5 More about Energy

LEARNING OUTCOMES

- Sources of energy: renewable and non-renewable
- Solar energy
- Biomass
- Wind energy
- Geothermal energy
- Tidal energy
- Hydroelectric energy
- Fossil fuels
- Air pollution
- Nuclear energy
- Conservation of energy

FACT FILE

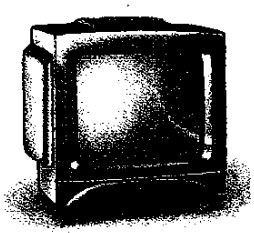
Ancient people used energy from fire to cook, energy from muscles to develop tools, energy from wind to move their boats, and energy from waterwheels for irrigation. Ancient Romans heated their public baths by running water over sun-exposed black tiles.

Do you notice any difference in yourself when you wake up in the morning and when you go to bed at night? In the morning, you are full of *energy* and feel fresh, while at night you feel tired and exhausted as your *energy* gets used up during the day in all your activities. What does this energy mean? You have studied it in earlier classes. Do you remember what energy is?

Energy is the ability to do work.

Energy is all around you everyday. Without energy there would be nothing—no wind, no rivers, and no life at all. Every object in our surrounding is full of energy. This energy exists in different forms such as potential energy, kinetic energy, solar energy, light energy, chemical energy, etc. In order to use all these energies efficiently, we need to change one form of energy to another. We call this *transformation of energy*. You might have studied about this in class 6.

In this chapter, you will learn about the various sources of energy, their advantages and disadvantages, and how they are useful to us.



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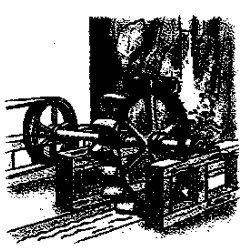

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Identify the energy transfer that occurs in these figures and write it in the space given.

Almost all forms of energy on this earth come from the energy of the sun, called the *solar energy*. The solar energy that we absorb from the sun is in the form of heat and light, which gives rise to many natural phenomena.

Some of the important energies that we obtain from the sun are summarized in Figure 5.1.

FACT FILE

The amount of energy the world's population uses in one year is equal to the amount of energy the sun sends to the earth in just 40 minutes!

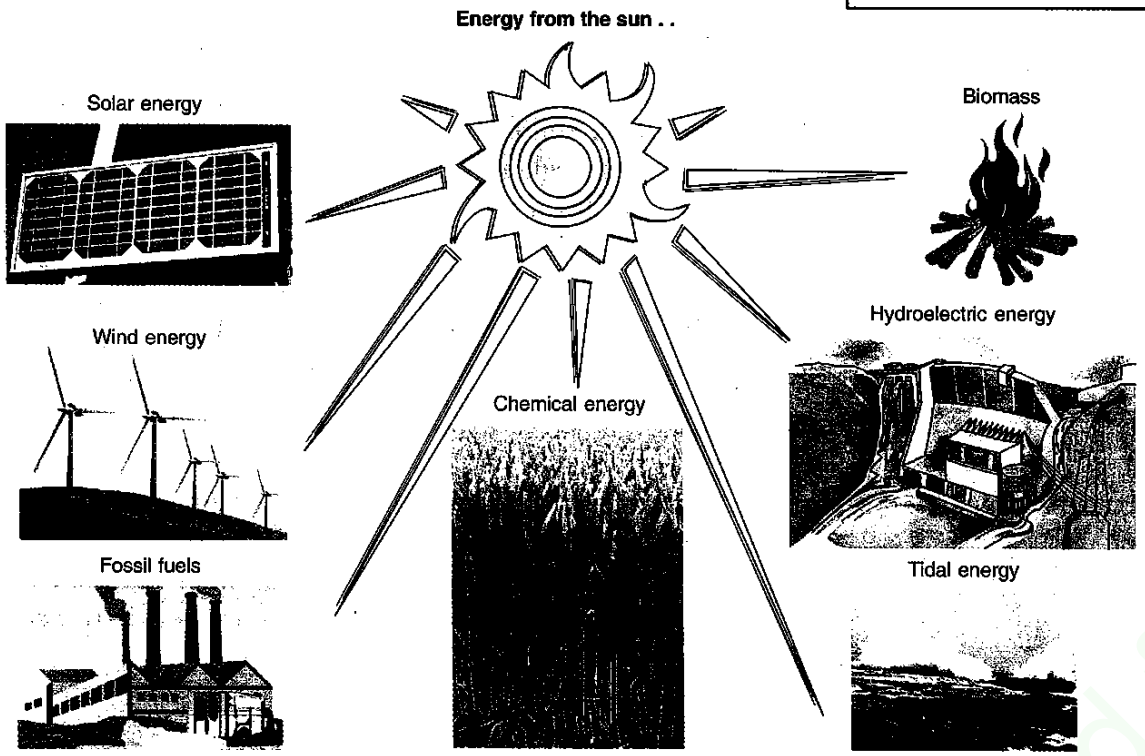


Fig. 5.1 *The sun is the ultimate source of all energy*

Sources of energy

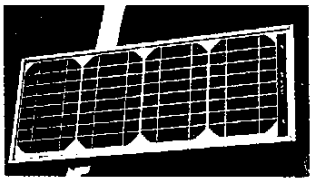
All forms of energy that we see in Figure 5.1 are stored in different energy sources that we use everyday. These sources are divided into two groups—*renewable* and *non-renewable sources of energy*.

You might be using LPG (cooking gas), petrol, kerosene, and coal in your day-to-day life. Do you know that these sources of energy are limited and they take a lot of time, over millions of years, to form? These resources, once used, cannot be replenished within a short period of time and will be lost forever. Such sources of energy are called *non-renewable sources of energy*. Even nuclear power and minerals like uranium, etc. are non-renewable sources of energy. However, other forms of energy that we get from sources like the sun, water, wind, tides, and biomass are

FACT FILE

Stored chemical energy is a type of potential energy. Plants store chemical energy in their leaves and roots and use it for growth. Animals and human beings store chemical energy in their muscles and body fat and use it during movement. Fuels and batteries store chemical energy and convert it into heat and electrical energy.

FACT FILE



Notice the solar collectors above. Each solar collector has a sheet of glass covering a black metal plate. Some collectors store solar energy for future use, while some other use fluid circulation to transfer the heat for direct use.

continuously replenished through a number of natural phenomena. So, such resources are called *renewable sources of energy*.

Let us learn about all these non-renewable and renewable sources of energy in detail.

RENEWABLE SOURCES OF ENERGY

Solar energy

We know that the sun is the ultimate source of all energy. But the solar energy that reaches our earth is in a diffused form, i.e., the solar energy falling on a unit area of the earth's surface is very small. Thus, special devices called *solar collectors* are used to collect the solar energy over large areas and change it into a storable and usable form. Some devices that use solar energy directly for some day-to-day functions are mentioned here.

Solar cooker: is a device which uses solar energy for cooking food. It is made of an insulated wooden box painted black from inside and has a glass cover on top. A plane mirror attached to the box reflects sunlight. The food to be cooked is kept in containers, painted black from outside, inside the box. Since food in a solar cooker is cooked at low heat, the nutrients are not destroyed. Also, this saves fuel like LPG (non-renewable) and does not produce smoke.

Solar photovoltaic cell: is a device that is used to convert solar energy into electrical energy by generating a potential difference. A solar cell is made of materials, like silicon, and is used in calculators, watches, and transistor radios where a very small amount of current is required. To generate a large amount of current, a number of solar cells are connected together forming a *solar panel*.

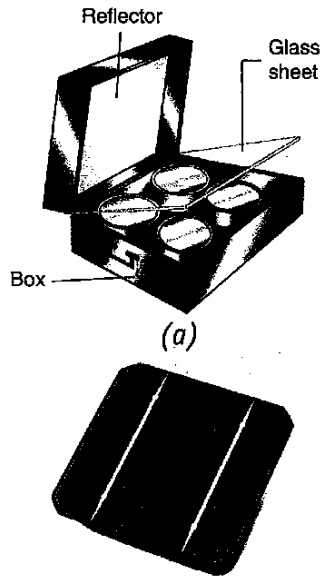


Fig. 5.2 *(a) Solar cooker; and (b) Solar cell*

Benefits and problems of solar energy

The use of solar cells is fast becoming more economical. Even though they are expensive, they are useful in remote areas where it is cheaper to build solar panels than to run power lines. They power irrigation pumps, telephone booths, and aircraft navigation beacons. Solar panels also provide power to satellites, spacecrafts, and sometimes to isolated buildings. Solar energy is renewable and non-polluting. However, solar cells and collectors are costly. Also, solar energy can be used to make electricity only in places that get enough sunlight everyday. So, people are working on new kinds of solar cells that work with less sunlight and are less expensive.

THE BIG SOLAR POND AT BHUJ

One way to trap solar energy is through the use of solar ponds. A **solar pond** collects and stores energy on a large scale in the bottom layer where there is dissolved salt. It can be used for water desalination, drying, and power generation. Apart from being cost-effective, solar ponds can be used for reducing the consumption of fossil fuels and bringing down pollution.

The **solar pond at Bhuj, Gujarat** is one of the largest operating solar ponds in the world. This pond has been successfully supplying processed heat since September, 1993. Some towns in Israel get their energy from solar ponds on the Dead sea. These ponds generate 5 MW of electricity, enough for a small town.

Biomass (Bio energy)

Have you ever come across the term '*biomass*'? Do you know what it means? ***Biomass means biological mass, which constitutes both plants and animals.*** Biomass collectively refers to plants, animals, industrial waste, wood, sewage, crop residue, cow dung, and other wastes. It is a rich renewable source of energy but is underutilized. Biomass, like wood, cow dung, etc., is usually burnt in air to obtain heat. However, this is not an efficient method of getting energy. An efficient method is to convert biomass into *biogas, a gaseous fuel*. This is done in a biogas plant (Fig. 5.3). Biomass is mixed with water and kept in a tank, which has no supply of air. In the absence of air, biomass mixed with water forms methane, carbon dioxide, and other gases. This mixture of gases is called *biogas*. After the formation of biogas, the residue left behind serves as a good fertilizer.

Table 5.1 shows the composition of biogas.

Biomass fuel used in India accounts for about one-third of the total fuel used in the country, being the most important fuel used in over 90% of the rural households and about 15% of the urban households.

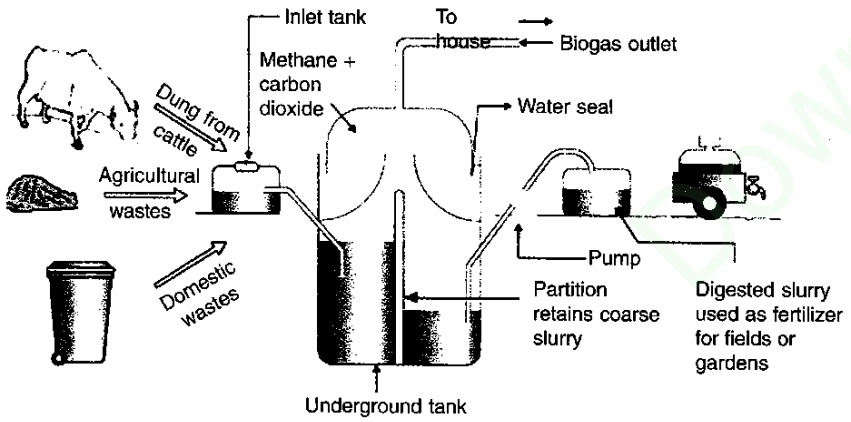


Fig. 5.3 A biogas plant

***Table 5.1** Composition of biogas*

Constituents	*Percentage (%)*
Methane	55–75
Carbon dioxide	25–45
Nitrogen	0–0.3
Hydrogen	1–5
Hydrogen sulphide	0–3
Oxygen	0.1–0.5

Wind energy

Collect information in your scrap book about various plants and their parts that are used as rich biomass energy. Some examples are given here for your help: jojoba plant, sugarcane, and sea weeds like kelp.

Do you know the difference between wind and air? ***Wind** refers to the moving air*. Since wind is moving air, it has kinetic energy. This kinetic energy of the wind, called *wind energy*, is converted to more useful forms of energy.

People have used wind energy for thousands of years. Windmills were once used to turn stones that ground grains into flour. It has also been used to propel boats for transportation as in the case of sail boats and for irrigation. Windmills are still used to pump water from wells in many countries, particularly in the rural areas.

Nowadays, modern windmills use the energy of winds to generate electricity. In areas or places where strong and steady winds blow, several windmills are set up in *windfarms* to generate electricity (Fig. 5.4). Windmills transform the energy of the wind into mechanical energy, which can then be used directly for grinding, etc., or further converted to electrical energy to generate electricity. Small windfarms called *aero-generators* can be used to charge large batteries.

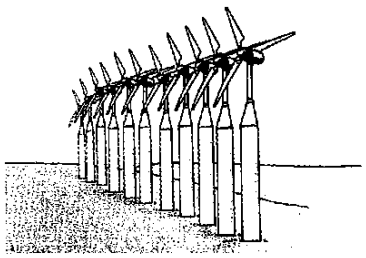


***Fig. 5.4** A windfarm*

Germany, USA, Denmark, Spain, and India account for 80% of the world's installed wind energy capacity. In India, Tamil Nadu and Gujarat lead in the field of wind energy. Other sites include western Madhya Pradesh, parts of Rajasthan and Karnataka, coastal areas, and the Bay of Bengal.

Geothermal energy

The name geothermal comes from two Greek words: '*geo*' meaning 'earth' and '*therme*' meaning 'heat'. We know that the deeper regions of the earth's crust are very hot. This heat energy from the earth's crust comes to the surface in the form of *volcanoes*, *hot-water springs*, and fountains called *geysers*. The steam that comes out at such surface manifestations is used to generate electricity. Many geothermal power stations have been established where the high-pressure steam from volcanoes, hot springs, and fountains is collected in a pipe and made to turn the turbine of a generator to produce electricity (Fig. 5.5).

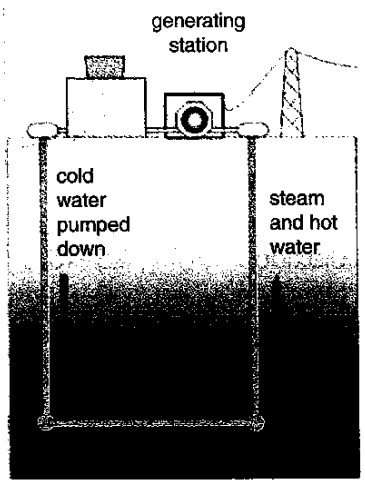


***Fig. 5.5** A geothermal plant*

The first geothermal power station was built in Italy. Geothermal energy is an important resource in volcanically-active places, such as Iceland and New Zealand. In India, Northwestern Himalayas and the western coast are considered as geothermal areas. The Geological Survey of India has already identified more than 350 hot springs sites, which can be explored as areas to tap geothermal

energy. The Puga valley in Ladakh has the most promising geothermal field.

Tidal energy

The energy obtained from the rising tides in the coastal areas is called *tidal energy*. This energy can be harnessed to produce electricity by constructing a *tidal dam* or a *tidal barrage*. A *tidal dam* or a *tidal barrage* is constructed only in locations where the tidal range, i.e., the difference between the level of water in high tide and low tide is high.

The first tidal energy project in India was set up at Vizhinjam, near Thiruvananthapuram. A major tidal wave project is proposed to be set up in the Hanthal Creek in the Gulf of Kutch in Gujarat.

How a tidal barrage works!

During high tide, when the level of water in the sea is high, the gates in the barrage open in order to fill the basin up to the high water level. The gates are then closed before the tide begins to fall. Once the tide level outside the barrage has dropped sufficiently, the water is allowed to flow out through large turbines, which drive generators to produce electricity.

Hydroelectric energy

Do you know that even flowing/moving water has a lot of energy in it? Can you tell which energy does moving water have? It has kinetic energy stored in it. This kinetic energy is used to generate electricity in *hydroelectric power plants* (Fig. 5.6).

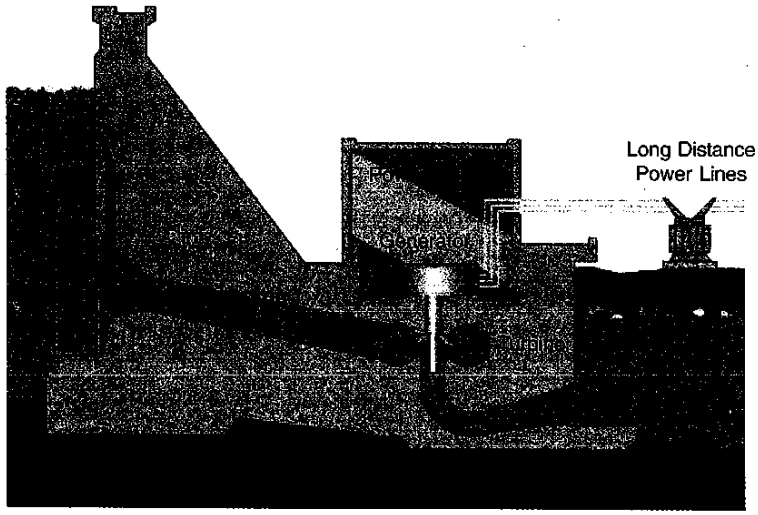


Fig. 5.6 *A hydroelectric power plant*

In a hydroelectric power plant, the energy of the flowing water is stored by building a dam across a river at a suitable point. The stored water is then made to fall from the top of the dam over the turbine blades at the bottom of the dam. This turbine drives generators and produces electricity, which is called *hydroelectricity*. Some advantages and disadvantages of hydroelectric power plants are summarized in Table 5.2.

TECH FILE

Tehri dam is the main dam of the Tehri Hydel Project, a major power project located near Tehri in the state of Uttaranchal in India. It is the fifth tallest dam in the world, towering 260 m. It generates power, supplies drinking water, and irrigates a large area of land. The relocation of one lakh people, disruption of ecosystems, and concerns regarding the safety of the dam has been the object of intense protests from people of this region and from environmentalists.

Table 5.2 *Advantages and disadvantages of hydroelectric power plants*

Advantages of hydroelectric power plants	*Disadvantages of hydroelectric power plants*
1. Once the dam is built, the energy is virtually free. No waste or pollution is produced. 2. It is much more reliable than wind, solar, or tidal power. Water can be stored above the dam to be ready to cope with peaks in electricity demand. 3. Hydroelectric power stations can be raised to full power very quickly, unlike other power stations. Electricity can be generated constantly.	1. Dams require ample land and are expensive to build. Large dam floods a large area upstream. 2. Some dams cannot make electricity forever as with time, sand and mud fill the area where water is stored. 3. Dams that block rivers affect fish and other living things. 4. Water quality and quantity downstream can be affected. 5. Impact on residents and environment may be unacceptable.

Some of the important hydroelectric projects in India are:

1. Bhakra-Nangal project in Himachal Pradesh;
2. Hirakud project in Orissa;
3. Damodar valley project in West Bengal;
4. Mettur dam in Tamil Nadu; and
5. Tungabhadra project in Andhra Pradesh.

TECH FILE

The **Bhakra dam,** the first project to be taken up after India's independence, is built across the Sutlej river, near the border between Punjab and Himachal Pradesh. The dam is part of the larger Bhakra-Nangal project whose aims are to prevent floods in the Sutlej–Beas river valley, to provide irrigation to the adjoining states, and to provide hydroelectricity.

You might have noticed that all the energy sources that you have studied so far generate electricity. Electricity supply is regarded as a major requirement for a modern society as it is a convenient form of energy. It can be converted into any form easily with the help of suitable appliances and can be carried from one place to another.

All the renewable sources of energy that you have studied so far have existed in nature for billions of years and are expected to last for billions of years to come without getting exhausted.

Scientists are doing research to get renewable sources of energy from fresh air, space, and even beyond the solar system. They are planning to build a huge power station in space where sunlight is much stronger. The solar energy absorbed in space is planned to be converted to electromagnetic waves and beamed down to a receiver on the earth.

But there are resources that have accumulated in nature over a period of millions of years and cannot be renewed quickly when exhausted. They are called *non-renewable* sources of energy. Let us study about them.

NON-RENEWABLE SOURCES OF ENERGY

Fossil fuels

You might have come across the term "fossil fuels" in many of your chapters. Do you know what fossil fuels mean?

*A **fuel** is any type of material that stores energy and can be burnt to supply heat.* And, *a **fossil fuel** is a fuel that is formed over millions of years from the remains of living things (plants and animals).*

Fossil fuels include coal, petroleum, and natural gas that we use in a large amount in our day-to-day household work (Fig. 5.7). These are called fossil fuels because they are formed from the fossil remains of dead plants and animals. When any plant or animal dies, its body gradually gets buried under the layers of sand, on land or in sea. New and new layers of sand keep depositing over these dead plants and animals. This builds up extremely high temperature and pressure inside the earth, which slowly converts the dead remains of plants and animals into fossil fuels, like coal, petroleum, or natural gas.

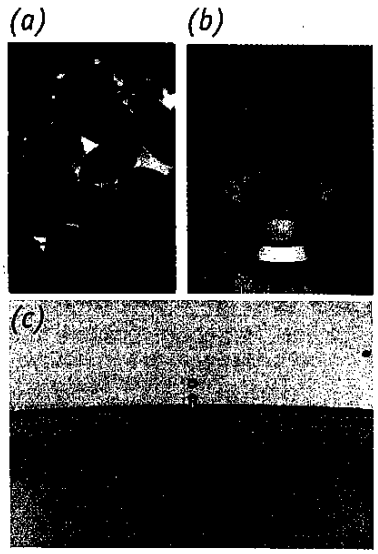
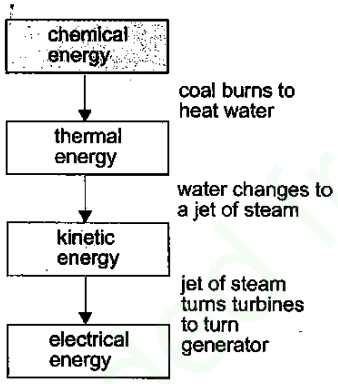


***Fig. 5.7** (a) Coal; (b) Natural gas; and (c) Petroleum*

We get petroleum by drilling holes into the earth's crust, where oil is found. Natural gas comes out first through the rocks with great pressure, after which petroleum comes out by itself. After the pressure subsides, it can be pumped out of the oil wells.

The oil that we get from an oil well is called 'crude' because it cannot be used in that same form. It has to be refined to be made fit for consumption. Crude oil is treated at a refinery, which makes many useful products from crude oil. At a refinery, crude oil is first heated up and made to pass through a distillation tower, which separates the components of crude oil producing petrol, diesel fuels, and oils that are used to make paints, plastics, and fertilizers.



Energy changes in a coal-burning power station

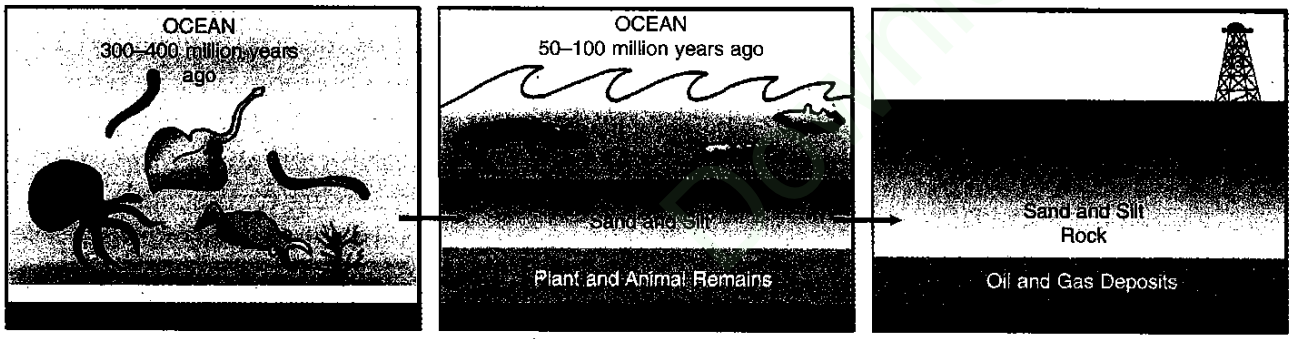


***Fig. 5.8** Formation of crude oil and natural gas*

Today, fossil fuels are the most important sources of energy. They give heat and light on burning. The thermal power stations use fossil fuels as their energy source and generate electricity.

What are peat bogs?

Peat bogs are waterlogged mounds of partially-decomposed plant material, which have accumulated naturally over thousands of years in cool wet climate. They are found in marshy lands and swamps. They are used as a fuel and as bedding material after drying. Peat bogs provide habitat for a great diversity of native plants and wildlife. Since they also act as a carbon sink, proper management of peat bogs can reduce global warming.

As discussed, we are using large amount of fossil fuels to meet our everyday requirements in home and industry and also for transportation. We do this without paying any attention to the tremendous amount of air pollution that is caused by the use of fossil fuels.

Air pollution by fossil fuels

Combustion of fossil fuels releases harmful and undesirable materials into the atmosphere and causes air pollution. Air pollution results in health problems, damages environment and property. The following are some of the ways in which fossil fuels cause air pollution:

Fig. 5.9 *Marble corrosion due to acid rain*

1. Combustion of fossil fuels produces a large amount of carbon dioxide gas. We know that carbon dioxide is a greenhouse gas, absorbing the infrared radiation from the sun but not releasing it back. This will lead to global warming and melting of the glaciers of the world.
2. When fossil fuels are burnt in an insufficient supply of oxygen, they produce carbon monoxide which is a poisonous gas and if inhaled, can be lethal.
3. Fossil fuels contain a large amount of sulphur, which produces a poisonous gas, sulphur dioxide, on burning. This sulphur dioxide dissolves in the water present in the air and forms sulphuric acid, which falls on the earth with rain as *acid rain*. This acid rain damages crops, harms living tissues, and corrodes metals and marbles of the buildings (Fig. 5.9).
4. The burning of fossil fuels releases ash and unburnt carbon particles. These are together called *suspended particulate matter (SPM)*.

These are very harmful and cause serious respiratory diseases when inhaled.

5. The smoke that is released from automobiles and factories contains poisonous compounds of nitrogen and lead compounds.

In order to reduce the air pollution caused by the excessive use of fossil fuels in automobiles, another alternative has recently gained importance. Can you name another fuel than is increasingly becoming popular as a fuel for automobiles? It is *CNG*. You might have come across this term. Can you tell its full form? CNG stands for ***Compressed Natural Gas***.

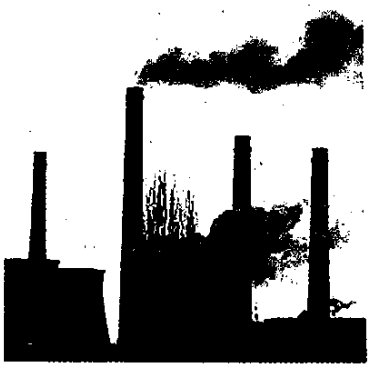


Fig. 5.10 *A thermal power plant*

Compressed natural gas (CNG) is a substitute for petrol and diesel fuel used in automobiles. It is considered to be an environmentally "clean" alternative to these fuels. It is a product that we get from natural gas. In response to the high fuel prices and environmental concerns, CNG is now being used in light-duty passenger vehicles, like autorickshaws and school buses. Check to see if your school buses use CNG as a fuel or not?

Nuclear energy

You might have studied about an atom and its nucleus in your chemistry classes. Do you know that the nucleus of an atom has a huge amount of energy stored in it? This is called *nuclear energy*. Because nuclear power is not renewed from an external energy source, it does not meet the conventional definition of renewable energy and so, is included under non-renewable sources of energy.

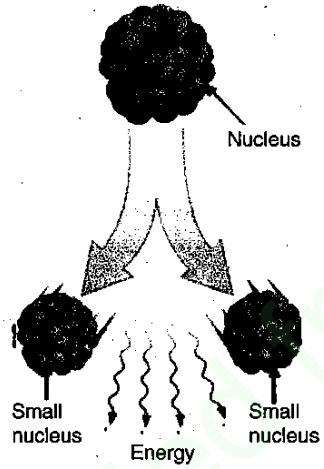


Fig. 5.11 *Nuclear fission*

The nuclear energy from an atom is liberated by two processes: *nuclear fission* and *nuclear fusion*.

The splitting up of a nucleus of an atom into two fragments with the emission of a large amount of energy is called ***nuclear fission***. With most elements nuclear fission is impossible because the nuclei are too tightly bound. However, some elements such as uranium are made up of atoms with big, unstable nuclei that are easy to break apart. The energy released is enormous and that is the source of nuclear power. Such large-scale nuclear fission reactions take place in specially-designed machines called *nuclear reactors*. These reactions are controlled in *nuclear power plants* and tremendous energy is released, which produces heat. This heat is then used to create steam, which turns turbines and generates electricity. When these nuclear fission reactions are allowed to proceed

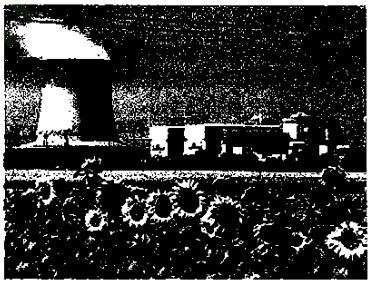


Fig. 5.12 *A nuclear power plant*

uncontrolled, an explosion of tremendous power occurs. This forms the basis of nuclear bombs, commonly called atom bombs.

Another type of nuclear reactions in which a huge amount of energy is liberated is *nuclear fusion. The process of two lighter nuclei combining to form a larger nucleus is called* ***nuclear fusion***. Nuclear fusion forms the basis of the energy of the sun; also, the principle behind the hydrogen bombs.

The major nuclear power plants in India are at **Kaiga** in Karnataka, **Kakrapur** in Gujarat, **Kalpakkam** in Tamil Nadu, **Narora** in Uttar Pradesh, **RanaPratap Sagar** in Rajasthan, and **Tarapur** in Maharashtra.

Some of the dangers associated with nuclear power plants are as follows:

1. Nuclear power plants do not burn fuel, but they give off dangerous radiations into the atmosphere. That is why a nuclear reactor has to be surrounded by a thick concrete or steel wall so that the radiation cannot escape. Even a low dose of radiation can make people feel ill. Higher doses can cause ulcers and burns on the skin and damage the bone marrow. Radiation can even harm the DNA in the body that may then be transferred to the offsprings.
2. Nuclear power plants also make dangerous waste, which remain radioactive for thousands of years to come. It can damage or destroy the cells of living things. Scientists are working to find ways to dispose off these wastes safely.
3. Nuclear and other power plants make another waste, extra heat. After steam has turned turbines, the steam must be cooled. Steam is sent through pipes that run through water in a nearby lake or river. As the water in the lake or river cools the steam, the steam changes back to hot water. This change affects living organisms in these lakes and rivers.

In order to avoid all the hazards of nuclear energy, the following steps could be taken:

1. The radioactive source should be stored with great care.
2. A person handling a radioactive source should wear protective clothing like lead apron and a special badge to monitor the extent of exposure to harmful radiation. Workers in the nuclear industry should wear dosimeters, which record how much radiation they have been exposed to. The air inside the nuclear

FACT FILE

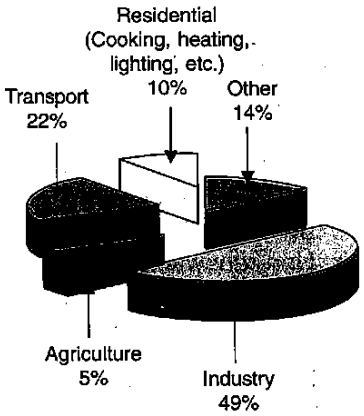
Scientists first used nuclear energy to make atomic bombs. The energy released by atomic bombs have awesome destructive powers. Two atomic bombs were dropped on the Japanese cities of Hiroshima and Nagasaki in 1945 during World War II. The bomb dropped on Hiroshima (6 August 1945) was nicknamed Little Boy, while the one dropped on Nagasaki (11 August 1945) was nicknamed Fat Man.

It is believed that more than 1,40,000 people died by the end of the year due to the bombings.

plants should be constantly monitored so that any leaks are detected immediately.

Conservation of energy

We all know that human population is increasing at a very rapid rate. But, our energy sources like fossil fuels and nuclear energy, to some extent, are not increasing at the same rate with which our need for energy is increasing. Therefore, it becomes very important that we use the sources of energy with utmost care and not waste them. Otherwise, we would experience an energy crisis soon.



Break-up of commercial energy consumption

The wise and economic use of energy resources is called *conservation of energy*. Some steps that we can take to save and conserve energy are:

1. Switching off all electric appliances, like TV, coolers, fans, light, etc. and turning off the water taps when not required.
2. Using more of the public transport that uses CNG and avoiding excessive use of fuels.
3. Fitting our homes with insulation to limit the amount of heat that is lost through the roofs and the walls.
4. Using devices like solar cooker, solar water heater, etc. that use renewable sources of energy.
5. Using more of tubelights and CFL bulbs in place of lamps, which consume more energy.
6. Gas pipes, oil pipes, and water pipes should be well-maintained to avoid loss of resources.
7. Reusing and recycling everything you can. Recycling of things such as paper, cans, bags, etc. use less energy than making them from raw materials. Create useful products from waste. E.g., set up compost pits so that organic manure can be produced from food and vegetable waste. Another example is hand-made paper from jute, cloth, and other waste material.

KEYWORDS

Energy The ability to do work

Renewable source of energy That can be replenished in a short period of time

Non-renewable source of energy That once used cannot be replenished within a short period of time

Biomass Biological mass, which constitutes both plants and animals

Fossil fuel Formed over millions of years from the remains of living things

Nuclear fission Splitting up of a nucleus of an atom into two fragments with the emission of large amount of energy

Nuclear fusion The process of two lighter nuclei combining to form a larger nucleus

SUMMARY

- Energy is the ability to do work.
- Sometimes energy needs to be converted from one form to the other before it is useful for us.
- The sun provides most of our energy.
- Renewable sources of energy include energy from the sun, wind, moving water, biomass, and geothermal energy.
- Non-renewable sources of energy include fossil fuels and nuclear power.
- Fossil fuels pollute the atmosphere and can harm living things.
- Nuclear power plant produces dangerous waste, which can remain radioactive for thousands of years to come.
- Air pollution is the contamination of air by the discharge of harmful materials in the atmosphere.
- Air pollution causes health problems, damages environment and property.
- Compressed Natural Gas is one of the most environment-friendly fuels.
- We should make an effort to reduce pollution and save energy in our own ways.

EXERCISES

I. Review questions

A. Choose the correct answer

1. ..... is a renewable energy source derived from the wastes of various human and natural activities.
   (a) Coal (b) Petroleum (c) Biomass (d) Uranium
2. ..... radiations can damage or destroy the cells of living things.
   (a) Solar (b) Nuclear (c) Sulphur (d) CO_2
3. The principle behind the hydrogen bomb is .....
   (a) nuclear fission (b) nuclear radiation
   (c) hydrogen radiation (d) nuclear fusion
4. ..... is used as a substitute for petrol and diesel fuel.
   (a) Methane (b) CO_2 (c) Acid rain (d) CNG
5. ..... damages crops, corrodes metals and marbles of buildings.
   (a) Coal (b) Nuclear radiations (c) Acid rain (d) Solar energy

B. Fill in the blanks

1. When a log of wood burns, it turns ..... (mechanical/chemical) energy to heat energy.
2. Sources of energy which cannot be replenished within a short period of time are called ..... (renewable/non-renewable) sources of energy.
3. ..... converts solar energy into electricity without using turbines (Solar cooker/Solar photovoltaic cell).
4. In biogas ..... (CO_2/methane) forms the major constituent in the mixture of gases.
5. Moving air (wind) has ..... (kinetic/potential) energy.
6. Geothermal energy is an important source in ..... (sunny/volcanically-active) places.
7. In a ..... (thermal/hydroelectric) plant, we use the energy of flowing water for the production of electrical energy.
8. Coal, petroleum, and natural gas are called ..... (efficient/fossil) fuels.

9. At a ..... (reactor/refinery), crude oil is separated into petrol, diesel fuels, and oils.
10. The splitting up of the nucleus of an atom into two fragments, with the release of large amount of energy is called nuclear ..... (fission/fusion).

C. Correct the statements that are false

1. The sun is one of the major sources of energy.
2. Biomass is a kind of fossil fuel.
3. Geothermal energy is a renewable source of energy.
4. Nuclear fission takes place in a nuclear reactor.
5. No waste is produced in a hydroelectric power plant.

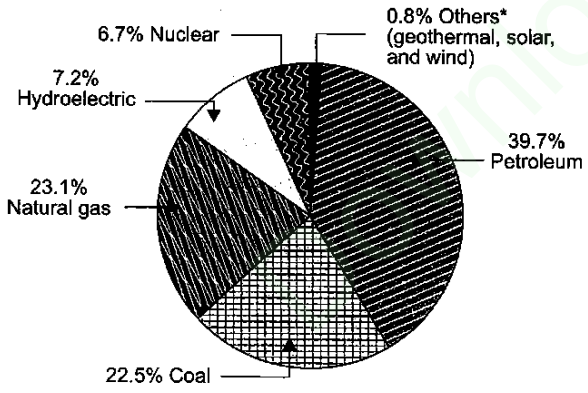
D. Answer the following questions

1. Name any four different kinds of energy.
2. What are renewable and non-renewable sources of energy? Give two examples of each.
3. Briefly explain the working of a solar cooker.
4. Write briefly the uses of wind energy.
5. How is geothermal energy used?
6. What are the advantages and disadvantages of hydroelectric power plants?
7. What are fossil fuels? Why are they so called?
8. How is electricity generated in a nuclear plant?
9. What precautions should be taken while handling radioactive substances?
10. What are the advantages of biomass over fossil fuels?
11. Briefly describe the air pollution caused by fossil fuels.
12. Write four ways in which you can save energy in your home.

II. Skill-based questions

E. The figure below shows the distribution of energy in the world. Looking at the pie chart, answer the following questions

1. Which is the major source of energy in the world ?
2. What is the percentage of non-renewable sources of energy in the world?
3. Consumption of which is more in the world—renewable or non-renewable sources of energy?



III. Fun time

The word maze given here contains ten words related to this chapter. You can go up, down, sideways, backwards, etc. to locate the hidden words. The list alongside has the words that are hidden in the maze.

Z	L	N	O	D	F	N	D	Y
B	Q	A	Y	L	P	U	W	B
I	E	S	D	J	A	C	I	T
O	L	N	T	I	Q	L	N	H
M	I	H	E	A	T	E	D	E
A	S	B	M	R	V	A	M	R
S	S	X	D	K	G	R	I	M
S	O	L	A	R	H	Y	L	A
P	F	U	S	I	O	N	L	L
A	C	I	D	R	A	I	N	X

Energy
Nuclear
Biomass
Solar
Windmill
Fossil
Fusion
Tidal
Thermal
Acidrain

PROJECT IDEAS

- Find out how many villages and in which parts of India are without electricity; and hence, how is their lifestyle different from yours. Make a chart on the other sources that they can use.
- Make a chart on how you can contribute your share to the energy crisis by saving energy at home, in school, and in your city or public places.
- Find out more about global warming and greenhouse effect. Build a model to demonstrate their effect.

TEACHER'S NOTES

- Students could be made aware of the importance of energy, the crisis we face, and how they can help to save energy.
- Discussion in class could be held for students to explore ways in which sources of energy can be utilized.
- Based on the local (regional) availability, teachers could take students to buildings that use solar cookers, solar cells, solar water heaters, etc.

Website references

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