



Why Support Geothermal Energy?

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Why Support Geothermal Energy?

Geothermal energy is a clean, renewable resource that provides energy in the U.S. and around the world. Heat flows constantly from the earth's interior and will continue to radiate for billions of years to come, ensuring an inexhaustible supply of energy.

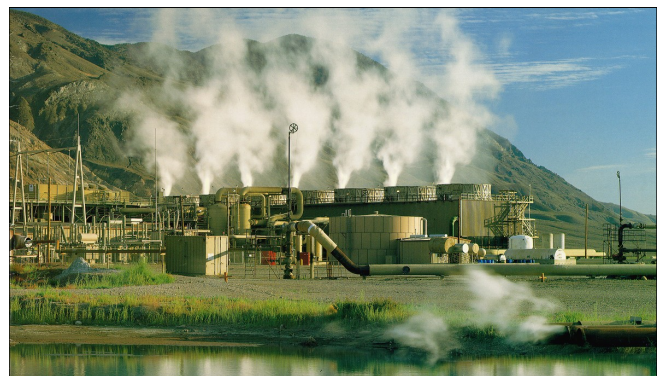
1. Geothermal Power is Reliable Power

Utility-scale geothermal power production adds reliability to the power system. Geothermal power can be produced as a baseload renewable energy resource, meaning it operates 24 hours a day, 7 days a week regardless of changing weather, providing a uniquely reliable and continuous source of clean energy. As a baseload power source, geothermal is well suited as a substitute for coal in our utility system.

Or, geothermal power can be flexible to support the needs of intermittent renewable energy resources such as wind and solar. Because geothermal energy can also be ramped up or down depending on need it can be used to supplement the integrity of the power grid, enhancing the efficiency of the entire system while providing clean, reliable power.

Geothermal is also capable of achieving high capacity factors – a measure of actual output over a period of time – usually at or above 90%, which is on par with, or higher than, other baseload power sources such as coal-fired or nuclear power plants, and much greater than intermittent sources.

Geothermal power production is also scalable. Power plants as small as a few tens of kW can be economically built for applications in communities, while utility-scale facilities on the multi-MW scale are common.



Photos (from top): Ormat Technologies' Desert Peak 2 geothermal power project, Steamboat, Nevada; 280 kW geothermal plant, Oregon Institute of Technology, Klamath Falls, Oregon; Terra-Gen Power's Dixie Valley geothermal plant, near Fallon, Nevada

2. Geothermal Power Creates Jobs and Spurs Economic Growth

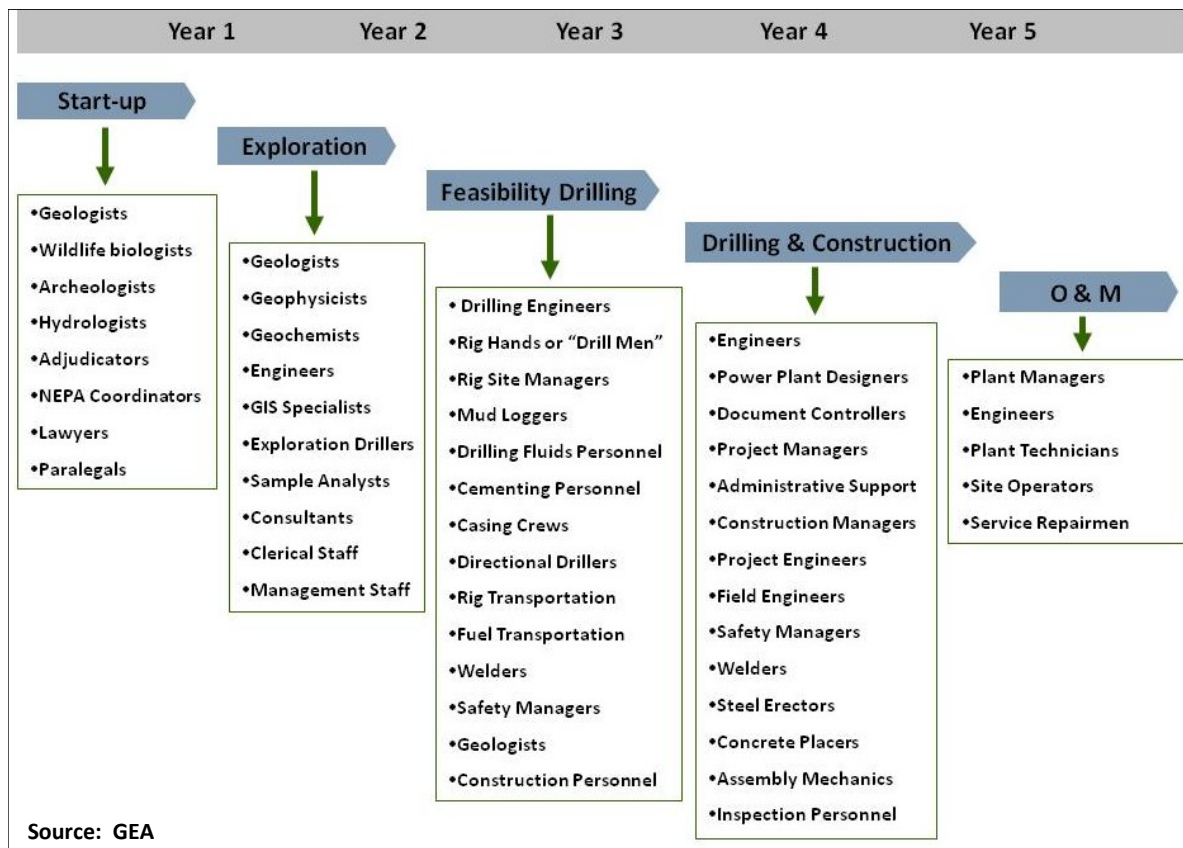
Geothermal projects provide economic growth and jobs, often in rural areas with high unemployment. For example, CalEnergy has plans to build a new power complex in Imperial Valley, California, one of the state’s highest unemployment areas. The project will mean investment of nearly \$1 billion which will be a boost to the local economy. The project will take almost four years to build, during which time an average of 323 construction workers will be employed. When the project is completed it will require 57 full time positions for operations, engineering, maintenance, and administration. This 235 MW geothermal plant compares favorably with either a gas or wind project, which CalEnergy notes would each require about 18 full time employees for a similar size project.



Construction worker at Stillwater, Nevada
Photo courtesy POWER Engineers

GEA has identified the following different types of jobs created by the geothermal industry during project development. This does not include the many jobs involved in manufacturing operations, controls, and other components of a power plant.

Job Types through the Project Timeline



And while today geothermal projects are largely concentrated in the Western U.S., the economic benefits translate nationwide. In 2010, geothermal companies purchased goods and services from vendors in nearly every state.

3. Geothermal Energy Promotes National Security

Geothermal energy is a domestic energy resource that does not require carbon-intensive fuel to operate. Geothermal power can displace use of fossil fuels, thereby reducing our reliance on foreign fuel markets. Also, as electricity becomes a larger part of our transportation system it can directly displace imported oil. Direct use of geothermal heat for certain commercial, industrial and agricultural uses, provides an alternative to other sources of thermal energy including electricity, natural gas, propane, or oil. By increasing the availability of indigenous fuels in the U.S., geothermal can improve our ability to control our economic future and improve our national security, while conserving our available oil and natural gas resources for high value uses, such as liquid fuels for transportation, chemical feedstock and pharmaceuticals.



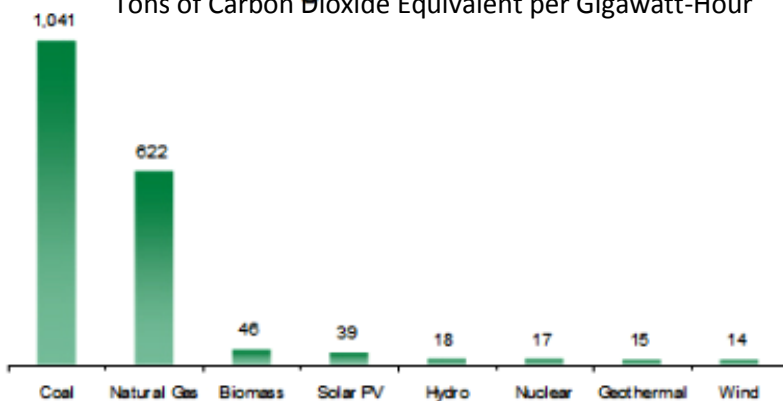
Calpine's Grant (Unit 20) at The Geysers. Photo by John Grice courtesy Calpine.

4. Geothermal is Environmentally Friendly

Geothermal power plants involve no combustion, unlike fossil fuels plants, so they emit very low levels of greenhouse gases. Binary geothermal plants, which currently represent around 20% of all geothermal plant capacity in the U.S., along with flash/binary plants, produce nearly zero air emissions. Even dry steam plants are considered environmentally benign compared with fossil fuels. According to the Nevada Geothermal Council, the state's 300 MW of geothermal power alone save 4.5 million barrels of oil (the equivalent fuel used by 100,000 cars) and avoid emissions of 2.25 million tons of CO₂ annually. Geothermal heat pumps, which are used to heat and cool buildings, are also considered to be one of the most efficient heating and cooling systems available – because of their very low electricity demand, their use greatly reduces emissions resulting from power generation. Additionally, geothermal energy has a very small land-use footprint – among the smallest, per kilowatt of ANY power generation technology, including coal, nuclear, and other renewables.

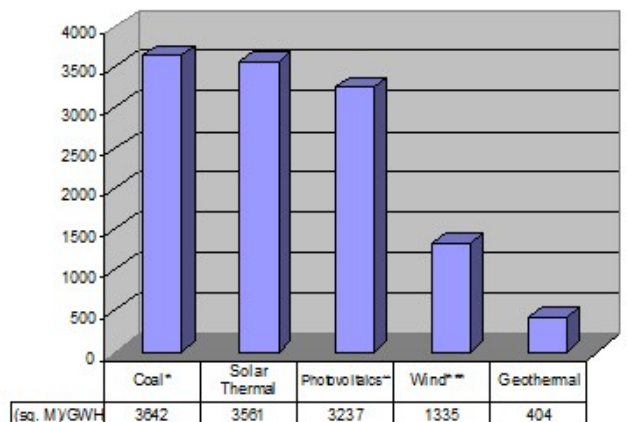
Comparison of Life-Cycle Emissions

Tons of Carbon Dioxide Equivalent per Gigawatt-Hour



Source: "Life-Cycle Assessment of Electricity Generation Systems and Applications for Climate Change Policy Analysis," Paul J. Meier, University of Wisconsin-Madison, August 2002.

30 Year Land Use Comparison

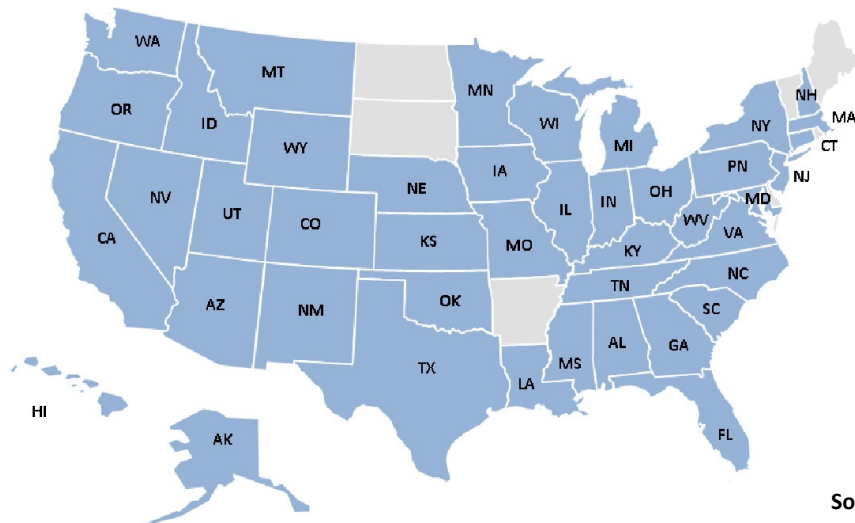


Source: GEA

5. Geothermal is Increasing U.S. Exports Abroad

The U.S. geothermal industry considers itself the world leader in geothermal energy technology. The U.S. has over 3,000 MW installed geothermal capacity – more than any other country in the world – and this number will continue to grow in the coming years. According to the Department of Commerce, geothermal is one of only two renewables that exports more than it imports in the United States. Geothermal equipment manufacturers and service providers exist in almost every state and are able to provide jobs in places like Kentucky or Oklahoma and then export their goods.

43 U.S. States had Vendors Supporting Geothermal Development in 2010



6. Geothermal Supports Local Economic Development

Since geothermal resources have to be cultivated locally, geothermal development brings significant economic advantages to local economies. Besides providing a variety of jobs to individuals in these areas, geothermal developers are often the largest taxpayers in the communities in which they produce geothermal energy. In addition to the economic development associated with plant construction and operations, many geothermal developers also voluntarily contribute to the local community. The Nevada Geothermal Council notes that Nevada's geothermal power plants pay sales & use tax, property tax, net proceeds of mine tax, modified business tax, bonus lease payments, royalties to the state and county, salaries and benefits to employees, and a range of local vendors for products and services.



Local employees at a CalEnergy US geothermal facility in Imperial Valley, California

"We're very excited to see the development of geothermal in Lake County. The job creation is huge for a rural area such as ours." Commissioner Brad Winters, Lake County, Oregon, about new geothermal development.



Photos (from left): sidewalk de-icing system; greenhouse heating at IFA Nurseries in Oregon; Champagne Pool, New Zealand

7. Geothermal is a Versatile Energy Resource

Geothermal is available everywhere in various forms. Geothermal power production, as discussed previously, provides reliable baseload power to the electricity grid and geothermal heat pumps are heating and cooling homes and businesses in all 50 U.S. states, and around the world. Geothermal energy can also be used for agricultural purposes in greenhouses, to de-ice sidewalks, for food dehydration, and in spas, among other applications. Plus, in many areas, natural geothermal systems are just plain cool to look at: Old Faithful, a natural geyser at Yellowstone National Park, is a huge tourist attraction.

8. Geothermal Makes Good Economic Sense

Geothermal projects produce energy for decades at stable, affordable prices. Viewed in terms of life cycle costs, geothermal power is economically attractive, providing the lowest cost renewable power and providing long-term fixed power prices. This also reduces price volatility, helping to avoid price spikes and energy crises, which can impose severe economic penalties on business and local communities. Also, in some localities, development of geothermal energy can free up more portable and valuable resources for higher-markup export to other markets or



Enel's Stillwater geothermal power plant, Churchill County, Nevada. Photo courtesy Enel North America.

overseas. For example, there is no global commodity market for the hot brine used for geothermal energy production, so its use can allow a locality or national economy to export portable energy fuels – gas, oil, coal, biomass – that are readily marketable elsewhere. It also works in reverse: intensive use of geothermal energy in isolated or island settings can avoid the need to import high-cost fuels from other locations.

9. Geothermal Uses Humanly Approachable Technology



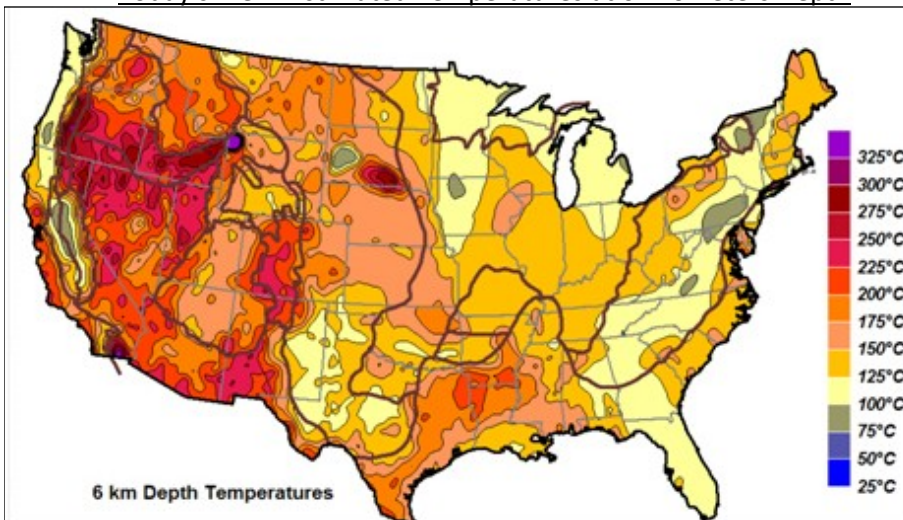
Workers at Oserian Development Company in Kenya

Sometimes engineers joke that today's advanced geothermal plants are at the cutting edge of late 19th Century technology. Now that the laughter has died down, we can appreciate that there's some useful truth to how straightforward a geothermal power plant really is. While geothermal plant and resource system technology is state-of-the-art, it is accessible to locally trained operators and can be understood and maintained by local workers. Geothermal plants empower operators to become experts in plant function and maintenance, providing communities access to state-of-the-art technology. The mystery to geothermal energy is the enormous resource that the heat of the earth represents for us to learn to use to meet our energy needs.

10. Geothermal Energy is Widely Available

The heat of the earth is available everywhere. Our ability to utilize geothermal energy is more a question of whether we have the technology to tap this expansive resource. Today, heat can be tapped for heating homes and businesses with geothermal heat pumps nearly everywhere in the U.S., and around the world. Hotter resources are needed for power production, and as technology develops, the areas where power production is economical will expand. In 2011, geothermal power projects were under development in nearly one-third of the U.S. But, as the heat flow map below shows, at a depth of 6km there is enough heat available to provide power from coast-to-coast.

Today's View: Estimated Temperatures at 6 Kilometers Depth



Heat flow map courtesy of SMU Geothermal Laboratory

States with Capacity Online vs. in Development

Geothermal Installed Capacity, 2010



Geothermal Capacity in Development, 2011



Source: GEA



For more information visit www.geo-energy.org.

Do you support geothermal? Join GEA today.

At GEA, we represent companies and organizations that are part of the fast-growing geothermal energy industry. We embody a wide variety of members ranging from industry developers to investors and other supporters. We are interested in providing our members with the most up-to-date information on what is going on in the geothermal industry today and the factors that are shaping the industry for tomorrow. Your participation is critical as we endeavor to expand the use of this clean, renewable, and sustainable energy source. Geothermal has the potential to preserve the environment, create jobs, and change lives across the United States and around the world. GEA members are easily recognized as a pioneers in a renewable energy field that is gaining new interest at unprecedented rates.

For more details, visit www.geo-energy.org/become_member.aspx.

Students and Individuals: Be recognized through GEA's Geothermal Web.

The goal of GEA's Geothermal Web is to connect and recognize companies and individuals who use and support geothermal energy, a renewable and sustainable energy source used throughout the U.S. today. It creates a networking opportunity for supporters and functions as a public database. Geothermal Web supporters are easily identified by the general public for their role in promoting the expanded development and use of geothermal energy. By joining the Geothermal Web, supporters are ambassadors of geothermal energy and encourage others in local communities and the nation to adopt greener practices themselves. **Find out more at www.geothermalweb.org.**



About the Geothermal Energy Association:

The Geothermal Energy Association (GEA) is a trade association composed of U.S. companies and organizations that support the expanded use of geothermal energy and are developing geothermal resources worldwide for electrical power generation and direct-heat uses. GEA encourages research and development to improve geothermal technologies, presents industry views to governmental organizations, provides assistance for the export of geothermal goods and services, compiles statistical data about the geothermal industry, provides a forum for the industry to discuss issues and problems, conducts education and outreach projects, and advocates for public policies that will promote the development and utilization of geothermal resources. For more information, please visit <http://www.geo-energy.org/>. Check out GEA's [YouTube Channel](#). Follow GEA on [Twitter](#). Become a fan on [Facebook](#).