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MBFIII - 1 – ENVIRONMENT MANAGEMENT

PROGRAMME EDUCATIONAL OBJECTIVES: PEO

- Will be recognized as a creative and an enterprising team leader.
- Will be a flexible, adaptable and an ethical individual.
- Will have a holistic approach to problem solving in the dynamic business environment.

3T2 – Environnement Management

Course Outcomes

- CO1-Ability to explain the need and importance of sustainable development and design& utilize a calendar of environmental activities to create public awareness.
- CO2-Ability to analyse the problems associated with non renewable resources and proposes solutions for conservation of these resources.
- CO3-Ability to define the types of ecosystems and justify the importance of conservation of biodiversity.
- CO4-Ability to assess the impact of different types of pollution (Air, Soil, Water, Noise, Thermal & Nuclear Pollution) on health, environment and industry.
- CO5-Ability to predict the harmful effects of climate change and examine the roles of various (Central, State & Local) bodies in pollution control.
- CO6-Ability to determine the problems associated with human population explosion and social issues in environment protection. Recommend possible solutions to these problems.

UNIT I

- **Unit I: Introduction to Environment Management -** Definition, Scope & importance, Need for public awareness-institution in environment, using an environmental calendar of activities. Fundamentals–sustainable development, Unsustainable to sustainable development. Natural resources – Renewable and non renewable resources, and associated problems, Role of an individual in conservation of natural resources; equitable use of resources for sustainable life cycles.



INTRODUCTION TO ENVIRONMENT MANAGEMENT


For Internal Circulation and Academic
Purpose Only

Topics to be covered

- Definition
- Scope & importance
- Need for public awareness
- Institution in environment
- Sustainable development
- Unsustainable to sustainable development

Definition

- “Managing the productive use of natural resources without reducing their productivity and quality”
- “Attempts to balance economic growth and environmental quality so as to maximise the welfare of the community”

- 
- The natural environment is a broad concept and consists of the following basic components
 - Atmosphere - Air environment
 - Hydrosphere - Water environment
 - Lithosphere - Land environment
 - The living component of the environment - Biosphere

Scope & Importance

- Environmental Science is an inter-disciplinary area of study that includes both applied and theoretical aspects of human impact on the world.
- Environmental science is a mixture of traditional science, social values and political awareness.



ENVIRONMENTAL SCIENCE

Biology

Physics

Chemistry

Economics

Sociology

Philosophy

Politics

Law

Agriculture

Earth Science

Engineering

Theoretical Aspects

- This aspect of Environmental science identify the threats of a sustainable world.
- The identified problems may be scientific, social or economic.
- example:- How does emission of greenhouse gases affect climate, agriculture yield etc...

Applied Aspects

- The applied aspects of environment science suggest solutions to the problems that have been identified

Need & Importance

- It has been identified globally the urgent need to protect the environment , in order to maintain the quality of life, has now been identified.
- Environment protection starts by creating an awareness among people so that it becomes a part of their lifestyle.

Need & Importance Contd...

- The lay public in the rural, tribal, slum and urban areas, women and students, teachers in schools, colleges and universities, planners and decision and policy makers, programme implementer's and R & D workers, all need to be educated about the environment.

Need & Importance Contd...

The prime importance of the study are as follows:

- 1) Important for each individual for self-fulfilment and social development. It helps in the maintenance of life and health, in self preservation, and in the preservation of the human race.
- 2) It helps to understand different food chains and ecological balance in nature.

Need & Importance contd...

- 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

Need & Importance contd...

- 6) It directs attention towards the problems of population explosion, exhaustion of natural resources and pollution of the environment, and throws light on the methods of solution.

Need For Public

- a) **Awareness** : Acquire an awareness of the environment as a whole and its allied problems and sensitivity.
- b) **Knowledge** : Gain a variety of experience and acquire a basic understanding of the environment and its associated problems.
- c) **Attitude** : Acquire a set of values and feelings of concern for the environment and the motivation for active participation in environmental improvement and protection

Need For Public contd...

- d) **Skill** : Acquire skills for identifying and solving environment problems.
- e) **Evaluation ability** : Develop the ability to evaluate environmental measures and education programmes in term of ecological, economic, and social factors
- f) **Participation** : To provide an opportunity to be actively involved at all levels in working towards the solution of environment problems.

Institution In Environment

- National Environmental Engineering Research Institute
- Kerala Forest Research Institute
- Centre for Water Resources Development and Management
- Bombay Natural History Society
- Centre for Environment Education (CEE)
- Centre for Science and Environment
- World Wide Fund for Nature

Sustainable Development

- It is a concept which underscores that the rate of consumption or use of natural resources should approximate the rate at which these resources can be substituted or replaced
- It further requires that a nation or society is able to satisfy its requirements i.e. social, economic and others – without harming the interest of future generation.

Sustainable Development Contd...

Developing the concept of sustainable development further, we must include both the national leaders and international institutions as both have responsibility for sound developmental, economic and environmental issues, keeping in view the principle of equity, and those principles that determine the intergeneration inequities.

Sustainable Development contd...


Another aspect of sustainability is that it is about system analysis, i.e. how economic, social and environmental systems interact at various scales of operation in a way that would lead to sustainable development that strikes optimal balance among the three sub-systems.

Sustainable Development contd...

- Sustainable development must lead to reducing poverty of people in developing countries by means that minimise resource depletion, environment damage and social instability.

Important Fundamentals Concerning Environment And Sustainable Development

- Population And Its Implications
- Limits To Growth
- Economy
- Poverty
- Human Settlement Issues
- Land Resources
- Forests
- Mountains
- Agriculture
- Biodiversity
- Protection Of Oceans

- 
- Business and industry
 - Ecological deficit
 - Village and community involvement



NATURAL RESOURCES

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Topics to be covered

- Concept
- Renewable And Non-renewable Resources
- Role Of An Individual In Conservation
- Use Of Resources For Sustainable Life Cycle
- Preserving Resources For Future Generation
- The Rights Of Animals

What Is a Natural Resource?

- A **natural resource** is anything people can use which comes from nature
- Definition: Natural resources (economically referred to as land or raw materials) occur naturally within environments that exist relatively undisturbed by mankind, in a natural form.
- People don't make natural resources, but gather them from the earth



Components of resources

- Atmosphere
- Lithosphere
- Hydrosphere
- biosphere

Activity

- Take a simple object in daily use and track its components back to each of its spheres.
- Eg: **A textbook:**
- Paper from wood – Biosphere
- Water for pulping – hydrosphere
- Bleach to whiten paper – a mineral from lithosphere



Our Natural Resources

- Forest Resources
- Water Resources
- Mineral Resources
- Food Resources
- Energy Resources
- Land resources



Classification of Natural Resources

- On the basis of origin:
 - Biotic: obtained from the biosphere
 - Abiotic: resources include non-living things
- On basis of stage of development
 - Potential Sources : *Potential resources are those whose entire quantity may not be known and these are not being used at present. These resources could be used in future.*
Actual Sources: that are being used as of now.

Classification of Natural Resources

- **Basis of Renewability:**
 - Renewable sources
 - Non-renewable sources
- **On the basis of availability**
 - Inexhaustible natural resources
 - Exhaustible natural resources

Natural Resources and Associated Problems

- **Unequal consumption of natural resources:**
- Major part of natural resources are today consumed in the technologically advanced or ‘developed’ world
- Consumption of resources per capita (per individual) of developed countries is upto 50 times greater than developing countries
- Advanced countries produce over 75% of global industrial waste and greenhouse gases
- USA with 4% of world’s population consumes 25% of the world’s resources

Our Daily Life – How Much of Natural Resources Do We Use Up?

- Brush your teeth – use up water
- Hot water for bath – Gas or electricity
- Iron your clothes – electricity
- Commute to college – Petrol
- Cooling (Fan/AC) - Electricity
- Cell Phone Charging, Laptops – Electricity
- Refrigerator – CFC

Natural Resources and Associated Problems

- **Planning Land use:**
- Land - a major resource, needed for food production, animal husbandry, industry, growing human settlements
- Intensive land use at the cost of 'wild lands' or forests
- Land resource under serious pressure due to an increasing demand to produce sufficient quantities of food
- Forests have rapidly vanished during recent times



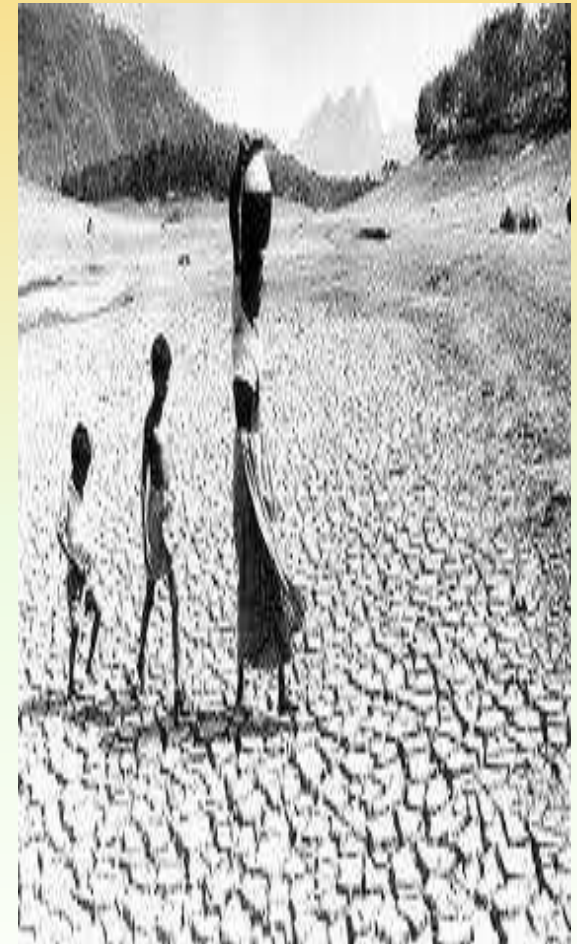
Non-Renewable Resources

- A non-renewable resource is a natural resource that **cannot be re-made, re-grown or regenerated** on a scale comparative to its consumption
- Fossil fuels, such as coal, petroleum, and natural gas are considered non-renewable resources
- Uranium ore, a solid, is mined and converted to a fuel (Nuclear



Renewable Resources

- Though water and biological living resources are considered renewable, they are **renewable only within limits**
- **Fresh water sources** can be overused or wasted that they locally run dry
- **Forests** take thousands of years to regrow: can be non-renewable resources if overused
- **Fish** is over-harvested until the catch has reduced
- The output of **agricultural land** if mismanaged drops drastically



Forest Resources

- **Use and overexploitation:**
- Instead of 33% of its land under forests, India has only about 12%
- The water we use depends on the existence of forests on the watersheds around river valleys
- Use of forests for timber extraction a serious issue



Forest Resources

- **Deforestation:**
- Today timber extraction and mining are serious causes of loss of forests in India
- Dams built for hydroelectric power or irrigation have submerged forests
- Timber extraction and our dependence on fuelwood is leading to destroying of forest resources



Forest Resources: Extinctions

- The Dodo of Madagascar and the Cheetah in India are well known examples of extinct species.
- Thousands of extinctions of small plants and animals are occurring every year due to loss of their habitat.
- Over harvesting and poaching threaten the existence of many others.



Water Resources

- **Overutilization and pollution of surface and groundwater:**
- Most people use more water than they really need
- Many agriculturists use more water than necessary to grow crops
- Agriculture pollutes surface water and underground water stores by the use of chemical fertilizers and pesticides
- Industry polluters release toxic wastes into streams, rivers and the sea



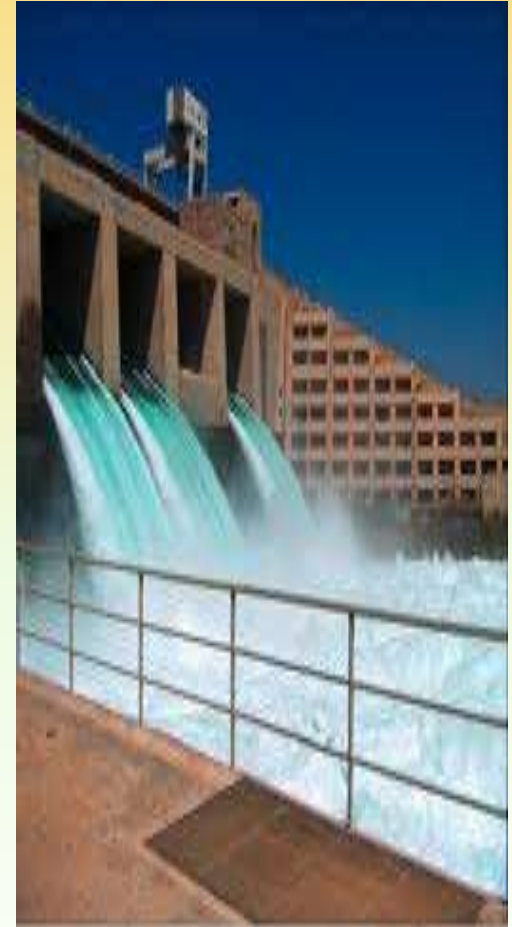
Water Resources

- **Floods:**
- Deforestation in the Himalayas causes floods that kill people, damage crops and destroy homes
- Rivers change course during floods and tons of valuable soil is lost to the sea
- **Drought:**
- Where rains are unpredictable, it leads to a serious scarcity of water
- Judicious use of water during good monsoon years necessary



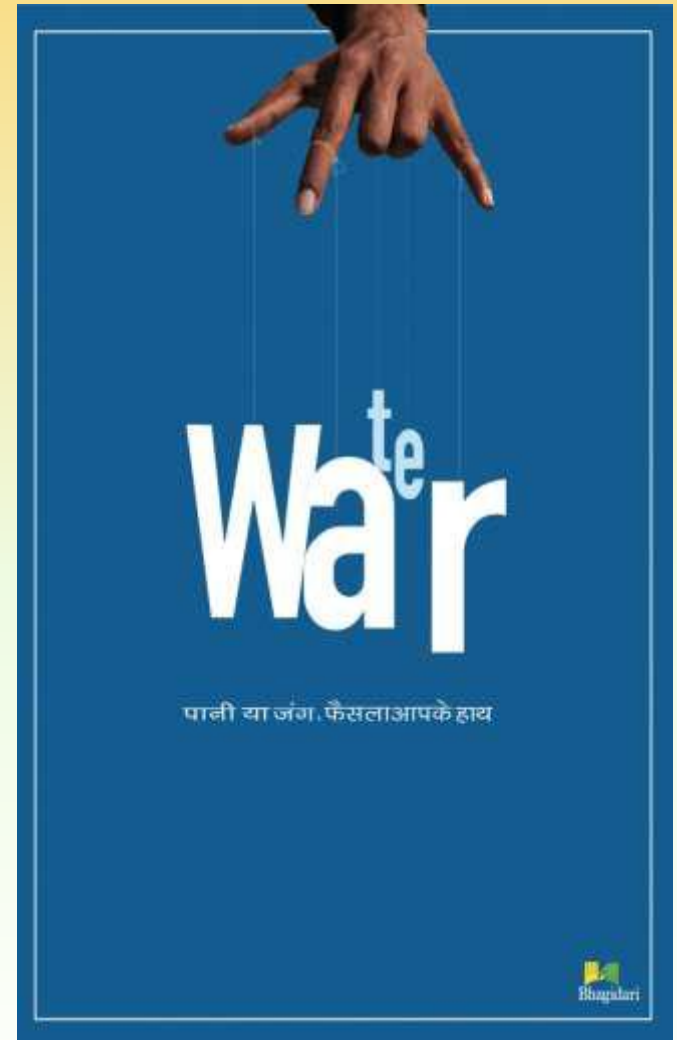
Water Resources

- **Water for Agriculture and Power Generation:**
- Increasing demand for water for **irrigated agriculture**, and **electricity** been met by creating large dams
- **Dams** have several serious environmental problems
- They alter river flows, change nature's flood control mechanisms destroy the lives of local people and habitats of wild species



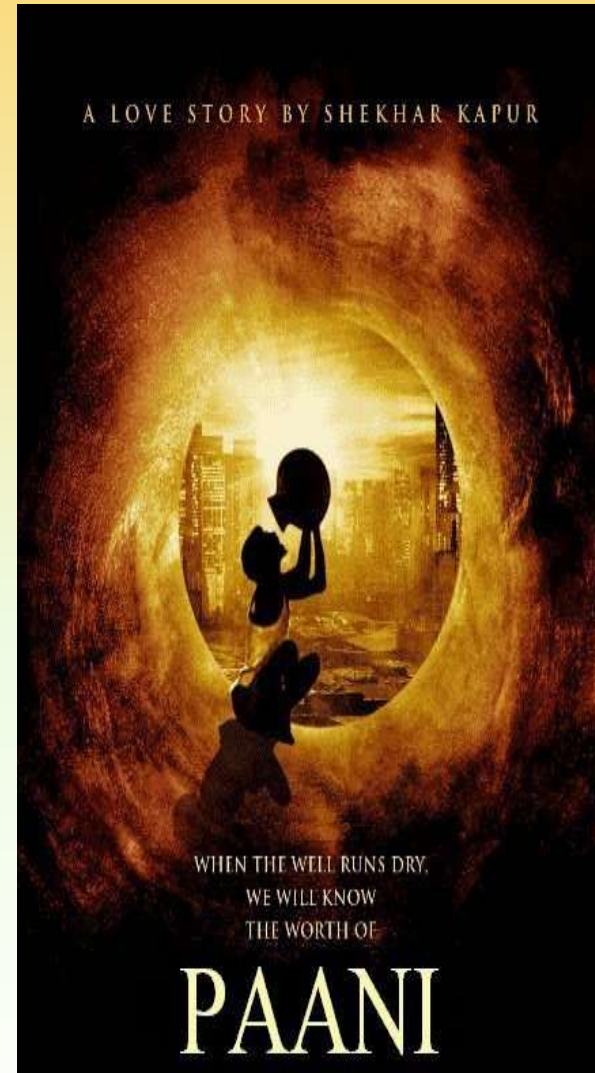
Water Resources

- **Sustainable water management:**
- Save water awareness campaigns essential
- Building several small reservoirs instead of few mega projects.
- Develop small catchment dams and protect wetlands
- Treating and recycling municipal waste water for agricultural use.
- Rainwater harvesting
- Drip Irrigation
- Pricing water at its real value makes people use it more responsibly



Shekhar Kapur's *Paani*

- Renowned International Director Shekhar Kapur's next movie – *Paani*
- Based on water scarcity scenarios in future
- The film is a forbidden love story with water shortage in Mumbai as the focus of the story
- Story of young love caught in conflict between two cities, one that is rich and waterful and the other that is poor and waterless
- Kapur believes that water could well become a weapon in the future with corporates taking over its distribution



Mineral Resources

- A mineral is a **naturally occurring substance of definite chemical composition** and identifiable physical properties
- Minerals and their ores need to be extracted from the earth's interior so that they can be used
- **Mining** is a hazardous occupation, and the safety of mine workers is important
- **Mining** poses several long-term occupational hazards to the miners



Mineral Resources

- Dust produced during mining operations is injurious to health.
- Mining operations are considered one of the main sources of environmental degradation
- **Depletion of available land** due to mining, waste from industries, conversion of land to industry and **pollution** of land, water and air by industrial wastes, are environmental side effects



Case Study: Sariska Tiger Reserve

- **Sariska Tiger Reserve, Rajasthan**
- The Forest Department has leased land for mining in the Sariska Tiger Reserve area by denotifying forest areas.
- The local people have fought against the mining lobby, and have filed a Public Interest Litigation in the Supreme Court in 1991.
- As many as 70 mines operate in close proximity to the forest
- As a result the Tiger is threatened

Food Resources

- Our food comes almost entirely from agriculture, animal husbandry and fishing
- Food production in 64 of the 105 developing countries is lagging behind their population growth levels
- These countries are unable to produce more food, or do not have the financial means to import it
- Our fertile soils are being exploited faster than they can recuperate
- Our fish resources show evidence of exhaustion.



Food Resources

- As living standards improve, people are eating more **non-vegetarian food**
- As a result, demand for **feed for livestock** based on agriculture increases as well
- Loss of nutrients and overuse of agricultural chemicals are major factors in **land degradation**.
- **Water scarcity** is an important aspect of poor agricultural outputs.
- Loss of **genetic diversity** in crop plants is leading to a fall in agricultural produce



Food Resources

- **Food Security:**
- 18 million people worldwide, mostly children, die each year by starvation or malnutrition
- The earth can only supply a limited amount of food.
- If the world's capacity to produce food cannot meet the needs of a growing population, anarchy and conflict will follow
- Food security is closely linked with population control
- Food security is only possible if food is equitably distributed to all
- Support for small farmers necessary, so that they don't shift to cities



Food Resources: Examples

- Israel began using drip irrigation systems as it is short of water.
- With this technique, farmers have been able to improve the efficiency of irrigation by 95%.
- Over a 20-year period, Israel's food production doubled without an increase in the use of water for agriculture.
- In India, some traditional communities grow their own vegetables in backyards on wastewater from their own homes.
- Kolkata releases its waste water into surrounding lagoons in which fish are reared and the water is used for growing vegetables.



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Energy Resources

For Internal Circulation and Academic
Purpose Only

Energy Resources

- Energy has always been closely linked to man's economic growth and development
- Between 1950 and 1990, the world's energy needs **increased four fold**
- Growing demand of energy is depleting energy resources quickly
- 3 main types of energy: **non-renewable**; **renewable**; and **nuclear energy**, which uses such small quantities of uranium



Coal

- Coal is a hard, black colored rock-like substance.
- It is made up of **carbon, hydrogen, oxygen, nitrogen** and varying amounts of Sulphur.
- There are three main types of coal - **anthracite, bituminous** and **lignite**
- Primarily used as a solid fuel to **produce electricity** and heat through combustion
- 75% of world's coal used to generate electricity



Usage of Coal

- China and India use 1,700 million long tons annually, forecast to exceed 3,000 million short tons in 2025
- USA consumes 1,100 million short tons of coal each year: 90% of it for electricity
- Coal is the **fastest growing energy source** in the world, with coal use increasing by 25% annually



Advantages of Coal

- Coal is the most abundant fossil fuel
- Coal has a more compact heat source than wood
- It is a low cost fuel
- Very large amounts of electricity can be generated in one place using coal, fairly cheaply.

Disadvantages of Coal

- The main drawback : **pollution**
- Burning any fossil fuel produces carbon dioxide, which contributes to the "**greenhouse effect**", warming the Earth.
- Burning coal produces more **CO₂** than burning oil or gas.
- Produces sulphur dioxide, a gas that contributes **to acid rain.**
- Mining coal can be **difficult and dangerous.** Strip mining destroys large areas of the landscape.
- Coal-fired power stations need huge amounts of fuel, which means train-loads of coal almost constantly
- This means covering a large area of countryside next to the power station with piles of coal.

Oil or Petroleum

- Petroleum : from Latin *petra* – rock and Greek *oleum* – oil
- Crude oil is a **naturally occurring liquid** found in formations in the Earth consisting of a **complex mixture of hydrocarbons**
- Petroleum is used mostly for **producing fuel oil and petrol** (gasoline)
- The world's most important source of energy since the mid-1950s

Oil or Petroleum

- Known reserves of petroleum are typically estimated at around 1.2 trillion barrels
- Consumption is around 84 million barrels/day
- At current consumption levels, world oil supply would be gone in about 32 years
- Petroleum forms naturally within the earth **too slowly** to be sustainable for human use.



Petroleum and Environment

- Exploring and drilling for oil disturbs land and ocean habitats
- Oil spills
- Air pollution: Refineries
- Leakages: a leak in a storage tank or pipeline occurs
- Greenhouse Effect
 - Petroleum products are burned as fuel, they give CO₂, that is linked with global warming.
 - Other pollutants - carbon monoxide, nitrogen oxides, particulate matter, and unburned hydrocarbons



Case Study: Oil related disasters

- During the Gulf War 1 (1991), oil installations burned for weeks polluting the air with poisonous gases.
- The fires wasted 5 million barrels of oil and produced over a million tons of airborne pollutants, including sulphur dioxide, a major cause of acid rain.
- The gases moved to a height of 3km and spread as far as India.
- Oil also polluted coastlines, killing birds and fish.



British Petroleum Oil Spill

- An oil spill in the Gulf of Mexico which flowed for three months in 2010
- Largest accidental marine oil spill in the history of the petroleum industry
- It was estimated that 53,000 barrels per day were escaping from the well just before it was capped
- The spill caused extensive damage to marine and wildlife habitats as well as fishing and tourism industries
- Over 7000 dead animals including birds, sea turtles, dolphins and other mammals



Natural gas

- Natural gas is a **gaseous fossil fuel** consisting primarily of **methane**.
- Also includes significant quantities of ethane, butane, propane, carbon dioxide, nitrogen, helium and hydrogen sulfide.
- Found in oil fields and natural gas fields, and in coal beds
- Requires extensive processing to remove almost all materials other than methane
- Can be **hazardous** through an explosion



Sources of Natural gas

- Commercially produced from oil fields and natural gas fields
- The largest two natural gas fields :
 - South Pars Gas Field in Iran
 - Urengoy gas field in Russia
- Qatar has 25 trillion cubic meters of natural gas (14% of the world's proven supply)



Urengoy gas field in Russia

Storage and transport of Natural Gas

- Major difficulty in the use of natural gas is **transportation and storage** because of its low density
- Natural gas **pipelines** are economical, but are impractical across oceans
- **LNG carriers** can be used to transport liquefied natural gas (LNG) across oceans
- **Tank trucks** can carry liquefied or compressed natural gas (CNG) over shorter distances
- Natural gas is often stored in **underground caverns** formed inside depleted gas reservoirs



LNG Carrier

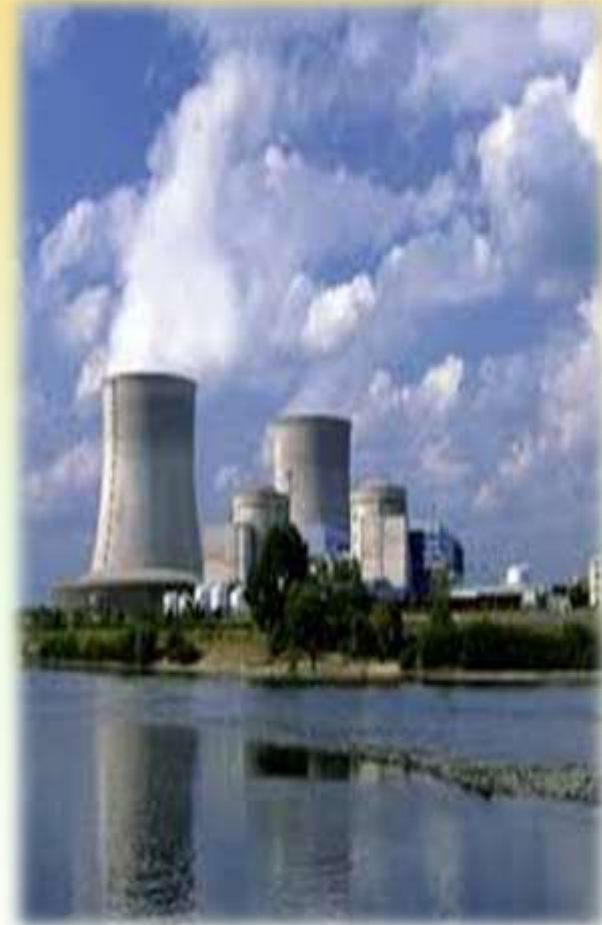
Uses of Natural gas

- Power generation
- To produce hydrogen that can be used in hydrogen vehicles
- Natural gas vehicles
- LPG is also used to fuel vehicles
- Residential domestic use
- Others: manufacture of fabrics, glass, steel, plastics, paints etc.



Nuclear fuel - uranium

- Nuclear power is a type of nuclear technology involving **controlled use of nuclear reactions** to release energy for work including propulsion, heat, and the **generation of electricity**
- The fuel most widely used by nuclear plants for **nuclear fission** is **uranium**
- Uranium is **non-renewable**, a common metal found in rocks all over the world
- **U-235** is used as fuel because its atoms are easily split apart



Nuclear fuel - uranium

- Though uranium is quite common, U-235 is relatively rare
- As of 2004, nuclear power provides 6.5% of the world's energy and 15.7% of the world's electricity.
- U.S., France, and Japan together account for 57% of all nuclear electricity
- France produces 80% of its electrical energy from nuclear reactors



Uranium Ore

Concerns about Nuclear Power

- Major environmental groups claim that nuclear power is an uneconomic and **potentially dangerous** energy source with a limited fuel supply
- Problem of **storing radioactive waste**
- Potential for possibly severe **radioactive contamination** by accident .

Nuclear Energy and Environment

- Nuclear generation does not directly produce pollutants associated with the combustion of fossil fuels.
- Does not Produce CO₂
- **Spent fuels** and other **radioactive wastes** are the principal concerns
- Most nuclear waste is **low-level radioactive waste**
- Spent fuel assemblies are **highly radioactive** and must initially be stored in **pecially designed pools**



Fuel Pool

Renewable Sources

- Energy derived from resources that are **regenerative** or for all practical purposes **cannot be depleted**
- Renewable energy sources is approx 29.3% of human energy use worldwide
- Many countries and organizations promote renewable energies through taxes and subsidies.



Renewable Energy

Wind power

Water power

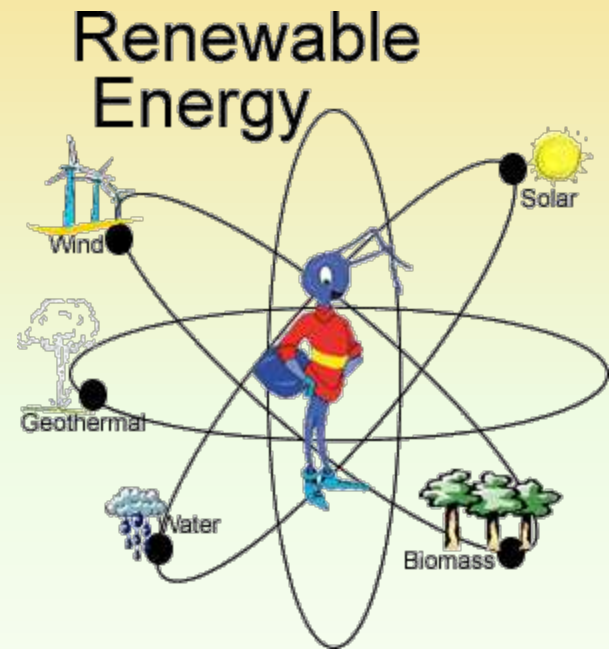
Solar energy

Biofuel

Solid biomass

Biogas

Geothermal energy



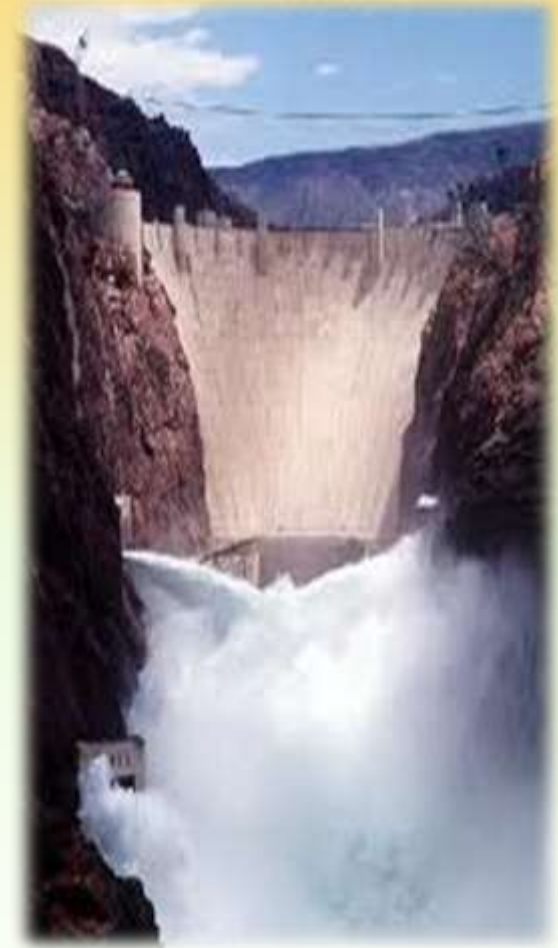
Wind Power

- Wind power is the **conversion of wind energy** into more useful forms, usually electricity, using wind turbines
- Produces less than 1% of worldwide electricity use
- Electricity generated by converting the **rotation of turbine blades** into electrical current by means of an electrical generator
- Wind energy is plentiful, renewable, widely distributed, clean



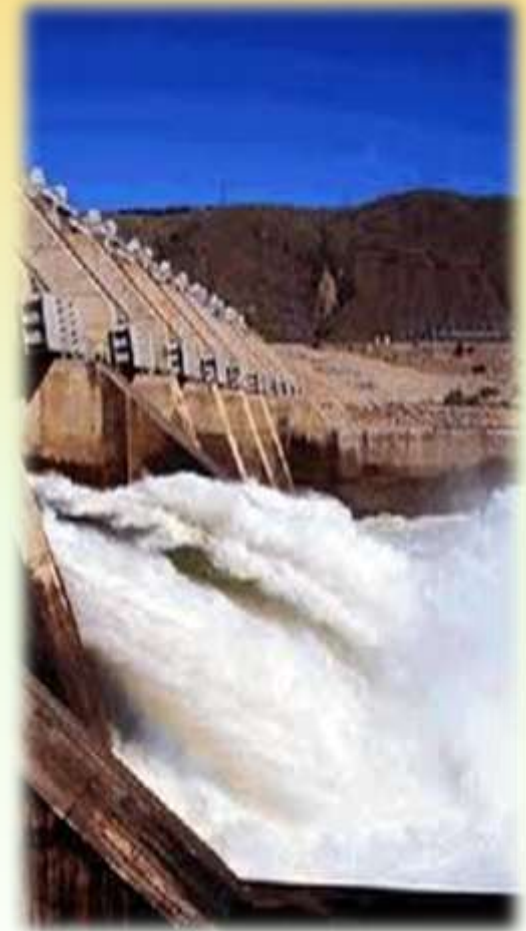
Water Power or Hydro Power

- Hydropower is the capture of the energy of moving water for some useful purpose
- Forms of water power:
 - **Waterwheels** , used for hundreds of years to power mills and machinery
 - **Hydroelectric energy**, usually referring to hydroelectric dams or run-of-the-river setups.
 - **Tidal power**, which captures energy from the tides in horizontal direction
 - **Tidal stream power**, which does the same vertically
 - **Wave power**, which uses the energy in waves



Hydroelectric power

- Hydroelectric power supplies 19% of world electricity
- Produces essentially **no CO₂** or other harmful emissions
- **Less expensive** than electricity generated from fossil fuels
- Hydroelectric dams can handle **seasonal** (as well as daily) high peak loads
- Sarda and Sarovar, Koyna dam and The Krishna - Kaveri river issue are the best examples



Hydropower - Disadvantages

- Dams are very **expensive to build**.
- A lot of surrounding **land is destroyed**
- People living in surrounding villages may **lose their land**
- The stagnant water of the dam is **not a healthy habitat** for fish.
- The fertile mud and sand, brought down by the rivers, is **stopped from flowing downhill** by the dam.
- The building of large multi-purpose dams may also lead to **earthquakes**

Hydroelectric Dams: Origins

- In India the first hydroelectric dams were built in the late 1800s and early 1900s by the Tatas in the Western Ghats of Maharashtra.
- Jamshedjee Tata, a great visionary who developed industry in India in the 1800s, wished to have a clean source of energy to run cotton and textile mills in Bombay as he found people were getting respiratory infections due to coal driven mills.
- He asked the British Government to permit him to develop dams in the Western Ghats to generate electricity.
- The four dams are the Andhra, Shirowata, Valvan and Mulshi hydel dams.
- These use the high rainfall in the hills as storage areas.
- Tata Power: Large turbines in the power plants generate electricity for
- Mumbai and its giant industrial belt.

Solar Energy

- Solar power (also known as solar energy) is Solar Radiation emitted from our sun
- Solar energy is currently used in a number of applications:
 - Heat (hot water, building heat, cooking)
 - Electricity generation (photovoltaics, heat engines)
 - Transportation (solar car)
 - Desalination of seawater.



Solar Energy-Advantages

- The 89 petawatts of sunlight reaching the earth's surface is **plentiful** compared to the 15 terawatts of average power consumed by humans
- Solar power is **pollution free** during use
- Facilities can operate with **little maintenance** or intervention after initial setup.
- Solar electric generation is **economically competitive** where grid connection or fuel transport is difficult, costly or impossible.
- When grid-connected, solar electric generation can displace the highest cost electricity during times of peak demands
- Grid-connected solar electricity can be used locally thus minimizing transmission/distribution losses
- Operating costs are low compared to existing power technologies.

Solar Energy-Disadvantages

- Solar electricity is **expensive** compared to grid electricity.
- Solar heat and electricity are **not available at night** and may be unavailable due to **weather conditions**; therefore, a storage system is required
- Solar cells produce **DC** that must be converted to **AC** when used in currently existing distribution grids. This incurs an energy loss of 4-12%.



Biomass Energy

- Use of **alcohol** as fuel is being promoted in some grain-growing regions
- Biomass energy can be produced as a **by-product** from wasted disposal (e.g., Sawmill waste, Sugar refinery waste, distillery waste, Municipal refuse and sewage etc)
- **Sugar cane, molasses, sugar beet, straw, bagasse**, etc, are all looked upon as sources of fuel
- **Biogas** can easily be produced from current waste streams



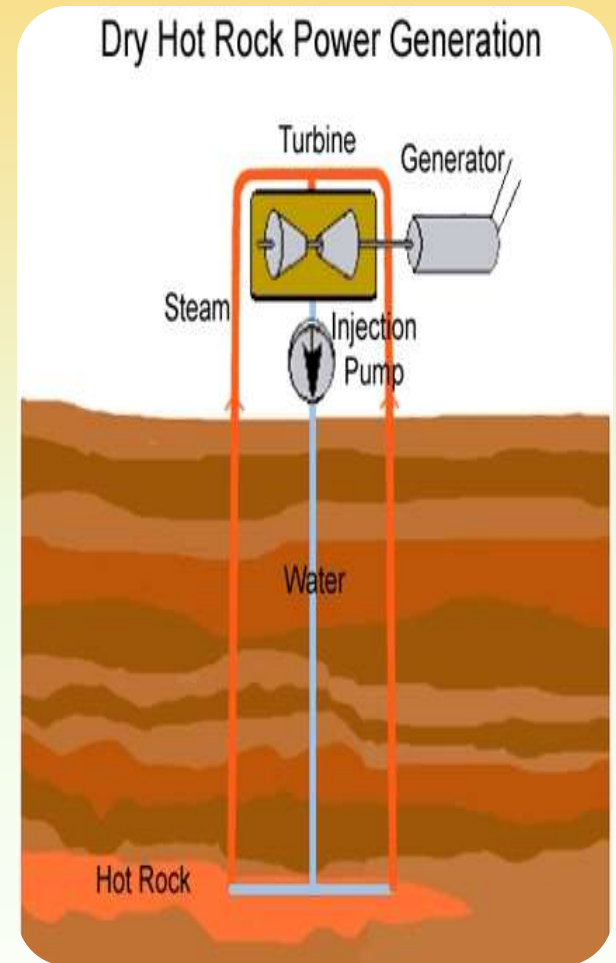
Geothermal Energy

- Geothermal energy is **energy obtained by tapping the heat of the earth** itself, usually from kilometers deep into the Earth's crust.
- **Expensive** to build a power station but operating costs are low



Geothermal Energy

- Geothermal energy can be produced from from **Hot Dry Rocks**.
- Holes at least 3km deep are drilled into the earth.
- Some of these holes pump water into the earth, while other holes pump hot water out
- Several companies in Australia are exploring this technology.



Role of an individual in conservation of natural resources

- Resource depletion affects **future generations**
- Concerned with finite non-renewable resources since they cannot be renewed
- What will be around for future generations is just what's left over from the present
- **Obligation to conserve resources** for future generations because they have equal rights to limited resources.
- Future generations have an **equal right** to limited resources

