thermal Energy

We all must have seen or heard about hot springs. These are a result of the Geothermal energy present inside the earth. In this article, we shall take a deeper look into it.

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What Is Geothermal Energy?

Geothermal energy is the thermal energy generated and **stored inside the Earth's crust**. The Earth's centre remains at the same temperature as the Sun, which is nearly constant due to the continuous process of nuclear fusion. Due to such high temperature and pressure, some rocks melt, resulting in the mantle's upward motion (as they become lighter with the heat). These molten rocks formed in the Earth's crust are pushed upward where they get trapped in certain regions called 'hot spots.' When underground water comes in contact with the hot spot, steam is generated. Sometimes this hot water-formed region finds outlets at the surface. When this hot water gushes out of one of these outlets, it is called hot springs.

Alternative Energy Sources

Alternative energy sources include those that do not consume fossil fuels. These are widely available and do not cause any undesirable consequences to the environment. Here is the list of major alternative energy sources.

- Hydroelectric Energy
- Solar Energy
- Wind Energy
- Biomass Energy
- Geothermal Energy
- Tidal Power

Hydroelectric Energy

The potential energy that is stored in the water is made to drive a water turbine that produces electricity. This kind of energy production is known as hydroelectric power. It is the most commonly adopted alternative energy source at the present time.

Solar Energy

This is the energy that is received from the Sun. It is the most promising alternative energy source and is bound to be available for centuries to mankind.

Wind Energy

The wind power is controlled by pushing the blades of the wind turbine that are connected to the electric generator to produce wind energy. It is an effective alternative source in fields where the wind velocity is high.

Biomass Energy

This energy is developed from the wastes of animals and humans that include by-products along with agricultural yields, municipal solid wastes, and the timber industry.

Geothermal Energy

It is the energy that is generated from the heat within the Earth. Hot rocks in the earth's core emit heat which generates steam and pressure and thus comes out of the earth's surface. This steam is used to run turbines and produce electricity.

Tidal Power

71% of Earth's surface is covered by water bodies which are mainly oceans. The tides in the water body fall and rise because of the moon and sun's gravity.

Geothermal gradient

A geothermal gradient is defined as the difference in the temperature between the core and the crust of the planet. The geothermal gradient is the driving force for the continuous conduction of thermal energy in the form of heat from the core to the surface. The temperature gradient may sometimes reach over 4000 °C.

Harnessing the Geothermal Energy

To harness geothermal energy, a hydrothermal convection system is used. In this process, a hole is drilled deep under the earth, through which a pipe is inserted. The steam trapped in the rocks is routed through this pipe to the earth's surface. This steam is then used to turn the blades of a turbine of an electric generator. In another method, the steam is used to heat water from an external source which is then used to rotate the turbine.

Applications of Geothermal Energy

Generation of electricity: Geothermal power plants are usually installed within a two-mile radius of the geothermal reserve. The steam from these reserves is either directly used to rotate the turbines of an electrical generator or is used to heat water which then produces steam for the process.

1. Farming: In cold countries, geothermal energy is used to heat greenhouses or to heat water that is used for irrigation.
2. Industry: Geothermal energy is used in industries for the purpose of food dehydration, milk pasteurizing, gold mining, etc.
3. Heating: Geothermal energy is used to heat buildings through district heating systems in which hot water through springs is directly transported to the buildings through pipelines.

Advantages of Geothermal Energy

- Renewable resource: Geothermal energy is free and abundant. The constant flow of heat from the Earth makes this resource inexhaustible and limitless to an estimated time span of 4 billion years.
- Green energy: Geothermal energy is non-polluting and environment-friendly as no harmful gases are evolved with the use of geothermal energy, unlike the use of fossil fuels. Also, no residue or by-product is generated.
- Generation of employment: Geothermal power plants are highly sophisticated and involve large-scale research before installation. This generates employment for skilled and unskilled labourers at a very large scale at each stage of production and management.
- Can be used directly: In cold countries, geothermal energy is used directly for the melting of ice on the roads, heating houses in winters, greenhouses, public baths, etc. Although the initial cost of installation is very high, the cost for maintenance and repair is negligible.

Disadvantages of Geothermal Energy

- Transportation and transmission: Unlike fossil fuels, geothermal energy cannot be transported easily. Once the tapped energy is harnessed, it can only be used efficiently in nearby areas. Also, with the transmission, there are chances of the emission of toxic gases getting released into the atmosphere.
- High installation cost: The installation of geothermal power plants to get steam from deep under the Earth requires a huge investment in terms of material and human resources.
- Intensive research required: Before setting up a plant, extensive research is required, as the sites can run out of steam over time due to a drop in the temperature due to excessive or irregular supply of inlet water.

- Limited to particular regions: The source of geothermal energy is available in limited regions, some of which are highly inaccessible, such as high-rise mountains and rocky terrains, which renders the process economically infeasible in many of the cases.
- Impact on the environment: Geothermal sites are present deep under the earth, so the process of drilling may result in the release of highly toxic gases into the environment near these sites, which sometimes prove fatal to the workforce involved in the process.