The Study of Environmental Science from Local, National & Global Point of View

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Abstract - Environment is defined as the natural world in which people, animals and plants live. The term Environment is derived from French terms '*virer* (to turn) or 'in/viron' meaning to encircle; and denotes the interaction between natural surroundings and organisms including human beings. Thus, environment is the surroundings in which living and non-living things live, interact, grow and perish. Environmental Science promotes communication among government, business and industry, academia, and non-governmental organisations who are instrumental in the solution of environmental issues such as climate change, biodiversity, environmental pollution and wastes, renewable and non-renewable natural resources, sustainability, and the interactions among these issues. Environmental science is a multidisciplinary academic field that combines physical, biological and information sciences to the environmental study. The social science fields that are incorporated into environmental science include geography, economics, and political science. Components of Environmental Science include Atmospheric Sciences, Environmental Chemistry, Forestry and Agricultural Sciences, Geosciences, Oceanography and Marine Sciences.

I. ENVIRONMENTAL SCIENCE

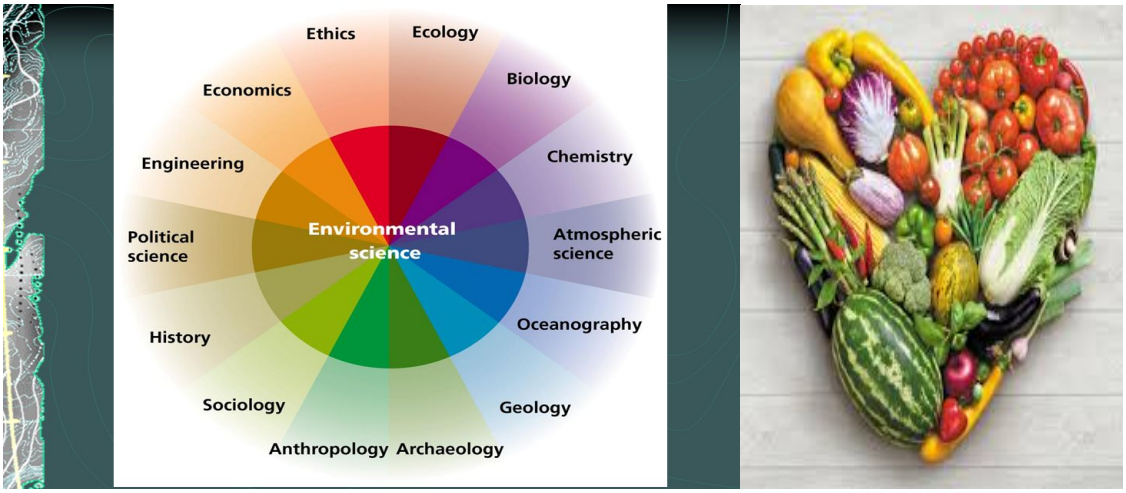
Environment as we all know is very precious gift from the mother nature. The survival of the human race depends mainly on the sustainability of the resources.

Need for Environmental studies (Environmental protection starts by creating awareness)

1. It is very important for every person for self-fulfilment and social development.
2. It helps to understand different food chains and ecological balance in nature.
3. It helps to understand and appreciate how the environment is used for making a living and for promoting a material culture.
4. It helps in appreciating and enjoying nature and society.
5. It generates concern for the changing environment in a systematic manner for the future as well as immediate welfare of mankind.
6. It directs attention towards population explosion, exhaustion of natural resources and pollution of environment and throws light on solutions.

II. GOALS OF ENVIRONMENTAL EDUCATION

"*To develop a world population that is aware of and concerned about environment as a whole and the problems associated with it, and committed to work individually as well as collectively towards solutions of current problems and prevention of future problems*"

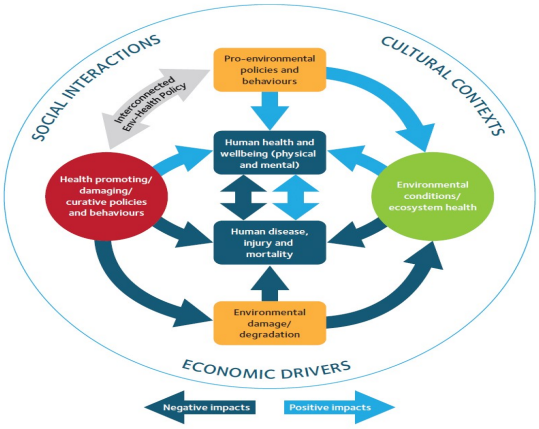


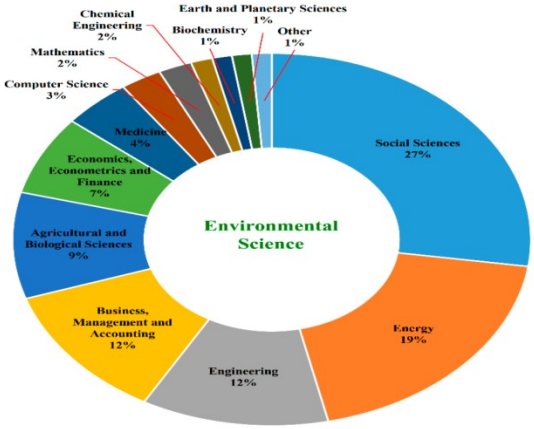
III.PRIMARY OBJECTIVES: (SPEAK AWARENESS)

1. **Skill:** Acquire skills for identifying and solving environmental problems.
2. **Participation:** To provide an opportunity to be actively involved at all levels in working towards the solution of environmental problems.
3. **Evaluation ability:** Develop the ability to evaluate environmental measures and education programmes in terms of ecological, economic, social and aesthetic factors.
4. **Attitude:** Acquire a set of values and feelings of concern; motivation for active participation to improve and protect environment.
5. **Knowledge:** Gain a variety of experiences and acquire a basic understanding of the environment and its associated problems.
6. **Awareness:** Acquire an awareness of the environment as a whole and its allied problems and sensitivity.

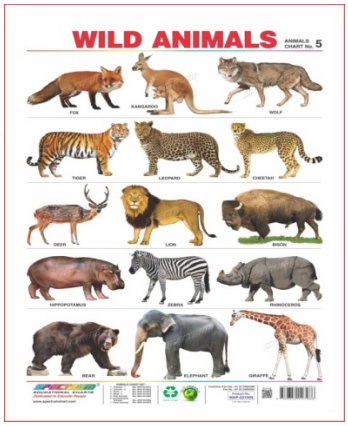
IV. GUIDING PRINCIPLES OF ENVIRONMENTAL SCIENCE

1. To consider the environment in its totality (natural, artificial, moral, cultural etc.)
2. To consider a continuous life process (pre-school to degree, formal, non-formal)
3. To be inter-disciplinary in approach
4. To emphasise active participation in the prevention and control of environmental problems
5. To examine the major environmental issues from local, national and global point of view





6. To focus on current potential environmental situations
7. To consider environmental aspects in plans for growth and development
8. To emphasise the complexity of environmental problems and the need to develop critical thinking and problem solving skills
9. To promote the value and necessity of local national and global cooperation in the prevention and control of environmental problems
10. To utilise diverse approaches for teaching and learning about environment
11. To help learners discover the symptoms of real causes of environmental problems
12. To relate environmental sensitivity, knowledge, problem solving and value clarification at every level
13. To enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences



V. FOUR COMPONENTS OF ENVIRONMENT

The four major components of environment include lithosphere, hydrosphere, atmosphere and biosphere, corresponding to rocks, water, air and life respectively.

1. **Lithosphere** is the outermost layer of earth called crust, which is made of different minerals. Its depth can reach up to 100 kilometers and is found on both land (terrestrial crust) and oceans (oceanic crust). The main component of lithosphere is earth's tectonic plates.
2. **Hydrosphere** comprises of all forms of water bodies on earth including oceans, seas, rivers, lakes, ponds, streams etc. It covers 70% of earth's surface. 97.5% of water found on Earth is in the oceans in the form of salt water. Only 2.5 % of water on Earth is freshwater. Out of this, 30.8% is available as groundwater and 68.9% is in frozen forms as in glaciers. Amount of 0.3% is available in rivers, reservoirs and lakes and is easily accessible to man.

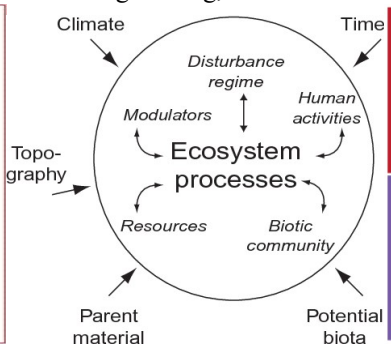
3. **Atmosphere** is gaseous layer enveloping the Earth. The atmosphere with oxygen in abundance is unique to Earth and sustains life. It mainly comprises 78.08% nitrogen, 20.95% oxygen, 0.93% argon, 0.038% carbon dioxide, and traces of hydrogen, helium, and noble gases. The amount of water vapour present is variable.
4. **Biosphere** refers to all the regions on Earth where life exists. The ecosystems that support life could be in soil, air, water or land. The term Biosphere was coined by Geologist Edward Suess who used this term for place on Earth where life can be found. Biosphere refers to the sum total of all living matter, the biomass or biota. It extends from the polar ice caps to the equator, with each region harboring some life form suitable to the conditions there.

VI. IMPACT OF MAN ON ENVIRONMENT

Direct or intentional impact (preplanned , man is aware of consequences)

1. Land use changes
   - Clearing of forests, burning of land, felling of trees, changes in cropping pattern
2. Construction and excavation
   - Construction of dams, diversion of rivers, construction of roads, bridges, urbanisation
3. Agricultural practices
   - Mechanisation of agriculture, use of chemical fertiliser, pesticide etc.
4. Weather modification programme
   - Cloud seeding to induce precipitation, dispersal and clearing of clouds, fogs
5. Nuclear programme
   - Use of nuclear energy for constructive and destructive purposes

Example of Construction of dams, diversion of rivers: Three Gorges Dam was built on Yellow river, China. The Chinese government regards the project as a historic engineering, social and economic success



VII. ECOLOGY

"The study of the relation of organisms or groups of organisms to their environment"
Or "The science of the interrelations between living organisms and their environment"
Or "The totality or patterns of relations between organisms and their environment"

Subdivisions of Ecology

1. *Taxonomic features*
   2. Plant ecology
   3. Animal Ecology
      - Avian ecology, Insect ecology, Bacterial ecology, Fungal ecology,
      - Behavioural ecology, Mycorhyza ecology

2. Habitat

Study of ecology based on the basis of the habitats and their interactions and the subsequent effects upon the organisms.

3. Organisation level

- **Autecology:** The study of the individual organisms
- **Synecology:** The study of groups of organisms which are associated together as a unit

VIII. TYPES OF SYNECOLOGY

- **Populations ecology:** Deals with study of individuals belonging to a species. Related to Population Size, growth rate, death rate, survival rate immigration, and emigration etc.
- **Community ecology:** Study of groups of individuals belonging to different species of plants as well as animals.
- **Biome Ecology:** Study of interactions among different communities of a particular area.
- **Ecosystem ecology:** Deals with circulation of energy and nutrients among biotic and abiotic components of ecosystems.

IX. CONCEPT OF ECOSYSTEM

- The system resulting from the integration of all living and non-living factors of the environment.
- Based on interactions and exchange of materials
- Communities in a given area interact with physical environment. This flow of energy leads to trophic structure, biotic diversity and material cycle
- It is an overall integration of a whole mosaic of interacting organisms and their environment
- Ecosystem is the highest level of ecological integration which is energy-based and this functional unit is capable of energy transformation, accumulation and circulation

X. TYPES OF ECOSYSTEM

- **Natural Ecosystems:** Self operating under natural conditions; no interference by man
- **Terrestrial ecosystems** e.g. forests, grassland
- **Aquatic ecosystems**
- **Freshwater ecosystem**
- **Lotic** – Running water e.g. river, stream, spring etc.
- **Lentic** – Standing water e. g. lake, pond, well swamp etc.
- **Marine ecosystems** e.g. ocean, sea etc.
- **Artificial Ecosystems:** Managed and maintained by man. E.g. cropland

XI. DIFFERENT ASPECTS OF ECOSYSTEM

1. *Structural (architectural) aspect*
   - The composition of biological community including species, numbers, biomass, life history etc.
   - The quantity and distribution of non-living materials like nutrients, water etc.
   - The conditions of existence such as temperature, light etc.

2. *Functional (working process) aspect*
   - The rate of energy flow
   - The rate of material (nutrient) cycles
   - Biological regulation including both regulation of organisms by environment (photoperiodism) and regulation of environment by the organism (nitrogen fixing organism)

Abiotic (non-living) components
- Includes inorganic substances (C, N, O, P, S etc.), inorganic chemicals (chlorophyll), organic materials (proteins, carbohydrates, lipids etc.)
- They are present either in biomass or in the environment

Biotic (living) components
- These are the trophic (nutritional) structure of ecosystem (trophic –feeding)
- Based on nutritional relationship they are distinguished

Autotrophic or self-nourishing components
- Use light energy to make food from simple inorganic substances (H_2O, CO_2)
- Photosynthesis, Known as producers
- Eg. Green plants, algae, photosynthetic bacteria

Heterotrophic or other-nourishing components
Macro Consumers (Phagotrophs)

Micro Consumers (Saprotrophs)

Functional Territory of Nature

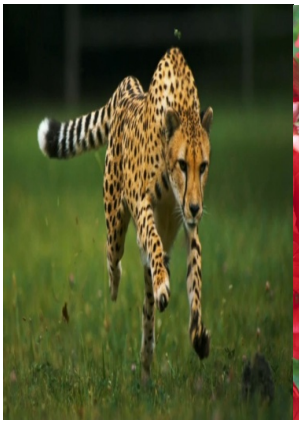
Ecological pyramids: An ecological pyramid (also trophic pyramid or energy pyramid) is a graphical representation designed to show the biomass or biomass productivity at each trophic level in a given ecosystem.

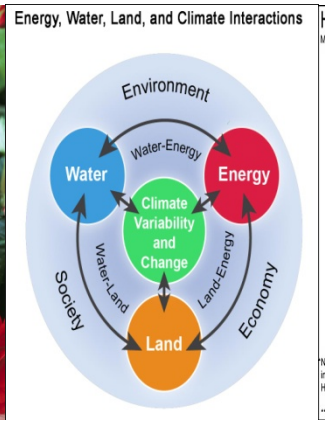
Pyramids of numbers: Depicts number of individual organisms at each trophic level

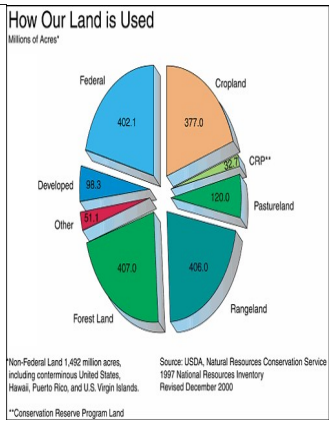
Pyramids of Biomass: Showing the total dry weight, calorific value or other measure of the total living material
Pyramids of Energy: Depicts the rate of energy flow and/or productivity at successive trophic levels

XII. PRODUCTIVITY CONCEPT OF ECOSYSTEMS

Productivity of an ecosystem is defined as "the rate at which radiant energy is stored by photosynthetic and chemosynthetic activity of producer organisms in the form of organic substances that can be used as food materials"







The amount of organic matter accumulated in any unit time is called productivity. The different types of Productivity are

1. *Primary Productivity*
2. *Secondary Productivity*
3. *Net Productivity*

1. *Primary Productivity*

- *"The rate at which radiant energy is stored by photosynthetic and chemosynthetic activity of producer "e.g. green plants, phytoplankton*

2. *Secondary Productivity*

- *The rates of energy storage at consumer levels"* It is dynamic i.e. keeps moving from one organism to another
- Consumers assimilate and not produce (Odum)

3. *Net Productivity*

- *"The rate of storage of organic matter not used by the heterotrophs (consumers) during the unit period of time"*
- It is the rate of increase of biomass of the primary producers which has been left over by the consumers
- It is expressed as production of C g/m2/day.
- Is also called as net community productivity

Population is a group of individuals of a particular species, sharing the common genepool and occupying a particular area at a specific time. There are two types of populations in ecology

XIII. LAND RESOURCES

Nature and importance of soil: Soil is defined as an uncemented aggregate of mineral grains and decayed organic matter with liquid and gas, occupying the void spaces between the soil particles.

Importance of soil

- It is required for plant growth
- Erosion leads to environmental degradation (control it)
- It is the source of sediment
- It acts as filter for ground water
- It serves as the bearing material for roads, pipelines etc. and act as a construction material for mud-built houses

XIV. WATER RESOURCES

Ocean covers 71 % of Earth's surface. Water is found in Glaciers, ice caps, lakes, streams, soils, underground reservoirs and in the bodies of all living organisms.

- *Ice melts in water*
- *A considerable amount of energy is consumed when ice melts (80 cal) and evolved when it boils (540 cal)*
- *Water is an excellent solvent for many different kinds of substances and is therefore called an universal solvent*
- *We use water in home, industry, agriculture etc.*
- *These use differ with respect to quality and quantity of the water.*
- *We use all available sources – inland water, groundwater, ocean water*
- *We pollute it, purify it, reuse it over and over again*
- **H_2O** is the molecular formula of water
- It has a bent shape
- The H-O-H bond angle is 104.5 °.
- Due to this **H_2O** has dipole.

- **H_2O** molecules are bonded to each other through H-bonding.

Hydrological cycle: The sequence of events involving the transfer of water from the atmosphere to the landmasses and oceans and its return to the atmosphere is called hydrological cycle.

Evaporation: It is the change of state of a liquid into vapour at a temperature below the boiling point of that liquid. It takes place from the surface of all water bodies in hydrosphere.

Condensation: The water vapour raises and gets cooled to form drops of water around the dust particles present in air. This is how clouds are formed.

Transpiration: The physiological process by which water is lost in the form of water vapour, from the green aerial parts of the plants.

Precipitation: It is a general term for all forms of atmospheric moisture which descend on to earth in the form of rain, snow, hail and sleet.

Run-off: It is the flow back of the precipitation to the oceans through streams. It consists wholly or partly of water contributed by overland flow (surface run-off) and by groundwater flow (base flow). Hydrological cycle is fuelled by the solar and planetary forces.

XV. AIR RESOURCES

Origin of Atmosphere

- Early aquatic organisms started producing organic matter through photosynthesis
- O_2 was liberated. It saturated the water then started filling atmosphere
- O_2 was toxic to some primitive organism hence they perished
- Other species started using O_2 for getting energy through respiration
- N_2 evolved from the Earth's interior

How was the ozone layer above the Earth's surface formed?

- ✓ Between 1-2 billion years ago O_2 built up in the atmosphere
- ✓ Some O_2 molecules were split by UV radiation to single atoms
- ✓ They combined with O_2 to form O_3. Thus O_3 layer was formed
- ✓ It absorbs the harmful UV radiation coming from Sun
- ✓ Life form started from sea then moved to land
- ✓ The present composition of atmosphere is same as it was 500 million years ago
- ✓ Due to biological activities it is changing now

The physical parameter of the atmosphere vary with altitude. **Density** decreases with increasing altitude. **Pressure** drops as we go up. **Temperature** varies from -100 °C to 1200 °C. Atmosphere mass is very small compared to Earth's mass.

Structure of the Atmosphere

What is atmosphere?

- It is the multilayer gaseous envelope that surrounds Earth
- It gives all the gases necessary for sustenance of all life forms in biosphere
- It filters harmful UV rays by filtering
- It protects the Earth from becoming too hot

Troposphere

What is troposphere?

- It is the lower most layer of the atmosphere
- The average height is 11 km. (16 km near equator and 6 km over poles)
- 70 % of the total mass of atmosphere is in troposphere

What is temperature inversion?

- Generally as we go up in altitude temperature decreases in troposphere
- A temperature inversion is a condition in which the temperature of the atmosphere increases with altitude

Mesosphere, Thermosphere

Mesosphere extends between 50-80 km, temperature decreases with increasing height. The temperature inversion happens at mesopause (—ve to +ve lapse rate)

- In **thermosphere** temperature increases rapidly with increasing height
- **Ionosphere**: it extends up to 640 km. D, E, F1 and F2 are different layers. Since they reflect signals they play a vital role in radio-communication
- **Exosphere**: it is the upper most layer.

XVI. AGRICULTURAL SOURCES

- Ploughing up of agricultural field
- Use of agricultural chemicals eg. Pesticides
- Field refuse burning

Air pollutant source are grouped according to their number and spatial distribution

1. **Single or Point Source:** Point sources are large stationary sources of pollution. Eg. Industrial chimneys
2. **Multiple or Area Source:** When pollutants are released directly into the atmosphere from an entire area, without the help of any primary exhaust system
   - Stationary area eg. Residential area, parking lot, storage
   - Mobile area eg. Vehicle, ship, auto mobile

XVII. ENERGY RESOURCES

1. Energy is defined as *the capacity to do work*.
2. **Mechanical Energy:** It is the energy possessed by a body by virtue of its position or configuration (potential energy).
3. **Kinetic Energy:** It is the energy possessed by a body by virtue of its motion.
4. Total mechanical energy = Potential energy and kinetic energy
5. Other forms of energy are Heat, light, electrical, sound, chemical, plasma etc.

Principle of conservation of energy state: Energy can neither be created nor destroyed. It only changes from one form to another.

Major Types of Natural Resources

1. **Renewable Energy Resources:** Mostly biological in nature - agriculture, animal forestry, solar, wind, water, geo-thermal, tidal, bio-fuel, hydro-electric etc.

2. **Non-renewable Energy Resources:** These are physical resources like fossil fuels coal, petroleum, natural gas etc.,

Energy sources can be of two types.

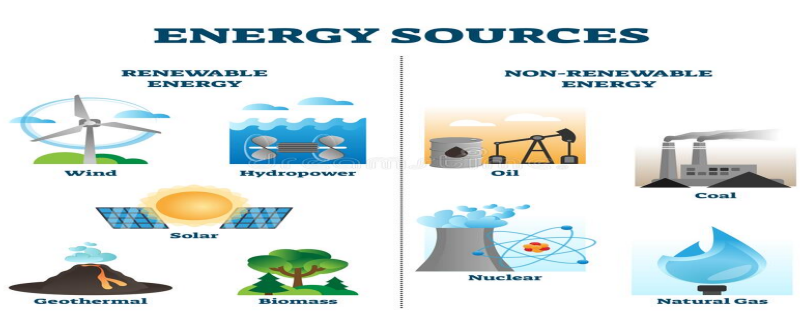
1. **Conventional energy sources:** They are in use for a longer period of time since 1700.
2. **Non-conventional energy sources:** They are alternative sources of energy which are both renewable and pollution free.

Different conventional sources of energy

1. Biomass or dried fuel
   - ❖ Wood leaves, cow dung, dried twigs
   - ❖ Consumed for domestic purpose in rural areas, Less useful to industry
2. Fossil fuels
   - ❖ Coal, Oil, Natural gas

Conventional sources of energy
Coal
- ➢ Present through out the world
- ➢ 2,730 X 106 Ton extracted per year
- ➢ Estimated mining 300-850 years

Natural gas
- ✓ CH_4 is major constituent
- ✓ Lower sulphur content
- ✓ Least polluting of all energy sources



Oil
Has high energy content; major constituents Petrol, kerosene, diesel, naphtha

Nuclear Energy
- ⁂ Developed after World war II.
- ⁂ It is a viable source of energy; It is a substitute for fossil fuel

Hydroelectric Energy
- ♥ Obtained from water flow; most conventional renewable source of energy
- ♥ Mechanical energy of down flowing water is harnessed to generate electricity

The Sun be the solution to the world's energy problem

Solar energy
- ➢ Sun provides continuous supply of energy that exceeds demand
- ➢ The solar radiation comprise of X-ray, gamma ray and UV rays
- ➢ Earth receives only a small portion of Sun's radiation

- The average value of solar radiation incident on Earth is 1.2 KW/m^2
- About 0.3 KW/m^2 is reflected back by Earth
- Around 0.9 KW/m^2 is being utilized for photosynthesis and evaporation
- The remaining enormous amount of energy is available to life on Earth
- Amount of energy received from Sun each day is 600 times greater than the amount of energy produced each day by all the other sources taken together

Solar energy be utilised as an alternative to the conventional energy resources

1. In a passive heating system, the solar energy is converted directly to heat for use at the site of collection
2. In an active heating system, the solar energy is converted into heat, but the heat energy must be transferred from the region of collection to the place of use
3. The solar energy may also be used to generate electricity which may be transmitted along normal wires or used to operate solar batteries

XVIII. WIND ENERGY

How can wind be used to generate electricity?

- ✓ When wind has higher speed (5-10 m/s) it can be converted to electrical energy by attaching a wind-electric generator to the axle of the wind mill
  - ✓ In California, USA 300 MW electricity is produced
  - ✓ In India, Gujarat, Western Ghats have high wind density of 10 $KW/m^2/day$
  - ✓ Mandvi (3.3 mW), Kutch (1.1 mW), Tuticorin (550 kW), Puri (550 kW)

XIX. TIDAL ENERGY

Tidal energy offers an alternative to the conventional sources of energy: The gravitational pull of the Sun and the Moon, along with the west to east rotation of the Earth causes tide. The greater the difference between high and low tides, the more is the energy that can be harvested.

OETC (ocean thermal energy conversion): It is the temperature difference existing between warm surface of sea water (29-30 °C) and the cold deep sea water (5-7 °C) which is available at a depth of 800-1000 m in tropical waters.

Wind Wave Energy

- The incessant motion of the sea surface in the form of wind waves provides a source of energy this is more efficient than direct collection of energy from wind.
- A multi purpose wave regulator system in the form of long barrier constructed on Indian coast line helps in harnessing this energy.
- It also helps in agriculture, space for transportation of lighter and faster crafts and shore protection from sea erosion.

XX. GEOTHERMAL ENERGY

The Earth's core is very hot. When the hot material is close enough to the surface, they heat the ground water and form steam. Geysers and hot springs are the natural openings through which steam and hot water come up to the surface. In the areas where the steam is trapped underground, geothermal energy can be tapped by drilling wells to obtain steam. This steam can be used to provide power to electrical generators. Geothermal energy is the energy that is produced from beneath the earth. It is clean, sustainable and environment friendly. High temperatures are produced continuously inside the earth's crust by the slow delay of radioactive particles. Hot rocks present below the earth heats up the water that produces steam. The steam is then captured that helps to move turbines. The rotating turbines then power the generators. Geothermal energy can be used by a residential unit or on a large scale by a industrial application. It was used during ancient times for bathing and space heating.

XXI. BIOMASS ENERGY

- ✓ Biomass is accumulation of organic materials produced by living things
- ✓ New plant growth, residues and wastes, herbaceous plants, fresh water algae, aquatic plants, agricultural and forest residues and wastes.

XXII. BIOGAS ENERGY

- ❖ About 22,425 X 106 m3 of biogas can be produced from animal dung.
- ❖ The slurry can produce 206 X 106 ton of organic manure. This can replace 1.4 X 106 ton N, 1.3 X 106 ton P2O5, 0.9 X 106 ton K2O. Around 15-26 X 106 household can get biogas.

Energy Plantation: Some plants latex serve as a source of liquid HC. Denuded wasteland can grow shrubs and trees of high calorific value. They provide fuel wood, charcoal, fodder, power. Plants belonging to *Euphorbiaceae, Apocynaceae, Asclepiadaceae, Utricaceae* are energy plants.

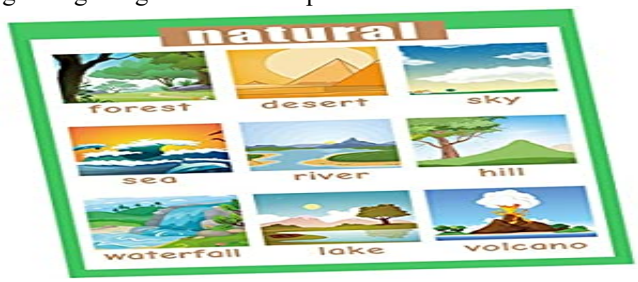
Bagasse: Bagasse a waste of sugar mills, is a good source for energy generation. They produce 2,000 MW of surplus electricity. 40 % of that is being used by sugar mills for power and the remaining used for irrigation etc.

XXIII. HYDEL ENERGY

Hydel energy considered to be the cheapest source of eco-friendly energy generation in India. Also known as hydraulic power, hydropower is the energy or force of moving water. The movement of water as it flows downstream creates kinetic energy that can be converted into electricity. It is also used for irrigation and operation of varied machines including textile machines, water mills and saw mills.

XXIV. SOLAR ENERGY

Solar power harvests the energy of the sun through using collector panels to create conditions that can then be turned into a kind of power. Large solar panel fields are often used in desert to gather enough power to charge small substations, and many homes use solar systems to provide for hot water, cooling and supplement their electricity. The issue with solar is that while there is plentiful amounts of sun available, only certain geographical ranges of the world get enough of the direct power of the sun for long enough to generate usable power from this source.



XXV. HYDROGEN ENERGY

Hydrogen is available with water (H_2O) and is most common element available on earth. Water contains two-thirds of hydrogen and can be found in combination with other elements. Once it is separated, it can be used as a fuel for generating electricity. Hydrogen is a tremendous source of energy and can be used as a source of fuel to power ships, vehicles, homes, industries and rockets. It is completely renewable, can be produced on demand and does not leave any toxic emissions in the atmosphere.

XXVI. WAVE ENERGY

Wave energy is produced from the waves that are produced in the oceans. Wave energy is renewable, environment friendly and causes no harm to atmosphere. It can be harnessed along coastal regions of many countries and can help a country to reduce its dependance on foreign countries for fuel. Producing wave energy can damage marine ecosystem and can also be a source of disturbance to private and commercial vessels. It is highly dependent on wavelength and can also be a source of visual and noise pollution.

XXVII. HYDROELECTRIC ENERGY

What many people are not aware of is that most of the cities and towns in the world rely on hydropower, and have for the past century. Every time you see a major dam, it is providing hydropower to an electrical station somewhere. The power of the water is used to turn generators to produce the electricity that is then used. The problems faced with hydropower right now have to do with the aging of the dams. Many of them need major restoration work to remain functional and safe, and that costs enormous sums of money. The drain on the world's drinkable water supply is also causing issues as townships may wind up needing to consume the water that provides them power too.

XXVIII. NUCLEAR POWER

While nuclear power remains a great subject of debate as to how safe it is to use, and whether or not it is really energy efficient when you take into account the waste it produces the fact is it remains one of the major renewable sources of energy available to the world. The energy is created through a specific nuclear reaction, which is then collected and used to power generators. While almost every country has nuclear generators, there are moratoriums on their use or construction as scientists try to resolve safety and disposal issues for waste.

XXIX. FOSSIL FUELS (COAL, OIL AND NATURAL GAS)

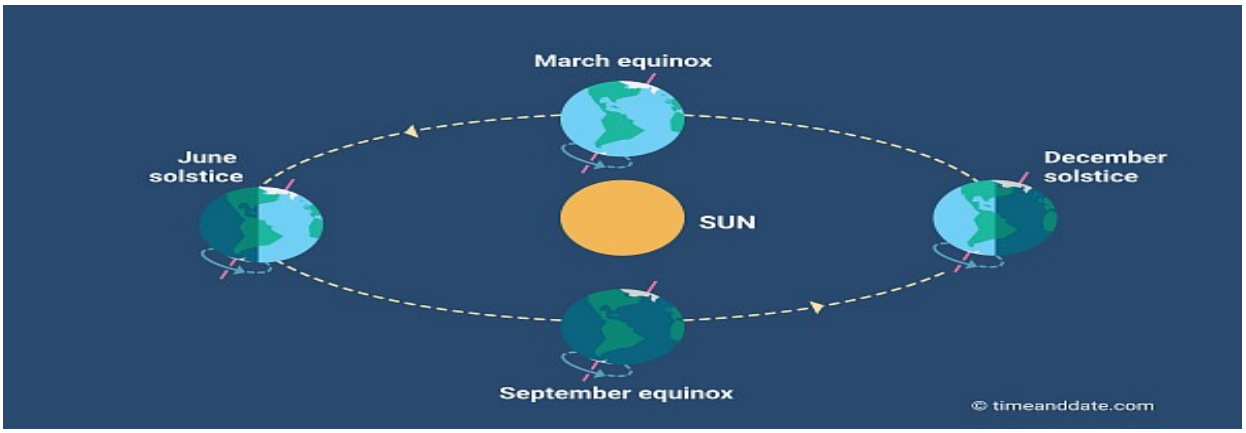
When most people talk about the different sources of energy they list natural gas, coal and oil as the options – these are all considered to be just one source of energy from fossil fuels. Fossil fuels provide the power for most of the world, primarily using coal and oil. Oil is converted into many products, the most used of which is gasoline. Natural gas is starting to become more common, but is used mostly for heating applications although there are more and more natural gas powered vehicles appearing on the streets. The issue with fossil fuels is twofold. The fossil fuel reserves are also limited, expecting to last only another 100 years given are basic rate of consumption. It isn't easy to determine which of these different sources of energy is best to use. All of them have their good and bad points. While advocates of each power type tout theirs as the best, the truth is that they are all flawed. What needs to happen is a concerted effort to change how we consume energy and to create a balance between which of these sources we draw from.

XXX. THE FOUR SEASONS

According to the meteorological definition, the seasons begin on the *first* day of the months that include the equinoxes and solstices:

1. Spring runs from March 1 to May 31;
2. Summer runs from June 1 to August 31;
3. Fall (autumn) runs from September 1 to November 30; and
4. Winter runs from December 1 to February 28 (February 29 in a leap year).

The beginning of each season marks the end of the last. Because the timings of the equinoxes and solstices change each year, the length of astronomical seasons within a year and between years also vary.



XXXI. CONCLUSIONS AND RECOMMENDATIONS

1. In Ecology and Environment, ecological concepts and topics included are the following:

    1. Natural resources and conservation
    2. Population and the Environment
    3. Biotic community
    4. Ecosystem,
    5. Pollution,. Waste management
    6. Forest conservation and Management
    7. Interaction between species
    8. Green house effect
    9. Ozone depletion
    10. Global environmental change
    11. Species interaction

2. The scope of environmental studies is very wide and it deals with many areas like
    i) Conservation of natural resources,
    ii) Ecological aspects,
    iii) Pollution of the surrounding natural resources,
    iv) Controlling the pollution,
    v) Social issues connected to it, and
    vi) Impacts of human population on the environment.

3. Sustainable use of resources necessarily includes the rational use of forest resources, to provide solutions for the local people who make their living by tapping and processing these resources.
4. National efforts to develop this kind of model for the sustainable use of forests resources through appropriate technology and financial resources should be supported by the international community.
5. Regardless of the economic activity, development is closely linked to use of the natural resource endowment.
6. Productive rehabilitation of degraded ecosystems, technical and financial assistance to farmers, and the compatibilization of a nation's agricultural and environmental policies appears to be basic for ensuring viability of a sustainable development strategy for agriculture.
7. Along with rational use of natural resources, viable regional development requires that priority be placed on human development.
8. Policies that have been followed in designing development for the border regions clearly show an orientation toward eradication of poverty, even though it is difficult to attain in the short term.
9. Physical planning and management can orient the land settlement process towards making efficient use of resources, setting standards to minimize potentially polluting activities, delimiting lands for multipurposes and uses, for protection or conservation, and for improving the infrastructure of the territory.
10. In order to achieve a more satisfactory relationship between society and its environment, timely provision should be made for the changes that human activities and competition over use of resources

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