

ENVIRONMENTAL STUDIES

MODULE - 3

MODULE-3 ENERGY RESOURCES

- SYLLABUS: Natural Resources: Renewable and Non-renewable Resources • Land Resources and land use change; Land degradation, soil erosion and desertification. • Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. • Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). • Heating of earth and circulation of air; air mass formation and precipitation. • Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

ENERGY RESOURCES

- **Energy** is defined by physicists as the capacity to do work.
- Energy is needed for any kind of work. Natural energy can be used directly where as other forms require some transformation.
- The sun is the primary energy source in our lives.
- Chemical energy, contained in chemical compounds is released when they are broken down by animals in the presence of oxygen.
- All energy use creates heat and contributes to atmospheric temperature. Many forms of energy release carbon dioxide and lead to global warming.
- Nuclear energy is held in the nucleus of an atom and is now harnessed to develop electrical energy.
- Nuclear waste disposal is a big environmental hazard if not handled properly.

Types of Energy

- The **conventional sources of energy are nonrenewable by any natural process. Non-conventional energy resources are renewable.** These resources are available in a limited quantity. Non-conventional energy sources are eco-friendly in nature.



Growing Energy needs

- At present almost 2 billion people worldwide have no access to electricity at all.
- Whereas some others are using excess energy.
- In addition, a large proportion of energy from electricity is wasted during transmission as well as at the user level.
- An Average American uses 24 times the energy used by an Indian.
- The world's demand for electricity has doubled over the last 22 years!

Non –Renewable energy forms

- Coal – Thermal power is generated from coal also used as a fuel.
- Coal is the world's single largest contributor of green house gases and is one of the most important causes of global warming.
- Burning coal also produces oxides of Sulphur and nitrogen which, combined with water vapor, lead to 'acid rain'. This kills forest vegetation, and damages architectural heritage sites, pollutes water and affects human health.
- OIL – petrol, diesel, kerosene, engine oil etc.
- GAS – from land and sea
- Nuclear energy

Renewable energy resources

- HYDRO ENERGY
- SOLAR ENERGY
- WIND ENERGY
- BIO-MASS ENERGY- wood-sugarcane & agri waste
- **Biogas:** Biogas is produced from plant material and animal waste, garbage, waste from households and some types of industrial wastes.
- **Tidal and Wave Power-**Tidal power is tapped by placing a barrage across an estuary and forcing the tidal flow to pass through turbines.

Hydro electric project-drawbacks

- To produce hydroelectric power, large areas of forest and agricultural lands are submerged. These lands traditionally provided a livelihood for local tribal people and farmers. Conflicts over land use are inevitable.
- Silting of the reservoirs (especially as a result of deforestation) reduces the life of the hydroelectric power installations.
- Water is required for many other purposes besides power generation. These include domestic requirements, growing agricultural crops and for industry. This gives rise to conflicts.
- The use of rivers for navigation and fisheries becomes difficult once the water is dammed for generation of electricity.
- Resettlement of displaced persons is a problem for which there is no ready solution

Forest resources

- Provides various resources for living for human beings & animals , birds etc.
- Forests area reduced from 33 % to 12 %
- Over utilization leads to deforestation.
- Now govt protects with acts and forest department
- Provides food, watershed protection, prevents soil erosion

Kazhiranga sanctuary- Assam-UNESCO



Kazhiranga sanctuary- Assam-UNESCO

What are the problems faced by Kaziranga National Park?



Rhino poaching, seasonal flooding and climate change impacts, unplanned tourism infrastructure, highway traffic, spread of invasive species (mimosa) and livestock grazing are current threats that have a direct bearing on the wildlife, habitats and values of the World Heritage site.

How can we protect Kaziranga National Park? **Villagers use searchlights, solar-powered fences, chili smoke, and nightly patrols to keep wildlife at bay.** Because of these conservation measures, people are more secure in their homes, and populations of major wildlife species are on the rise.

Water for Agriculture & power Generation

- Irrigated land increased from 40 million hectares in 1900 to 271 million in 1998 and 2020 hectares in 2015.
- Dams provide the support, main source of storage of rain water.
- Unequal distribution of water causes problems to small farmers.

Conserve Environment

- No natural resource is limitless.
- Natural resources need to be sustainable.
- The two most damaging factors leading to the current rapid depletion of all forms of natural resources are increasing 'consumerism' on the part of the affluent sections of society, and rapid population growth.
- Even biological resources traditionally classified as 'renewable' - such as those from our oceans, forests, grasslands and wetlands, are being degraded by overuse and may be permanently destroyed

Global climate change

- Green house effect- trapping of green house gases –increases temp.
- **Floods:** Floods have been a serious environmental hazard for centuries- due to deforestation- damage of catchment areas-land.
- **Drought:** In most arid regions of the world the rains are unpredictable-no rains-dry lands. Due to deforestation- no rain water stored.

Sustainable water management

- Save water campaign- awareness
- Building several small reservoirs instead of few mega projects.
- Develop small catchment dams and protect wetlands.
- Soil management, micro catchment development.
- Recycling water
- Rain water harvesting.
- Prevent leakages from dams
- Water conservation measures like drip irrigation, etc.

NLC INDIA LTD-LIGNITE MINES

NEYVELI



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NEYVELI



NLC India Limited (NLC) (formerly Neyveli Lignite Corporation Limited) is a government-owned-**fossil fuel miner and thermal power generator** under the ownership of Ministry of Coal, Government of India

The Neyveli II coal mine is an opencast mine, operated by NCL India Limited, with a capacity of **15 million tonne per year**, located near the town of Neyveli in Cuddalore district in Tamil Nadu, India. The mine supplies the 600 megawatt (MW) Neyveli Thermal Power Station and the 420MW Thermal Power Station

MINING OPERATIONS

- Minerals and their ores need to be extracted from the earth's interior so that they can be used. This process is known as mining. Mining operations generally progress through four.
- (1) Prospecting: Searching for minerals.
- (2) Exploration: Assessing the size, shape, location, and economic value of the deposit.
- (3) Development: Work of preparing access to the deposit so that the minerals can be extracted from it.
- (4) Exploitation: Extracting the minerals from the mines. In the past, mineral deposits were discovered by prospectors in areas where mineral deposits in the form of veins were exposed on the surface. Today, however, prospecting and exploration is done by teams of geologists, mining engineers, geophysicists, and geochemists who work together to discover new deposits.

Coal mines- Negative effects

- Many coal-based power generation plants are not fitted with devices such as electrostatic precipitators to reduce emissions of suspended particulate matter (SPM) which is a major contributor to air pollution.
- Burning coal also produces oxides of sulphur and nitrogen which, combined with water vapour, lead to 'acid rain'. This kills forest vegetation, and damages architectural heritage sites, pollutes water and affects human health.

MINE SAFETY & PROBLEMS

- Mining is a hazardous occupation, and the safety of mine workers is an important environmental consideration of the industry.
- Metal mining is less hazardous than coal mining. Large explosions have occurred in coal mines, killing many miners. More miners have suffered from disasters due to the use of explosives in metal mines.
- **Mining poses** several long-term occupational hazards to the miners. Dust produced during mining operations is injurious to health and causes a lung disease known as black lung, or pneumoconiosis. Fumes generated by incomplete dynamite explosions are extremely poisonous. Methane gas, emanating from coal strata, is hazardous to health although not poisonous in the concentrations usually encountered in mine air. Radiation is a hazard in uranium mines.

Mine land Reclamation methods

- Mine land reclamation, let us examine the processes involved in restoring land after a coal mining operation:
- First, potential AMD-producing materials are buried, and the area is graded so that water will drain away and slopes will not erode. This will prevent future formation of AMD.
- Second, after grading and drainage controls are completed, the area is covered with topsoil and seeded with a fast-growing cover crop.

FOOD RESOURCES

- Today our food comes almost entirely from agriculture, animal husbandry and fishing.
- Use of pesticides pollute the soil.
- Sustainable agriculture needed.
- In organic fertilizers suggested-Integrated crop Management system.

WORLD FOOD PROBLEMS

- Food production in 64 of the 105 developing countries is lagging behind their population growth levels.
- Some countries face Water and financial problems importing food.
- India is one of the countries that have been able to produce enough food by cultivating a large proportion of its arable land through irrigation.

OVER USAGE OF LAND

- Wet and forest lands taken for cultivation.
- Ecological imbalance created.
- Over fishing and exhausting marine resources.
- People shift from veg to Non-veg- over usage of Live stock.
- Globally 5-7 million hectares of farm land degraded.

OTHER PROBLEMS-FOOD

- Loss of genetic diversity in crop plants.
- Rice, wheat and corn are the staple foods of two thirds of the world's people.
- The ability to enhance traits that are resistant to diseases, salinity, etc. is lost.

What can you do as an individual?

- Avoid polluting soil, water and air.
- Avoid using plastic.
- Plant tree saplings as many as possible.
- Advise family members and friends.
- Do not litter in public places; use dust bins.

What can you do to save electricity ?

1. Turn off lights and fans when not needed.
2. Use tube lights and energy efficient bulbs that save energy rather than energy-wasting bulbs.
3. Keep the bulbs and tubes clean. Dust on tubes and bulbs decreases lighting levels by 20 to 30 percent.
4. Switch off other electric gadgets as soon as their use is over.

Save Energy.....

5. Use Public transport or car pooling whenever possible.

6. Cooperate in recycling and reuse of paper, metal and glass.

Conserve water

1. Check and fix any water leaks.
2. Install water-saving devices on your faucets and toilets.
3. Do not wash dishes with the water running continuously.
4. Wash and dry only full loads of laundry and dishes.
5. Avoid shower or install a low-flow shower head.
6. Turn off washing machine's water supply to prevent leaks, check and fix water leaks as a pin hole sized leak will lead to the wastage of 640 liters of water per month.
7. Water plants in the evenings when evaporation losses are minimum.
8. Farmers should use drip irrigation.

Types of Soil Erosion

- Water-induced soil erosion is of the following types:
- Sheet Erosion- When there is uniform removal of a thin layer of soil usually by run off, from a large surface area, it is called sheet erosion
- Rill Erosion- When there is rainfall and rapidly running water produces finger-shaped grooves or rills over the area it is called rill erosion.
- Gully Erosion- When the rainfall is very heavy, deeper cavities or gullies are formed which may be U or V shaped.
- Slip Erosion- The soil layer slips due to heavy rainfall on slopes of hills and mountains.
- Stream bank erosion- during rainy season, the stream changes direction suddenly cutting the soil.

Wind-Induced soil erosion

- Wind induced soil erosion shows three types of soil movement :
- Saltation- Due to the stormy wind the soil particles of 1-1.5 mm diameter move up in a vertical direction.
- Suspension-The fine soil particles less than 1mm diameter which are suspended in the air are carried in that manner to distant places.
- Surface creep- Here larger particles creep around surface with wind.

Desertification

- Desertification is the process in which the productive potential of arid or semiarid land falls by 10% or more as a result of poor land management.
- Causes of desertification :
 - 1. Overgrazing is the major cause of desertification worldwide. Plants of semi-arid areas are adapted to being eaten by grazing mammals which has contributed to the massive advance of deserts in recent years as animals gather around waterholes and overgraze the area.
 - 2. Destruction of vegetation in arid regions, often for fuelwood which invariably exceeds the rate of its regeneration.

ENVIRONMENTAL TERMS

- Eutrophication is the enrichment of bodies of fresh water by inorganic nutrients (e.g. nitrate, phosphate) causing fast growth of algae or plants, which cuts off dissolved oxygen supply to aquatic life either due to the plant cover over the water surface or due to the decomposition of the algae that have a short life cycle. Eutrophication may occur naturally but can also be the result of human activity (cultural eutrophication from fertilizer runoff and sewage discharge)

Effects of desertification

1. Desertification reduces the ability of land to support life, affecting wild species, domestic animals, agricultural crops and people.
2. The reduction in plant cover that accompanies desertification leads to accelerated soil erosion by wind and water. South Africa losing approximately 300-400 million tonnes of topsoil every year. As vegetation cover and soil layer are reduced, rain drop impact and runoff increases.
3. Water is lost off the land instead of soaking into the soil to provide moisture for plants. Even long-lived plants that would normally survive droughts die.
4. A reduction in plant cover also results in a reduction in the quantity of humus and plant nutrients in the soil, and plant production drops further. As protective plant

Acid Mine Drainage (AMD)

Acid Mine Drainage (AMD) - AMD is the most serious environmental problem in mining today. It is caused by mining of sulfur-based materials, particularly high-sulfur coal and metal sulfide ores. AMD occurs when oxygen-rich water percolates through sulfur-bearing minerals exposed by mining resulting in sulfuric acid. Water containing sulfuric acid drains out of the mine which apart from itself being toxic also result in acidic reactions which release other toxic materials in the rock, particularly