

Energy

MEANING OF ENERGY

- When an object is capable of doing work, we say that it has energy. This means energy is the ability to do work.

HUMAN AND ENERGY

- The most common form of energy humans have used over the ages and still continue to use is the energy stored in the muscles of the body. We obtain this energy from the food we eat. Of course, as we age or fall sick, our ability to do physical work decreases.
- The external sources of energy used by humans in the seventeenth century were:
 - Fire: Primitive humans had discovered fire and used it for heat and light.
 - Food: The energy that the humans obtained from the food they ate was used to do most of their work.
 - Animals: Humans domesticated animals and used the energy of their muscles to perform more laborious tasks.
 - Wind and water: The kinetic energy of wind and flowing water was also used to do work through windmills and water wheels like grinding the grain, pottery, mining and metallurgy.

ACCOUNTING ENERGY

- Whenever we move an object by the application of a force, we do some work. Work is measured in joules. When a force of one newton displaces an object by one metre, we say that one joule of work has been done. That is, all forms of energy are always measured in joules.

ACCOUNTING POWER

- ? The rate at which energy is supplied is called power.
- ? If one joule of energy is supplied in a second, the power of the source is said to be one watt.
- ? Power was earlier measured in a unit called horse power. One horse power was roughly equal to 746 watts.
- ? The kilowatt-hour is used as a commercial unit of energy.

SOLAR HEATING DEVICES

- ? All solar heating devices are designed to facilitate the collection of as much solar energy as possible. Solar cooker and solar cell are chief examples of such kinds of device.

Solar Cooker

- ? For making a solar cooker, a blackened sheet is placed in an insulated box and its open face is covered with a glass sheet.
- ? The glass sheet on the top allows both visible and infrared components of the sunlight to fall on the blackened sheet. Often the inner walls of the box are also painted black to maximise absorption of heat and to minimise heat loss due to reflection.
- ? When such a solar heating device is kept in the Sun for some time, its inner surfaces become hot after absorbing solar energy. As a result, these surfaces start radiating heat in the form of infrared radiations. However, the glass sheet on the top does not allow these radiations to go out. Thus, the heat inside the box is retained in it.
- ? This type of design is often known as box-type solar cooker. The temperature inside the cooker can go up to _____ in 2-3 hours. This solar cooker can be used to prepare food items, which require slow heating. These cookers are generally not used for baking and frying.
- ? One major drawback of all solar energy heating devices has been that they must be adjusted every half-an-hour or so to keep them facing the Sun. This is an essential requirement to optimise collection of solar energy. These days, special arrangements are made to ensure that the device keeps on rotating so that it always faces the sun.
- ? To meet growing energy demands, India became the first country in the world to start production of solar cookers on a commercial scale in 1962. The Department of Non-Conventional Energy Sources (DNES) of the Government of India and similar departments at the state level are making all efforts to popularise the use of solar cookers. Solar water heaters on the rooftops of hotels, hospitals and industrial complexes are now a common sight. Many solar energy parks are being planned to harness solar energy on a commercial scale.

Solar Cells

- ? A solar cell is a device which directly converts solar energy into electricity.
- ? For making a solar cell, a wafer of selenium is placed in sunlight and it produces electricity. Since the efficiency of such a solar cell was very low, no significant efforts were made to utilise this phenomenon for producing electricity.
- ? These days, solar cells are usually made from semiconductor materials like silicon and gallium. To obtain a much higher power, a large number of solar cells are arranged in a special order in a solar cell panel. The use of such solar cells has been found very effective in remote and isolated locations.
- ? All artificial satellites and space probes mainly depend on electricity generated by solar panels.
- ? In India, the use of solar cells for lighting, operating water pumps, radio and TV receivers has been demonstrated. Besides, they have also been used to provide electric power to light houses and offshore oil drilling platforms.

WIND ENERGY

- ? The wind energy is the kinetic energy associated with the movement of large masses of air.
- ? For centuries, wind energy has been utilised to power sailboats and windmills. Even modern aeroplanes utilise wind energy to manipulate their upward and downward motions. However with the harnessing of more efficient, convenient and economical energy sources like electricity and fossil fuels, windmills are gradually losing their importance.
- ? Once again, harnessing wind energy on a large scale is being considered by the world to meet the growing energy demands and to conserve the non-renewable fossil fuels like petroleum and coal.
- ? A windmill works on a very simple principle. When the blowing wind strikes across the blades of a windmill, it exerts force that rotates its blades. The rotational effect is due to a special design of the blades like those of an electric fan. The rotating fan blows air while the blowing air rotates the blades of the windmill.
- ? The following regions of India have been found to be high wind energy locations? Gujarat, parts of Rajasthan, western Madhya Pradesh, coastal belts, southern Tamil Nadu, Bay of Bengal, the Arabian Sea Islands and parts of Karnataka.

HYDROELECTRICITY

- ? A more efficient and convenient way of utilising hydro energy is to convert it into electrical energy. The water flowing in a river is collected with the help of a dam. The potential energy of stored water is then converted into kinetic energy water by allowing it to fall through pipes from the top of the dam to hydroelectric generators.

- ? The flowing water rotates a turbine which, in turn, rotates the armature of a generator to produce electricity.
- ? Though the electricity generation by hydroelectric power is non-polluting and water is a renewable source of energy, numerous environmental problems are associated with them. Construction of dams results in a variety of ecological changes in the downstream region of the river on which it is constructed. A vast variety of flora and fauna and even human settlements get submerged by a dam.
- ? The decision for hydroelectricity generation through high-rise dams, therefore, requires careful consideration of its impact on the environment and social life.

ENERGY FROM THE OCEANS

The oceans cover almost 70.4 per cent of the Earth. The energy from the oceans is available in many forms as:

- ? There is always a temperature difference between water at the surface and at deeper levels of oceans. This difference many places is of the order of . This form of energy is known as ocean thermal energy (OTE) which can be converted into usable forms of energy like electricity.
 - ? Another form in which ocean energy manifests itself is the energy associated with its waves. These waves are up by the wind and the shorelines continuously. Besides, tidal waves keep billions of litres of water in movement as they build up and recede twice a day.
 - ? The difference in the concentration of salt, where water from two different seas meet can also be utilised to obtain energy in usable form.
 - ? Sea vegetation or biomass is another indirect source of energy.
 - ? The vast seaweed plantation may provide an endless supply of methane fuel in the future.
 - ? Oceans are also a source of deuterium or the heavy hydrogen atom. Deuterium is an isotope of hydrogen which has one proton and one neutron in its nucleus. Efforts are going on to achieve controlled fusion of deuterium. Success in these efforts may convert the sea into a source which could supply energy for our present demands for a billion years.
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