

3

Mineral and Power Resources



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Fig. 3.1: Loading of a truck in a coal mine

Kiri was visiting Sukant in his native place near Dhanbad. Kiri was amazed to see that large areas were black. “Sukant, why is this place so black and dusty?” she asked. “This is because of the coal mines nearby. Do you see the trucks? They are carrying the mineral coal”, replied Sukant.

“What are minerals?,” asked Kiri. Sukant replied, “Have you ever seen a baker baking biscuits? The flour, milk, sugar and sometimes eggs are mixed

together. While eating the baked biscuits can you see these ingredients separately? Just as in the biscuits, there are a number of things that you cannot see, rocks on this earth have several materials called minerals mixed in them. These minerals are scattered throughout the earth’s rocky crust”.

A naturally occurring substance that has a definite chemical composition is a **mineral**. Minerals are not evenly distributed over space. They are concentrated in a particular area or rock formations. Some minerals are found in areas which are not easily accessible such as the Arctic ocean bed and Antarctica.

Minerals are formed in different types of geological environments, under varying conditions. They are created by natural processes without any human interference. They can be identified on the basis of their physical properties such as colour, density, hardness and chemical property such as solubility.

Do you know?

The salt in your food and graphite in your pencil are also minerals.



TYPES OF MINERALS

There are over three thousand different minerals. On the basis of composition, minerals are classified mainly as metallic and non-metallic minerals (Fig. 3.2).

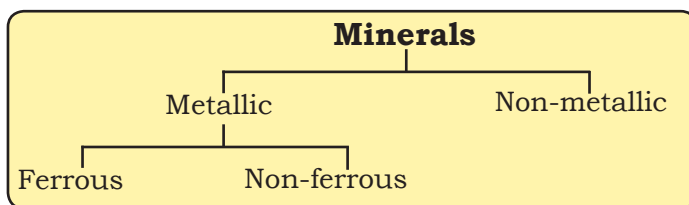


Fig. 3.2: Classification of Minerals

Metallic minerals contain metal in raw form. Metals are hard substances that conduct heat and electricity and have a characteristic lustre or shine. Iron ore, bauxite, manganese ore are some examples. Metallic minerals may be ferrous or non-ferrous. **Ferrous** minerals like iron ore, manganese and chromites contain iron. A **non-ferrous** mineral does not contain iron but may contain some other metal such as gold, silver, copper or lead.

Non-metallic minerals do not contain metals. Limestone, mica and gypsum are examples of such minerals. The mineral fuels like coal and petroleum are also non-metallic minerals.

Minerals can be extracted by mining, drilling or quarrying (Fig 3.3).

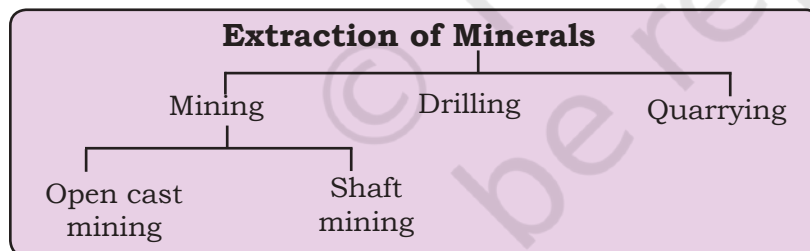


Fig. 3.3: Extraction of Minerals

The process of taking out minerals from rocks buried under the earth's surface is called **mining**. Minerals that lie at shallow depths are taken out by removing the surface layer; this is known as **open-cast mining**. Deep bores, called **shafts**, have to be made to reach mineral deposits that lie at great depths. This is called **shaft mining**. Petroleum and natural gas occur far below the earth's surface. Deep wells are bored to take them out, this is called **drilling** (Fig 3.4). Minerals that lie near the surface are simply dug out, by the process known as **quarrying**.

Do you know?



A **rock** is an aggregate of one or more minerals but without definite composition of constituent of mineral. Rocks from which minerals are mined are known as **ores**. Although more than 2,800 types of minerals have been identified, only about 100 are considered **ore** minerals.



Fig. 3.4: Off shore drilling of oil



Do you know?

You can always tell if a rock contains copper because then the rock looks blue in colour.



DISTRIBUTION OF MINERALS

Minerals occur in different types of rocks. Some are found in igneous rocks, some in metamorphic rocks while others occur in sedimentary rocks. Generally, metallic minerals are found in igneous and metamorphic rock formations that form large plateaus. Iron-ore in north Sweden, copper and nickel deposits in Ontario, Canada, iron, nickel, chromites and platinum in South Africa are examples of minerals found in igneous and metamorphic rocks. Sedimentary rock formations of plains and young fold mountains contain non-metallic minerals like limestone. Limestone deposits of Caucasus region of France, manganese deposits of Georgia and Ukraine and phosphate beds of Algeria are some examples. Mineral fuels such as coal and petroleum are also found in the sedimentary strata.

ASIA

China and India have large iron ore deposits. The continent produces more than half of the world's tin.

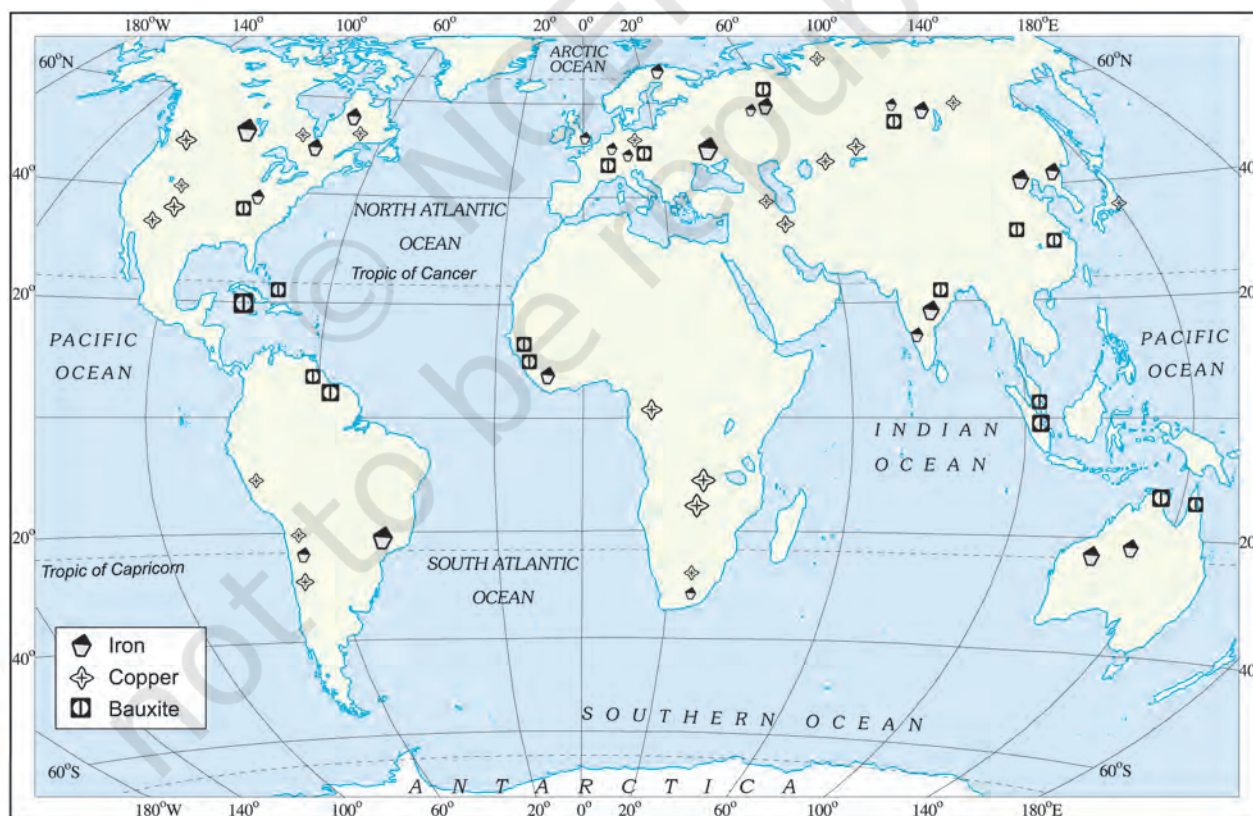
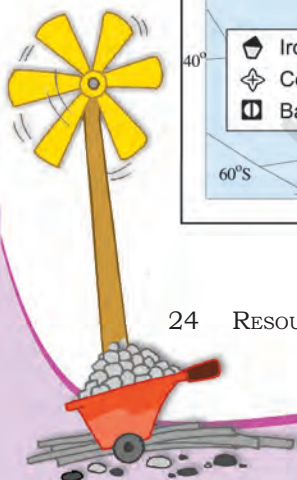


Fig. 3.5: World: Distribution of Iron, Copper and Bauxite



China, Malaysia and Indonesia are among the world's leading tin producers. China also leads in production of lead, antimony and tungsten. Asia also has deposits of manganese, bauxite, nickel, zinc and copper.

EUROPE

Europe is the leading producer of iron-ore in the world. The countries with large deposits of iron ore are Russia, Ukraine, Sweden and France. Minerals deposits of copper, lead, zinc, manganese and nickel are found in eastern Europe and European Russia.

Do you know?

Switzerland has no known mineral deposit in it.



NORTH AMERICA

The mineral deposits in North America are located in three zones: the Canadian region north of the Great Lakes, the Appalachian region and the mountain ranges of the west. Iron ore, nickel, gold, uranium and copper are mined in the Canadian Shield Region, coal in the Appalachians region. Western Cordilleras have vast deposits of copper, lead, zinc, gold and silver.

Let's do

Identify the Canadian Shield, the Appalachians, Western Cordilleras and Lake Superior with the help of an atlas.



Fig 3.6: World: Distribution of Mineral Oil and Coal



Do you know?

The oldest rocks in the world are in Western Australia. They date from 4,300 million years ago, only 300 million years after the earth was formed.



SOUTH AMERICA

Brazil is the largest producer of high grade iron-ore in the world. Chile and Peru are leading producers of copper. Brazil and Bolivia are among the world's largest producers of tin. South America also has large deposits of gold, silver, zinc, chromium, manganese, bauxite, mica, platinum, asbestos and diamond. Mineral oil is found in Venezuela, Argentina, Chile, Peru and Columbia.

AFRICA

Africa is rich in mineral resources. It is the world's largest producer of diamonds, gold and platinum. South Africa, Zimbabwe and Zaire produce a large portion of the world's gold. The other minerals found in Africa are copper, iron ore, chromium, uranium, cobalt and bauxite. Oil is found in Nigeria, Libya and Angola.

AUSTRALIA

Australia is the largest producer of bauxite in the world. It is a leading producer of gold, diamond, iron ore, tin and nickel. It is also rich in copper, lead, zinc and manganese. Kalgoorlie and Coolgardie areas of western Australia have the largest deposits of gold.

ANTARCTICA

The geology of Antarctica is sufficiently well known to predict the existence of a variety of mineral deposits, some probably large. Significant size of deposits of coal in the Transantarctic Mountains and iron near the Prince Charles Mountains of East Antarctica is forecasted. Iron ore, gold, silver and oil are also present in commercial quantities.

USES OF MINERALS

Minerals are used in many industries. Minerals which are used for gems are usually hard. These are then set in various styles for jewellery. Copper is another metal used in everything from coins to pipes. Silicon, used in the computer industry is obtained from quartz. Aluminum obtained from its ore bauxite is used in automobiles and airplanes, bottling industry, buildings and even in kitchen cookware.

Let's do

List uses of any five minerals.



CONSERVATION OF MINERALS

Minerals are a non-renewable resource. It takes thousands of years for the formation and concentration of minerals. The rate of formation is much smaller than the rate at which the humans consume these minerals. It is necessary to reduce wastage in the process of mining. Recycling of metals is another way in which the mineral resources can be conserved.

POWER RESOURCES

Sunny's mother begins her day by switching on the geyser. She irons Sunny's school uniform before waking him up. She then rushes to the kitchen to prepare a glass of orange juice for him in the blender.

"Sunny, have you finished taking bath? Come and have your breakfast", calls out mother while preparing breakfast on the gas stove for Sunny.

While going to school Sunny forgets to switch off lights and fans. When mother switches them off she thinks that life in the cities may be more comfortable, but its dependency on more and more gadgets all of which consume energy has led to a wide gap between the demand and the supply. With the advent of science and technology the life styles are changing very fast.

Power or energy plays a vital role in our lives. We also need power for industry, agriculture, transport, communication and defense. Power resources may be broadly categorised as conventional and non-conventional resources.

Conventional Sources

Conventional sources of energy are those which have been in common use for a long time. Firewood and fossil fuels are the two main conventional energy sources.

Firewood

It is widely used for cooking and heating. In our country more than fifty per cent of the energy used by villagers comes from fire wood.

Remains of plants and animals which were buried under the earth for millions of years got converted by the heat and pressure into fossil fuels. **Fossil fuel** such as coal, petroleum and natural gas are the main sources of

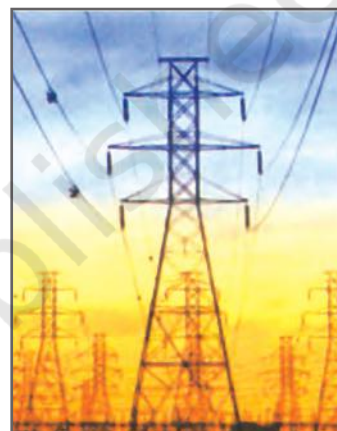


Fig. 3.7: National Power Grid to supply Electricity



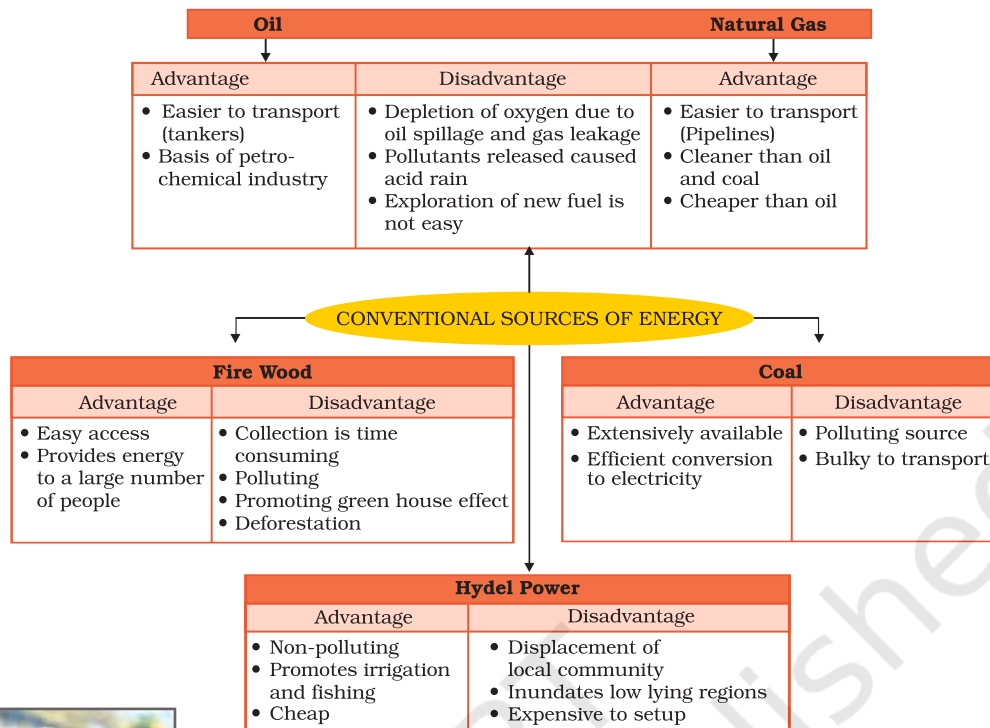


Fig 3.9: A woman carrying firewood in North East India

Fig 3.8: Conventional Sources of Energy

conventional energy. The reserves of these minerals are limited. The rate at which the growing world population is consuming them is far greater than the rate of their formation. So, these are likely to be exhausted soon.

Coal

This is the most abundantly found fossil fuel. It is used as a domestic fuel, in industries such as iron and steel, steam engines and to generate electricity. Electricity from coal is called **thermal power**. The coal which we are using today was formed millions of years ago when giant ferns and swamps got buried under the layers of earth. Coal is therefore referred to as **Buried Sunshine**.

The leading coal producers of the world are China, USA, Germany, Russia, South Africa and France. The coal producing areas of India are Raniganj, Jharia, Dhanbad and Bokaro in Jharkhand.



Fig 3.10: A view of a Thermal Power Station

Petroleum

The petrol that keeps your car running as well as the oil that keeps your cycle from squeaking, both began as a thick black liquid called Petroleum.



Fig 3.11: Crude Oil

It is found between the layers of rocks and is drilled from oil fields located in off-shore and coastal areas. This is then sent to refineries which process the crude oil and produce a variety of products like diesel, petrol, kerosene, wax, plastics and lubricants. Petroleum and its derivatives are called **Black Gold** as they are very valuable. The chief

petroleum producing countries are Iran, Iraq, Saudi Arabia and Qatar. The other major producers are USA, Russia, Venezuela, and Algeria. The leading producers in India are Digboi in Assam, Bombay High in Mumbai and the deltas of Krishna and Godavari rivers.

Natural Gas

Natural gas is found with petroleum deposits and is released when crude oil is brought to the surface. It can be used as a domestic and industrial fuel. Natural gas is an important clean energy resource with diverse usages. It is used as a fuel in power sector to generate electricity; for heating purpose in industries; as a raw material in chemical, petrochemical and fertiliser industries; as transport fuel and as cooking fuel. Globally, USA, Russia, Iran, Qatar, China, Canada and Australia are the major producers of natural gas.

In India, major natural gas reserves are located in the Mumbai High, Krishna Godavari basin, Cambay basin, Tripura and Assam.

The sharp increase in our consumption of fossil fuels has led to the depletion of oil reserves at an alarming rate. The toxic pollutants released from burning these fuels are also a cause for concern. Natural gas is abundant and is the cleanest hydrocarbon, producing around half the carbon dioxide and just one tenth of the air pollutants of coal when burnt to generate electricity. Natural gas can help to support renewable or non-conventional sources of energy as cleaner alternative to fossil fuels. Using natural gas can help to bridge the journey of moving from fossil fuels to clean energy sources.

Word Origin

The word petroleum is derived from Latin words –*Petra* meaning rock, *oleum* meaning oil. So, petroleum means rock oil.



Do you know?

Compressed natural gas (CNG) is a popular eco-friendly automobile fuel as it causes less pollution than petroleum and diesel.



Do you know?

Norway was the first country in the world to develop hydroelectricity.



Hydel Power

Rain water or river water stored in dams is made to fall from heights. The falling water flows through pipes inside the dam over turbine blades placed at the bottom of the dam. The moving blades then turn the generator to produce electricity. This is called hydro electricity. The water discharged after the generation of electricity is used for irrigation. One fourth of the world's electricity is produced by hydel power. The leading producers of hydel power in the world are Paraguay, Norway, Brazil, and China. Some important hydel power stations in India are Bhakra Nangal, Gandhi Sagar, Nagarjunsagar and Damodar valley projects.

Do you know?

The site of the world's first solar and wind powered bus shelter is in Scotland.

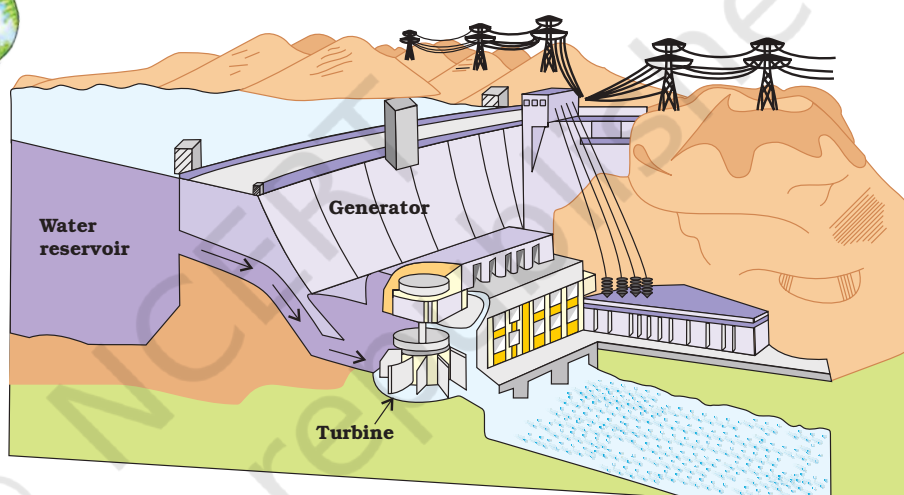


Fig. 3.12: Hydel Power

NON-CONVENTIONAL SOURCES OF ENERGY

The increasing use of fossil fuels is leading to its shortage. It is estimated that if the present rate of consumption continues, the reserves of these fuel will get exhausted.

Moreover, their use also causes environmental pollution. Therefore, there is need for using non-conventional sources such as solar energy, wind energy, tidal energy which are renewable.

Solar energy

Sun's heat and light energy can be felt by us every day. Solar energy trapped from the sun can be used in solar cells to produce electricity. Many of these cells are joined into solar panels to generate



Fig. 3.13: Salal Hydroelectric Project Jammu and Kashmir



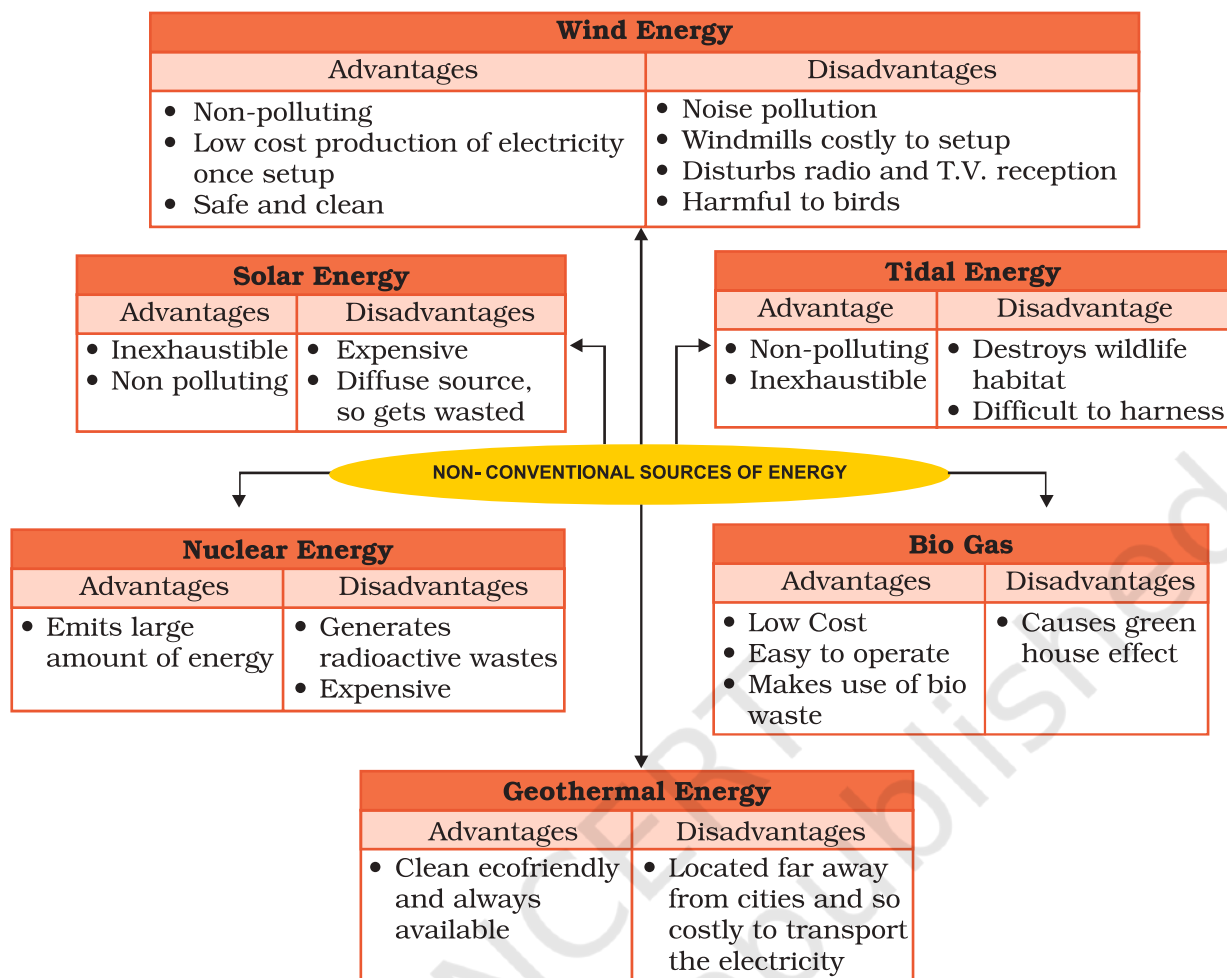


Fig 3.14: Non-conventional Sources of Energy

power for heating and lighting purpose. The technology of utilising solar energy benefits a lot of tropical countries that are blessed with abundant sun shine. Solar energy is also used in solar heaters, solar cookers, solar dryers besides being used for community lighting and traffic signals.

Wind Energy

Wind is an inexhaustible source of energy. Wind mills have been used for grinding grain and lifting water since times immemorial. In modern time wind mills, the high speed winds rotate the wind mill which is connected to a generator to produce electricity. Wind farms having clusters of such wind mills are located in coastal regions and in mountain passes where strong and steady



Fig 3.15: Solar Panels to trap solar energy



Activity

Solar Cooker

Take an old car tube. Inflate it and keep it on a wooden platform. Paint an aluminium vessel black from outside and add 1 cup rice with 2 cups of water to it. Close the vessel with a lid and place the vessel in the inner circle of the tube. Now place a glass frame over the tube and keep the set out in the sun. After the glass frame is placed, air can neither come in nor go out but the sun rays coming into the closed cavity enclosed by the tube, get trapped and cannot escape. The temperature increases slowly cooking the rice over a few hours.



winds blow. Windfarms are found in Netherlands, Germany, Denmark, UK, USA and Spain are noted for their wind energy production.

Nuclear Power

Nuclear power is obtained from energy stored in the nuclei of atoms of naturally occurring radio active elements like uranium and thorium. These fuels undergo nuclear fission in nuclear reactors and emit power. The greatest producers of nuclear power are USA and Europe. In India Rajasthan and Jharkhand have large deposits of Uranium. Thorium is found in large quantities in the Monozite sands of Kerala. The nuclear power stations in India are located in Kalpakkam in Tamilnadu, Tarapur in Maharashtra, Ranapratap Sagar near Kota in Rajasthan, Narora in Uttar Pradesh and Kaiga in Karnataka.



Fig. 3.16 : Nuclear power station , Kalpakkam

Geothermal Energy

Heat energy obtained from the earth is called **geothermal energy**. The temperature in the interior of the earth rises steadily as we go deeper. Some times this heat energy may surface itself in the form of hot springs. This heat energy can be used to generate power.

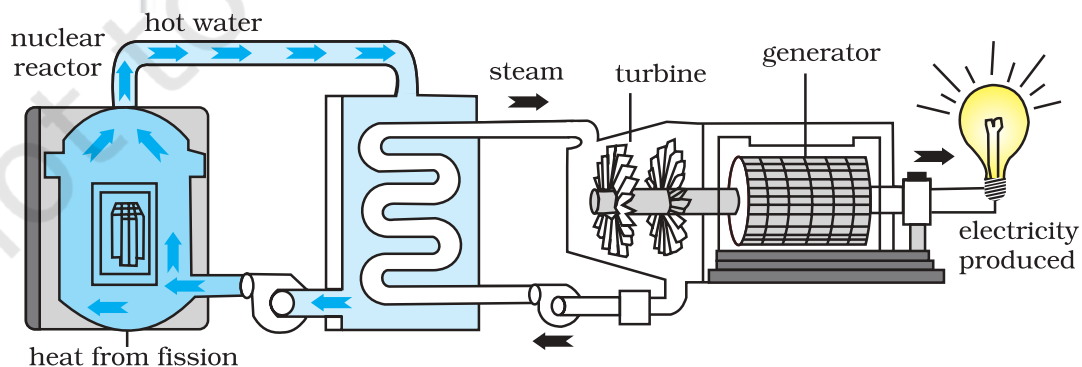


Fig. 3.17 : Nuclear Energy

Geothermal energy in the form of hot springs has been used for cooking, heating and bathing for several years. USA has the world's largest geothermal power plants followed by New Zealand, Iceland, Philippines and Central America. In India, geothermal plants are located in Manikaran in Himachal Pradesh and Puga Valley in Ladakh.



Fig. 3.18 : (a) Geothermal Energy in Manikaran
(b) Cooking food with the help of Geothermal Energy

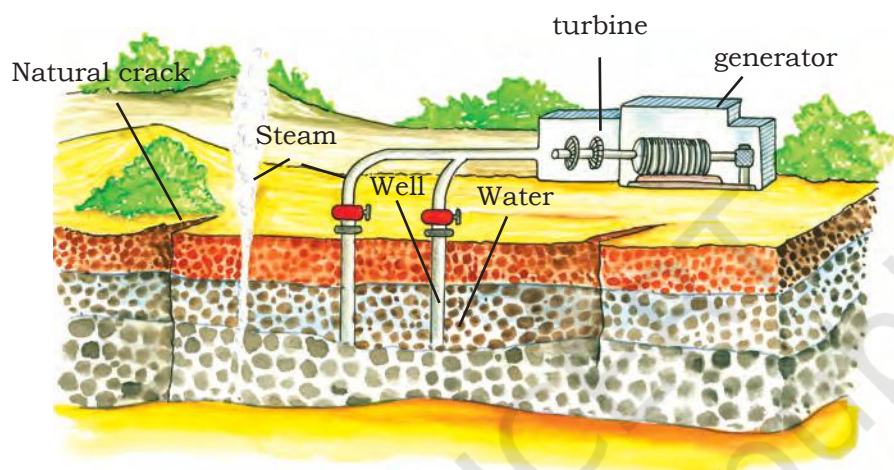


Fig. 3.19 : Geothermal Energy

TIDAL ENERGY

Energy generated from tides is called **tidal energy**. Tidal energy can be harnessed by building dams at narrow

Do you know?

The first tidal energy station was built in France.

Low tidal energy is used to produce electricity

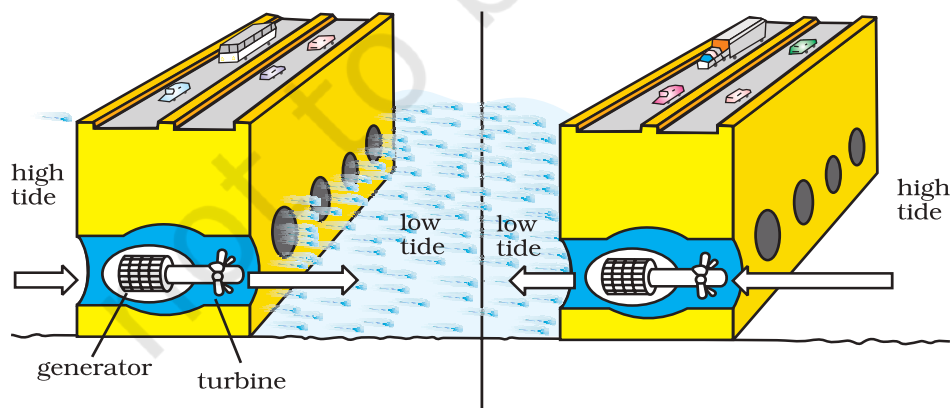


Fig. 3.20: Tidal Energy



openings of the sea. During high tide the energy of the tides is used to turn the turbine installed in the dam to produce electricity. Russia, France and the Gulf of Kachchh in India have huge tidal mill farms.

BIOGAS

Organic waste such as dead plant and animal material, animal dung and kitchen waste can be converted into a gaseous fuel called biogas. The organic waste is decomposed by bacteria in biogas digesters to emit biogas which is essentially a mixture of methane and carbon dioxide. Biogas is an excellent fuel for cooking and lighting and produces huge amount of organic manure each year.

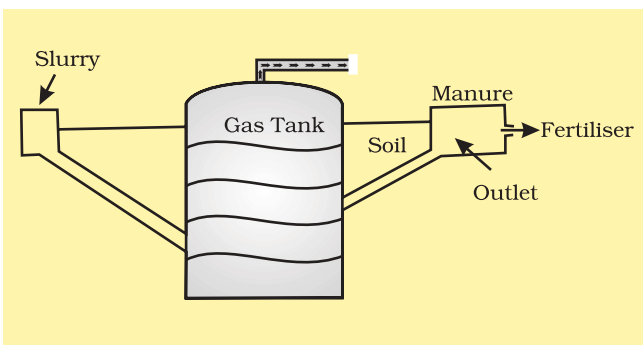


Fig. 3.21 : Biogas

Energy is everywhere but we can see that harnessing this energy is both difficult as well as costly. Each one of us can make a difference by not wasting energy. Energy saved is energy generated. Act now and make brighter energy future.



Exercises

1. Answer the following questions.

- (i) Name any three common minerals used by you every day.
- (ii) What is an ore? Where are the ores of metallic minerals generally located?
- (iii) Name two regions rich in natural gas resources.
- (iv) Which sources of energy would you suggest for
 - (a) rural areas
 - (b) coastal areas
 - (c) Arid regions
- (v) Give five ways in which you can save energy at home.





2. Tick the correct answer.

- (i) Which one of the following is NOT a characteristic of minerals?
 - (a) They are created by natural processes.
 - (b) They have a definite chemical composition.
 - (c) They are inexhaustible.
 - (d) Their distribution is uneven.
- (ii) Which one of the following is a leading producer of copper in the world?
 - (a) Bolivia
 - (b) Ghana
 - (c) Chile
 - (d) Zimbabwe
- (iii) Which one of the following practices will NOT conserve LPG in your kitchen.
 - (a) Soaking the dal for some time before cooking it.
 - (b) Cooking food in a pressure cooker.
 - (c) Keeping the vegetables chopped before lighting the gas for cooking.
 - (d) Cooking food in an open pan kept on low flame.

3. Give reasons.

- (i) Environmental aspects must be carefully looked into before building huge dams.
- (ii) Most industries are concentrated around coal mines.
- (iii) Petroleum is referred to as “black gold”.
- (iv) Quarrying can become a major environmental concern.

4. Distinguish between the followings.

- (i) Conventional and non conventional sources of energy
- (ii) Biogas and natural gas
- (iii) Ferrous and nonferrous minerals
- (iv) Metallic and nonmetallic minerals

5. Activity

- (i) Use pictures from old magazines to show different kinds of fuels used by us in our lives and display them on your bulletin board.
- (ii) Design a poster highlighting energy conservation tips you would take for your school.
- (iii) Salma's class took up an action campaign to do an energy audit of their school by surveying electricity consumption. They prepared survey sheets for the students of the school.



Electricity Audit

S. No.	Appliance	Quantity (No. being used)	Usage Time (Approx. No. of working hours)	Quantity (No. actual- ly needed)	Is it switched on even when not in use? (Yes or No)
1.	Fluorescent Tube light 40 W				
2.	Incandescent Bulb 40 W / 60 W				
3.	Co-impact fluorescent lamps				
4.	Fans				
5.	Exhaust Fans				
6.	Electric Bell / Buzzer				
7.	TV				
8.	Computers				
9.	Air Conditioners				
10.	Refrigerators				
11.	Oven / Hot Case				
12.	Public Address System				
13.	Water Pump / Water Cooler				
14.	Overhead Projector				
15.	Photostat Machine				
16.	Any other				

Using the data collected during the survey, students calculated the units consumed for one month and the approximate expenditure and compared it with the electricity bill of the previous month. They also calculated the approximate cost of electricity consumed by fans, lights and other appliances not switched off. Thus, they highlighted the amount that could be saved and suggested simple energy conservation habits like

- Switching off the appliances when not in use.
- Minimal usage as per requirement.



- Maximising the use of natural breeze and light by keeping the windows open.
- Keeping the lights dust free.
- The appropriate maintenance and usage of appliances as per the given instructions.

Can you add some more tips to this list?

You could conduct a similar survey at home and then extend it to your apartment and make your neighbours also energy wise.

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