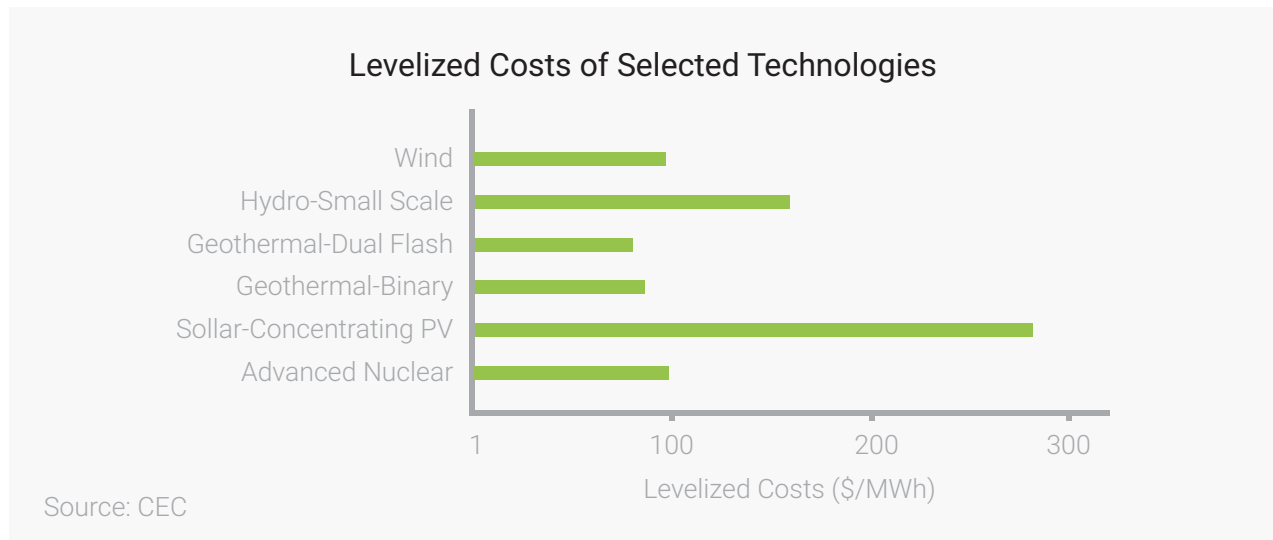


Geothermal Basics

1. How much does a geothermal power plant cost?

According to studies, an economically competitive geothermal power plant can cost as low as \$3400 per kilowatt installed. (1) While the cost of a new geothermal power plant is higher than that of a comparable natural gas facility, in the long run the two are similar over time. This is because natural gas construction costs account for only one third of the total price of the facility, while the cost of the fuel at a natural gas facility represents two thirds of the cost. The initial construction costs of a geothermal facility, in contrast, represent two thirds or more of total costs. So although initial investment is high for geothermal, natural gas and geothermal are still economically comparable over a long term.

Figure 27: Levelized Costs of Selected Technologies



2. How much does power from a geothermal power plant cost?

California Energy Commission (CEC) 2007 estimates place the levelized (2) generation costs for a 50 MW geothermal binary plant at \$92 per megawatt hour (3) and for a 50 MW dual flash geothermal plant at \$88 per megawatt hour, which over the lifetime of the plant can be competitive with a variety of technologies, including natural gas. (4) According to the CEC report, natural gas costs \$101 per megawatt hour for a 500 MW combined cycle power plant and \$586 per megawatt hour for a 100 MW simple cycle plant. On average the cost for new geothermal projects ranged from 6 to 8 cents per kilowatt hour according to a 2006 report, including the production tax credit. (5) But, it should be noted that the cost for individual geothermal projects can vary significantly based upon a series of factors discussed below, and that costs for all power projects change over time with economic conditions.

"However, it must be remembered that a major impact on geothermal power cost is the local, regional, national, and global competition for commodities such as steel, cement, and construction equipment. Geothermal power is competing against other renewable and non-renewable power development, building construction, road and infrastructure improvements, and all other projects that use the same

commodities and services. Until equipment and plant inventories rise to meet the increase in demand for these commodities and services, project developers can expect the costs to rise well above the background inflation level." (6)

3. Does the price of geothermal power fluctuate like the price of oil and gas?

No. Geothermal energy acts as a price stabilizer that offsets U.S. dependence upon highly volatile fossil fuel power markets. This is because geothermal power does not need outside fuel to operate— geothermal relies on a constant source of free fuel. Geothermal is capital intensive, thus all of the fuel is essentially paid for upfront. However, once the power project is built, most of its power production costs are known and few market parameters can modify them.

4. What factors influence the cost of a geothermal power plant?

There are many factors that influence the cost of a geothermal power plant. In general, geothermal plants are affected by the cost of steel, other metals and labor, which are universal to the power industry. However, drilling costs may vary as well. Geothermal projects are site-specific, thus the costs to connect to the electric grid vary from project to project. Also, whether the project is the first in a particular area or reservoir impacts both risks and costs. The acquisition and leasing of land also varies, because to fully explore a geothermal resource a developer is required to lease the rights to 2,000 acres or more. Challenges to leasing and permitting vary from project to project; especially on federal lands.

These factors include:

- o Size of the plant
- o Power plant technology
- o Knowledge of the resource
- o Temperature of the resource
- o Chemistry of the geothermal water
- o Resource depth and permeability
- o Environmental policies
- o Tax incentives
- o Markets
- o Financing options and cost
- o Time delays

5. What else should I consider about the cost of geothermal power compared with other technologies?

A 1995 study estimates that costs of power generation would increase 17% for natural gas and 25% for coal if environmental costs were included. (7) These costs include land degradation, emissions of toxic chemicals and emissions, forced

extinction and destruction of animals and plants, and health impacts to humans. Even higher national security costs need to be factored in if the fuel, such as oil or natural gas, is imported. For more information about geothermal energy and the environment, visit <http://www.geo-energy.org/reports/Environmental%20Guide.pdf>.

6. Don't geothermal power plants cost a lot more than a gas or coal power plant?

Geothermal power plants are characterized by high capital investment for exploration, drilling wells, and plant installation, but low cost for operation and maintenance. In 2001, EPRI estimated that capital reimbursement and associated interest account for 65% of the total cost of geothermal power. (8) Capital costs of a combined cycle natural gas power plant, in contrast, only represents about 22% of the levelized cost of electricity produced from the plant, while the fossil fuel cost accounts for 67% . (9) However, geothermal plants have no fuel costs, and over a typical 30-year plant life the fuel costs for a natural gas or coal plant can represent twice their initial capital cost. Over the life of the plant, when you consider capital costs and total fuel costs, geothermal projects can be a sound investment.

7. How will the cost of geothermal energy compare to the cost of fossil fuel in the future?

Costs for geothermal generation at some facilities have decreased to half the original price per kilowatt hour of power in 1980 , compared to when the first independent geothermal plants were installed. (10) Their cost falling at a faster rate than coal over this same period. The current price for extensions onto existing projects can be competitive with polluting coal-fired plants. While geothermal's costs have steadily decreased throughout the years, those of natural gas have increased, often experiencing boom and bust type cycles that can negatively impact the economy.

California Energy Commission (CEC) analysis examines what it estimates are the cost of different technologies based upon "levelized cost" which includes both capital and fuel costs. Their study places geothermal energy at a lower levelized cost (\$/MWh) than many other types of merchant owned power plants including: Natural Gas Combined-Cycle, Wind, Biomass Combustion, Nuclear, Solar Thermal, and Photovoltaic. (11)

Many industry experts agree that geothermal is one of only a few alternative technologies that will compete economically with polluting technologies in the near term—even without considering the additional benefits of geothermal production.