



Introduction

This is a learning as well as an exam preparation video.

At the end of the video are practice assignments for you to attempt.

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Chapter 5: Sources of Energy

Chapter 5: Sources of Energy

Introduction

Energy comes in different forms and one form can be converted into another. A source of energy is one which provide adequate amount of energy in a convenient form over a long period of time.

Need of energy

For making food

For lightning

For transport

For running machines

For industrial activities and agricultural work

Chapter 5: Sources of Energy

Introduction

A source of energy provides adequate amount of energy over a long period of time.

Renewable source of energy

- They are inexhaustible.
- They are being produced continuously in nature.
- E.g. Wood

Non-Renewable source of energy

- They are exhaustible.
- They are not produced continuously in nature.
- E.g. Coal

Chapter 5: Sources of Energy

Introduction

A good source of energy would be one which would:

Do a large amount of work per unit volume or mass

Be easy to transport from one place to another

Be easily accessible

Be economical

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Introduction

The materials which can be burnt to produce heat energy are known as fuels. Wood, coal, petrol, kerosene etc. are fuels.

Sources of energy can also be categorised as conventional sources of energy and nonconventional sources of energy

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Conventional Sources of Energy

Conventional sources of energy are those energies that have been predominantly in use for the better part of civilization. They are non-renewable in nature, meaning that once a sample of conventional energy source is used up, it cannot be used again. The most extensive kind of conventional energy source is fossil fuels.

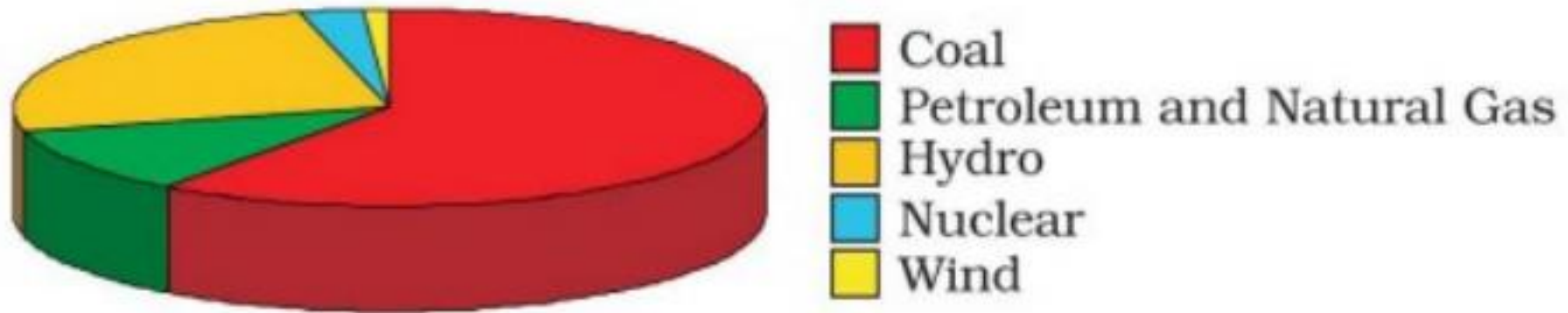
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Fossil Fuel

As the name suggests, fossil fuels are formed from the buried bodies of organisms by the natural phenomenon of anaerobic decomposition over thousands of years. Commonly used energy sources like petroleum, coal, natural gas and their derivatives such as kerosene, propane etc., are all examples of fossil fuels. Fossil fuels contain high percentages of carbon because they are derived from carbon-based organisms. The extensive consumption of fossil fuels is problematic for two reasons: The amount of pollution caused by fossil fuels is very hazardous to the health of the environment, and because fossil fuels are not consumed at a sustainable rate so they cannot be replaced as fast as they are getting used up.

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Fossil Fuel



Pie-chart showing the major sources of energy for our requirements in India

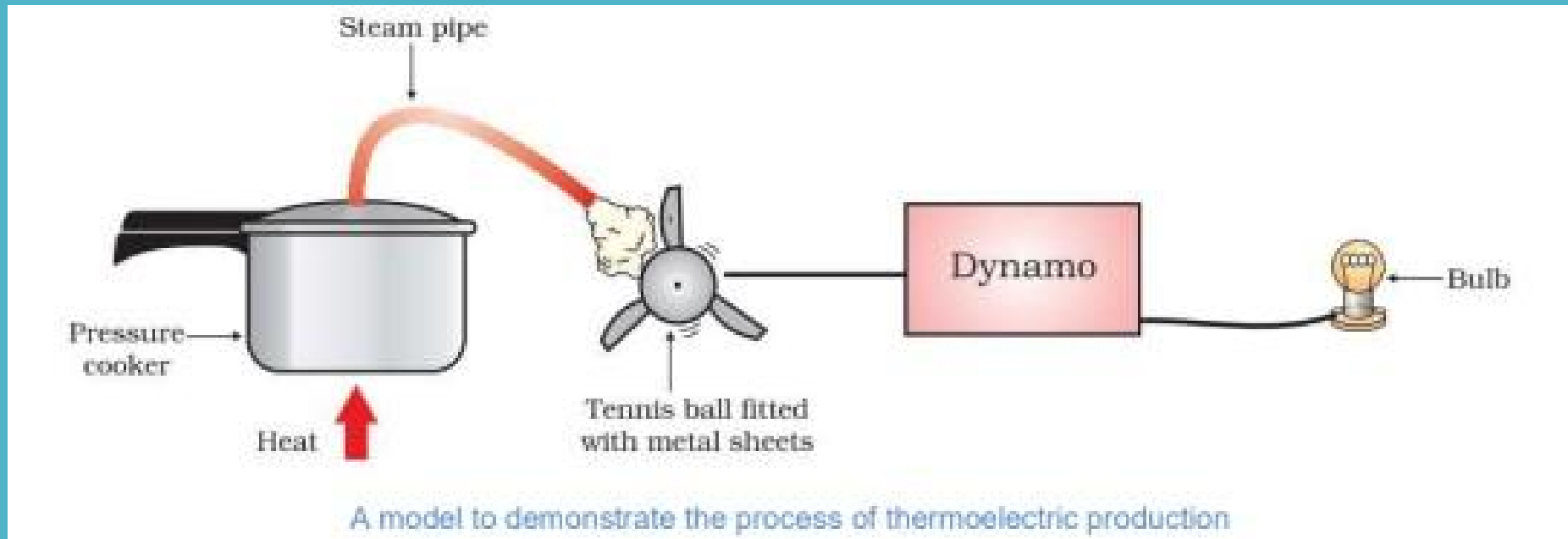
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Thermal Power Plant

Thermal power plant generate electrical energy from the combustion of coal and petroleum. Consider the world without electricity. Electricity is a fourth need of mankind. In today's life we cannot imagine the world without electricity. Daily requirement of electricity in India is approximately few billions unit. So this huge requirement of electricity led to increase the number of power stations. Power station converts chemical energy of fuel into electrical energy. Thermal power station works on fossil fuel. We can easily transport electrical energy than fuel.

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Thermal Power Plant



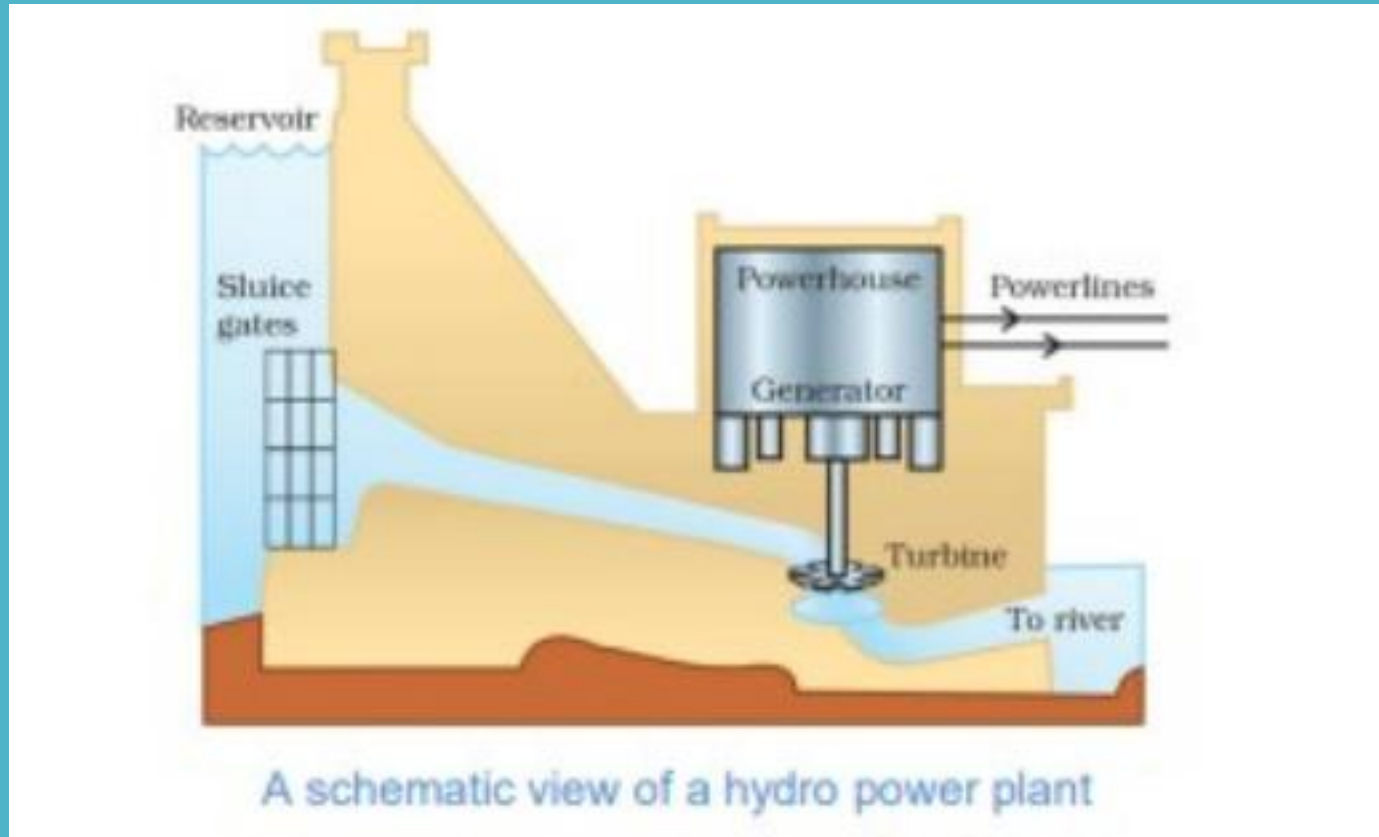
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Hydro Power Plants

The natural or artificial flow of water, even at a small rate, can be used to generate electricity. Though there are many types of hydropower, the most popular type and developed is hydroelectric dams and reservoirs. Hydroelectric dams are built atop rivers that have a decent flow of water. The natural flow of the river is then used to drive turbines that are connected to generators. When the turbines are rotated, electricity is produced by the generator, which is stored and then later transported for consumption.

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Hydro Power Plants



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Bio-Mass

Biomass is the source of energy derived from living things (organic matter). For a long time, we relied on wood for the source of heat energy. In India, we make fuel out of biowaste such as cow dung due to the availability of a thriving population of livestock.

When wood is burnt in a limited supply of oxygen and water until volatile materials are removed, the residue left behind is charcoal. Charcoal has good heat generating efficiency. It also burns without flames.

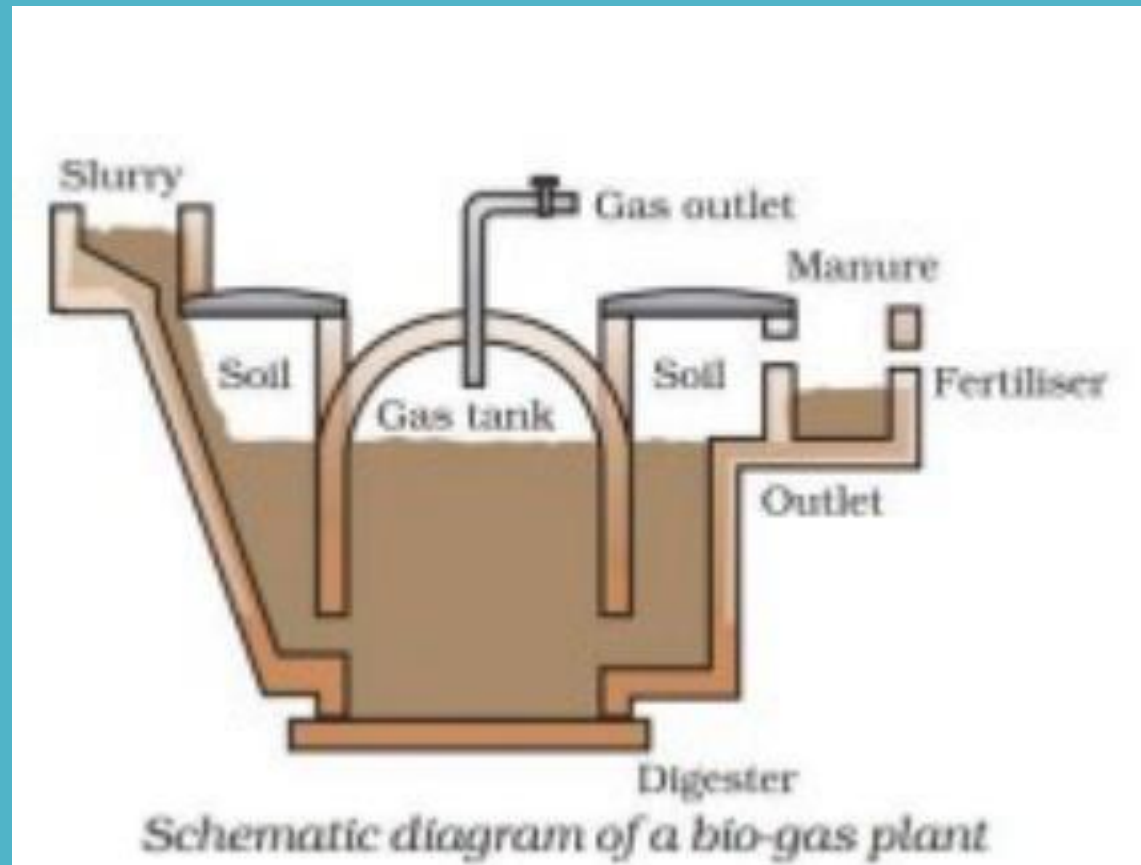
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Bio-Mass

Bio-gas plant: In India cow dung, sewage waste, plant matter are decomposed in absence of oxygen to produce biogas. Since it has cow dung it is often termed as gobar gas. A biogas plant is a dome-like structure built with bricks where cow dung and other biowaste are mixed with water to form a slurry and put into a digester. The digester is a sealed chamber with anaerobic bacteria which breaks down the slurry. This decomposition process releases gases like methane, CO₂, hydrogen sulfide and hydrogen. These gases are drawn via pipes which are transmitted to a turbine for the production of electricity.

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Bio-Mass



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Wind Energy

Moving air is called wind. The energy possessed by wind is due to its high speed (or motion). The wind possesses kinetic energy. Solar energy (or sun's energy) is responsible for the blowing of wind. Wind blows due to the uneven heating of earth by the sun in different regions.

The energy of wind is harnessed by using a windmill. A windmill consists of big sized, table fan like blades which are fixed over the top of a tall pole in such a way that they are free to rotate. When the fast moving wind strikes on the blades of windmill it makes them rotate continuously. The rotatory motion of the windmill is then used to do mechanical work through a shaft connected to the rotating blades.

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Wind Energy



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Non-Conventional Sources of Energy

Sources of energy which are not familiar to most people are known as non-conventional sources of energy.

The types of non-conventional sources of energy are

Solar Energy

Light energy and heat energy from the sun are known as solar energy. Sun has been radiating energy from the past 5 billion years and will continue to do so at the same rate for another 5 billion years or more. We must find ways to harness the energy with maximum efficiency, although only a small fraction of the solar energy reaches the earth's surface.

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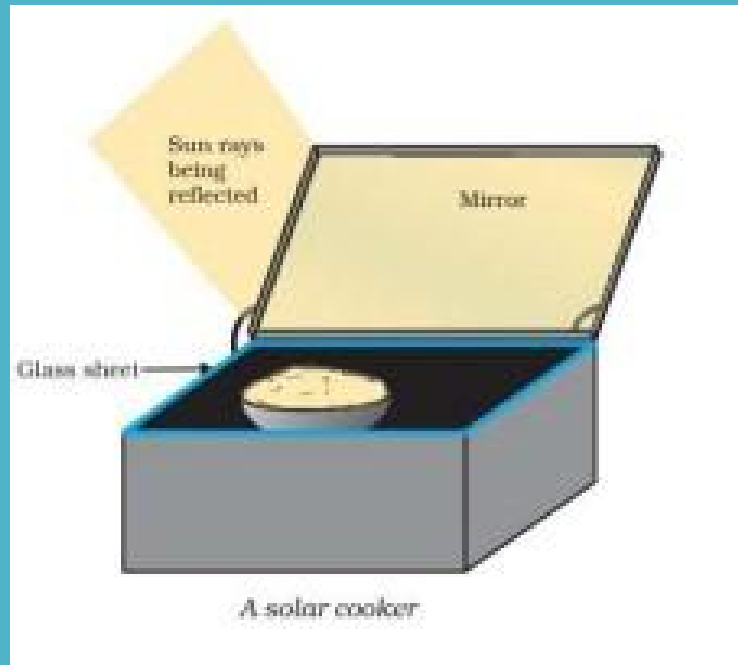
Solar Energy

- **The Sun is the most powerful source of radiation energy. It has been radiating energy for the past 5 billion years and will continue to do so for the next 5 billion years.**
- **India receives approximately 5000 trillion kWh of solar energy per year.**
- **The solar constant is the solar energy reaching unit area at the outer edge of the Earth's atmosphere exposed perpendicularly to the rays of the Sun at an average distance between the Earth and the sun. Its value is approximately equal to 1.4 kJ per second per m² or 1.4 kW/m².**

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Solar Energy

- A device which either uses solar energy directly as heat or converts it into electricity is called a solar energy device. For example, solar cooker, solar cell, solar water heater etc.



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Energy from the Sea

Tidal Energy

Due to the gravitational pull of mainly the moon on the spinning earth, the level of water in the sea rises and falls. This phenomenon is called high and low tides and the difference in sea-levels gives us tidal energy. Tidal energy is harnessed by constructing a dam across a narrow opening to the sea. A turbine fixed at the opening of the dam converts tidal energy to electricity. As you can guess, the locations where such dams can be built are limited.

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Energy from the Sea

Wave Energy

The kinetic energy possessed by huge waves near the seashore can be trapped in a similar manner to generate electricity. The waves are generated by strong winds blowing across the sea. Wave energy would be a viable proposition only where waves are very strong. A wide variety of devices have been developed to trap wave energy for rotation of turbine and production of electricity

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Energy from the Sea

Ocean Thermal Energy

The water at the surface of the sea or ocean is heated by the Sun while the water in deeper sections is relatively cold.

This difference in temperature is exploited to obtain energy in ocean-thermal-energy conversion plants. These plants can operate if the temperature difference between the water at the surface and water at depths up to 2 km is 20 K (20°C) or more. The warm surface-water is used to boil a volatile liquid like ammonia. The vapours of the liquid are then used to run the turbine of generator. The cold water from the depth of the ocean is pumped up and condense vapour again to liquid

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Energy from the Sea

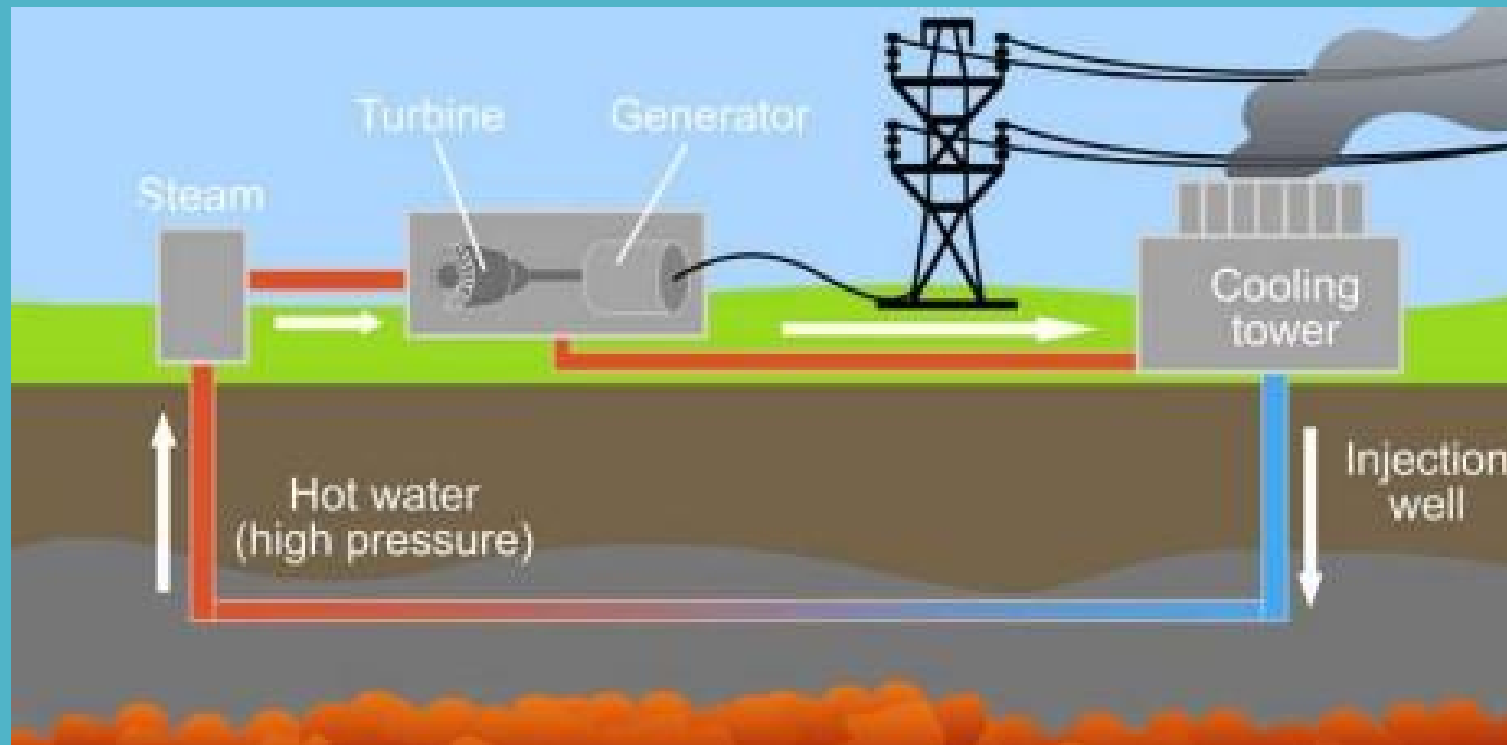
Geothermal Energy

- There is a huge amount of heat trapped inside the earth. Molten rocks from Earth's core sometimes come up due to geological changes and get trapped in hotspots. Harnessing this heat energy is called geothermal energy.
- Any underground water present gets heated due to the hotspots and gets converted to steam which escapes from the surface of the earth as hot springs.
- This steam is used to rotate turbines and generate electricity.

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Energy from the Sea

Geothermal Energy



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Energy from the Sea

Nuclear Energy

- The energy obtained from the nucleus of an atom is called nuclear energy.
- Nuclear fission is the phenomenon of splitting of an unstable nucleus of a heavy atom into two medium weight nuclei with the liberation of an enormous amount of energy.
- A nuclear reaction in which the particle which initiates the reaction is also produced during the reaction and it carries the reaction further is called a nuclear chain reaction.
- An uncontrolled nuclear chain reaction is the basis of the atom bomb and a controlled nuclear chain reaction is the basis of a nuclear power plant.

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Energy from the Sea

Nuclear Energy

- Nuclear fusion is the phenomenon of combining two or more lighter nuclei to form a more stable heavy nucleus with the liberation of a large amount of energy.
- Uncontrolled nuclear fusion is the basis of the hydrogen bomb.
- The sum of the masses of products of a nuclear reaction is somewhat less than the sum of the masses of the reactants. The difference in mass appears as mass defect (Δm). It is this mass defect which appears in the form of energy according to Einstein's massenergy relation, $E = (\Delta m)c^2$

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Energy from the Sea

- **Advantages Or Nuclear Energy:**

 - **Alternative source of energy due to depletion of fossil fuels.**

 - **A significant amount of energy is released from a small amount of fuel.**

- **Disadvantages of using nuclear energy**

 - **Nuclear waste is hazardous as heavy atoms decay into harmful subatomic particles.**

 - **High setup and maintenance cost**

 - **Limited availability of uranium**

 - **Can be used for destructive purposes**

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Environmental Consequences

- **Factors to be kept in mind while choosing a source of energy are:**
 - The economics of extracting energy from the source.**
 - The efficiency of the technology available.**
 - The damage to environment which will be caused by using that source.**
- **Some environmental consequences of the increasing energy demands are:**
 - Burning of fossil fuels causes air pollution.**

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Environmental Consequences

Construction of dams destroys large ecosystems and creates problem of rehabilitation of displaced population.

Continuous whirling and whistling of windmills cause noise-pollution and plays havoc with the lives of migratory birds.

Heavy energy structures to exploit wave energy affect marine mammal and seabird population.

Using wood as fuel results in deforestation which affects environment.

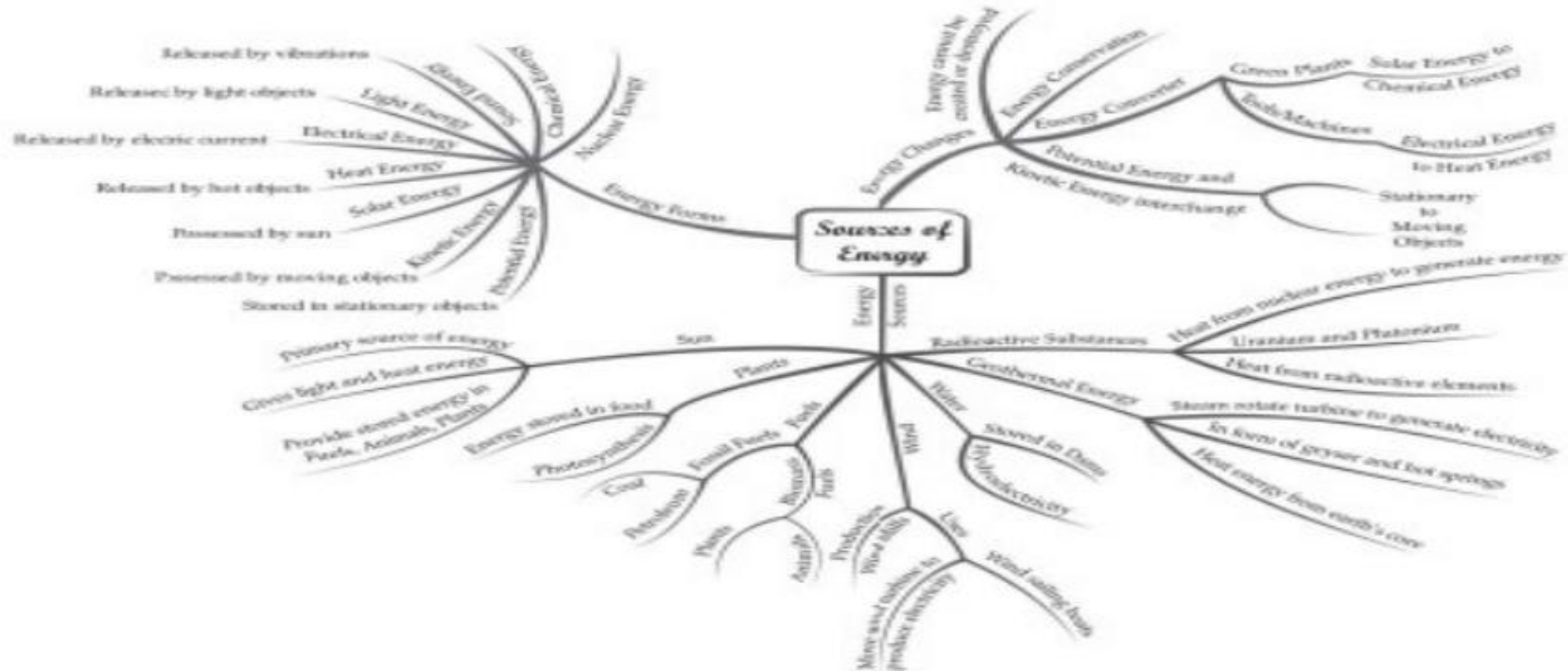
Assembly of solar cell causes some environmental damage.

The cutting down of trees from the forests causing soil erosion and destroys wild life.

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MIND MAP : LEARNING MADE SIMPLE

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