



GEOTHERMAL ENERGY

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ABSTRACT

This paper deals with the use of geothermal resources for production of electricity energy. Next is technologies of changes geothermal energy into electrical energy, future of geothermal energy and advantages and disadvantages of geothermal energy.

1. INTRODUCTION

Geothermal energy is energy from the heat of the earth's core. Geothermal energy isn't a renewable resource, because his origin is from earth's core, but assigned to between these resources. Geothermal energy is possible use for electricity generation, direct use of heat and ground source heat pumps. Direct use includes for heating buildings and greenhouse.

2. GEOTHERMAL RESOURCES

Understanding geothermal energy begins with an understanding of the source of this energy - the earth's internal heat. The Earth's temperature increases with depth, with the temperature at the center reaching more than 4200 °C (7600 °F) [1]. A portion of this heat is a relic of the planet's formation about 4.5 billion years ago, and a portion is generated by the continuing decay of radioactive isotopes [1]. Heat naturally moves from hotter to cooler regions, so Earth's heat flows from its interior toward the surface. is fed back into the transmission grid.

Because the geologic processes known as plate tectonics, the Earth's crust has been broken into 12 huge plates that move apart or push together at a rate of millimeters per year. Where two plates collide, one plate can thrust below the other, producing extraordinary phenomena such as ocean trenches or strong earthquakes. At great depth, just above the down going plate, temperatures become high enough to melt rock, forming magma [1]. Because magma is less dense than surrounding rocks, it moves up toward the earth's crust and carries heat from below. Sometimes magma rises to the surface through thin or fractured crust as lava.

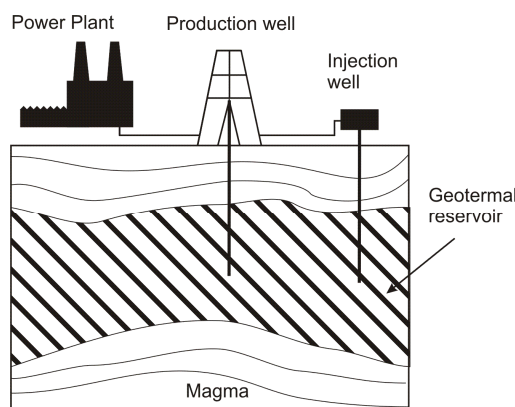


Fig.1. Schematic of geothermal power plant production and injection wells [1].

However, most magma remains below earth’s crust and heats the surrounding rocks and subterranean water. Some of this water comes all the way up to the surface through faults and cracks in the earth as hot springs or geysers. When this rising hot water and steam is trapped in permeable rocks under a layer of impermeable rocks, it is called a geothermal reservoir. These reservoirs are sources of geothermal energy that can potentially be tapped for electricity generation or direct use. Figure 1 is a schematic of a typical geothermal power plant showing the location of magma and a geothermal reservoir [2]. Here, the production well withdraws heated geothermal fluid, and the injection well returns cooled fluids to the reservoir.

3. RESOURCES IDENTIFICATION

Geological, hydrogeological, geophysical, and geochemical techniques are used to identify and quantify geothermal resources. Geological and hydrogeological studies involve mapping any hot springs or other surface thermal features and the identification of favorable geological structures. These studies are used to recommend where production wells can be drilled with the highest probability of tapping into the geothermal resource. Geophysical surveys are implemented to figure the shape, size, depth and other important characteristics of the deep geological structures by using the following parameters: temperature (thermal survey), electrical conductivity (electrical and electromagnetic methods), propagation velocity of elastic waves (seismic survey), density (gravity survey), and magnetic susceptibility (magnetic survey) [1]. Geochemical surveys (including isotope geochemistry) are a useful means of determining whether the geothermal system is water or vapor-dominated, of estimating the minimum temperature expected at depth, of estimating the homogeneity of the water supply and, of determining the source of recharge water.

Geothermal exploration addresses at least nine objectives [1]:

1. Identification of geothermal phenomena
2. Ascertaining that a useful geothermal production field exists
3. Estimation of the size of the resource
4. Classification of the geothermal field
5. Location of productive zones
6. Determination of the heat content of the fluids that will be discharged by the wells in the geothermal field
7. Compilation of a body of data against which the results of future monitoring can be viewed
8. Assessment of the pre-exploitation values of environmentally sensitive parameters
9. Determination of any characteristics that might cause problems during field development

4. CHANGES GEOTHERMAL ENERGY

Utility-scale geothermal power production employs three main technologies. These are known as dry steam, flash steam and binary cycle systems. The technology employed depends on the temperature and pressure of the geothermal reservoir. Unlike solar, wind, and hydro-based renewable power, geothermal power plant operation is independent of fluctuations in daily and seasonal weather.

4.1. Dry steam

Power plants using dry steam systems were the first type of geothermal power generation plants built. They use steam from the geothermal reservoir as it comes from wells and route it directly through turbine/generator units to produce electricity. An example of a dry steam generation operation is at the Geysers Region in northern California [3].

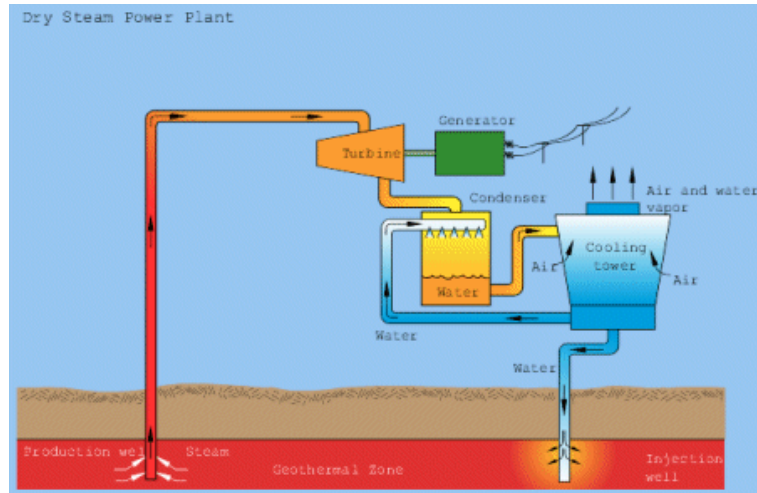


Fig.2. Schematic of the dry steam power plant [3].

4.2. Flash steam

Flash steam plants are the most common type of geothermal power generation plants in operation today. They use water at temperatures greater than 360°F (182°C) that is pumped under high pressure to the generation equipment at the surface. Upon reaching the generation equipment, the pressure is suddenly reduced, allowing some of the hot water to convert or “flash” into steam. This steam is then used to power the turbine/generator units to produce electricity. The remaining hot water not flashed into steam, and the water condensed from the steam, is generally pumped back into the reservoir. An example of an area using the flash steam operation is the CalEnergy Navy I flash geothermal power plant at the Coso geothermal field [3].

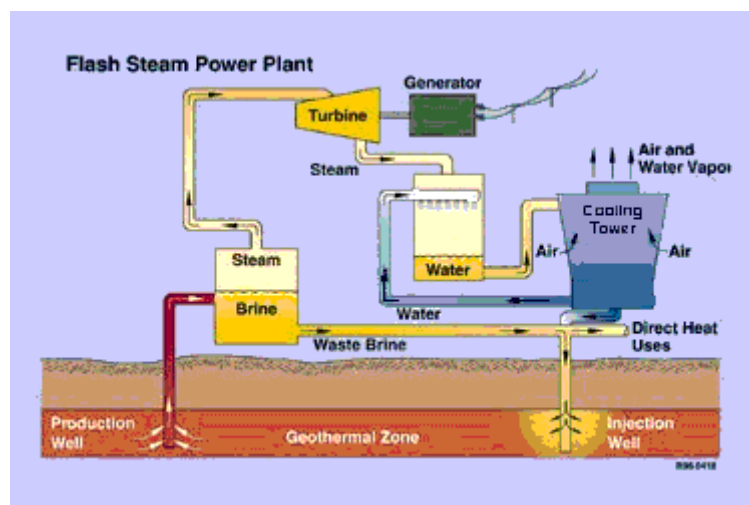


Fig.3. Schematic of the Flash steam power plant [3].

4.3. Binary Cycle

Binary cycle geothermal power generation plants differ from dry steam and flash steam systems because the water or steam from the geothermal reservoir never comes in contact with the turbine/generator units. In the binary system, the water from the geothermal reservoir is used to heat another “working fluid,” which is vaporized and used to turn the turbine/generator units. The geothermal water and the “working fluid” are each confined in separate circulating systems or “closed loops” and never come in contact with each other. The advantage of the binary cycle plant is that they can operate with lower temperature waters (225°F to 360°F) by using working fluids that have an even lower boiling point than water. They also produce no air emissions. An example of an area using a binary cycle power generation system is the Mammoth Pacific binary geothermal power plants at the Casa Diablo geothermal field [3].

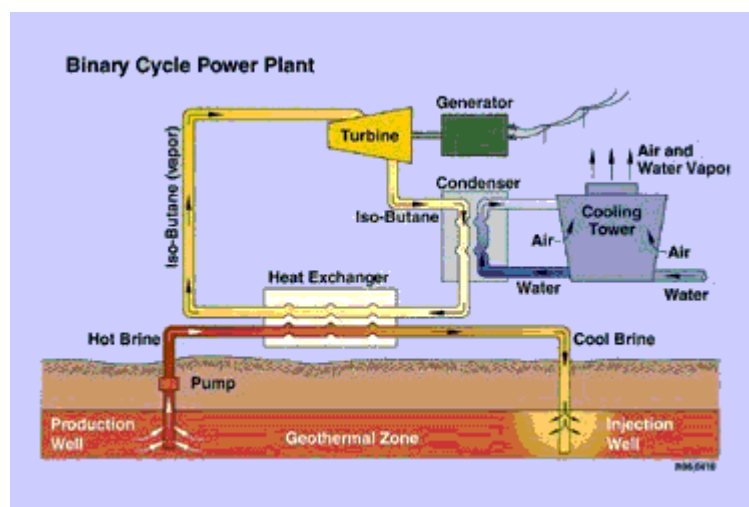


Fig.3. Schematic of the Due steam power plant [3].

5. FUTURE OF GEOTHERMAL ENERGY

Steam and hot water reservoirs are just a small part of the geothermal resource. The Earth's magma and hot dry rock will provide cheap, clean, and almost unlimited energy as soon as we develop the technology to use them. In the meantime, because they're so abundant, moderate-temperature sites running binary-cycle power plants will be the most common electricity producers. [4]

6. CONCLUSIONS

Geothermal energy has many advantages. Geothermal energy neither produces any pollution, nor does it add to the greenhouse effect. Besides, it does not need any fuel. Geothermal energy impacts soil very minimally since the cooler water is re-injected into the ground.

But geothermal energy has some disadvantages. Unfortunately, there aren't many places where you can set up a geothermal power station. Besides, hot rocks of a certain kind are needed that can go down a particular depth where they can be drilled. The earth may also throw up certain hazardous gases and minerals from underground that are difficult to dispose of.

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