

## CHAPTER 1

### ALTERNATE SOURCES OF ENERGY

#### After studying this chapter you

- know about the need for alternative sources of energy.
- learn the various sources of non conventional energy.
- realize the vast potential of harnessing solar energy.
- know other sources of renewable energy.

In your previous classes you have learnt that the sources of energy are depleting and that there is a need for their conservation. Is it just enough if we think of some measures of conserving energy sources such as fossil fuels? Are such measures going to be effective? Should we not think of alternative sources of energy? Yes, the need of the day is to look for alternative sources of energy. Are there any such alternative source of energy?

The social, economic and scientific development of a country are directly linked to its energy resources. The conventional sources of energy that are being used for a long time, are generally non renewable. They include coal, petroleum, natural gas and electricity. We are using them so extensively that their reserves are depleting at a fast rate. At the same time, it is becoming increasingly difficult to discover new deposits. Keeping this in mind, there are attempts all over the world to tap alternative sources of energy.

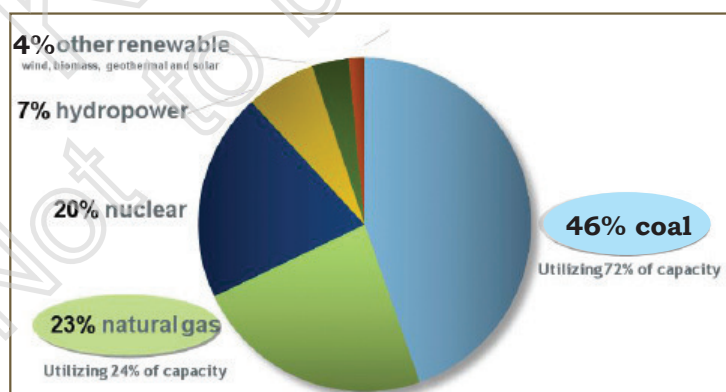


Fig. 1.1 Percentage global use of different sources of energy

Which other sources of energy are being used now? (fig 1.1) At present, there are several sources of renewable energy which are being tapped. These are commonly described as **non-conventional sources of energy**. They include energy from sun, wind, tides, geothermal sources, biomass and even from wastes. These forms of energy are abundant, renewable, pollution free and ecofriendly. They can also be conveniently made available in urban, rural and even remote areas. Use of non-conventional forms of energy can serve two purposes.

- supply of energy in a decentralized system.
- sustaining a cleaner environment.

Let us now look into these alternative sources of energy.

## Solar Energy

Sun provides us enormous amount of energy in the form of solar radiation. It reaches the Earth from a distance of about 150 million kilometers, in the form of small wave packets called **photons**. It is the result of continuous thermonuclear fusion taking place in the sun.

### Know this

*The amount of solar energy reaching per square meter of Earth's atmosphere is called **solar constant**. It is equivalent to 1.36 kw in 12 hours of time. Energy being received in the atmosphere is about  $1.5 \times 10^{18}$  kwh per day.*

Application of solar energy has the following processes

### 1. Conversion of solar energy into heat energy

Solar energy falling on the surface of the earth can be converted into thermal energy. The heat generated can be stored in **solar collectors**. It can be utilized for various purposes such as heating of water and cooking of food. You are familiar with the solar water heaters erected on the roof tops of houses. Solar heaters are also being used in drying of food grains and vegetables, seasoning of wood and desalination of marine water.



Fig. 1.2 Solar collectors

### Solar Pond

- *Solar Pond is one of the most promising technology in harnessing solar energy. It is a large scale solar collector with an integrated arrangement for storage of heat energy.*

*You know that water and air become lighter and rise above, when heated. When water is heated by solar radiation, hot water from the bottom of the pond rises and reaches the surface. It loses the heat gained, to the atmosphere. The result is that pond water remains at a temperature nearer to that of the atmosphere. This loss of heat is prevented by dissolving salts in the bottom of the pond. It makes water denser and hence, it cannot rise to the surface. Thus, solar energy remains trapped in the pond.*

- *India was the first Asian country to have established a solar pond in Bhuj, in Gujarat. It is designed to supply about 220 lakh kwh of thermal energy annually.*

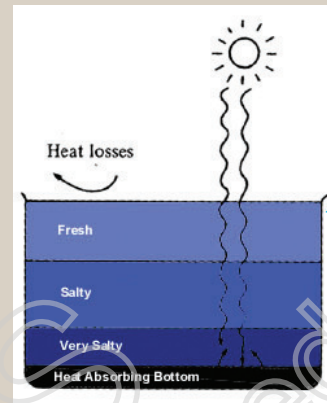


Fig. 1.3 Solar pond

## 2. Conversion of solar energy into electrical energy.

This requires the use of some solid state materials. It uses the principle of **photo voltaic effect**. Such a device is called **solar cell**. You have seen such solar cells being used in the traffic signals in cities, lighting lamps and pumping water and for other purposes in rural areas.

### Bio energy

It includes those processes where biological matter such as plants and plant products provide the basis for energy and its conversion. Plant, organic matter, also called **vegetable biomass**, offers clean fuel for energy. It maintains an unpolluted environment and reduces the carbondioxide content in the atmosphere. Biomass improves quality and water retention capacity of the soil.

#### Know this

##### Biogas

*Biogas is a clean, unpolluted and inexpensive source of energy for rural areas. It contains nearly 70% of methane, an inflammable gas. It is produced from cowdung in a specific **biogas plant** commonly called **gobar gas plant**. It helps in obtaining both cooking fuel and enriched manure. It can also be used for lighting and running small engines.*

### Know this

How is biomass converted into energy?

There are three basic processes involved in the conversion of biomass into energy sources.

1. **Combustion pyrolysis** : It is a process of chemical decomposition at high temperature (as high as  $5000^{\circ}\text{C}$ ) in total or partial absence of air. It yields fuel gas, ethanol and charcoal.

2. **Bio gasification** : It is a process of anaerobic digestion of biomass to produce a combustible gas called **biogas**, containing methane and hydrogen.

3. **Fermentation** : Conversion of sugars into alcohol to produce ethane and solid residual fuel.



Fig. 1.4 Sources of biomass

### Bio alternative to diesel

The oil extracted from the seeds of the plant, *Jatropha* is now being used as a bio alternative to diesel. It requires the conversion of crude oil from the seeds to a commercially useful fuel. This process called **trans esterification** has been standardised by the scientists at Indian Institute of Science Bangalore.

*Jatropha* is a hardy plant which can grow on any type of soil, under any kind of agro-climatic conditions. The plant can easily be propagated through seeds or stem cuttings. It grows very fast. Moreover, it is not grazed by animals even during periods of drought.

*Pongamia pinnata* (Honge) is another plant that yields biofuel.

### Know this

Government of Karnataka has a scheme to encourage farmers to grow *Jatropha* in their field during lean periods of agriculture. The seeds of the plant are purchased by the government, to extract oil.

Biodiesel obtained from such sources is being used to run transport vehicles. The state government owned buses are now using biodiesel.

### **Activity 1.1**

*Collect information about other plants which can be used for obtaining alternatives to diesel.*

The other forms of renewable energy are wind energy, tidal energy and ocean energy.

### **Wind energy**

Wind energy is the kinetic energy associated with the movement of large masses of air, resulting from the differential heating of atmosphere by the sun. Hence, wind energy is a converted form of solar energy. The total potential of wind energy is very large. It varies not only from region to region, but also in the same region from time to time. For the utilization of wind energy, ideally the speed of wind should be between 8 and 22 m per sec. Wind turbines are used for the purposes of obtaining **wind energy**. (Fig1.5).



*Fig. 1.5 Wind mills*

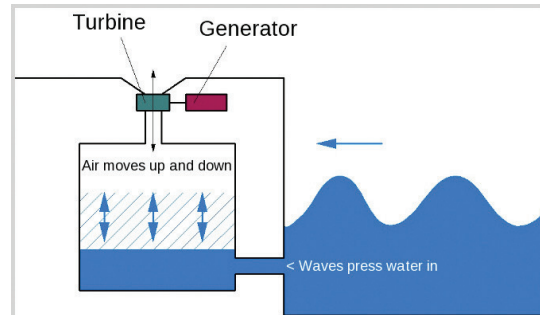
The largest installation of wind turbines in the country are found near Kanya Kumari in Tamil Nadu.

### **Wave energy**

Movement of large quantities of water up and down in the seas and oceans, in the form of **waves** is also a source of energy. This energy can be converted into mechanical energy and electrical energy. The tropical coastline of our country, especially the south west coast



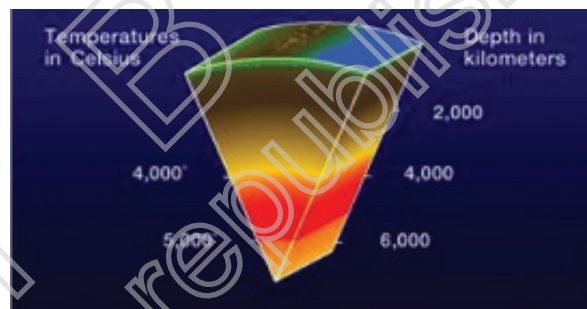
line, is found to be highly suitable for establishing energy conversion plants. However, the cost of energy conversion per unit, is very high, since it requires many special equipments to be created near the sea. Wave energy is however more reliable than wind energy since the fluctuations are comparatively less pronounced.



*Fig. 1.6 Conversion of wave energy*

### **Geothermal energy**

It refers to heat of the Earth within 10 km. from the surface. It can also be processed for power. Geothermal energy has a temperature of about 1300°C



*Fig 1.7 Temperatures in the Earth*

There are about 340 hot springs identified in different parts of our country. Of these, only a few have been used. There have been attempts to utilize the geothermal energy in Puga, Manikaran, Tatapani and Bakneshwar. Puga in Ladakh and Tatapani in Madhya Pradesh are most promising.

### **Energy from wastes**

A huge quantity of waste is generated in our towns and cities. Waste generation is very high, especially in sugar, paper and pulp industries. Such wastes can also be converted into energy.

Thus, in the recent years search for alternative sources of energy has yielded good results. If they are properly put into use, we can be self sufficient and can look towards sustainable development.

## EXERCISE

### I. Choose the correct answer from those given, for the following questions

1. Identify from the following, a conventional source of energy
  - a. solar energy
  - b. tidal energy
  - c. natural gas
  - d. bio energy
2. The largest installation of wind turbines in our country is in
  - a. Ladakh
  - b. Gujarat
  - c. Kanyakumari
  - d. Madhya Pradesh
3. Which of the following is not a feature of bio energy?
  - a. it improves soil quality
  - b. it enhances water retention
  - c. it reduces carbon dioxide content in the atmosphere
  - d. it increases pollution
4. Which of the following is an indirect form of solar energy?
  - a. tidal energy
  - b. energy from wastes
  - c. geothermal energy
  - d. electricity

### II. Fill in the blanks with suitable words.

1. The principle involved in the conversion of solar energy into electrical energy is called \_\_\_\_\_ .
2. The conversion of crude oil from plant seeds into a useful fuel involves a process called \_\_\_\_\_.
3. Wind energy is a converted form of \_\_\_\_\_ .
4. The energy trapped within 10 km. of Earth's crust is known as \_\_\_\_\_ .

**III. Answer the following questions.**

1. What is the need for exploring alternative sources of energy?
2. Make a list of the advantages of non conventional sources of energy.
3. Differentiate between solar collectors and solar cells.
4. What is bio energy?
5. Name any two plants that are sources of biofuel.
6. Write a brief note on geothermal energy.



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