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# Environmental Sustainability through Renewable Energy

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**Abstract**: Energy is a key of development of any nation. Any country's economic development is considered on the amount of energy production and consumption. Pro Homi Jahangir Bhaba has rightly said- No power is costlier than no power. The pattern of production and consumption of energy is reflected in the pace of industrialization of third world countries. Now development is directly associated with energy use, so the importance of energy resources is increasing. With technological and scientific skills, man has made rapid progress in agriculture, irrigation, mining, industry, transportation, forestry and many other areas with a huge demand of energy resources. Earlier the conventional sources of energy such as coal, petroleum, and natural gas played an important role in global energy production .The exhaustion of these resources gave a threat to future energy production along with a number of environmental issues. The limitation of these sources such as scarcity of fossil fuels, their limited geographical distribution and their harmful effects on environment forced many countries to develop more useful and sustainable forms of renewable energy sources. Environmental sustainability does not include the use of exhaustible natural resources but also demands rational use of resources. The wind energy, solar energy, tidal energy, hydropower, geothermal power, biomass energy are the renewable sources of energy having good hope promises for future. The present paper is an attempt to analyze the renewable energy sources of India to get environmental sustainability in India.

**Key Words**- Environmental sustainability, pollution, conventional energy, renewable energy

## Introduction

Energy is a basic requirement for economic development. There has been a tremendous increase of energy production in recent years. Between 1985 and 1995, energy production increased by 25 percent. Between 1995 and 2005, production of energy recorded a growth of 33 percent from 365 thousand petajoules to 1204 thousand petajoules in 2005. Among these solid fuels especially coal contributed 28 percent while liquid fuels especially petroleum contributed about 38 percent and only 13 percent has been contributed by gaseous fuels. Petroleum contributes a large share that coal in energy production. Nuclear power and hydro power contribute15 percent and 16 percent respectively According to International Renewable Energy Agency, China ranks first as the largest producer of renewable energy while Brazil ranks third in this list. India is the fifth-largest producer of solar energy and the sixth-largest producer of renewable energy. In India, efforts to utilize non conventional renewable energy sources were started during seventies and a separate department of Non conventional energy sources (DNES) was established. The country urgently needs to develop a sustainable path of energy development. Promotion of energy conservation and increased use of renewable energy sources are the twin planks of a sustainable energy. India is blessed with a variety of renewable energy sources, like biomass, the solar, wind, geothermal and small hydropower and implementing one of the world's largest programs in renewable energy. India is determined to becoming one of the world's leading clean energy producers.

## Sustainable Development

Sustainable development is an integring concept embracing economic, social and environmental issues. With technological and scientific skills, man has made rapid progress in agriculture, irrigation, mining, industry, transportation, forestry and many other areas. But these have caused destruction of many natural resources. The world commission on Environment and Development (WCED) says that the future is to face ever increasing environmental decay, poverty hardship and more polluted world. The increasing population uses more natural resources and puts destructive pressure on the biosphere changing environmental conditions. Globe 2000 report says that the globe will become more crowed, more polluted, ecologically less stable and more vulnerable to destruction. The scientic and technological development has benefited mankind in many ways but it is also responsible for various environmental problems. In a primitive society, there was little need of energy for cooking, lighting and heating. Industrial revolution has changed the concentrated use of large amount of energy. Per capita energy consumption had increased many times in technologically advanced countries of the world. There has been a rapid rise in global energy consumption since the fossil fuels came into use. Per capita consumption of energy is not same all over the world. Developed western countries use highest energy resources. Only 20 % of the world population use two-third of total energy produced by men and rest of the population has to depend on only one- third of energy supply.

The term sustainable development is a wide area. The world commission on Environment and Development says that sustainable development is an advancement that addressed the issues of present without trading off the capacity of future eras to address their own particular issues. In fact sustainable development recognizes the inter dependence of environmental, social and economic systems.

**Environmental sustainability principles**

To target agricultural land, forest, water resources, protected areas, and biodiversity

Require to correct the over exploitation or in appropriate use of natural resources

Establish projects and policies on appropriate levels- community, national, regional level

Production of environmental friendly products

Incoprate institutional development and new technologies

Weather forecasting to reduce natural hazards

Recycling of wastes of residues

Implementation of environmental protection laws

Reduce risks and vulnerability of farming communities

Production of environmental friendly products

**Energy Types**

On the basis of pattern and nature of energy, energy is divided into two groups

1. Non renewable energy 2. Renewable energy sources

**1. Non renewable energy**

It includes fossil fuels, coal, Petroleum, natural gas and nuclear power. Since industrial revolution, the use of fossil fuels has been a clear trend in energy production scenario. These fuels provided more energy. The use of wood was gradually replaced by coal, which in turn was replaced by petroleum and natural gas. In 1980s and 1990s, the limitation of fossil fuels came to notice. The combustion of fossil fuels disturbed the carbon dioxide content in the atmosphere. The scarcity of fossil fuels and their limited storage and their harmful environmental effects forced many countries to develop more reliable and sustainable forms of energy for their developmental activities.

**2. Renewable energy**

Wind energy

Wind energy is pollution free, inexhaustible, renewable source of energy. It is a widely distributed energy resource. Wind energy is being developed in the industrialized world for environmental reasons. Winds are generated by complex mechanisms involving the rotation of the earth, heat energy from the sun, the cooling effects of the oceans and polar ice caps, temperature gradients between land and sea and the physical effects of mountains and other obstacles. The availability of wind varies for different regions. Wind resources can be exploited mainly in areas where wind power density is at least 400 W/m2 at 30 m above the ground. The Wind Resource Assessment Program is being implemented by C-WET (Centre for Wind Energy Technology) in coordination with state nodal agencies covering 13 states and union territories, namely Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttaranchal, and West Bengal. The Wind Power Program in India was initiated towards the end of the Sixth Plan, in 1983– 1984. By the mid 1990s, the subcontinent was installing more wind generating capacity than North America, Denmark, Britain, and the Netherlands. The ten machines near Okha in the province of Gujarat were some of the first wind turbines installed in India. These 15-m Vestas wind turbines overlook the Arabian Sea.

Solar energy

Solar energy is the source of all life on earth. It provides energy base to transform organic material to fossil fuels and renewable bio mass. It creates winds that power wind mills. It moves hydrological cycles feeding streams and rivers. Solar energy is experienced by us can be used through two routes: the thermal route uses the heat for water heating, cooking, drying, water purification, power generation, and other applications; the photovoltaic route converts the light in solar energy into electricity, which can be used for a number of purposes such as lighting, pumping, communications, and power supply in un electrified areas. Solar energy is cost competitive, eco friendly and easy to construct. It is 7 % more effective than coal and 10 % more effective than nuclear plants. It is more effective in bright areas. The highest annual radiation energy is received in Western Rajasthan while the North Eastern region of the country receives the lowest annual radiation. A Government scheme for 'Accelerated development and deployment of Solar Water Heating systems in domestic, industrial and commercial sectors' has been introduced, with the object of promoting solar energy. Solar buildings have been promoted by the MNRE is an effort to increase energy efficiency. The state government in Himachal Pradesh has actively promoted the incorporation of passive solar design into building design.

Geothermal energy

Geothermal energy is now one of the key renewable energy sources which might ease our present energy crisis of the world. The possible areas of geothermal energy are geysers, hot springs, volcanoes. Geothermal is energy generated from heat stored in the Earth's core, mantle and crust. Geothermal energy is at present contributing

about 10,000 MW over the world. The next decade may be predictable to see a harvesting of geothermal energy utilization throughout the world. India has 10,600 MW of potential in the geothermal region but it still needs to be utilized. India has a number of potential resources e.g. Himalayan regions, Aravalli belt, Naga-Lushi, Andaman and Nicobar (A&N) arc, Surajkund, Hazaribagh in Jharkhand. India has about 340 hot areas spread over the country around 62 are distributed in the northwest Himalaya (J&K, HP and Uttarakhand). Cambay graben (Gujarat) is nearly about 200 km long and 50 km wide geothermal regions. Naga-Lushi region marked a series of thermal springs and A&N arc is the only places in India which have volcanic activity.

Bio mass energy

Bio mass has been an important source of energy for mankind since ancient but for today needs it is not often a convenient fuel. It has to be converted to suitable state before use. Biomass is a biological material derived from living organism such as wood waste and alcohol fuels. It is commonly plant matter grown to generate electricity or produce heat.

Bio mass energy is derived from three distinctive energy sources- wood , waste and alcohol fuels .Wood energy is derived both from direct use of harvested wood as fuel and from wood waste stream. The largest source of energy from wood is pulping liquor or black liquor, a waste product from processing of the pulp and paperboard industry. The sources of waste energy are municipal solid waste, manufacturing waste and landfill gas. Bio mass alcohol fuel or ethanol is derived from crops like corn and sugarcane after fermentation process. Energy production from food wastes or food processing wastes, especially from waste edible oils, seems to be attractive based on bio-resource sustainability, environmental protection and economic consideration

Biogas represents an alternative source of energy, derived mainly from organic wastes. In India, the use of biogas derived from animal waste, primarily cow dung has been promoted for cooking food in rural areas. Biogas is a clean fuel produced through anaerobic digestion of a variety of organic wastes: animal, agricultural, domestic, and industrial. India's National Project on Biogas development (NPBD) has been one of the well organized .The energy obtained from biomass is a form of renewable energy which does not add carbon dioxide, a major greenhouse gas, to the atmosphere. India is very rich in biomass and has a potential of 16,881 MW (agro-residues and plantations), 5000 MW (bagasse cogeneration) and 2700 MW (energy recovery from waste).

Hydropower

Hydropower is another source of renewable energy that converts the potential energy or kinetic energy of water into mechanical energy in the form of watermills, textile machines, etc., or as electrical energy (i.e., hydroelectricity generation). It refers to the energy produced from water (rainfall flowing into rivers, etc.). Hydropower is the largest renewable energy resource being used for the generation of electricity. Countries like Norway, Canada, and Brazil have all been utilizing more than 30% of their hydropotential, while on the other hand India and China have lagged far behind. India ranks fifth in terms of exploitable hydropotential in the world.

According to CEA (Central Electricity Authority), India is endowed with economically exploitable hydropower potential to the tune of 148,700 MW.

Tidal energy

Gravitational pull exercised by sun and moon causes tides to develop. Sea level rises and falls depending upon position of sun and moon. As the sea level rises, water may be derived through suitable channels to inshore reservoirs, driving the turbines during its entry. The stored water may be released driving the turbines again during the periods of low tides. India has huge potential of tidal energy as it is surrounded by sea on three side's east–south, west and south regions. A reservoir is created behind a barrage and then tidal water passes through turbine to generate electricity, On India's west coast, the Gulf of Khambhat and the Gulf of Kutch have the maximum tidal range was 11 and 8 m with average tidal range of 6.77 and 5.23 m, respectively. In the Ganges delta in the Sunderbans in West Bengal, the maximum tidal range was 5 m. Gujarat state is the highest harvest of tidal energy (8 GW) in India., GOI and the renewable energy development agency West Bengal jointly agreed to implement India's first 3.75 MW Durgaduani Mini Tidal Power Project in 2011.Tidal energy may be an attractive solution to meet the local energy demands of this remote delta regions.

**Advantages of Renewable Energy**

a) Private sector involvement**:** The huge target from renewable by the government created a huge opportunity for the private sector to get involved in the design and manufacturing of components of renewable energy technology in India.

b) Reliability**:** Solar and wind energy are more reliable in availability in comparison to conventional sources of power.

c) Creation of storage infrastructure**:** To overcome the variable nature of renewable sources of energy, it is vital to invest in affordable batteries of large capacity.

d) Low cost of maintenance: Renewable energies like wind energy, bio power or solar energy requires almost zero maintenance and thus provide longer working hours and reduced labor cost.

e) Eco friendly: Renewable energy has almost nil carbon footprints and does not emit any harmful pollutants like PM2.5 or PM10 or greenhouse gases like carbon dioxide, NOx etc.

f) Fulfill several government objectives-Renewable energy is helpful achieving the Panchamri*t* goals, SDGs, make in India, INDC of Paris Climate Deal and employment generation.

g) Decentralized: Renewable energy plants can be located near the location of demand for energy. For example, a biogas plant or a solar plant can be established near a far-off cluster of villages thus eliminating the need to connect such remote villages to the national grid

**Government policies for Renewable Energy in India**

India is the first country in the world to have Ministry of New and Renewable Energy (MNRE) for promotion of renewable energy in India. MNRE has started many programmes and schemes for development of renewable energy.

Release of Green Hydrogen mission**:** The Mission aims to make India a green hydrogen hub with the target of production of 5 million tonnes of Green hydrogen by 2030 and the related development of renewable energy capacity.

Launch of PLI scheme: A Production Linked Incentive (PLI) Scheme 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage' to promote renewable energy storage infrastructure and manufacturing capacity.

The Setting up of the Solar Energy Corporation of India: The SECI aims to facilitating the implementation of the National Solar Mission and the achievement of targets set therein.

Grid Connected Solar Rooftop programme: This scheme promotes the installation of solar panels at the rooftops of the residential, commercial, industrial and institutional buildings across the country.

Sustainable Rooftop Implementation for Solar Transfiguration of India (SRISTI) scheme: This scheme provides financial aids to the beneficiaries who install a solar power plant at the rooftop within the country.

Small Hydropower Programme: It involves the development of Small Hydro Power (SHP) Projects up to 25 MW station capacities. It is mostly in the Himalayan States where the rivers are abundant and in States which have sufficient irrigation canals

Green term ahead market: the government has launched Green Term Ahead Market (GTAM) in electricity which is an alternative new model introduced for selling off the power by the renewable developers in the open market without getting into long term PPAs.

Nation Green Corridor Programme: This project aims at synchronising energy that is produced from renewable energy sources with the conventional stations.

National Clean Energy Fund: It is the fund created using the carbon tax for backing research and development of innovative eco-friendly technologies.

FDI Policy**:** FDI up to 100% is allowed in the renewable energy sector under the Automatic route and no prior Government approval is needed.

Policy for Repowering of the Wind Power Projects: The main objective of this policy framework is to promote optimum utilization of the wind energy resources. This policy aims to replace the old wind turbines and promote a newer version of wind energy technologies

A new Hydropower policy for 2018-28 has been drafted for the growth of hydro projects in the country.

National Biogas and Manure Management Programme **(**NBMMP): It is a central scheme that promotes setting up of Family Type Biogas Plants mostly for the use of rural and semi-urban households. The energy is generated from biodegradable wastes such as cow-dug, wastes from the garden, kitchen, etc.

National Offshore Wind Energy Policy, 2015: Under this Policy, the Ministry of New & Renewable Energy (MNRE) has been authorized to explore and promote the deployment of offshore wind farms in the Exclusive Economic Zone (EEZ)

**Conclusions**

The conventional sources of energy such as coal, oil, natural gas are non renewable and their use causes problems of environmental pollutions. In villages, large scale use of wood causes deforestation. The scarcity of fossil fuels, their limited geographical distribution and harmful effects on environment forced to develop more useful and sustainable forms of renewable energy sources. Renewable energy is energy derived from resources that do not deplete over time. Renewable energy contributes to reduce carbon emissions, clean the air, and put our civilization on a more sustainable footing. Renewable energy sources provide energy in decentralized manner to small areas. Large scale use of renewable energy sources tends to reduce burden from non conventional energy systems. The Indian efforts in utilization of renewable energy sources have been focused on utilization of solar thermal energy, conversion of solar energy into electricity, wind energy and bio mass energy. In fact, economic growth and environment protection along with energy security are the national energy policy drivers of any country. So there is a need to take serious steps for promotion of renewable energy sources.

**References**

Asthana, D.K and Asthana, M (2013): Environmental studies, S Chand and Company, Ltd, New Delhi.

Aggarwal, V (2008): Solid waste management: Issues and perspectives, Prashanshika, XXXV,

Bhide, A.D, Shekdar, A.V (1998). Solid waste management in Indian urban centers. International Solid Waste Association Times (ISWA) (1), 26–28.

Bose, Ashish (1995): Urbanization and Slums, Haranand Publications, New Delhi.

Davis, Kinsgley (1965). "The Urbanization of Human Population," Scientific American, Vol. 213, p. 44.

Dreze'Jean and Sen, Amartya (2002): India: Development and participation, Oxford university press, New York.

Gautam Alka (2022): Geography of Resources: Exploitation, conservation and management, Sharda Pustak Bhawan, Prayagraj.

Ghanchi, DA (2013): Sustainable development through designated research; An innovative mission, University News

Jain, A. K. (2009): Urban Housing and slums, Readworthy, publication, New Delhi.

Thudipara, Jacob, Z. (2008). Urban Community Development, Rawat Publication, Jaipur.

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