employers expressed their opinions regarding general workforce issues. The survey revealed that all construction employers had difficulty with specific workforce challenges related to recruiting and retaining employees. Specifically,

³ Leed Categories of Sustainable Building include: 1) Sustainable Sites 2) Water Efficiency 3) Energy and Atmosphere Design 4) Materials and Resources 5) Indoor Environmental Quality, and 6) Innovation and Design Process - www.usgbc.org.

over two-thirds of green construction employers stated at least some difficulty if not great difficulty recruiting and retaining both entry and non-entry-level employees.

The high level of difficulty recruiting both entry and non-entry level employees is another indicator of a gap between the demand for green construction occupations and the available supply of qualified candidates. The survey results also provide other indicators of a potential shortage of qualified green construction applicants including strong hiring expectations over the next 12 months. Green construction employers also indicated they had more difficulty with each of the workforce challenges examined in comparison to traditional construction employers, except for keeping current workers trained.

Employers also expressed interest in community college programs that could provide training and education for construction and building occupations. Some of the specific survey results included:

Assistance recruiting entry and mid-level employees had the greatest percentage of interest (either some interest or great interest), while a certificate program in understanding the basics in green construction generated interest from half of construction employers.

Results of the survey show that over 40 percent of construction employers indicated interest in all of the certificate and associate degree programs evaluated.

Occupational Outlook

Specific job projections are difficult to determine since this is an emerging industry and labor market information doesn't exist. Secondary reports, a scan of existing and developing legislation, and direct surveys to existing construction companies, along with in-depth web research, were utilized to validate this strategic opportunity for the colleges. While this industry is still in its nascent stages, indicators reveal that this fledgling industry is rapidly expanding and the colleges should act now to assist in creating a well-trained workforce.

California and Los Angeles are viewed as critical leaders for the green construction industry. In Los Angeles, green construction employers are looking to hire additional individuals and traditional construction firms are trying to gain experience in the green market. Green construction employers are like their traditional construction counterparts in that they are seeking occupational training that is short (i.e. less than 8 weeks in duration), and relatively hands-on. Results of the research show that the building industry as a whole, and particularly that segment with experience with green projects, is having increased difficulty finding an adequate quantity of qualified applicants for its needed occupations.

For this study, green building occupations fall into two groups; those traditional construction occupations that will require new training or education because of the transition to green building; and occupations that are emerging as the building industry develops more green and sustainable building practices.

Traditional construction positions such as construction manager, cost estimator, construction building inspector, and construction sales representative are all impacted by the 'greening' of the building industry. These positions will require additional training and education in green building materials and techniques. The proliferation of green construction is also creating a demand for new occupations such as solar panel installers and technicians, energy auditors, energy modelers, and deconstruction specialists.

The employer survey and executive interviews also included feedback from employers in landscaping and maintenance. Most established green employers indicated that if they were to hire a landscape architect for green construction they would likely require at least a 4-year degree. However, there may be entrepreneurial opportunities for landscape planners who understand how to use sustainable plants and develop more sustainable landscapes. Thus, colleges may have an opportunity to develop certificate programs through continuing education units in this area.

Traditional Construction Occupations Impacted by Green Building

The table and discussion presented below outline demand and wage information for a selection of traditional construction occupations. Later in this section, we present information from survey participants regarding the potential level of impact on each job due to the influence of green construction techniques and principles.

Detailed occupational profiles are presented in Appendix C ⁴.

Table 1. Traditional Construction Occupations in Green Building – Demand and Wages

SOC Code	Occupational Title	Estimated Employment- Los Angeles (2007)	Annual Openings Due to Growth & Separations	Median Wage
11.9021	Construction Managers	7,485	197	\$91,540
13.1051	Cost Estimators	4,572	162	\$56,120
47.1011	First-Line Supervisors of Construction Trades	13,816	341	\$60,902
47.2111	Electricians	13,885	364	\$60,902
47.4011	Construction and Building Inspectors	2,769	103	\$65,560
41.3099	Sales Representatives, Services, All Other	23,708	721	\$60,902
47.2051	Cement Masons and Concrete Finishers	4,020	128	\$40,540
47.2181	Roofers	4,110	142	\$41,600
	Total	74,365	2,158	

⁴ A more detailed discussion of the Knowledge, Skills, and Abilities (KSA) for these occupations is available at our website www.ccewd.net/industryscans. See "Green Building Occupational Profiles, Nov. 2007".

Demand for Construction Managers is strong and is growing at the national and state average in traditional construction, but considerably faster for green construction. The median wage⁵ for Construction Managers in Los Angeles is approximately \$91,540 annually or \$44.01 an hour.

Demand for Cost Estimators is reasonably strong but can be found in industries beyond building and construction. Growth in the occupation is expected to be consistent with overall occupational growth trends at both the national and state level. The median wage for Cost Estimators in Los Angeles is approximately \$56,120 annually or \$27.98 an hour.

Demand for First-Line Supervisors of Construction is over 10,000 in Los Angeles County and growing nationally and within the state at about the average occupational growth rate (i.e., between 10 percent and 15 percent) over the next 10 years. The median wage for First-line Supervisors of Construction in Los Angeles is approximately \$60,902 annually or \$29.28 an hour.

Demand for Electricians is also over 13,000 in Los Angeles and is increasing faster than average within California, at about 20% over the next 10 years. A large portion of that increase is tied to the need for electricians that can install solar panels. The median wage for Electricians in Los Angeles is approximately \$60,902 annually or \$29.28 an hour, but is often higher, by \$5 to \$10 dollars an hour for those electricians that are installing or working on solar panels.

Demand for Construction and Building Inspectors is currently below 3,000 in Los Angeles County, but national, state and regional data indicate strong growth for this occupation through 2014. California expects to increase overall employment in this occupation by over 25 percent by 2014. A large portion of the growth in this position is tied to the increase of regulations and complexity associated with green buildings. The median wage for Construction and Building Inspectors in Los Angeles is approximately \$65,560 annually or \$31.52 an hour.

Demand for Sales Representatives is over 20,000 in Los Angeles County, but like Cost Estimators is often found in industries outside of construction. Within the building industry in Los Angeles, Sales Representatives account for approximately 10% of total occupational employment or 2,300 positions. But demand for the occupation is growing by over 20 percent in the next 10 years within California. The median wage for Sales Representatives in Los Angeles is approximately \$60,902 annually or \$29.28 an hour.

Demand for Cement Masons and Concrete Finishers is currently just above 4,000 positions in Los Angeles County and is expected to increase faster than average within California. The median wage for Cement Masons and Concrete Finishers in Los Angeles is approximately \$40,540 annually or \$19.49 an hour.

Demand for Roofers is also currently just above 4,000 positions in Los Angeles County and is expected to increase faster than average within the State. The median wage for Roofers in

⁵ Median wages were taken from the Employment Development Department's median wage by SOC occupations for Los Angeles County.

Los Angeles is approximately \$41,600 annually or \$20.00 an hour. Roofing is also an important skill for those individuals interested in becoming solar panel installers.

Career Ladders with Green Construction Employers

The Green Building industry is still developing career pathways, so many of the occupational opportunities have not been clearly defined. The following table identifies some career pathways that employers indicated have been followed by individuals. The colleges have an opportunity to assist industry in developing formalized career pathways.

Table 2. Career Pathways for Green Construction

Entry – Level Positions	Mid – Level Advancement	Top – Level Advancement	Advancement Requirements
Deconstruction Workers (\$11 to \$15 an hour)	Deconstruction Crew Chief (\$14 to \$19 an hour)	Construction Manager (Mean annual Salary \$92,000)	2 Week Intensive Training for Workers, Each additional step is based on Work Experience & OJT
Solar PV Installer (\$11 to \$17 an hour)	Senior PV Installer (\$17 to \$22 an hour)	Lead PV Installer (\$20 to \$30 an hour)	Pass Licensing Exam for Electrician and OJT & Experience
Construction Supervisor (Mean annual salary \$47,000)	Construction Manager (Mean annual salary \$99,000)	Construction Director	Advancement is typically tied to Certificates and OJT

The construction industry generally places more value towards on-the-job training than formal academic degrees. This may change somewhat in green construction because of its systems-oriented approach to building as well as the need for greater planning and collaboration between different specialists or sub-contractors.

Occupational Skills and Training Requirements for Green Construction

Below is a brief assessment of the educational requirements and skills that were identified for each of the eight traditional construction occupations and the impact of green building on their training and education needs. The final column indicates whether the occupation could be highly impacted by the increase in green building or if the impact is expected to be less substantial. Each occupation is also evaluated to consider skills and training, and education needed as it relates to green construction.

Table 3. Traditional Construction Occupations in Green Building – Training and Education

SOC Code	Occupational Title	Education & Training	Impact of Green Building
11.9021	Construction Managers	Associate or Bachelors, 2 to 3 years work experience	High
13.1051	Cost Estimators	Associate or Bachelors, 2 to 4 years work experience	High
47.1011	First-Line Supervisors of Construction	Vocational School or an Associate Degree, OJT for 1 to 2 years	High
47.2111	Electricians (Solar Panel Installers)	Several Years as an Apprentice or Schooling and Pass Exam	High
47.4011	Construction and Building Inspectors	Associate or Bachelors Degree & OJT for 2 to 3 years	High
41.3099	Sales Representatives, Services, All Other	Associate or Bachelors, 2 to 3 years work experience	Lower
47.2051	Cement Masons and Concrete Finishers	Vocational School or Several Years OJT	Lower
47.2181	Roofers	Vocational School or Several Years OJT	Lower

Emerging Occupations in Green Construction

Many of the emerging occupations that have been identified as central in the development of green buildings have existed as niche occupations for many years. However, with the expected increases in employment within green construction these niche occupations will become more prevalent in the construction industry. Labor market information on these occupations is either non-existent or quite incomplete, so most of the information for these occupations was gathered through executive interviews and some secondary data sources.

Table 4. Emerging Green Building Occupations

Occupational Title	Entry-Level Training & Education	Overall Employment Potential
Solar Installer & Technician (Electrician)	Up to 5 Years as an Apprentice or Vocational Schooling and Pass Licensing Exam	High

Deconstruction Worker	2 Week Intensive Training & OJT	High
Energy & Indoor Air Quality Auditor	Bachelors Degree, 2 to 4 years work experience	Medium
Energy Modeler	Bachelors Degree, 2 to 4 years work experience	Medium
Operations & Maintenance for HVAC and PV (HVAC Technicians & Electricians)	Vocational School, Associate Degree or Certificate & OJT for 2 to 3 years	Medium
Commissioning Agent or Certification Consultant	Bachelors or Graduate Degree, 2 to 4 years work experience & OJT	Low

Solar Installer & Technician is typically an electrician who has also been trained to place and install PV (photo-voltaic) panels. The training emphasizes maximizing the performance of the solar panel in terms of optimizing energy generation and minimizing maintenance problems associated with PV systems. The training also focuses on safety and minimizing the risks associated with live electrical systems. Wages for Solar Panel installers vary greatly depending on education and experience but range from approximately \$11 to \$40 an hour.

Deconstruction Worker is an entry-level opportunity to move into the green construction industry with only a 2 week intensive training course. The position is focused on reducing all waste associated with rebuilding or retrofitting a house or facility and reusing as many materials as possible. Deconstruction workers typically earn \$10 to \$15 an hour and can move up relatively quickly to a Deconstruction crew chief earning \$12 to \$18 an hour.

Energy & Indoor Air Quality Auditor has the potential to grow significantly as legislation (AB 1103, Saldana) in Sacramento is being considered that would require new buildings to assess their production of greenhouse gas emissions or their carbon footprint. Even without new legislation, these positions will increase due to the increased demand for greater energy efficiency from new buildings and the increased focus on measuring and maintaining healthy indoor air quality. Healthy Buildings International is a leader in evaluating indoor air quality and their air quality specialists require 1 to 5 years of industrial/environmental work experience. Starting salaries vary depending on the employer, but \$40,000 to \$65,000 is the typical range for most employers depending on responsibilities and work experience.

Energy Modeler is becoming increasingly important as green builders become more focused on quantifying the performance parameters of a given facility particularly as it relates to energy efficiency and generation. This occupation can also play a valuable role in meeting certification requirements for LEED, CHPS or other relevant standards. These occupations are typically found in larger commercial and industrial construction firms; however, they may become more widespread as more firms move into green construction. These positions typically require at least a bachelor's degree due to the intense mathematical requirements and sophisticated software usage. Starting salaries vary depending on the employer but

\$50,000 to \$70,000 is the typical range for most employers depending on responsibilities and work experience.

Operations and Maintenance for HVAC and PV (Electricians & HVAC Technicians) is not technically a new position, but the changing training and education requirements for electricians and HVAC technicians that operate and maintain green facilities is synonymous with re-categorizing a position. These occupations will require a new understanding of energy systems management as green facilities integrate PV systems with HVAC and lighting systems. In general these individuals will need to have a much stronger understanding of the entire system as green buildings are much more integrated from the bottom up.

Commissioning Agent or Certification Consultant are personnel that assist construction firms, school districts and local governments build green facilities that meet LEED, CHPS and other appropriate certifications. These occupations typically require at least a Bachelor's Degree in urban planning or environmental studies and often require other certifications such as a LEED AP (Accredited Professional). These positions should technically disappear as construction managers and supervisors have a comprehensive understanding of green buildings and related certifications, but currently demand for these positions is strong and growing.

Industry Validation

In prior sections of this report, information from local construction employers was used to support growth projections, employment challenges, and educational requirements. The information was obtained from several stages of research focused on better understanding the workforce and training needs of regional green construction employers.

Industry Trends and Labor Market Assessment: Using secondary data sources, including California's Employment Development Department (EDD), O*Net online, the American Community survey, the Bureau of Labor Statistics and economy.com's detailed industry forecasts, an industry assessment of regional construction employers' general occupational profiles was developed for the green construction industry.

Since Labor market information did not exist for this area, a survey was conducted of local construction companies to determine their extent of involvement with green projects today and potential for growth in the coming years.

Quantitative Telephone & Internet Surveys: One hundred and sixteen employers in Los Angeles County were interviewed either over the phone or through an email invitation and an Internet survey. Interviews were typically conducted with a human resources manager for larger firms (with at least 25 employees) and an owner or acting manager for smaller firms (less than 25 employees). The purpose of the quantitative survey was to gather reliable measures of green and sustainable building practices within the construction industry as well as the workforce needs of the construction industry as it related to green building.

Qualitative Executive Interviews: Fifteen executive interviews were completed with green construction experts in industry, academia and public planning. The interviews were meant to get a more contextual understanding of the skills and abilities that green construction employers are looking for among current and future employees. Respondents were also

asked to provide feedback on different scenarios that could support the development of green construction professionals and the evolving training and educational needs of these individuals.

A description of the survey methodology and participants is presented in Appendix D.

Data Limitations

There were three fundamental challenges in studying the workforce needs of the green building industry in Los Angeles that should be considered when evaluating the findings of this study.

1. Labor market information on green building occupations, wages and overall market sizing is virtually non-existent. Clearly there is information that exists for the greater construction industry but wages, skill-sets and hiring expectations are not delineated by green versus traditional employers.
2. There is no comprehensive database of green building employers. The quantitative survey included all construction employers to determine the level of green penetration within the entire building industry. However, generalizations about the green building industry from the survey data are limited due to the small sample size and most information about the emerging occupations is largely anecdotal or taken from whatever relationship could be established with the greater construction industry.
3. Occupational titles and responsibilities are still emerging and seldom consistent among employers. The occupations that were identified in this study are mostly agreed upon by the leading green builders, but titles and responsibilities could still change in the coming years.

Data compiled for this report were drawn from external sources, including information from California's Employment Development Department, economy.com, and the US and LA Green Building Council.

Training and Education Providers for Green Construction

Los Angeles County is a diverse economy with a broad array of training and educational opportunities. However, green technology and more specifically green construction is in its formative stages and training and education opportunities in green construction are relatively limited. The leading universities in green construction and sustainable development are found outside of Los Angeles in Central and Northern California and Colorado. Their program offerings include:

- California State University at Sonoma offers six classes on sustainability and green building. These courses include energy sources, green building materials, indoor environmental air quality and innovations in green building.⁶

⁶ (www.sonoma.edu/ensp/etc/)

- University of California at Davis offers seven classes on sustainability and the built environment. These courses include sustainable planning, water resource management, energy sources, green building materials and green building case studies.
- Colorado State University offers a 12 week course that introduces students to the green building process including certifications, the economics of sustainability and integrating building and energy systems.

Currently, none of the universities in Los Angeles or the surrounding Southern California region offers a comprehensive degree or certificate program in green construction although there are many examples of individual courses that include components of green building and green design. In fact, California State University at Fullerton recently added a certificate in Green Building to be offered through its University Extended Education. The certificate consists of nine courses and participants can earn Continuing Education Units (CEUs). More information can be found on their website: <http://www.csufextension.org/>. The University of California also offers Sustainable Landscaping through its Cooperative Education programs. Many universities have also set-up sustainable centers such as the University of California at Los Angeles' (UCLA's) Institute of the Environment and the University of Southern California's (USC's) Center for Sustainable Cities. These Centers are important components of the infrastructure that can support efforts to create greener communities.

Many professional organizations are also beginning to offer training for individuals in related fields. Build It Green offers a two-day Certified Green Building Professional (CGBP) training for building professionals involved in the design and construction of residential buildings, as well as those that support and develop the market for green building. A listing of the covered topics can be found at their website: <http://www.builditgreen.org/>.

There are some training programs offered with unions and regional colleges that will train and prepare individuals for specific occupations within green construction such as the International Brotherhood of Electrical Workers (IBEW) local 11 training program for solar installers and the East Los Angeles Skills Center PV (photovoltaic) installer course, but at the time this report was written, no comprehensive programs at a college or university in the region focused on green construction.

Green Building Programs at Community Colleges

Green building related training programs are beginning to be available through various entities from adult and career education centers, to unions, to California State Universities, and industry associations. Some of these were mentioned previously, such as the East LA Skills Center, IBEW, and Cal State Fullerton. Industry associations are also taking the lead; one example is the Certified Energy Analyst certification being developed by the California Association of Building Energy Consultants (CABEC.org). Many of these organizations are adapting programs because they are not readily available at local colleges. Companies have also had to develop internal training programs for their employees. Thus, there is an opportunity for the community colleges to adapt existing programs and develop new courses to better meet the emerging need for skilled employees in green construction.

Many community colleges are moving forward on developing courses in Green Building that address specific occupations, such as solar panel technician, or that may offer a more general understanding of the practice of sustainable building. Community colleges have historically offered a core of programs in traditional construction that could be easily adapted to train workers for green building. As a supplement to this report, a regional list of community college programs associated with traditional construction, construction support, and architecture activities has been developed.⁷ These programs could be adapted to assist students to acquire skills needed to be successful in these areas. The programs include: Architecture, Civil and Construction Management Technology, Environmental Control Technology (HVAC), Energy Systems Technology, Construction Crafts Technology, and Landscape Design and Maintenance. This list also includes specific courses and programs related to green construction that are currently being offered or developed at community colleges in Los Angeles and Orange County.

Several colleges have anticipated the need for trained workers in these areas and have already established programs to train students and serve the workforce. One college in California, Diablo Valley College in Pleasant Hill, offers **Photovoltaic System Design and Installation**. This course covers photovoltaic systems, site evaluation, configuration options, installation options, performance testing and maintenance. It includes “hands on” activities working with real equipment. It is also aligned with The North American Board of Certified Energy Practitioners (NABCEP) for those interested in certification. Catalog course descriptions and full course outlines can be accessed on the college’s website: <http://www.dvc.edu/wcs/index.asp>.⁸ A selection of the courses is presented in Appendix E.

Cape Cod Community College in Massachusetts has been training students in multiple green programs for over ten years. Courses have evolved from cleaning and remediation to energy efficiency; they are now offering a green building program. Their Construction Technology Certificate includes electives from environmental technology courses which range from renewable energy sources to an introduction to solar energy. For a detailed description of the Certificate see Appendix F.

Other two-year colleges are targeting workers who are already working in a related field and need specific knowledge in sustainable issues. Columbus State Community College in Ohio offers a four-course sustainable construction certificate program for architectural and construction management professionals. For an outline of the certificate requirements, see Appendix G.

Mt. Hood Community College offers a Sustainable Building Advisor Certificate Program for Working Professionals. This is a nine-month program delivered in a weekend format. A sample schedule of offerings is included in Appendix H.

⁷ The list, Green Building: Related Community College Programs in Southern California, is available at our website at www.cccewd.net/industryscans.

⁸ Search by “Subject”. Select “Alternate Energy Technologies”.

Many schools are also taking an internal look at existing programs and identifying where they align with emerging sustainable industries. Locally, the Los Angeles Community College District is leading a large sustainable building effort with over 40 new buildings to be LEED certified. Plans also include retrofitting buildings to integrate new methods to reduce energy and water usage. LACCD plans to be completely off the grid by the end of 2008. It has also established a district-wide effort to build sustainable curriculum.

Los Angeles Trade Technical College outlined its priorities for 2007-2009 academic years based on the 17 Most Promising Industries with Green Activity in Los Angeles. See Appendix I for a recap of their work.

Colleges around the region are responding to the need for new programs. A sample list of programs is included in the report titled, Green Building: Related Community College Programs at www.ccewd.net/industryscans.

While this is by no means a comprehensive list of offerings associated with the green building movement, it provides some examples of ways community colleges across the Nation are recognizing the need in this area.

The Partnership for Environmental Technology Education (PETE) is a non-profit 501 (c) (3) organization that helps facilitate, augment, and broker partnerships with educational institutions, industry, and government. Their mission is to provide leadership in environmental education and training through community and technical college partnerships with business, industry, government, and other educational providers. The website offers multiple resources including *Energy Services Careers*, a report that offers job descriptions and information on job duties on such emerging green occupations as Energy Auditor, Energy Analyst, and Building Operator/Building Technician. This report can be downloaded at: http://www.ateec.org/publ/energy_book.pdf

Appendix J presents a list of industry associations and additional resources that may be helpful.

Implications and Recommendations for Community Colleges

Community Colleges should play a larger role in training and educating green construction professionals. As the potential shortage of green building professionals becomes more pronounced, so does the need for increased participation by the regional colleges.

Challenges for Community Colleges

Colleges that want to be early movers on green initiatives will need to find creative solutions for several challenges that are expected to arise as they work with industry partners on new programs, technologies, and curriculum.

- The traditional semester system is too long for most construction employers, who want training programs to be more incremental and completed in 2 to 8 weeks, while employees remain on the job.

- Construction employers have little experience working with community colleges, so relationships would need to be developed.
- Green technologies are rapidly changing, so colleges may find keeping up with changes could be costly. Space on college campuses could also pose challenges.
- Hiring new faculty in these emerging areas may be difficult due to the minimum qualification requirements that may not even exist in these newer areas.

Opportunities for Community Colleges

With these challenges in mind, we recommend that community colleges might respond to this opportunity in the following ways:

- Develop or form a consortium of colleges, adult education centers, trade schools, high schools, and workforce investment boards, local unions, and leverage existing efforts such as the aforementioned <http://fourenergy.net>, PETE or the Los Angeles Orange County Regional Consortium.
- Develop continuing education courses that can be adapted into the for-credit curriculum. These can serve existing students or current professionals seeking skills advancement.
- Develop a sustainability overview course that can be taken as an elective in connection with existing programs such as business, construction, architecture, and the like.
- Offer cross-disciplinary approaches that fuse skills necessary to be successful in the industry.
- Develop strong partnerships with local businesses to provide students with hands-on experience in construction, roofing, electrical, and plumbing through paid internships.
- Partner with local universities to assist in incubator opportunities for entrepreneurs.

Programmatic Recommendations

- Develop a certificate program for managers and supervisors. This should be an intense 4 to 8 week program, taught after the work day and providing participants with the information needed to become a LEED Accredited Professional. This program would be targeted to those construction firms that already have experience with green construction.
- Develop a certificate program that provides a basic understanding of green construction for those individual contractors that have little or no experience with green building. This program would be targeted to those construction firms that want to enter the green construction market as well as those individuals who are interested in working in the construction industry.
- Coordinate with the Los Angeles Workforce Investment Board (LAWIB) to develop a recruiting program for the construction industry focusing on those occupations that are more likely to be impacted by green building. In the recruiting process, individuals

would be introduced to the green building certificates being offered by the community colleges.

- Develop and implement a solar installer program that would combine training of an electrician with the additional curriculum of placing panels to optimize performance and increase durability of the panel. Such a program might coordinate with the International Brotherhood of Electrical Workers (IBEW) program, which is a 5-year apprenticeship program track, this program would teach all of the requirements for becoming a certified electrician with specific instruction in solar installation, maintenance and repair.

Conclusion

The building industry in Los Angeles is in the midst of a major transition. This transition provides a strategic opportunity for community colleges within the region to develop and improve programs for the building industry. Most training opportunities within this sector are relevant to community college offerings and are within the scope of their core competencies.

While it is difficult within this emerging industry to document specific occupational data, findings from both the secondary data sources and the results from the primary research indicate the need to adapt and expand building and construction courses and programs that are offered at the colleges. Employers are interested in programs that would incorporate green and sustainable building techniques and processes as well as programs that are dedicated to green building for entry-level applicants. There is also a need for career enhancement training on green practices for those individuals looking to move ahead in the building industry.

If colleges adapt current construction programs and develop green construction programs, they will, in turn, increase employment opportunities for community college students and contribute to a trained workforce for regional employers.

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APPENDIX A: How to Utilize this Report

About Us - Description of BWPI

The Business and Workforce Performance Improvement (BWPI) initiative is focused on building the capacity of the colleges in the area of economic and workforce development to enhance their ability to deliver education and training services to businesses and workers in high growth industries, new technologies, and other clusters of opportunities.

The Centers of Excellence (COE) within BWPI provide information regarding workforce trends, increasing awareness and visibility about the colleges economic and workforce development programs and services, and building partnerships with business and industry. The difference this will make to the colleges is that it will position them as THE workforce partners of choice to business and industry and ensure that college programs are current and responsive. This will contribute to the overall economic vitality of the communities in which they serve.

How to Use This Environmental Scan Report

The Centers of Excellence within the Business and Workforce Performance Improvement Initiative of the California Community College Economic and Workforce Development Program have undertaken Environmental Scanning to provide targeted and valuable information to community colleges on high growth industries and occupations.

This report is intended to assist the decision-making process of California community college administrators and planners in addressing local and regional workforce needs and emerging job opportunities in the workplace as they relate to college programs. The information contained in this report can be used to guide program offerings, strengthen grant applications, and support other economic and workforce development efforts.

This report is designed to provide current industry data that will:

- Define potential strategic opportunities relative to an industry's emerging trends and workforce needs;
- Influence and inform local college program planning and resource development; and
- Promote a future-oriented and market responsive way of thinking among stakeholders.

This Environmental Scan included a review of the California Regional Economies Project reports and Employment Development Department (EDD) Labor Market Information (LMID) projections that cover the communities in this region, as well as many other sources as referenced.

Important Disclaimer:

All representations included in this report/study have been produced from a secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings. The purpose of the Environmental Scan is to assist the California Community Colleges to respond to emerging market needs for workforce performance improvement. However, neither the BWPI Centers of Excellence, COE host college, nor California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon this study including components or recommendations.

APPENDIX B: Transformation of the Building Industry

The current and expected proliferation of the green building industry and the respective employment opportunities in Los Angeles are driven by four fundamental factors:

- the **legislative imperative to combat global warming** and improve our environment,
- the **increased costs of energy and traditional building materials**,
- the **increased demand for minimal environmental impacts**, and
- the opportunity to **develop an innovative economic cluster** within the region.

Legislative Imperative to Combat Global Warming and Improve our Environment

The construction and operation of buildings in California account for approximately 35%⁹ of greenhouse gas emissions. This is just a few percentage points less than transportation which we typically associate as the primary culprit in global warming. This is consistent with national findings that indicate creating and operating buildings account for 35% to 40% of national greenhouse gas emissions. Because buildings, both the creation and operation, are such a significant contributor to greenhouse gas emissions, they also need to be a focal point for any potential solutions.

Policy makers in Sacramento and throughout Los Angeles have offered multiple pieces of legislation or local ordinances with the goal of improving the environment and/or combating global warming. Some examples of this legislation and local ordinances include:

- AB 32: The Global Warming Solutions Act of 2006 – This legislation mandates the state of California to reduce its greenhouse gas emissions back below 1990 levels by 2020
- SB 1: The Million Solar Roofs Bill – Provides funding, incentives and mandates to increase solar panels throughout the state.
- AB 35: Green Buildings – Requires state buildings to be built to environmental standards such as LEED.
- As part of Mayor's Villaraigosa's Plan to create the "Greenest Big City in America" all new city buildings will be built to LEED standards. The city presently has 59 LEED registered projects, placing it fifth in the US for the highest number of registered projects¹⁰.
- Additionally, Los Angeles plans to audit 500 city buildings and study the potential for green retrofitting job opportunities and training programs. The result could save the City \$10 million in energy costs per year.¹¹
- Santa Monica¹² has implemented aggressive green building ordinances that require energy saving measures be incorporated into new residential and commercial buildings.

⁹ Source: California Energy Commission, 2006 CA GhG Inventory

¹⁰ Information on Mayor Villaraigosa's Green Los Angeles plan taken from http://www.citymayors.com/environment/la_green.html

¹¹ Scope & Scale: Strategic Concepts in Organizing and Policy Education Vol.1 Fall 2007.

¹² One example is the City of Santa Monica amending sections 8.108.030 AND 8.108.040 of the Santa Monica Building Code which requires increased use of LEED certifications on new buildings in the City.

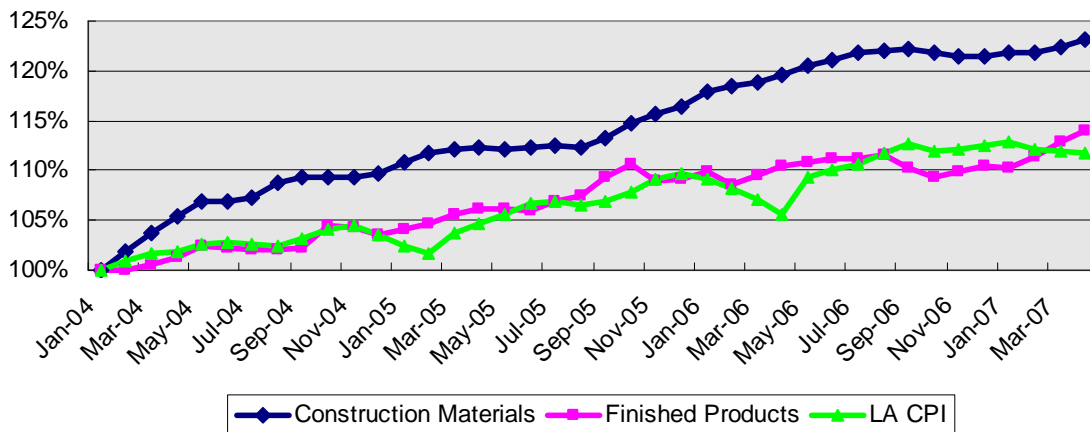
- The City of Pasadena¹³ recently passed a comprehensive ordinance to require most new buildings in the City to comply with green building regulations.
- Currently AB118 is sitting on Speaker Nunez's desk. It would provide increased funding for green technology, including green buildings.
- The Green Jobs Act of 2007 (H.R. 2847) passed in June 2007, will create the energy efficiency and renewable energy worker training program within the Workforce Investment Act. Twenty percent of the program's \$125 million appropriation will be dedicated to services that create pathways out of poverty for low-income adults.
- Energy Efficiency and Renewable Energy Workforce Development Amendment sponsored by Senator Bernie Sanders of Vermont and Senator Hillary Clinton. The amendment allots \$100 million to train workers in "green collar jobs" – jobs that involve the design, manufacture, installation, operation, and maintenance of clean, efficient energy technologies.

These legislative examples illustrate the region, state, and Nation's commitment to reduce Greenhouse gases and improve our environment. To meet the goals and mandates set forth in this legislative package, the building industry, which has already begun to respond to these legislative initiatives, will need to further bring green buildings into the mainstream.

Increased Costs of Energy and Traditional Building Materials

Costs are a motivating factor for any business, and while energy costs have been steadily climbing since 2000, the cost of traditional building materials has also gone up sharply in the last few years. The figure below compares the construction materials index, a composite measure of overall prices for construction materials to the finished goods price index, a composite measure of overall prices for all finished goods and the consumer price index (CPI) for Los Angeles¹⁴. Since January of 2004, the cost of construction materials has been increasing at almost twice the rate of all finished goods as well as twice the rate of inflation in Los Angeles. The building industry has been more receptive to using alternative green building materials as the price of traditional counterparts continues to rise substantially.

Figure 1 Producer Price Index Comparison for Construction Materials and Finished Goods



¹³ Pasadena Municipal Code Chapter 14.90 Green Building Practices Ordinance

¹⁴ Source, Bureau of Labor Statistics, Produce Price Index & Regional CPI

Increased Demand for Minimal Environmental Impacts and Development of an Innovative Economic Cluster are closely connected.

The U.S. Green Consumer marketplace represents \$209 billion in consumer sales. As consumers increasingly incorporate their values of environmental and social responsibility into their purchase decisions, the green marketplace will increase and entrepreneurs and venture capitalists will work on supplying their needs.

Multiple industry and academic studies¹⁵ have been completed in the last 12 months which advocate a strong economic development effort focused on the green technology sector and more specifically the green building industry for Los Angeles. These studies generally agree upon some key strategies when developing programs for the regional workforce.

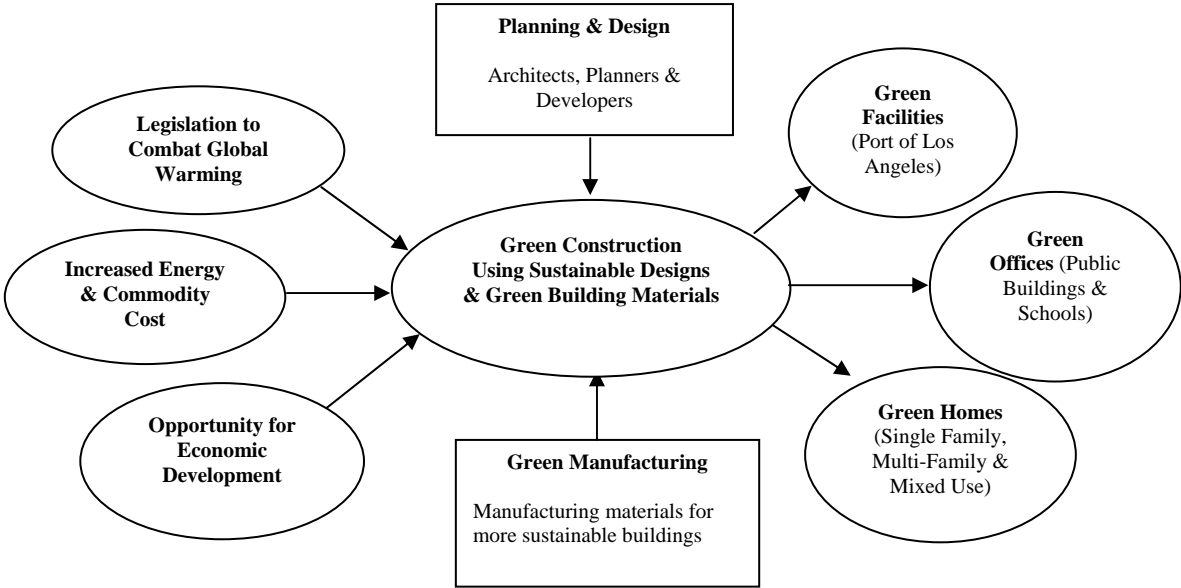
1. Move quickly. As firms grow and become established, it is much harder to get them to move to a different region within the country. Programs should be developed that can be implemented quickly and can be altered over time based on the needs of the marketplace.
2. Workforce development programs should strengthen economic equity by offering training programs to disadvantaged populations¹⁶ so all neighborhoods share in the benefits of economic growth from green employment.

There is a sizeable base from which to build this new sector. The construction and building industry play a substantial role in the Los Angeles economy, as industries like real estate and architecture are closely linked to the building industry. Green construction, while part of the greater green technology sector, is largely connected to both green manufacturing, which provides the building materials for the industry and the planners and designers who provide the plans to create the buildings. The figure below illustrates the basic relationship between green construction and its two primary supporting industries, planning & design, and green manufacturing. It should be noted that this includes the development of green facilities, offices, and homes that are built from the ground up as well as pre-existing facilities, offices and homes that are being **retrofitted** or **renovated** to be more energy efficient and environmentally benign.

¹⁵ These studies include "Attracting Green Industry: An Economic Development Approach for the City of Los Angeles", 2006 by Laurie Kaye, "Jobs in L.A.'s Green Technology Sector", 2006 Economic Roundtable, Patrick Burns and Daniel Fleming and "Green Building Manufacturing: Los Angeles County" 2007, UCLA

¹⁶ The Economic Development Potential of the Green Sector. Paul Ong and R. Varisa Patraporn. June 2006

Figure 2 Green Construction Industry Relationships



APPENDIX C: Occupational Profiles¹⁷

Construction Managers: This is an entry to mid-level position that typically requires a bachelor's degree for commercial and industrial builders and often an associates degree or higher for residential builders. The work is focused on planning and coordinating the building of a home or facility. Green buildings require more planning and integration of different systems, subcontractors and building materials. Leaders in green construction, like Turner Construction and Swinerton, have developed their own internal training program so construction managers are taught the nuances of planning and implementing the design of a green home or facility. These internal training programs are typically intensive 4 to 8 week programs that not only teach the many different aspects of green construction management but also provide a better understanding of the LEED and/or other certifications.

Cost Estimators: This is an entry-level to mid-level position that typically requires at least an associate's degree and sometimes a bachelor's degree. In the construction industry, cost estimators must have a comprehensive understanding of how the design process is implemented and which building materials will work for a given design and how they should be priced. Because green construction requires different designs and uses different building materials, cost estimators are significantly impacted by green construction. A common perception is that green construction facilities are generally estimated to cost more than traditional construction facilities, because cost estimators are not as familiar with green construction processes and materials, and if people are not familiar with costs they tend to over-estimate rather than under-estimate.

First-line Supervisors of Construction: This is an entry-level position that has very different training and education requirements depending on the employer. Some require a bachelor's degree while others will only require OJT (on-the-job training). The work is somewhat similar to construction managers but instead of managing the entire building process, it typically is focused on managing a group of employees or sub-contractors to complete a component of the construction project. Like construction managers, supervisors need to have a general understanding of how to implement a green construction design and be familiar with more sustainable building materials. As projects become greener, there will be a greater need to coordinate among a larger group of sub-contractors. The supervisor position often provides an opportunity to move up to construction manager.

Electricians (Solar Panel Installers & Technicians): This is an entry to mid-level position that typically requires five years as an apprentice (Local 11 IBEW – Solar Panel Installers Program) or several years of vocational training and passing a licensing exam. Electricians are a critical occupation in green construction because solar installers and many solar technicians must be trained as electricians. Experienced and properly trained solar installers are an important component in maximizing the energy generated by solar panels, both in the placement of the panel as well as ensuring that they are installed in such a way to minimize future maintenance problems. Non-solar panel electricians can also be impacted by green buildings as they will need to work with energy systems that are more complex than traditional

¹⁷ For additional detail and information regarding Knowledge, Skills, and Abilities (KSAs) for these occupations, see "Green Building Occupational Profiles Report, November 2007" at www.ccewd.net/industryscans.

systems, such as energy management systems that are integrated with HVAC (Heating, Ventilation, Air Conditioning and Cooling), lighting and refrigeration.

Construction and Building Inspectors: This is an entry to mid-level position that like many construction occupations can be trained through extensive on the job training, or through a college degree, such as a bachelor's. Given the importance of certifications as well as the need to measure performance of a facility in terms of energy efficiency and/or energy generation in green construction, inspectors play an important role in the development of green buildings. Their fundamental role of focusing on safety and liability is changing to become much more concerned with performance. The training and education for inspectors will need to become more rigorous as more certifications are implemented for residential buildings and legislative requirements are put into place for commercial and industrial facilities.

Sales Representatives: This is an entry to mid-level position which can be trained through extensive on-the-job training or with less training and a college degree (associate's or bachelor's). Sales Representatives working for green builders need to be conversant with LEED, CHPS and other relevant certifications; green building materials; and the impact of ever-changing legislative requirements and incentives, which are occurring at both the state and local level. The training and education requirements for Sales Representatives will be impacted by the transition to greener, more sustainable buildings, but not as significantly as for occupations like Construction Managers or Building Inspectors.

Cement Masons and Concrete Finishers: This is an entry-level position that typically requires moderate on the job training or some vocational schooling. Cement Masons and Concrete Finishers working on green building projects will need to understand the complexities of using different types of paving especially pervious or porous cement. The training and education requirements for Cement Masons will be impacted by the transition to greener, more sustainable buildings, but not as significantly as for occupations like Construction Managers or Building Inspectors.

Roofers: This is an entry-level position that also typically requires moderate on the job training or some vocational schooling. Roofers working on green building projects face more complexities than traditional roofers as roofs are often very different for green projects and also typically include solar panels. Green roofers need to be familiar with a broader spectrum of roofing materials and will often need to coordinate with solar panel installers. The training and education requirements for Roofers will be impacted by the transition to greener, more sustainable buildings, but not as significantly as for occupations like Construction Managers or Building Inspectors.

APPENDIX D: Survey Methodology

The table below briefly outlines the methodology for this project. A total of 116 construction and landscape maintenance firms, each with a minimum of 10 employees, completed a telephone or Internet survey, representing a total universe of 2,993 companies within Los Angeles County.

Table 1 Methodology

Technique	Telephone & Internet survey of construction and landscape maintenance firms who employ building and landscape professionals
Universe	195 Landscape Maintenance Firms (10+ employees) 1,491 Small Construction Firms (10 to 19 employees) 935 Construction Firms (20 to 49 employees) 372 Large Construction Firms (50+ employees)
Number of Respondents	10 Landscape Maintenance Firms (10+ employees) 37 Small Construction Firms (10 to 19 employees) 39 Construction Firms (20 to 49 employees) 30 Large Construction Firms (50+ employees)
Field Dates	February 26 to April 20, 2007

Questionnaire Design

Through an iterative process, BW Research worked closely with the Los Angeles Center of Excellence to develop the questionnaire for the study.

Randomization of Questions

To avoid the problem of systematic position bias - where the order in which a series of questions is asked systematically influences the answers to some of the questions - several of the questions in this survey were randomized such that respondents were not consistently asked the questions in the same order. The series of items relating to industry workforce issues, employee development practices, and interest in training and education programs (Question 4, 5, 6, 11, 12, and 17) were randomized to avoid the systematic position bias.

Participants

For this study, building and construction employers include firms who fall under the North American Industry Classification System (NAICS) code 236, who are focused on the construction of buildings. Firms in code 237 (civil engineering construction) were also included, as well as code 238 which includes specialty trade contractors who support the construction industry. Additionally, code 56173, those firms that provide landscaping services for building and facilities, were included.

The survey only included firms that were found in these industries and employed at least five people within Los Angeles for the initial 100 interviews. The remaining 16 follow-up interviews were completed with firms that were found among the Los Angeles Community College District's construction consultant's list. Potential respondents were stratified by industry and firm size (in terms of number of employees) to ensure a representative sample of respondents.

APPENDIX E: Diablo Valley College

Catalog Course Descriptions

Alternative Energy Technologies

AET – 120 Introduction to Alternate Energy Systems

2 Units, SC

36 hours Lecture / 18 hours Laboratory per Term

This course will cover present day energy systems, and then cover an in-depth analysis of the design and installation of alternate energy systems. Alternate energy systems to be covered in detail are solar water heating systems, solar electrical systems, wind electrical systems, wind mechanical systems, small hydro-electrical systems and unique conservation methods. Also presented are topics on geothermal energy, fuel cells, and biomass systems. Additional topics include applications of alternate energy in transportation, industrial, commercial and residential systems. CSU

AET – 130 Photovoltaic Systems Design and Installation

2 Units, SC

May be repeated once

2 hours Lecture / 1 hour Laboratory per Week

This course will show students how to do solar site evaluations, electrical load calculations, solar system size calculations, and installation techniques. This course will help students design and install their own solar system and/or obtain skills for employment. CSU

AET – 150 Topics in Alternate Energy Technologies

0.3 – 4 Units, SC

May be repeated twice

Variable Hours

A supplemental course in Alternate Energy Technology that provides a study of current concepts and practices in Alternate Energy Technology and related subdivisions. Specific topics will be announced in the schedule of courses. CSU

AET – 150B Photovoltaic System Design and Installation

2 Units, SC

May be repeated once

36 hours Lecture / 18 hours Laboratory per Term

This course follows the “Introduction to Alternate Energy Systems” course. Students will learn how to do solar site evaluations, design and install solar grid-tie systems, stand-alone systems and emergency back up systems.

AET – 150C Energy Audits and Conservation Techniques

1 Unit, SC

May be repeated twice

3 hours Lecture per Week

This course will introduce students to how energy audits are performed on residential, commercial and industrial locations. Based on results of energy audits, conservation techniques will be established. CSU

AET – 120 Introduction to Alternate Energy Systems

2 Units, SC

36 hours Lecture/ 18 hours Laboratory per Term

This course will cover present day energy systems, and then cover an in-depth analysis of the design and installation of alternate energy systems. Alternate energy systems to be covered in detail are solar water heating systems, solar electrical systems, wind electrical systems, wind mechanical systems, small hydro-electrical systems and unique conservation methods. Also presented are topics on geothermal energy, fuel cells, and biomass systems. Additional topics include applications of alternate energy in transportation, industrial, commercial and residential systems. CSU

AET – 130 Photovoltaic Systems Design and Installation

2 Units, SC

May be repeated once

2 hours Lecture/ 1 hour Laboratory per Week

This course will show students how to do solar site evaluations, electrical load calculations, solar system size calculations, and installation techniques. This course will help students design and install their own solar system and/or obtain skills for employment. CSU

AET – 150 Topics in Alternate Energy Technologies

0.3 Units, SC

May be repeated three times

Variable hours

A supplemental course in Alternate Energy Technology that provides a study of current concepts and practices in Alternate Energy Technology and related subdivisions. Specific topics will be announced in the schedule of courses. CSU

AET – 150B Photovoltaic System Design and Installation

2 Units, SC

May be repeated once

36 hours Lecture/ 18 hours Laboratory per Term

This course follows the “Introduction to Alternate Energy Systems” course. Students will learn how to do solar site evaluations, design and install solar grid-tie systems, stand-alone systems and emergency back up systems.

AET – 150C Energy Audits and Conservation Techniques

1 Unit, SC

May be repeated twice

3 hours Lecture per Week

This course will introduce students to how energy audits are performed on residential, commercial and industrial locations. Based on results of energy audits, conservation techniques will be established. CSU

AET – 120 Introduction to Alternate Energy Systems

2 Units, SC

36 hours Lecture/ 18 hours Laboratory per Term

This course will cover present day energy systems, and then cover an in-depth analysis of the design and installation of alternate energy systems. Alternate energy systems to be covered in detail are solar water heating systems, solar electrical systems, wind electrical systems, wind mechanical systems, small hydro-electrical systems and unique conservation methods. Also presented are topics on geothermal energy, fuel cells, and biomass systems. Additional topics include applications of alternate energy in transportation, industrial, commercial and residential systems. CSU

AET – 130 Photovoltaic Systems Design and Installation

2 Units, SC

May be repeated once

2 hours Lecture/ 1 hour Laboratory per Week

This course will show students how to do solar site evaluations, electrical load calculations, solar system size calculations, and installation techniques. This course will help students design and install their own solar system and/or obtain skills for employment. CSU

AET – 150 Topics in Alternate Energy Technologies

0.3-4 Units, SC

May be repeated three times

Variable hours

A supplemental course in Alternate Energy Technology that provides a study of current concepts and practices in Alternate Energy Technology and related subdivisions. Specific topics will be announced in the schedule of courses. CSU

AET – 150B Photovoltaic System Design and Installation

2 Units, SC

May be repeated once

36 hours Lecture/ 18 hours Laboratory per Term

This course follows the “Introduction to Alternate Energy Systems” course. Students will learn how to do solar site evaluations, design and install solar grid-tie systems, stand-alone systems and emergency back up systems.

AET – 150C Energy Audits and Conservation Techniques

1 Unit, SC

May be repeated twice

3 hours Lecture per week

This course will introduce students to how energy audits are performed on residential, commercial and industrial locations. Based on results of energy audits, conservation techniques will be established. CSU

APPENDIX F: Cape Cod Community College

Construction Technology Certificate

Course #	Course Title	Credits	Prerequisites	Semester Offered	Semester Taken	Grade Earned
CON100	Quantitative Skills for Construction	2	MAT030 or satisfactory basic skills assessment score			
CON105	Materials of Construction	3				
CON110	Construction Technology	3		Spring		
CON120	Understanding and Working with the MA State Building Codes	3		Fall, Spring		
CON130	Computer Aided Drafting I	3		Fall		
	Construction Technology electives** (or) Environmental Science electives**(2)	6				
ENL101	English Composition I	3	Appropriate score on the Computerized Placement Test or grade of C or better in ENL050 or ESL201	every		
Total Credits:		23				

Overview: The certificate provides an introduction to the process of construction from start to finish, including the application of Massachusetts State Building Code, experience using computer assisted drafting software, and building materials and testing. Unique to this program is the integration of principles, practices, standards, and materials necessary to ensure sustainable construction which address environmental issues and renewable energy use. In addition, students have the opportunity to complete the certificate with the selection of two electives from a selection of construction, business, and environmental technology courses.

Career Outlook: Completion of the Construction Technology certificate may allow a student to move from worker/tradesman to journeyman, foreman, or superintendent; to start a new business; or to better handle a variety of other jobs in lumber yards, real estate, and banks. Students may also pursue careers as drafters or construction/building inspectors. The coursework in the Construction Technology

certificate may be helpful in obtaining the knowledge and skills necessary to pass the Massachusetts Construction Supervisors Exam.

Program Outcomes: Upon completion of the Construction Technology certificate, students will be able to:

- Apply basic construction knowledge and skills
- Integrate sustainable and renewable energy standards, methods and materials to residential and commercial building construction projects
- Demonstrate knowledge of industry standard tools for effective building practices including software, code implementation, and interpretation
- Prepare basic working drawings for building construction using computer assisted drafting with AutoCAD software
- Use basic business practices and principles for the execution of a construction project

*** Construction Technology & Environmental Science Electives:**

CON101 Blueprint Reading: Construction Trades
CON115 Construction Estimating
CON125 Architectural Drafting and Construction Drawing
CON135 Computer Aided Drafting II
CON225 Architectural Computer Aided Drafting I
BUS120 Business Law
GIT 1106 Office Accounting (or)
ACC111 Accounting I with Computer Applications
ANV122 Environmental Management and Decision Making
ENV140 Introduction to Water: Concepts and Technologies
ENV170 Renewable Energy Sources
ENV171 Energy Efficiency and Conservation Methods
ENV172 Commercial Energy Audits
ENV173 Introduction to Solar Energy

Construction Technology Course Sequence

Fall 2007 Semester

CON100 Quantitative Skills for Construction
CON105 Materials of Construction
CON110 Construction Technology
CON115 Construction Estimating
CON120 Understanding and Working with the MA State Building Codes
CON130 Computer Aided Drafting I
CON225 Architectural Computer Aided Drafting I

Spring 2008 Semester

CON100 Quantitative Skills For Construction
CON110 Construction Technology
CON115 Construction Estimating

CON120 Understanding and Working with the MA State Building Codes
CON130 Computer Aided Drafting I
CON235 Computer Aided Drafting II

For additional information, contact:

Stephanie Brady

Environmental Technology Program Coordinator

Cape Cod Community College

2240 Iyannough Rd.

West Barnstable, MA 02668-1599

Phone: 508-362-2131 ext 4468

Fax: 508-375-4166

sbrady@capecod.edu

<http://www.capecod.mass.edu/envirotech>

APPENDIX G: Columbus State Community College

Sustainable Building Certificate

Sustainable Building Certificate

COURSE

Quarter 1

EVR 282	Sustainable Building Strategies.....	3
CMGT 282	Sustainable Building Documents, Drawings & Materials.....	2
TOTAL CREDIT HOURS.....		5

Quarter 2

ARCH 283	Sustainable Architectural Design.....	3
CMGT 283	Sustainable Building Methods, Estimating & Marketing.....	2
TOTAL CREDIT HOURS.....		5
TOTAL CERTIFICATE CREDIT HOURS.....		10

ENVR 282 Sustainable Building Strategies **3 credits**

This course is an introduction to the field of environmentally-friendly construction. Sustainable architecture and building site principles will be presented, including strategies for energy-efficient heating and cooling, “green” building materials and methods, alternative energy sources, water efficiency and waste management. Topics include the need for sustainability, energy efficient design, construction and controls, site selection, passive solar heating and cooling, “green” building materials and methods, alternative energy sources and water efficiency and waste management.

Lecture: 3 hours

Lab fee: \$10.00

ARCH283 Sustainable Architectural Design 3 credits(on demand)

This course introduces the student to the issues and concepts related to the sustainable design of buildings. The impact of climate and of the building’s site on design decisions is studied. Energy efficient design, renewable forms of energy, use of sustainable and durable materials is evaluated. Students study the need to provide efficient means of recycling within the complete structure and for the reuse and adaptability of the building itself.

Lecture: 2 hours - Lab: 3 hours

Prerequisite: ENVR282 and CMGT282

Lab fee: \$10.00

ENVR 283 Ecological Residential Construction **3 credits**

(on demand)

This course addresses the important aspects of building green homes. The topics include environmentally-friendly design, the use of alternative materials, and the utilization of sustainable systems.

Lecture: 2 hours – Lab: 2 hours
Lab fee: \$10.00

CMGT 282 Sustainable Building Documents, Drawings and Materials
(on demand) 2 credits

This course is a study of sustainable building drawings and specifications, bidding procedures, and material selection as applied to new construction and existing facilities. Codes and regulations are also discussed.

Lecture: 1 hour – Lab: 3 hours
Lab Fee: \$10.00

CMGT 283 Sustainable Building Methods, Estimating and Marketing
(on demand) 2 credits

This course is the study of sustainable building methods, estimating and sales and marketing of construction management services for sustainable building as applied to new construction and existing facilities.

Lecture: 1 hour – Lab: 3 hours
Prerequisite CMGT 282 and ENVR 282
Lab fee: \$10.00

APPENDIX H: Mt. Hood College, Oregon

Mt. Hood offers a Sustainable Building Advisor Certificate Program. This nine-month program aims to assist graduates, consultants, employers to gain tools and strategies for implementing sustainable building.

A brochure can be accessed at:

<http://www.mhcc.edu/sbap/Sustainable%20Building%20brochure%20mhcc.pdf>

A sample schedule is below.

Sustainable Building Advisor Program

Unit Schedule 2007 – 2008 Fall Program

Mt Hood CC Program – Tentative Schedule

**Please note that this schedule is tentative as we schedule guest instructors and field trips*

Unit	Title	Location	Length	Dates
1	Fundamentals of Sustainable. Building & Design	Classroom	7 hours	Friday, 10/12/2007
2	Importance of Place: Site Assessment	Classroom & Field	5 hours	Saturday, 10/13/2007
2	Importance of Place: Land Use, and Transportation	Classroom	7 hours	Friday, 11/16/2007
½	"Green Buildings, Green Communities"	Field Trip	5 hours	Saturday, 11/17/2007
3	Climate Responsive Energy Design	Classroom	7 hours	Friday, 12/14/2007
3	HVAC, Domestic Hot Water::; Daylighting	Classroom	5 hours	Saturday, 12/15/2007
3	Daylighting; Electric Lighting	Classroom	7 hours	Friday, 1/18/2008
3	Green Power; Whole Building Topics	Classroom	5 hours	Saturday, 1/19/2007
4	Green Material Selection	Classroom	7 hours	Friday, 2/15/2008
5	Indoor Environmental Quality & Health	Classroom	7 hours	Saturday, 2/16/2008
3/4/5	"Healthy, Energy Efficient Buildings"	Field Trip	7 hours	Friday, 3/14/2008
5	Indoor Environmental Quality & Health	Classroom	7 hours	Saturday, 3/15/2008
6	Water Conservation & Quality Protection	Classroom	7 hours	Friday, 4/18/2008
6	"Designing with Water in Mind"	Field Trip	5 hours	Saturday,

				4/19/2008
6	Water Conservation & Quality Protection	Classroom	7 hours	Friday, 5/16/2008
7	Sustainable Job Site Operations	Classroom	5 hours	Saturday, 5/17/2008
7	"Green Job Site Practices"	Field Trip	3 hours	Evening (tbd)
8	Sustainable Operations and Maintenance	Classroom	7 hours	Friday, 6/13/2008
Final	Presentations & Graduation	Classroom	4 hours	Saturday, 6/14/2008

APPENDIX I: Los Angeles Trade Technical College Green Educational Program Priorities for 2007-2009 Academic Years

Establish academic programs, courses, content, and teaching methods:

- in disciplines at LATTC that align with the 17 most promising industries with green activity in Los Angeles County;
- in disciplines that align with the top 15 Los Angeles County industries by green technology employment;
- in disciplines that align with the 9 major green technology industries that have stable or growing job levels and pay average wages of at least \$2,500 a month;
- in disciplines that align with industries in the green technology sector with the highest output or that add the greatest value within the City of Los Angeles; and
- in new and emerging green technology industries with high growth job potential.

17 Most Promising Industries with Green Activity and LATTC Departments/Disciplines

500+ Jobs in LA City, stable or growing employment, monthly wages of \$2,500+

Industry - Utilities	LATTC Department/Discipline
Water and Sewage Systems	Supply Water Technology Waste Water Technology

Industry - Utilities	LATTC Department/Discipline
Water and Sewage Systems	Supply Water Technology Waste Water Technology
Industry - Construction	LATTC Department/Discipline
Residential Building Construction Building Equipment Contractors Building Finishing Contractors	Construction Technologies- Carpentry, Electrical, Plumbing, Refrigeration & Air Conditioning Mechanics, Welding, Gas & Electric; Electric Construction & Maintenance Motor Control, Programmable Logic Controllers

Industry – Nondurable Manufacturing	LATTC Department/Discipline
Petroleum Production Recycling Cleaning Compound Manufacturing	Chemical Technology Process Technology

Industry – Durable Manufacturing	LATTC Department/Discipline
HVAC Equipment Manufacturing Other Electrical Equipment Manufacturing	HVAC Electrical Construction & Maintenance- Motor Control, Programmable Logic Controllers

Industry – Wholesale	LATTC Department/Discipline
Miscellaneous Durable Goods Wholesale Wholesale Electronics	Electronics Computer Maintenance Technician

Industry – Professional Services	LATTC Department/Discipline
Legal Services Architecture and Engineering Computer Systems Design Scientific and Technology Consulting Scientific R&D	Business Architectural Technology Computer Information Systems Science

Industry – Waste Management	LATTC Department/Discipline
Waste Collection Remediation & Waste Management	Solid Waste

Top 15 Los Angeles County Industries by Green Technology Employment and LATTC Departments/Disciplines

Industry	LATTC Department/Discipline
Motor Vehicle Parts Wholesale	Automotive Technology
Architectural & Engineering Services	Architectural Technology Engineering
Science & Technology Consulting Services	Science
Computer Systems Services	Computer Information Systems
Plumbing & Heating Equipment Wholesale	Plumbing HVAC, Refrigeration & Air Conditioning
Instruments Manufacturing	Machine Shop – CAN Electrical Construction Electrical Construction & Maintenance- Motor Control, Programmable Logic Controllers
Structural Contractors	Construction Technology
Electronic Component Manufacturing	Electronic Machine Shop – CNC Electrical Construction & Maintenance- Motor Control, Programmable Logic Controllers

Building Equipment Manufacturing	Construction Technology Machine Shop – CNC
Motor Vehicle Parts Manufacturing	Automotive Technology Machine Shop - CNC
Motor Vehicle Parts Manufacturing	Automotive Technology Machine Shop - CNC
Animal Processing	Process Technology
Petroleum Products Manufacturing	Chemical Technology Process technology
Other Electrical Equipment Manufacturing	Electronics Electrical Construction & Maintenance- Motor Control, Programmable Logic Controllers
Machinery Manufacturing	Machine Shop - CNC
Power Train Equipment Manufacturing	Automotive Technology Machine Shop - CNC

9 Major Green Technology Industries in LA and LATTC Departments/Disciplines

Industries in LA City with stable or growing employment, monthly wages of \$2,500+, Jobs 2002

Industry	LATTC Department/Discipline
Building Equipment Contractors (11,217 jobs)	Construction Technologies – Carpentry, Electrical, Plumbing, Refrigeration & Air Conditioning Mechanics, Welding, Gas & Electric; Electrical Construction Electrical Construction & Maintenance- Motor Control, Programmable Logic Controllers
Science & Technology Consulting Services (10,419 jobs)	Science
Architectural & Engineering Services (9,565 jobs)	Architectural Technology Engineering
Computer Systems Design (8,452 jobs)	Computer Information Systems
Scientific Research and Development Services (3,775 jobs)	Science
Electrical Component Manufacturing (1,162 jobs)	Electronics Machine Shop – CNC Electrical Construction & Maintenance- Motor Control, Programmable Logic Controllers

Waste Remediation and Management (928 jobs)	Solid Waste Management
HVAC Equipment Manufacturing (608 jobs)	HVAC
Power Train Equipment Manufacturing (431 jobs)	Automotive Technology Machine Shop - CNC

**Industries in L.A. City's Green Technology Sector
With the Highest Output
and LATTC Departments/Disciplines**

Industry	Output	LATTC Department/Discipline
Single-Family Housing Construction	\$7.6 Billion	Construction Technologies - Carpentry, Electrical, Plumbing, Refrigeration & Air Conditioning Mechanics, Welding, Gas & Electric; Electrical Construction Electrical Construction & Maintenance - Motor Control, Programmable Logic Controllers
Measuring and Control Device Manufacturing	\$7.3 Billion	Electrical Construction Electrical Construction & Maintenance - Motor Control, Programmable Logic Controllers
Engineering Services and Testing Labs	\$5.4 Billion	Engineering Chemical Technology
Environmental Consulting Services	\$3.7 Billion	All green programs
Trans and Power Train Parts Manufacturing	\$2.9 Billion	Automotive Technology Machine Shop – CNC

**Industries in L.A. City's Green Technology Sector
That Add the Greatest Value
and LATTC Departments/Disciplines**

Industry	Value	LATTC Department/Discipline
Engineering Services and Testing Labs	\$4.0 Billion	Engineering Chemical Technology
Measuring and Control Device Manufacturing	\$3.4 Billion	Electrical Construction Electrical Construction & Maintenance

		- Motor Control, Programmable Logic Controllers
Single-Family Housing Construction	\$3.3 Billion	Construction Technologies - Carpentry, Electrical, Plumbing, Refrigeration & Air Conditioning Mechanics, Welding, Gas & Electric; Electrical Construction Electrical Construction & Maintenance - Motor Control, Programmable Logic Controllers
Environmental Consulting Services	\$2.8 Billion	All green programs
Research and Development in the Physical, Engineering and Biological Sciences	\$1.5 Billion	Engineering Biology Sciences

Sources:

Economic Roundtable research; U.S. Department of Commerce. "County Business Patterns 2002: California". Washington, DC: U.S. Government Printing office.
 Rosner, Sigalle. "Job Implications of Los Angeles' Green Building Industry." Masters Client Project for UCLA. June 2006.
www.ladwp.com

APPENDIX J: Associations/Resources

Apollo Alliance - www.apolloalliance.org

Carla Din
Western Regional Field Director
6114 La Salle Ave., #350
Oakland, CA 94611
ph: (510) 336-3311

Apollo Alliance is a national coalition for "good jobs and clean energy".

Build It Green – www.builditgreen.org

1436 University Ave
Berkeley, CA 94702
Phone: 510.845.0472 ext.2

Build It Green is a professional non-profit membership organization whose mission is to promote healthy, energy and resource-efficient buildings in California.

California Association of Building Energy Consultants (CABEC) - (www.CABEC.org)

9974 Scripps Ranch Blvd., Ste. #130
San Diego, CA 92131
Tel: 1-877-530-3045

CABEC is a non-profit organization that fosters professional development and ethics in the field of energy compliance through sponsorship of educational programs for industry professionals on building energy efficiency. Certification is being developed for a certified energy analyst.

California Solar Energy Industries Association (CAL SEIA) -<http://calseia.org>

California Solar Energy Industries Association supports the widespread adoption of solar thermal and photovoltaic systems by educating consumers, supporting solar legislation and conducting business in a professional and ethical manner.

California Integrated Waste Management Board (CIWMB)

1001 I Street
P.O. Box 2815
Sacramento, CA
95812-2815
(916) 341-6489
www.ciwmb.ca.gov/greenbuilding.

The CIWMB is California's Green Building and Design website that provides resources and information on green building.

Four Energy- <http://fourenergy.net>

Four Initiatives of the California Community College Economic and Workforce Development Program are working to identify emerging energy technologies and workforce skills.

Global Green USA - www.globalgreen.org

2218 Main Street, 2nd Floor
Santa Monica, CA 90405
(310) 581-2700

Global Green USA is a national environmental organization with a vision to address and solve pressing environmental challenges.

The North American Board of Certified Energy Practitioners (NABCEP)

Saratoga Technology + Energy Park
10 Hermes Road, Suite 400
Malta, NY 12020
518.899.8186
<http://www.nabcep.org/about.cfm>

NABCEP is a volunteer board of renewable energy stakeholder representatives whose mission is to support and work with the renewable energy and energy efficiency industries, professionals, and stakeholders to develop and implement quality credentialing and certification programs for practitioners.

The Partnership for Environmental Technology Education (PETE)

584 Main Street
South Portland, ME 04106
Kirk Laflin
Ph.: 207-767-2539
www.ateec.org/pete

PETE's mission is to provide leadership in environmental education and training through community and technical college partnerships with business, industry, government, and other educational providers.

USGBC - <http://www.usgbc.org/>

US Green Building Council Los Angeles Chapter - <http://www.usgbc-la.org/>
315 W. 9th Street, Room 312
Los Angeles, CA 90015
(213) 689-9707

The U.S. Green Building Council (USGBC) is a non-profit composed of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. Information on LEED can be accessed at this site.