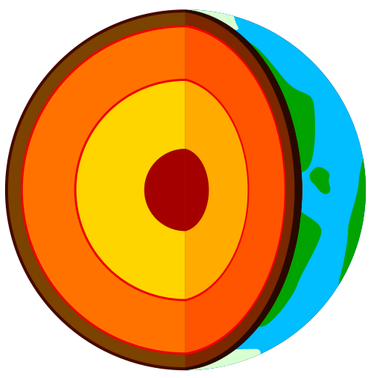
Geothermal

What Is It?

The interior of the Earth gives off heat primarily from radioactive decay. Geothermal energy harnesses this heat to generate electricity.



How Clean Is It?

Steam geothermal plants release just 26 pounds of carbon dioxide per million Btu, and binary-cycle geothermal plants release no carbon dioxide at all, making it cleaner than any carbon-based resource and certain renewables when accounting for manufacturing and disposal.

What Does It Cost?

Geothermal energy plants have high startup costs and require extensive geologic surveying, but operating costs are low, requiring no fuel costs. Geothermal energy typically costs 3-10 cents per kWh.

Space

Geothermal energy plants are fairly land efficient, and require no resource transportation or storage. However, they do require extensive geologic surveying and are only feasible in some locations. Much of the eastern United States is unfavorable for geothermal energy production, and geothermal power plants require some water resources to function.

How Does It Work?

1. Heat is generated under the surface of the earth by tectonic plate friction and radioactive decay of potassium, thorium, and uranium.
2. Heat from under the earth manifests itself in volcanoes, hot springs, and more.
3. Extensive surveying reveals a location where the heat from the earth can be harnessed by drilling deep wells.
4. A geothermal plant is constructed, and a geothermal fluid (usually water) is pumped down an injection well, where it will be heated in the geothermal zone.
5. Heated geothermal fluid (usually steam) is pumped back up into the plant through the production well, where it will be used to push a turbine or put through a heat exchanger.
6. Electricity is generated from the turbine, and the geothermal fluid is cooled to be pumped back into the injection well.

Point ⟷ Counterpoint

- Geothermal energy has very low carbon dioxide emissions. ⟷ Geothermal energy requires a large capital investment, including emission-causing requirements like concrete and deep drilling.
- Geothermal energy does not rely on commodities or fuel. ⟷ Geothermal energy can run out in 30-40 years in some locations.
- Geothermal energy has a small land footprint. ⟷ Geothermal energy is location dependent and requires extensive surveying.
- Geothermal has low maintenance costs once operation begins. ⟷ Initial investment in geothermal can carry significant costs, which can be prohibitive in some cases.
- Geothermal can provide base load power and in some cases can be dispatchable to dial up or down with demand. ⟷ Geothermal energy production in the United States has essentially remained unchanged since 2001, providing only half of one percent of the electricity to the grid.
- Geothermal energy requires no resource extraction, transportation, or storage. It is not reliant on supply chains or foreign resources. ⟷ Deep drilling can possibly lead to surface instability, including earthquakes. And while no material transport is needed, transmission lines to the grid are required for electricity.

Did You Know?

Natural hot springs have been used for thousands of years by cultures across the world, helping ancient humans in heating, bathing, and cooking.

What's Next?

Geothermal can provide constant base load power and is unaffected by weather. Production will likely increase as technology proliferates, and hydrocarbon wells could be repurposed into geothermal plants. Transferrable skills from the oil and gas sector (namely drilling) may enable a future transition.