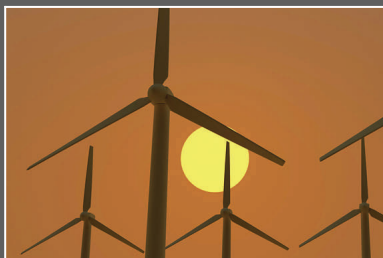


# Research Preview, 2009

## Green Industries & Jobs in California



Centers of Excellence  
Economic and Workforce Development  
California Community Colleges

The Centers of Excellence, in partnership with business and industry, deliver regional workforce research customized for community college program decision making and resource development.

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### Inside:

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Defining the Green Economy  
Green Occupations  
Education and Training





**Mission:** The Centers of Excellence, in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development.

**Vision:** We aspire to be the premier source of regional economic and workforce information and insight for community colleges.

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Centers of Excellence, Economic and Workforce Development Program

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# GREEN INDUSTRIES & JOBS IN CALIFORNIA

## A SPECIAL PREVIEW REPORT

January/2009



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Inform Connect Advance



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

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In 2008, the Centers of Excellence (COE) of the California Community Colleges Economic and Workforce Development Program launched a study of the green economy and green jobs in the state. Considering the emerging character of this field of study and the absence of one commonly accepted definition of the green economy and what industries it comprises, the COE decided to focus the first phase of the study on identifying green and clean tech industries. After establishing a set of criteria, the COE matched green industries with occupations and occupational groups that could provide new and/or evolving career opportunities. In addition, the COE compiled a list of community college programs currently in place to train for these occupations. The efforts resulted in a comprehensive crosswalk between green clusters, industries, occupations, and college programs. Although work on the crosswalk is ongoing, this Preview will provide its shortened draft version. The second phase of the green economy study is scheduled to begin in March 2009. It will focus on surveying employers to collect comprehensive quantitative and qualitative data on green industries and occupations as identified in the crosswalk.

This Preview features a snapshot of key ideas and findings regarding California's green economy, career opportunities, and training gaps, as identified by the COE team. The purpose of this report is not to list every "green" job opportunity, but rather to point out and describe a few significant occupations that may warrant special attention from community colleges in California.

Multiple information sources were used to produce this Preview, including several published and in-progress research scans by the COE, as well as publications from other agencies. As this report uses preliminary data and information, most of which still needs to be verified and validated, findings presented here should be treated as rough approximations or estimates.

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- EWD Centers of Excellence Initiative: Elaine Gaertner, John Carrese, Kevin Fleming, Lisa Lewenberg, Michelle Marquez, Philip Jordan, Sharon Dwyer, Theresa Milan, Jennifer Oliver, and Laura Coleman.
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## DEFINITIONS

There have been numerous studies published on the subject of defining the green economy and green jobs. However, the common definition is yet to be found. Existing definitions vary widely, primarily due to the differences in the purpose and scope of these studies. The context of COE research dictated the necessity to look at emerging, changing, and rapidly growing industries, as well as occupations that are completely new (emerging) and/or require new knowledge, skills and abilities (KSA). Keeping this perspective in mind, the following definitions were developed:

A **Green Firm** is an organization that provides products and/or services that are aimed at utilizing resources more efficiently, providing renewable sources of energy, lowering greenhouse gas emissions, or otherwise minimizing environmental impact.

A **Green Job** is an occupation that 1) directly works with policies, information, materials, and/or technologies that contribute to minimizing environmental impact, and 2) requires specialized knowledge, skills, training, or experience in these areas.

## GREEN INDUSTRIES CROSSWALK

Under the guidance of these working definitions, we have identified six major sectors/areas of the green economy. Each of the sectors represents a value chain of activities (R&D, Manufacturing, Distribution, Installation, Maintenance & Repair), which are clustered around a similar “green” technology and/or purpose. This approach allowed us to cover each aspect of a “green” technology value chain, and thus look at a full picture of potential employment opportunities in a cluster of green industries. The following sectors were identified:

**Renewable Energy: Energy Generation, System Installation & Storage** group includes activities that are aimed at developing, introducing and installing the technologies, which harness, generate, store, and distribute renewable sources of energy. This cluster includes major renewable energy industries, such as solar power, wind power, and geothermal.<sup>1</sup>

**Green Building and Energy Efficiency** is a category comprised of industries that are clustered around the purpose of making new and existing buildings resource efficient and friendly to the environment. Energy Efficiency, as well as being part of Green Building, also includes private and public agencies responsible for energy planning and management. Industries within this sector range from manufacturing of more efficient products and systems, construction of new “greener” buildings and retrofitting of existing ones, as well as installation and repair of energy efficient equipment.

**Biofuels Production & Farming** is an area associated with producing alternative fuels and/or energy from biological products and waste, as well as incorporating environmentally friendly practices and principles in the overall farming process.

**Transportation & Alternative Fuels** group focuses on developing the technology, manufacturing and servicing vehicles that run on alternative fuels, and “greening” transportation infrastructure and logistics processes.

**Water, Wastewater & Waste Management** area includes the development and operation of systems, connected with treatment and conservation of water, recycling of wastewater, and solid waste management.

**Environmental Compliance & Sustainability Planning** contains establishments and governmental agencies that plan, establish, execute and control environmental quality standards, usually in regards to air, water,

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<sup>1</sup> Biofuels is separated from the *Renewable Energy* cluster to highlight the relationship among agriculture, farming, and biofuels production. Most biofuels are produced from corn, sugarcane, and palm oil crops, which generate harmful greenhouse emissions and threaten biodiversity. Therefore, it is important to consider environmentally friendly agricultural and farming practices, as well as alternative methods to producing biofuels (such as the use of waste or forest bi-products).

land, and other environmental resources. These agencies also play a significant role in guiding and shaping the developments of the other five clusters.

The table below contains a list of green industries and industry clusters included into each green economy area or sector.

*Table 1 – Classification of Green Industries*

Green Economy Area/Sector	Green Industries and Industry Clusters
I. Renewable Energy: Energy Generation, System Installation & Storage	<ul style="list-style-type: none"> <li>• Solar power (thermal &amp; photovoltaic systems)</li> <li>• Wind power</li> <li>• Water &amp; hydro-electric power</li> <li>• Geothermal power</li> <li>• Hydrogen</li> <li>• Energy storage</li> <li>• Energy transmission/ distribution</li> <li>• Energy services (ESCO)</li> <li>• Utility-scale renewable energy plants</li> </ul>
II. Green Building and Energy Efficiency	<ul style="list-style-type: none"> <li>• Green product manufacturing (Lighting; Construction materials; “Smart” systems and equipment; HVAC/R equipment)</li> <li>• Green construction materials wholesaling</li> <li>• Energy Services (ESCO)</li> <li>• Design and construction of new buildings</li> <li>• Retrofitting of existing structures</li> <li>• Retro-commissioning of existing buildings</li> <li>• Green building operations and maintenance</li> <li>• Deconstruction</li> <li>• Certifications (LEED)</li> <li>• Green landscaping</li> </ul>
III. Biofuels Production & Farming	<ul style="list-style-type: none"> <li>• Biofuels production</li> <li>• Organic farming practices</li> <li>• Biomethane production (Energy from animal waste; Energy from landfills)</li> <li>• Sustainable fisheries</li> </ul>
IV. Transportation & Alternative Fuels	<ul style="list-style-type: none"> <li>• Transportation technology (hydrogen electrical, biofuels, hybrid systems)</li> <li>• Fuel efficient vehicle manufacturing</li> <li>• Repair &amp; maintenance of alternative fuel vehicles: individual, mass transit, and trucking (hybrid/electrical; hydrogen/fuel cells; biofuels; natural gas, LNG &amp; CNG)</li> <li>• Logistics</li> <li>• Green infrastructure (ports, airports, etc.)</li> </ul>
V. Water, Wastewater & Waste Management	<ul style="list-style-type: none"> <li>• Water shed conservation and management</li> <li>• Water treatment</li> <li>• Harvesting rainwater and recycling gray water</li> <li>• Wastewater treatment &amp; management</li> <li>• Solid waste management/recycling</li> <li>• Hazardous waste management/recycling</li> </ul>
VI. Environmental Compliance & Sustainability Planning	<ul style="list-style-type: none"> <li>• Air quality</li> <li>• Conservation and pollution prevention</li> <li>• Pollution prevention, rule development and enforcement</li> <li>• Cleanup/safety</li> <li>• Emissions control</li> <li>• Monitoring and compliance</li> <li>• Transportation systems</li> </ul>

The Centers of Excellence are currently in the process of building a comprehensive crosswalk between the above listed green industry clusters and more traditional industries (as defined and coded by North American Industries Classification System), emerging and traditional occupations, and community college programs in California. This crosswalk is expected to be completed and made available by April 2009.

## TOP JOBS/OCCUPATIONS

According to the completed research and currently available information within the six green economy sectors (see Table 1), the following emerging and changing occupations and occupational groups will present high-growth employment opportunities and will require community college support and/or training throughout California:

- |   |                                    |
|---|------------------------------------|
| • Solar System Installers (primarily in Photovoltaics)      | Renewable Energy                   |
| • Wind Turbine Technicians                                  | Renewable Energy                   |
| • Energy Efficiency cluster of occupations                  | Green Building & Energy Efficiency |
| • Green Engineering cluster of occupations                  | Green Building & Energy Efficiency |
| • Cost Estimators for Green Building/ Retrofitting Projects | Green Building & Energy Efficiency |
| • Ethanol and Biodiesel Production Technician               | Biofuels & Farming                 |
| • Alternative Fuel Automotive Technicians                   | Transportation & Alternative Fuels |

Conducting primary and secondary research studies in the above areas, in addition to partnering with industry association groups and representatives, enabled the compilation of information relevant to these occupations and occupational groups. The quantitative statewide data from primary research are not equally available for all of them. Some occupational information was pulled from executive interviews and secondary sources, including Economic Modeling Specialists, Inc. and California's Labor Market Information Division. Details on these green occupations are presented in the sections that follow.

## SOLAR SYSTEM INSTALLER/TECHNICIAN

### Factors Influencing the Industry

1) On a federal level, the Obama Administration has committed to a renewable energy generation stimulus package. In particular, federal incentives for solar energy generation systems are expected in 2009.

2) On a state level, the AB32 Global Warming Solutions Act was extended in 2008. It aims to reduce greenhouse gas emissions by 25% in California by 2020. To get there, utilities are required to enlarge their share of renewable sources in the energy portfolio.<sup>2</sup>

3) On a local level, a number of incentives are currently available through municipalities and are expected to continue.

### Employment & Earnings Potential

The most new jobs are expected to be created for **solar photovoltaic (PV) system installers**. According to the COE statewide solar survey conducted in 2008, there were about 3,300 PV installers in California. The industry was projected to add 64% PV installer jobs in the following year, resulting in about 2,400 new jobs. According to solar companies in California, median annual earnings for solar PV installers ranged from \$31,200 to \$52,000, depending on training and experience.

In terms of projected job growth, solar PV installers were followed by solar sales representatives or estimators (1,200 new jobs). Thermal installers were expected to gain 600 jobs, while solar systems designers or engineers and installation managers or foremen were projected to increase by 500 jobs

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<sup>2</sup> Education and workforce development implications of AB32 are addressed in the Air Resources Board's proposed scoping plan, revised in 2008, under section IV: Implementation (pages 101-104).

each. The highest median wages statewide were reported for solar designers or engineers (\$50,000/entry-level; \$83,200/experienced) and solar installation managers or project foremen (\$50,000/entry-level; \$72,800/experienced), with the highest wages offered in the Bay Region.

### New Skills and Competencies Required

Solar PV system installers are considered a new, emerging occupation, since it requires a new skill set associated with the technology to be installed, especially as photovoltaic technology is rapidly changing to deliver better efficiency characteristics. However, traditional construction workers, such as roofers and electricians, can perform the work after receiving the necessary short-term training. Solar thermal system installers need skills and competencies in thermal technology, an older technology, and although advancing, it doesn't require completely new training. Traditionally, plumbers and HVAC technicians make good solar thermal installers, provided that they receive training and/or experience in working with the technology.

In order of priority, solar employers in California consider the following skills and knowledge the most important for new hires:

- (1) General construction experience (82.1%)
- (2) Ability to work on a roof (67.5%)
- (3) **General understanding of the mechanics and engineering of solar power (60.4%)**
- (4) Customer service skills (55.2%)

While the first two skills are traditional for construction workers, understanding of mechanics and engineering of solar energy systems requires additional training.

### Current Training Provided & Training Gap

Colleges currently provide anything from non-credit training to certificate programs in PV and other solar systems. Current and planned solar training programs are known for about 20 community colleges, with only 5 of these in Southern California. Here are some examples of community college course titles:

- PV Solar Design and Installation course
- PV Installation Certificate
- Environmental Sustainability Certificate
- Solar Energy Technician Certificate

Based on the data collected by the COE Directors, community colleges in California are estimated to train about 1,100-1,200 solar PV system installers this year.<sup>3</sup> Using the occupational projections established in the 2008 COE solar study, **the estimated gap in supply-demand could be as high as 1,300 trained workers annually.**

### Community College Response

Based on the COE research findings, community colleges are recommended to:

- Address the absence of available courses to prepare the following occupations: solar cost estimator, solar designer/engineer, and solar installation manager/project foreman.
- Develop curriculum and training programs that are aligned with industry standards.
- Explore the potential to find instructors from industry and labor unions, as half of the colleges surveyed report difficulty in finding instructors.
- Deliver customized training to employers through contract education.

For more information, access the COE reports on the solar industry online at [www.coecc.net/solar](http://www.coecc.net/solar).

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<sup>3</sup> This range was calculated based on the available numbers for 8 colleges in California. These numbers were then extrapolated to represent all colleges, for which solar training programs were known.

## WIND TURBINE TECHNICIAN<sup>4</sup>

### Factors Influencing the Industry

On a federal level: 1) The US Department of Energy has advocated that 20% of the nation's electricity be derived from wind by 2030. Currently the output for wind energy is 1.8% of the country's total. 2) So far this decade, cumulative **wind power capacity has grown an average of 27% per year** in the United States with no sign of slowing. 3) Nationally, the extension of the wind production tax credit (PTC) has accelerated plans for wind farm construction and small (residential) turbine sales. 4) New, innovative wind turbine designs are increasing the wind industry's efficiency in capturing wind and creating energy. 5) **There are over 25,000 wind turbines in the United States and less than 15 educational institutions in the nation training technicians.**

On a state level: 1) Out of 50 states, California is second only to Texas in wind turbine capacity. Consequently, there are many turbines throughout the state that need to be maintained on a regular basis. 2) California aims to derive 20% of its power from solar, wind and other renewable sources by 2010. Currently, the state receives 2.6% of energy from wind. 3) The largest barrier to the wind industry's growth in California is that the transmission system is in need of an upgrade. In a few years, when the transmission upgrades are expected to be completed in the Tehachapi Mountains (at an estimated cost of \$1.8 billion), California's wind capacity will more than double.

### Employment & Earnings Potential

- There are approximately 40 to 140 jobs needed during construction per 100 megawatt. California currently has 1,342 MW in various stages of wind farm development. Estimated additional jobs: 520-1,820.
- Once operational, 6 to 10 permanent operations and maintenance (O&M) jobs are needed per 100 MW. California's wind farms currently have the capacity for 2,439 MW (with the 1,342 in development, a combined total of 3,781 MW). This will require 228 to 380 full-time turbine technicians in California. The average turnover for a technician is just 3 years, as they get promoted or transition into other jobs. After the Tehachapi transmission upgrades are complete, **the demand for technicians could double to as many as 456 to 760 technicians, with an additional 150-250 in annual replacements needed.**<sup>5</sup>
- In a recent survey conducted by the American Wind Energy Association (AWEA), 91% of companies anticipate **growth of over 25%** in the next 2 years (24% anticipate growth over 50%). This will result in approximately 115-190 new openings for O&M technicians a year.
- Presently, some of California's wind farm construction and turbine maintenance is outsourced to out-of-state companies.
- Wind technicians earn **\$14 - \$24 per hour as a starting wage**. Experienced technicians, those traveling with overtime, and most supervisors can earn more than \$120,000 annually.

### New Skills and Competencies Required

#### Traditional Skills:

Good physical condition for ladder climbing and occasional heavy lifting; meteorology; basic math; ability to work comfortably at heights up to 350 feet, safety certification, experience using hand and power tools, electrical, basic engineering skills; mechanical, hydraulic, and electrical maintenance repair and troubleshooting experience.

#### New Skills:

Understanding advances in technologies and turbine designs, computer software and computer diagnostic systems, testing equipment, and schematics.

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<sup>4</sup> Sources used: US Department of Energy; Wind Farm Data: Industrial Information Resources; The San Jose Mercury News. American Wind Energy Association, Lawrence Berkeley National Laboratory, and The Wall Street Journal.

<sup>5</sup> Calculated in a different way, approximately 1 Wind Turbine Technician is needed per 20 turbines and there are over 25,000 turbines in the United States. Thus, approximately 1,250 technicians are needed in the U.S. at all times. Existing supply is unknown, but according to AWEA, it is substantially less.



### Current Training Provided & Training Gap

The ATTEi, in partnership with industry, created a 208-hour training curriculum to increase the pipeline of Wind technicians. So far about 50 faculty members have been trained throughout the state to teach the curriculum. Cerro Coso Community College currently offers an Energy Technology Certificate with an emphasis in Wind, and an Industrial Technology AS degree (with an emphasis in wind energy). Cerro Coso, Shasta College, and College of the Desert currently offer the 208 hour curriculum through contract education units.

### Community College Response

General recommendations to the colleges are the following:

- Add a wind technology class to existing automotive, pre-engineering, industrial and technological science programs.
- Offer the ATTEi training program through contract education units.

### Economic Impact

Every \$1 billion investment in wind farms creates some 3,350 jobs – nearly four times the 870 jobs created with a similar investment in coal-fired power plants.<sup>6</sup>

The Centers of Excellence are currently partnering with AWEA to survey wind employers on their employment needs and produce an industry scan on wind energy in California. The full report is expected in late May 2009.

## ENERGY EFFICIENCY OCCUPATIONS<sup>7</sup>

### Factors Influencing the Industry

On a federal level: 1) Energy Efficiency is increasingly being viewed by producers and consumers of energy as the "first fuel" in the race for secure and clean energy sources. 2) Recently, a combination of environmental, economic and political forces, in concert with technological advances, has put energy efficiency efforts front and center. 3) As new, more advanced energy efficiency technologies are transferred from research labs to the marketplace, manufacturing jobs will also be created to produce these new products. Trained technicians will be needed to install and monitor these new devices in buildings, homes and industrial settings. 4) The Obama Administration supports an economic stimulus package that will include energy efficiency investments as a significant strategy. In addition, President Obama has pledged to invest \$150 billion over the next 10 years to advance Energy Efficiency and Renewable Energy efforts that, if implemented, will create an estimated 5 million new jobs. 5) The U.S. has less than 5% percent of the world's population but consumes 30% of the world's fossil fuels each year. Given the rising cost of energy and current energy shortages, energy conservation and efficiency have become a vital part of the energy industry. 6) According to the U.S. Green Building Council, buildings in the United States account for 36% of total energy use and 30% of greenhouse gas emissions.

On a state level: 1) California is leading the way on greener building codes, appliance standards, energy efficiency resource standards, and other key policies that drive energy efficiency investment. The state's efforts to reduce greenhouse gas emissions (CA Assembly Bill 32) and business and industry's need to manage rising energy costs has spurred investment in energy efficiency and clean technologies. 2) California is ranked by the American Council for an Energy-Efficient Economy (ACEEE) as the top state in the U.S. (tied with Vermont and Connecticut) on energy efficiency policies and programs. 3) Increasingly, new construction projects and retro-commissioning projects of existing buildings will occur under tougher Leadership in Energy and Environmental Design (LEED) standards. This will create an increased demand for skilled energy efficiency technicians who can install the equipment and energy systems required under

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<sup>6</sup> See data at [http://www.earthpolicy.org/Updates/2008/Update80\\_data.htm](http://www.earthpolicy.org/Updates/2008/Update80_data.htm)

<sup>7</sup> Sources used: Energy Efficiency, Innovation & Job Creation in California, (Roland-Holst, 2008); Energy Efficiency Occupations, Strategic Possibility Report (Carrese, 2007); ATEEC and PETE Publication: Energy Services and Technology Program, 2000, 2008; San Francisco Chronicle; and Lawrence Berkeley National Laboratory.

these new building codes. Technicians will install more energy efficient heating, ventilation and air conditioning (HVAC), lighting, water heating, building envelope, and mechanical systems. 4) State and city building sector policies that regulate the lighting and HVAC systems in commercial, government and residential buildings, as well as appliances used within those buildings, will have a major impact on the growth of energy efficiency occupations. 5) In the Bay Area, more and more cities, including San Jose and Oakland; and counties, including Alameda and San Mateo, now require that new public structures be built to standards established by the U.S. Green Building Council. 6) Because energy that is not used does not have to be produced, making energy conservation and efficiency a priority has worked in California. The state's per capita energy consumption over the past 30 years has remained relatively flat when compared to U.S. per capita energy consumption, which has increased by 50% over the same period.

### Employment & Earnings Potential

- Energy efficiency measures have enabled California households to redirect their expenditures toward other goods and services, creating about 1.5 million full-time jobs with a total payroll of \$45 billion, driven by well-documented household energy savings of \$56 billion from 1972-2006.
- As a result of energy efficiency, California reduced its energy import dependence and directed a greater percentage of its consumption to in-state, employment-intensive goods and services, whose supply chains also largely reside within the state, creating a “multiplier” effect of job generation.
- The same efficiency measures resulted in slower (but still positive) growth in energy supply chains, including oil, gas, and electric power. For every new job eliminated in these sectors, however, more than 50 new jobs have been created across the state's diverse economy.
- Major utilities such as Pacific Gas and Electric (PG&E) invest heavily in energy efficiency programs. Between 2006 and 2008, PG&E invested nearly \$1 billion in energy efficiency programs for residential, commercial and industrial customers. As a result of PG&E's investment in energy efficiency, the utility avoided the need for more than 600 megawatts of new generation – roughly the electricity production capacity of a large power plant. Rebates for installing energy-efficient technologies, “tuning” services for commercial and industrial facilities, and incentives for customized energy-efficiency projects and new construction are just some of the programs the utility offers. However, **PG&E will need to replace thousands of workers soon because 68% of their 20,000 employees are baby boomers and 43% of these are retirement eligible over the next five years.** There are currently not enough skilled workers to fill these jobs. The company will also need to sub-contract energy efficiency work to energy firms that can help customers reduce their energy use through better management and conservation strategies.
- Wages are good or excellent in this industry and track along the wages of construction trades workers and technician level jobs in the range of **\$22-\$30 per hour.**
- Through interviews and primary research, the Bay Area Centers of Excellence have identified eight occupations within Energy Efficiency that are expected to experience growth and change in skill sets. These occupations are listed here (definitions are available in Appendix A):
  - Energy auditor or home energy rater
  - Building performance or retro-fitting specialist
  - Compliance analyst or energy regulation specialist
  - Project manager for construction or design work
  - HVAC mechanics, technicians or installers
  - Resource conservation or energy efficiency manager
  - Building controls systems technician
  - Building operator or Building Engineer

## **New Skills and Competencies Required**

Some of the core skills that employers have indicated they need are:

- Basic skills in math, writing, communication, and analysis
- Skilled in computers and networks
- Technical skills in energy technology and energy systems
- Concerned about the environment and their community
- Ability to communicate technically and plainly with customers
- Ability to be flexible and adapt to change

However, depending on the occupation and industry of energy efficiency cluster, these skills vary. Appendix B shows specific skills that the Bay Area Centers of Excellence identified for the different segments of the energy efficiency industry. These skills are included in an employer survey currently being conducted around the state to collect information on what skills energy efficiency businesses consider the most important.

## **Current Training Provided & Training Gap**

The following college programs are known to have energy efficiency component:

- De Anza College has a program in Energy Management and Climate Policy. The Kirsch Center at De Anza provides energy management and renewable energy courses and certificates.
- Merritt College has a program in Environmental Design and Energy Technology.
- San Jose City College has several programs related to energy efficiency: Facilities Maintenance; Energy Conservation; Green Construction.
- Laney College has a program in Environmental Controls Technology/Commercial HVAC.
- Cabrillo College has Associate Degree and Certificate programs in Construction and Energy Management. Electives related to energy efficiency are offered in these programs.
- College of the Sequoias offers Environmental Control Technology (HVAC) program.

## **Community College Response**

The colleges are recommended to:

- Review and consider adopting the model curriculum developed by the Advanced Technology Environmental Education Center (ATEEC) and the Partnership for Environmental Technology Education (PETE). These courses teach students how to optimize the use of energy resources.
- Integrate elements of the ATEEC/PETE curriculum into existing vocational/technical programs related to the energy field such as heating, ventilation, and air conditioning; facilities maintenance; construction; architecture; and environmental science/technology.
- Offer courses and/or certificate programs that would provide the prerequisite knowledge students need prior to enrolling in industry certification programs. Certifications such as the Certified Energy Plan Examiner (CEPE) or Certified Energy Analyst (CEA) offered through the California Association of Building Energy Consultants (CABEC) are examples of these industry certifications.

The analysis of employer survey results on the energy efficiency workforce should be available in late February 2009 for the Bay Region and in April-May 2009 for the remaining regions.

## GREEN ENGINEERING OCCUPATIONS<sup>8</sup>

### Factors Influencing the Industry

The following legislature will drive the efforts in developing and manufacturing products that are more energy efficient and earth-friendly:

- Executive Order #S-3-05 calls for a 30% reduction below business as usual by 2020
- Global Warming Solutions Act AB32
- CA Air Resources Board (ARB) Scoping Plan
- CPUC Long Term Efficiency Plan
- HR 6 Energy Bill signed December 2008 by former President Bush appropriating \$125 million for workforce training in renewable energy industries
- AB 2021 – created to overcome market barriers
- SB 1760 (in-state green technology)
- SB 1672 (\$3 billion bonds for new jobs)
- AB2477 CA Green Jobs Act 2008

### Employment & Earnings Potential

With the expansion of the green movement, engineers at all levels will be impacted:

**Chemical Engineers** (biofuels industry)

**Civil Engineers** (Mass Transit, Green building, irrigation/reservoir, Waste Management industries)

**Conservation, Biological, Agricultural Engineers**

**Electrical Engineers** (Smart Grid, Solar/PV, Wind, Biomass Energy Technicians)

**Environmental Engineers** (Pollution Control, Ecological, Air Quality)

**Mechanical Engineers** (Alternative Fuels and Transportation)

Engineering technician positions associated with the above engineering jobs will be affected by the green movement as well. Both groups are expected to add jobs in the next several years. The most employment growth is projected among environmental engineers at **13.8% over the next five years**. Overall demand for engineering technicians in all specialties is projected to grow by 4.1%, resulting in approximately 2,430 new jobs.

Table 2 – Engineering Occupations: Five-year Employment Projection<sup>9</sup>

SOC Code	Description	2008 Jobs	2013 Jobs	New Jobs	% Change	2007 Hourly Earnings
17-3020	Engineering technicians	59,638	62,076	2,438	4.1%	\$26.84
17-2070	Electrical and electronics engineers	48,085	48,965	880	1.8%	\$45.39
17-2050	Civil engineers	37,396	40,868	3,472	9.3%	\$38.95
17-2190	Engineers, all other	32,536	33,898	1,362	4.2%	\$44.85
17-2140	Mechanical engineers	22,569	23,469	900	4.0%	\$40.10
17-2080	Environmental engineers	4,815	5,478	663	13.8%	\$38.80
17-2040	Chemical engineers	1,461	1,588	127	8.7%	\$41.54
17-2020	Agricultural engineers	285	309	24	8.4%	\$38.80
<b>TOTAL</b>		<b>206,785</b>	<b>216,651</b>	<b>9,866</b>	<b>4.8%</b>	<b>\$38.11</b>

<sup>8</sup> Sources used: Next 10: Energy Efficiency, Innovation and Job Creation, Green Jobs Guidebook, Cassio Green Careers Resource Guide, Yahoo Hot Jobs, US Bureau of Labor Statistics.

<sup>9</sup> Source: EMSI Covered Employment - Fall 2008

Generally, engineering occupations offer good wages. The median salary for an experienced Environmental engineer is \$61,000. For Mechanical engineers, earnings range from \$65,000 to \$120,000.

### New Skills and Competencies Required

Environmental engineers work behind the scenes and are well-versed in biology and chemistry to develop solutions to environmental problems (global warming, car emissions, acid rain). However, focus is expected to shift from controlling existing problems to preventing problems. Therefore, these engineers will need new knowledge and skills in prevention of environmental problems.

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

### Current Training Provided & Training Gap

Currently, 60 colleges offer programs in Engineering Technology and Pre-Engineering. Most of these programs are transfer-oriented. They offer an Associate Degree or Certificate in Engineering Technology. In 2007-2008, there were approximately 224 degrees awarded (this includes General Engineering, Mechanical Technology, and Chemical Technology). Technical institutes and vocational schools also offer engineering, and, according to COE secondary research, they are graduating more students than community colleges.

Employers generally require a bachelor's degree for engineers. However, engineering technicians will be hired if they possess an associate degree or a related college certificate. With 224 degrees awarded by community colleges last year, and an estimated 487 engineering technicians needed in California, there is a gap of more than 250 graduates to meet industry demand. Considering that at least two-thirds of all community college engineering graduates will transfer to a four-year college and only one-third will immediately enter the workforce, **the gap between demand and supply will be even larger, perhaps as high as 420** (calculated as a difference between 487 in demand and 74 in supply).

### Community College Response

Recommendations to colleges include:

- Strengthening relationships and agreements with four-year engineering programs at local universities, and strengthening partnerships with high schools and middle schools to develop pipelines.
- Possibly offering courses that assist graduates in their preparation for the licensing exam as there is a high fail rate in California. This would most likely be accomplished through contract or continuing education units in colleges.
- Adding courses to engineering technology programs that are more driven toward preparing environmental engineering technicians.

## COST ESTIMATORS FOR GREEN BUILDING/RETROFITTING PROJECTS<sup>10</sup>

### Factors Influencing the Industry

Green building, or green construction, 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 workforce impact will not only be felt in the construction industry, but also among those firms that are involved in green design (i.e. architects and planners), as well as firms that develop and produce green building materials.

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<sup>10</sup> Sources used: Environmental Scan Report, LA County: Green Building, Center of Excellence, Los Angeles Community College District, 2007; Green Economy Workforce Study: Central Valley Region, Center of Excellence, Central Region, 2008; Economic Modeling Specialists, Inc (EMSI).

Green Building ratings, particularly the Leadership in Energy and Environmental Design (LEED) rating system implemented by the United States Green Building Council (USGBC), play an important role in both providing a gold standard for builders to aim for, as well as certifying that a building or facility is as “green” as it says it is. 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. The number of green buildings in California has been experiencing double-digit growth. As of December 2008, 27 cities in California have enacted mandatory Green Building Ordinances, including such large cities as Los Angeles, San Francisco, Long Beach, etc.<sup>11</sup> This will spur further activity in green building and retrofitting projects, and, therefore, the need for a workforce qualified to do them.

Appendix C features a list of legislation that is or will be affecting green building movement in California.

### Employment & Earnings Potential

Cost estimators are one of the occupation groups that are critical for green building projects. They need to know not only the principles of estimating costs for construction projects, but also the specificity of green building, the rating systems, the use of appropriate materials and products, etc.

According to available labor market data, demand for cost estimators in general is reasonably strong and 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. Thus, there will be about 3,400 new job openings for cost estimators in the next five years in California (see Table 3).

Table 3 – Cost Estimators: Five-year Employment Projection<sup>12</sup>

SOC Code	Description	2008 Jobs	2013 Jobs	New Jobs	% Change	2007 Average Hourly Earnings
13-1051	Cost Estimators	25,325	28,713	3,388	13%	\$30.92

Median salary for cost estimators in California is \$29.45 an hour or \$61,300 annually.

### New Skills and Competencies Required

Traditional tasks include:

- Consult with clients, vendors, personnel in other departments or construction foremen to discuss and formulate estimates and resolve issues.
- Analyze blueprints and other documentation to prepare time, cost, materials, and labor estimates.
- Prepare estimates for use in selecting vendors or subcontractors.
- Confer with engineers, architects, owners, contractors and subcontractors on changes and adjustments to cost estimates.
- Prepare estimates used by management for purposes such as planning, organizing, and scheduling work.
- Prepare cost and expenditure statements and other necessary documentation at regular intervals for the duration of the project.
- Assess cost effectiveness of products, projects or services, tracking actual costs relative to bids as the project develops.
- Set up cost monitoring and reporting systems and procedures.
- Conduct special studies to develop and establish standard hour and related cost data or to effect cost reduction.

<sup>11</sup> [http://ag.ca.gov/globalwarming/pdf/green\\_building.pdf](http://ag.ca.gov/globalwarming/pdf/green_building.pdf)

<sup>12</sup> Source: EMSI Covered Employment - Fall 2008

- Review material and labor requirements to decide whether it is more cost-effective to produce or purchase components.

In the construction industry, and especially green building, cost estimators must have a comprehensive understanding of how the design process is implemented, including what “green” building materials will work for a given design and how they should be priced. **Because green construction requires different designs and uses different building materials, cost estimators are significantly impacted by green construction.** A common perception is that green construction facilities are generally estimated to cost more than traditional construction facilities. Cost estimators unfamiliarity with green construction processes and materials may result in overestimating costs, rather than underestimating. Therefore, a well-trained cost estimator is crucial for green building projects.

### Current Training Provided & Training Gap

Currently, within the California Community College system, there are no degree programs specifically for cost estimators. Related instructional programs for this occupation include:

- Business Administration and Management, General
- Business/Commerce, General
- Construction Engineering
- Construction Engineering Technology/Technician
- Manufacturing Engineering
- Materials Engineering
- Mechanical Engineering

Some technical institutes and career schools in California provide training that is specifically geared toward cost estimators. They offer programs such as Estimator/Estimations, Constructions Estimation, Construction Project Manager, Cost Estimation – Residential, and Cost Estimation – Commercial. Although this occupation seems to require bachelor’s degree, more than two-thirds of cost estimators in the field only hold high school diplomas or have some college courses completed. Experience in the field is an important factor for employers, when they consider hiring cost estimators.

However, with a new body of knowledge that is rapidly emerging from the green construction/retrofitting movement, there is a growing need for cost estimators (entry-level or experienced) to receive specialized training. Colleges are only partly addressing this need. There are several short-term non-credit trainings in LEED certification offered by colleges through contract education units, but they are limited in number and in scope.

### Community College Response

Based on qualitative secondary research, the COE would suggest that colleges address the need by developing a certificate program that provides a basic understanding of green construction for those cost estimators and project managers that have little or no experience with green building. This program would be targeted to construction firms that want to enter the green construction market as well as individuals who are interested in working in the construction industry. In addition, the COE suggests developing a recruiting program for the construction industry that focuses on 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.

## BIOFUEL PRODUCTION TECHNICIANS<sup>13</sup>

### Factors Influencing the Industry

Although there is a lot of criticism around ethanol production in the U.S., recent research is indicating that there might be other oil-based crops (such as canola and algae) that would make efficient biofuel. In California, the biofuels movement is supported by AB32 legislation that is aimed at reduction in greenhouse gases emission. Some of the developments in the biofuels industry in California include:

- A research team from Stanford has undertaken a national survey of the potential for cultivating biofuels on marginal lands that are unused and unsuitable for food cultivation. The team modeled former farm lands that have fallen into disuse or have been returned to forest, and calculated that up to 10 percent of the US fuel supply could be satisfied from this source, based on currently understood technologies and feedstocks.
- The San Diego region is undertaking a broad initiative to accelerate development of algae-to-biofuels technology by establishing a new organization, the San Diego Center for Algae-based Biofuels, or SD-CAB. The center is being organized by a consortium of academic and industry researchers and represents a regional effort to make sustainable algae-based biofuel production a reality in the next 5 to 10 years, according to Steve Kay, Dean of Biological Sciences at UC San Diego.<sup>14</sup>

### Employment & Earnings Potential

The US Conference of Mayors released a “Current and Potential Green Jobs in the U.S. Economy” report that projected 1.5 million new jobs by 2038 in the alternative fuels sector. The report projected 1.2 million new jobs in renewable power and 81,000 jobs in energy efficiency.

Some of the industry experts estimate that the development of biofuels industry in California would bring approximately 1,600 to 5,300 new jobs and \$270 million to \$850 million in monetary gains to the economy.

Biofuel production companies in California employ various workers to support their operations, including chemists, engineers, lab technicians, plumbing/maintenance workers, truck drivers, and plant operators. The need for plant operators is growing faster than any other occupation, but requires the least amount of training (high school diploma and on-the-job training). The course work from a community college might enhance an applicant's desirability, but not by much.

In the biofuels field, specialized training is especially needed for lab technicians. Lab technicians have to possess basic math skills, basic knowledge of chemistry, as well as data management skills with knowledge of Microsoft Excel. Some refer to lab technicians in biofuel production industry as Biofuel Production Technicians. This is an emerging occupation. However, its skill set is connected with that of chemical and biological technician. Labor market projections for these two traditional occupations indicate that there will be a need for 2,173 biological and chemical technicians in the next five years (see Table 4):

Table 4 – Biological and Chemical Technicians: Five-year Employment Projection<sup>15</sup>

SOC Code	Description	2008 Jobs	2013 Jobs	New Jobs	% Change	2007 Avg Hourly Earnings
19-4021	Biological technicians	9,870	11,442	1,572	16%	\$21.30
19-4031	Chemical technicians	6,718	7,319	601	9%	\$20.66
	<b>TOTAL</b>	<b>16,588</b>	<b>18,761</b>	<b>2,173</b>	<b>13%</b>	<b>\$21.04</b>

<sup>13</sup> Sources used: Biofuelsdigest.com, ccco.edu, [www.xconomy.com](http://www.xconomy.com), Economic Modeling Specialist, Inc. (EMSI)

<sup>14</sup> <http://www.xconomy.com/san-diego/2009/01/21/san-diego-algae-biofuels-industry-gains-steam-with-rd-consortium/>

<sup>15</sup> Source: EMSI Covered Employment - Fall 2008



Median hourly wages for both technician occupations are slightly more than \$20.00, while annual earnings range from \$26,600 for entry-level and up to \$66,400 for experienced workers.

### New Skills and Competences Required

**Traditional skills** for biological technicians include:

- Basic skills in chemistry, biology, and math;
- Ability to analyze experimental data and interpret results;
- Ability to conduct research or assist in the conduct of research, including the collection of information and samples,
- Skills and knowledge in standardized biological, microbiological or biochemical tests and laboratory analyses.
- Ability to measure or weigh compounds and solutions for use in testing or animal feed.
- Ability to monitor laboratory work to ensure compliance with set standards.
- Ability to use computers, computer-interfaced equipment, robotics or high-technology industrial applications to perform work duties.

Biofuel Production Technicians require **additional knowledge and skills** to perform their job duties. Short-term training in areas of plant propagation, tissue culture and crop production is necessary to prepare technicians for the production and processing of biofuels.

### Current Training Provided & Training Gap

There are 71 colleges in California that have approved programs in Biology/Biological Science, and 20 colleges that have Biotechnology programs. The programs in General Agricultural Technologies and Sciences could also train biofuel technicians. Twenty one community colleges are approved to provide this program.

In 2007-2008, community colleges in California graduated 209 students with an associate degree or certificate (29 graduates completed General Agriculture Technology and Sciences programs and 178 graduates - Biotechnology and Biomedical Technology program). **The approximate five-year gap between demand and supply would be over 1,000.** In the biofuels field, this gap might be significantly lower, considering that biological technicians are needed in a variety of industries.

### Community College Response

Colleges could respond to a growing demand for Biofuels Production Technicians by developing new short-term courses and certificates that will focus on the production and processing of biofuels, i.e. training of technicians for areas such as ethanol and biodiesel production.

## ALTERNATIVE FUEL AUTOMOTIVE TECHNICIANS<sup>16</sup>

### Factors Influencing the Industry

Increasing response to reducing greenhouse gas emissions and air pollution, and the critical need to reduce petroleum demand are driving the actions interest in alternative fuels field on both national and state levels. The most significant development in California is the enactment of Assembly Bill 118, which requires the California Energy Commission to develop and implement an alternative fuel investment plan. This plan will raise \$1.4 billion dollars over the next seven years to fund projects that promote clean alternative fuels and improve air quality in California. The air quality improvement fund in AB 118 would enable investments in cleaner technologies and control strategies that reduce on and off-road diesel pollution, promote the use of cleaner equipment to reduce off-road gasoline emissions, support a new vehicle scrappage program designed by the California Air Resources Board, and generally assist state and local air quality attainment efforts. The first funding is anticipated in June-July, 2009.

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<sup>16</sup> Sources used: Economic Modeling Specialist (EMS), Inc.; [www.cccco.edu](http://www.cccco.edu)

With the high emphasis on alternative fuel vehicle development coming from the new Obama administration, significant incentives in this field are expected to come from the federal government as well, further spurring activities in California.

On a local level, many municipalities are transitioning to a fleet (primarily buses and trucks) that consists of some kind of alternative fuel vehicles. On the passenger vehicle side, there is a growing interest to purchase hybrid, electrical and other alternative fuel vehicles. Despite the downturn in the economy, these vehicles have been driving new car sales.

### Employment & Earnings Potential

From the labor market perspective, the occupational group that will be most affected by the alternative fuels movement is Automotive Technicians and Mechanics. To adapt to new alternative fuel vehicle technology, this occupational group will need to acquire knowledge and skills in one of the following: hybrid/electrical vehicles, hydrogen/fuel cell vehicles, natural gas vehicles or biodiesel automobiles. Based on that, all alternative fuel automotive technicians could be divided into the following groups:

Alternative Fuel Automotive Technicians – Passenger Vehicles	Alternative Fuel Automotive Technicians – Buses and Trucks
(1) Hybrid/Electrical Vehicle Technician	(1) Natural Gas (LNG & CNG) Vehicle Technician
(2) Hydrogen/Fuel Cell Vehicle Technician	(2) Biodiesel Vehicle Technician
(3) Natural Gas Vehicle Technician	(3) Alternative Fuels Technician (multiple technologies)
(4) Biodiesel Vehicle Technician	
<b>Corresponding traditional occupations:</b>	<b>Corresponding traditional occupations:</b>
<ul style="list-style-type: none"> <li>• 1,2,3 – Automotive technicians and repairers (SOC 49-3020), except Biodiesel Vehicle Technicians</li> <li>• 4 – Bus and truck mechanics and diesel engine specialists (SOC 49-3030)</li> </ul>	<ul style="list-style-type: none"> <li>• 1,2,3 – Bus and truck mechanics and diesel engine specialists (SOC 49-3030)</li> </ul>

Employment projections for traditional automotive technicians in California are favorable. On the passenger vehicle side (except diesel), the number of jobs for technicians and mechanics is expected to increase by about 6,500 or 8% in the next five years. On the transit, trucks and diesel engine side, over 2,100 jobs are expected to be added (see Table 5).

According to the COE interviews with industry employers, there will be more demand for alternative fuel buses and trucks technicians than alternative fuel passenger vehicles, as municipal transit agencies and large trucking companies are aggressively transitioning to “greener” vehicles. Also, beginning this year, Mercedes and BMW are expected to start marketing their diesel vehicles in California, which will increase the need for diesel technicians.

Table 5 – Automotive Technician Occupations: Five-year Employment Projection<sup>17</sup>

SOC Code	Description	2008 Jobs	2013 Jobs	New Jobs	% Change	2007 Avg Hourly Earnings
49-3020	Automotive technicians and repairers	82,829	89,322	6,493	8%	\$19.65
49-3030	Bus and truck mechanics and diesel engine specialists	25,549	27,681	2,132	8%	\$21.27
<b>TOTAL</b>		<b>108,378</b>	<b>117,002</b>	<b>8,624</b>	<b>8%</b>	<b>\$20.03</b>

<sup>17</sup> Source: EMSI Covered Employment - Fall 2008

The median hourly wage for automotive technicians and repairers is \$18.55, while bus and truck mechanics and diesel engine specialists earn an average of \$21.10 hourly. However, according to industry experts, alternative fuel technicians have higher earning potential as they are in high demand.

### **New Skills and Competencies Required**

Significant changes in skills and competences needed for alternative fuel technicians are associated with **the process of diagnostics**. Diagnostics of alternative fuel vehicles requires a combined understanding of the fuel chemistry and impact on a fuel system, electronics, and computer software and technology. More sophisticated computer software is required for diagnosing problems with hybrid and electrical vehicles and is posing a challenge for retraining automotive technicians, as they generally have low skill levels in computer technology. The industry suggests that the pipeline for diagnosticians should start with recruiting computer software students and training them in Automotive Technology, rather than recruiting automotive students and training them in computer technology.

For biodiesel fuel technicians, knowledge and skills in chemistry are important. Also, technicians will need excellent communication and customer service skills, as customers tend to prefer interacting directly with the technician rather than with a customer manager.

### **Current Training Provided & Training Gap**

Many community colleges (69) have existing automotive programs, graduating a total of 2,296 students last year. Passenger automotive programs are fairly strong in terms of number of students. The programs that address trucks and transits are not as strong because students have a poor image perception of bus or truck technicians.

Regarding alternative fuels curriculum, colleges in Southern California have adapted their traditional programs faster. The ATTEi Center in San Diego Miramar College offers fee-based programs related to the bus and trucks side. Long Beach City College and Rio Hondo College have natural gas curriculum to address the growing need for LNG/CNG technicians in local ports, which are rapidly transitioning to clean air vehicles.

**Colleges in Northern California seem to be lagging behind with adopting alternative fuels curriculum, especially in transit and trucking, which could create a training gap for natural gas and biodiesel vehicle technicians.** One of the challenges that colleges face in adopting alternative fuels curriculum is a need to upgrade their automotive shops. Programs tied to manufacturer partnerships seem to retool faster and provide timely training to faculty using the manufacturer resources. But for colleges that do not have existing agreements with auto manufacturers, this represents a challenge.

### **Community College Response**

Recommendations to colleges include:

- Expand faculty professional development in all facets of diagnostic work to account for electrical and computer systems (hardware and software) innovations. There is a special need for professional development on the bus and transit side, as these programs do not have the same partnership relationship as passenger vehicle programs. Therefore, it is more difficult and challenging to ensure relevant faculty training.
- Colleges will likely need to revamp, expand, and/or modify the existing automotive curriculum. More attention should be paid to the diagnostics component of alternative fuel vehicles.
- Colleges should address the growing demand for natural gas and biodiesel technicians in transit and trucking industries by modifying their Bus and Trucks and Diesel Engine curriculum, as well as by marketing these careers to high-school students.
- Colleges need to work with high school automotive programs to ensure smoother pathways and to get students into the workforce earlier.

## Appendix A

Below are the definitions of the eight occupations in Energy Efficiency Cluster, identified through the interviews and secondary research by the Centers of Excellence. Employers in California are currently being surveyed about these occupations. Complete statewide results should be available by summer 2009.

Occupation 1: **Energy auditor or home energy rater** – These positions are responsible for collecting, analyzing and validating energy usage in the field and preparing reports on a building or home's total energy profile.

Occupation 2: **Building Performance or retrofitting specialist** – These positions are often contractors who improve the energy efficiency of homes or buildings by installing insulation, windows, lighting and other energy efficient products using the most up-to-date energy efficient construction techniques.

Occupation 3: **Compliance analyst or energy regulation specialist** – These positions are responsible for evaluating if projects are meeting regulatory requirements and/or incentives and providing recommendations as needed to meet compliance.

Occupation 4: **Project manager for construction or design work** – These positions are responsible for communicating with project partners and ensuring that the project is completed in a timely manner and within budget

Occupation 5: **HVAC mechanics, technicians or installers** – These positions are often responsible for installing, repairing and maintaining Heating, Ventilation, Air-Conditioning and Refrigeration systems.

Occupation 6: **Resource conservation or energy efficiency manager** – These positions are typically involved in assessing current energy and resource consumption and developing strategies to reduce usage.

Occupation 7: **Building controls systems technician** – These positions combine traditional skill sets of building technicians with advanced skills in controls programming, networking, and systems integration.

Occupation 8: **Building operator or building engineer** – These positions troubleshoot, install, replace, and repair building energy systems and controls to optimize energy efficiency.

## **Appendix B**

The following represents additional/new/emerging knowledge, skills and abilities that are needed for Energy Efficiency occupations. These skills vary depending on the nature of industry, and therefore they are clustered by industry or industries group.

### **Industry #1: Utilities and Resource Management**

- A. Understanding of local and state energy efficiency requirements and incentives for new and existing buildings
- B. Identify and apply regulatory codes when conducting energy assessments and/ or site visits
- C. General understanding of the mechanics and engineering of energy systems, including HVAC, lighting, and renewable energy systems
- D. Ability to perform economic analysis related to energy efficiency projects
- E. Ability to conduct Energy Utilization Analysis
- F. The ability to effectively communicate with customers, in writing and in-person

### **Industry #2: Design and/or Construction of New Buildings**

- A. Ability to develop CAD (computer assisted design) or GIS (Geographic Information Systems) drawings
- B. General understanding of the mechanics and engineering of energy systems, including HVAC, lighting, and renewable energy systems
- C. Understanding of local and state energy efficiency requirements and incentives for new buildings
- D. General construction experience
- E. Knowledge of LEED standards and principles
- F. The ability to effectively communicate with customers, in writing and in-person

### **Industry #3: Energy Retrofitting**

- A. Construction skills related to Energy Efficiency, including installing insulation, windows, and weatherization material
- B. Ability to conduct home performance diagnostic testing
- C. Ability to conduct Energy Utilization Analysis
- D. Building Inspection for Safety, Quality of Installation, Verification of Efficiency
- E. Understanding of local and state energy efficiency requirements and incentives for new and existing buildings
- F. The ability to effectively communicate with customers, in writing and in-person

### **Industry #4: Retro-Commissioning/Existing Building Commissioning**

- A. Ability to perform measurement and verification of energy systems
- B. Ability to test and troubleshoot building and process systems, including HVAC, electrical and electronic systems
- C. Ability to program a building's energy management system, including control strategies
- D. Ability to install and troubleshoot data acquisition equipment
- E. Understanding of local and state energy efficiency requirements and incentives for existing buildings
- F. The ability to effectively communicate with customers, in writing and in-person

### **Industry #5: Facility or Building Operations and Maintenance**

- A. Understanding of efficient lighting design, installation, and controls
- B. Understanding of HVAC systems functions, operations, and maintenance
- C. Understanding of building control and automation systems
- D. Understanding of the entire building design and its impact on energy efficiency
- E. Computer hardware and networking skills
- F. The ability to effectively communicate with customers, in writing and in-person
- G. Understanding of local and state energy efficiency requirements and incentives for new and existing buildings

## Appendix C: Legislation

The construction and operation of buildings in California account for approximately 36% of greenhouse gas emissions.<sup>18</sup> This is just a few percentage points less than transportation (typically associated as the primary culprit in global warming). Because buildings, both creation and operation, are such a significant contributor to greenhouse gas emissions, they also need to be a focal point for any potential solutions. Policymakers in Sacramento have authored multiple pieces of legislation, or local ordinances, with the goal of improving the environment and/or combating global warming. Many of these affect green building practices. Some examples include:

- AB 32: Assembly Bill 32 (AB32), the California Global Warming Solutions Act of 2006 mandates that California must reduce its greenhouse emissions to 1990 levels by 2020. The bill sets a goal of approximately an 11% reduction from current emissions levels and nearly a 30% reduction from projected business-as-usual levels in 2020. 25% of the state's greenhouse gas emissions are attributable to electricity generation while 38% is attributed to the transportation sector. Education and workforce development implications of AB32 are addressed in the Air Resources Board's proposed scoping plan, revised in 2008, under section IV: Implementation (pages 101-104).<sup>19</sup>
- CA EXECUTIVE ORDER S-14-08 (November 17, 2008). This order established a Renewable Portfolio Standard target for California mandating that all retail sellers of electricity shall serve 33% of their load with renewable energy by 2020. State government agencies are hereby directed to take all appropriate actions to implement this target in all regulatory proceedings, including siting, permitting, and procurement for renewable energy power plants and transmission lines.<sup>20</sup> Section 16 states, "In order to facilitate the timely permitting of renewable energy projects, all state regulatory agencies shall give priority to renewable energy projects as set forth in this Executive Order."
- In 2006, Governor Schwarzenegger [announced](#) SB 1: The Million Solar Roofs Bill. This bill provides funding, incentives and mandates to increase solar panels throughout the state. Now known as the California Solar Initiative, the \$3.3 billion incentive plan for homeowners and building owners who install solar electric systems will lead to one million solar roofs in California by 2017. The bill aims to achieve 3,000 megawatts of additional clean energy and to reduce the output of greenhouse gases by three million tons - the equivalent to taking one million cars off the road. Announced as a component of the California Solar Initiative in 2007, the New Solar Homes Partnership (NSHP) aims to create a self-sustaining market for solar homes and gain builder commitment to install solar energy systems. A new home that qualifies for the NSHP is at least 15% more efficient than the current building standards.
- In September 2008, Governor Schwarzenegger signed [AB 1451](#) by Assemblyman Mark Leno (D-San Francisco). AB 1451 will build on the state's solar power usage by continuing a property tax exclusion for projects that utilize solar panel energy and expanding the exclusion to builder-installed solar energy systems in new homes.
- In September 2008, Governor Schwarzenegger also signed [AB 2466](#) by Assemblyman John Laird (D-Santa Cruz). AB 2466 will increase energy efficiency and help protect the environment by authorizing local governments to receive a utility bill credit for surplus renewable electricity generated at one site against the electricity consumption at other sites.
- In September 2008, Governor Schwarzenegger signed [AB 2267](#) by Assemblyman Felipe Fuentes (D-Sylmar). AB 2267 builds on the state's green economy by requiring the CPUC to grant incentives to eligible California-technology manufacturers. This bill also requires the Energy Commission to give priority to California-based companies when granting awards and will not only create jobs for hardworking Californians but will attract more clean-tech and green-tech companies to the state.
- AB 35: Green Buildings – Requires state buildings to be built to environmental standards such as LEED.

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<sup>18</sup> <http://gov.ca.gov/executive-order/3360/>

<sup>19</sup> [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)

<sup>20</sup> <http://gov.ca.gov/index.php?/press-release/11073/>

- California has adopted the first statewide green building code which will promote green building practices and energy efficient technologies. This purpose of this code is to conserve natural resources, protect the economy, and reduce California's carbon footprint.<sup>21,22</sup> The provisions of the California Building Code will apply to every building in California. The new standards become guidelines starting July 2009 and a grace period will render the new code optional until 2010 so that industry and enforcement agencies have time to prepare for the new building standards.<sup>23</sup>
- As part of Los Angeles Mayor Villaraigosa's plan to create the "Greenest Big City in America" all new city buildings will be built to LEED standards.<sup>24</sup> The city presently has 59 LEED registered projects, placing it fifth in the nation for the highest number of registered projects. 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.
- AB 118 provides the funding for development and implementation of alternative fuel transportation. It is aimed at moving California forward toward a petroleum-free future by raising funds to invest in research and development of clean alternative fuel and vehicle technologies, deploy alternative fuel vehicles and fuels, and support development of alternative fuel infrastructure. The bill will raise \$1.4 billion dollars over the next 7 years to fund the program.
- 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.
- The Energy Efficiency and Renewable Energy Workforce Development Amendment sponsored by Senator Bernie Sanders of Vermont and former Senator Hillary Clinton of New York 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 these various legislative packages, the building industry – which has already begun to respond to these legislative initiatives – will need to further bring green buildings into the mainstream.

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<sup>21</sup> [http://www.documents.dgs.ca.gov/bsc/prpsd\\_stds/governors\\_press\\_release\\_cgbsc.pdf](http://www.documents.dgs.ca.gov/bsc/prpsd_stds/governors_press_release_cgbsc.pdf)

<sup>22</sup> [http://www.bsc.ca.gov/prpsd\\_stds/default.htm](http://www.bsc.ca.gov/prpsd_stds/default.htm)

<sup>23</sup> [http://www.documents.dgs.ca.gov/bsc/prpsd\\_stds/combined\\_green\\_et\\_7\\_08.pdf](http://www.documents.dgs.ca.gov/bsc/prpsd_stds/combined_green_et_7_08.pdf). Title 24 Part 11 of the code contains regulations for energy efficiency, water efficiency and conservation, material conservation and resource efficiency, environmental quality, and more.

<sup>24</sup> [http://www.documents.dgs.ca.gov/bsc/prpsd\\_stds/governors\\_press\\_release\\_cgbsc.pdf](http://www.documents.dgs.ca.gov/bsc/prpsd_stds/governors_press_release_cgbsc.pdf)

## **Appendix D: How to Utilize this Report**

This report is designed to provide current industry data to:

- Define potential strategic opportunities relative to an industry's emerging trends and workforce needs;
- Influence and inform local college program planning and resource development;
- Promote a future-oriented and market responsive way of thinking among stakeholders; and,
- Assist faculty, Economic Development and CTE administrators, and Community and Contract Education programs in connecting with industry partners.

Some of the information in this report may have been validated by employers and may also include a listing of what programs are already being offered by colleges to address those workforce needs. In some instances, the labor market information and industry validation will suggest that colleges might not want to begin or add programs, thereby avoiding needless replication and low enrollments.

### ***About the Centers of Excellence***

The Centers of Excellence (COE), in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development. This information has proven valuable to colleges in beginning, revising, or updating economic development and Career Technical Education (CTE) programs, strengthening grant applications, assisting in the accreditation process, and in supporting strategic planning efforts.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the premier source of regional economic and workforce information and insight for California's community colleges. More information about the Centers of Excellence is available at [www.coeccc.net](http://www.coeccc.net).

### ***Important Disclaimer***

All representations included in this report have been produced from primary research and/or 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; however, neither the Centers of Excellence, COE host District, nor California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon components or recommendations contained in this study.

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### ***Contact the COE***

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