

Delhi Public School, Sonapat
CLASS-10
SUBJECT-PHYSICS (SCIENCE)
Chapter 14: SOURCES OF ENERGY

- ✧ **Source of Energy:** A specific source which provides useful energy.
- ✧ The total energy of the system is conserved but it converts into a form which cannot be utilized again.
- ✧ **Characteristics of Good source of energy:**
 1. It must provide adequate quantity of useful energy and do large amount of work.
 2. Should be easily accessible.
 3. Should be economical (affordable).
 4. Safe to use.
- ✧ **Characteristic of Good fuel:**
 1. It must provide large quantity of energy.
 2. Should be easily accessible.
 3. Should be economical (affordable).
 4. Safe to use.
 5. Should be easy to store and transport.
 6. Should have a safe ignition temperature.
 7. Should give out least amount of smoke and cause minimum pollution.
- ✧ **Sources of energy are of two types:**

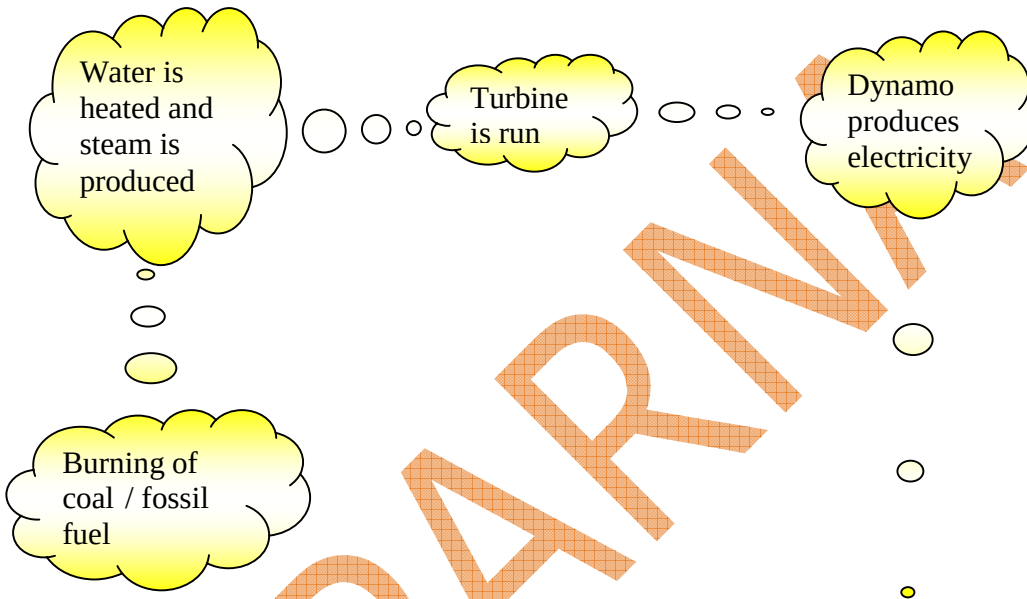
Renewable / Non Conventional	Non Renewable / Conventional
The sources of energy which can be used again and again.	The sources of energy which are limited and cannot be used again and again.
They are usually non conventional sources of energy and technology needed to use them has been developed recently.	They are usually conventional sources of energy which are being used from ancient times.
Examples – Energy from the sea, Geothermal energy, Nuclear energy. 😊 Solar energy and Wind energy are Renewable sources but are Conventional sources.	Examples – Fossil fuels like coal and petroleum, biomass like wood. 😊 Wood can be considered a renewable resource if grown in proper quantity though it is conventional resource.

- ✧ **DIFFERENT TYPES OF SOURCES OF ENERGY:**
 - ◆ **Fossil Fuels:** The dead remains of plants and animals buried under the earth's crust transformed to fossil fuel due to the action of microorganisms under high temperature and pressure.
 - 🌀 Sun is the ultimate source of energy of fossil fuels.
 - 🌀 Most of the technologies are developed to use these type of sources of energy.

➔ **Disadvantages:**

1. They are non renewable resources of energy.
2. They cause lot of pollution as on burning they produce acidic oxides that lead to acid rain.
3. They produce green house gases like CO₂ on burning.

◆ **Thermal Power Plant:** The power stations where electricity is generated by producing large amount of steam by burning coal which turns the turbine.



❁ Transmission of electricity is cheaper than transporting coal. So these power stations are built near coal fields.

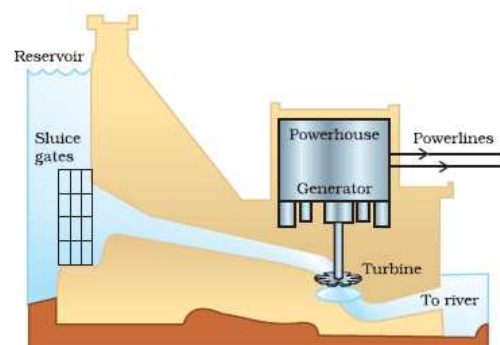
◆ **Hydro Power Stations:** These power stations convert the potential energy of water into electrical energy. Dams are built for this purpose as they obstruct the flow of water and it is collected in reservoirs. The water from a high level in the dam is carried through pipes to the turbine which moves to produce electricity.

➔ **Advantages:**

1. It is a renewable resource.
2. It is a non polluting fuel.

➔ **Disadvantages:**

1. Construction of dams can be done only in limited number of places.
2. Agriculture land and human inhabitations are destroyed.
3. The submerged vegetation rots under anaerobic conditions to produce greenhouse gases like methane.
4. Ecosystems are destroyed.
5. Problem of satisfactory rehabilitation of displaced people is created.



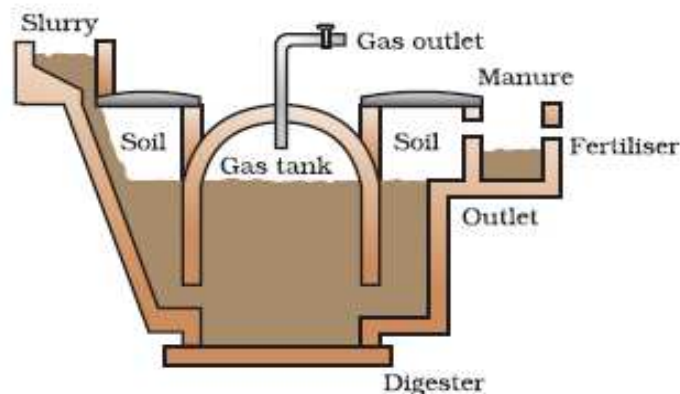
◆ **Improvements have been made lately in conventional sources of energy.**

🌀 **Wood:** Wood can be considered a renewable resource as the plants can be grown again. Burning of wood does not produce much amount of heat and releases lot of smoke. Wood converts into **CHARCOAL** when burnt in the limited supply of oxygen due to loss of volatile materials and water. Charcoal

- a) Burns without flame.
- b) Is smokeless.
- c) Generates large amount of heat.

🌀 **Biogas:** Cow dung, various plant materials like residue after harvesting crops, vegetable waste and sewage are decomposed in the absence of oxygen by anaerobic microorganisms to give bio-gas (gobar-gas).

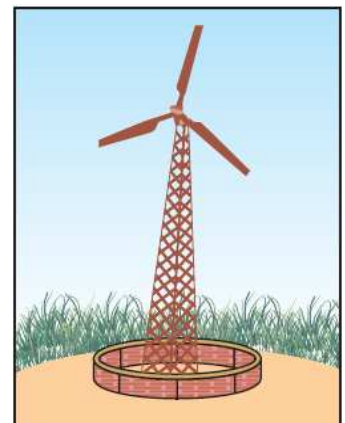
➔ In a bio-gas plant a mixture of water and the organic waste called **SLURRY** is made in the mixing tank from which it is fed into a cylindrical dome like structure called **DIGESTER**. There it is broken down by anaerobic microorganisms in few days to generate gases like **methane (75%), carbon dioxide, hydrogen and hydrogen sulphide**. The slurry left behind is taken out from tank three and used as manure.



➔ **Advantages:**

- 1. It acts as an excellent fuel as it contains large amount of methane which burns without smoke.
- 2. It leaves no residue on burning.
- 3. Its heating capacity is high.
- 4. It can also be used for lighting by producing electricity.
- 5. The slurry left behind is used as manure as it is rich in nitrogen and phosphorus.

🌀 **Wind Energy:** Wind is caused by unequal heating of land mass and water bodies by the solar radiations. The kinetic energy of wind is used to do work. **WIND MILLS** are used to convert wind energy into electricity and do mechanical work.



- The rotatory motion of the windmill due to blowing wind is used to turn the turbine which rotates the turbine connected to the electric generator.
- **Wind farms:** The output of one wind mill is very less. Hence the output of a large number of wind mills are connected together and called wind energy farm.
- Denmark is called the country of winds.
- Germany is the leading country in using wind energy to produce electricity while India ranks fifth.
- The largest wind energy farm has been built in Kanyakumari in Tamil Nadu which generates electricity of 380 MW.

→ **Advantages:**

1. Wind energy is environment friendly renewable source of energy.
2. It requires no recurring expenses for production of electricity.

→ **Disadvantages:**

1. The wind energy farms can be set up at only few limited places where the wind frequently keeps blowing. The speed of the wind should also be greater than 15 km/hr to maintain the speed of turbine.
2. It needs back up facility like storage cells when there is no wind.
3. Wind farms need large area of land to establish.
4. The initial cost of installation is also high.
5. High level of maintenance is required as the wind mill is exposed to vagaries of nature like rainfall, cyclones etc.

☞ **Solar energy:** Energy obtained from the sun (solar energy) reaching the surface of the earth daily varies from 4 to 7 kWh/m². It can be used for running solar cookers, solar water heaters and solar cell panels.

☞ **Solar Constant:** The solar energy reaching the unit area of earth's atmosphere exposed perpendicularly to the rays of the sun at the average distance between sun and earth. Its value approximately is equal to 1.4 kW/m².

→ **Advantages:**

1. It is a renewable source of energy which is free of cost.
2. Does not cause any pollution.

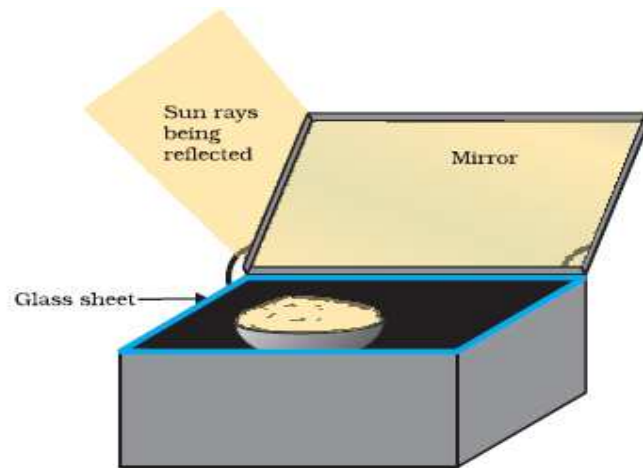
→ **Disadvantages:**

1. Cannot be used during rainy days, at night etc.
2. Direction of reflector has to be kept changing from time to time according to the direction of the sun.

☞ **Box Type Solar Cooker:** It is a box made up of **insulating material** such as wood with inner walls **painted black** to increase heat absorption. The outer walls of the utensil are painted black too. A **plane mirror** is used as reflector to increase the number of infrared radiation s falling on the box. A **thin glass sheet** is used as a lid to cover the box to minimize the loss of heat radiations, creating a green house effect.

→ **Advantages:**

1. The cost of making such a cooker is very less.
2. The food never gets burnt in this type of cooker and stays hot.



→ **Disadvantages:**

1. This type of cooker cannot be used for frying or preparing chapattis.
2. This device cannot be used at night for preparing food.

☞ **Solar Cell Panels:** Solar cell is a device that converts solar energy into electrical energy. It is made up of a semiconductor called silicon and there is wiring of silver done to ensure no loss of electricity. It develops a voltage of 0.5 – 1 V and produces a current of 0.7 W when exposed to electricity.

When a large number of solar cells are combined together in an arrangement called Solar Cell Panel. They are mounted on specially designed inclined roof tops so that more solar energy is incident over it.

→ **Uses:**

1. Solar cells are used for many scientific and technological applications.
2. Artificial satellites and space probes use them as main source of energy.
3. Radio, wireless transmission systems or TV relay stations in remote locations use solar cell panels.
4. Traffic signals, calculators and many toys use them.

→ **Advantages:**

1. They have no moving parts and require little maintenance.
2. They work satisfactorily without the use of any focusing device.
3. They can be set up in remote and inaccessible regions or very sparsely inhabited areas where laying power transmission lines will be expensive.

→ **Disadvantages:**

1. The process of manufacturing solar cells is still very expensive as it requires special grade silicon which is very limited. Silver is used for inter connection of the cells which adds to the cost.
2. It cannot be moved with the direction of sunlight if mounted on the roof tops.

◆ **Energy obtained from the sea is of three types: Tidal energy, Wave energy and Ocean thermal energy.**

☞ **Tidal Energy:** Tides are formed as the level of the water rises and falls in seas and ocean due to the gravitational pull of the moon and the sun. The difference in

the sea levels gives us tidal energy which can be harnessed by constructing a dam across a narrow opening to the sea. A turbine fixed at the dam converts tidal energy to electricity.

→ **Advantages:**

1. It is a renewable source of energy that can be used all through the day and night.
2. It is a non polluting source and does not cost any thing.

→ **Disadvantages:**

1. The locations where such dams can be built are limited.
2. The cost of building such dams and maintaining them is also expensive.

🌀 **Wave Energy:** Waves are generated by the strong winds blowing across the sea. The kinetic energy of these waves can be trapped using a wide variety of devices for rotation of turbine and electricity can be generated.

→ **Advantages:**

1. It is a renewable and non polluting source of energy.
2. It can be used all through the day and night.

→ **Disadvantages:**

1. It can be used only when the waves are strong.
2. There are limited areas and devices to trap this type of energy.

🌀 **Ocean Thermal Energy:** The difference in the temperature of the water on the surface of seas and oceans (due to heating by sun) and that of water in the deeper sections (that are relatively cold) is used to obtain electrical energy in **Ocean Thermal Energy Conversion (OTEC) Plants**. These plants can operate only when the **difference in the temperature** between the water at the surface and at the **depth of 2 kms is 293 K (20 °C)**. The warm surface water is used to boil a volatile liquid like ammonia and the vapours of the liquid are then used to run the turbine of the generator. The cold water from the depth is pumped up to cool the vapours again to liquid.

→ **Advantages:**

1. It is a renewable and non polluting source of energy.
2. It can be used all through the day as well as at night.

→ **Disadvantages:**

1. These OTEC plants can be set up in only limited number of places.
2. Efficient commercial exploitation of such type of energy is difficult.

🌿 **Geothermal Energy:** The heat energy obtained from under surface of the earth is called Geo (earth) Thermal (heat) energy. Due to geological changes, the molten rocks are pushed up and get trapped in regions called '**hot spots**'. When underground water comes in contact with the hot spots steam is formed which moves the turbine to generate electricity. The hot water which reaches the surface is called **hot spring**. The countries which use geothermal energy power plants in large numbers are New Zealand and U.S.A.

→ **Advantages:**

1. The cost of production is very less.

2. This energy can be used any time in 24 hours.

→ **Disadvantages:**

1. There are very few commercial viable sites where such energy can be used for generation of electricity on a large scale.

◆ **Nuclear Energy:** Nuclear energy can be obtained when a nuclear reaction takes place. Nuclear reaction is of two types: (1) Nuclear Fission and (2) Nuclear Fusion.

→ **Nuclear Fission:** In this reaction the nuclei of a heavy element like uranium, thorium and plutonium is bombarded with low energy neutrons which **split** it into lighter nuclei and is accompanied by huge amount of energy. This released energy is used to generate steam by heating water and move the turbine to generate electricity.

☞ **Why is large amount of energy released in Nuclear Fission reaction?**

→ Energy is released during nuclear fission because there is a difference in the total mass of the reactants (more) and products (less) which appears in the form of heat according to the relationship of **Einstein:** $E = \Delta m c^2$

☞ The nuclear power reactors are at Tarapur (Maharashtra), Rana Pratap Sagar (Rajasthan), Kalpakkam (Tamil Nadu), Narora (UP), Kakrapar and Kaiga (Karnataka).

→ **Nuclear Fusion:** In this reaction the nuclei of lighter nuclei **join** together to form the nuclei of heavier element. Large amount of heat is generated because the total mass of reactants is slightly larger than the products. Example:



☞ A hydrogen bomb is based on a thermonuclear fusion reaction.

☞ It has **not been possible** to obtain energy commercially by fusion reactions as such reactions need **large amount of heat and pressure** to force the nuclei to join together. So it takes place in stars like sun.

→ **Advantages:**

1. The energy released during fission is 10 million times more than burning equal amount of coal.

→ **Disadvantages:**

1. The storage and disposal of wastes pose a great hazard as the used nuclear fuel like radioactive uranium keeps emitting radiations which may be hazardous.
2. Accidental leakage of the nuclear radiations can cause environmental contamination.
3. The availability of uranium and other heavy elements is very limited increasing the cost of production.
4. The technology involved is also quite costly.
5. There is always a risk factor in using nuclear raw material as it can be misused for destructive purposes.

◆ **What should be done to ensure regular supply of source of energy / fuel?**

◆ **Three steps** should be taken to ensure the above:

1. Reduce the use of non renewable sources of energy.
2. Stop using fuel which causes lot of pollution and leaves harmful smoke.
3. Develop technology to utilize the large reserves of renewable and cleaner fuel in optimum manner.
4. The controlling agencies which manage the resources must not allow over usage of the fuel. There must be a system of control and maximum limit to use of any source of non renewable energy.

SUPARNA