

## **MINERALS.**

Minerals can be obtained by the mining process. Mining is the extraction of valuable or other geological materials from the earth. Materials recovered by mining include base metals, precious metals, iron, uranium coal, diamonds, limestone, oil shale, rock salt and potash. Any material that cannot be grown through agricultural processes, or created artificially in a laboratory or factory, is usually mined.

### **Process of mining:**

A large area of forest cleaned out then the removal of upper layer of land for surface mining. Use of heavy machinery for digging tunnels or shafts into the earth to reach buried ore deposits for underground mining is done.

## **AGRICULTURAL LANDS:**

Agricultural lands feed the increasing world population. Agriculture output purely depends on land resource. Thus, lack of access to land, increases incidence of poverty specifically in rural areas. Quality of land has a direct bearing on the productivity of agriculture, which is not true for other activities.

## **LAND DEGRADATION;**

Lowering of the quality of land is referred to as land degradation. The causes are

- Mining
- Urbanization
- Deforestation
- Overgrazing
- Construction of dams and canals
- Excessive use of fertilizers
- Dumping of industrial and domestic waste

## **SOIL EROSION**

The detachment and transportation of the top fertile layer of the soil is termed soil erosion.

The causes are;

- Deforestation
- Heavy floods
- Overgrazing
- Dry violent winds
- Improper agricultural techniques

### **Effects of soil erosion**

- Decrease in productivity of land
- Desertification of land
- Reduction in agricultural lands along the banks of rivers

- Deposition of soil in river beds and canals causing diversion of their natural flow leading to natural disasters

### **Methods of controlling soil erosion**

- Reduced tillage
- Contour bunding
- Vegetative bunds
- Strip cropping
- Terracing
- Afforestation on barren land
- Control of overgrazing
- Construction of small check dams
- Prevention of excavation of lands
- Promotion of equitable use of water resources

### **DESERTIFICATION**

Conversion of fertile land in to infertile desert land is termed as desertification. The causes are natural as well as anthropogenic. The natural causes include very low rainfall, increased difference in diurnal temperatures, excessive evaporation, and high temperatures. The other factors include deforestation, overgrazing, over irrigation, excessive ploughing, excessive use of fertilizers and conversion of pastures to arable lands.

### **Effects of desertification;**

- Poor soil quality
- Rapid soil erosion
- Unfavourable climate
- Low water table
- Huge economic loss

### **Control of desertification**

- Afforestation
- Changing agricultural practices and promoting dry land farming
- Development of pasture lands and control of overgrazing
- Promoting equitable use of water resources
- Development of catchment areas

### **RENEWABLE ENERGY RESOURCES**

**Renewable energy** is generally defined as energy that comes from resources

which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves, and geothermal heat. Renewable energy flows involve natural phenomena such as sunlight, wind, tides, plant growth, and geothermal heat. Renewable energy is derived from natural processes that are replenished constantly. Climate change and global warming concerns, coupled with high oil prices, peak oil, and increasing government support, are driving increasing renewable energy legislation, incentives and commercialization. According to a 2011 projection by the International Energy Agency, solar power generators may produce most of the world's electricity within 50 years, reducing the emissions of greenhouse gases that harm the environment. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services:

- **Power generation**

Renewable hydroelectric energy provides 16.3% the world's electricity. When hydroelectric is combined with other renewable such as wind, geothermal, solar, biomass and waste: together they make the "renewable" total, 21.7% of electricity generation worldwide as of 2013.

- **Heating**

Solar water heating makes an important contribution to renewable heat in many countries. Worldwide, total installed solar water heating systems meet a portion of the water heating needs of a few households. The use of biomass for heating continues to grow as well. In Sweden, national use of biomass energy has surpassed that of oil. Direct geothermal for heating is also growing rapidly.

- **Transport fuels**

Renewable biofuels have contributed to a significant decline in oil consumption in the world since 2006. For example, U.S. oil use fell 8.5% from 2005 to 2014. The 93 billion litres of biofuels produced worldwide in 2009 displaced the equivalent of an estimated 68 billion litres of gasoline, equal to about 5% of world gasoline production.

### **There are many forms of renewable energy**

Most of these renewable energies depend in one way or another on sunlight. Wind and hydroelectric power are the direct result of differential heating of the Earth's surface which leads to air moving about (wind) and precipitation forming as the air is lifted. Solar energy is the direct conversion of sunlight using panels or collectors. Biomass energy is stored sunlight contained in plants. Other renewable energies that do not depend on sunlight are geothermal energy, which is a result of radioactive decay in the crust combined with the original heat of accreting the Earth, and tidal energy, which is a conversion of gravitational energy.

#### **Solar**

This form of energy relies on the nuclear fusion power from the core of the Sun. This energy can be collected and converted in a few different ways. The range is from solar water heating with solar collectors or attic cooling with solar attic fans for domestic use to the complex technologies of direct conversion of sunlight to electrical energy using mirrors and boilers or photovoltaic cells. Unfortunately, these are currently insufficient to

fully power our modern society.

**Solar energy** is radiant light and heat from the sun harnessed using a range of ever evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture and artificial photosynthesis. The sun's energy can be captured to generate electricity or heat through a system of panels or mirrors.

- Solar, or photovoltaic, cells convert sunlight directly into electricity. Most photovoltaic cells are made primarily of silicon, the material used in computer semiconductor chips, and arranged on rectangular panels. When sunlight hits a cell, the energy knocks electrons free of their atoms, allowing them to flow through the material. The resulting DC (direct current) electricity is then sent to a power inverter for conversion to AC (alternating current), which is the form in which electric power is delivered to homes and businesses.
- Solar thermal collectors use heat-absorbing panels and a series of attached circulation tubes to heat water or buildings.
- Solar concentration systems use mirrors - usually arranged in a series of long, parabolic troughs, a large round dish, or a circle surrounding a 'power tower' – to focus the sun's reflected rays on a heat-collecting element. The concentrated sunlight heats water or a heat-transferring fluid such as molten salt to generate steam, which is then used conventionally to spin turbines and generate electricity.

### **Wind Power**

The movement of the atmosphere is driven by differences of temperature at the Earth's surface due to varying temperatures of the Earth's surface when lit by sunlight. Wind energy can be used to pump water or generate electricity, but requires extensive areal coverage to produce significant amounts of energy. Wind turbines work much like windmills, but they are used specifically to generate electricity. A wind turbine usually has fewer blades and is made of lighter materials, such as plastics, which allow the blades to turn more quickly and with less wind. The blades of the wind turbine capture the energy of the wind and send it down a shaft inside the nacelle. This shaft spins the turbines of a generator. Inside the generator is a large pole with metal wires wrapped around it. On the inside walls of the generator are magnets. As the turbine poles spin, the magnets draw electrons from the wire and produce electricity. A wind turbine can produce enough electricity to satisfy the needs of a home. In some cases, a single turbine may also produce excess energy that can be stored in batteries or sold to a local utility company. Wind turbines can also be grouped together to create large quantities of electricity. This is referred to as a wind farm. Wind farms are becoming more widespread throughout the world.

### **Advantages of Harnessing**

#### **The Wind Energy:**

1. Wind energy is cleaner, cheaper and more renewable than many of the current sources of energy used in this country.
2. Not only is wind power a renewable energy, but like other renewable energies it gives off no harmful greenhouse gases while being operated - no methane, no carbon dioxide.
3. Wind energy is one of the cleanest and most effective forms of harnessing a renewable form of energy.

### **Reasons for Harnessing Wind Energy:**

1. First, it produces no pollution or greenhouse gases.
2. Fourth, wind power produces more jobs per watt produced than all other energy platforms, including oil and coal.
3. Second, it is renewable and will last for as long as our sun about another four billion years.

**Hydroelectric energy.** This form uses the gravitational potential of elevated water that was lifted from the oceans by sunlight. It is not strictly speaking renewable since all reservoirs eventually fill up and require very expensive excavation to become useful again. At this time, most of the available locations for hydroelectric dams are already used in the developed world.

**Hydroelectricity** is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. It is the most widely used form of renewable energy.

### **Conventional (dams)**

Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator. The power extracted from the water depends on the volume and on the difference in height between the source and the water's outflow. This height difference is called the head. The amount of potential energy in water is proportional to the head. A large pipe (the "penstock") delivers water to the turbine.

### **Pumped-storage**

This method produces electricity to supply high peak demands by moving water between reservoirs at different elevations. At times of low electrical demand, the excess generation capacity is used to pump water into the higher reservoir. When the demand becomes greater, water is released back into the lower reservoir through a turbine.

Pumped-storage schemes currently provide the most commercially important means of large-scale grid energy storage and improve the daily capacity factor of the generation system. Pumped storage is not an energy source, and appears as a negative number in listings.

### **Run-of-the-river.**

Run-of-the-river hydroelectric stations are those with small or no reservoir capacity, so that the water coming from upstream must be used for generation at that moment, or must be allowed to bypass the dam.

### **Tide**

A tidal power station makes use of the daily rise and fall of ocean water due to tides; such sources are highly predictable, and if conditions permit construction of reservoirs, can also be dispatchable to generate power during high demand periods. Less common types of hydro schemes use water's kinetic energy or undammed sources such as undershot waterwheels. Tidal power is viable in a relatively small number of locations around the world.

**Biomass** is the term for energy from plants. Energy in this form is very commonly used throughout the world. Unfortunately, the most popular is the burning of trees for cooking

and warmth. This process releases copious amounts of carbon dioxide gases into the atmosphere and is a major contributor to unhealthy air in many areas. Some of the more modern forms of biomass energy are methane generation and production of alcohol for automobile fuel and fuelling electric power plants. **Biomass** is biological material derived from living, or recently living organisms. It most often refers to plants or plant-based materials which is not used for food or feed, and are specifically called lignocellulosic biomass. As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Conversion of biomass to biofuel can be achieved by different methods which are broadly classified into:

*thermal, chemical, and biochemical* methods.

There are three sources of biomass:

- 1- **Woody source of biomass'**(*Lignocelluloses*) such as:*Forest residues, Landscaping residues, Energy wood plantations, Residues from food, Industrial wood residue, Waste wood residues*
- 2- **Non-Woody biomass** (Oil, sugar, starch) such as: Energy plants from agriculture, Straw and other harvesting residues from agriculture, Residues from food industry, Landscaping residues (grass etc.)
- 3- **Animal/ (Fats/Proteins)**, Farm slurry /excrements, Slaughter waste, Organic waste from households and industry Wood remains the largest biomass energy source to date; examples include forest residues (such as dead trees, branches and tree stumps), yard clippings, wood chips and even municipal solid waste. In the second sense, biomass includes plant or animal matter that can be converted into fibres or other industrial chemicals, including biofuels. Plant energy is produced by crops specifically grown for use as fuel that offer high biomass output per hectare with low input energy.

Biomass can be converted to other usable forms of energy like methane gas or transportation fuels like ethanol and biodiesel. Rotting garbage, and agricultural and human waste, all release methane gas—also called landfill gas or biogas. Crops, such as corn and sugar cane, can be fermented to produce the transportation fuel, ethanol. Biodiesel, another transportation fuel, can be produced from left-over food products like vegetable oils and animal fats. Also, biomass to liquids (BTLs) and cellulosic ethanol are still under research. There is research involving algal, or algae-derived, biomass due to the fact that it is a non-food resource and can be produced at rates five to ten times faster than other types of land-based agriculture, such as corn and soy. Once harvested, it can be fermented to produce biofuels such as ethanol, butanol, and methane, as well as biodiesel and hydrogen.

#### **Methods of generating energy from biomass:**

The methods of generating energy can be split in two different groups. There are the dry processes and the wet processes. The dry processes are:

Combustion and Pyrolysis

The wet processes are:

Anaerobic Digestion, Gasification and Fermentation.

## **Combustion**

The most obvious way of extracting energy from biomass, the technology of direct combustion is well understood, straightforward and commercially available. Combustion systems come in a wide range of shapes and sizes burning virtually any kind of fuel, from chicken manure and straw bales to tree trunks, municipal refuse and scrap tyres. Some of the ways in which heat from burning wastes is currently used include space and water heating, industrial processing and electricity generation. One problem with this method is its very low efficiency. With an open fire most of the heat is wasted and is not used to cook or whatever. One method of improving this in developing countries is to build stoves out of mud and scrap iron.

## **Pyrolysis**

A wide range of energy-rich fuels can be produced by roasting dry woody matter like straw and woodchips. The process has been used for centuries to produce charcoal. The material is pulverised or shredded then fed into a reactor vessel and heated in the absence of air. Pyrolysis can also be carried out in the presence of a small quantity of oxygen ('gasification'), water ('steam gasification') or hydrogen ('hydrogenation'). One of the most useful products is methane, which is a suitable fuel for electricity generation using high-efficiency gas turbines.

## **Anaerobic Digestion.**

Biogas is produced when wet sewage sludge, animal dung or green plants are allowed to decompose in a sealed tank under anaerobic (oxygen-free) conditions. Feedstocks like wood shavings, straw and refuse may be used, but digestion takes much longer. Each kilogram of organic material (dry weight) can be expected to yield 450-500 litres of biogas. The residue left after digestion is a potentially valuable fertilizer or compost. Fermentation: Ethanol (ethyl alcohol) is produced by the fermentation of sugar solution by natural yeasts. Suitable feedstocks include crushed sugar beet and fruit. Sugars can also be manufactured from vegetable starches and cellulose by pulping and cooking, or from cellulose by milling and treatment with hot acid. After about 30 hours of fermentation, the brew contains 6-10 per cent alcohol, which can be removed by distillation as a fuel.

## **Gasification**

This process, usually using wood produces a flammable gas mixture of hydrogen, carbon monoxide, methane and other non flammable by products. This is done by partially burning and partially heating the biomass (using the heat from the limited burning) in the presence of charcoal (a natural by-product of burning biomass). The gas can be used instead of petrol and reduces the power output of the car by 40%. It is also possible that in the future this fuel could be a major source of energy for power stations.

## **Fermentation**

If the biomass used is (or can be converted into) mostly sugar, then yeast can be added. The fermentation that follows produces alcohol which is a very high energy fuel that makes it very practical for use in cars. Hydrogen and fuel cells. These are also not strictly renewable energy resources but are very abundant in availability and are very low in pollution when utilized. Hydrogen can be burned as a fuel, typically in a vehicle, with only water as the combustion product. This clean burning fuel can mean a significant reduction of

pollution in cities. Or the hydrogen can be used in fuel cells, which are similar to batteries, to power an electric motor. In either case significant production of hydrogen requires abundant power. Due to the need for energy to produce the initial hydrogen gas, the result is the relocation of pollution from the cities to the power plants. There are several promising methods to produce hydrogen, such as solar power, that may alter this picture drastically.

**Geothermal power.** Energy left over from the original accretion of the planet and augmented by heat from radioactive decay seeps out slowly everywhere, everyday. In certain areas the geothermal gradient (increase in temperature with depth) is high enough to exploit to generate electricity. This possibility is limited to a few locations on Earth and many technical problems exist that limit its utility. Another form of geothermal energy is Earth energy, a result of the heat storage in the Earth's surface. Soil everywhere tends to stay at a relatively constant temperature, the yearly average, and can be used with heat pumps to heat a building in winter and cool a building in summer. This form of energy can lessen the need for other power to maintain comfortable temperatures in buildings, but cannot be used to produce electricity.

### **The Earth as an Energy Source**

The geothermal energy available from the Earth is potentially enormous. Unlike solar and wind energy, the supply of geothermal energy is constant and doesn't vary with the time of day or change with the weather. Although geothermal energy may always be available *when* it is needed, like the other two sources it is not always available *where* it is needed. The Earth's core maintains temperatures in excess of 6000°K due to the heat generated by the gradual radioactive decay of the elements it contains. This heat energy continuously flows outwards from the hot core due to conductive and convective flows of the molten mantle beneath the crust.

### **What are Non-Renewable Sources of Energy?**

Non-renewable energy sources are those sources that drain fossil reserves deposited over centuries. This results in depletion of these energy reserves. There are many countries, which have recorded significant reduction of these sources and are currently suffering from the side effects of drilling these energy reserves from deep underground. Most non-renewable energy sources are fossil fuels: coal, petroleum, and natural gas. Carbon is the main element in fossil fuels. For this reason, the time period that fossil fuels formed (about 360-300 million years ago) is called the Carboniferous Period. Over time, dead animals and plants were crushed under the seabed. Rocks and other sediment piled on top of them, creating high heat and pressure underground. In this environment, the plant and animal remain eventually turned into fossil fuels (coal, natural gas, and petroleum). Today, there are huge underground pockets (called reservoirs) of these non-renewable sources of energy all over the world.

### *Advantages and Disadvantages*

Fossil fuels are a valuable source of energy. They are relatively inexpensive to extract. They can also be stored, piped, or shipped anywhere in the world. However, burning fossil fuels is harmful for the environment. When coal and oil are burned, they release particles that

can pollute the air, water, and land. Some of these particles are caught and set aside, but many of them are released into the air. Burning fossil fuels also upsets Earth's "carbon budget," which balances the carbon in the ocean, earth, and air. When fossil fuels are combusted (heated), they release carbon dioxide into the atmosphere. Carbon dioxide is a gas that keeps heat in Earth's atmosphere, a process called the "greenhouse effect." The greenhouse effect is necessary to life on Earth, but relies on a balanced carbon budget. The carbon in fossil fuels has been sequestered, or stored, underground for millions of years. By removing this sequestered carbon from the earth and releasing it into the atmosphere, Earth's carbon budget is out of balance. This contributes to temperatures rising faster than organisms can adapt. There are many places in the world that are experiencing fast degradation of non-renewable sources in terms of fossil fuels. Soon there will be none left if appropriate measures are not taken into consideration.

This is a trend that has to be reversed if the world is to survive the degradation process that is going or happening at a much rapid pace. The main non-renewable energy sources are: -

1. Coal
2. Oil
3. Natural gas
4. Nuclear energy

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