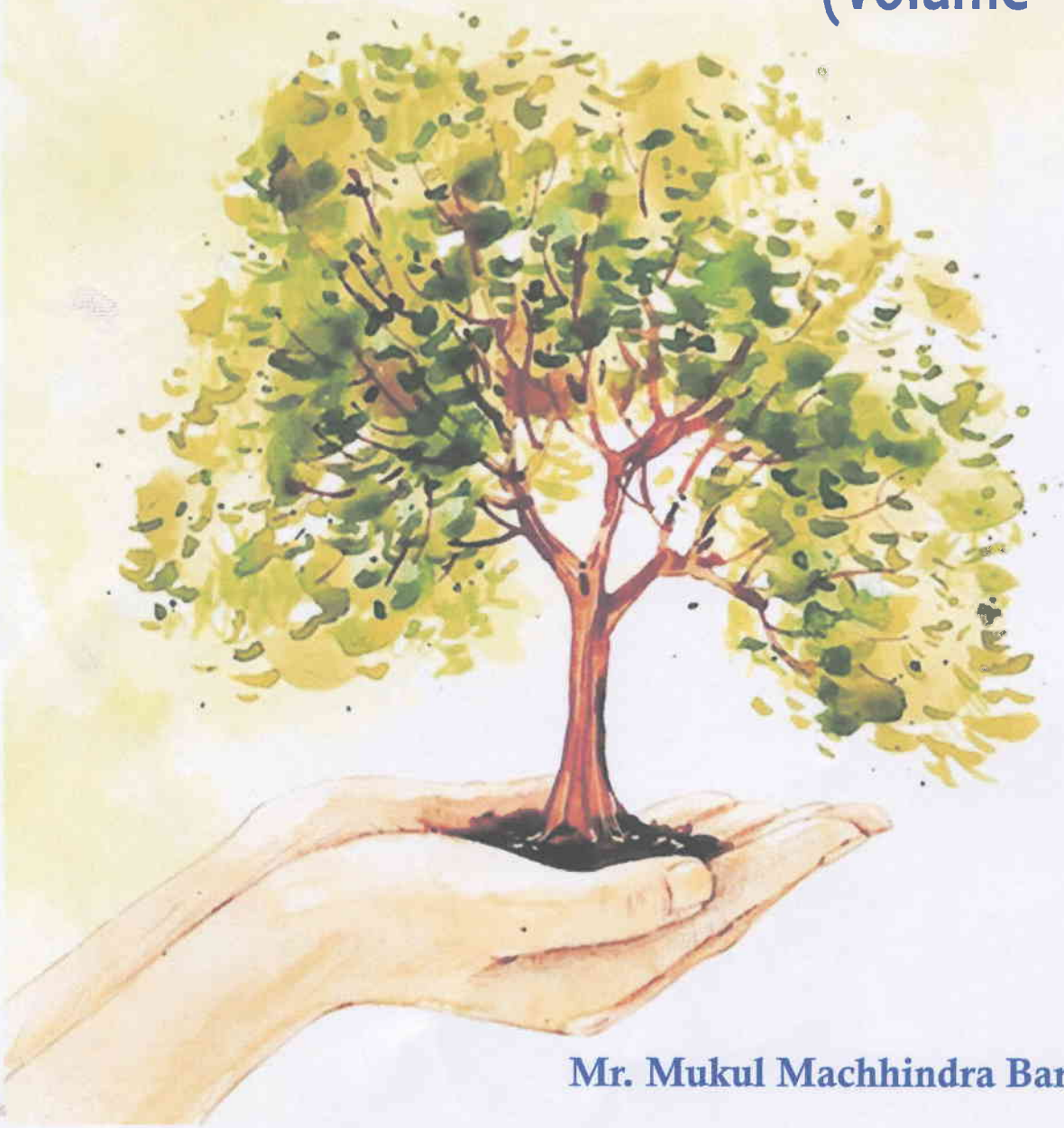
ENVIRONMENT CONSERVATION, CHALLENGES THREATS IN CONSERVATION OF BIODIVERSITY

(Volume - IV)



Mr. Mukul Machhindra Barwant

ENVIRONMENT CONSERVATION, CHALLENGES THREATS IN CONSERVATION OF BIODIVERSITY

VOLUME -IV

Edited by

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ECO-FRIENDLY ENERGY RESOURCES

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ABSTRACT

An increased human activities and population explosion has resulted in an ever-growing requirement for energy. Energy is the considered as an essential factor for the economic development of the nation, in order to meet the growing needs demands of energy and maintenance of quality in every walk of life. Energy sources can be broadly classified as eco-friendly energy resources or renewable and non-renewable. The non-renewable sources in recent days are rapidly declining in its availability resulting in the energy demand and power supply deficits. The use of renewable and alternate sources of energy is considered as an important in order to reduce the pollution and generate eco-friendly energies. The renewable energy sources include solar system, hydropower, wind, tidal wave, ocean thermal energy geothermal and biomass energy. The most important aspect of them is that they are constantly replenished in the environment and are direct sources of energy in nature. Renewable technologies have long term global applications, which are be able reverse the environmental degradation such as climate change, global warming, desertification, pollution etc. Sustainable development is possible by the generation cleaner energy global energy system. Hence, environment friendly measures should be taken in productions agriculture, farming, electricity, transportation, building constructions and other energy sectors. Environment friendly energy production and the energy conservation technologies should be prioritized.

KEYWORDS: Eco-friendly energy sources, Environment, Sustainable development.

INTRODUCTION

The energy requirements of human history started as man started using fire for cooking. Later the revolution of industries took place in twentieth century lead to the excessive consumption of fossil fuels or non-renewable resources around the world. It also gave rise to detrimental effects on environment causing an imbalance in the nature of environment. In the 1970s environmentalists began to think in the lines of promoting eco-friendly energy resources or renewable energy as a replacement. Sustainable alternative sources of energy can be produced to meet the energy needs such as transport, electricity, agriculture irrigation, industries etc. Environment friendly and sustainable energy resources management is possible by the use of renewable energy sources like hydro-power, solar, wind, tidal wave, geothermal, ocean thermal and biomass. These energy sources are more or less equitably distributed on the surface of the earth and environment-friendly. The non-conventional energy or renewable resources will provide more sustained form of energy

which is growing at faster rate than the fossil fuels. Eco-friendly cheaper energy after the initial cost is taken care of in terms of Economy.

WHAT ARE ECO-FRIENDLY ENERGY SOURCES?

- It is energy that is derived from natural sources which can be replenished or renewable. It includes hydro-power, solar energy, wind energy, tidal wave energy, ocean thermal energy, geothermal energy and biomass energy.
- It is universally accessible and decentralized form of energy.
- Renewable energy resources are spread over a much wider area than traditional sources of energy (which are present in a very limited area of the world).This energy resources are more easily available to all countries. Fruitful interactions with nature is possible by renewable energies described below:

I. Hydro power energy

II. Solar energy

III. Wind energy

IV. Tidal and wave energy

V. Ocean thermal energy

VI. Geothermal energy

VII. Biomass energy

I .HYDROPOWER ENERGY

Hydropower is a power that is obtained from the energy of water flowing down the gradient to move the turbines to generate energy that can be converted into electricity. It is usually done by construction of dams across the river. It is based on the cycling of water in the installed capacity. The production of energy by hydro-power plants is considered as renewable energy resource. In India the first hydro-power project was built in 1800's by Jamshedjee Tata, in Western Ghats of Maharastra for the production of cotton and textile based industry. Later on 1900's, several dams were constructed to generate electricity.

Hydropower plants are classified into three categories according to operation and nature of water flow. Run-of-River (RoR), storage (reservoir) and pumped storage hydropower plants vary from small to large in terms of scale, depending on the hydrology and topography of the watershed. A Run-of-River hydropower plant draws the energy for electricity production mainly from the available flow of the river. Hydropower today is an extremely flexible power technology which has the best energy conversion efficiency from 90% of water to wire. It is considered as environment friendly energy resource, due to its direct transformation efficiency from hydraulic energy to electricity (Fig. 1).

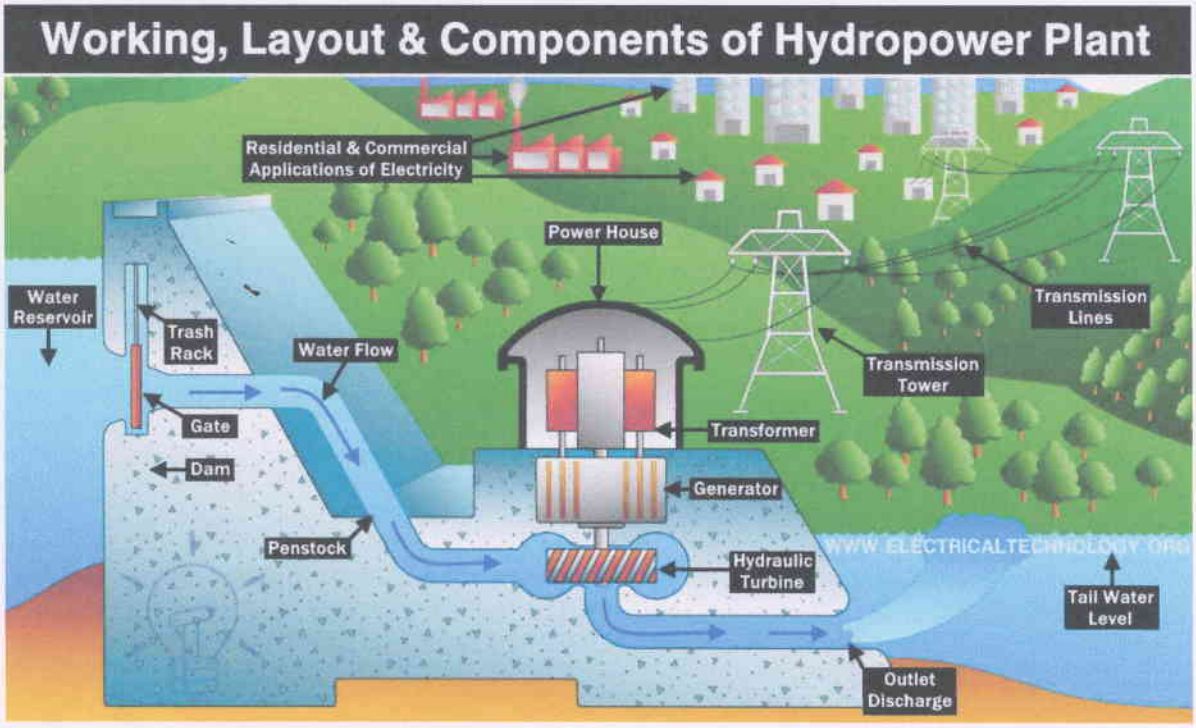

Fig. 1: Working, Layout & Components of Hydropower Plant

II. SOLAR ENERGY

The sun produces enormous amount of energy by nuclear fusion reactions. Sun is the source of all forms of energies in nature. These sunrays reach the earth in the form of radiation. The primary forms of energy of sun rays are heat and light. Sunlight and heat are transformed and absorbed by the environment in a multitude of ways and there are different transformation technologies available to collect and store the solar energy.

The methods of solar transformation are

1. **Photovoltaic panels or cells**: It is otherwise called as solar cell or photovoltaic cell (PV), which is able to produce electricity. The cells contain silicon which is the second most abundant element in the earth's surface. This silicon is converted into p and n type semi-conductor. P type forms the top layer which is doped with B and N-type forms the bottom layer which is doped with P, when the sunlight hits the top layer the charge or electrons from valence band begins to move to the bottom layer. However, due to the flow of electrons between the layers it forms a conduction band in P-N junction. Potential difference developed between the two layers results in flow of electrons, voltage generation and electricity is produced. The PV cells are wired to develop a module. For more power more PV modules are wired together. A 40 cells module is enough to power light bulb. It works well when sun is shining. The array of them is enough to meet the electrical needs of home (Fig. 2).

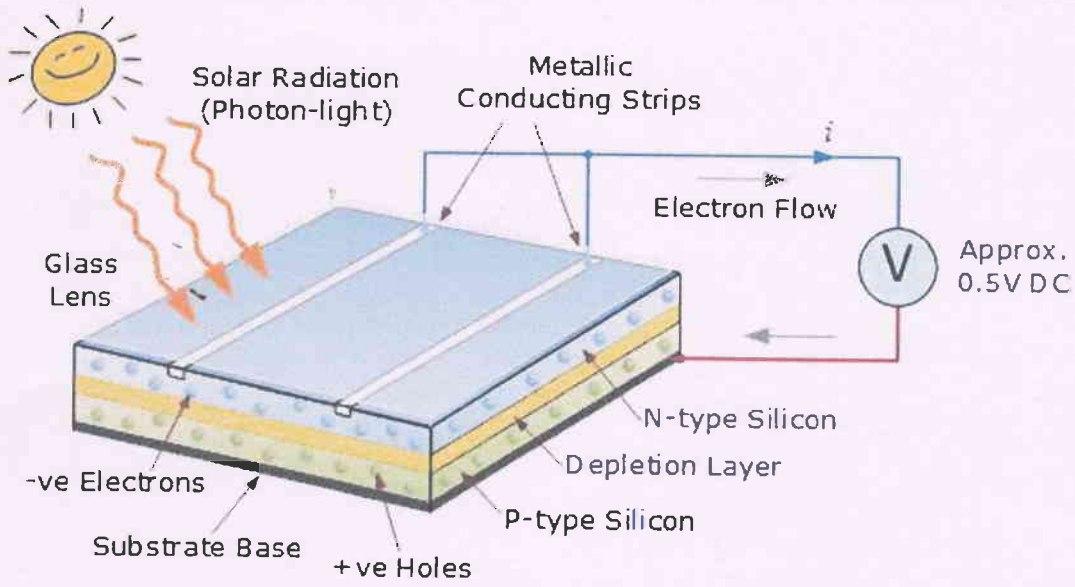

Fig. 2: Photovaltic Panel

USES

Solar energy technologies convert sunlight into electrical energy. It has a longer life span and requires less maintenance. Unlike conventional thermal power generation (by coal), solar energy also does not pose the problem of pollution and the production of clean electrical energy can be promoted.

Free solar energy is abundant in almost all parts of the country. The use of solar energy also does not require the use of electric wires and transmission, as it can locally available for use. It is used in calculators, electronic watches, street light, water pumps etc-It can power the water pumping, weather stations, small electrical appliances, railway signaling, rural electrification, microwave repeaters, mobile towers, TV transmission and reception devices. The PV cells are environment friendly and do not release toxic materials into the environment.

2. **Solar water heater:** It consists of insulated box containing black color coated copper coils and a flat glass lid, which is a carefully arranged group of lenses and has the ability to focus enough sunlight to generate heat. The glass lid is also called flat plate collector or concentrator. The cold water is allowed to flow into the tubes in the metal absorber plate box, where it is heated up and flows out into a insulated storage tank from which water is supplied through pipes (Fig. 3). Solar thermal technology has some relative advantages over all other non-renewable energy sources. It is cost competitive environment friendly and easy to construct solar energy is 7 per cent more effective than coal or-oil based plants and 10 per cent more effective than nuclear plants. It is generally used more in appliances like heaters, crop dryers, solar cookers, etc.

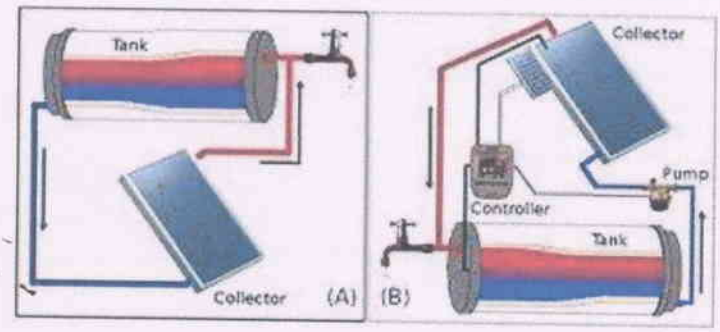

Fig. 3: Solar Water Heater

Solar cooker: Heat produced by the sun can be used for cooking is called solar cooker. It is a metal box, where the lid has the reflective surface to reflect the heat from the sun. It contains vessels which is black inside and can retain heat. The vessels are the places where the food can be cooked.

Solar drier: Glass windows which act as heat absorbers are designed to collect sun's heat and release heat. Large verandahs, roofs, tiles, bricks can serve this purpose.

Solar battery: Large number of solar cells connected in series is called solar battery. It is used in remote areas where continuous power supply is a problem.

Solar energy in India

India is committed to achieve the target of 100 GW of solar power as renewable energy source by the year 2022.

Jawaharlal Nehru National Solar Mission

The Jawaharlal Nehru National Solar Mission was launched on 11 January 2010 by the then Prime Minister of India. Under this mission, an ambitious target of producing 20,000 MW of grid-connected solar power by the year 2022 was made. In the year 2015, the Government of India gave its approval to increase the India's solar power capacity target by five times by the year 2022, which has become 1,00,000 MW. The western part of India has greater potential for the development of solar energy Eg: Gujarat and Rajasthan desert areas where the high temperatures received from the sunlight are capable of generating electrical energy.

Suryamitra Program

The program was initiated by the National Institute of Solar Energy under the Ministry of New and Renewable Energy. The objective of this program is to skill the youth in this field given the new opportunities arising in the field of solar energy at the national and international levels. Suryamitra program also prepares the youth to become new entrepreneurs in the solar energy sector.

Solar loan program

The program was started in the year 2003 and in just three years, more than 16,000 solar home systems have been financed through 2,000 bank branches. This program worked especially in the rural areas of South India where till then there was no electricity.

III. Wind energy: Moving air is called wind. The kinetic energy which can be recovered from the force of the blowing wind is called wind energy. Wind power is a function of wind's speed. Wind speed increases with increase in height for example 80 m height produces more wind power than 30 m above the ground. The wind by the use of power producing turbines converts the mechanical form energy into electrical energy. The country currently has the fourth highest wind installed capacity in the world with total installed capacity of 39.25 GW (as on 31st March2021).

a. **Wind mills:** When a blowing wind reaches the blade of the wind mill, it rotates continuously. And rotational motion of the blade drives number of machines like water pump for irrigation and electric generators to grind grains in flour mills.

Windmills are used for power plant generation such as mechanical power generation, wind pumps for pumping water or drainage, or sails to propel ships or Sailing ships. The first wind turbines for electricity generation were developed at the beginning of the 20th century. The technology has gradually improved since the early 1970s. By the end of the 1990s, wind energy has re-emerged as one of the most important sustainable and eco-friendly energy resource.

b. **Wind farms:** When a large number of mills are installed and joined together in a definite pattern – it forms wind farm. It produces large amount of electricity. There are large wind farms generating 850mW capacity of electricity in Tamil Nadu farm. It is the third world largest producer of wind energy in the world. **Condition:** Minimum speed for wind generator is 15 Km/hr (Fig. 4)

Fig. 4: Wind Farms

Advantages

It does not cause air pollution. Wind energy is absolutely pollution free, inexhaustible source of energy.

Limitations: cost-effective

Wind energy in India: India generating 1200 MW electricity using the wind energy. Largest wind farm situated near Kanyakumari in Tamilnadu India already started generating wind energy. It has an ambitious programme to install 250 wind driven turbines with a total capacity of 45 mega watts, spread over 12 suitable locations, especially in coastal areas. The ministry of non-conventional sources of energy is developing wind

energy in India to lessen the burden of oil import bill. The countries potential to wind power generation exceeds 50000 mega watts of which one fourth can be easily harnessed. In Rajasthan, Gujarat, Maharastra and Karnataka favourable conditions for wind energy exist. It produces 380 MW electricity.

IV. Tidal wave energy

Due to the sun, the moon and the gravitational force of the earth, the tides are generated, which can be transformed to energy. Tidal waves and Ocean currents are the store house of infinite energy. The tidal wave energy is more concentrated in the 40-60 latitudes of the earth in both northern and southern hemispheres. High tides - rise of water in the ocean. Low tides - fall of water in the ocean. During tides sea water enters into the reservoirs and rotates the turbine to produce electricity. Tidal or wave energy can be used by turbo-generators in tidal barrage, which convert motion of waves to electricity, and later transmitted by the cable to the land. Tidal power is tapped by placing a barrage across an estuary and places where winds blow more strongly (Fig. 5).

Tidal wave energy in India

Large tidal waves are known to occur along the west coast of India. In Gujarat, central electrical authority at Kutch tidal power project, Navlakhi is involved in generation of electricity about 900MW from tidal wave energy. Various institutes associated with tidal wave energy are National Hydroelectric power Corporation (NHPC), National institute of oceanography, Geological survey of India (GSI) and Central water and power Research station.

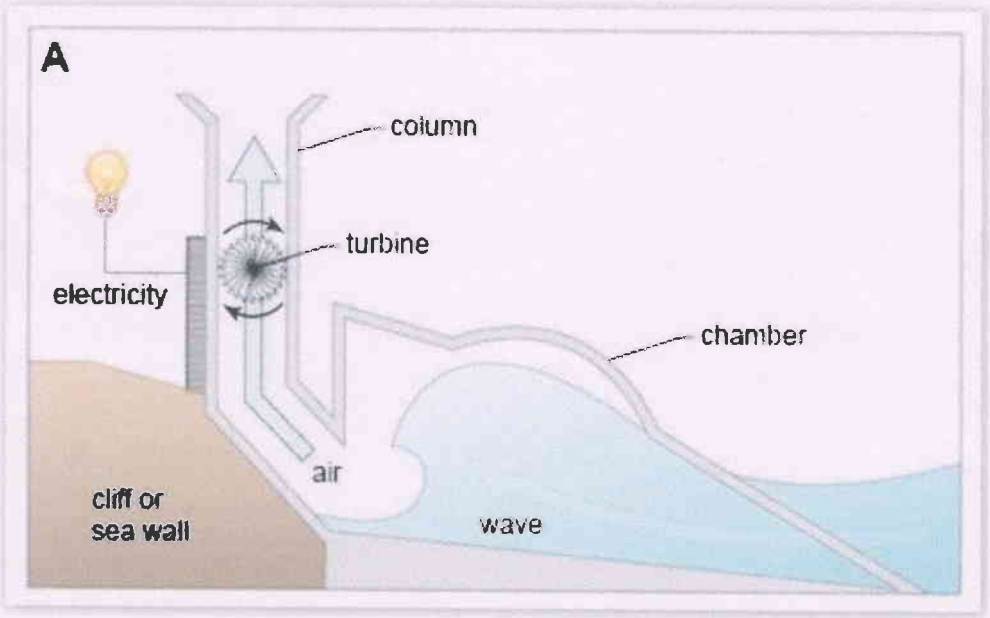

Fig. 5: Tidal Wave energy

V. Ocean thermal energy: The warming of water by the sun generates temperature difference between surface water and cold deeper level water in oceans generates electricity. The energy available due to the difference in temperature of water is called ocean thermal

energy. The phenomenon process is the vapors on the surface of warm water increases the vapour pressure which is able to rotate the turbine and generates electricity. **Condition:** The temperature difference should be 200°C, the deeper level cold water is pumped to cool and condense the vapour in to liquid.

Ocean thermal energy in India: The department of ocean development had a plant in Tiruchendur in Tamilnadu generates 1 mW/day.

VI. Geo Thermal Energy

The energy obtained from the high temperature present inside the earth is called geothermal energy. When the magma from the hot interior surface of the earth comes out on the earth crust, a tremendous heat is released. Heat energy can successfully be tapped and converted into electrical energy. (Fig. 6)

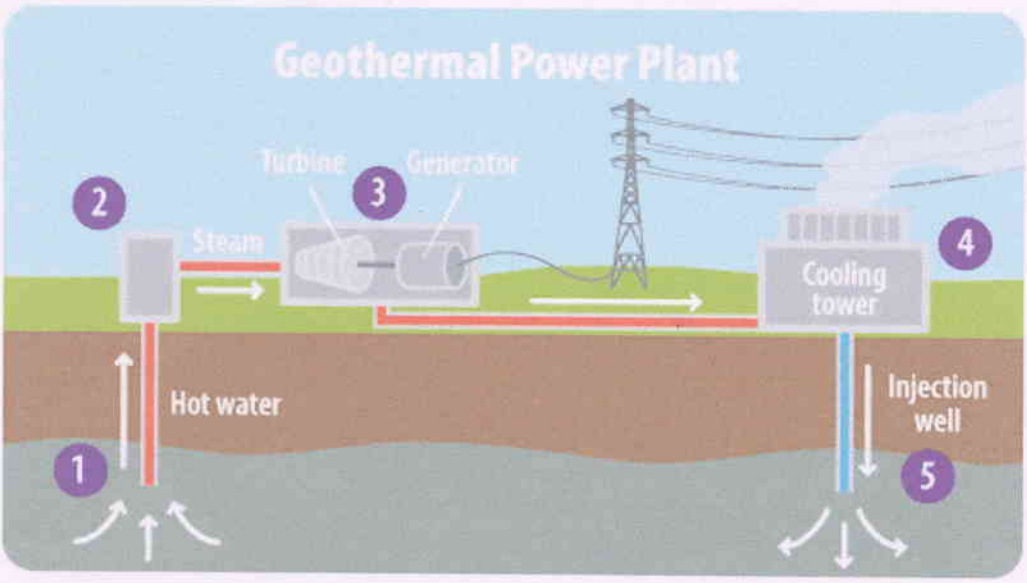

Fig. 6: Geo Thernal Energu

Natural geyser wells: Geo thermal energy can be used to heat the water that gushes out of the ground through the natural cracks or geyser wells. This results in heating of natural geyser wells present in underground water pools such as hot springs.

Artificial geyser: The bore wells were drilled artificially up to the hot region and sending pipes into it can be used tap geothermal energy directly which provides a steady stream of hot water which can be used on a large scale for energy production through a geothermal power plant. High-temperature geothermal systems (greater than 180 °C) are associated with volcanic active regions. Intermediate-temperature (between 100 and 180 °C) and low temperature geothermal systems (less than 100 °C) are associated with places of earth having shallow surfaces, where above-normal heat production through radioactive isotope decay increases terrestrial heat flow. Geothermal systems occur in different geological environments where the temperatures and depths of the reservoirs vary

accordingly. Under appropriate conditions, high, intermediate and low temperature geothermal fields can be utilized for both power generation and the direct use of heat.

Advantages: Geothermal power is considered a cost-effective, reliable, and environmentally friendly energy source.

Geothermal energy in India: The hot springs and geyser wells are being used in India since the medieval period. A geothermal energy plant has been commissioned at Manikaran in Himachal Pradesh, Badrinath in Uttarakand and in some parts of Uttar Pradesh.

VII. BIOMASS ENERGY

Biomass is referred to as a total cellular and organic material mass produced by the living systems which include plants, microorganisms, animals and their waste materials. Biomass is considered as a renewable source of energy which derives its energy primarily from the storage of sunlight through the process of photo synthesis in plants. In latter stages, its conversion is utilized to generate energy in all other forms of biological organisms and its derived products. Biomass based energy is called as bio-energy. Biomass can be converted into different forms of energy

1. Direct burning to generate heat: woody plantation for the fire wood with low moisture content in biomass can be used to generate heat.
2. Biological conversion: The biomass can be converted into liquid fuel called as biofuel or gas like fuel called as biogas.

Bio fuels: The biologically produced liquid fuel is called as biofuel. It includes Bioethanol, biodiesel, hydrogen etc. The biofuels are mainly aimed to use in transport as a substitute for petroleum.

A. Bioethanol: It is obtained from the plants crops which can convert solar energy into substrates such as fermentable sugars, starch and cellulosic materials The fermentable sugary raw materials include molasses, whey, sugar beet, fruit juice sucrose etc. The starchy biomaterials include wheat, maize, rice potato etc. The cellulosic materials include wood and agricultural wastes. The raw materials are subjected to hydrolysis by acids or enzymes such as cellulases which are produced by micro organisms (*Trichoderma resei* (fungi), *zymomonas mobilis*) to release monosaccharide units needed for alcohol production. The hydrolysed raw materials derivatives are further subjected to anaerobic fermentation of biomass with the help of yeast (saccharomyces cerevisiae), bacteria or fungi. Later, the microbial biomass is separated from the remaining fluid contain bioethanol, which is obtained by fractional distillation process. Ex: Mixture of ethanol and gasoline are used as transport fuel in cars and buses.

B. Biodiesel: The biodiesel means the liquid like fuels obtained from biological origin is called biodiesel. It can be produced from biological systems such as petroleum plants, algal sources and seed crops.

a. Petroleum plants: Storage of the sun's energy through photosynthesis process can lead to the accumulation of high molecular weight long chain hydrocarbon (10,000 mol. wt). It is considered as a substitute for conventional petroleum. These plants are able to reduce

carbon dioxide beyond the carbohydrates to form complex compounds. Eg: The euphorbiaceae family plants found to posses highly complex hydrocarbons called terpenoids which can be further converted into petrol or gasoline. The other hydro carbon producing plants include *Hevea braselensis* (rubber plant), *parthenium argentatum* (guayule), *Taraxacum koksaghyz* (Russian dandelion), aak plant (calotropisprocera), *and Calotropis multijuga* (Brazil leguminous tree).

Biopetroleum in India

In India screening of petroleum producing plants are carried out by NBRI (Lucknow) and Indian institute of petroleum in terms of habitat, biomass yield and hydrocarbon content.

b. Algal hydro carbons: Unicellular algae such as *Botrycoccus braunii* which grows well in tropical and temperate zones are able to store more hydrocarbons under nutrient deficient conditions in the outer walls and cytoplasm of the cell is capable to accumulate the 25-31 chain length hydrocarbons. This hydrocarbon can be isolated by centrifugal isolation, The isolates have similar resemblance to that of crude oil.

c. Seed crops with lipid hydrocarbons: the processing of crops producing seeds such as soya, sun flower, jatropa, pea nut etc for oil products can be used to form biodiesel by esterification process. The oil based Biodiesel production may lead to increase in the cost of vegetable oils due to the conversion of edible oils into biodiesel products. These crops may result in increased demands both for agriculture and bioenergy products. This indirect demand may lead to monoculturing process, where farmers will prefer cultivating such crops for the generation of biofuels.

2. Biogas: Biogas is obtained by anaerobic fermentation after the decomposition of organic matter such as animal wastes (or) plant wastes in the presence of water by anaerobic bacteria in the absence of oxygen. Methane gas is a major by-product obtained in Biogas. It is typically composed of 65% methane (CH_4) and 25% carbon dioxide (CO_2), 2% nitrogen(N_2), 5% hydrogen(H_2), oxygen and carbon mono-oxide in traces . It is similar to natural gas where the biological methane formation occurs geologically in anaerobic environments, which is composed of 99% methane. The methanogenic bacterial strains are involved in methane production include methanobacter, methanobrevibacter, methanococcus, methanosarcina, methanospirillum etc. Biogas is a clean and renewable energy, which is devoid of smell and burns with a blue flame without smoke. It may be substituted to natural gas to cook, to produce vapour, hot water or to generate electricity. Any organic waste has the ability to produce biogas which includes human excreta, animal waste, agricultural manure, animal slurry, fruit and vegetable wastes, slaughter house waste, meat packing waste, dairy factory waste, municipal, industrial sources, brewery and distillery waste etc. Fibre rich wastes like wood, leaves etc make poor feed stocks for digesters as they are difficult to digest.

In India National Biogas and Manure Management Program

The National Biogas and Manure Management Program is a central sector scheme. Under this, a provision has been made to set up a biogas plant to promote biogas as a source of cooking fuel and light for households in rural and semi-urban areas of the country.

Hydrogen fuel: hydrogen fuel is zero carbon emission fuel when burned in the presence of oxygen. In general Hydrogen produced by pyrolysis, photolysis and electrolysis of water. It has high calorific value. It is a non polluting fuel which can be used in vehicles combustion engines and the combustion product is water.

Disadvantages

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

Bio-hydrogen fuel: Microbesare used to generate bio-hydrogen fuel. The Hydrogen producing algae and bacteria can be used for biohydrogen fuel production.

Bio-hydrogen producing algae-when water is used as a raw material by the action of hydrogenase enzyme, bio-photolysis of water takes place generating hydrogen. The algal examples are *chlorella, chlamydomonas, anabena* etc.

Bio- hydrogen production by bacteria: The photo synthetic bacterium such as *Rhodospirillum* can produce hydrogen from anaerobic digestion of organic wastes and the reaction is catalysed by enzyme hydrogenase eg: *Clostridium* species. In leguminous plants nitrogen is a by-product of nitrogen metabolism catalysed by enzyme nitrogenase.

Advantages: Bio-Hydrogen fuels can be used in transport like cars, motor bikes and other vehicles. It can be used in power generation In India, bio-hydrogen the national institute of resource and environment work on energy generation through the hydrogen producing algae

STATUS OF ECO-FRIENDLY ENERGY SOURCES IN INDIA

India has estimated renewable potential energy of 900 GW. This includes achieving 750 GW from solar power, 102GW from wind power, 20 GW from bio-mass energy power, and 25 GW from small hydropower projects. With this ambitious goal achieved, India will join the ranks of the world's largest clean energy producers. It will even overtake many developed countries. In the year 2018, thermal power accounted for 63.84 percent, nuclear power 1.95 percent, hydropower 13.09 percent, and renewable energy 21.12 percent in the country's total installed capacity.

CHALLENGES INVOLVED

Generating more energy from renewable resources than fossil fuels remains a major challenge. Energy productions from renewable resources completely depend on the weather and climate conditions and if the weather is not conducive to energy production, then we will not be able to produce energy as required. Renewable energy should be supplemented with high efficient technologies to minimize the short falls at each and every step.

THE FUTURE OF ENERGY

Eco-friendly energy resources have minimum or no hazardous effects on the environment. The sustainable nature of wind, hydropower, geothermal, solar, tidal wave, oceanic thermal energy and biomass highly encourage the energy supply requirements. It can reduce the financial burden on oil imports. It can reduce pollution. Moreover, people can set up small solar panels over their homes to reduce the money pay for energy. The public health can be protected because the renewable energy resources reduce air pollution. Conservation of energy and utilizing eco-friendly energy resources is the wisest choice and ultimate destination of global energy.

CONCLUSION

Eco-friendly energy resources help to protect our environment from the risks of fossil fuel emissions. The decentralized form renewable sources play an important role in future. Renewable Energy generation and conservation awareness must be initiated among the public, power companies should make a shift to gradually resort themselves to the use of eco-friendly energy resources as they are profuse and will never deplete. Global community such as governments, industries, social media, colleges and universities can play a key role in this by educating people about energy sources and their utilization. Eco-friendly energy production is definitive future clean and green energy. It can enhance bioavailability of renewable fuels and fuel economy.

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