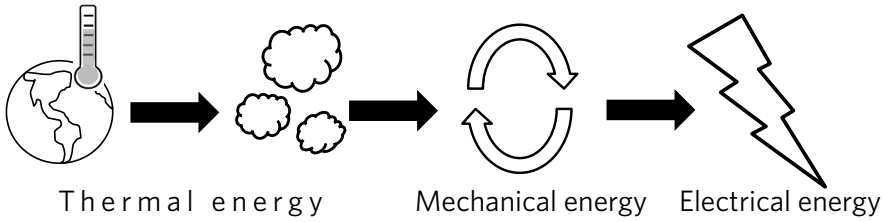
Geothermal Energy

How is electricity generated at a geothermal power plant? Well, it is often a lot like how electricity is generated at a coal-fired power plant, but with one key difference. In both cases, water is heated into steam, which turns a turbine connected to a generator. The generator converts the mechanical energy of the spinning turbine into electrical energy that can be transmitted to homes and buildings through transmission lines.

In a coal power plant, burning coal supplies the energy to heat the water. This process releases carbon dioxide—a powerful greenhouse gas that contributes to global warming and climate change—and other pollutants that can be harmful to the environment and human health into the atmosphere. But in a geothermal power plant, this energy comes from heat that is already present below the Earth's surface. Geothermal energy is a good energy option in places where there is hot magma close to the Earth's surface that naturally heats water in the ground into steam. In such places, geothermal energy is a constant and reliable source of energy.



Compared to coal and other fossil fuels, geothermal energy releases much less carbon dioxide into the atmosphere[1] and produces much less pollution. But geothermal energy isn't a good option everywhere. The best places for geothermal energy production are where there is a heat source, like magma, close to the Earth's surface, as well as a constant supply of water in the ground that can be heated into steam. Some water can be pumped back into the ground after it is used, but some of it evaporates into the atmosphere, so over time the water in the ground often needs to be replenished. During a drought, this can be an issue. Also, there is evidence that the pumping of water into and out of the ground associated with geothermal power can generate small earthquakes[2].

With geothermal energy, there is no fuel cost, since the fuel is naturally-occurring magma. However, upfront costs associated with building a new geothermal power plant and drilling wells to access the steam underground can be high[3].

1 National Renewable Energy Laboratory: Energy Analysis

2 University of California, Santa Cruz Newscenter: Geothermal power facility induces earthquakes, study finds

3 Geothermal Energy Association

Weighing the Benefits and Drawbacks of Geothermal Energy

For a complex problem, we need to evaluate how a solution fares across multiple dimensions:	Benefits	Drawbacks
Environmental Factors		
Social & Cultural Factors		
Economic Factors		

Exploring Energy

Weighing the Benefits and Drawbacks of Geothermal Energy

For a complex problem, we need to evaluate how a solution fares across multiple dimensions:	Benefits	Drawbacks
Environmental Factors	• Geothermal power plants produce less pollution and greenhouse gas emissions than coal-fired power plants.	• Pumping water into and out of the ground might induce small earthquakes around a geothermal power plant.
Social & Cultural Factors		
Economic Factors	• The 'fuel' for geothermal energy is free since it is naturally-occurring magma. • In places where geothermal energy is a viable option, it is a constant and reliable source of energy.	• Geothermal energy is location-specific and isn't an option where there isn't enough heat below the ground. • The initial costs associated with building a geothermal power plant and drilling steam wells can be high.

Additional resources

Learn about The Geysers geothermal power plant in California