

Resources Institute, 1997)

2.6.2 RENEWABLE AND NON-RENEWABLE ENERGY SOURCES

What are the major sources of energy that we use?

A source of energy is one that can provide adequate amount of energy in a usable form over a long period of time. These sources can be of two types:

1. **Renewable resources which can be generated continuously in nature and are inexhaustible** e.g. wood, solar energy, wind energy, tidal energy, hydropower, biomass energy, bio-fuels, geo-thermal energy and hydrogen. They are also known as non-conventional sources of energy and they can be used again and again in an endless manner.
2. **Non-renewable resources which have accumulated in nature over a long span of time and cannot be quickly replenished when exhausted** e.g. coal, petroleum, natural gas and nuclear fuels like uranium and thorium.

Wood is a renewable resource as we can get new wood by growing a sapling into a tree within 15-20 years but it has taken millions of years for the formation of coal from trees and cannot be regenerated in our life time, hence coal is not renewable. We will now discuss various forms of renewable and non-renewable energy resource.

2.6.3 SOLAR ENERGY

Sun is the ultimate source of energy, directly or indirectly for all other forms of energy. The nuclear fusion reactions occurring inside the sun release enormous quantities of energy in the form of heat and light. The solar energy received by the near earth space is approximately $1.4 \text{ kilojoules/second/m}^2$ known as solar constant.

Traditionally, we have been using solar energy for drying clothes and food-grains, preservation of eatables and for obtaining salt from sea-water. Now we have several techniques for harnessing solar energy. Some important solar energy harvesting devices are discussed here.

(i) **Solar heat collectors:** These can be passive or active in nature. Passive solar heat collectors are natural materials like stones, bricks etc. or material like glass which absorb heat during the day time and release it slowly at night. Active solar collectors pump a heat absorbing medium (air or water) through a small collector which is normally placed on the top of the building.

(ii) **Solar cells:** They are also known as photovoltaic cells or PV cells. Solar cells are made of thin wafers of semiconductor materials like silicon and gallium. When solar radiations fall on them, a potential difference is produced which causes flow of electrons and produces electricity. Silicon can be obtained from silica or sand, which is abundantly available and inexpensive. By using gallium arsenide, cadmium sulphide or boron, efficiency of the PV cells can be

improved. The potential difference produced by a single PV cell of 4 cm^2 size is about 0.4-0.5 volts and produces a current of 60 milli amperes. Figure 2.14 shows the structure of a solar cell.

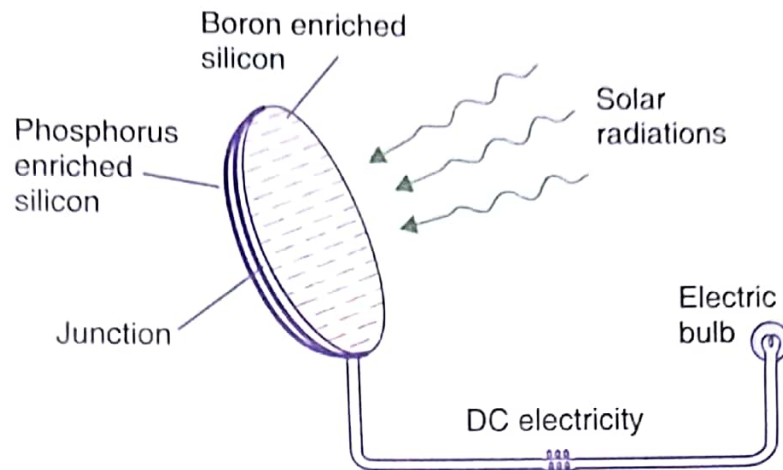


Fig. 2.14 A solar cell (PV cell).

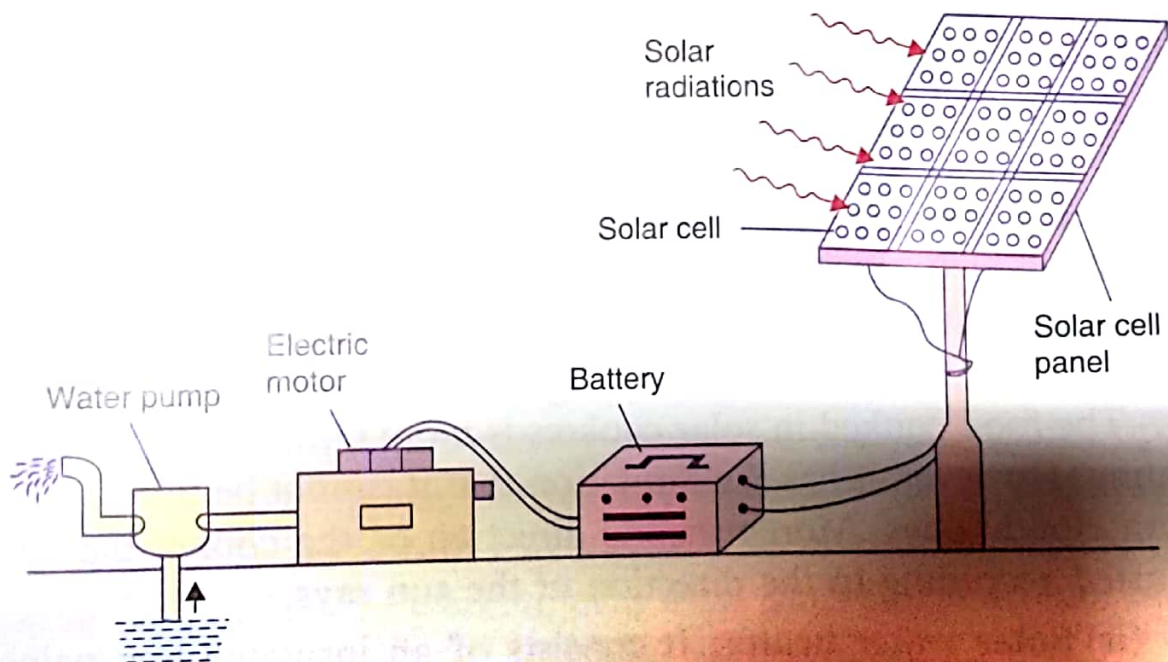


Fig. 2.15 A solar pump run by electricity produced by solar cells.

A group of solar cells joined together in a definite pattern form a solar panel which can harness a large amount of solar energy and can produce electricity enough to run street-light, irrigation water pump etc. see in Fig. 2.15.

Solar cells are widely used in calculators, electronic watches, street lighting, traffic signals, water pumps etc. They are also used in artificial satellites for electricity generation. Solar cells are used for running radio and television also. They are more in use in remote areas where conventional electricity supply is a problem.

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(iii) **Solar cooker:** Solar cookers make use of solar heat by reflecting the solar radiations using a mirror directly on to a glass sheet which covers the black insulated box within which the raw food

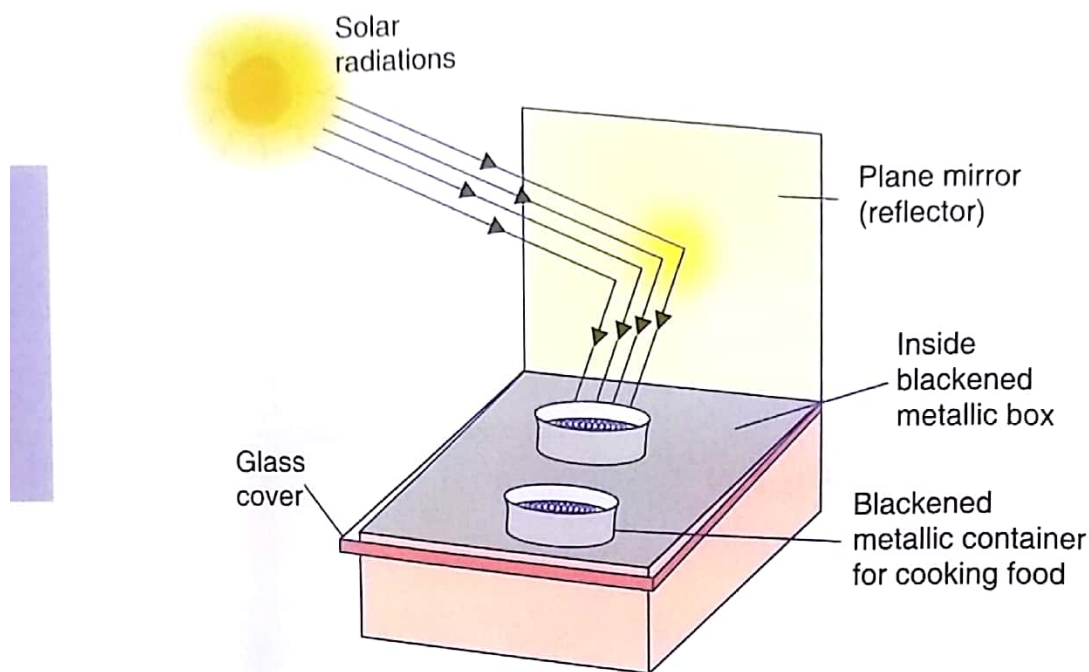


Fig. 2.16 Simple box-type solar cooker.

is kept as shown in Fig. 2.16. A new design of solar cooker is now available which involves a spherical reflector (concave or parabolic reflector) instead of plane mirror that has more heating effect and hence greater efficiency.

The food cooked in solar cookers is more nutritious due to slow heating. However, it has the limitation that it cannot be used at night or on cloudy days. Moreover, the direction of the cooker has to be adjusted according to the direction of the sun rays.

(iv) **Solar water heater:** It consists of an insulated box painted black from inside and having a glass lid to receive and store solar heat. Inside the box it has black painted copper coil through which cold water is made to flow in, which gets heated and flows out into a storage tank. The hot water from the storage tank fitted on roof top is then supplied through pipes into buildings like hotels and hospitals.

(v) **Solar furnace:** Here thousands of small plane mirrors are arranged in concave reflectors, all of which collect the solar heat and produce as high a temperature as 3000°C .

(vi) **Solar power plant:** Solar energy is harnessed on a large scale by using concave reflectors which cause boiling of water to produce steam. The steam turbine drives a generator to produce electricity. A solar power plant (50 K Watt capacity) has been installed at Gurgaon, Haryana.