

Quadrant IV- Notes (Module- wise)

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Quadrants(notes):

Non-conventional Energy Sources: Geothermal Energy

What is Energy?

The term 'Energy' refers to the capacity or ability to do work. Kinetic energy, electrical energy, thermal energy, potential energy, chemical energy, nuclear energy, and other types of energy exist. All sources of energy are related to motion. Kinetic Energy, for example, is connected with any moving object or body.

Energy, according to the principle of conservation of energy, or the fundamental rule of thermodynamics, cannot be generated or destroyed, but can only be transformed from one form to another.

*There are two primary sources of energy: **Conventional sources of energy** and **Non-Conventional sources of energy**.*

Conventional Sources of energy- *The sources of energy that are in use for long periods of time by humans and once finished cannot be replaced quickly are called conventional sources of energy. For example Coal, petroleum, etc.*

Non-Conventional Sources of energy- *The sources of energy that are continuously replenished in nature and are widely available. They are called non-conventional because till now they are not used extensively in our daily life. These sources of energy also do not cause pollution. For example Solar energy from the sun, wind energy from the winds, tidal energy, Bio-gas, and so on.*

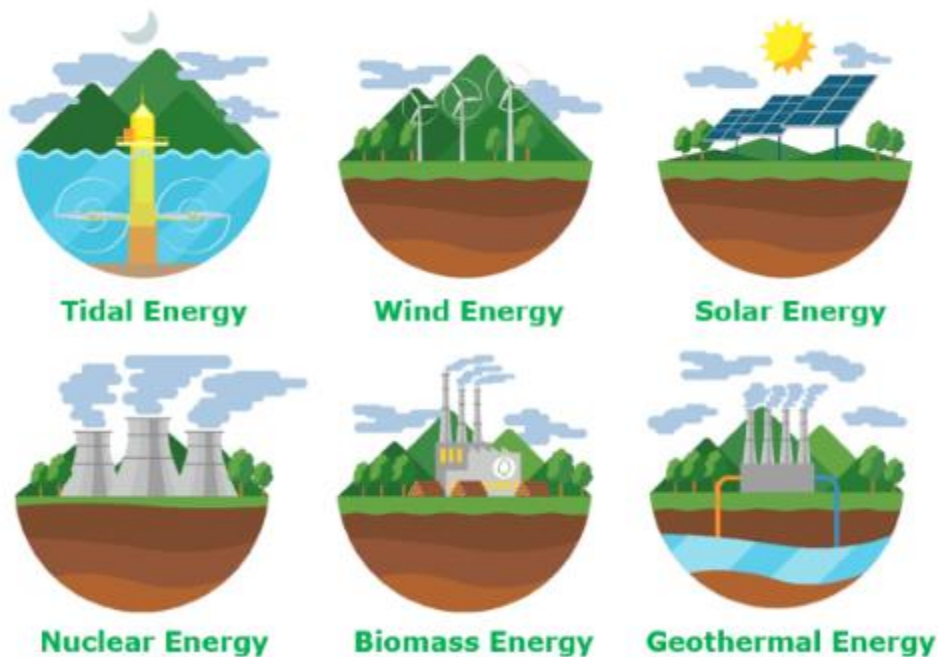
Let's discuss the Non-Conventional sources of energy more deeply as:

Non-Conventional Sources of Energy

The Sun is the ultimate source of energy on our planet and all other examples that are mentioned above are obtained either directly or indirectly from the sun. For example, the wind energy that we obtain from the winds and the winds are produced by the unequal heating of two different regions of the surface of the earth. Thus, we can use these sources of energy till our earth receives light from the sun, which is there for the next millions of years. This is also the reason why non-conventional sources of energy are also called **renewable sources of energy** as every day these energies are getting renewed in nature.

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Tidal, Wind, Solar, Nuclear, Biomass, and other natural resources geothermal energy, are referred to as “**non-conventional resources**.” Because they are pollution-free, we can use them to generate clean energy with minimal waste.

Furthermore, these energy sources are less expensive and do not contaminate the environment or natural surroundings. They are also known as renewable energy sources since they may be created or created through natural processes at a rate greater than or equal to the rate at which they are used.

Geo-thermal Energy

Geo-thermal energy is the heat energy possessed by the rocks inside the earth. The places where the rocks inside the hot is very hot are called hotspot.

Now, the heat of these rocks heats up the underground water and turns it into steam. This steam is extracted by drilling hole into the ground and connecting pipeline to rotate the turbine with the help of the steam and produce electricity for use.

In India, only one place is Madhya Pradesh has a hotspot . But in US there are a no. of geo-thermal power plants. The Pacific ring of fire is also a suitable spot for geo-thermal energy sites.

<https://www.geeksforgeeks.org/non-conventional-sources-of-energy/>

What is Geothermal Energy?

Geothermal energy is the thermal energy generated and **stored inside the Earth's crust**. The center of the Earth 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, which results in the upward motion of the mantle (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.

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.

Geothermal energy

In order to harness the 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 surface of the earth. 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

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

- 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 laborers at a very large scale at each stage of production and management.
- Can be used directly: In cold countries, the 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

- 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 the nearby areas. Also, with the transmission, there are chances of 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 a period of time due to a drop in the temperature as a result of 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.

<https://byjus.com/physics/geothermal-energy/>