

CHAPTER-1

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition – Scope and importance – Need for public awareness

NATURAL RESOURCES

Renewable and Non-renewable resources- Natural resources and Associated problems- Forest resources:-Use and over – Exploitation – Deforestation – Case studies – Timber extraction – Mining – Dams and their ground water – Floods – Drought – Conflicts over water – Dams – Benefits and Problems – Mineral Resources:- Use Effects on Forests and Tribal People – Water Resources:- Use and Over-Utilization of Surface and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies – Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity, Case Studies – Energy Resources:- Growing Energy Needs, Renewable and Non Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies

1.1 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

1.1.1 INTRODUCTION

- The word environment is derived from the French word '**environner**' which means to '**encircle or surround**'.
- Thus our environment can be defined **as “the Social, Cultural and Physical conditions that surround, affect and influence the survival, growth and development of people, animals and plants”**
- This broad definition includes the natural world and the technological environment as well as the cultural and social contexts that shape human lives.
- It includes all factors (living and nonliving) that affect an individual organism or population at any point in the life cycle; set of circumstances surrounding a particular occurrence and all the things that surrounds us.

1.1.2 SEGMENTS OF ENVIRONMENT

Environment consists of four segments.

1. Atmosphere- Blanket of gases surrounding the earth.
2. Hydrosphere- Various water bodies present on the earth.
3. Lithosphere- Contains various types of soils and rocks on the earth.
4. Biosphere- Composed of all living organisms and their interactions with the environment.

1.1.3 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

- The Environment studies is a multi-disciplinary science because it comprises various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc.
- It is the science of physical phenomena in the environment. It studies about the sources, reactions, transport, effect and fate of physical and biological species in the air, water, soil and the effect of from human activity upon these.
- As the environment is complex and actually made up of many different environments like natural, constructed and cultural environments, environmental studies is inter disciplinary in nature including the study of biology, geology, politics, policy studies, law, religion engineering, chemistry and economics to understand the humanity's effects on the natural world.
- This subject educates the students to appreciate the complexity of environmental issues and citizens and experts in many fields.
- By studying environmental science, students may develop a breadth of the interdisciplinary and methodological knowledge in the environmental fields that enables them to facilitate the definition and solution of environmental problems.

1.1.4 SCOPE OF ENVIRONMENTAL STUDIES

Environmental studies as a subject has a wide scope. It includes a large number of areas and aspects, which may be summarized as follows:

- **Natural resources**- their conservation and management
- **Ecology and Biodiversity**
- **Environmental pollution and control**
- **Human population** and environment
- **Social issues** in relation to development and environment

These are the basic aspects of environmental studies which have a direct relevance to every section of society. Several career options have emerged in these fields that are broadly categorized as:

(i) Research and development in environment:

Skilled environmental scientists have an important role to play in examining various environmental problems in a scientific manner and carry out R&D activities for developing cleaner technologies and promoting sustainable development.

(ii) Green advocacy:

With increasing emphasis on implementing various Acts and Laws related to environment, need for environmental lawyers has emerged, who should be able to plead the cases related to water, air, forest, wildlife, pollution and control etc.

(iii) Green marketing:

While ensuring the quality of products with ISO mark, now there is an increasing emphasis on marketing goods that are environment friendly. Such products have ecomark or ISO 14000 certification. Environmental auditors and environmental managers would be in great demand in the coming years.

(iv) Green media:

Environmental awareness can be spread amongst masses through mass media like television, radio, newspaper, magazine, hoardings, advertisements etc., for which environmentally educated persons are required.

(v) Environmental consultancy:

Many non-government organizations, industries and government bodies are engaging environmental consultants for systematically studying and tackling environment related problems.

1.1.5 IMPORTANCE OF ENVIRONMENTAL STUDIES

- The importance of environmental studies is that, the current trend of environmental degradation can be reversed if people of educated communities are organized, empowered and experts are involved in sustainable development.
- Environmental factors greatly influence every organism and their activities.

- At present a great number of environmental issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. These issues are studied besides giving effective suggestions in the environment studies.
- The environment studies enlighten us, about the importance of protection and conservation of our natural resources, indiscriminate release of pollution into the environment etc.

Environment studies have become significant for the following reasons:

1. Environment Issues being of International Importance:

It has been well recognized that environment issues like global warming, ozone depletion, acid rain, marine pollution and loss of biodiversity are not merely national issues but are global issues and hence must be tackled with international efforts and cooperation.

2. Problems Cropped in The Wake of Development:

Development, in its wake gave birth to Urbanization, Industrial Growth, Transportation Systems, Agriculture and Housing etc. However, it has become phased out in the developed world. The North, to cleanse their own environment has, fact fully, managed to move 'dirty' factories to South. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Evidently such a path is neither practicable nor desirable, even if developing world follows that.

3. Explosively Increase in Pollution:

World census reflects that one in every seven persons in this planet lives in India. Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land. Agricultural experts have recognized soils health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

4. Need for An Alternative Solution:

It is essential, specially for developing countries to find alternative paths to an alternative goal. We need a goal as under:

- (1) A goal, which ultimately is the true goal of development an environmentally sound and sustainable development.
- (2) A goal common to all citizens of our earth.

(3) A goal distant from the developing world in the manner it is from the over-consuming wasteful societies of the “developed” world.

5. Need To Save Humanity From Extinction:

It is incumbent upon us to save the humanity from extinction. Consequences to our activities cause destructing the environment and depleting the biosphere, in the name of development.

6. Need For Wise Planning of Development:

Our survival and sustenance depend. Resources withdraw, processing and use of the product have all to be synchronized with the ecological cycles in any plan of development. Our actions should be planned ecologically for the sustenance of the environment and development.

1.1.6 NEED FOR PUBLIC AWARENESS

- 1. Growing Population:** A population of over thousands of millions is growing at 2.11 per cent every year. Over 17 million people are added each year. It puts considerable pressure on its natural resources and reduces the gains of development. Hence, the greatest challenge before us is to limit the population growth. Although population control does automatically lead to development, yet the development leads to a decrease in population growth rates.
- 2. Poverty:** India has often been described a rich land with poor people. The poverty and environmental degradation are mixed with one another. The vast majority of our people are directly dependent on the nature resources of the country for their basic needs of food, fuel shelter and fodder. About 40% of our people are still below the poverty line.
- 3. Environment degradation** has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge of environment degradation are two facets of the same challenge.
- 4. Agricultural Growth:** The people must be made familiar with the methods to sustain and increase agricultural growth without damaging the environment. High yielding varieties have caused soil salinity and damage to physical structure of soil.
- 5. Need to Increase Ground water:** It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents, chemical

fertilizers and pesticides have polluted our surface water and affected quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies. Suitable strategies for conservation of water, provision of safe drinking water and keeping water bodies clean should be developed.

6. Development and Forests: Forests serve catchments for the rivers. With increasing demand of water, plan to harness the mighty river through large irrigation projects were made. Certainly, these would submerge forests; displace local people, damage flora and fauna. As such, the dams on the river Narmada, Bhagirathi and elsewhere have become areas of political and scientific debate. Forests in India have been shrinking for several centuries owing to pressures of agriculture and other uses. Vast areas that were once green, stand today as waste lands. These areas are to be brought back under vegetative cover. The tribal communities inhabiting forests, respects the trees, birds and animals give them sustenance. We must recognize the role of these people in restoring and conserving forests. The modern knowledge and skills of the forest department should be integrated with the traditional knowledge and experience of the local communities. The strategies for the joint management of forests should be evolved in a well planned way.

7. Degradation of Land: At present out of the total 329 mha of land, only 266 mha possess any potential for production. Of this, 143 mha is agricultural land nearly and 85 suffers from varying degrees of soil degradation. Of the remaining 123 mha, 40 are completely unproductive. The remaining 83 mha is classified as forest land, of which over half is denuded to various degrees. Nearly 406 million head of livestock have to be supported on 13 mha, or less than 4 per cent of the land classified as pasture land, most of which is overgrazed. Thus, out of 226 mha, about 175 mha or 66 per cent is degraded to varying degrees. Water and wind erosion causes further degradation of almost 150 mha This degradation is to be avoided.

8. Evil Consequences of Urbanization: Nearly 27% of Indians live in urban areas. Urbanization and industrialization has given birth to a great number of environmental problems. Over 30 percent of urban Indians live in slums. Out of

India's 3,245 towns and cities, only 21 have partial or full sewerage and treatment facilities. Hence, coping with rapid urbanization is a major challenge.

9. Air and water Pollution: Majority of our industrial plants are using outdated and pollution causing technologies and makeshift facilities devoid of any provision of treating their wastes. A great number of cities and industrial areas have been identified as the worst in terms of air and water pollution. Acts are enforced in the country, but their implement is not so easy. The reason is their implementation needs great resources, technical expertise, political and social will. Again the people are to be made aware of these rules. Their support is indispensable to implement these rules.

1.1.7 INSTITUTIONS IN ENVIRONMENT

Managing natural resources require efficient institutions at all levels i.e. local, national, regional and global. Among the large number of institutions that deal with environmental protection and conservation, a few well-known organization include government organizations like the BSI and ZSI, and NGOs like the BNHS, WWF-1, etc.

- **The Bombay Natural History Society (BNHS), Mumbai**
- **World Wide fund for nature- India (WWF-1), New Delhi**
- **Centre or science and environment (CSE), New Delhi**
- **C.P.R Environmental Education Centre, Madras**
- **Centre for Environment Education (CEE)**
- **Bharati Vidyapeeth University, Institute of Environment Education & Research, Pune**
- **The Salim Ali Center for Ornithology and Natural History (SACON)**
- **Wild life Institute of India (WII), Dehradun**
- **Zoological survey of India (ZSI)**
- **The madras Crocodile Bank Trust (MCBT)**
- **Botanical Survey of India (BSI)**

1.2 NATURAL RESOURCES

1.2.1 INTRODUCTION

- Natural resources can be defined as 'variety of goods and services provided by nature which are necessary for our day-to-day lives'.
- Eg: Plants, animals and microbes (living or biotic part), Air, water, soil, minerals, climate and solar energy (non- living or abiotic part).
- They are essential for the fulfillment of physiological, social, economical and cultural needs at the individual and community levels.

1.2.2 TYPES OF NATURAL RESOURCES

They are of two types of resources namely Renewable and Non-Renewable Resources.

- 1. Renewable resources:** The resources that can be replenished through rapid natural cycles are known as renewable resource. These resources are able to increase their abundance through reproduction and utilization of simple substances.

Ex: Plants, (crops and forests) and animals.

- Some examples of renewable resources though they do not have life cycle but can be recycled.

Ex: Wood and wood-products, pulp products, natural rubber, fibers (e.g. Cotton, jute, animal wool, silk and synthetic fibers) and leather.

- In addition to these resources, water and soil are also classified as renewable resources.
- Solar energy although having a finite life, as a special case, is considered as a renewable resource in as much as solar stocks is inexhaustible on the human scale.

- 2. Non renewable resources:** The resources that cannot be replenished through natural processes are known as non-renewable resources. These are available in limited amounts, which cannot be increased. These resources include fossil fuels (petrol, coal etc.), metals (iron, copper, gold, silver, lead, zinc etc.), minerals and salts (carbonates, phosphates, nitrates etc.). Once a non-renewable resource is consumed, it is gone forever.

- Non-renewable resources can further be divided into two categories, viz.
 - A) Recyclable and
 - B) Non-recyclable

A) Recyclable: These are non-renewable resources, which can be collected after they are used and can be recycled. These are mainly the non-energy mineral resources, which occur in the earth's crust (Ex: Ores of aluminum, copper, mercury etc.) and deposits of fertilizer nutrients (e.g. Phosphate rock and potassium and minerals used in their natural state (asbestos, clay, mica etc.)

B) Non-recyclable: These are non-renewable resources, which cannot be recycled in any way.

Ex: Fossil fuels and uranium, which provide 90 per cent of our energy requirements

1.2.3 NATURAL RESOURCES AND ASSOCIATED PROBLEMS:

- The main problem associated with natural resources is unequal consumption.
- A major part of natural resources are consumed in the 'developed' world. The 'developing nations' also over use many resources because of their greater human population. However, the consumption of resources per capita (per individual) of the developed countries is up to 50 times greater than in most developing countries.
- Advanced countries produce over 75% of global industrial waste and greenhouse gases.
- Energy from fossil fuels consumed in relatively much greater quantities in developed countries. Their per capita consumption of food too is much greater as well as their waste.

1.2.4 FOREST RESOURCES

A forest can be defined as a biotic community predominant of trees, shrubs or any other woody vegetation usually in a closed canopy. It is derived from latin word '*foris*' means '*outside*'. India's Forest Cover is 6,76,000 sq.km (20.55% of geographic area). Scientists estimate that India should ideally have 33% of its land under forests. Today we only have

about 12% thus we need not only to protect our existing forests but also to increase our forest cover.

1.2.4.1 FUNCTIONS OF FOREST

1. It performs very important function both to human and to nature.
2. They are habitats to millions of plants, animals and wild life.
3. They recycle rain water.
4. They remove pollutant from air.
5. They control water quality.
6. They moderate temperature and weather.
7. They influence soil condition and prevent soil erosion.

1.2.4.2 USES OF FOREST

1. Commercial uses
2. Ecological uses

1. Commercial uses:

- i. Wood – used as a fuel
- ii. Supply wood for various industries – Raw materials as pulp, paper, furniture timber etc.
- iii. Minor forest products – gum, dyes, resins
- iv. Many plants – Medicines
- v. Supply variety of animal products – honey. Ivory, horns etc.
- vi. Many forest lands are used for - Mining, grazing, for dams and recreation.

2. Ecological uses: Forest provides number of environmental services.

- i. **Production of oxygen:** Photosynthesis produces large amount of oxygen which is essential for life.
- ii. **Reducing global warming:** Carbon dioxide is one of the main green house gas. It is absorbed by plants for photosynthesis. Therefore the problem of global warming caused by CO₂ is reduced.
- iii. **Soil conservation:** Roots of trees bind the soil tightly and prevent soil erosion. They also act as wind breaks.
- iv. **Regulation of hydrological cycle:** Watershed in forest act like giant sponges and slowly release the water for recharge of spring.

- v. **Pollution moderators:** Forest can absorb many toxic gases and noises and help in preventing air and noise pollution.
- vi. **Wild life habitat:** Forest is the home of millions of wild animals and plants.

12.4.3 REASON FOR DEFICIENCY OF FOREST:

In India the minimum area of forest required to maintain good ecological balance is about 33% of total area. But at present it is only about 12%. So over exploitation of forest material occurs.

1.2.4.4 OVER EXPLOITATION OF FOREST: Due to over population, there is an increased demand for medicine, shelter, wood and fuel. Hence exploitation of forest materials is going on increasing.

Cause of over exploitation:

1. Increasing agricultural production.
2. Increasing agricultural activities.
3. Increase in demand of wood resources.

1.2.4.5 DEFORESTATION: It is process of removal of forest resources due to natural or manmade activities (i.e.) destruction of forests.

Causes of deforestation:

1. **Developmental projects:** Developmental projects causes deforestation through two ways.
 - Through submergence of forest area.
 - Destruction of forest area.
Ex: big dams, hydro electric projects, road construction etc.
2. **Mining operations:** It reduces forest areas. Ex: Mica, coal, Manganese and lime stone.
3. **Raw materials for industries:** Wood is an important raw material for various purposes.
Ex: Making boxes, furniture and paper etc.
4. **Fuel requirement:** Wood is the important fuel for rural and tribal population.

5. **Shifting cultivation:** Replacement of natural forest ecosystem for mono specific tree plantation. Ex: Teak
6. **Forest fires:** Forest fire destructs thousands of acres of forest.
7. **Over grazing:** Over grazing by cattle reduces the cultivation land

Consequences of deforestation (or) impacts of deforestation:

1. Economic loss
2. Loss of biodiversity
3. Destructs the habitats of various species
4. Reduction in stream flow
5. Increases the rate of global warming
6. Disruption of weather patterns and global climate
7. Degradation of soil and acceleration of the rate of soil erosion.
8. Induces and accelerates mass movement / land slides.
9. Increases flood frequency, magnitude / severity.
10. Breaks the water cycle
11. Breaks the nutrient cycle

1.2.4.6 PREVENTIVE MEASURES (OR) AVOID OF DEFORESTATION (OR) METHODS OF CONSERVATION OF FORESTS

1. New plants of more or less of the same variety should be planted to replace the trees cut down for timber
2. Use of wood for fuel should be discouraged.
3. Forest pests can be controlled by spraying pesticides by using aero planes
4. Forest fire must be controlled by modern techniques.
5. Over grazing by cattle must be controlled.
6. Steps should be taken by the government to discourage the migration of people into the islands from mainland.
7. Education and awareness programmes must be conducted.
8. Strict implementation of law of Forest conservation Act.

Case study:

Deforestation in the Himalayan region, involves clearing of natural forests and plantation of monoculture like Eucalyptus. Nutrient in the soil is poor; therefore soil losing their fertility, hence, Himalayan area facing the serious problem of desertification.

1.2.4.7 MAJOR ACTIVITIES IN FORESTS

1.2.4.7.1 TIMBER EXTRACTION

Wood used for engineering purposes like building houses, making furniture is called timber. The products derived from timber have been important to many civilizations, and thus it has acquired value within these civilizations. Timber extraction results in deforestation and in the fragmentation of the last remaining forests. It harms valuable species of trees, birds and wild animals. In spite of this, it is sometimes necessary to extract timber, so as to meet the needs of a developing country. During the extraction of timber, cutting, felling and handling should be done selectively, carefully and in a planned manner, in order to save the remaining forests and biodiversity.

Effects of Timber Extraction

The major effects of timber extraction on forest and tribal people include:

1. Poor logging results in a degraded forest.
2. Floods may be intensified by cutting of trees or upstream watersheds.
3. Loss of biodiversity.
4. Climatic changes such as less rains.
5. New logging roads permit shifting cultivators to gain access to logged areas and cut the remaining trees.
6. It results in forest fragmentation which promotes loss of biodiversity because some species of plants and animals require large continuous areas of similar habitat to survive.
7. Exploitation of tribal people by the contractors.
8. Soil erosion especially on slopes occurs extensively.
9. Sedimentation of irrigation systems, floods may be intensified by cutting of trees on upstream.

Case Study-Chipko Movement

The world famous **Chipko Movement**, pioneered by **Dasohli Gram Swarajya Mandal** in Gopeshwar brought about a general awareness about conservation of forests.

The first Chipko Movement dates back to 1731, when a village woman named Amrita Bai led the Bishnoi women against the Maharajas men to prevent them from cutting trees. In this attempt to save the trees, she sacrificed her life along with the lives of her husband, three daughters and 363 people. The movement was given this name because the village women embraced or hugged the trees to stop them from being cut. In 1972, in Uttar Pradesh, the Chipko Movement was led by Bachnoi Devi of Advani who protected the hill forests from the contractors axe men.

1.2.4.7.2 DAMS

Today there are more than 45,000 large dams around the world, which play an important role in communities and economies that harness these water resources for their economic development. Current estimates suggest some 30-40% of irrigated land worldwide relies on dams. Hydropower, another important the use of stored water, currently supplies 19% of the world's total electric power supply and is used in over 150 countries. The world's two most populous countries – China and India –have built around 57% of the world's large dams.

Dams problems

Dams are the massive artificial structures built across the rivers to store water for much beneficial purpose.

Dams are considered a "Temples of modern India". Dams destruct vast area of forest area. India has more than 1600 large dams.

Effects of dams on forest:

1. Thousands of hectares of forest will be cleared.
2. Killing of wild animals and destruction of aquatic life.
3. Spreading of water borne diseases.
4. Water logging increases the salinity of the soil.

Ex: Narmadha Sagar project it has submerged 3.5 lakhs hectares of forest.

Effects of dam on tribal people

1. Construction of big dams lead to the displacement of tribal people.
2. Displacement and cultural change affects the tribal people both mentally and physically.
3. They do not accommodate the modern food habits and life style.
4. Tribal people are ill treated by the modern society.

5. Many of the displaced people were not recognised and resettled or compensated.
6. Body condition of tribal people will not suit with new areas and hence they will be affected by many diseases.

Case study- Sardar Sarovar Project:

The World Bank's withdrawal from the Sardar Sarovar Project in India in 1993 was a result of the demands of local people threatened with the loss of their livelihoods and homes in the submergence area. This dam in Gujarat on the Narmada has displaced thousands of tribal folk, whose lives and livelihoods were linked to the river, the forests and their agricultural lands. While they and the fishermen at the estuary, have lost their homeland, rich farmers downstream will get water for agriculture. The question is why should the local tribals be made homeless, displaced and relocated to benefit other people? Why should the less fortunate be made to bear the costs of development for better off farmers? It is a question of social and economic equity as well as the enormous environmental losses, including loss of the biological diversity of the inundated forests in the Narmada valley.

1.2.4.7.3 MINING

The process of extracting mineral resources and fossil fuels like coal from the earth is called as mining.

Types of mining

1. Surface mining: Mining of minerals from shallow deposits
2. Underground mining: Mining of minerals from deep deposits

Steps involved in mining

1. Exploration
2. Development
3. Exploitation
4. Ore processing
5. Extraction and purification of minerals

The extent of damage by underground mining is more than that of surface mining, which needs enormous amount of land area for its operation and management.

Effects of mining

1. Pollute soil, water and air.
2. Destruction of natural habitat.
3. Continuous removal of minerals leads to the formation of trench where water is logged which contaminates the ground water.
4. Vibrations cause earth quakes.
5. Produces noise pollution
6. Reduces shape and size of the forest.
7. Increased risk of landslides.
8. Spoils the aesthetic beauty.

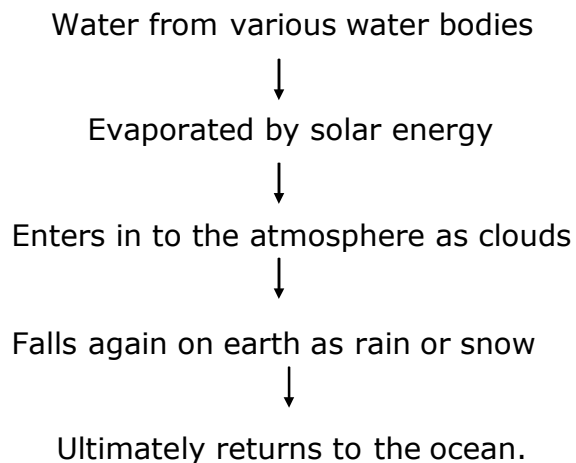
1.2.5 WATER RESOURCES

Water claims to be an important resource. An important use of water in our country is for irrigation. Besides, water is also required in large amounts for industrial and domestic consumption.

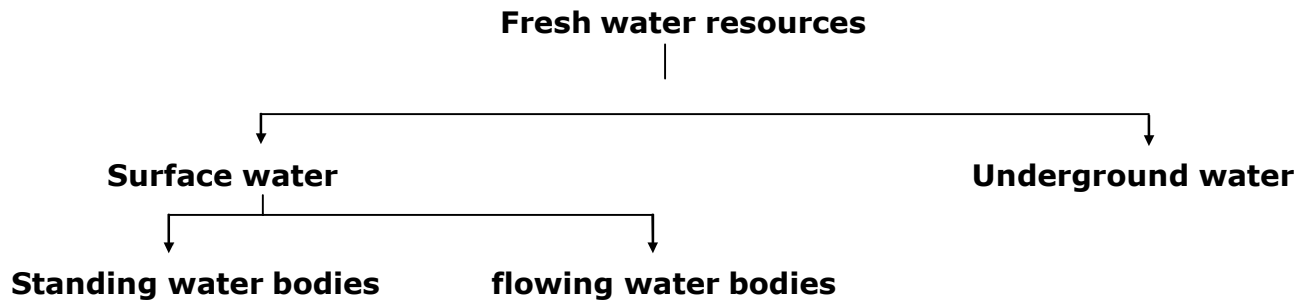
1.2.5.1 USES

- Is essential for all forms of life.
- Many uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually, all of these human uses, require fresh water.
- No plant or animal species can survive without water. If water in our body drops by 1% we feel thirst, if it drops by 10% we face death.

1.2.5.2 HYDROLOGICAL CYCLE:



1.2.5.3 DISTRIBUTION OF WATER RESOURCES



1.2.5.3.1 UNDERGROUND WATER

Aquifer: Layers of highly permeable rock that can store water is called an aquifer. Layer of sand and gravels are good aquifers. Clay and crystalline rocks are not good aquifers.

Effects of over utilization of water

1. Decrease of ground water:

- i. Increased usage decreases the ground water.
- ii. Insufficient rain fall
- iii. Building construction activities sealing the permeability of the soil.

2. Ground subsidence: If ground water withdrawal is greater than it's recharge rate, then the sediments in the aquifers get compacted. As a result shrinkage of land surface takes place.

Problems: a. Structural damages to the buildings

- b. Fracture in pipes.
- c. Reversing the flow of canals.

3. Lowering of water table: Over utilization of ground water in arid and semi arid regions for agriculture disturbs the state of equilibrium of the hydrological cycle.

Problem: a. Lowering of water table
b. Decrease the number of aquifers
c. Change the speed and direction of water.

4. Intrusion of salt water: In coastal area over exploitation of ground water leads to the intrusion of salt water from sea. Therefore that water cannot be used for drinking and agriculture.

5. Over utilization of water causes earth quakes, landslides and famines.

6. Drying up of wells: Due to over utilization, ground water level decreases much faster than can be regenerated. It leads to drying up of dug well and bore wells.

7. Pollution of water: Near the agricultural land ground water decreases therefore water containing nitrogen enters into the ground and pollute the ground water.

Problem: Water which contains excess nitrate content is not suitable for drinking.

1.2.5.3.2 REASONS FOR DECLINE OF GROUND WATER

Population continues to rise at an unprecedented and unsustainable rate; many more areas are expected to experience this imbalance in the near future.

1. Population explosion: World population is > 6 billion and will continue to increase significantly during the next few decades - Enormous demands on the world's limited freshwater supply. The total annual freshwater withdrawals today are estimated at 3800 cubic kilometers, twice as much as just 50 years ago (World Commission on Dams, 2000).

2. Overutilization of Surface and Groundwater: Occurs at various levels. Use of more water than really needed by human beings. Many agriculturists use more water than necessary to grow crops. Industries in order to maximize short-term economic gains, does not bother its liquid waste and releases it into streams, rivers and the sea.

3. Deforestation: Once hill slopes are removed of forest cover, the rainwater rushes down the rivers and is lost. Forest cover permits water to be held in the area permitting it to seep into the ground. This charges the underground stores of water in natural aquifers. This can be used in drought years if the stores have been filled during a good monsoon. This soil and water management and afforestation are long-term measures that reduce the impact of droughts. The destruction of forests influences the regulation of natural water cycle. The removal of dense and uniform cover over the hilly zones leads to occurrence of floods in drainage basins. Nations situated in tropical climates including India experience disastrous floods caused by the indiscriminate deforestation of the slopes above the valleys.

4. Hydropower generation: Large amount of water is used for generating power which otherwise used for human needs.

5. Dams - for Agriculture and Power Generation

- 6. Rain fall:** The erratic and inadequate rainfall results in reduction in storage in subsurface reservoirs. The building construction activities are sealing the permeable zone, reducing the area for percolation of rainwater into subsurface and increase in surface runoff.
- 7.** India's increasing demand for water for intensive irrigated agriculture, for generating electricity, and for consumption in urban and industrial centers, has been met by creating large dams. Dams support 30 to 40% of this area.

1.2.5.4 FLOOD

It is an over flow of water. It happens when the magnitude of flow of water exceeds the carrying capacity of the channel within its bank.

1.2.5.4.1 CAUSES OF FLOOD

1. Heavy rainfall, melting of snow and sudden release of water from dams. (Flash floods)
2. Reduction in the carrying capacity of the channel.
3. Deforestation, mining and over grazing increase the runoff from rains and the level of flood raises.

1.2.5.4.2 EFFECT OF FLOOD

1. Water spreads in the surrounding area and submerges them.
2. Cultivated land gets affected.
3. Extinction of civilization.

1.2.5.4.3 FLOOD MANAGEMENT

1. Floods can be controlled by dams.
2. Channel management control flood.
3. Flood hazards reduced by forecasting or flood warning.
4. Flood may also be reduced by reduction of run off by increasing infiltration through appropriate afforestation in the catchment area.

1.2.5.5 DROUGHT

Drought is nothing but scarcity of water, which occurs due to

1. Inadequate rain fall
2. Late arrival of rain fall
3. Excessive withdrawal of ground water.

Lack of water for the needs of agriculture, livestock, industry or human population may be termed as a drought. Drought causes serious damages to plants, animals and human life.

1.2.5.5.1 CAUSES OF DROUGHT

1. When annual rain fall is below normal and less than evaporation, drought is created.
2. High population.
3. Intensive cropping pattern

Ex: Maharashtra - There has been no recovery from drought for the last 30 years due to over exploitation of water by sugarcane crop.

1.2.5.5.2 EFFECTS OF DROUGHT

1. Drought causes hunger, malnutrition and scarcity of drinking water an also changes the quality of water.
2. Drought causes widespread crop failure leading to acute shortage of food and adversely affects human and live stock population.
3. Worst situation of drought causes desertification.
4. Raw materials of agro based industries are critically affected during drought time, hence industrial and commercial growth decreases.
5. Drought increases the degradation of natural resources.
6. Drought causes large migration of people and urbanization.

1.2.5.5.3 DROUGHT MANAGEMENT

1. Indigenous knowledge is essential.
2. Rain water harvesting system.
3. Construction of reservoirs to improve ground water level.
4. Modern irrigation technology (drip irrigation) very useful to conserve water.
5. Afforestation activities also improve the potential of water in the drought area.
6. Crop mixing and dry forming are the suitable methods which minimize the risk of crop failures in dry area.

1.2.5.6 DAMS

Dams made significant contributions to human development and the benefits derived from them have been considerable. Large dams are designed to control floods and to help the drought prone areas, with supply of water. But large dams have proved to

cause severe environmental damage. Hence an attempt has been made to construct small dams. Multiple small dams have less impact on the environment.

Benefits: Dams ensure a year round supply of water for domestic use and provide extra water for agriculture, industries and hydropower generation.

Problems: They alter river flows, change nature's flood control mechanisms such as wetlands and flood plains, and destroy the lives of local people and the habitats of wild plant and animal species, particularly is the case with mega dams.

Some of the problems are mentioned below.

- Dam construction and submersion leads to significant loss of farmland and forest and land submergence
- Siltation of reservoirs, water logging and salination in surrounding lands reduces agricultural productivity
- Serious impacts on ecosystems - significant and irreversible loss of species and ecosystems, deforestation and loss of biodiversity, affects aquaculture
- Socio economic problems for example, displacement, rehabilitation and resettlement of tribal people.
- Fragmentation and physical transformation of rivers
- Displacement of people - People living in the catchment area, lose property and livelihood
- Impacts on lives, livelihoods, cultures and spiritual existence of indigenous and tribal people
- Dislodging animal populations
- Disruption of fish movement and navigational activities
- Emission of green house gases due to rotting of vegetation
- Natural disasters – reservoirs induced seismicity, flash floods etc and biological hazards due to large-scale impounding of water – increase exposure to vectorborne diseases, such as malaria, schistosomiasis, filariasis.

1.2.5.7 SUSTAINABLE WATER MANAGEMENT

- Building several small reservoirs instead of few mega projects
- Developing small catchment dams and protecting wetlands

- Soil management, micro-catchment development and afforestation permits recharging of underground aquifer, thus reducing the need for large dams
- Treating and recycling municipal waste water for agricultural use.
- Preventing leakages from dams and canals and loss in municipal pipes
- Effective rainwater harvesting in urban environments
- Water conservation measures in agriculture, such as using drip irrigation, control of growing water intensive cash crops ; control of water logging.
- Pricing water at its real value makes people use it more responsibly and efficiently and reduces wastage
- In deforested areas where land has been degraded, appropriate soil management practices, making bunds along the hill-slopes and making nalla plugs can help retain moisture and make it possible to revegetate degraded areas
- Use waste water for activities that does not need fresh water – Recycling
- Adopt mini water harvesting models for domestic usage.
- Protect existing tanks
- Develop systematic water management and adopt strict water auditing
- “Save water Campaigns” for public awareness on water scarcity
- Through rainwater harvesting, community based participatory initiatives and holistic watershed management.
- Responsible water usage can only be achieved by empowering local communities and creating local accountability.
- The government should develop policies that protect water resources, promote sustainable watershed management and invest in technologies that will increase efficiency in irrigation, industrial usage and improve water harvesting techniques.

1.2.5.8 WATER CONFLICTS

1. Conflict through use: Unequal distribution of water led to interstate and international disputes.

National conflicts:

- a. Sharing of Cauvery water between Karnataka and TamilNadu.
- b. Sharing of Krishna water between Karnataka and Andrapradesh
- c. Siruvani – TamilNadu and Kerala

International conflicts:

Indus – India and Pakistan & Colorado river – Mexico and USA

1.2.6 MINERAL RESOURCES

Naturally occurring inorganic crystalline solids with uniform chemical composition are called as minerals.

1.2.6.1 USES AND EXPLOITATION OF MINERALS

1. Development of industrial plants and machinery. - Fe, Al & Cu
2. Construction work – Fe, Al & Ni
3. Generation of energy - coal, lignite, uranium
4. Designing defense equipments like weapons and ornaments
5. Agricultural purposes – fertilizers and fungicides – Zn & Mn
6. Jewellery – Au, Ag & Pt
7. Making alloys for various purposes
8. Communication purposes – telephone, wires, cables and electronic devices
9. Medicinal purposes, particularly in ayurvedic system

1.2.6.2 ENVIRONMENTAL DAMAGES CAUSED BY MINING ACTIVITIES**1. Devegetation:**

- Topsoil and vegetation get removed
- Deforestation leads to several ecological losses
- Land scape gets badly affected

2. Ground water contamination: Mining pollutes ground water; sulphur is converted into sulphuric acid which enters into the soil.

3. Surface water pollution: Radioactive wastes and other acidic impurities affect the surface water, which kills many aquatic animals.

4. Air pollution: Smelting and roasting are done to purify the metal which emits air pollutants and damage the nearby vegetation. It causes many health problems.

5. Subsidence of land: Mainly underground mining results in cracks in houses, tilting of buildings and bending of rail tracks.

1.2.6.3 EFFECTS OF OVER EXPLOITATION OF MINERALS

1. Rapid depletion of mineral deposits
2. Wastage
3. Environmental pollution
4. Needs heavy energy requirements.

1.2.6.4 MANAGEMENT OF MINERAL RESOURCES

1. The efficient use and protection of mineral resources.
2. Modernization of mining industries
3. Search for new deposit
4. Reuse and recycling of the metals.
5. Environmental impacts can be minimized by adopting eco friendly mining technology.

1.2.6.5 CASE STUDIES-MINING AND QUARRYING IN UDAIPUR

200 open cast mining and quarrying in Udaipur. But 100 mines are illegal. 150 tons of explosives are used per month. It pollutes air, soil and water. It affects irrigation and wild life.

1.2.7 FOOD RESOURCES

Food is an essential requirement for survival of life. Main components are carbohydrates, fats, proteins, minerals and vitamins.

1.2.7.1 TYPES OF FOOD SUPPLY

1. Crop plants: Grains mostly constitute about 76% of the world's food.

Ex: Rice, Wheat and Maize

2. Range lands: Produces 17% of world's food from trees and grazing animals.

Ex: Fruits, milk and meat

3. Ocean: Fisheries – 7% of world's food

1.2.7.2 WORLD FOOD PROBLEM

1. In the earth's surface, 79% is water out of total area. 21% land (forest, desert, mountain and barren land) . Less % cultivated land, at the same time population explosion is high therefore world food problem arises.
2. Environmental degradation like soil erosion, water logging, water pollution, salinity affects agricultural land.
3. Urbanization affects agricultural land. Hence production of rice, wheat, corn and other vegetable is difficult.

1.2.7.3 TYPES OF NUTRITION

1. Nutritious nutrition: To maintain good health and disease resistance, we need large amount of carbohydrate, proteins, fats and smaller amount of micronutrients such as vitamins and minerals such as Fe, Ca and iodine. Food and agricultural organization (FAO) of United Nations estimated that on an average, the minimum calorie intake on a global state is 2500 calories/day.

2. Under nutrition: People who cannot buy enough food to meet their basic energy needs suffer from under nutrition. They receive less than 90% of this minimum dietary calorie.

Effect of under nutrition: Suffer from mental retardation and infectious diseases.

3. Mal nutrition: Besides minimum calorie intake we also need proteins, minerals, vitamins, iron and iodine. Deficiency leads to malnutrition resulting in several diseases.

Effect of mal nutrition:

.No	ciency of nutrients	Effects
1	in	th
2		ia
3	e	r
4	in – A	ess

India 3rd largest producer of crops, nearly 300 million Indians are still under nourished.

World food summit 1996: The world food summit, 1996 has set the goal to reduce the number of under nourished and mal nourished people to just half by 2015.

1.2.7.4 OVER GRAZING

It is a process of eating the forest vegetation without giving a chance to regenerate.

1.2.7.4.1 EFFECTS OF OVER GRAZING

1. Land degradation

- Over grazing removing the cover of vegetation
- Exposed soil gets compacted
- Soil moisture reduces.
- Desertification - OG leads to poor, dry and compacted soil.
- Land cannot be used for further cultivation.

2. Soil erosion: When the grasses are removed the soil becomes loose and gets eroded by the action of wind and rain fall.

3. Loss of useful species: OG affects the plant population and their regenerating capacity. OG replace the plant of high nutritive value with plant of low nutritive value.

1.2.7.5 AGRICULTURE

Agriculture is an art, science and industry of managing the growth of plants animals for human use. It includes cultivation of the soil, growing and harvesting crops, breeding and raising livestock, dairying and forestry.

1.2.7.5.1 TYPES OF AGRICULTURE

1. Traditional agriculture
2. Modern (or) industrialised agriculture

1. Traditional agriculture

Small plot, simple tools, surface water, organic fertilizer and a mixture of crops constitute traditional agriculture. They produce enough food to feed their family and to sell it for their income.

2. Modern agriculture

Hybrid seeds of single crop variety, high tech equipments, lot of fertilisers, pesticides and water to produce large amount of single crops.

1.2.7.5.2 EFFECTS OF MODERN AGRICULTURE

1. Problems in using fertilizers

- a. **Excess of fertilizers causes micronutrient imbalance.** (e.g) Punjab and Haryana deficiency of nutrient zinc in the soil affect the productivity of the soil.
- b. **Blue baby syndrome** (nitrate pollution): Nitrate present in the fertilizer causes blue baby syndrome, when the amount exceeds the limit leads to death.
- c. **Eutrophication:** Nitrogen and phosphorus in the crop fields washed out by runoff water in the water bodies, which increases the nourishment of the lakes called eutrophication. Hence algal species increases rapidly. Life time of the species is less and they decompose easily and pollute the water which affects the aquatic life.

2. Problems in using pesticides

1. Death of non target organism.
2. Producing new pest – super pest
3. Bio magnification – Most of the pesticides are non bio degradable, keep on concentrating in the food chain and it is harmful to human beings.
4. Risk of cancer:
 - a. It directly acts as carcinogen
 - b. It indirectly supports immune system.

3. Water logging: Land where water stand for most of the year.

Causes of water logging:

1. Excessive water supply
2. Heavy rain
3. Poor drainage

Remedy:

1. Preventing excessive irrigation
2. Subsurface drainage technology
3. Bio drainage like trees like Eucalyptus

1.2.7.6 CASE STUDY- PESTICIDES IN INDIA

In Delhi the accumulation of pesticide in the body of mother causes premature delivery and low birth weight infant.

Pesticides in Pepsi and Coca Cola India has reported that Pepsi and coca cola companies are selling soft drinks with pesticide content 30-40 times higher than EU limits. This damages the nervous system,.

1.2.8 ENERGY RESOURCES

1.2.8.1 ENERGY DISTRIBUTION IN THE WORLD

- Developed countries like USA and Canada constitute only 5% of the world's population but consume 25% of the world's available energy.
- Energy consumed by a person in a developed country for a single day is equal to energy consumed by a single person in a poor country for one year.
- Developed country GNP increases and energy consumption increases. In the poor country GNP and energy consumption are less.

1.2.8.2 TYPES OF ENERGY RESOURCES:

1. Renewable energy resource (or) Non conventional energy resources
2. Non renewable energy resources (or) Conventional energy resources

1.2.8.2.1 RENEWABLE ENERGY SOURCES: Energy which can be regenerated.

Merits of renewable energy resources

1. Unlimited supply
2. Provides energy security.
3. Fits into sustainable development concept.
4. Reliable and the devices are modular in size.
5. Decentralized energy production.

Types of renewable energy resources

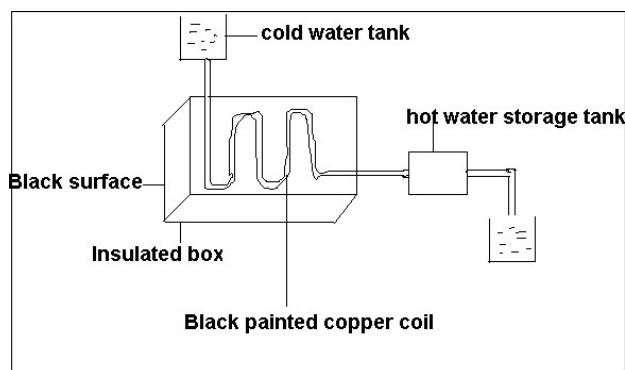
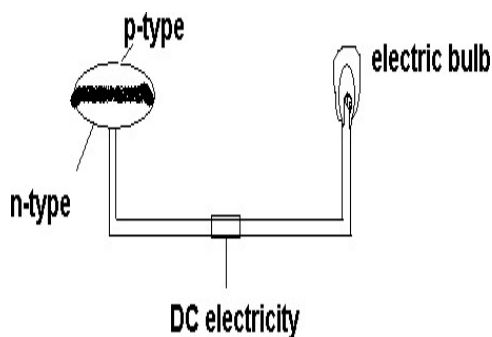
1. **Solar energy:** Nuclear fusion reaction of sun produces enormous amount of energy. Several techniques are available for collecting, storing and using solar energy.

a. Solar cell (or) Photovoltaic cell (or) PV cell:

- Solar cell consists of p- type semi conductor (Si doped with B) and n-type semi conductor (Si doped with P). P-type forms top layer and n-type forms bottom layer.
- Solar rays fall on the top layer, the electrons from valence band promoted to the conduction band which crosses the p-n junction into n-type semi

conductor. Potential difference between the two layers is created which causes flow of electrons.

Uses: It is used in calculators, electronic watches, street light, water pumps etc.



- b. **Solar battery:** Large number of solar cells connected in series is called solar battery. It is used in remote areas where continuous power supply is a problem.
 - c. **Solar water heater:** It consists of insulated box painted with black paint with glass lid. Inside the box black painted copper coil is present. Cold water is allowed to flow, it is heated up and flows out into a storage tank from which water is supplied through pipes.
2. **Wind energy:** Moving air is called wind. The energy recovered from the force of the wind is called wind energy. Its speed is high.
- a. **Wind mills:** When a blowing wind strikes the blade of the wind mill, it rotates continuously. And rotational motion of the blade drives number of machines like water pump, flour mills and electric generators.
 - b. **Wind farms:** When a large number of mills are installed and joined together in a definite pattern – it forms wind farm. It produces large amount of electricity.

Condition: Minimum speed for wind generator is 15 Km/hr

Advantages:

- 1. It does not cause air pollution
- 2. Very cheap

3. Ocean energy:

Tidal energy (or) Tidal power: Ocean tides are due to gravitational force of sun and moon which produce enormous amount of energy. High tides – rise of water in the ocean. Low tides – fall of water in the ocean. Tidal energy can be used by constructing a tidal barrage. During high tides sea water enters into the reservoirs and rotates the turbine, produce electricity. During low tides water from reservoir enters into the sea rotate the turbine produce electricity.

Ocean thermal energy:

Temperature difference between surface water and deeper level water in ocean generates electricity. The energy available due to the difference in temperature of water is called ocean thermal energy.

Condition: Temperature difference should be 200C.

Process: Ammonia is converted into vapours on the surface of warm water, it increases the vapour pressure which rotate the turbine and generates electricity. Deeper level cold water is pumped to cool and condense the vapour in to liquid.

3. **Geo thermal energy:** Temperature of the earth increases at a of 20 –750C per/km when we move down the earth. The energy utilised from the high temperature present inside the earth is called geothermal energy.

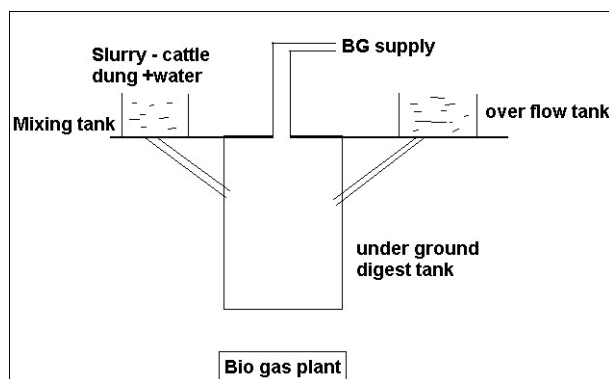
Natural geysers: Hot water or steam comes out of the ground through cracks naturally is called natural geysers.

Artificial geysers: Artificially a drill hole up to the hot region and by sending a pipe into it. The hot water or steam is used to rotate the turbine and generate electricity.

4. Bio mass energy:

Bio mass: Organic matter produced by plants or animals used as source of energy

Bio gas: Mixture of methane, carbondioxide and hydrogen sulphide. Methane is the major constituent. It is obtained by anerobic fermentation of animal dung (or) plant wastes in the presence of water.



Bio fuels: Fuels obtained by the fermentation of biomass.

Ex: Ethanol, methanol

Ethanol: Produced from sugar cane. Calorific value is less.

Methanol: Obtained from ethanol Calorific value too less.

Gasohol: Mixture of ethanol and gasoline India trial is going on to use gasohol in cars and buses.

Hydrogen fuel: Hydrogen produced by pyrolysis, photolysis and electrolysis of water. It has high calorific value. Non polluting one because the combustion product is water.

Disadvantages:

1. Hydrogen is highly inflammable and explosive.
2. Safe handling is required.
3. Difficult to store and transport.

1.2.8.2.2 NON RENEWABLE ENERGY SOURCES:

Energy which cannot be regenerated is called as non-renewable.

1. Coal: It is a solid fossil fuel.

Disadvantages:

1. When coal is burnt large amount of CO₂ is released which causes global warming.
2. S, N produces toxic gases during burning.

2. Petroleum: Crude oil is a liquid consists of more than hundreds of hydrocarbons and small amount of impurities. The petroleum can be refined by fractional distillation. In the world level 25% of oil reserves are in Saudi Arabia. At present rate of usage, the world crude oil reserves are expected to get exhausted in just 40 years.

3. Liquefied petroleum gas (LPG): Petroleum gases obtained during FD and cracking can be easily converted into liquid under high pressure as LPG. It is colorless and odorless gas, but during cylindering mercaptans are added to detect leakage.

4. Natural gas: These are found above oil in oil wells. It is a mixture of methane and other hydrocarbons. Calorific value is high. There are two types. Dry gas and wet gas.

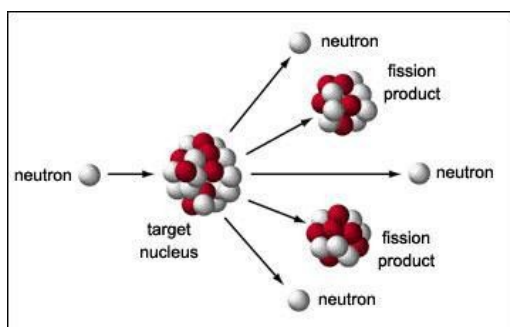
5. Nuclear energy: Dr.H.Bhabha is a father of nuclear power development in India. 10 nuclear reactors are present in India. It produces 2% of India's electricity. Nuclear energy can be produced by two types of reactions. Nuclear fission and nuclear fusion.

Nuclear fission; It is a nuclear change in which heavier nucleus split into lighter nuclei on bombardment of fast moving neutrons. Large amount of energy is released through chain reaction.

Ex: Uranium with fast moving neutron gives barium and krypton in addition to three neutrons; in the second stage it gives nine neutrons and so on. This process of propagation of the reaction by multiplication is called chain reaction.

Nuclear fusion: It is a nuclear change in which lighter nucleus is combined together at extremely high temperature (1 billion °C) to form heavier nucleus and a large amount of energy is released.

Ex: Isotopes of hydrogen combine to form helium molecule.



1.2.8.9 CASE STUDY

Wind energy in India: India generating 1200 MW electricity using the wind energy. Largest wind farm situated near Kanyakumari in Tamilnadu. It produces 380 MW electricity.

Hydrogen fuel car: General motor company of china discovered a experimental car (fuel H₂) can produce no emission only water droplets and vapors come out of the exhaust pipe. This car will be commercially available by 2010.