	INDIAN SCHOOL AL WADI AL KABIR	
Class: X	Department of Science 2020-2021 Subject:- PHYSICS	
HANDOUTS	TOPIC:- SOURCES OF ENERGY	ATTACH IN: A4 file format
Name of the student:	Class & Section:-	Roll No:-

SOURCES OF ENERGY

A source of energy is one which can provide adequate amount of energy in a convenient form over a long period of time.

Renewable and Non-renewable sources of energy

The sources of energy that get exhausted are called **Non-renewable sources of energy**.

Non-renewable source of energy - Coal, Petroleum, Natural Gas

The sources of energy that do not get exhausted, are called as **Renewable sources of energy**.

Renewable Source of energy - Air, Water, Solar radiation, Geothermal Energy, ocean waves etc.

Conventional Source of Energy	Non-Conventional Source of Energy
<ul style="list-style-type: none"> • Fossil Fuels Eg. Coal & Petroleum • Thermal Power Plant • Hydro Power Plants • Bio-Mass • bio gas plant • Wind Energy 	<ul style="list-style-type: none"> • Solar Energy Eg. Solar Cooker, Solar Cell Panel • Energy From the Sea. Eg. Tidal & wave energy, ocean thermal energy • Geothermal Energy • Nuclear Energy

Characteristics of a good source of energy

- High calorific value
- Easily accessible
- Easy to store and transport

- Be economical
- Non-polluting
- Safe to handle and use

Fuels

Fuels are the substances that are burnt to produce heat energy.

Examples:- wood, petroleum, diesel, coal, kerosene, CNG,LPG...

Characteristics of a good fuel

- High calorific value
- Proper ignition temperature
- Cheap and easily available
- Easy to store and transport
- Safe to handle and use
- No pollution and residue
- Should burn smoothly

CONVENTIONAL SOURCES OF ENERGY

1. FOSSIL FUELS: Fuels developed from the fossils. E.g. Coal & Petroleum

- Formed over millions of years ago by the decomposition of dead remains of plants and animals, have only limited reserves
- These are non-renewable sources of energy.

Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ High calorific value ➤ Cheap Source of energy ➤ Easy and Safe to transport. ➤ Useful byproducts ➤ Reliable 	<ul style="list-style-type: none"> ➤ Releases oxides of Carbon, Nitrogen, sulfur (acidic in nature) cause Air Pollution & Acid rain & greenhouse effect.

2. THERMAL POWER PLANT

In a thermal power plant, the steam/fluid formed from boiling water by burning fossil fuels gives energy to the rotor of a turbine which can move shaft of the generator to produce electricity. A very large amount of fossil fuels is burned in Thermal Power Plant to heat up water to produce steam.

The transmission of electricity is more efficient than transporting coal and petroleum. Therefore most of the thermal power plants are located near the coal or oil fields.

Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ The fuel used is quite cheap. ➤ Less initial cost as compared to other generating stations. ➤ It can be installed at any place irrespective of the existence of coal. The coal can be transported to the site of plant by rail or roads. 	<ul style="list-style-type: none"> ➤ It pollutes the atmosphere due to producing large amount of smoke and fumes. ➤ Higher maintenance cost and operational cost ➤ Huge requirement of water.

3. HYDROPOWER PLANTS: Convert the Potential energy of falling water into Electricity.

In hydro power plants, high -rise dams are constructed on the river to collect water in large reservoirs. Near the bottom of the dam wall there is the water intake. Gravity causes the water to fall through the penstock. At the end of the penstock there is a turbine, which is turned by the moving water. The turbine is connected to a generator. When the turbine turns, electricity is generated.

Advantages	Disadvantages of construction of Big Dams
<ul style="list-style-type: none"> ➤ Renewable source of energy ➤ Require low maintenance ➤ The water after running the turbine can be used for irrigation and other purpose. ➤ No pollution 	<ul style="list-style-type: none"> ➤ Dams can be constructed only in a limited number of places. ➤ Large areas of agricultural land and human habitation are to be sacrificed as they get submerged. ➤ Eco-systems are destroyed ➤ The vegetation which is submerged rots under anaerobic conditions and gives rise to methane which is a greenhouse gas.

4. BIOMASS

Agricultural & animal wastes that can be used as a fuel. The energy stored in biomass is called biomass energy.

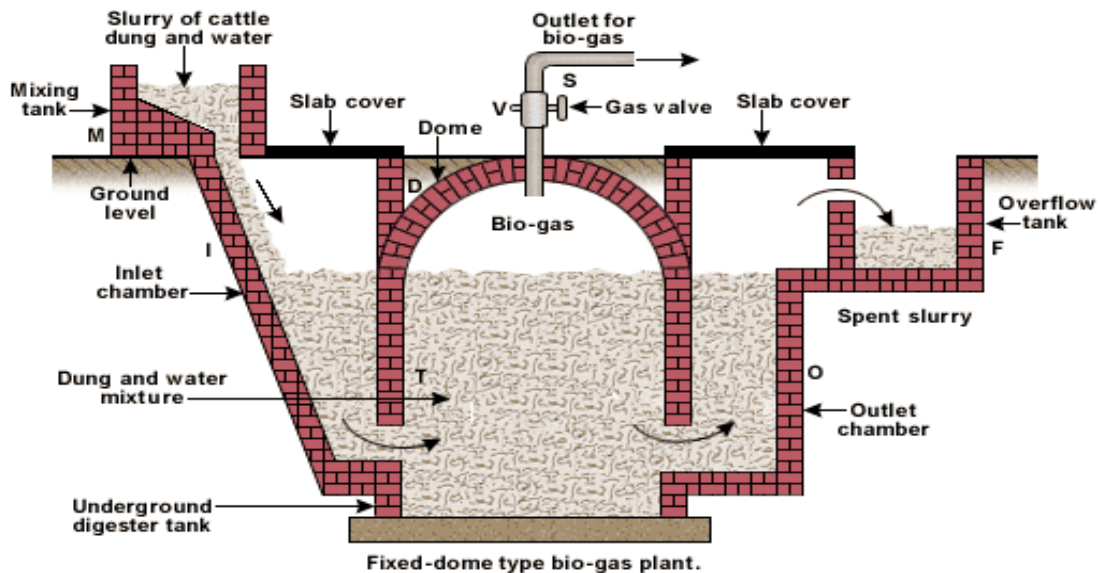
Example of Biomass – Firewood, cattle dung, sewage, dry leaves and stems.

Normally biomass has a low calorific value & produce lot of smoke when they are burnt. Their efficiency as a good fuel has been increased tremendously with the application of technology.

For example: Cow dung becomes efficient in a bio gas plant.

Charcoal burns without smoke, flames & has high calorific value.

Biogas is produced by anaerobic decomposition of the slurry (cow dung + water mixture) by microbes. This process is done in a Bio gas plant.



The Biogas is stored in the gas tank from which they are drawn through pipes for use in a Bio-gas plant.

Bio-gas is an excellent fuel & contains 75% of Methane (CH_4). the other components present are Carbon dioxide, Hydrogen and Hydrogen sulfide. It burns without smoke, leaves no residue like ash, and possesses high calorific value.

Bio gas is used for lighting, cooking in the rural areas. While the slurry left behind is used as excellent manure, rich in nitrogen and phosphorous

The large scale use of Bio-wastes & sewage material provide a safe and efficient method of waste-disposal besides supplying energy and manure.

5. WIND ENERGY

Unequal heating of the land mass and water bodies by solar radiation generates air movement & causes winds to blow. This kinetic energy of the wind can be used to do the work.

This energy is utilised to lift water from the well & to generate electricity in the windmill.

The rotatory motion of the windmill is used to turn the rotor of the turbine, which then generate electricity through Dynamo.

The output of a single windmill is quite small, so a number of windmills are erected over a large area - called wind energy farm.

The minimum wind speed for wind mill to serve as a source of energy is 15 km/h.

Advantages	Limitations
<ul style="list-style-type: none"> ➤ Eco friendly ➤ An efficient source of renewable energy. ➤ No recurring expenses for production of electricity 	<ul style="list-style-type: none"> ➤ Wind energy farms need large areas of land ➤ Difficulty in getting regular wind speed of 15-20 km/h ➤ The initial cost of establishing a wind energy farm is very high. ➤ High level of maintenance of blades of wind mill.

NON-CONVENTIONAL SOURCES OF ENERGY/ ALTERNATIVE SOURCES OF ENERGY

1.SOLAR ENERGY

➤ SOLAR COOKERS

Solar cooker is a device that is used to cook food by utilising the energy radiated by the sun.

Solar cookers are painted black from outside and there is a large glass plate to trap solar radiations by greenhouse effect.



Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ It saves fuel ➤ It does not create pollution- Environment friendly ➤ Renewable ➤ The nutrients of the food do not get destroyed ➤ Easy and safe to use ➤ Negligible maintenance cost ➤ Used in rural areas. 	<ul style="list-style-type: none"> ➤ It cannot be used during night time and on a cloudy day. ➤ The direction of reflector of solar cooker has to be adjusted frequently. ➤ It cannot be used to make chapattis or for frying. ➤ It takes longer time for cooking. ➤ Cooking time may vary from time to time. ➤ Use of solar cooker is limited.

➤ **SOLAR CELLS**

Solar radiations can be converted electricity through solar cells(photovoltaic cells). (*Solar cells convert solar energy into electricity.*)

Photovoltaic cells convert solar radiations directly into electricity through silicon solar cells.

SOLAR CELL PANEL

- ▶ A typical cell develops a voltage of 0.5–1 V and can produce about 0.7 W of electricity when exposed to the Sun.
- ▶ A large number of solar cells are, combined in an arrangement called solar cell panel that can deliver enough electricity for practical use.

Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ Does not cause any pollution ➤ Requires little maintenance ➤ Work quite satisfactorily without the use of any focussing device. ➤ They can be set up in remote and inaccessible hamlets in which laying of a power transmission line may be expensive and not commercially viable. 	<ul style="list-style-type: none"> ➤ Silicon, which is used for making solar cells, is abundant in nature but availability of the special grade silicon for making solar cells is limited. ➤ The entire process of manufacture is still very expensive, silver used for interconnection of the cells in the panel further adds to the cost. ➤ The solar cell panels are mounted on specially designed inclined roof tops so that more solar energy is incident over it. The domestic use of solar cells is, however, limited due to its high cost.

Other solar devices- Solar water heater, Solar furnace

2. ENERGY FROM THE SEA

(A) **Tidal energy:** Locations in India – Gulf of Kutch, Gujrat & W. Bengal

Due to the gravitational pull of the moon and the sun on the spinning earth, the level of water in the sea rises and falls. This phenomenon causes high tides and low tides.

Tidal power or tidal energy is the form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity.

Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ It is an inexhaustible source of energy ➤ Environment friendly ➤ There is scope to generate this energy on large scale. ➤ We can predict the rise and fall of tides 	<ul style="list-style-type: none"> ➤ Cost of construction of tidal power plant is high. ➤ There are very few ideal locations for construction of plant. ➤ Intensity of sea waves is

<ul style="list-style-type: none"> ➤ Efficiency of tidal power is very high ➤ Maintenance cost are relatively low ➤ Tidal energy does not require any kind of fuel to run ➤ The life of tidal energy power plant is very long 	<ul style="list-style-type: none"> unpredictable ➤ Influences aquatic life adversely ➤ Transmission is difficult and expensive
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(B) Wave energy:

The kinetic energy possessed by huge waves near the sea shore can be trapped in similar manner to generate electricity. Waves are generated by strong winds blowing across the sea. Wave energy, also known as ocean energy or sea wave energy, is the energy harnessed from ocean or sea waves. The rigorous vertical motion of surface ocean waves contains a lot of kinetic (motion) energy that is captured by wave energy technologies to do useful tasks. For example, generation of electricity, desalinization of water and pumping of water into reservoirs.

(C) Ocean thermal energy

It is the energy derived from the difference of temperature between the water at the surface and water at depths.

Principle of working of ocean thermal energy

The water at the surface of the ocean is warmer than the water at deeper depths. The temperature difference can be used by Ocean Thermal Energy Conversion systems to generate electricity.

In the Ocean Thermal Energy Conversion plant(OTEC plant), the energy of warm surface water is used to convert low boiling point liquid ammonia into gaseous state. The vapour of ammonia at high pressure is used to spin the turbines of generators converting the Ocean Thermal energy to electricity. The used vapour passes through the condenser where cold water, pumped from the deeper parts of ocean condenses ammonia vapour into a liquid. This process is repeated again and again to get continuous production of electricity.

Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ Eco-friendly ➤ Minimal maintenance costs compared to other power production plants 	<ul style="list-style-type: none"> ➤ Cost of production of energy is very high. ➤ OTEC plants must be located where a difference of about 20°C occurs year round. ➤ Construction of OTEC plants in coastal waters may cause localized damage to marine ecosystems.

3.GEO THERMAL ENERGY:

Energy harnessed from the heat of the interior of the earth is called Geo thermal energy.

Due to geological changes, molten rocks formed in the deeper hot regions of earth’s crust are pushed upward and trapped in certain regions called ‘hot spots’. When underground water comes in contact with the hot spot, steam is generated. Sometimes hot water from that region

finds outlets at the surface. Such outlets are known as hot springs. The steam trapped in rocks is routed through a pipe to a turbine and used to generate electricity.

Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ It is a renewable source of energy. ➤ It involves low running cost. ➤ It does not create any pollution ➤ It helps in sustaining a clean environment. ➤ Maintenance cost of geothermal power plant is low 	<ul style="list-style-type: none"> ➤ Geographically, there are very limited number of places where geothermal power plants are likely to operate effectively. ➤ Enhanced geothermal system can trigger earthquakes, therefore it affects land stability severely. ➤ There is an abundance of greenhouse gases below the earth's surface. They might escape through the holes drilled during construction. This leads to global warming and acid rain. ➤ Geothermal energy cannot be easily transported unlike other sources of energy.

Nuclear energy:

(i) Energy derived from the nucleus of the atom is called nuclear energy. There are two methods of harnessing nuclear energy

1. Nuclear fission (Takes place in Nuclear power plants)
2. Nuclear fusion (Takes place in Stars)

➤ **Nuclear fission**

The nucleus of a heavy atom (such as uranium, plutonium or thorium), when bombarded with low-energy neutrons, can be split apart into lighter nuclei. When this is done, a tremendous amount of energy is released if the mass of the original nucleus is just a little more than the sum of the masses of the individual products.

➤ **Nuclear fusion**

Fusion means joining lighter nuclei to make a heavier nucleus, most commonly hydrogen or hydrogen isotopes to create helium. It releases a tremendous amount of energy, according to the Einstein equation, as the mass of the product is little less than the sum of the masses of the original individual nuclei.

Such nuclear fusion reactions are the source of energy in the Sun and other stars. It takes considerable energy to force the nuclei to fuse.

Advantages	Disadvantages
<ul style="list-style-type: none"> ➤ Alternative source of energy due to depletion of fossil fuels. ➤ From a small amount of fuel, a large amount of energy is released. ➤ It is a clean fuel, provided the plant is operated properly with utmost care 	<ul style="list-style-type: none"> ➤ Improper nuclear waste storage and disposal results in environmental contamination. ➤ High cost of installation of nuclear power plant. ➤ Limited availability of uranium. ➤ Risk of accidental leakage of nuclear radiation due to some natural or man made causes.

Environmental consequences

► The source of energy we select depends on factors like :

- Ease and cost of extracting energy from that source
- Efficiency of technology available for using that source of energy
- Environmental damage caused by using that source.

Exploiting any source of energy can environmental damage in many ways:

- Burning of Fossil fuels can release harmful gases and cause air pollution.
- Even renewable sources of energy like the solar cell may seem to be pollution free but the assembly of device causes environmental damage
- Construction of Dams to generate hydroelectricity also causes harm to the environment as it affects the aquatic life.

STEPS TO ENSURE THAT CURRENT RESOURCES LAST LONGER

- Judicious use of energy sources,
- Minimize use of fossil fuels such as wood, coal, petrol and LPG. etc.
- Planting more trees as they release oxygen and absorb carbon dioxide gas in the atmosphere.
- Minimize the use of automobiles. Minimize the use of personal vehicles by using public transport systems.
- For the generation of electricity, use of renewable resources like wind and water in the place of fossil fuels.
- Use of recycled materials instead of plastic.
- Reduce growing energy demand through improved energy efficiency and conservation.
- Research, develop and deploy a broad range of energy sources, both domestic and international, to work with global markets to help meet future energy demands.

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