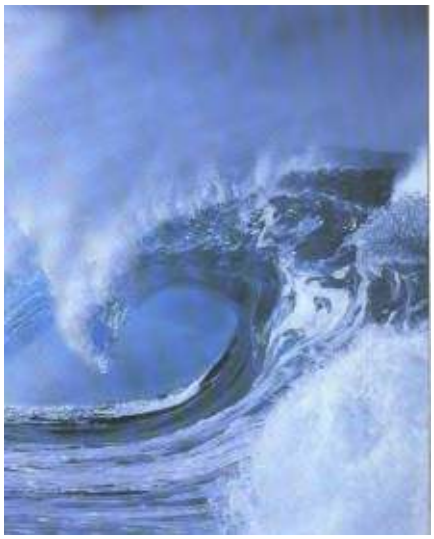
7 ENERGY

In this chapter you will learn:

- Work and Energy
- Different Forms of Energy
- Interconversion of Energy
- Demand of Energy
- Production of Electrical Energy
- Measurement of Energy
- Energy and the Environment
- Degradation of Environment
- Nuclear Fuel Hazards
- Conservation of Energy

Energy is the essential part of our lives. Energy is used in our daily life in different forms. We do many tasks from dawn till dark. For this, we have to spend energy. When we get tired after working we feel hungry, we take food which provides us energy. We cannot do any thing without light. Light is also a form of energy. We require heat to warm ourselves in winter. Heat is yet another form of energy. In summers, we use fans, refrigerators and air-conditioners for cooling. Besides them, we use many other appliances all of them work with electricity. Electricity provides them energy to run. All of motorbikes, heavy vehicles, aeroplanes and ships consume fuel, which provides energy. As our usage for machines increases, our requirement of energy also increases.



There is an incredible amount of energy in big tides of sea. There is a positive and negative prospective of this.

7.1 Work and Energy

For the proper definition of energy, we should first learn about work.

Work

Suppose a person works in an office for the whole day or a worker holds up a wooden box for half an hour. Apparently both of them have performed work, but in the scientific term this would not be considered as work. There is a proper definition of work in Physics. When a force acts on a body and the body is displaced, then the force is said to have done work on the body.

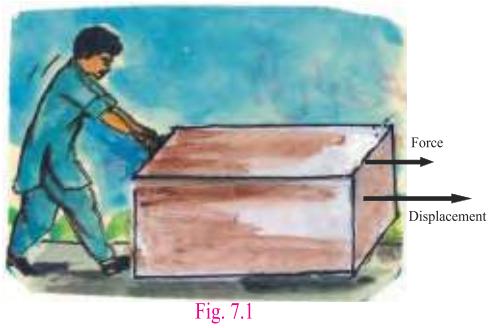


Fig. 7.1

Work is the product of force and distance in the direction of force.

i.e., Work = Force × Distance covered in the direction of force

The unit of work is joule (J).

The ability of a body to do work is known as energy. Energy is defined as:

Energy is the ability to do work.

Since the unit for work is joule therefore, the unit for energy is also joule.

7.2 Different Forms of Energy

There are many forms of energy. Some common forms of energy are as follows:

(i) Kinetic Energy

When a body is moving, it possesses energy. Because a force is acting on it and it also covers some distance. It means that the body has the ability to do work.

Energy possessed by a body due to its motion is known as kinetic energy.

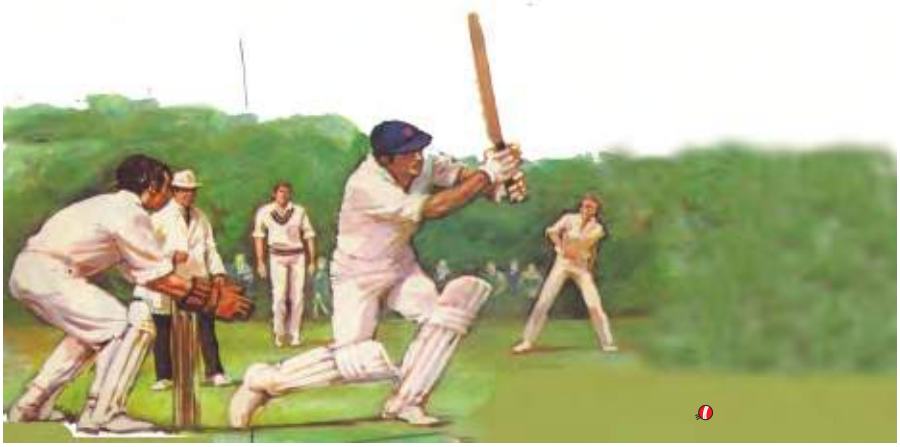


Fig. 7.2

When a cricket ball is hit with a bat, the ball runs fast. We say that the running ball possesses kinetic energy. But we observe that ball stops after covering some distance, then where did the kinetic energy go? (Fig: 7.2). Actually a force acts on the moving ball in opposite direction, which is ground friction. This frictional force causes the ball to stop. Here the friction of air is negligible.

The ball has to apply the same amount of force opposite to the frictional force to keep its motion. Thus the ball is doing work against friction, which is the product of its force and the distance covered. All of the kinetic energy of the ball is consumed in doing work and the ball eventually stops. This proves that a body can do work due to kinetic energy.

The kinetic energy of a body depends upon its mass and speed. The more the mass or speed of a body the more is its kinetic energy.

(ii) Potential Energy

A stone lying on the ground does not possess the ability to do work. If that stone has to be moved up to a certain height, a force equal to the gravitational force will have to be applied on it. In other words, work has to be done on it. The work done will be stored in the stone as energy and it will gain the ability to do work. Now if the stone is released at this height, it will fall to the ground by itself doing work. The energy possessed by the stone at height is the potential energy.

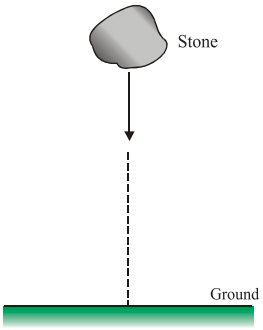


Fig. 7.3

Energy possessed by a body due to its position is known as potential energy.

(iii) Elastic Potential Energy

When a spring is pressed, an elastic potential energy is stored in it. When it is released, it shoots up by itself and possesses the ability to do work. The energy stored in a body by pressing, stretching or twisting is known as elastic potential energy. If a piece of rubber or the rubber of a slingshot is stretched an elastic potential energy is stored in it. (Fig: 7.4).

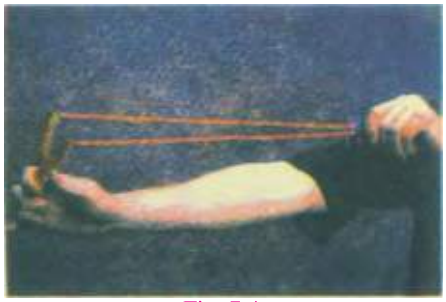


Fig. 7.4

(iv) Chemical Energy

Sometimes, energy is emitted during chemical reactions. The source of this energy is the chemical bonds between atoms. When these bonds break, energy is released. In cells and batteries, chemical energy transforms into electrical energy. The energy obtained by burning fuel in cars is also chemical energy. The energy obtained by our bodies by consuming food is also chemical energy.

(v) Heat Energy

Heat is also a form of energy. Heat energy is due to the movement of the molecules of bodies. The faster the movement of molecules, the greater is the heat energy. The Sun is the largest source of heat energy. Burning of fuel is another source of heat energy. When current passes through the element of an electric heater or an electric iron, heat is produced.

(vi) Light energy

Light is another form of energy. We can see things with the help of light. Like heat, the largest source of light is also Sun. When current passes through a bulb, it emits light. When electrons revolving around the nucleus jump from a higher energy orbit to a lower energy orbit, light is emitted. The leaves of plants prepare food by photosynthesis. This process can not be done without light. All creatures on Earth are directly or indirectly dependent upon the food made by plants.

(vii) Electrical Energy

Electrical energy is the energy of moving charges. Electrical energy is used on large scale, because it can be easily achieved and transferred from one place to another and can also be transformed into different forms of energy. We use energy obtained from different sources by converting it into electrical energy. For this purpose, power stations are built that supply electricity at far off places.

(viii) Nuclear Energy

Nuclear energy is obtained by breaking the nuclei of heavy atoms. The process is called nuclear fission. This process is done in a nuclear reactor where energy is released in the form of heat. This heat can be used to produce electricity. Energy is also released when the nuclei of small atoms fuse together. This is known as nuclear fusion. It is also nuclear energy. The heat and light coming from the Sun are released due to this process.

Do you know?

The energy for destruction in the atom bomb is also nuclear energy

7.3 Interconversion of Energy

We use energy daily in the form of heat, light and electricity. As a matter of fact, energy changes its form in different conditions. When a body is taken at a height, gravitational potential energy is stored in it. When the body is dropped, the gravitational potential energy converts into kinetic energy. The chemical reaction in cells or batteries convert chemical energy into electrical energy. When current passes through a bulb, it emits light and heat. The electrical energy in a bulb is converted into heat and light. The food you eat possesses chemical potential energy. Your body has the capability to transform potential energy into heat that maintains your temperature. The body also converts some chemical energy into kinetic energy of blood so that you can live.

Some energy in the body is also converted into electrochemical energy on which your nervous system works.

The chemical energy is present as potential energy in the muscles of cat.

When the cat leaps for its prey then the energy is converted into kinetic energy.

The example given above proves that one form of energy can be transformed to another form, but the total energy is always conserved. This is known as the law of conservation of energy. The definition of the law is as follows:

Energy can neither be created nor destroyed.

In other words, the total energy of an isolated system always remains constant, although it is transformed from one form to the other. When we say that energy is consumed, we actually mean that it is changed from one form to the other or it is transferred from one place to the other. In most of the cases, energy is eventually transformed to heat.

7.4 Demand of Energy

50 years ago, there was no electricity in most of the houses. People used to illuminate their houses by candles, lanterns or other such things. Instead of electric fans, hand held fans were used. There was no concept of things like refrigerator or television. But, with the advancement of science, people got many comforts of life. Today not only cities, but villages also have been provided electricity. The increase in consumption of electricity is not confined to houses only, but the dependence of industries on electricity has increased manifolds. Not only large scale factories but small workshops are also using machines. The use of electricity in agriculture is also increasing. Earlier, people used to wait for rain or get water from wells, but now tubewells are run by electricity. Many barren lands have been irrigated by this. The yield per acre has increased. In many other fields of life, the consumption of energy is constantly increasing. It is required to discover more resources of energy and the present resources utilized in a better way.

7.5 Production of Electrical Energy

We use energy in the form of heat, light and motion etc. but the most important use of energy is in the form of electrical energy. We change electrical energy in the form of heat, light and motion according to the demand. The traditional methods to make electricity involve the use of running water, burning fuel and nuclear energy, but these resources are not sufficient to keep

with the increasing demand of electricity. We have to find new resources. Some of the traditional and non-traditional sources of producing electricity are as follows:

Traditional Methods of Production of Electricity

(i) Hydroelectric Power

The conversion of kinetic energy of running water to electrical energy is known as hydro-electric power. Water is stored in a high lake or reservoir. At a height, gravitational potential energy is stored in the water. When water falls from height, the potential energy is changed into kinetic energy.

Tunnels are made to bring water from the reservoir to a lower place. The kinetic energy of running water turns the turbines which in turn runs the electric generators. By this method electricity is produced. (Fig.7.5). In fact, electrical energy is that potential energy of water which is obtained from falling water. There is no heat, smoke or gas pollution in this method. Moreover, water from the power station is used for agricultural purposes.

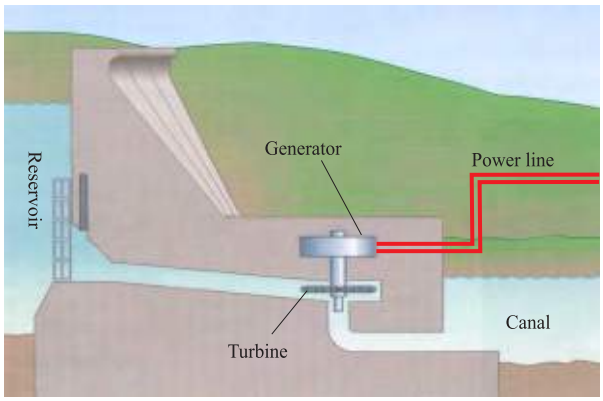


Fig. 7.5: Hydroelectric Power

(ii) Thermal Power

In this method, coal, oil and natural gas are burnt. These are known as fossil fuels. The remainings of plants and animals buried for millions of years under the Earth are changed into fossil fuels. These fuels are in a limited quantity. It will take millions of years to form new fuels once the old ones are exhausted. The chemical potential energy is stored in fossil fuels. The burning of these fuels gives out heat which is used to generate steam that turns the turbines to produce electricity. (Fig. 7.6).

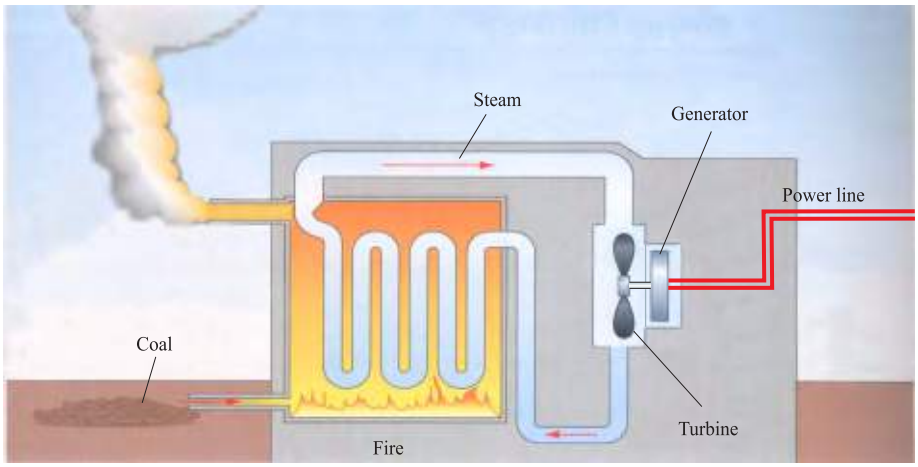


Fig. 7.6: Thermal Power

(iii) Nuclear Power

Many developing and developed countries generate electricity by nuclear energy. In Pakistan, there are nuclear power stations which are built at Karachi and Chashma.

The source of nuclear is the nucleus of an atom in which energy is stored. When the nucleus of a heavy atom is broken, a large amount of energy in the form of heat is released. This process is known as nuclear fission. Uranium-235 or Plutonium is used as fuel in nuclear fission. The whole process of nuclear fission is done in a nuclear reactor which is protected by a concrete wall. The heat obtained by nuclear fission is used to change water to steam, which in turn runs the electric generators. In this way electricity is produced. Figure (7.7) shows different parts of nuclear power station.

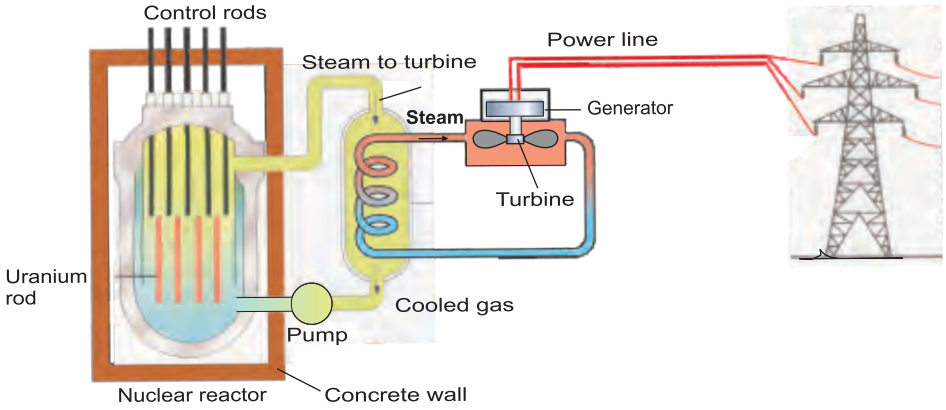


Fig. 7.7 : Nuclear Power Station

Non-traditional methods of producing electricity

We can not depend on the traditional methods of getting energy for long. We should take all possible steps to promote new methods so that we may have sufficient and cheap resources to fulfil our needs. Some of the non-traditional methods of producing electricity are given below:

(i) Solar Power

You must have seen calculators that run without cells. The photocells installed in them transform light to electricity. Solar energy is the energy obtained from the Sun. Usually, the solar energy falling on the atmosphere of Earth is almost 1.4 kilowatt per square metre. The dust particles, water vapours and gases present in the atmosphere absorb, reflect or disperse most of the energy. But still about 1 kilowatt of energy per square metre reaches the Earth's surface. Solar energy is used in two ways. In one way solar pennels absorb heat. These consist of large plates that have been painted black.

Fig. 7.8 : Solar Power

The absorbed heat is used to heat houses or run a water heating system. Steam can also be produced by using reflectors or lenses that runs the turbines of generators and produce electricity (Fig. 7.8).

In the second method, sunlight is directly transformed to electricity with the help of solar cells. The voltage of one cell is very small but for practical use we can connect many cells in series to get large voltage (Fig. 7.9). At present this method is expensive but it is hoped to get it cheaper in future.

Fig. 7.9: Solar Cells

(ii) Wind Power

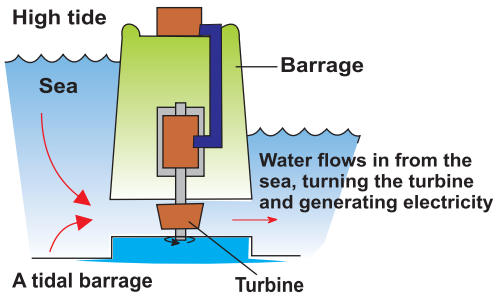
In wind power, kinetic energy of fast blowing air is used to produce electricity. A wind mill consists of three or four wings mounted on top of a pole. These are called turbines of wind mill. When turbines turn due to air, we can make use of this energy in many ways. Traditional wind mill is used to grind grains and to fetch water from the well. But the modern wind mill is used to run generators that produce electricity. A big form of many wind mills is made to produce electricity. This is capable of running huge generators.

Fig. 7.10: Wind Form

(iii) Tidal Power

Big tides of water are generated in the see due to attraction of moon. The energy of these tides is known as tidal energy. The tidal energy can be used to produce electricity. A dam is constructed for this. At the arrival of high tide, water is trapped in the dam. On return of tide, trapped water is allowed to flow out in such a way that it turns the turbine. The generator joined to the turbine produces electricity. The high tide moving towards the dam is also used to turn the turbine (Fig. 7.11).

Fig. 7.11: Tidal Power



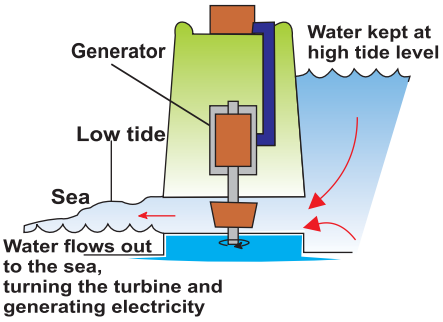


Fig. 7.12: Tidal Power

(iv) Geothermal Power

To make use of energy deep under the Earth in the form of hot water or steam is known as geothermal. About 10 km below the surface of Earth, there are hot semi-molten rocks at some places. The temperature of these rocks is 200°C or above. Where there is water present over such rocks, it comes out to the surface of Earth in the form of fountains, geysers and steam. The steam is used to run generators. Where there is no water over tunnels are drilled there up to the rocks and cold water is pumped through one tunnel, which comes out in the form of steam through the second tunnel. The steam runs the generator, which produces electricity (Fig: 7.13).

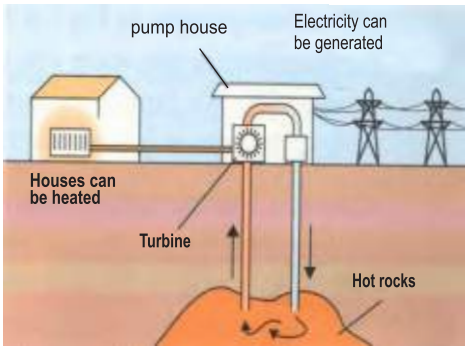


Fig. 7.13: Geothermal Power

Fig. 7.14: Geothermal Station

Production of Electricity from Biomass and Solid Waste

Biomass is a natural source of energy. It consists of all organic materials such as residue of crops, trees, plants, vegetable peels, animal dung and sewage etc. Sewage is that dirt which is remained after straining dirty water. The fuel obtained by biomass is of two types. Ethanol (alcohol) is produced by the alcoholic fermentation of biomass, this is a substitute of gasoline. Another type of fermentation gives out methane gas, which is the substitute of natural gas. This is called biogas. It can be burnt or used to produce electricity.

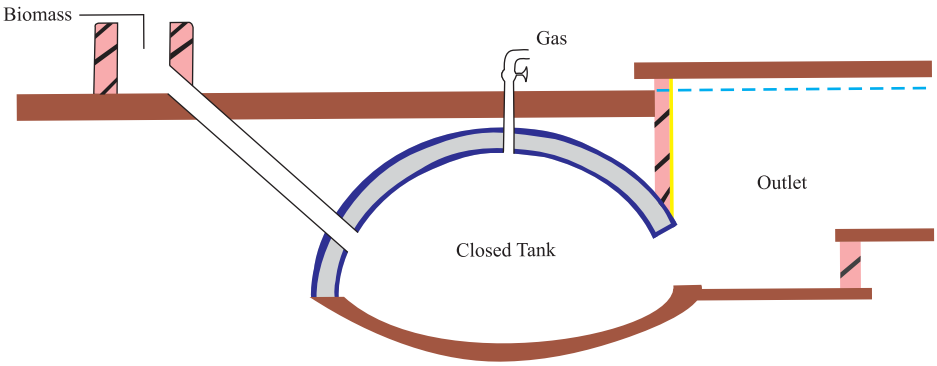


Fig. 7.15

The method of producing biogas from biomass is not complicated. Biomass is rotted in a closed tank or a pit. Bacteria helps to fermentate it and biogas is the output that can be piped out easily. The residue left over in the pit is a good fertilizer (Fig: 7.15)

Solid waste is the dry garbage that is collected by the municipality. Solid waste is burnt in a type of furnace. The heat thus produced is directly supplied to the boiler, which converts water into steam. The generators are run with this steam to produce electricity. This also solves the problem of solid waste disposal.

7.6 Measurement of Energy

Since energy is the ability to do work, therefore the unit of energy will be the same as that of work. The SI unit of work and energy is joule (J). This very unit is used for all kinds of energy.

Measuring Electrical energy

Electrical energy can also be measured in joules. But practically kilowatt-hour unit is used for its measurement. The meters installed in our homes measure electricity in this unit. The number of units consumed by an electric appliance depends upon its power as well as the duration for which it is kept on.

The energy consumed in one second is called power.

$$\text{Power} = \frac{\text{Energy}}{\text{Time}}$$

The unit of power is watt. The symbol used for this is W. You might have read 60 W, 100W etc. printed over bulbs. This is the power of bulb. Power of the appliance is mostly printed on it. One thousand watt power is called as one kilowatt.

Unit of electrical Energy

The unit of electrical energy is kilowatt-hour, which is denoted as kWh. The electricity meters measure electricity in this unit.

One kilowatt-hour is the amount of energy that is consumed by a 1000 watt appliance in one hour.

According to above definition of kWh a 100W bulb consumes one unit of electricity in 10 hours and a 200W bulb consumes in 5 hours. An air conditioner of 2500W consumes 2.5 units of electricity in one hour.

Electricity Meter

An electricity meter is shown in (Fig. 7.16). The working principle of a meter is the same as that of electric motor.

Fig. 7.16 – Electricity Meter

Live wire of main supply passes through the field coils of the meter. At the centre of field coils there is another coil which can rotate about its axis. This coil is connected to the main supply through a high resistance. When an appliance in the home is turned on, current starts flowing through the field coils. This produces a magnetic field due to which the coil inside the field rotates. The disc rotating along with coil can be seen from outside. The larger the current flowing through the meter, the faster is the rotation of disc. The gears attached to the disc display meter reading on the dial in the form of digits. Usually the digit to the extreme right is $\frac{1}{10}$th of the unit i.e., decimal point, while the reading to its left shows the number of units in kilowatt-hours.

Measuring Natural Gas

Natural gas is measured in cubic metres. The gas turns a wheel while passing through its way. The gears attached to the wheel display the volume of gas on the dial (Fig. 7.17).

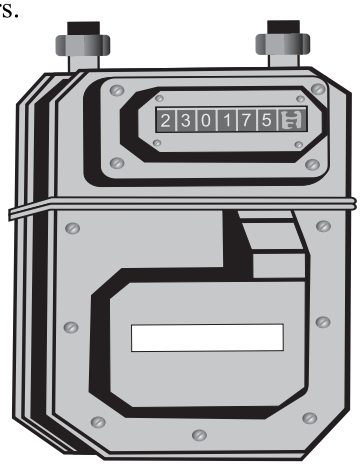


Fig. 7.17: Gas Meter

Although petrol, diesel and natural gas are measured in units of volume, but these fuels can also be measured in units of energy. For this, we should know the amount of heat produced in joules by a specific amount of fuel.

These days, gas bills are being charged on the base of Btu instead of cubic metres. The Btu is a unit of energy called the British Thermal Unit. One Btu is equal to 1055 joules.

7.7 Energy and Environment

The living place of people and all physical and social factors around that affect their living and working conditions is called the environment. Air, water and land are the inanimate components of environment. Air is the main component of Earth environment. In the absence of air, no life could have been possible on Earth. Air is present up to the height of about

200 kilometres from the surface of Earth. It is called atmosphere. That part of atmosphere where all living bodies reside is 8 to 20 kilometres thick cover of gases over the earth. This cover acts as a shield against heat. Without this, the Earth would scorch with heat in the day and its temperature would fall to below $0^{o}C$ in the night.

Thermal Pollution

The unpleasant change occurring in air, water and surface of Earth that causes unhygienic effects on the human and animal life as well as on the plants is called pollution. Pollution is of many types, but we will discuss here the thermal pollution only.

The pollution caused in the environment by heat, smoke harmful gases is called as thermal pollution.

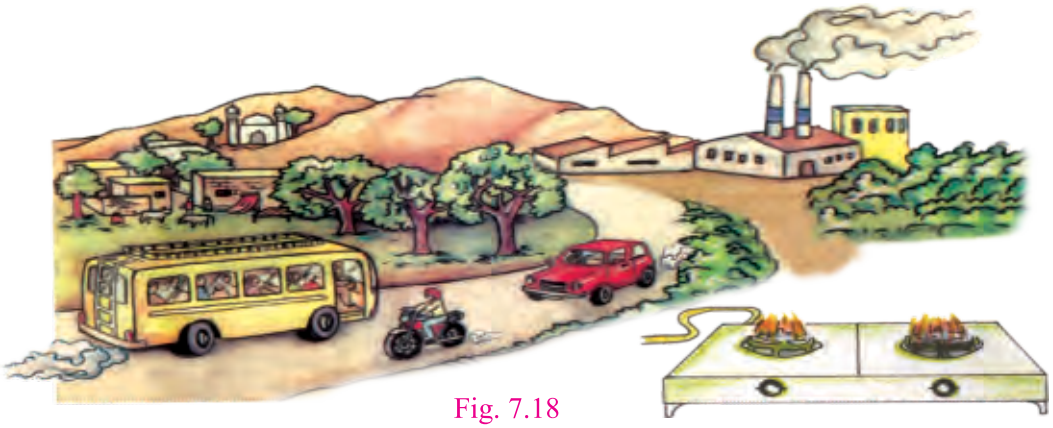


Fig. 7.18

Although heat is very essential for plants, animals and human life, but if the proportion of heat in the environment exceeds a certain limit, it could be harmful. The excessive use of energy has increased the thermal pollution in our environment. There are many factors that cause thermal pollution.

Carbon dioxide, carbon monoxide, sulphur dioxide, lead compounds and other harmful gases in addition to tremendous amount of heat are added in the atmosphere by the burning of fossil fuels. Fossil fuels are burnt in transport, in industries, for the production of thermal power and for many other purposes. The nuclear energy used for producing electricity is also a cause of addition in the thermal pollution. The cooling towers of

Fig. 7.19: Cooling Tower

nuclear reactors are adding heat into the atmosphere all the time. Other than this, all the forms of energy that we use are ultimately transformed into heat.

A big cause of increase in thermal pollution is the greenhouse effect. Carbon dioxide acts like glass of greenhouse. When the Earth after absorbing Sun heat, emits heat rays of larger wavelengths, carbon dioxide does not allow them to escape out into space but instead absorbs them. Therefore, the increase of carbon dioxide gas in the atmosphere causes increase in temperature at the surface of Earth. As the thermal pollution is increasing, the temperature of Earth's environment is also increasing.

7.8 Degradation of Environment

Normal thermal pollution does not affect the environment badly. Various natural processes such as plants, water etc. are always in action to keep the balance of environment. If thermal pollution is too much, the regional climate can be affected badly. The change of climate can also affect the whole system of agricultural production.

When pollution more than a certain limit is added to the environment, it is known as degradation of the environment.

In such an environment, not only the health of living bodies is damaged but also plants are affected. Harmful gases cause enhancement of eye, nose, ear and throat diseases.

Steps to Minimize Environmental Degradation

The following steps can be useful to minimize thermal pollution.

1. The main role to minimize thermal pollution is played by forests. Plants absorb carbon dioxide from the atmosphere and emit oxygen. This helps to maintain balance of environment. But the growing population has started deforestation for their energy needs. This is depriving human beings of great blessing of God. It is needed that forestation be increased so that balance of environment may not be shattered.

2. The fitness of vehicles running on roads should be observed. Vehicles should not make smoke. Rickshaws particularly motorcycle rickshaws are producing too much pollution in cities. A better system of public transport can reduce pollution to much extent. If comfortable buses are available easily for public transport in cities, many people will stop driving their own cars and motorcycles. This will reduce pollution as well as save national money. Pollution will be minimized too much extent, if the trains has to run with electricity instead of fossil fuels. Electric trains network should be promoted in our country.

3. Industries consume almost 20% of energy resources. In addition to heat, poisonous gases emitted by them also cause pollution. Appropriate processing is needed for this.

4. Such energy sources should be promoted, which produce less pollution e.g., electric energy, solar energy, wind energy, tidal energy.

5. Excessive growth in population is also one reason of enhancement in pollution. As population increases, the need for energy also increases with the same ratio. Consumption of more energy means more increase in pollution. It suggests that population planning is very important.

6. People should be careful to burn solid waste and tyres etc. at public places.

7.9 Nuclear Fuel Hazards

The use of nuclear energy for production of electricity in advanced countries is increasing day by day. The possibility of leakage of the radiation during the use of nuclear energy cannot be denied. Radiation means the emission of alpha (α), beta (β) and gamma (γ) rays from some elements called the radioactive elements. The fuel of nuclear reactors is radioactive. The danger of radiation leakage is always there while storing, handling and using such fuel. The people who are working around reactors are always in danger.

Radiation has the capability to change the structure of cells, tissues and genes of living bodies by their impact with them. This can cause skin diseases and cancer. Even a small accident in a nuclear reactor could be very disastrous.

Fig. 7.20: The nuclear reactor of churnoble where the accident took place

In 1986, the cooling system of a reactor in Churnoble (Russia) failed, due to which roof of the reactor blew up with a blast in a few minutes and radioactive gas clouds spread all over the

area. Hundreds of people were killed in that accident. Later on many of the people died after suffering from cancer.

The used nuclear fuel does also emit some radiation. That is called nuclear waste. The disposal of nuclear waste is very necessary for safety against radiation. Different ways are adopted for this purpose. These methods include dumping of nuclear waste in the tunnels deep under the Earth and store it in sealed containers at the bottom of the sea. But no method is considered to be completely safe. One suggestion is that such material should be stored after fusing it into glass blocks. Another suggestion is that nuclear waste be filled in rockets and sent to the space or other planets or sent towards the Sun. But it is feared that rockets may explode in the Earth's atmosphere or they may come back to the Earth.

For protection from dangers of radiation, it is necessary that the workers should keep away from the radioactive source. Such sources should be kept in lead containers of thick walls, because lead does not allow radiation to pass through it. Thick concrete walls should be built around nuclear reactors and the nuclear waste should be disposed off very safely.

7.10 Conservation of Energy

The use of energy in factories, transport, offices, educational institutions and homes is so large that fuel reserves such as coal, oil and gas are exhausting very rapidly. Non-conventional resources of energy are still not out of research and development stage. Although efforts are made to use existing resources in a better way, but after all these resources are limited. In these circumstances, it is our national duty to consume energy carefully and promote alternative resources of energy. We can save much energy by acting upon the following suggestions:

- Substitute fuels should be used for transport. Many people are running their vehicles on CNG. Alcohol could be a good substitute fuel. Brazil has practiced it very successfully. Most of the vehicles run there with alcohol.
- People should be instigated to use public transport rather than driving their own vehicles. In this way many people can go to work in one big bus instead of going in many individual vehicles.
- The bodies of the vehicles should be made light so that they may consume less fuel.
- The engines with more efficiency should be designed for vehicles.
- A large amount of energy is wasted in the industries as heat. This heat can be used for different purposes.
- The need of energy in some industries can be fulfilled by burning different waste materials.

- We should be careful about unnecessary use of energy in offices schools and homes. Bulbs can be replaced by energy savers for light. We can use such electric appliances that consume less energy.
- We should develop the habit of walking for small distances.
- Biogas energy can be made available easily in villages free of any cost. Villagers should be instigated to make use of biogas.
- The small hydal power station should be constructed to fulfil the local needs of electricity.
- The use of non-conventional energy sources like solar energy, wind energy and tidal energy should be made practicable.

IMPORTANT POINTS

- Work is the product of force and distance in the direction of force.
- Energy is the ability to do work.
- Energy possessed by a body due to its motion is known as kinetic energy.
- Energy possessed by a body due to its position is known as potential energy.
- The energy stored in a body by pressing, stretching or twisting is known as elastic energy.
- The energy which is emitted during the chemical reactions is called chemical energy.
- Energy of a body due to the movement of the molecules is called heat energy.
- When the electrons revolving around the nucleus jump from a higher energy orbit to a lower energy orbit, light is emitted.
- Electrical energy is the energy of moving charges.
- Energy is obtained by breaking the nuclei of heavy atoms. This process is called nuclear fission.
- The energy obtained in the process of nuclear fission is called nuclear energy.
- Conservation law of energy states that energy can neither be created nor destroyed.
- The conversion of the kinetic energy of running water to electrical energy is known as hydro-electric power.
- The production of electricity of burning coal, natural gas and oil is called thermal power.
- The production of electricity through the nuclear fission process is called nuclear power.
- The production of electricity from solar energy is called solar power.

- The production of electricity due to the kinetic energy of fast blowing air is called wind power.
- Tidal energy is the energy due to the tides of water. The production of electricity from tidal energy is called tidal power.
- To make use of energy deep under the Earth in the form of hot water or steam is known as geothermal.
- Organic materials and their residues are called biomass.
- The pollution caused in the environment by heat, smoke and harmful gases is called thermal pollution.
- When pollution more than a certain limit is added into an environment, it is known as degradation of the environment.
- The residue of the used nuclear fuel is called nuclear waste.

GLOSSARY

Work:	Product of force and distance.
Energy:	Ability to do work.
Kinetic Energy:	Energy due to motion.
Potential Energy:	Energy due to position.
Elastic Potential Energy:	Energy stored due to pressing, stretching or twisting.
Chemical Energy:	Energy produced due to chemical reaction.
Heat Energy:	Energy due to molecular motion.
Light Energy:	Energy due to which we see things.
Electrical Energy:	Energy of moving charges.
Nuclear Energy:	Energy from the nucleus of atom.
Hydroelectric Power:	Production of electricity from flowing water.
Thermal Power:	Production of electricity from burning fossil fuels.
Nuclear Power:	Production of electricity from nuclear energy.
Solar Power:	Production of electricity from solar energy.
Wind Power:	Production of electricity from wind energy.
Tidal Power:	Production of electricity from force of water tides.
Geothermal Power:	Production of electricity by steam or hot water coming from depth of Earth.

Biomass: Organic materials and their residues.

Solid Waste: Garbage.

Biogas: Gas produced by biomass.

Kilowatt-hour: Unit of electrical energy.

Environment: Living place of people including physical and social factors around them.

Thermal Pollution: Addition of heat and harmful gases in the atmosphere.

Greenhouse Effect: Increase in temperature of environment due to carbon dioxide gas.

Degradation of Environment Addition of pollution in environment more than a certain limit.

Nuclear Fuel: Materials, where from nuclear energy is obtained.

Radiation: Alpha, beta and gamma rays.

QUESTIONS

Q. 1 Select the correct answer for the following statements:

(i) The unit of energy is

(a) newton (b) metre

(c) joule (d) second.

(ii) The energy due to motion is called

(a) potential energy (b) kinetic energy

(c) nuclear energy (d) chemical energy.

(iii) The method of production of electricity that does not produce pollution is

(a) hydroelectric power (b) thermal power

(c) nuclear power (d) burning of biogas.

(iv) By burning fossil fuels, we get

(a) solar power (b) tidal power

(c) nuclear power (d) thermal power

(v) We can save energy

(a) by increasing personal vehicles

(b) by making vehicles of heavier bodies

(c) by not walking

(d) by avoiding unnecessary use of energy.

Q. 2 Fill in the blanks:

(i) Work is the product of force and distance travelled in the direction of _____.

(ii) We can see things with the help of _____.

(iii) Photocells convert light into _____.

(iv) The energy of the sea tides is called _____ energy.

(v) The safe disposal of _____ is very necessary to protect from radiation.

Q. 3 Mark '✓' against true and '×' against false statement:

(i) The energy possessed by a body due to position is called kinetic energy.

(ii) Electrical energy is the energy of flowing charges.

(iii) Chemical potential energy is stored in fossil fuels.

(iv) Cooling towers of nuclear reactors absorb heat from the atmosphere.

(v) When pollution less than a certain limit is added to the environment, it is known as degradation of environment.

Q. 4 Give short answers to the following questions:

(i) What is the law of conservation of energy?

(ii) Define the unit of electrical energy.

(iii) Define environment.

(iv) What is meant by degradation of environment?

(v) Write down the names of three conventional methods and five non-conventional methods of producing electricity.

(vi) Give any three suggestions for the conservation of energy.

(vii) Point out two suggestions for the safe disposal of nuclear waste.

Q. 5 Define energy. What is the difference between kinetic and potential energy? Explain with the help of examples.

Q. 6 Describe different forms of energy.

Q. 7 What is meant by interconversion of energy? State law of conservation of energy.

Q. 8 What are the conventional methods of producing electricity? Write a detailed note on any one of them.

Q. 9 Describe any three non-conventional methods of producing electricity.

Q. 10 In what unit is the electrical energy measured? Describe the principle and working of electricity meter.

Q. 11 What is thermal pollution? How is it produced? How does it affect the environment?

Q. 12 Write notes on the following:

(i) Nuclear fuel hazards (ii) Conservation of energy.