Sources of Energy

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Energy plays a huge factor in our lives, providing comfort, increasing productivity and allowing us to live the way we want too. Energy lights our cities, powers our vehicles, used in cooking, manufacturing etc.



What is energy Crisis?

An energy crisis occurs when we all have a great need of fuel or electricity but does not have enough amounts of them. For example, a large portion of the energy we use is derived from oil. Some experts claim that we will run out of oil in just a few decades.

But why energy crisis occurs?

When we use energy in its usable form like in cooking, we convert the form of energy and get our work done during the process. Since we cannot reverse the change involved in this process so we cannot get back the original usable form of energy. Due to this, it becomes important to think about energy shortage and the related energy crisis.

Good Source of Energy

- It should give large amount of energy per unit mass.
- It should be easy to access.
- It should be easy to store and transport.
- It should be cheap.

Source of Energy

Sources of energy can be divided into two types:

1. Conventional 2. Non – conventional

Conventional sources of energy – Sources which are being used since long time like coal, wood, wind etc.

Non-conventional sources of energy – Sources whose use has started only recently like sun, wave etc.

Sources of energy can be categorized in one more way: 1. Renewable 2. Non – renewable

Renewable – Source which can last for a very long time. It's supply is unlimited. They are also called non – exhaustible sources of energy. Examples of such type of energy resources are sun, wind, wood and wave etc.

Non- Renewable – Sources whose supply is limited and is likely to be finished one day. They are also called exhaustible sources of energy. Examples of such type of energy resources are coal, petrol etc.

Conventional Sources of Energy

1. Fuel

Fuels are such sources of energy which give heat energy on burning such as coal, petroleum, wood.

Properties of Good Fuel:

- Good fuel should give more heat.
- Should release less smoke.
- Should be cheap.
- Should be easily available.
- Safe
- Should be easy to store.
- Less ash should be left.
- Should have proper burning temperature.

Fossil fuels:

These are the fuels formed from remains of dead plants and animals under the earth crust due to excessive pressure and temperature for millions of years.

Examples: Coal, Petroleum (Petrol, Diesel, Kerosene, LPG), Natural gas.

It is a most commonly and widely used source of energy. We can say that fossil fuel is a key factor for industrialization. But as it is a non-renewable source of energy, so must be used carefully.

Disadvantages of fossil fuel:

- It causes air pollution. When we burn fossil fuel, poisonous gases like oxides of carbon, nitrogen, sulphur are released.
- When these gases release in air, they cause acid rain. When acid rain falls to the earth, it undergoes various physical and chemical changes and causes soil and water pollution.
- Fossil fuels release lots of smoke.

Uses of fossil fuels:

- In cooking: LPG (a petroleum product), Coal.
- In Vehicles: Petrol, diesel.
- To produce electricity in thermal power plants.

Thermal Power Plant:

Thermal power plant is a plant in which electricity is produced from fossil fuels mainly coal.

Working of Thermal Power Plant:



First the coal is burnt into the furnace of steam boiler. High Pressure steam is produced in the boiler. In turbine, this steam force rotates the turbine blades. As the turbine turns, it causes the generator to do its work and create electricity.

The transmission of electricity is more efficient than transporting coal or petroleum over the same distance. Therefore, many thermal power plants are set up near coal or oil fields.

2. Hydropower

Hydropower is electricity generated using the energy of falling and running water. It is a conventional source of energy. But it has been enhanced by use of modern technology.

Working of Hydropower Plant:



Dam / reservoir is made over a river to collect water in large amount. Water coming of high speed rotates the turbine which in turn activates a generator to produce electricity. Some hydroelectric power plants just use a small canal to channel the river water through a turbine.

It is a renewable source of energy. Quarter of India's power supply comes from hydro power plant.

Disadvantages of Hydro-Power Plant:

- Hydropower can be established in some certain locations, it depends on location of river, ocean. Also large area is required to build a dam and results is rehabitation of people.
- Vegetation submerged below dam produces methane which leads to greenhouse effect.

3. Bio-Mass

Biomass is a source of energy that is directly obtained from plants and animals such as wood, agricultural waste, gobar (cow-dunk). It produces less energy and releases lot of smoke.

Wood & Charcoal:

When wood is burned in limited oxygen, it looses water and other volatile substances, leaving charcoal behind.

Benefits of charcoal over wood:

- No flame.
- Charcoal produces more energy.
- Releases less smoke.

Gobar and agricultural waste:

Gobar and agricultural waste is used to produce Bio-gas/ gobar gas.

How to produce Bio gas/ gobar gas?



- Biogas plant is generally made of bricks.
- The various forms of biomass are mixed with in equal quantity of water in the mixing tank. This forms the slurry.
- The slurry is fed into the digester through the inlet chamber.
- Anaerobic microorganisms decompose slurry to form Methane (75%), CO₂, H₂ and H₂O gas. Gases are stored in chamber.
- These gases are called bio-gas.

Advantages of Bio-gas:

- No smoke.
- No ash unlike wood or charcoal.
- Large supply of heat.
- Waste left in biogas pant is a good fertilizer because it has nytrogen and phosphorus in excess.
- Good way to dispose sewage. Sewage can be used with gobar and agricultural waste to produce biogas in biogas plant.
- It is a renewable source of energy.

Bio gas is used for cooking purpose, for street lighting, generation of electricity.

4. Wind Energy

We have been harnessing the wind's energy for hundreds of years. From old time windmills have been used for grinding grain, to lift water from well. But in modern times, wind energy is used to generate electricity.

Working:

The energy in the wind turns the turbine blades around the rotor. A shaft connects the rotor to a generator. So when the rotor turns, it spins a generator to make electricity. The electrical energy from the generator is transmitted along cables to a substation.





Individual wind turbines can be used to generate electricity on a small scale. To generate electricity on much larger scale, a large number of wind turbines grouped together sometimes known as wind farms.

Advantages:

- No pollution
- Renewable
- No recurring cost.

Disadvantages:

- Wind farms can only be established at those places where the wind speed is greater than 15 km/hr.
- Wind turbine cannot work if there is no wind and wind speed is not so high. So we need to store a power backup.
- Requires large area around 1 MW 2 Hectare land.
- High set up cost.
- Towers and specially blades are exposed to rough weather. So blades get damaged and increases the cost of maintenance.

Non – conventional Sources of Energy 1. Solar energy

The sun is the main source of energy for all living beings on this earth. Even the energy in the fossil fuels has come from the sun. The sun has an endless reservoir of energy which would be available as long as the solar system is in existence.

It is renewable and non-conventional source of energy. Examples of solar energy are solar cooker, solar panel.

Solar Cooker:

A solar cooker is a device which uses the energy of direct sunlight to cook food. Interior of cooker is usually black in color as black color absorbs most of the energy. Plane mirror or concave mirror is fixed at top side of cooker. On the other side a transparent glass is placed. The light reflected from the plane mirror concentrates the solar energy inside the solar cooker which generates enough heat to cook food.



Solar Panel:

Solar panels are devices that convert solar light into electricity. Solar panels are comprised of several individual solar cells which are themselves made of silicon. The more light that hits a cell, the more electricity it produces.



Uses of Solar Panel:

- Used in satellites and mars probe
- Used in traffic signals and street lights
- Used in houses
- In calculators and toys
- Used in TV stations and radio stations in remote location.

Advantages of Solar Panel:

- No moving parts
- Required little maintenance
- Can be used in remote locations where there no connection of light.
- It is a renewable source of energy.

Disadvantages of Solar Panel:

- Can produce electricity only on sunny days.
- Special grade silicon is required for making solar cells.
- Manufacturing is expensive.
- Produces low energy.

2. Energy from Sea

The oceans cover about 70% of the terrestrial area. They contain a lot of energy. A small part of it can be used. Energies which are technically available are the following:

a. Tidal energy b. Wave energy c. Ocean thermal energy

All these are renewable and non – conventional sources of energies.

a. Tidal Energy:

Due to gravitational attraction of moon(and even sum to some extent), the level of water in ocean changes twice in a day. When level of water is high, tides are high. When level of water is low, tides are low.



Dams or reservoirs are built near seashores to collect the water which comes during a high tide. Turbines in the barrier generate electricity as the tide floods into the reservoir. Once the tide outside the barrier has receded, water retained can then be released through turbines into ocean, again generating electricity.

b. Wave Energy:

Waves are created due to movement of wind on ocean surface. A variety of technologies have been proposed to capture the energy from waves. They can be used in several ways to rotate rotor of dynamo to generate electricity.

c. Ocean – Thermal Energy:

Ocean thermal energy is a renewable energy technology that harnesses the solar energy absorbed by the oceans to generate electric power. The Sun's heat warms the surface water a lot more than the deep ocean water, which creates the ocean's naturally available temperature gradient, or thermal energy.

Working:

For ocean thermal plant, temperature difference between hot and cold layer should be at least 20°C to vaporize a working fluid, which has a low boiling point, such as ammonia. The vapor expands and spins a turbine coupled to a generator to produce electricity.

The vapor is then cooled by seawater that has been pumped from deeper ocean layer. That condenses the working fluid back into a liquid, so it can be reused. This is a continuous electricity generating cycle.

3. Geothermal Energy

Heat from the earth can be used as an energy source in many ways. This heat energy, known as geothermal energy.

This thermal energy is contained in the rock and fluids beneath Earth's crust. It can be found from ground to several miles below the surface, and even farther down to the extremely hot molten rock called magma. Earthquakes and magma movement break up the rock covering, allowing heated underground water or steam to accumulate on earth surface. This process is known as geyser and that region where hot water accumulates, is known as hot spring.



The hot water and steam can be tapped to generate electricity and for other work directly. In some geothermal plants, the steam trapped in rocks is routed through a pipe to a turbine and used to generate electricity.

Advantages:

- Most power plants need steam to generate electricity and they use fossil fuels to boil water for steam. Geothermal power plants, however, use steam produced from reservoirs of hot water. So in geothermal plant, steam used is free and thus cheap.
- Round the clock
- Pollution free

Disadvantages:

• Very few viable sites. **Nuclear Energy**



Nuclear power is derived from energy that is released when relatively large atoms like atoms of uranium, thorium are split by shooting neutrons on them. In this process, one atom forms some small atoms, 3 neutrons and heat. The process of splitting an atom is known as nuclear fission. The resulting heat is used to boil water which drives a steam turbine to generate electricity.

Chain Reaction:

If we trigger one reaction of nuclear fission, chain reaction starts. In a chain reaction, particles released by the splitting of the atom strike other uranium atoms and split them. The particles released by this, further split other atoms in a chain process.

Advantages:

- Can produce huge amount of electricity.
- 1 Kg Coal can light up 1 Bulb for 8 hours.

1 Kg Uranium can light up 1 Bulb for 3 x 10⁴ years.

Disadvantages:

- High set up cost.
- Chance of accident radiations emitted can cause huge loss to environment and civilization.
- Waste products are very harmful. Needs to be disposed carefully.

Environmental Consequences

- No source of energy is pollution free. It's good to use sources with less pollution.
- Burning fossil fuels causes air pollution.
- Vegetation submerged below hydropower dam leads to greenhouse effect.
- CNG creates much lesser pollution than petrol and diesel.
- LPG is the best choice for cooking purpose because it releases more energy per unit mass, smokeless, does not cause air pollution and ash.
- Sun is the ultimate source of energy. For example,

1. Plants convert light energy from sun into chemical energy as food by process of photosynthesis. Animals eat plants and use that energy for all their activities. The fossil fuel that we use comes from dead animals and plants.

2. Heat energy from the sun causes changing weather patterns that produce wind. That we use as wind energy.

3. Hydroelectricity is produced from moving water, and water flows because heat energy from the sun causes evaporation that keeps water moving through the water cycle.