FUELS

-BY
AVISHISHT GUPTA
00419011721
IIOT B1

Table of contents

INTRODUCTION

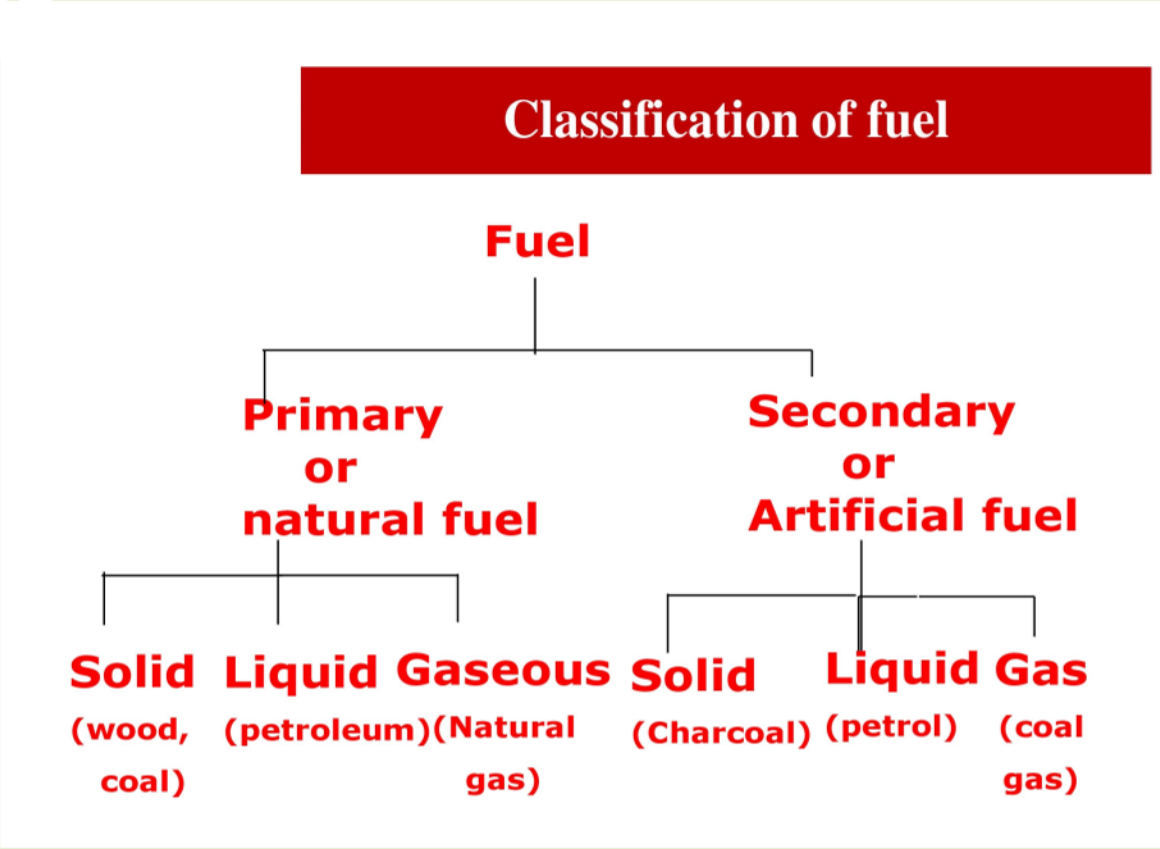
A fuel is any material that can be made to react with other substances so that it releases energy as thermal energy or to be used for work.

The concept was originally applied solely to those materials capable of releasing chemical energy but has since also been applied to other sources of heat energy, such as nuclear energy (via nuclear fission and nuclear fusion).

Calorific Values

- The *calorific value* is the total energy released as heat when a substance undergoes complete combustion with oxygen under standard conditions.
- The chemical reaction is typically a hydrocarbon or other organic molecule reacting with oxygen to form carbon dioxide and water and release heat.
- It may be expressed with the quantities:
  - energy/mole of fuel
  - energy/mass of fuel
  - energy/volume of the fuel

Classification of Fuels



Comparison between solid, liquid and gaseous fuels

Comparison of solid, liquid and gaseous fuel

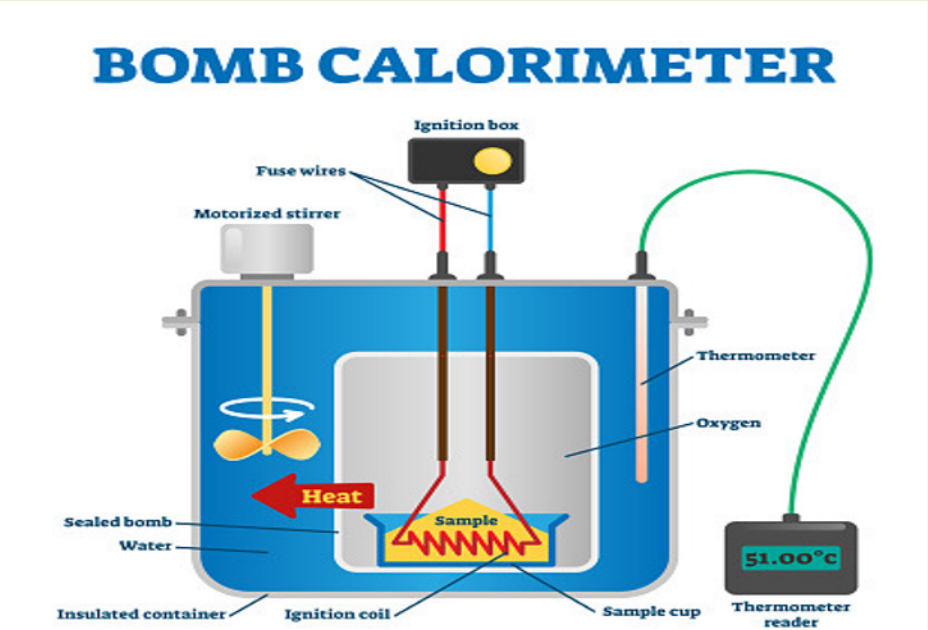
Solid fuel	Liquid fuel	Gaseous fuel
1. **Calorific value:** Their calorific value is low.	Their calorific value is high	Their calorific value is highest.
2. **Pollution:** Their ash content is high and they produces lot of smoke on burning.	Their ash content is low and they burn without smoke.	They are almost pollution free; they burn without smoke and ash less.
3. **Ignition temp and fire hazard:** Their possess moderate ignition temperature	Their ignition temp is low so there is a chance of fire hazard.	They have a very low ignition temp so they are highly inflammable and chances of fire hazard is highest.
4. **Cost:** Their production cost is low.	Cost is relatively higher than solid fuel.	They are more costly compare to solid and liquid fuel.

Comparison of solid, liquid and gaseous fuel

Solid fuel	Liquid fuel	Gaseous fuel
5. Transportation: They are easy to transport through normal carriage so cost is low.	They can be transported through pipelines hence it is more costly.	They can be conveyed through pipelines hence costly.
6. **Storage** Their storage needs lot of space but there is no risk.	Costly special storage tank is required for storing and safety precaution has to be taken to prevent fire hazard as most of them are highly inflammable and volatile	They can be compressed in cylinder so storage doesnot need lot of space. Safety precaution has to be taken to prevent fire hazard as they are highly inflammable and volatile.

Bomb Calorimeter

A thick-walled steel container used to determine the energy contained in a substance by measuring the heat generated during its combustion.



Wood-fuel

In many areas, wood is the most easily available form of fuel, requiring no tools in the case of picking up dead wood, or few tools, although as in any industry, specialized tools, such as skidders and hydraulic wood splitters, have been developed to mechanize production.

The discovery of how to make fire for the purpose of burning wood is regarded as one of humanity's most important advances.

Today, wood fuel can be used for cooking and heating, and occasionally for fueling steam engines and steam turbines that generate electricity. Wood may be used indoors in a furnace, stove, or fireplace, or outdoors in furnace, campfire, or bonfire.

Coal

Coal is a combustible black or brownish-black sedimentary rock, formed as rock strata called coal seams.

Coal is mostly carbon with variable amounts of other elements, chiefly hydrogen, sulfur, oxygen, and nitrogen.

Coal is primarily used as a fuel. While coal has been known and used for thousands of years, its usage was limited until the Industrial Revolution.
With the invention of the steam engine, coal consumption increased. In 2020 coal supplied about a quarter of the world's primary energy and over a third of its electricity.

TYPES OF ENERGY

01

SOLAR ENERGY

02

WIND ENERGY

03

BIOMASS POWER

04

HYDRO POWER

Non-conventional sources of Energy

Renewable energy sources, often known as non-conventional energy, are sources that are renewed by natural processes on a continual basis.

Solar energy, wind energy, bio-energy (bio-fuels cultivated sustainably), hydropower, and other sustainable energy sources are some examples.

A renewable energy system transforms energy from the sun, wind, falling water, sea waves, geothermal heat, or biomass into heat or electricity that humans can utilize.

The majority of renewable energy originates from the sun and wind, either directly or indirectly, and can never be depleted, which is why it is termed renewable.

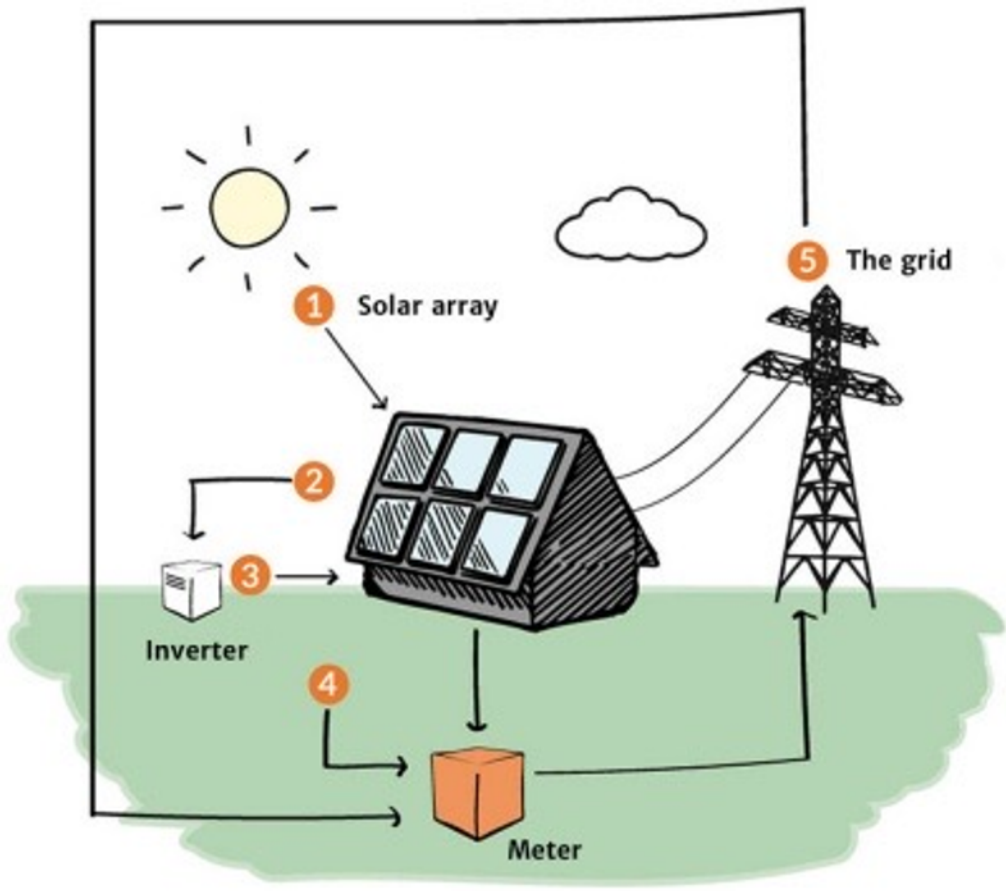
Solar Energy

Since prehistoric times, solar energy has been the most easily available and free source of energy.

Every year, solar energy estimated to be equivalent to approximately 15,000 times the world's annual commercial energy consumption reaches the planet.

Australia has the highest amount of solar power in the world, accounting for 9.9% of total electricity demand in 2020.
Solar thermal devices are utilized in residential and industrial solar water heaters, air warmers, solar cookers, and solar dryers.

Solar Energy



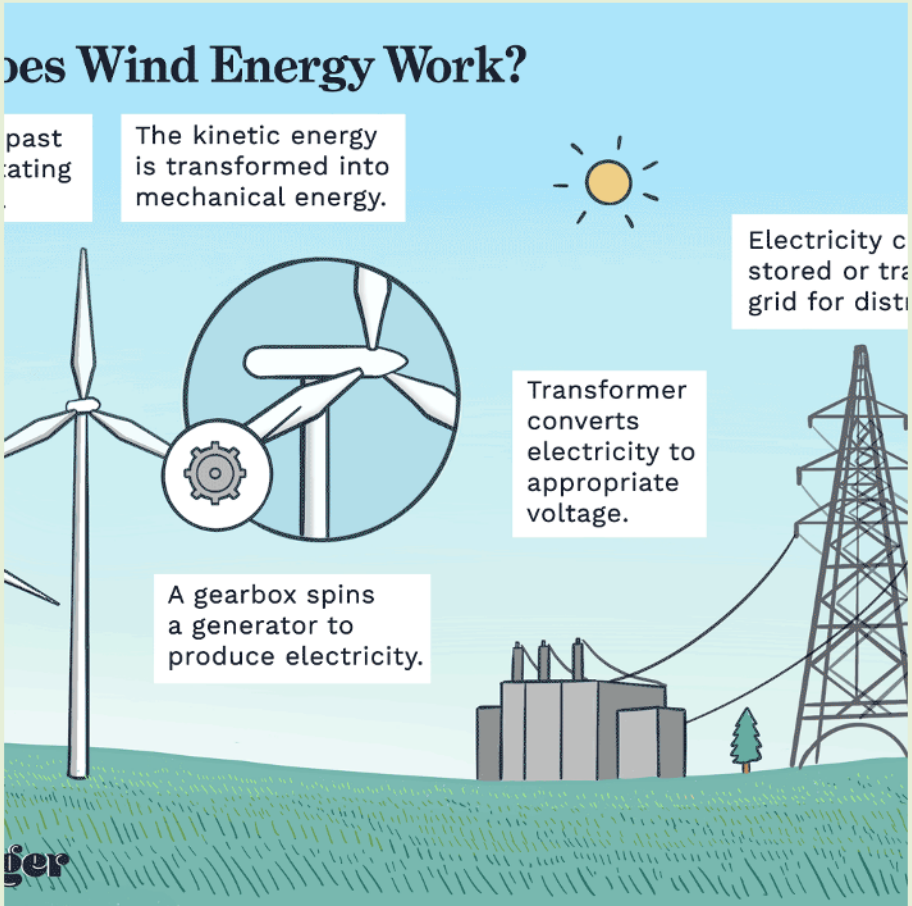
Wind Energy

Wind energy is the process of harnessing wind power to generate electricity.

The wind's kinetic energy is transformed into electrical energy. Winds are created as air moves from warmer to colder locations, and it is these airflows that are captured in windmills and wind turbines to generate electricity.

With a potential of 20,000 MW, *India has been identified as one of the most attractive countries for wind power development*. As of September 2001, the world's total installed capacity of wind power generators was 23270 MW.

Wind Energy


oes Wind Energy Work?
past
ating
The kinetic energy is transformed into mechanical energy.
Electricity c
stored or tra
grid for distı
Transformer converts electricity to appropriate voltage.
A gearbox spins a generator to produce electricity.
ger

Biomass Power

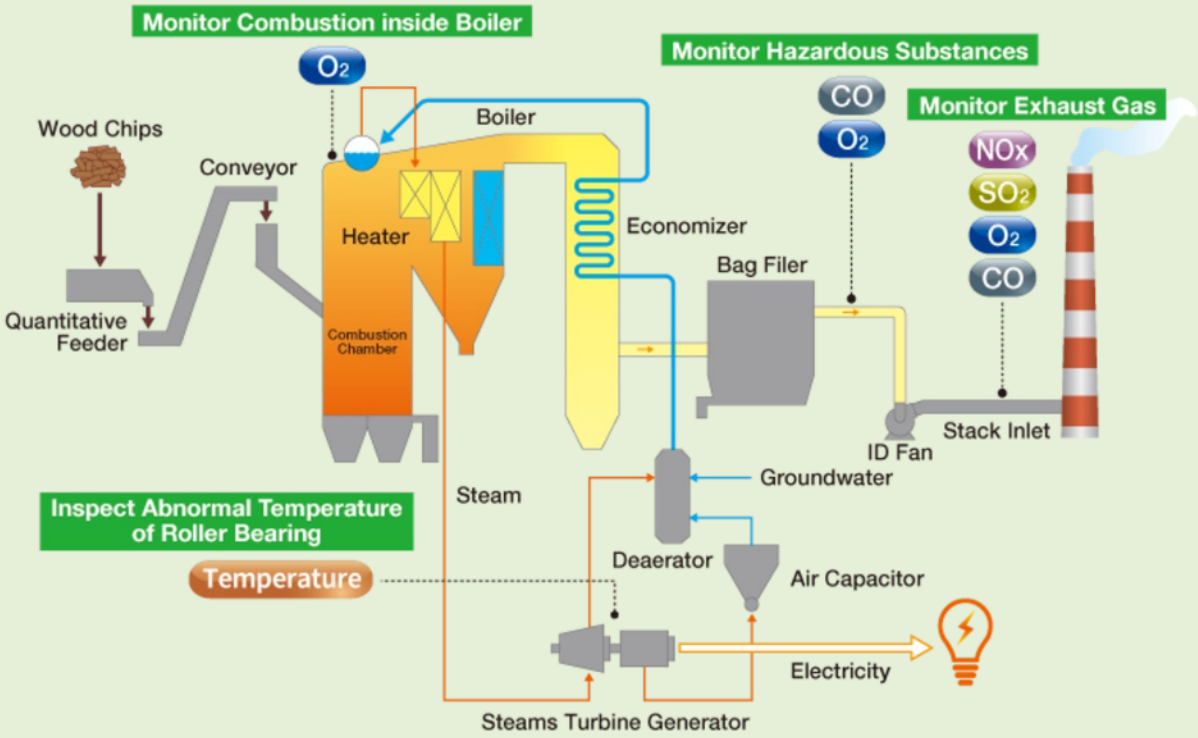
Biomass is a renewable energy source made up of carbon-based waste from human and natural activity.

It comes from a variety of places, including wood industry by-products, agricultural crops, forest raw material, domestic trash, and so on.

Biomass does not emit carbon dioxide into the atmosphere since it absorbs the same amount of carbon throughout its growth as it emits when burned.

Biomass, in the form of Biogas, has a better energy efficiency than direct burning. Biogas is a clean and efficient fuel made from cow dung, human waste, or any other biological substance that has been fermented anaerobically.

Biomass Power



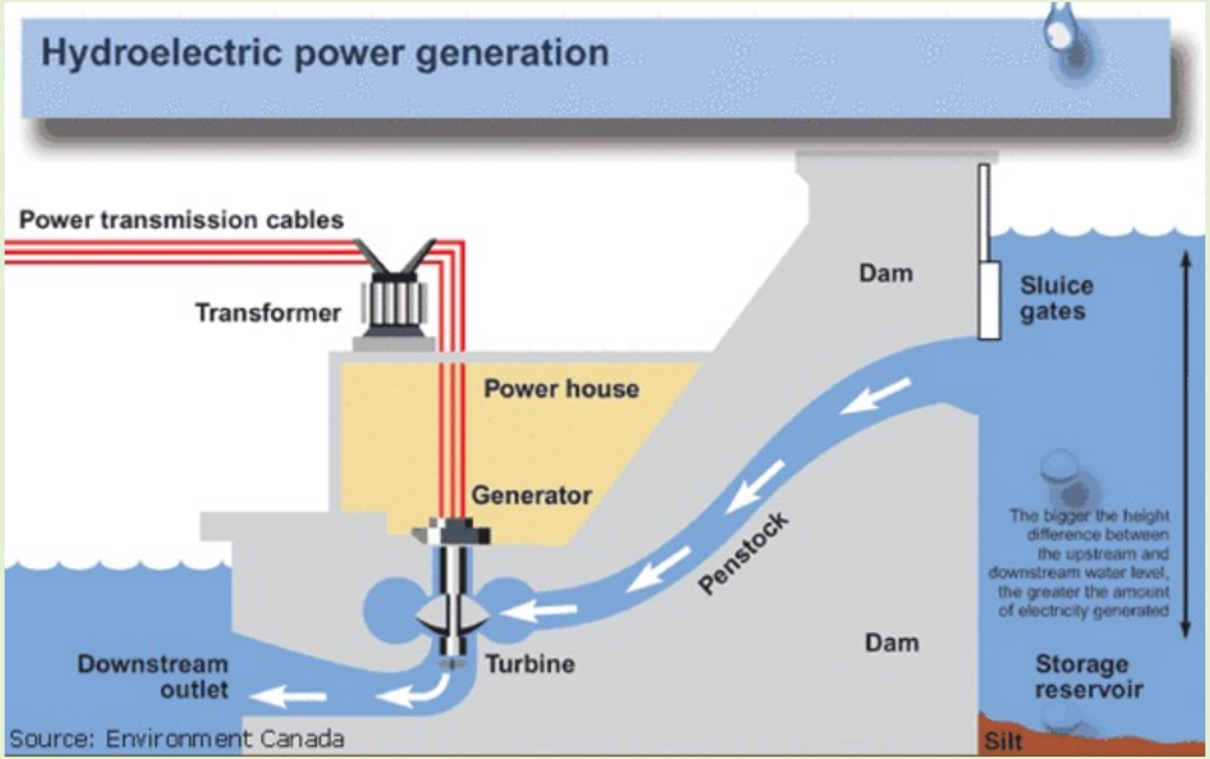
Hydropower

The commencement of the industrial revolution was driven by the potential energy of falling water, which was collected and transformed to mechanical energy by waterwheels.

A turbine spins because water under pressure flows through it. The Turbine is linked to a generator, which generates power.

The potential of small hydropower in India is estimated to be over 10,000 MW.

Hydropower


Hydroelectric power generation
Power transmission cables
Transformer
Power house
Generator
Penstock
Turbine
Downstream outlet
Dam
Sluice gates
Dam
The bigger the height difference between the upstream and downstream water level, the greater the amount of electricity generated
Storage reservoir
Silt
Source: Environment Canada

Ocean and Tidal Energy

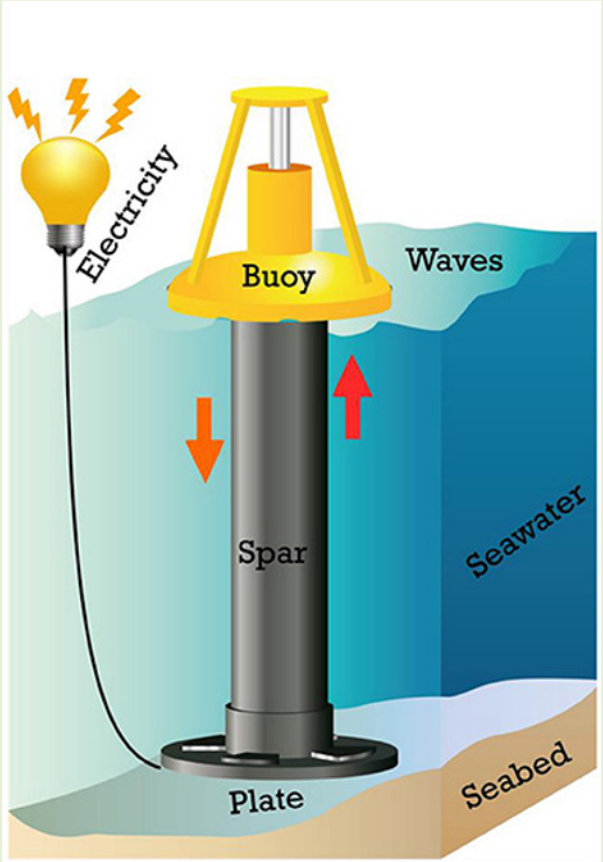
As with hydroelectric dams, the head of water is utilized to drive turbines that create energy from the raised water in the basin for tidal power generation. Barrages can be built to generate power on the ebb, flood, or both sides of the river.

For cost-effective operation and adequate head of water for the turbines, a tidal range of at least 7 m is necessary.

Ocean energy is derived from water waves, tides, and thermal energy (heat) stored in the ocean.

The sun warms the topwater far more than the deep ocean water, storing thermal energy in the process.

Ocean and Tidal Energy

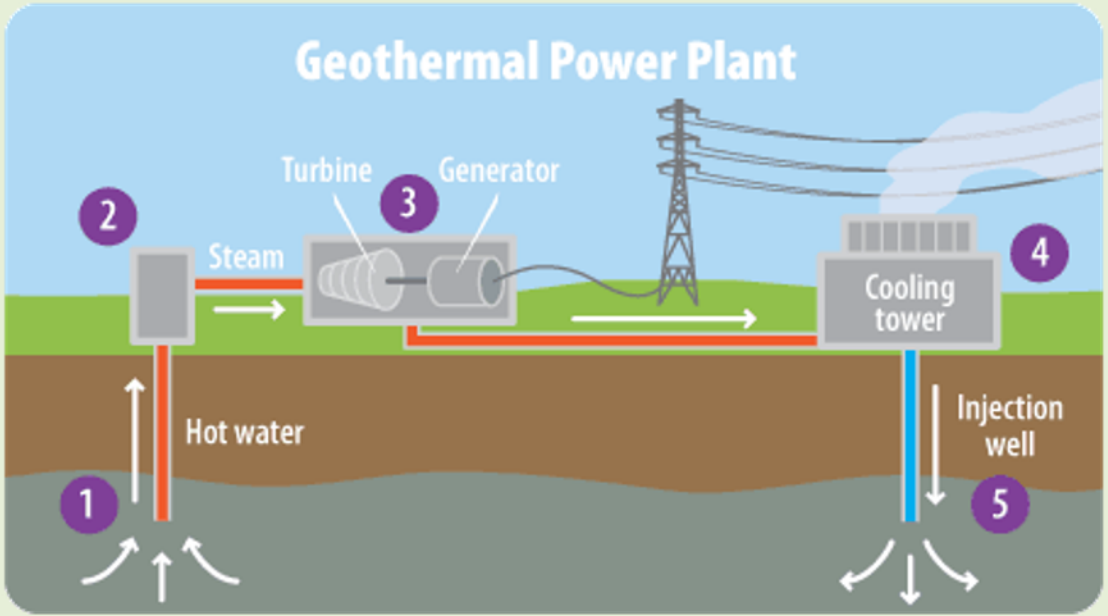


Geothermal Energy

It is a type of energy that comes from the earth. It is trapped in the Earth's crust at a depth of 10 km in the form of hot springs, geysers, and other natural phenomena.

The National Aerospace Laboratory in Bangalore has established a pilot project near Manikaran for research and development as well as data collection in order to construct larger geothermal power plants.

Geothermal Energy



Thanks!

Do you have any questions?

PPT MADE BY-

AVISHISHT GUPTA