A CASE STUDY ON GEOTHERMAL ENERGY

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ABSTRACT: ***Geothermal energy is thermal energy generated and stored in the Earth. Thermal energy is the energy that determines the temperature of matter. The geothermal energy of the Earth's crust originates from the original formation of the planet and from radioactive decay of materialsGeothermal systems occur in a range of crustal settings. The emphasis of this review is on those occurring in regions of active or recently active volcanism, where magmatic heat at depths up to 8 km leads to convection of groundwater in the upper crust. Hot water (and steam) flows are controlled by the permeability of the crust and recent data have emphasised the dominance of secondary permeability, especially fractures. Drilling to depths of up to 3 km in these systems encounters near-neutral pH alkali chloride waters with temperatures up to about 350°C and chloride contents generally in the range 500 to 15,000 mg kg.***

Keyword: Radioactive, thermal, temperature, flash, electricity.

I. INTRODUCTION

The temperature at Earth's core measures close to 7200 degrees Fahrenheit. As you might imagine, such a high temperature can produce extraordinary amounts of sustainable energy and untold gigawatts of electricity.Technically speaking, geothermal energy is regarded as a renewable source of energy which can produce energy for a long as our planet exists. Geothermal heating and geothermal heat pump Lower temperature sources produce the energy equivalent of 100M BBL per year. Sources with temperatures of 30–150 °C are used without conversion to electricity as district heating, greenhouses,fisheries, mineral recovery, industrial process heating and bathing in 75 countries. Heat pumps extract energy from shallow sources at 10–20 °C in 43 countries for use in space heating and cooling. Home heating is the fastest-growing means of exploiting geothermal energy

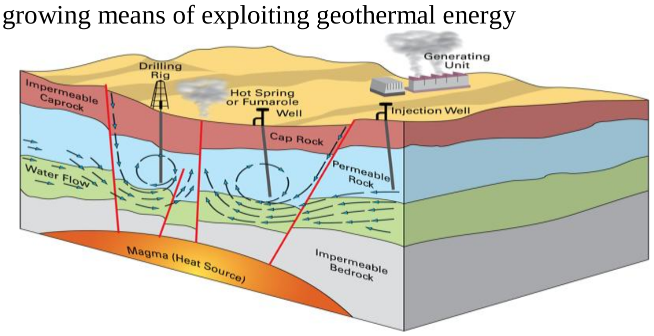

Fig.1. Geothermal energy.

II. GEOTHERMAL HEAT PUMP

Geothermal (ground-source) heat pumps have the largest energy use and installed capacity worldwide, accounting for 70.95% of the installed capacity and 55.30% of the annual energy use. The installed capacity is 49,898 MWt and the annual energy use is 325,028 TJ/yr, with a capacity factor of 0.21 (in the heating mode).

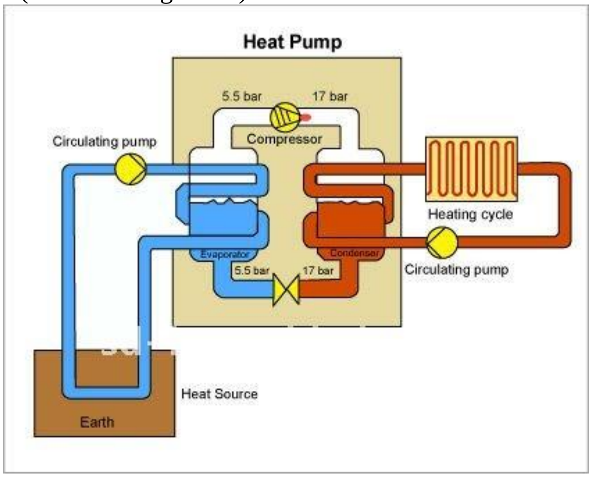

Fig.2.Geothermal heat pump

The net thermal efficiency of a heat pump should take into account the efficiency of electricity generation and transmission, typically about 30%.

III. GEOTHERMAL POWER PLANTS

Geothermal power plants runs by the use hydrothermal resources which have two common ingredients: water (hydro) and heat (thermal). Geothermal plants require high temperature (148.88 to 371.11degrees celsius) hydrothermal resources that may come from either dry steam wells or hot water wells. We can use these resources by drilling wells into the earth and piping the steam or hot water to the surface. Geothermal wells are one to two miles deep. Geothermal power plants have much in common with traditional power-generating stations. Geothermal power plants use many of the same components, including turbines, transformers, generator and some other standard power generating equipment as required. While there are three types of geothermal power plants.

A. Dry system power plants

Dry Steam Plants use hydrothermal fluids that have to be dry steam. The dry steam will be directed to a turbine, which drives a generator that produces electricity.

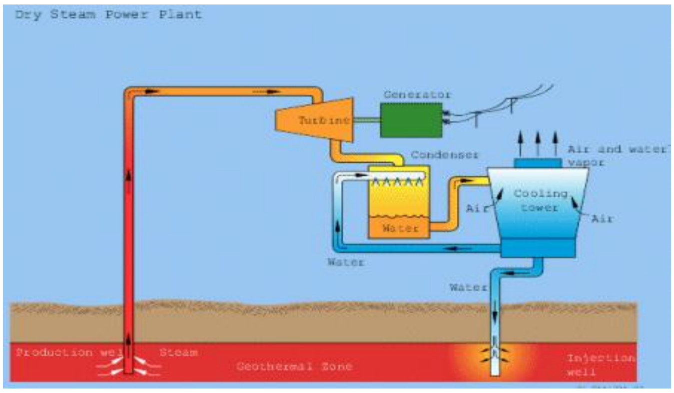

Fig.3. Dry system power plant.

B. Flash system power plants

Hydrothermal fluids above 182°C can be used in flash plants to produce electricity. Fluid is sprayed into a tank held at a much lower pressure than the fluid, causing some of the fluid to rapidly vaporize, or "flash". The vapour then drives a turbine, which drives a generator.

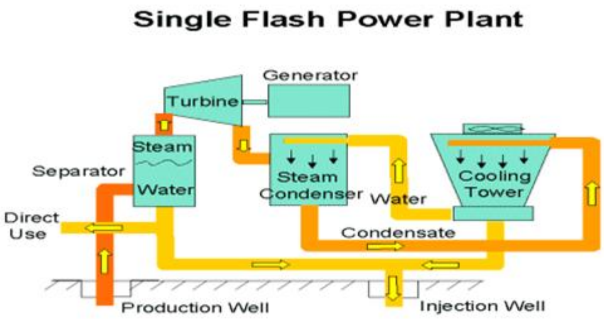

Fig.4. single flash power plant

C. Binary cycle power plants

Binary plants specifically use a second working fluid (hence, "binary") with a much lower boiling point than water. The binary fluid is operated through a conventional Rankine cycle.The binary cycle can operate with geothermal fluid temperatures ranging from 85°C to 170°C.

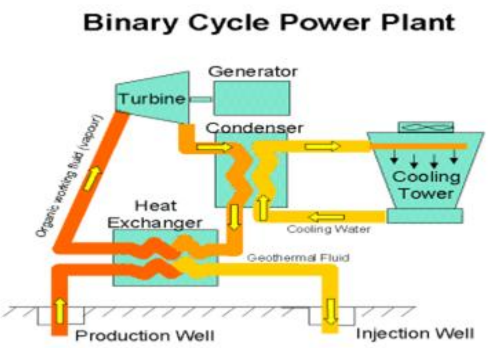

Fig5. Binary cycle power plant

IV. RESOURCES OF GEOTHERMAL ENERGY

The earth's heat content is about 1031 joules. This heat naturally flows to the surface by conduction at a rate of 44.2 terawatts (TW)and is replenished by radioactive decay at a rate of 30 TW.These power rates are more than double humanity's current energy consumption from primary sources, but most of this power is too diffuse (approximately 0.1 W/m2 on average) to be recoverable. The Earth's crust effectively acts as a thick insulating A geothermal heat pump can extract enough heat from shallow ground anywhere in the world to provide home heating, but industrial applications need the higher temperatures of deep resources.

V. RENEWABILITY AND SUSTAINABILITY

Geothermal power is considered to be renewable because any projected heat extraction is small compared to the Earth's heat content. The Earth has an internal heat content of 1031 joules (3·1015 TW·hr), Even though geothermal power is globally sustainable, extraction must still be monitored to avoid local depletion. Power plants and thermal applications of geothermal energy are mature technologies, whereas enhanced geothermal systems (EGS) projects are a new type of application.

VI. ENVIRONMENTAL IMPACTS

Fluids drawn from the deep earth carry a mixture of gases, notablycarbon dioxide (CO_2), hydrogen sulfide (H_2S), methane (CH_4),ammonia (NH_3) and radon (Rn). These pollutants contribute toglobal warming, acid rain, radiation and noxious smells if released.

VII. ADVANTAGES OF GEOTHERMAL ENERGY

- It is a renewable source of energy.
- By far, it is non-polluting and environment friendly.
- There is no wastage or generation of by-products.
- Geothermal energy can be used directly. In ancient times, people used this source of energy for heating homes, cooking, etc.
- Maintenance cost of geothermal power plants is very less.
- Geothermal power plants don't occupy too much space and thus help in protecting natural environment.
- Unlike solar energy, it is not dependent on the weather conditions.

VIII. DISADVANTAGES OF GEOTHERMAL ENERGY

- Only few sites have the potential of Geothermal Energy.
- Most of the sites, where geothermal energy is produced, are far from markets or cities, where it needs to be consumed.
- Total generation potential of this source is too small.
- There is always a danger of eruption of volcano.
- Installation cost of steam power plant is very high.
- There is no guarantee that the amount of energy which is produced will justify the capital expenditure and operations costs

IX. CONCLUSION

Geothermal energy is sustainable energy from nature,by means of earh's core.It is very important to study about gothermal energy because by getting information about geothermal energy we can reduce the uses of non-renewable energy.It has very advantages like low cost maintanance.It is not dependent upon weather. A geothermal heat pump or ground source heat pump (GSHP) is a central heating and/or cooling system that transfers heat to or from the ground.The heat pump was described by Lord Kelvin in 1853 and Peter Ritter von Rittinger developed it in 1855. Robert C. Webber built the first direct exchange ground-source heat pump in the late 1940s by experiment with freezer°C.

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