



Guide for



## Biomass Engineers in California

**May also be called:** Alternative Energy Engineers; Chemical Engineers; Fermentation Process Engineers

### What Would I Do?

Homes and businesses have long used biomass in the form of wood in industrial boilers and home fireplaces, woodstoves, and barbeques as a source of heat and fuel. Currently, Biomass Engineers are developing the processes and technology used to deliver energy from alternative sources with prices comparable to today's carbon-based options. The typical sources of biomass include garbage, wood, biological waste, and landfill gases. They specifically attempt to convert biomass into a viable source of energy or fuel through scientific processes, which include thermal, chemical, and biochemical conversion methods. The primary process for converting biomass into a usable form of energy is combustion, a form of thermal conversion. Biomass Engineers use the combustion process to burn the biomass in order to boil water and produce steam, which then spins a turbine to produce electricity. The method and technology used for conversion will affect the amount of energy produced from the biomass; therefore, Biomass Engineers are responsible for maintaining and properly using the current conversion processes.

Biomass Engineers also work with enzymes and technology used in ethanol, methanol, and biodiesel production. Most Engineers perform bioengineering research on advanced biofuels and renewable energy, using different conversion processes.

### Tools and Technology

Tools and technology for Biomass Engineers vary depending on the project and the employer, and are related to tasks, such as mass transfer, heat transfer, aseptic design, and sterilization. Some of the technology includes software, such as analytical or scientific, life-cycle assessment, modeling, computer-aided design (CAD), spreadsheet, and word processing. Tools and equipment include distributed control systems, mass analyzers and detectors, gas chromatographs, catalytic combustion analyzers, fermenters, furnaces, turbines, and boilers.

### Important Tasks and Related Skills

A formal survey to determine specific skills requirements for Biomass Engineers has yet to be completed. Therefore, the sample skills shown below are common in many of the job listings for Biomass Engineers and related occupations.

Each task is matched to a sample skill required to carry out the task.

| <b>Task</b>   | <b>Skill Used in this Task</b> |
|---|--------------------------------|
| Design waste, emissions, and turbine components in biomass facilities.  | Technical Design               |
| Applying the principles of mass and energy conservation, fluid dynamics and heat transfer to process and equipment design, including conceptual and detail design.  | Engineering and Technology     |
| Assessing the sustainability of the biomass flow and the environmental impact of the plant e.g. the proper management and recycling (as a fertilizer) of the ash produced when burning the biomass.         | Systems Analysis               |
| Screen environmental microbes for new potential cellulosic biofuel production hosts, biomass pretreatment chemicals, and next generation biofuels to enhance conversion of biomass to fuel.                 | Judgment and Decision Making   |
| Analyze test results and determine differences between predictions and measurements of integrated biofuels production process.  | Science                        |
| Assist in the design, implementation, and expansion of novel fermentation processes to produce biofuels from a variety of biomass sources.  | Coordination                   |
| Monitor environmental compliance and provide regulatory analysis, advice, and expertise for federal, state, and local environmental regulations applicable to fossil, biomass, and renewable energy plants. | Law and Government             |
| Obtain data on fermentation process developments, give presentations on progress, and contribute to writing operating procedures or technical bulletins.  | Inductive Reasoning            |
| Identify, analyze, and recommend environmental strategies to meet business and ecological risk goals.   | Systems Evaluation             |
| Develop robust disturbance algorithms for integration using Earth system models to improve treatment of carbon cycles, land use, and climate feedback mechanisms.   | Mathematical Reasoning         |

Sources: U.S. Department of Labor [Occupational Information Network \(O\\*NET\)](http://online.onetcenter.org) at online.onetcenter.org and The Conference Board Help Wanted Online™ (HWOL) data series

### **Working Conditions**

Biomass Engineers split their time between the office, laboratory, project sites, and industrial manufacturing settings. They may work in companies developing one or more forms of fuel and energy or companies that build equipment and design processes that convert biomass to energy. When on site, Engineers may experience strong odors and hot and cold temperatures. To ensure safety, employers require Engineers to use proper safety equipment and protocols. Most Engineers work a standard 40-hour week, but can expect occasional evening, weekend, and holiday work to meet pressing needs. Biomass Engineers may also travel extensively to interact with clients or to work at job sites due to a shortage of experienced, local Engineers.

Biomass Engineers working in government agencies may become members of unions such as the Professional Engineers in California Government (PECG).

### ***Will This Job Fit Me?***

The job of Biomass Engineer may appeal to those who enjoy working with ideas that require an extensive amount of thinking. Engineers search for facts using a variety of sources in order to solve complex engineering problems.

They may also work independently or as part of a team. Engineers should be able to multitask and adapt to new and innovative material and procedures while still giving attention to detail. Engineers should be flexible with their work schedules.

### ***What Wages and Benefits Can I Expect?***

#### **Wages**

A formal salary survey is not available; however, references to annual salaries range from \$80,000 to \$110,000. All salaries depend on the pay structure established by each employer based on work performed, experience level, the nature of the project, and the level of skill required.

#### **Benefits**

Biomass Engineers typically receive competitive benefits that may include medical, dental, vision, and life insurance as well as sick leave, vacation, holidays, 401(k), and retirement plans. Some private businesses may provide bonuses for employees.

### ***What is the Job Outlook?***

As this is an emerging occupation, the number of Biomass Engineers in California is unknown at this time. Employment opportunities should increase in the future considering society's growing interest in environmental protection and the development of alternative energy sources.

### ***How Do I Qualify?***

#### **Education, Training, and Other Requirements**

Biomass Engineers come from a wide variety of academic backgrounds. The minimum education requirement is a bachelor's degree in engineering or a related field of study. Most Biomass Engineers have a degree in one of the following areas: analytical chemistry, biochemistry, biology, microbiology, or molecular biology, as well as biochemical, chemical, electrical, mechanical, or systems engineering. As with any new or emerging occupation, specific training options in this field are somewhat lacking. Some Engineers continue their education by obtaining a master's or doctoral degree.

#### **Experience**

Employers generally require applicants to possess two to seven years of work experience in order to consider them for the position. This is due to the varying nature and complexity of projects throughout the field. Experience in such areas as energy, resource recovery systems, vehicle integration, sanitary and environmental consulting, and other related areas may be helpful in obtaining employment.

#### **Early Career Planning**

High school students planning to become a Biomass Engineer should take classes in English, chemistry, mathematics, physics, biological and life sciences, computer science or computer-aided design (CAD) programs, and mechanical drawing. Preparatory training programs in engineering are also available through Regional Occupational Programs (ROP). To find an ROP program near you, go to the California Association of Regional Occupational Centers and Programs Web site at [www.carocp.org/carocps.html](http://www.carocp.org/carocps.html).

## Continuing Education

While continuing education is not a requirement, most Biomass Engineers should update their knowledge through workshops, seminars, and ongoing training. They should also keep up with changes to environmental codes and regulations.

## Licensing

Although a Professional Engineer's (PE) license is not required for most Biomass Engineers, a licensed Engineer will have a competitive edge for advancement to more responsible positions.

To obtain a PE license, Engineers must first pass the Engineer-in-Training or Fundamentals of Engineering examination which requires at least three years of coursework from a college or university offering an engineering program accredited by the Accreditation Board for Engineering and Technology (ABET), or three years of engineering-related experience. The next step in the process is to pass the professional examination which requires a bachelor's degree in engineering from an ABET-accredited institution, along with two years of eligible engineering experience. Engineers without a bachelor's degree in engineering must possess six years of eligible experience. The license must be renewed every two years. Contact the agency that issues the license for additional information.

## Where Can I Find Training?

There are two ways to search for training information at [www.labormarketinfo.edd.ca.gov/?Pageid=1013](http://www.labormarketinfo.edd.ca.gov/?Pageid=1013):

- [Search by Field of Study](#) to find what programs are available and what schools offer those programs. You may use keywords such as: ABET, Chemical, Energy, and Engineer.
- [Search by Training Provider](#) to find schools by name, type of school, or location.

Contact the schools you are interested in to learn about the classes available, tuition and fees, and any prerequisite course work.

## Where Would I Work?

According to the 2009 *California Green Economy Survey*, Biomass Engineers were surveyed under the broader field of Alternative Energy Engineers. Results indicate they largely work in research and development firms as well as the following industries: Engineering and Consulting Services, Specialty Trade Contractors, Educational Services, and Utilities.

## Finding a Job

Direct application to employers remains one of the most effective job search methods. Biomass Engineers can also register with their school placement center for job leads. Professional associations and organizations provide job leads as well. **Online job opening systems** include JobCentral at [www.jobcentral.com](http://www.jobcentral.com) and CalJOBS<sup>SM</sup> at [www.caljobs.ca.gov](http://www.caljobs.ca.gov).

To find your nearest One-Stop Career Center, go to [Service Locator](http://www.servicelocator.org) at [www.servicelocator.org](http://www.servicelocator.org). View the [helpful job search tips](http://www.labormarketinfo.edd.ca.gov/ocguides/JobSearchTips.pdf) at [www.labormarketinfo.edd.ca.gov/ocguides/JobSearchTips.pdf](http://www.labormarketinfo.edd.ca.gov/ocguides/JobSearchTips.pdf) for more resources. (requires [Adobe Reader](#)).

## Yellow Page Headings

You can focus your local job search by checking employers listed online or in your local telephone directory. Below are some suggested headings where you might find employers of Biomass Engineers.

- Alternative Power
- Biodiesel
- Biofuel
- Biomass
- Green Energy

## Find Possible Employers

To locate a list of employers in your area, use “Find Employers” on the LaborMarketInfo Web site at [www.labormarketinfo.edd.ca.gov/aspdotnet/databrowsing/empMain.aspx?menuChoice=emp](http://www.labormarketinfo.edd.ca.gov/aspdotnet/databrowsing/empMain.aspx?menuChoice=emp)

- Select the search for employers by occupation.
- Select a geographic area.
- Search for an occupation by keyword, occupation, or category.
- Select one of the top industries that employ the occupation.
- This will give you a list of employers in that industry in your area.
- Click on “View Filter Selections” to limit your list to specific cities or employer size.
- Click on an employer for the street address, telephone number, size of business, Web site, etc.
- Contact the employer for possible employment.

## Where Could This Job Lead?

After years of experience working for private firms or government agencies, Biomass Engineers may join consulting firms or start their own businesses. Engineers may also take on additional responsibilities and work on more complex projects as means for advancement or may choose technical customer service and sales positions. Still, others may go into academic fields where they conduct research, instruct, and contribute to published scientific works.

## Related Occupations

Below is a list of occupations related to Biomass Engineers.

- Biochemical Engineer (SOC 17-2199)
- Chemical Engineers (SOC 17-2041)
- Civil Engineers (SOC 17-2051)
- Electrical Engineers (SOC 17-2071)
- Geothermal Engineers
- Mechanical Engineers (SOC 17-2141)
- Solar Energy Systems Engineers (SOC 17-2199)
- Wind Energy Engineers (SOC 17-2199)

## Other Sources

- California Department of Consumer Affairs, Board for Professional Engineers, Land Surveyors, and Geologists  
[www.pels.ca.gov](http://www.pels.ca.gov)
- California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)
- California Environmental Protection Agency  
[www.calepa.ca.gov](http://www.calepa.ca.gov)
- California Society of Professional Engineers  
[www.cspe.com](http://www.cspe.com)
- U.S. Department of Energy, Energy Efficiency & Renewable Energy  
[www.eere.energy.gov](http://www.eere.energy.gov)
- Accreditation Board for Engineering and Technology  
[www.abet.org](http://www.abet.org)
- American Society for Engineering Education  
[www.asee.org](http://www.asee.org)
- Institute of Electrical and Electronics Engineers  
[www.ieee.org](http://www.ieee.org)
- National Society of Professional Engineers  
[www.nspe.org](http://www.nspe.org)

- Professional Engineers in California Government  
[www.pecg.org](http://www.pecg.org)
- Technology Student Association  
[www.tsaweb.org/](http://www.tsaweb.org/)

These links are provided for your convenience and do not constitute an endorsement by EDD.

### ***For the Career Professional***

The following codes are provided to assist counselors, job placement workers, or other career professionals.

| <b>System</b>   | <b>Code</b> |
|---|-------------|
| SOC – <a href="http://www.bls.gov/soc">Standard Occupational Classification</a> at <a href="http://www.bls.gov/soc">www.bls.gov/soc</a>                 | N/A         |
| O*NET – <a href="http://online.onetcenter.org">Occupational Information Network</a> at <a href="http://online.onetcenter.org">online.onetcenter.org</a> | N/A         |

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