



# California Occupational Guides

Guide for



## Geothermal Engineers in California

**May also be called:** Alternative Energy Engineers; Chemical Engineers; Drilling Engineers; Energy Engineers; Geothermal Power Engineers; Mechanical Engineers; Power Phase Engineers; Renewable Energy Engineers; Reservoir Engineers

### *What Would I Do?*

Geothermal energy is the natural heat of the earth. For centuries, geothermal heat has heated structures and natural hot springs, yet the first use of geothermal energy to generate electricity was not until the early 20<sup>th</sup> Century. The formation of the planet, decaying radioactive material, volcanic activity, and solar energy absorbed into the earth are all contributors to geothermal heat. Geothermal Engineers help harness the use of geothermal heat and power as a renewable energy source.

Geothermal Engineers usually work in teams experimenting, analyzing, and developing new projects that will increase the efficiency of technologies harnessing geothermal power. There are two main methods to use geothermal energy, either direct use or indirect use. First, buildings and other structures can directly use geothermal heat without pumps or power plants for their heating needs. Second, geothermal heat can indirectly produce electricity by powering a turbine from combining heat and water creating steam. Engineers have developed methods of obtaining this heated water either directly from the earth from natural geothermal reservoirs close to the surface, or by pumping cold water into a geothermal reservoir deeper under ground which then allows the geothermal heat to turn the water into steam and return to the surface for application and use. Engineers will often need to test and monitor the flow and volume of the geothermal reservoirs while providing technical support for other related operations of geothermal sites.

Some Engineers may assist in the construction and maintenance of Geothermal plants by designing projects, assuring compliance with appropriate building and operating standards, and choosing the appropriate equipment for facilities. Others may also develop long range plans and provide leadership and direction to plant operations staff. They are responsible for safely creating an environmentally clean and efficient form of energy, while in some cases also acting in a supervisory role.

Some Engineers may work through academics or agencies by researching and producing technical reports and peer-reviewed journal articles.

In California, the current use of geothermal energy as a renewable resource is minimal compared to its vast potential for energy production.

### **Tools and Technology**

Depending on the project and the employer, Geothermal Engineers might use a combination of tools and technology including, computer-aided design (CAD), hydraulic, spreadsheet, word processing, and temperature simulation modeling software.

### Important Tasks and Related Skills

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

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

<i>Task</i>	<i>Skill Used in this Task</i>
Determine the type of geothermal loop system most suitable to a specific property and its heating and cooling needs.	Equipment Selection
Design and lay out geothermal heat systems according to property characteristics, heating and cooling requirements, piping and equipment requirements, applicable regulations, or other factors.	Technology Design
Perform pre- and post-installation pressure, flow, and related tests of vertical and horizontal geothermal loop piping.	Systems Evaluation
Collect and record data associated with operating geothermal power plants or well fields.	Operation Monitoring
Determine whether emergency or auxiliary systems will be needed to keep properties heated or cooled in extreme weather conditions.	Problem Sensitivity
Test water sources for factors such as flow volume and contaminant presence.	Systems Analysis
Design and test microsteam turbines and pumps.	Operations Analysis
Research and develop turbines and other power-producing materials and components.	Mechanical
Install and maintain turbines and related power-producing materials and components.	Equipment Maintenance

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

### Working Conditions

Geothermal Engineers split their time between an office, laboratory, at project sites, and in industrial manufacturing settings. When on site, Engineers may experience hot, cold, and otherwise adverse conditions. General physical demands of Geothermal Engineers include, walking on rugged terrain, sitting and standing for long periods of time, kneeling, stooping, crouching, climbing, and balancing. Geothermal Engineers may be required to handle or move objects up to 25 pounds. 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. Geothermal Engineers may also travel extensively due to a shortage of experienced Engineers.

Geothermal Engineers may become members of such unions as the Professional Engineers in California Government (PECG), Society of Petroleum Engineers (SPE), and the American Association of Drilling Engineers (AADE).

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

The job of Geothermal 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 flexible with their work schedules and show a strong focus on operational excellence.

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

#### **Wages**

A formal salary survey is not available; however, references to annual salaries range from \$50,000 to \$130,000. All salaries depend on the pay structure established by each employer for work performed, the nature of the project, and the level of skill required.

#### **Benefits**

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

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

As this is an emerging occupation, the number of Geothermal 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**

Geothermal 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 Geothermal Engineers have a degree in one of the following areas: biochemical, chemical, civil, electrical, environmental resources, geothermal, or mechanical engineering. Specific training options in this field are somewhat limited but growing. Some Engineers continue their education by obtaining a master's or doctoral degree, and may substitute this education for required experience.

#### **Experience**

Employers generally require applicants to possess 2 to 15 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 oil and gas exploration, engineering studies, power plant designs, and other related areas may be helpful in obtaining employment.

#### **Early Career Planning**

High school students planning to become a Geothermal Engineer should take classes in English, chemistry, mathematics, biological and life sciences, computer science or CAD programs, and mechanical drawing.

#### **Continuing Education**

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

## Licensing

Although a Professional Engineer's (PE) license is not required for most Geothermal 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 engineering experience. Engineers without a bachelor's degree in engineering must possess six years of experience. Engineers must renew the license 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*, Geothermal Engineers were surveyed under the broader field of Alternative Energy Engineers. Results indicate that they largely work in research and development and engineering and consulting services firms as well as in the following industries: Specialty Trade Contractors, Educational Services, and Utilities.

## Finding a Job

Direct application to employers remains one of the most effective job search methods. Geothermal 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](#) at [www.servicelocator.org](http://www.servicelocator.org). View the [helpful job search tips](#) at [www.labormarketinfo.edd.ca.gov/occguides/JobSearchTips.pdf](http://www.labormarketinfo.edd.ca.gov/occguides/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 Geothermal Engineers.

- Alternative Power
- Environmental Compliance
- Geothermal
- 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, Geothermal Engineers may join consulting firms or start their own businesses. Engineers may also take on additional responsibilities and work on more complex projects as a means for advancement.

### ***Related Occupations***

Below is a list of occupations related to Geothermal Engineers.

- Biomass Engineers
- Chemical Engineers (SOC 17-2041)
- Civil Engineers (SOC 17-2051)
- Electrical Engineers (SOC 17-2071)
- Geoscientists, Except Hydrologists and Geographers (SOC 19-2042)
- Mechanical Engineers (SOC 17-2141)
- Mining and Geological Engineers, Including Mining Safety Engineers (SOC 17-2151)
- Solar Energy Systems Engineers (SOC 17-2199)
- Wind Energy Engineers (SOC 17-2199)

### ***Other Sources***

- California Board for Professional Engineers, Land Surveyors, and Geologists  
[www.pels.ca.gov](http://www.pels.ca.gov)
- California Department of Consumer Affairs  
[www.dca.ca.gov](http://www.dca.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)
- U.S. Environmental Protection Agency  
[www.epa.gov](http://www.epa.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)
- Geothermal Resources Council  
[www.geothermal.org](http://www.geothermal.org)
- Institute of Electrical and Electronics Engineers  
[www.ieee.org](http://www.ieee.org)
- Junior Engineering Technical Society  
[www.jets.org](http://www.jets.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)

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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