

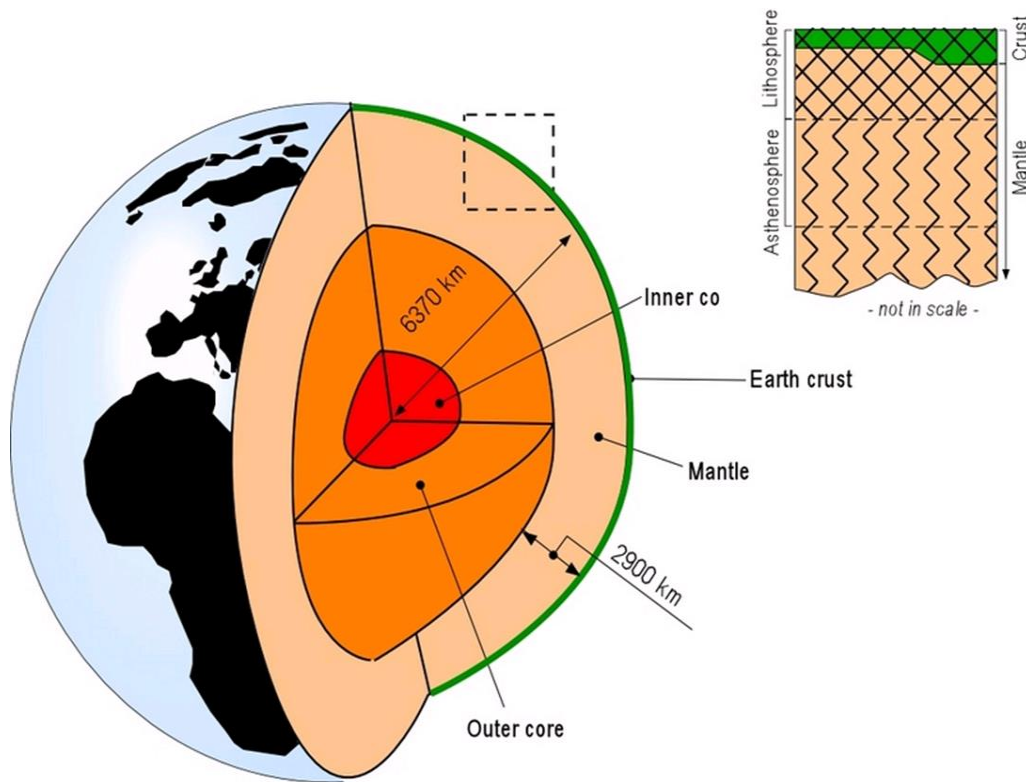
What is Geothermal Energy?

- Heat contained within the earth that creates geological phenomena on a planetary scale.
 - Plate Tectonics
- The part of the Earth's heat that can be exploited by mankind, to produce electricity and usable heat, is called geothermal energy.



Earth's Structure

- The earth can be divided into
 - the Crust
 - the Mantle
 - the Outer Core
 - the Inner Core
 - The layers of the earth before the core (within the mantle) can be divided due to their mechanical properties
 - Lithosphere
 - Asthenosphere
 - Mesosphere.



Geothermal Energy Production

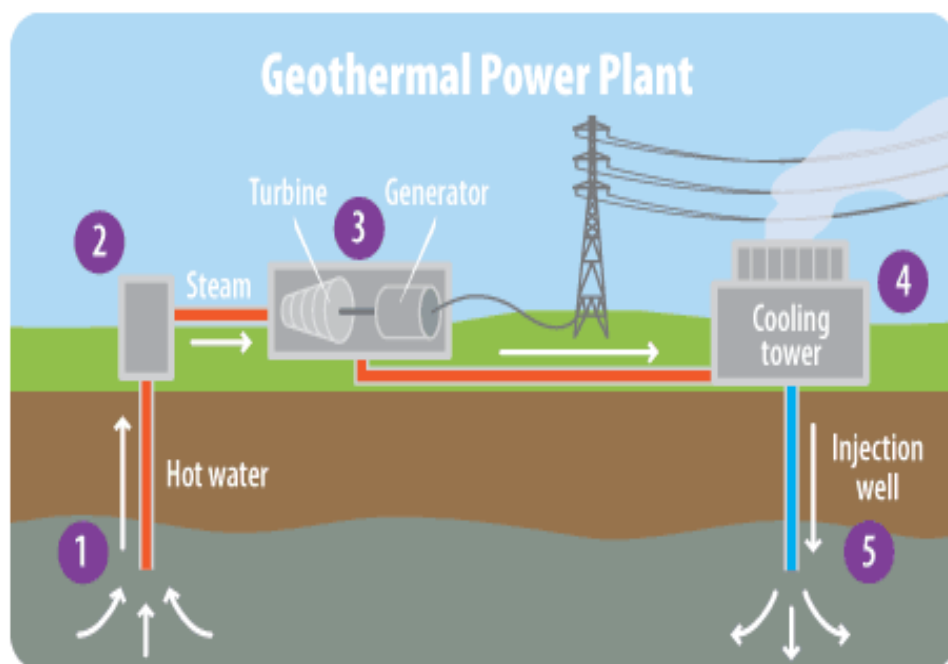
- Heat flows out of the earth due to the temperature difference between its inside and outside.
 - The centre of the earth is at about 6000°C
 - The average surface temperature is at about 15°C
- The heat is there for two reasons
 - When the earth formed the gravitational and kinetic energy associated with the process was transformed into heat.
 - Long lived radioactive isotopes give off heat as they decay and account for about half of the surface heat flow

Geothermal Energy Production

Engineer systems in two main ways

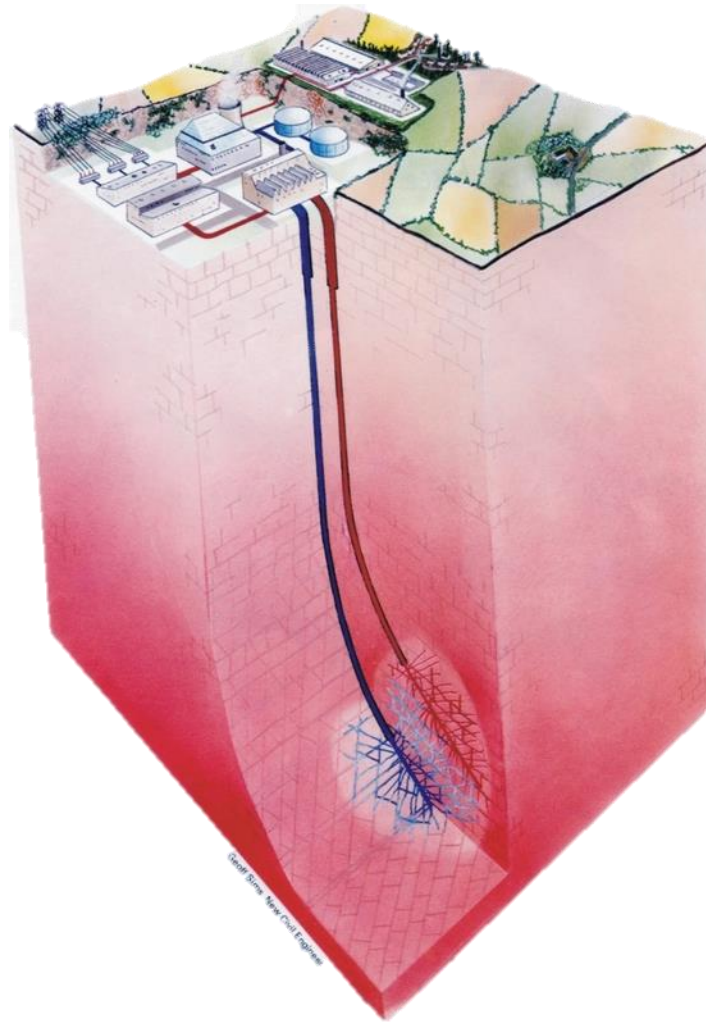
– Injection Wells

Hot fluid is uplifted to the surface, they get converted to the steam. Steam is used to produce electricity. Heat can also be imported. Water is cooled and finally injected to the subsurface again. Continuous process, therefore, Renewable.



-Hot Dry Rocks

- Exploits “dry” heat stored in rocks
- Cold water is pumped under pressure to the hot zone
- Hydraulic fracturing creates an aquifer. Drilling depth is lesser than injection wells
- Hot water is pumped to the surface. Process is repeated, therefore Renewable



Steam Turbine

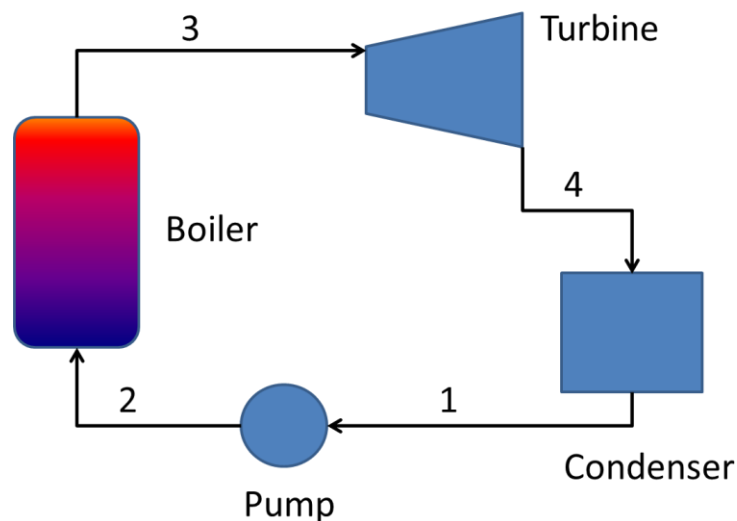
- The performance of a steam turbine system can be modelled as a heat engine using The Rankine Cycle
- It consists of 4 processes
 - Compression
 - Heating
 - Expansion
 - Condensation

Rankine Cycle

- **Process 1-2:** The working fluid is pumped from low to high pressure.
- **Process 2-3:** The high pressure liquid enters a boiler where it is heated at constant pressure by an external heat source to become a dry saturated vapour.
- **Process 3-4:** The dry saturated vapour expands through a turbine, generating power. This decreases the temperature and pressure of the vapour, and some condensation may occur.
- **Process 4-1:** The wet vapour then enters a condenser where it is condensed at a constant temperature to become a saturated liquid.

Rankine Cycle

The geothermal energy is produced by steam turbine, following the Rankine Cycle



Environmental Issues

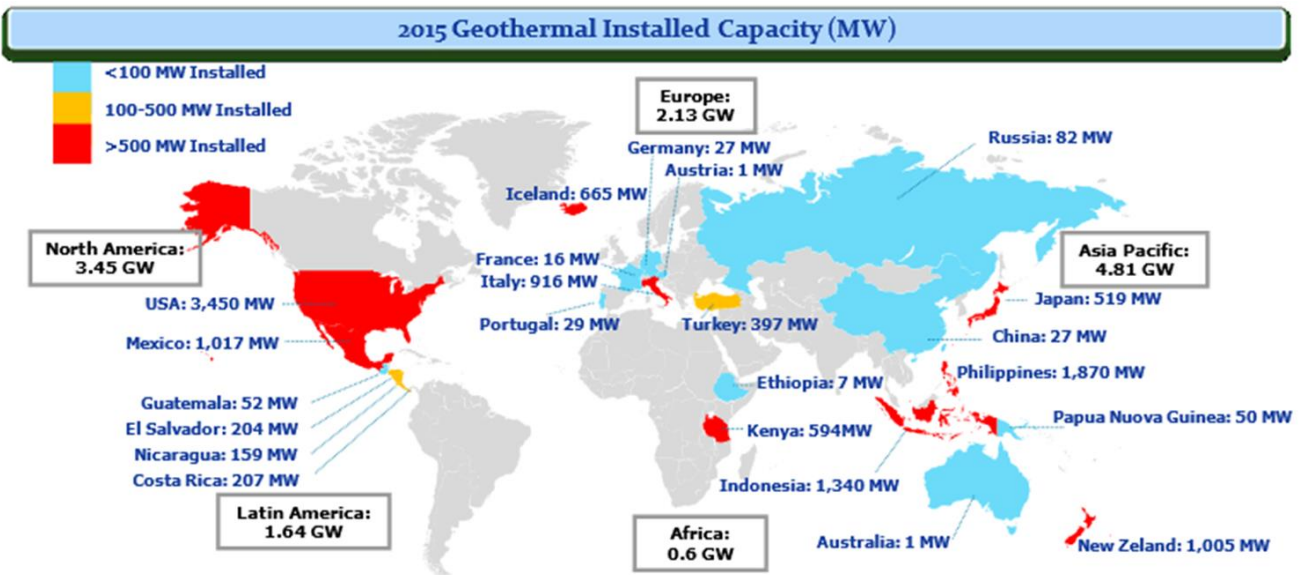
- Surface disturbances
- Physical effects of fluid withdrawal
- Noise
- Thermal effects
- Chemical pollution
- Biological effects
- Protection of natural features

Geothermal in The World

Hot Spring indicates good geothermal energy zones. It says about the magma intrusion, igneous rocks succession, heat conduction and suitability for geothermal energy. World's Geothermal hot regions are South or Central America, Indonesia, Phillipines, New Zealand mainly.



Geothermal in The World



Geothermal in The Bangladesh

Literally no prospect. The rock succession is completely sedimentary, therefore igneous rocks and magma intrusions are not available. There is a site at Labanakhya, 5 km north of Sitakund and 40 km from central Chittagong, which has a hot water spring. This site can be investigated more by geophysical surveys or Remote sensing.

