NATURAL RESOURCES

The term “resource” means any thing that we use from our environment to achieve our objective. **A resource can be defined as ‘any natural or artificial substance, energy or organism, which is used by human being for its welfare.** These resources are of two types:

(a) Natural resources and

(b) Artificial resources.

All that the nature has provided such as soil, air, water, minerals, coal, **sunshine** (sunlight), animals and plants, etc., are known as **natural resources**. Human being uses these directly or indirectly for survival and welfare. The resources, which have been developed by human being during the growth of civilization, are called **artificial resources**. For example, biogas, thermal electricity, plastics, etc are manmade resources. These man-made resources are generally derived from some other natural resources. For example, plastics and many other chemical products are ultimately derived from the natural resource of petroleum.

Classification of Natural Resources:

Natural resources can be classified as:

Inexhaustible Resources

The resources which cannot be exhausted by human consumption and other uses, are called **inexhaustible resources.** These include energy sources like solar radiation, wind power, water power (flowing streams) and tidal power, and substances like sand, clay, air, water in oceans, etc.

Exhaustible Resources

On the other hand, there are some resources, which are available in limited quantities and are going to be exhausted as a result of continus use. These are called **exhaustible resources**. For example, the stock of coal in the earth is limited and one day there will be no more coal available for our use. Petroleum is another
important exhaustible resource.

Renewable Resources

Some of the exhaustible resources are naturally regenerated after consumption and are known as **renewable resources.** e.g. The living beings (both animals and plants) reproduce and can thus, replace the dying or killed individuals. However, if the consumption of these resources

exceeds the rate of regeneration they may also get totally exhausted. Some examples are fresh water, fertile soil, forest (yielding wood and other products), vegetation, wildlife, etc.

Non-renewable Resources

The resources, which cannot be replaced after the use, are known as **non-renewable Resources.** These include minerals (copper, iron etc.) fossil fuels (coal, oil etc.). Even the wildlife species (rare plants and animals) belong to this category.

CONSERVATION OF NATURAL RESOURCES

Conservation is the proper management of a natural resource to prevent its exploitation, destruction or degradation.

Conservation is the sum total of activities, which can derive benefits from natural resources but at the same time prevent excessive use leading to destruction or degradation. As the human population is continuously growing the consumption of natural resources is also increasing. With the increasing industrialisation and urbanisation of the modern human society, the use of all the resources is rising. If they are not properly used and well managed, a serious scarcity will result. Therefore we need to conserve the natural resources. This will also upset the ecological balance.

Need for Conservation of Natural Resources

We know that nature provides us all our basic needs but we tend to overexploit it. If we go on exploiting the nature, there will be no more resources available in future. There is an urgent need to conserve the nature. Some of the needs are :

- to maintain ecological balance for supporting life.
- to preserve different kinds of species (biodiversity).
- to make the resources available for present and future generation.
- to ensure the survival of human race.

Physical resources

Soil: Soil may be defined as a natural body, synthesized in profile form from a variable mixture of broken and weathered minerals and decayed organic matter, which covers the earth in a thin layer and which supplies, when containing the amounts of air and water, mechanical support and imparts sustenance for plants (Brady & Weil, 2000).

Soil is the uppermost layer of earth's crust, which supports growth of plants. It is a complex mixture of (i) mineral particles (formed from rocks), (ii) humus (organic material formed from

decaying plant remains), (iii) mineral salts, (iv) water, (v) air, and (vi) living organisms (larger ones like earthworms and insects and microscopic ones like the bacteria and fungi).

Humus

A brown or black organic substance consisting of partially or wholly decayed vegetable or animal matter that provides nutrients for plants and increases the ability of soil to retain water. Soil is a renewable as well as non-renewable resource.

- Soil is renewable because its productivity can be maintained with fertilizers and manures rich in humus.
- If the soil has been removed from a certain place by erosion, it is practically non-renewable because formation of new soil may take hundreds and thousands of years.

Soil Erosion

Erosion literally means "to wear away". You might have noticed during the summer, when wind blows it carries away sand and soil particles from one place to another. Similarly flowing water removes some amount of soil along with it. **This removal of top layers of soil by wind and water is called soil erosion.** You know that top layers of soil contain humus and mineral salts, which are vital for the growth of plants. Thus, erosion causes a significant loss of humus and nutrients, and decreases the fertility of soil.

Causes of soil Erosion

Now we shall discuss the causes of soil erosion. There are several causes of soil erosion, these include:

(a) Natural causes; and

(b) Anthropogenic causes (human generated causes)

(a) Natural Causes of Soil Erosion

Erosion of soil takes places due to the effect of natural agents like wind and water. High velocity winds over lands, which have no vegetation, carry away the loose top soil. Similarly in areas with no or very little vegetation, the pouring raindrops carry away the soil.

(b) Anthropogenic Causes of Soil Erosion

Besides the natural agents, there are some human activities, which cause soil erosion. Let us know about them.

1. Deforestation: If the forests are cut down for timber, or for farming purposes, then the soil is no longer protected from the effect of falling rains. Consequently, the top soil is washed away into the rivers and oceans.

2. Poor farming methods: Improper tillage and failure to replace humus after successive crops and burning the stubble of weeds reduce the water-holding capacity of the soil. So the soil becomes dry and can be blown away as dust.

3. Overgrazing: Overgrazing by flocks of cattle, buffaloes, goats and sheep leave very little plant-cover on the soil. Their hooves make the soil dry and soil can be blown away easily.

Conservation of Soil

In the previous section we learnt about the various causes of soil erosion. Soil loses its fertility due to erosion. So we need to conserve the soil. Soil conservation means checking soil erosion and improving soil fertility by adopting various methods. Let us know some of these methods.

1. Maintenance of soil fertility: The fertility can be maintained by adding manure and fertilizers regularly as well as by rotation of crop.

2. Control on grazing: Grazing should be allowed only on the areas meant for it and not on agricultural land.

3. Reforestation: Planting of trees and vegetation reduces soil erosion by both water and wind.

4. Terracing: Dividing a slope into several flat fields to control rapid run of water. It is practised mostly in hilly areas.

5. Contour ploughing: Ploughing at right angles to the slope allows the furrows to trap water and check soil erosion by rain water.

WATER – A PRECIOUS RESOURCE

Water is the most important component of all life forms and necessary for sustaining life. It regulates climate, generates electricity and is also useful in agriculture and industries.

About 97% of the water on earth is saline in nature, which is found in seas and oceans. The remaining 3% is fresh water, and most of which is stored in ice caps and glaciers, and just about 0.36% is distributed in lakes, rivers, ponds, etc. Sea water supports marine life and contributes to the production of fish and sea foods and several other commercial products (iodine, agar, coral, pearls, etc.). Fresh water is needed by humans for their personal use (drinking, cleaning, sewage disposal), It is also used by other animals, in agricultural, and for industrial purposes. Fresh water is a renewable resource as it is continuously being produced through hydrological cycle (evaporation, condensation and precipitation).

Degradation of Water

Degradation of water is the decrease in quality and quantity of water on the earth surface. With increase in population and industrial growth, water is being degraded day by day. The main reasons for the degradation of water are:

1. to meet the need of increasing population, surface water (water from ponds, lakes, rivers, etc) and ground water are overdrawn.
2. sewage i.e., waste water from domestic and municipal use makes fresh water unfit for use by human beings and animals.
3. waste water, from all industries flow down the surface water bodies and ground water bodies and they get polluted.
4. agricultural wastes containing manures, fertilizers and pesticides enter the water bodies and degrade the quality of water.
5. the continuous decrease of ground water level along coastal regions often cause movement of saline sea water into freshwater wells, thus, spoiling their water quality

Conservation of Water

Conservation and management of water are essential for the survival of mankind, plants and animals. This can be achieved adopting the following methods:

1. Growing vegetation in the catchment areas, which will hold water in the soil and allow it to percolate into deeper layers and contribute to formation of ground water.

2. Constructing dams and reservoirs to regulate supply of water to the fields, as well as to enable generating hydroelectricity.

3. Sewage should be treated and only the clear water should be released into the rivers.

4. Industrial wastes (effluents) should be treated to prevent chemical and thermal pollution of fresh water.

5. Judicious use of water in our day-to-day life.

6. Rainwater harvesting should be done by storing rainwater and recharging groundwater.

BIORESOURCE

Bioresource can be defined as the resource obtained from flora and fauna i.e. variety of all plants, animals and microbes of a region. When we observe our surrounding, we find different types of plants, ranging from small green grasses to large trees. Large variety of animals, from tiny insect to human being and many other big animals. Besides these there are micro-organisms in the soil, air and water that we can’t see through our naked eyes. These

varieties of plants, animals and microbes together form the biological diversity or biodiversity of your surrounding.

Importance of Bioresource

Bioresource is essential for maintenance of ecosystem. It maintains gaseous composition of atmosphere, controls climate, helps in natural pest control, pollination of plants by insects and birds, soil formation and conservation, water purification and conservation, geo-chemical cycles etc.

Some of the uses of biodiversity are given below:

- Food: All kind of food is derived from plants and animals.
- Drugs and Medicines: Around 25% of drugs are obtained from plants e.g. quinins used for treatment of malaria is obtained from *Chinchona officinalis*. All antibiotics are derived from microbes.
    - Cultural and Aesthetic value: You enjoy watching butterflies, animals, birds and flowers. Eco-tourism is a source of income.
    - Religious values: Plants like tulsi, peepal, banyan and animals like cows, ox, elephant are worshiped.
    - It is essential for maintenance of ecosystem.
    - It is required for disposal and pollination in plants, formation and conservation of soil and purification and conservation of water.

Threat to Bioresource

Though bioresource is so important for our survival, we are destroying it knowingly or unknowingly. It is under threat due to the following reasons:

(i) Destruction of habitat by cutting down trees, filling up the wetland, ploughing of grassland or burning a forest.

(ii) Population explosion has increased demand for food and shelter. It has lead to culture of single crop that will result in disappearance of some other crops.

(iii) Industrialisation and urbanisation has changed and destroyed the natural habitat of plants and animals.

(iv) Pollution of soil, air and water changes the habitat quality and may reduce or eliminate sensitive species.

(v) Mining activities add to the pollution of air and water and threaten the survival of the animals in the nearby areas.

(vi) Construction of dams, roads and railways destroys huge patches of forests, grassland etc. thus, disturb the biodiversity.

(vii) Indiscriminate killing of animals for different purposes has resulted in their reduction.

(viii) Introduction of exotic/foreign species in an area threaten the survival of existing natural biodiversity; e.g., water hyacinth clogs rivers and lakes and threatens the life of many aquatic species in our country.

Conservation of Bioresource

Now you have an idea of the importance of biodiversity for our survival and how it is destroyed. Let us know how to protect the biodiversity. There are two basic strategies for conservation of biodiversity:

(i) **In-situ** conservation

(ii) **Ex-situ** conservation

(i) **In-situ (on site)** conservation includes the protection of plants and animals within their natural habitats or in protected areas. Protected areas are areas of land or sea dedicated to protection and maintenance of biodiversity. For example: e.g., National Parks, Wildlife Sanctuaries, Biosphere Reserves, etc.

(ii) **Ex-situ (off site)** conservation is the conservation of plants and animals outside their natural habitats. These include Botanical Gardens, Zoo, Gene Banks, DNA Banks, Seed Banks, Pollen Banks, Seedling and Tissue Culture etc.

WILDLIFE

Now we shall know about an important resource of the nature called the wildlife. At home you may have a pet dog or a cat, even some may have cows, buffalos, sheeps, goats etc. In your garden you may grow different types of vegetables and flower plants. In addition to these, there are other plants and animals, which are not cultivated or reared by you. **The plants, animals and microorganisms other than the cultivated plants and domesticated animals constitute the wildlife.** Animals and plants living in their natural habitat constitute **wildlife**. The wildlife forms an important resource as it plays a major role in maintaining ecological balance. It is used in research as experimental material and also used for recreational purposes. Like other resources it is also facing severe threat. So it should beconserved and maintained for the use of future generation.

Need for Conservation of wildlife

Wildlife needs to be conserved for :

1) maintaining ecological balance for supporting life.

2) preserving different kinds of species (biodiversity).

3) preserving economically important plants and animals.

4) conserving the endangered species.

Methods of Conservation of Wildlife

After knowing the need for conservation of wildlife, let us discuss how to conserve it. We can protect it by adopting various means, like:

- Establishing biosphere reserves, national parks and sanctuaries.
- Afforestation (Tree planting programme).
- Special schemes for preservation of threatened species.
- Improvement of natural habitats of wildlife.
- Educating people about the need and methods of conservation of wildlife.
- Formulation of Acts and Regulations to prevent poaching (killing animals) for sports and money.

MINERAL RESOURCES

Minerals are defined as the naturally occurring substance that has a definite chemical composition is a mineral. These are formed in different types of geological environments, under varying conditions and are not equally distributed over space. A mineral deposit represents a geochemically anomalous concentration of elements in a very limited sector of the crust. The crustal elements have to undergo enrichment upto several orders to attain the status of an economic deposit. Minerals 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.

Types of Minerals

On the basis of composition, minerals are classified mainly as:

1. Metallic minerals
2. Non-metallic minerals

• Metallic minerals contain metal in raw form.

→ Examples: Iron ore, bauxite, manganese ore.

• Metallic minerals may be ferrous or non-ferrous.

→ Ferrous minerals contains iron. Examples are iron ore, manganese and chromites.

→ 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.

→ Examples: Limestone, mica and gypsum and mineral fuels like coal and petroleum.

Extraction of minerals:

Minerals are found deep embedded in the earth's crust and need a proper extraction. They can be extracted by mining, drilling or quarrying. 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.

The mining in which deep bores, called shafts, have to be made to reach mineral deposits that lie at great depths is called is shaft mining.

Deep wells are bored to take minerals out is called drilling. Petroleum and natural gas are extracted through drilling method.

Minerals that lie near the surface are simply dug out, by the process known as quarrying.

Geographical Distribution of Minerals

Minerals occur in different types of rocks such as igneous rocks, metamorphic rocks or sedimentary rocks. Generally, metallic minerals are found in igneous and metamorphic rock formations that form large plateaus.

• Metamorphic examples: Iron-ore in north Sweden, copper and nickel deposits in Ontario, Canada, iron, nickel, chromites and platinum in South Africa.

• Sedimentary rock examples: Limestone deposits of Caucasus region of France, manganese deposits of Georgia and Ukraine and phosphate beds of Algeria

Asia

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

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

North America

Mineral deposits in North America are located in three zones:

- The Canadian region north of the Great Lakes: Iron ore, nickel, gold, uranium and copper
- The Appalachian region: Coal
- The mountain ranges of the west: Copper, lead, zinc, gold and silver

South America

• Iron Ore: Brazil

• Copper: Chile and Peru

• Tin: Brazil and Bolivia

• Mineral Oil: Venezuela, Argentina, Chile, Peru and Columbia

• South America also has large deposits of gold, silver, zinc, chromium, manganese, bauxite, mica, platinum, asbestos and diamond.

Africa

• It is the world's largest producer of diamonds, gold and platinum.

• Gold: South Africa, Zimbabwe and Zaire

• Oil: Nigeria, Libya and Angola.

• Other minerals found in Africa are copper, iron ore, chromium, uranium, cobalt and bauxite.

Australia

• It 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.

Antartica

• Deposits of coal in the Transantarctic Mountains and iron near the Prince Charles Mountains of East Antarctica is predicted

• Iron ore, gold, silver and oil are also present in commercial quantities.

Distribution of minerals in India

India has a rich tradition of mineral exploration. The distribution of minerals in India is very uneven. Innumerable old workings, mine dumps slag heaps, etc. are the tell-tale signs of this glorious tradition. The flourishing diamond trade in the Deccan peninsula, mainly in the Golconda kingdom, had attracted world's attention during historical time.

Diamond

India has the distinction of producing many of the historically famous diamonds like the Kohinoor (186 ct), the Great Moghul (787 ct), the Hope (67ct), Nizam (440ct), Pitt/Regent (410 ct), Orloff (300 ct) and Daryainoor (185 ct). Till the discovery of the Brazilian diamondfields, India was leading in diamond mining.

Diamond occurrences in India are quite widespread. The known areas of occurrences of diamond source rocks are broadly grouped into three diamond provinces, namely the South Indian Diamond Province (SIDP), the Central Indian Diamond Province (CIDP) and the East Indian Diamond Province (EIDP)

Iron

Iron ore deposits are found practically in every state of India.however 96% of the total reserves are in Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Goa, Maharashtra and Karnataka.

Bauxite

It is non_ferrous metallic mineral.it is the ore from which aluminium metal is extracted. It has a wide occurance in the country and mainly found in Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra and Tamil Nadu.

Mica

India is the leading producer and exporter of mica in the world\. Although it is widely distributed in Jharkhand, Bihar, Andhra Pradesh and Rajasthan.

Copper

Copper is mainly found in Rajasthan, Madhya Pradesh, Jharkhand, Karnataka and Andhra Pradesh.

Manganese

It is widely distributed in the areas of Maharashtra, Madhya Pradesh, Chhattisgarh, Odisha, Karnataka and Andhra Pradesh.

Limestone

Limestone is used in a wide range of industries in the country.mainly found in Bihar, Jharkhand, Odisha, Madhya Pradesh, Chhattisgarh, Rajasthan, Gujarat and Tamil Nadu.

Gold

Kolar in Karnataka has deposits of gold in India. These mines are among the deepest in the world which makes mining of this ore a very expensive process.

Salt

It is obtained from seas, lakes and rocks. India is one of the world's leading producers and exporters of salt.

Uses of Minerals

Minerals are considered as the backbone of industries and are used for various purposes. For example minerals are used in various styles for jewellery. Copper is 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 etc.

Problems

There are various problems posed by mineral resources.the major problems are as:

1. **Depletion of mineral resources**:
   Due to the excessive exploitation many minerals are going to be depleted in near future.so it calls for conservation and judicious utilization.
2. **Ecological problems**:
   Mineral extraction has led to the serious environmental problems. For example rapidly growing mining activities and removal of natural vegetation has rendered large areas almost useless. In many mines, miners have to work under hazardous conditions.
3. **Pollution:**
   Many mineral producing areas led to air and water pollution in the surrounding region leading to various health hazards.
4. **Social problems:**
   Discovery of new minerals results in emigration as many tribal areas are rich in minerals, so trials are more effected. Industrialization of such areas has shuttered their economy, values and life style

Why to conserve minerals?

Minerals are a non-renewable resource and 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.

Conservation of Mineral resources:

In the world of diminishing resources it is necessary to use the mineral resources judiciously so to ensure a resource base for future generation.

The strategies for resource conservation include:

01. Reclamation:

Efforts should be made to reclaim various mineral resources by means of latest technologies. Remote sensing is one of them.

02. Recycling

Recycling of metals is another way in which the mineral resources can be conserved. Recycling means reuse of the waste in a production process. For example waste papers, rags, bottles etc. should be recycled to make new products. Such processes saves our other mineral resources.

03. Reduce:

By reducing wastage in the process of mining.

04. Substitution:

Due to advancement of technology new needs have led to many changes in the use of minerals. Products of petro chemical industry have replaced traditional brass or clay jars. Plastic now compete with copper for uses such as piping and the steel in car bodies.

ENERGY RESOURCES

We have always been using different form of energy obtained from various sources for our daily activity like cooking, heating, ploughing, transportation, lighting, etc. For example, heat energy required for cooking purpose is obtained from firewood, kerosene oil, coal, electricity or cooking gas. LPG (liquefied petroleum gas) We use animal power (horse, bullock, etc.) for transportation and for running minor mechanical devices like the Persian wheel for irrigation or for running a “kolhu” for extracting oil from oilseeds. Different forms of these energies are obtained fromvarious sources.

Types of Energy Sources

There are two main categories of energy sources:

(i) Conventional Sources of Energy, which are easily available and have been in usage for a long time.

(ii) Non-Conventional Sources of Energy, that are other than the usual, or that are different from those in common practice.

Conventional Nonrenewable Energy

(Mostly fossil fuels found under the Ground)

Examples: Coal, Oil, Natural gas etc.

- Solar Energy Hydel Energy

- Wind Energy
- Nuclear Energy
- Hydrogen Energy
- Geothermal Energy
- Biogas
- Tidal Energy
- Bio-fuel

Conventional Renewable Energy

(Mostly non-fossil fuels seen above theGround)

Examples: Firewood,Cattle Dung, Farm Vegetable Wastes, Wood charcoal, etc

Conventional Sources of Energy

Let's first discuss about the conventional sources of energy. These have been in use since ancient times. Most important among them are the fossil fuels. So we shall know details about the fossil fuels.

Fossil Fuels

Fossil fuels are the fossilised remains of plants and animals, which over millions of years have been transformed into coal, petroleum products and natural gas.

Coal is the most abundant fossil fuel. It is widely used for combustion in cooking and industrial activities. There are different types of coal products such as coal gas, coal tar, benzene, toluene, etc., which are used for various purposes.

Oil and Natural gases are formed from plants and animals which once lived in the tropical seas. Oil (or petroleum) is a source of countless products. Apart from petrol, diesel and other fuels, petroleum products include lubricants, waxes, solvents, dyes, etc. Petroleum reserves are supposed to last for another 100 years or so.

Natural gas is often found with petroleum. The gas mainly contains methane. Apart from serving as fuel in several industries, it is being increasingly used as domestic fuel in many countries including India. United States of America is the largest producer as well as consumer of natural gas.

Now a days in big cities and town it is being supplied through pipelines which is called **Piped Natural Gas (PNG).** The natural gas is also used as a fuel to run vehicles. It is known as **Compressed Natural Gas (CNG).** It is accepted as an economical and less polluting fuel for transport.

The **Liquefied Petroleum Gas (LPG)** is the common cooking gas used in Indian homes. It is a mixture of propane and butane gases kept under pressure in liquid form, but they burn in gaseous form. This gas is made available in a specific container for domestic as well as industrial uses. It is a byproduct of petroleum refineries.

Non-Conventional Sources of Energy

We have already learnt known about conventional sources of energy, whether renewable or non-renewable (coal, oil, etc.), which are fast depleting and will not last long. Therefore, greater utilisation of non-conventional sources of energy (solar, wind, hydro, geothermal, etc) will have to be used. We will discuss about some of these energy sources.

1. Solar Energy

Solar energy is the ultimate source of all energies on earth. Firewood, coal, oil or natural gas are the products of plants and other organisms, which had used solar energy for the synthesis of organic molecules during photosynthesis. Even today it will turn out to be the most important answer to problems of energy except nuclear energy. The solar energy has the following advantages:

(i) It is abundant

(ii) It is everlasting

(iii) It is available almost everywhere.

(iv) It is free from political barriers.

Various technologies in which solar energy can be, and is being utilised are as follows:

(i) Solar cookers

(ii) Solar hot water systems

(iii) Solar dryers (used for drying crop yields)

(iv) Solar air heaters

(v) Solar kilns (vi) Solar desalination systems (vii) Solar batteries

2. Hydel /Hydro Energy

The generation of electricity by using the force of falling water is called hydroelectricity or hydel power. It is cheaper than thermal or nuclear power. For its generation dams are built to store water, which is made to fall to rotate turbines that generate electricity.

3. Wind Energy

Wind as an energy can be utilised in our daily life by converting it into mechanical energy. This mechanical energy is used to generate electricity, raise water from wells and rivers for irrigation and other purposes. Windmills have been in use since early times to provide power

for grinding grains. It is also used for grain cutting and shelling. In India a large number of windmills are being constructed on the sea beach and hilly areas.

4. Tidal Energy: Tidal energy is one that is produced by making the use of water movement froma high tide to a low tide. Ocean waves and tides can be made to turn a turbine and generate electricity. Areas where rivers flow into the sea experience waves and tides and electricity can be generated there. It has much potential. As you know we have a large coastline and major river systems in our country, electricity canbe generated on a large scale from waves and tides.

5. Nuclear Energy

Radioactive elements like uranium and thorium disintegrate spontaneously releasing large quantities of energy. This energy can be trapped to produce electricity. 25% of world's thorium reserve is found in our country, which can be utilised to generate electricity. Most advanced countries have nuclear power stations. We too have somein India, for example, Tarapur (Maharashtra), Kalpakkam (Tamil Nadu), Narora (Uttar Pradesh), Kota (Rajasthan). Approximately 3% of India's electricity comes from nuclear power and about 25% is expected to come by 2050. Installation costs of nuclear power stations are very high, but maintenance costs are relatively low. If not carefully maintained, these also have an inherent risk of causing radioactive pollution.

6. Hydrogen Energy

Hydrogen is the primary fuel for the hydrogen based fuel cells and power plants. Power can be generated for industrial, residential and transport purposes by using hydrogen.

7. Geothermal Energy

This is the energy derived from the heat in the interior of the earth. In volcanic regions, springs and fountains of hot water called "geysers" are commonly found. These eruptions of hot steaming water can be used to turn turbines and produce electricity in geothermal power plants. In this method cold water is allowed to seep through the fissures in the rocks till it reaches the hot rocks in the lower layers. Water gets heated and gets converted into steam which forces out to the surface to be used in power generation. Besides the superheated steam of hot springs can also generate electricity. There are 46 hydrothermal areas in India where the water temperature normally exceeds 150 degree centigrade. Electricity can be generated from these hot springs.

8. Biogas

Another form of non-conventional energy is **biogas**. It is produced by the microbial activity on cattle dung in a specially designed tank called digester. A mixture of water and cattle dung is poured in this digester where anaerobic decomposition takes place and biogas is generated.

This gas contains 55 – 70 percent methane, which is inflammable and it is generally used as cooking gas and for generation of electricity. The "waste" left in the tank after the generation of biogas is used as manures. Thus, biogas plant provides us both the fuel and the manure. Biogas plants are becoming very popular in rural India.

There are two types of biogas plants:

(a) Family type gas plants- These are small and are used individually by a family.

(b) Community type gas plants- These are large and are used by larger rural populations.

9. Bio-fuel

You know it very well that fossil fuels have been the main source of energy for transportation and industries for more than a century. Their rapid consumption has depleted the reserves of fossil fuels. Their fast depletion and non-renewable nature has sent an alarm to look for alternative fuel. Among the fuels, consumption of liquid fuels is the highest. So there are attempts to identify potential plant species as sources of liquid hydrocarbons, a substitute for liquid fossil fuels. The hydrocarbons present in such plants can be converted into petroleum hydrocarbons. This liquid hydrocarbon is the bio-fuel and the plants producing it are called petroplants. These plants belong to families Euphorbiaceae, Asclepiadaceae, Apocyanaceae, Urticaceae, Convolvulaceae and Sapotaceae. The plant species, *Jatropha curcus* is the most suitable one, which yields bio-diesel. The Indian OilCorporation is carrying out experiments for preparation of bio-diesel from various vegetable oils extracted from rice bran, palm, karanjia, sunflower etc.

Advantages of Bio-diesel

Bio-diesel has several advantages; some of them are given below-

- It is an agriculture based fuel substitute.
- It can be made from both vegetable oil and animal fats.
- It can be used without major modifications in engines.
- It does not need separate infrastructure for storage and delivery.
- Handling bio-diesel is safer.
- Planting of *Jatropha curcus* will utilise wasteland in our country.
- It's combustion emits less carbon monoxide, sulphates, unburnt hydrocarbons and particulate matters, thus reduces air pollution.

Conservation of Energy Sources

We have already leant about the different types of sources of energy and how they are useful to us. Now you think about your daily activities and the types of energy you are using in each

activity. Make a list of the sources, which produce these energies. Everyday you and your family members are using four to five sourcesof energy. Similarly other people, industries and different establishments are using energy everyday. The demand for energy is increasing day-by-day and exploitation of the energy sources is on the rise. Thus, energy sources are depleting gradually. There is an urgent need to conserve energy, else adequate energy will not be available in future. Some methods to conserve energy are:

- Minimise exploitation of non-renewable energy resources.
- Emphasis on use of renewable sources of energy.
- Stop wastage of energy.
- Creating awareness among people regarding wise and judicious use of energy and more use of bio-mass based energy.