



### What is Geothermal Power?

- Geothermal power is the generation of electrical power using geothermal energy. Geothermal energy is the heat generated from the natural decay of radioactive elements within the Earth's crust.
- Geothermal energy has been used for centuries and can be seen throughout history, such as hot springs for bathing and heating of homes. Only recently (20<sup>th</sup> Century) has geothermal energy been used to generate power, with the first geothermal power plant developed in Italy in 1904.

### Benefits of Geothermal Power

- Renewable and sustainable, with a low carbon footprint and much lower levels of pollution compared to fossil fuels.
- No fuel is required to operate the power plants.
- Provides both electrical power and heating for homes/offices.
- Consistent output of energy as it is not reliant of weather or sun light, with an estimated potential to provide up to 2 Terawatts of energy from the Geothermal power plants (Global electrical energy consumption was ~23 TWh in 2019). Reducing the need for conventional fossil fuel power plants which emit CO<sub>2</sub> and impact on climate change due to power generation.
- Small/compact power plant footprint compared with fossil fuel equivalent.
- Geothermal energy can provide a source of cost-effective electricity. The power generated from geothermal resources is one of the cheapest electricity sources available today.

### Limitation/cons of Geothermal Power

- Location specific – Geothermal power is one of the most location specific renewable energy sources. It is limited to countries which have tectonic fault lines within the Earth's crust for maximum potential (E.g. US, Iceland, Kenya and Indonesia)
- Large initial investment for exploration and drilling for geothermal resources. However, this is offset by the low running/maintenance cost becoming cheaper to run over a long operational time when compared with fossil fuel power generation.
- Similar to fracking, there is evidence which suggests that the drilling of wells can cause minor seismic activities and could potentially contaminate water sources.

### How is power generated using Geothermal energy?

Geothermal power plants work like fossil fuel power plants, where an energy source is used to vaporise a working fluid (normally water/steam) to drive a turbine/generator unit which generates electricity.

There are three types of geothermal power plants:

- **Dry Steam** – Steam is piped directly from underground wells to power plants to drive a turbine. These sources of underground steam are commonly located near geysers.
- **Flash Steam** – Wells are drilled into underground reservoirs of water with temperatures above 180°C. Due to the ground pressure in the well, the very hot water flows up through the pipes. This decreases the pressure and causes some of the hot water to boil (flash) off into steam. The steam is separated from the water and used to power a turbine and the remaining water/condensed water is pumped back into the reservoir to be reheated.
- **Binary Steam** – Utilises reservoirs of hot water (between 107°C to 182°C), to heat up and boil a working fluid (usually an organic compound) with a low boiling point in a heat exchanger. This vaporises the working fluid which is used to turn a turbine. The cooled water is pumped back into the ground to be reheated. The process is called binary as the two fluids are separate, never coming in direct contact so no contamination occurs.

### References/Further Reading

<https://www.power-technology.com/analysis/what-is-geothermal-energy/>

<https://www.lovegeothermal.org/explore/what-is-geothermal/>

[https://en.wikipedia.org/wiki/Induced\\_seismicity\\_in\\_Basel](https://en.wikipedia.org/wiki/Induced_seismicity_in_Basel)

<https://www.clean-energy-ideas.com/geothermal/geothermal-energy/geothermal-energy-pros-and-cons/>

<https://www.twi-global.com/technical-knowledge/faqs/geothermal-energy/pros-and-cons#WhataretheAdvantagesofUsingGeothermal>

<https://www.iea.org/reports/electricity-information-overview>