

## MODULE - 5

### Environmental Conservation



Notes

# 18

## WATER AND ENERGY CONSERVATION

You have already learnt in the previous lesson 16 that water and energy are required for survival of all organisms. You have also learnt that there is growing shortage of water and energy which limits growth and development. Human beings, through overexploitation of water resources have made water scarce. Pollution of natural water bodies such as sea, rivers, lakes etc., have made their water unusable. The problem of growing shortages of two essential resources namely water and energy can be solved only through their wise use and effective conservation. In this lesson, you shall learn about water and energy conservation.



### OBJECTIVES

After completing this lesson, you will be able to :

- *list the factors responsible for increasing water demand;*
- *describe the various methods for conservation of water;*
- *explain the need and importance of water conservation and sustainable management;*
- *describe national river conservation plan;*
- *define energy and explain the use of energy for human society; list various conventional and non-conventional sources of energy;*
- *explain how to improve energy efficiency in home, place of work, transport and industry;*
- *learn about various energy conservation programmes being carried out in the country.*

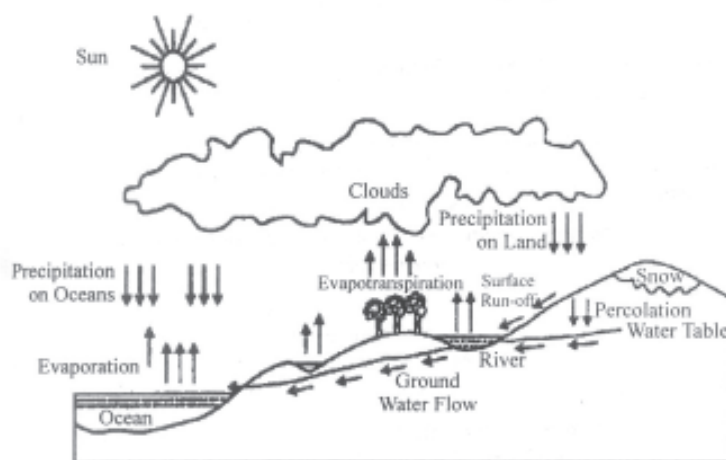
### 18.1 WATER AS A NATURAL RESOURCE

Water is an indispensable, natural resource as no life can exist without water. It is also renewable and reusable. Scientists estimate that nearly three fourths of earth is covered



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with water of the ocean, seas, rivers, lakes, snow, glaciers and ground water as you have already learnt in lesson 8 of the module-3. However, only less than 1% of this water is fresh water and usable for living organisms including humans. Though water cycle ((Fig. 18.1) throughout the year, everywhere, it is being overused and some of it is even wasted. Hence, water conservation has become very necessary. At present, one-third of the global population is facing acute water shortage. In the villages, women have to walk long distances to fetch water. In certain hilly areas, women may have to walk as much as ten kilometers uphill to reach a well. According to UN estimates, by 2025, almost two-third of the world will face shortage of potable (fit for drinking) water. We have to be cautious about using water and devise methods of conserving it. But first let us understand as to what made water scarce.



*Fig. 18.1: Water cycle*

## 18.2 FACTORS RESPONSIBLE FOR INCREASING WATER DEMAND

Following factors for responsible for increasing water demand are as follows:

- Expansion of irrigation
- Increasing demand by industry
- Rising demand due to growing population
- Increasing water use due to changing life style

### (a) Expansion of irrigation

India is an agricultural country hence plenty of water is needed for irrigation. 5.36 billion cubic meter water was used for irrigation in the year 2000. It is 81% of the total water used. The remaining percentage (19%) of water was used for domestic, industrial and other purposes mentioned above. There has been a rapid increase in the irrigated area in

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India since independence. Thus the demand for irrigation in India has been increasing continuously. The reasons for the increasing demand of irrigation are:

- regional and seasonal variation in the distribution of rainfall.
- uncertainty of rainy season.
- growing demand of water for commercial crops.
- changing cropping pattern.

More efficient and environmentally sound irrigation technologies can greatly reduce water demands and waste on fields by delivering water more precisely to crops. For example, low pressure sprinklers (allows 80% of water to reach crops) and microirrigation (delivers small amounts of water precisely to crops). Israel now treats and reuses 30% of its municipal sewage water for crop production and plans to increase their percentage to 80% by 2025.

However, many of the world's poor farmers cannot afford most of the modern technological methods for increasing irrigation and irrigation efficiency. Instead, they use low cost traditional technologies which use up huge amount of water.

**(b) Industrial use of water**

Most industries require water at various stages of production of goods and products. Water is used in industries in both consumptive and non-consumptive ways. Be it agro-based industries (cotton, textile, jute, sugar and paper) or mineral based industries (iron, steel, chemical and cement). Water is needed in large amounts during the production process or as heat exchanger for cooling various machine parts which get heated up during the production process.

In power plants water is used as a power source as well as a cooling agent. The ore and oil refining industries use water in various chemical processes.

**(c) Rising demand for growing population**

Population of India has been increasing continuously and it has increased three times since independence. Due to this increase in population, the demand for water has increased. We need water for drinking, for flushing or draining sewage or human waste, domestic use, irrigation, industries.

- Rising demand for water due to growing population is a single most important factor leading to water scarcity in our country and elsewhere.
- It is becoming impossible for the state to supply clean drinking water to its people.
- Most other human activities like washing, cleaning, cooking, flushing of waste etc. require water.



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- More the number of people more is the demand for water to carry out day to day work.

#### (d) Changing life style

Industrial development led to economic development. Purchasing capacity of individuals has increased. Thus the life style of people changed and the standard of living has gone up.

Large number of attractive appliances, gadgets and fittings for kitchen and bathroom are available in the market and people are generally tempted to use them, for example taps and showers are designed in such a way that large amounts of water come out when they are turned on. Washing machines and dishwashers use large amounts of water but are convenient and suit the present day life style.

Lot of water is used for recreational purposes like 'water parks' are becoming extremely favorite place for people to enjoy holidays. Most of the sports or games here require huge quantity of water. Although much of the water used in various water games are actually recycled and reused.

Water in the reservoirs are used for recreational purposes –boating, swimming and angling etc. Golf is becoming a very favorite sport and many golf courses are coming up at various places. Golf courses use excessive amount of water for its maintenance. Private and public gardens too require water for their maintenance.

We receive the second highest rainfall in the world, first being Brazil, but much less rain water infiltrates the soil or is retained to increase water table. A sizeable amount of water is drained as run off (moving out from the soil surface) draining into the sea.

Public and private swimming pools require water supply and sanitation.

## 18.2 VARIOUS METHODS FOR CONSERVATION OF WATER

You must have realized that it is crucial to conserve water. You may do your bit (1) by making people aware of water scarcity so that they may use it judiciously. (2) never waste water. Get leaking pipes and taps required. Use only as much as water needed. (3) Close taps between brushing your teeth, bathing and shaving. It hardly required efforts to open and closed taps. (4) collect rain water and use for domestic use. Remember it is clean water.

We can do conservation of water by using various methods such as reforestation, re-use, recycle, increase water use efficiency, water harvesting and ground water recharge.

#### (i) Reforestation

There is a continuous interchange of moisture between earth and atmosphere, constituting the hydrological cycle. The movement of water through the hydrological cycle has a major

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influence on rainfall distribution and temperature modification. Plants play an important role in hydrological cycle through the process of transpiration. In tropical forests, 75% of the annual precipitation is returned to the atmosphere by the plants. Thus forests play a very important role in maintaining water balance of the soil and atmosphere. Forests play a protective function and conserve soil and water.

Forests provide major ecological services like-

- support energy flow and chemical cycling.
- reduce soil erosion.
- absorb and release water.
- purify water.
- purify air.
- influence local and regional climate.
- store atmospheric carbon.

Cutting down of large areas of forest reduces the ecological services provided by the forest and it can lead to regional and global climate change.

Deforestation is the temporary or permanent removal of large areas of forest for agriculture or other uses.

Reforestation is the process of planting of trees on the deforested area or of increased tree cover from regrowth and planting of trees (plantations). Reforestation increases soil fertility by preventing soil erosion, prevents run-off of eroded soil into aquatic systems and prevents flooding. Thus reforestation plays a major role in conservation of water.

**(ii) Recycling of water**

The wastewater from industrial or domestic sources can be used after proper treatment for irrigation, recharging ground water and even for industrial and municipal use.

Agricultural lands close to cities can be irrigated with municipal wastewater. Household level recycled 'grey water' (untreated household water which does not come in contact with toilet waste) can be used for various purposes.

Grey water from shower, bath, washbasins, laundry troughs and washing machines can be put to various uses to reduce pure water requirement. Pure water after used in bath and shower can be used for watering plants.

**(iii) Reuse of wastewater**

Wastewater containing lots of nutrients. These nutrients may help the growth of plants when such water is used in irrigation.



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Reuse of wastewater occurs most effectively with on-site or small treatment system. The reuse option in the local context at the community level must be seriously considered.

(iv) **Water harvesting**

Water harvesting is collecting rainwater that falls on a house or on and around any building and then putting it to use later on or simply replenishing the ground water by allowing the water to reach underground.

Time has come when we should work on our ancient methods of water management including capturing of water from swollen streams and rivers during monsoon season and storing it in various forms of water bodies.

(v) **Recharging of groundwater**

The available groundwater is about 13-20 times as much as water available on surface. The groundwater consists of water contained in the soil or aquifers (underground natural water reservoir).

- Flood water may be injected into aquifers through series of deep pits or ditches.
- Small reservoirs and percolation tanks can be dug to hold runoff water recharging ground water.
- Storm water, used water (municipal and domestic), domestic drains can be fed into pits, trenches, depressions to be filtered and percolated through the soil for recharging ground water.
- Desiltation of canals and tanks should be done regularly.
- Premonsoon tillage of fields help to conserve soil moisture.



**INTEXT QUESTIONS 18.1**

1. State any three factors responsible for increase in water demand.

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2. Name two environmentally effective systems of irrigation.

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3. Why should water be conserved?

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4. Mention any two ways an individual can help in conserving water.

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5. Mention one important cause of water scarcity in our country.

\_\_\_\_\_

**Notes****18.3 MANAGEMENT OF WATER RESOURCES**

The total amount of water available for use by humans is limited. In view of the variability of rainfall in our country, this precious resource needs to be effectively managed and conserved. Due to the unwise use of water resources by our enormously large population and poor distribution and maintenance practices, the existing system has resulted in serious shortages.

Effective management and conservation of water has to incorporate the following two strategies:

- (1) Reduction in loss and wastage of water.
- (2) Harvesting, collection and improved storage of water.

**18.3.1 Reduction in wastage of water**

Reduction in wastage of water can be best achieved by launching awareness campaigns to involve all sections of the society for the conservation of water. Such awareness is possible through different media such as newspapers, radio and TV. Other ways would be to organize short plays, street plays or lectures.

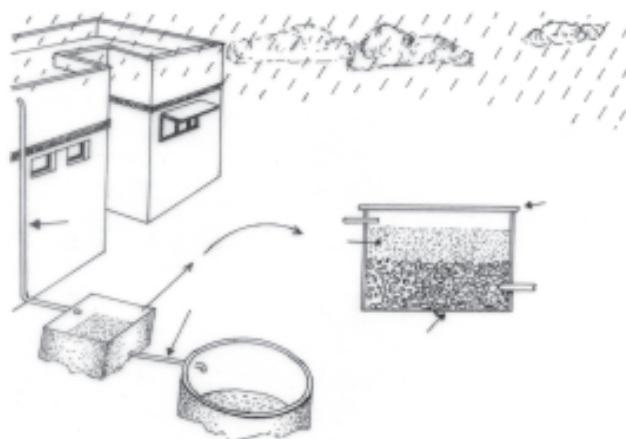
- Any agency either government or otherwise responsible for water meters and charging for water use should make it a point to install efficient meters and decide to charge a rate which will force the public to reduce use of municipal water.
- Tap, shower flow restrictors and low volume toilet flushes can help in reducing water use.
- Any leak in water pipes and faucets should be detected and repaired immediately.
- Lawns and gardens should be watered in the early morning or late in the evening so that water evaporation losses are minimized.
- Rain water is the major source of water for irrigation of agricultural fields in the country and for recharging the ground water. Rain fall is restricted to three months in a year therefore rain water should be stored and use of ground water well planned as ground water is a renewable water source and gets replenished by natural process of recharge. Loss of water through seepage and evaporation, water wasted on weeds, cost of bringing water from ponds to place of use should be minimized.

**18.3.2 Harvesting, collecting, recharging of ground water and water storage****1. Recharging of ground water**

- Flood waters may be injected into aquifers (underground water reservoirs) through series of deep pits or ditches.



- Small reservoirs and percolation tanks can be dug to hold run off water recharging ground water. (Fig. 18.2)
- Rain water harvesting carried out by building power for recharging ground water.
- Storm water, used water, domestic drains can be fed into pits, trenches, depressions to be filtered and percolated through the soil for recharging ground water.
- Desiltation of canals and tanks should be done regularly.
- Pre-monsoon tillage of fields helps to conserve soil moisture.



*Fig. 18.2: Collection of rain water*

## 2. Removal of pollutants to transform polluted water into usable form

- Proper treatment of domestic and municipal waste water which is rich in organic matter and pathogens material also helps to conserve water. Treatment ensures the removal of pollutants, germs and toxic elements.
- Growing algae or floating masses of water hyacinth also helps in cleaning the water polluted by absorbing phosphates, nitrates and other nutrients. These aquatic plants can be harvested for producing biogas.

## 18.4 NATIONAL RIVER CONSERVATION PLAN

There are several small and large rivers in India such as Ganga, Yamuna, Brahmaputra, Sutlej, Krishna, Narmada, Kaveri, Godavari etc.

Many of the Indian rivers are polluted and their waters over large stretches are unfit for human use. River pollution is mostly from discharge of effluents by industries, and cities developed along river courses.

To clean up the rivers, massive action plans have been launched by the Government of India.



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Two important action plans are:

1. Ganga Action Plan
2. Yamuna Action Plan

**Ganga Action Plan or GAP:** Ganga is the largest and most important Indian river. It is 2,525 Km long. The watershed of river Ganga spreads over ten Indian states. The major cause of Ganga water pollution is unrestricted discharge of untreated sewage and industrial effluents all along its course. Ganga Action Plan (GAP) is an ambitious and first of its kind river cleaning project. Ganga Action Plan (GAP) has been launched by the Government of India to clean the river Ganga.

The first phase of the project was completed in 1993.

**Yamuna Action Plan (YAP)** was implemented in April, 1993 under the banner-

“यमुना को स्वच्छ बनाना है।  
हम सबको हाथ बटाना है।”

Yamuna is a major tributary of the river Ganga.

Yamuna Action Plan (YAP) aims at cleaning and conserving water of the river Yamuna by removing pollutants from it.



### INTEXT QUESTIONS 18.2

1. State in a sentence how TV can help in spreading awareness regarding water conservation.  
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2. Why is it more sensible to irrigate plants and lawns in early morning or late evening?  
\_\_\_\_\_
3. In your opinion what can be done to motivate people to reduce wastage of water?  
\_\_\_\_\_
4. State one method of recharging ground water.  
\_\_\_\_\_
5. What is the role of algae or aquatic plants like water hyacinth in removing pollutants from waste water?  
\_\_\_\_\_
6. What are GAP and YAP?  
\_\_\_\_\_



7. Why is such action plans undertaken?

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8. Name two more important rivers of our country?

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## 18.6 ENERGY CONSERVATION

### What is energy?

Energy may be defined as the capacity to do work. Energy can be transformed from one form to another form. Energy gets used up? When used and accordingly energy cannot be recycled like nutrients. You have already learnt in earlier lessons that the sources of energy may be (i) renewable or (ii) non-renewable. However, energy can neither be created nor destroyed and can not be recycled.

### 18.6.1 Use of energy by society

Human beings and all other living organisms require energy for their activity and physiological functions. Living organisms obtain this energy required by them from food and is in the form of a chemical compound adenosine –tri –phosphate (ATP). This compound is synthesized mainly during the oxidation of food which occurs during cellular respiration.

You already know that in nature, transfer of energy takes place through the food chains (refers Fig. 5.2, lesson-5) the ultimate source of energy is the sun. Plants use solar energy for photosynthesis and they are called producers. Herbivores eat plants. They are the consumers. Carnivores eat herbivores. In this way, energy is transferred from one organism to another. Some energy is, however, always lost as heat.

Apart from energy required for one's own body processes, humans need energy for carrying out various kinds of activities.

- Heat or electrical energy is required for cooking and heating
- Electricity is required for lighting bulbs and tube lights, running fans, coolers and air conditioners.
- Fuel such as petrol or diesel or compressed natural gas (CNG) is required in vehicles such as cars, buses, trains, trucks, aeroplanes which are responsible for transporting human beings and goods from one place to another.
- Energy (electricity) is required for pumping water up the multi-storied buildings.
- Energy is required for the various industrial processes that ultimately result in the manufacture of different kinds of goods.

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- Energy is required in agriculture, for irrigation, tractors and other farm machines, spraying pesticides.
- Energy is required in power generation e.g. rotating the turbines in hydro-electrical power generations.

Thus energy is a very important resource for human beings.



### INTEXT QUESTIONS 18.3

1. Define energy.  
\_\_\_\_\_
2. List four human activities for which energy is required.  
\_\_\_\_\_
3. Name the energy compound synthesized by human beings.  
\_\_\_\_\_

## 18.7 CONVENTIONAL AND NON-CONVENTIONAL SOURCES OF ENERGY

The **conventional sources** of energy are the **fossil fuels**. It took millions of years for the formation of fossil fuels, hence they are **limited** and **non-renewable**. Fossils are remains of organisms that lived in the past and fossil fuels are plants that got buried under earth that became rock over years. Fossil fuels have to be unearthed from mines.

Most fossil fuels release energy as heat. The types of fossil fuels are:

1. **Coal** is solid. It is mined and then transported in trucks and trains. In our country coal mines are found in Raniganj, Jharia and Dhanbad in Bihar.
2. **Oil** is liquid which is pumped out from the ground after drilling a well. It is sent to far away places in oil tankers or pipe lines. Oil (petroleum) is used in automobiles and aeroplanes. In India oil is found along the west coast and in Digboi oil fields, Assam.
3. Natural gas is a mixture of gases. The gas we use for cooking which comes in cylinders is LPG or **Liquefied Petroleum Gas**. **Compressed Natural gas** or **CNG** is used in the public transport vehicles (buses, scooters, auto-rickshaws and taxi).

Oil and natural gas are fossils of phytoplankton (floating algae) which lived millions of years ago and sank to ocean bottom when they died. Over years, under pressure and heat, they became petroleum and filled reservoirs underneath the sea bed.

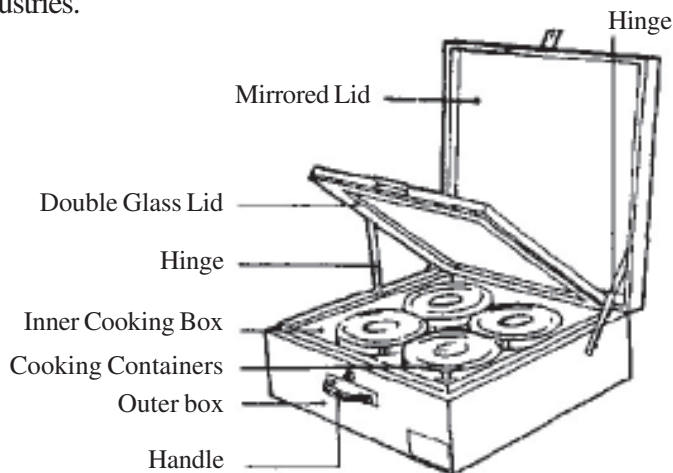


Till about five decades ago, human beings were not worried about the exhaustion of fossil fuel. But as population increased and consumption of fossil fuels became enormous, environmentalists began to talk about fossil fuels as non-renewable and limited (last for limited period of time) and scientists began to think and discuss about other sources of energy (non-conventional), which were till then used by humans to some extent only.

Non-conventional sources of energy are:

- solar energy
- wind energy
- hydel power
- tidal energy
- geothermal power
- energy from biomass.

These resources are **renewable** and almost **inexhaustible**. Of these solar energy or energy from the sun is very important. It is widespread in nature is non-polluting and available free of cost. **Solar energy** is now harnessed through “solar panels” directly which heat homes by solar radiations, solar photovoltaic cells used in solar TVs and solar thermal energy is used to cook food in solar cookers (Fig. 18.5). Solar energy is also used in industries.



**Fig. 18.5:** Solar cooker

### Wind energy

Wind energy has been traditionally used to lift water for domestic purposes and irrigation of fields. Kinetic energy of wind is converted into electrical energy and used.

### Hydro-power (Hydel power)

Many dams have been built on rivers to store water at a height and then potential energy of the stored mass of water is converted to kinetic energy by letting the massive water flow



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over **turbines**. Thus electrical energy is obtained converting potential energy of the mass of water.

### Tidal energy

Tidal energy is the energy of ocean or sea waves which derive energy from wind which in turn is driven by solar energy. Tidal energy can be transformed into electrical energy.

### Geothermal power

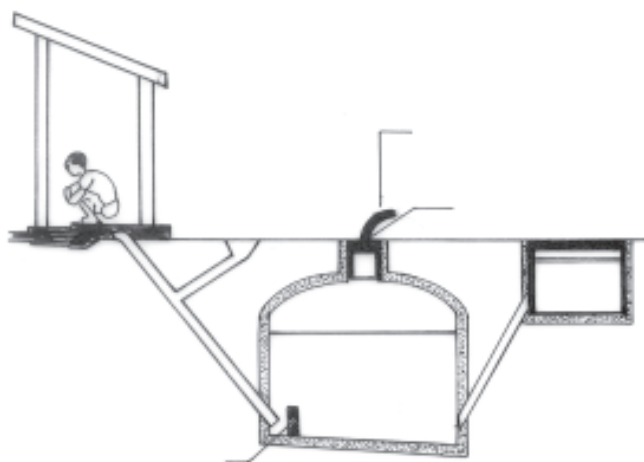
Geothermal power is the heat energy or thermal energy present in the earth's crust. The heat in the uppermost part of earth is readily accessible and can be used to generate electricity.

### Energy from biomass

Biomass is plant matter produced as a result of photosynthesis. Some of it can be burnt to provide heat, for example wood, agricultural waste. Biomass can also be used for power generation or converted into alcohol (liquid or methane gas) to be used as fuel. Since these are obtained from plant material, they are called **bio-fuels**.

Biomass is renewable energy and shall be available as long as plants grow on earth. Thus for supplying fuel wood, fast growing trees like oil palm, species such as *Euphorbia*, *Jatropha* etc. are planted. Another use of biomass as fuel is to collect agricultural waste and crop residues and animal manure.

Organic wastes, sewage and any other solid biomass can be converted by bacteria into **biofuels** such as **biogas**. Biogas digesters (Fig. 18.6) are large vessels in which organic wastes (plants and animals waste) are made to undergo bacterial fermentation and produce biogas which can be used for heating and cooking. Biogas is a mixture of methane and carbon-di-oxide. Methane can be obtained by anaerobic (in absence of air) digestion of manure and sludge of sewage treatment units by means of anaerobic bacteria.



*Fig. 18.6: Biogas digester*

Recently, the idea of using ethanol as car fuel is doing the rounds. It is made from sugar cane, sorghum, corn or beet root by fermentation and distillation. Pure ethanol may be used and there is no need to change the engine for using ethanol in place of petrol.

**Biodiesel**

India has many varieties of oilseed plants. Biodiesel may be get from vegetable oils. Some oil yielding trees that can give biodiesel are (1) Ratanjot or *Jatropha curcas* (2) Nagchampa or *Callophyllum ionophyllum* (3) Rubber seeds or *Hevea braziliensis*. Biodiesel does not contain any petroleum but it substitutes for petroleum in the same conventional engines.



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**INTEXT QUESTIONS 18.4**

1. Distinguish between non-renewable and renewable sources of energy.

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2. Name one conventional and one non-conventional sources of energy.

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3. Name three fossil fuels.

\_\_\_\_\_

4. Name one biodiesel yielding plant.

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5. What do you mean by (a) biomass and (b) biogas?

\_\_\_\_\_

6. Name two chemical compounds which can be called biofuel.

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7. Why are they termed biofuels?

\_\_\_\_\_

**18.8 IMPROVING ENERGY EFFICIENCY**

**At home**

- Do not waste electricity. Switch off lights and fans when not in use, minimize use by sharing to sit and work at one place.

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- Use fuel efficient hearths (chulhas) for cooking. Do not use smoking stoves.
- Cut only dry branches of trees for burning.
- Use the gas at simmer level. It saves cooking gas and makes cooked item healthier and tastier.
- Keep material ready for cooking before lighting the gas so that it does not burn unnecessarily.
- Use solar cookers for heating and cooking.

#### At work place

- Use car pool to reach office – share the transport vehicles.
- Switch off lights and fan when not used. Does not matter if somebody else is paying bills. It is not about saving money so much as it is about saving power.
- Computer to be switched off when not in use.

#### In transport

- To use public transport system as much as possible instead of using personally owned vehicles.
- Car speed should be maintained as far as possible 50 to 60km/hr. Moderate driving; driving at lower speeds.
- Do not use choke unless necessary. When choke is used, put it off as soon as engine is warmed up, if there is a starting trouble, depress clutch to start the engine.
- Take care to check and mend leak if fuel tanks and exhausts of vehicles.
- Turning off a vehicles engine at stops rather than idling.

### 18.9 PROMOTION OF SOLAR ENERGY(POWER) IN INDIA

India is both densely populated and has high solar insolation, providing an ideal combination for using solar power in India.

- The Ministry of New and Renewable Energy (MNRE) have initiated schemes and incentives-like subsidy, easy loan, concessional duty on raw material imports, excise duty exemption on certain devices/systems etc. to encourage and use of solar energy systems.
- The Indian Renewable Energy Development Agency (IREDA) provides financial helps for the purchase of PV (Photovoltaic) systems.



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- Government is planning to set up 10 million square meter solar collector area by 2022. This will conserve electricity equivalent to that generated from a 500 MW power plant.
- The state of West Bengal has initiated to make the use of solar power mandatory in new multi-storied buildings.
- Rajasthan government has set aside a 35,000 km<sup>2</sup> areas of the Thar desert for solar power.
- Rural electrification can be done for about 2700 village by using SPV (Solar photovoltaic) systems.
- Currently many companies in India are engaged in manufacturing PVs.
- Australian government has come forward to train next generation solar energy engineers specially from India and China as a part of the Asia-Pacific partnership (APP) on Clean Development and Climate. Many programmes have been designed under this for rural solar energy usage.
- In the agriculture sector, solar PV water pumping systems are used for irrigation and drinking water. Solar driers are used to dry harvests before storage.
- Solar cookers, solar energy used for supply of hot water in hospitals, hotels and large kitchens have solved the problem of electricity to some extent and if needs to be extended.

### (i) Promotion of CFLs (Compact Fluorescent Light Bulbs)

- Mercury is an essential element in the operation of fluorescent lighting. It allows the bulbs to be an efficient light source.
- CFLs use less electricity than traditional light bulbs (75% less), they reduce demand for electricity.
- CFLs contain very small amount of mercury-an average of 4 milligrams in each bulb.
- No mercury is released when bulbs are intact or in use, however, it is important to be careful in the disposal of these products.
- Most people have started using CFLs at home to cut down their electricity bill.
- Government offices and institutions have replaced traditional light bulbs with CFLs.

### (ii) Use of star rating of electrical equipments

Bureau of Energy Efficiency (BEE) is an agency of the Government of India, under the Ministry of Power created in March, 2002 under the provision of Energy Conservation



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Act. The agency's function is to develop programs which will increase the conservation and efficient uses of energy in India.

- The government has proposed to make it mandatory or compulsory for appliances in India to have ratings by the BEE starting in January 2010.
- The BEE Star Energy Efficiency Labels have been created to standardize the energy efficiency ratings of different electrical appliances and indicate energy consumption under standard test conditions.
- These labels indicate the energy efficiency levels through the number of stars highlighted in colour on the label.
- Star rating system ranges from one star (least energy efficient thus least money saved) to five stars (most energy efficient, thus most money saved).

Refrigerators, Air conditioners, washing machines, lighting systems etc. will bear the star levels to indicate their energy efficiency.

**(iii) Transport and energy**

The transport sector is the fastest growing source of green house gases (carbondioxide ( $\text{CO}_2$ ), Methane ( $\text{CH}_4$ ) Nitrous oxides ( $\text{N}_2\text{O}$ )). Of the total green house gas emissions from transport, over 85% are due to  $\text{CO}_2$  emissions from road transport vehicles.

Reducing energy waste requires improving energy efficiency by using less energy to do more useful work. Reducing such energy waste has numerous economic and environmental advantages.

- The best way to save energy in transportation is to increase the fuel efficiency of motor vehicles.
- Fuel efficient vehicles powered by a hybrid gas-electric engine and electric vehicles powered by fuel cells running on hydrogen are being developed.
- Fuel cells are about twice as efficient as internal combustion engines, have no moving parts, require little maintenance and produce little or no pollution.
- Reva is a small electric car developed in our country. Use of small sized cars instead of big cars and using two wheelers can go a long way in saving energy.
- Large reductions in energy costs can be done by using vehicles with efficient engine that reduces consumption of petroleum (i.e. petroleum electric hybrid vehicle) or preferably that uses renewable energy sources throughout its working life.
- Using biofuels instead of petroleum fuels is a new field where government of India is giving a lot of attention at the moment.

**INTEXT QUESTIONS 18.5**

1. Mention how you improve energy efficient at home, at work place and in transport sector. Give two points in each.

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2. Expand the following:

MNRE, IREDA, CFL

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3. Why have people started using CFL at homes?

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4. What does BEE stand for? What is its function?

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5. What is the difference between 'one star' and 'five star' refrigerators?

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**WHAT YOU HAVE LEARNT**

- Water is an indispensable natural resource.
- Sources of usable water are rivers, lakes, ponds, tanks and groundwater
- Several factors responsible for water scarcity are –
  - (i) Increased demand of an increasing population.
  - (ii) Increasing demand by expansion of irrigation and its demand.
  - (iii) Increasing water use due to changing in lifestyle.
  - (iv) Silting of rivers
  - (v) Bad management of water resources.
- Since water is needed for domestic purposes, in industries, irrigation and rearing livestock, its conservation is absolutely necessary.
- Water may be conserved by proper management of water resource. this can be in four directions:(i) Reducing wastage of water, (ii) Storage, (iii)Recharging and (iv) Harvesting of water.




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- Water wastage is best reduced by generating public awareness through the media, enforcement by the government and by individual efforts.
- Water harvesting is through collection of rainwater, regular desiltation of canals and ponds, injecting flood waters into aquifers.
- Another way of obtaining usable water is by removing pollutants from freshwater bodies.
- Our rivers Ganges and Yamuna had been polluted and are being cleaned through the river action plans.
- Energy is defined as the capacity to do work. Energy is renewable and non-renewable.
- Conventional sources of energy are fossil fuels whereas non conventional sources are solar, wind, hydel power, tidal, geothermal and biomass energies.
- Biofuels are obtained from plants and plant products and may be in the form of liquid (Bioethanol) may be obtained as gases  $\text{CO}_2$  and  $\text{CH}_4$  (bio gas). Oil seeds of plants like Jatropha, Hevea and Callophyllum yield biodiesel.
- Certain careful actions at home and place of work can save energy.
- India has a well chalked out electricity conservation programme.
- Promotion of solar energy power in India and promotion of CFL.
- Star rating of electrical equipments by BEE, an agency of Government of India under Energy Conservation Act.
- Development of fuel efficient vehicles to reduce emission of green house gase as well as to reduce energy waste.



### TERMINAL EXERCISE

1. State the factors responsible for water scarcity.
2. Mention the strategies for water conservation.
3. What is water harvesting? In what ways can it be done?
4. Write short notes on: Ganga Action and Yamuna Action Plan.
5. What are conventional and non-conventional energy resources? Explain with examples.
6. What are bio fuels?
7. Write notes on (i) Biogas digesters (ii) Biodiesel (iii) Fossil fuels
8. What are the ways of conserving energy as an individual?

9. What is the need for making electrical gadgets/equipments with star rating?
10. How can transport vehicles be made energy efficient?
11. Mention three ways of using solar energy as an energy resource.



Notes



## ANSWER TO INTEXT QUESTIONS

### 18.1

1. Increasing demand by industry, Rising demand due to growing population, Expansion of irrigation, Increasing water use due to changing life style (any two).
2. Low pressure sprinklers and micro irrigation.
3. To overcome the problem of scarcity of water, we need to judicious use of water and conserved it for use of future generations.
4. Use water very judiciously. To repair leaking pipes and taps to collect rain water for domestic use.
5. Growing population.

### 18.2

1. Awareness programmes in the form of small skits or conversation or cartoons can reach a large population.
2. Because transpiration is low so water loss is reduced.
3. Change an appropriate amount on water consumption.
4. Divert supply from region of surplus to that of scarcity. Feed used water into pits/ inject flood waters into aquifers / desilt canals/ hold runoff water/ till fields before monsoon/ harvest rain water (any two)
5. They take up phosphates and nitrates from water bodies.
6. Ganga Action Plan and Yamuna action plan.
7. Because the rivers Yamuna and Ganga got badly polluted.
8. Krishna/ Kaveri/ Godavari/ Rabi / Brahmaputra/ Narmada (any other)

### 18.3

1. Capacity to do work
2. Cooking, using electrical gadgets, fuel for vehicles in industries and agriculture
3. ATP or Adenosine trphosphate.

## MODULE - 5

### Environmental Conservation



#### Notes

#### 18.4

1. Non renewable is limited in supply; Renewable energy is available in an unlimited amount.
2. Conventional- coal or petroleum: Non-conventional-solar/hydel/ tidal/ biomass
3. Coal, natural gas, Petroleum (oil).
4. Jatropha/ Callophyllum/ Hevea (Rubber).
5. Biomass = plant matter.  
Biogas = Gas used as fuel, containing  $\text{CH}_4$  and made by action of anaerobic bacteria on organic waste.
6. Ethanol, Methane.
7. Because they are obtained from plants or by bacteria both of which are biological organisms.

#### 18.5

1. i. Switch of light, fan and AC when not in use, use gas at simmer level, it saves cooking gas.  
ii. Switch off light, fan and AC when not in use, use car pool to reach office, use CFL, computer to be switch off when not in use.  
iii. Car speed should be maintained at 50-60 km/h, turn off a vehicle engine at stops rather than idling. (Any other)
2. MNRE- Ministry of New and Renewable Energy; IREDA- The Indian Renewable Energy Development Agency; CFL- Compact Fluorescent Light Bulbs
3. Energy consumption is low hence cuts down electricity bill.
4. Bureau of Energy Efficiency – the function of BEE is to develop programme to increase conservation and efficient uses of energy in India.