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## Renewable and Non-Conventional Energy Sources and Engineering System

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# Renewable and Non-Conventional Energy Sources and Engineering System

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*Abstract: Energy is the gift of nature to man kind in various forms. Energy is the need for all kinds of work done by human being and nature. There are many sources of energy that help to run the various machines invented by man. But as the population and development activities increases, the requirement of the energy (demand) will also increase. If this trend of continuous exploitation of energy sources, continue the sources are going to be exhausted very soon n near future. So we need to look for the alternative of conventional sources of energy and the best alternative of conventional energy sources are the non-conventional energy sources of energy which are also called renewable source of energy. The conventional source of energy are coal, petroleum, natural gas, etc. which are kind of fossil fuel and non-conventional are renewable sources of energy ar in the form of solar, wind, geothermal, biomass, ocean thermal, hydro and Tidal energy. Sun is the main source of energy.*

*Key words: Non-conventional/Renewable source of energy are solar energy, Wind energy, bio energy (bio fuels), hydro power etc. are some of the renewable energy sources.*

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## I. INTRODUCTION

Energy is an important component for the development of any country. Developing countries like India have greater energy intensity and therefore greater energy dependence as compare to the developed countries. Energy has been an important component to meet day to day need of human being. The degree of civilization is measured by he energy utilization for human advancement are needs. Day by day the energy consumption is increasing. The world's fossil fuel supply coal, petroleum and natural gas will be depleted in few hundred years. The rate of energy consumption increasing, supply is depleting resulting in inflation and energy shortage. As a country developed over a period of time, the growth of Gross domestic product (GDP) occurs along with an increase in population with the consequence demand for housing, transportation, consumer goods and services. So growth of GDP is almost parallel to that of energy consumption. The standard of living of any country can be directly related to its per capita energy consumption. In developing countries, the energy sector is of critical importance because of ever increasing energy needs and the huge investments to meet them.

Due to above mentioned developments, the attention is being focused to develop and utilize renewable and non-conventional energy sources which have been largely

- Large hydro resources affect wild life, cause deforestation and pose various social problems.

neglected so far due to unhindered and cheap availability of oil as a result, extensive

R and D efforts are going on toward the development of these resources and related technologies. Consequently, the knowledge related to development in these technologies needs frequent updating.

An advantage of renewable and non-conventional energy sources lies in the fact i.e.

- The demand of energy is increasing by leap and bounce due to rapid industrialization and population growth and enhance the conventional sources of energy will not be sufficient to meet the growing demand.
- Conventional sources (except hydro) are non-renewable and are bound to finish up one day.
- Conventional sources (fossil fuel, nuclear) also caused pollution, thereby their use degrades the environment.

Source/Technology	Units	Available Potential	Actual Potential Exploited
Bio-gas	Million	12	3.22
Bio-mass-based power	MW	19500	384
Efficient wood stove	Million	120	33.86
Social energy	MW/km <sup>2</sup>	20	1.74
Small Hydro	MW	15000	1398
Wind Energy	MW	45000	1367
Energy recovered from waste	MW	1700	16.2

- In addition to supplying energy, fossil fuels are also used extensively as feed stock material for the manufacturing organic chemicals.
- As reserve deplete, the needs for using fossil fuels extensively for such purposes may become greater.

Due to these reasons, it has become important to explore and develop non-conventional and renewable energy resources. However, the trend of developments of non conventional sources indicate that these will serve as supplement rather than substitute for conventional sources for some more time to come.

## II. RENEWABLE ENERGY SOURCES POTENTIAL

There is a growing consensus that renewable energy sources will play a very important part in the solution of energy needs. There is a growing concern over the pollution, resource depletion and possibility of climate change due to continuous use of conventional fossil fuel and nuclear fuels. Recent technological development have improved the cost effectiveness of many of the renewables. The energy requirement of rural areas, particularly, remote villages can be met by locally available renewables as it is difficult to service these areas through the conventional power grid. Tables below gives the available potential and the actual potential exploited till august 2011 for various renewable sources of energy.

### RENEWABLE ENERGY SOURCES POTENTIAL

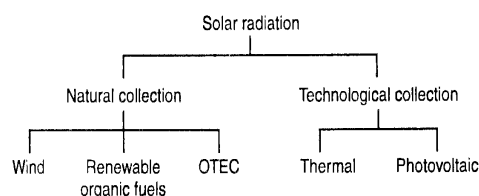
#### SOLAR ENERGY

The installed capacity of Tidal Power point in the Gulf of Kutchh is about 900 MW. The first commercial 240 MW

The earth and its atmosphere is continuously receiving  $1.7 \times 10^{17}$  W of radiation from the sun. A world population of 10 billion with a total power need per person of 10 kW would require about  $10^{11}$  kW of energy. It s thus apparent that if radiation on only one percent of earth's surface could be converted in to useful energy with 10% efficiency, solar energy could fulfill the energy needs of the entire world population. Another interesting comparison is that the total energy on earth is less than the solar energy incident upon the earth in one year.

Solar energy is, however, very diffuse, cyclic and often undependable. It, therefore, needs system and components that can gather and concentrate it efficiently for conversion to any of uses and that can do the conversion as efficiently as possible.

The solar energy resource can be divided into natural and technological collection system. Further sub-division is shown in fig.



### Solar Energy Resources

#### A. OCEAN ENERGY AND TIDAL ENERGY

The vast potential of energy of the seas and oceans, which cover about 3/4<sup>th</sup> of our planet, can make is significant contribution to meet our energy requirement. The various forms of energy from seas and ocean which are receiving attention at present are Tidal Power, Ocean Thermal Energy Conversion (OTEC), Waves and Ocean Currents.

The Ocean contains the vast energy potential in its waves, in its tides and in the temperature difference between cold deep waters and warm surface water, caused by winds blowing across miles of open sea, waves offer a power source for which numerous systems have been conceived. Tides are as result of the gravity of the sun, the moon and the rotation of earth, working together. In some of area of the world, the ocean rises and falls over 12 m twice a day. These tides can be used to produce electrical power which known as tidal power.

tidal power station in the world is in operation in France since 1966 across the mouth of the La Race Estuary. The average tidal range at La Race is 8.5 m.

The main advantage of tidal power are that they are free from pollution, exhaustible and does not depend on rain.

**B. WIND ENERGY**

The wind power technology is well developed and cost estimates in favourable reasons of the world are fairly closed to those of other energy sources. Rotar diameter of 50 meters and height 100 meters are dimensions typically for wind generation to produce appreciable amount of power. The unreliability of power production due to large variability in wind velocity has hamphared the large scale application even in favourable reasons.

The available potential of wind energy in India is 45000 megawatt out of which 1367mw have been exploited till august 2011. Table provides the top six wind energy generator countries in the world.

**WIND GENERATION COUNTRIES**

Country	Generation Capacity(MW)
Germany	10650
United States	4329
Spain	4039
Denmark	2515
India	1507
Italy	755

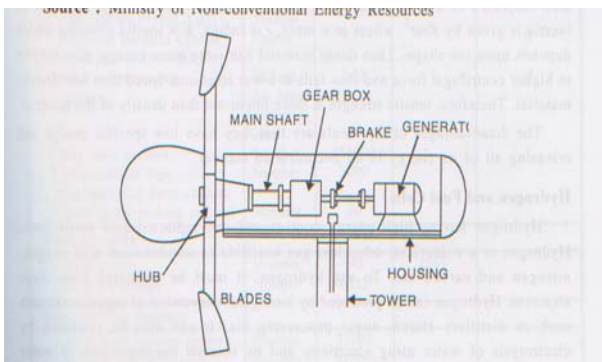


Figure 1: WIND POWER GENERATION NON CONVENTIONAL MACHINE

**D .GEOTHERMAL ENERGY**

Geothermal energy is primarily energy from the earths on interior. Vast natural heat stores lies beneath the earth’s crust. It is recoverable in the form of steam are hot water. These are used for electric generation, space heating, cooking, and medicinal purposes. The main location of geothermal energy is USA, Italy, Japan, and New Zealand. The world projections for geothermal electric production are given in table given below.

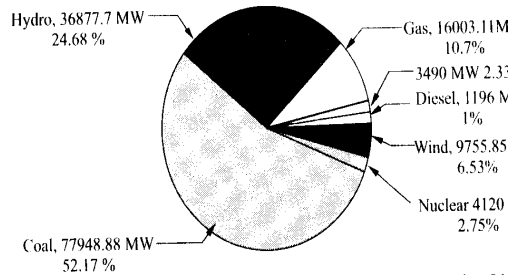
**World Geothermal Energy Utilization**

Country	Electricity (MW)		Space and Process Heat (MW)
	Installed	Under construction	
USA	773	641	30
Italy	421	-	1
New Zealand	203	150	70
Japan	166	100	37
Maxico	150	30	-
EI Salvador	60	35	-
Iceland	33	30	475
USSR	6	58	300
Phillipines	60	605	-
Turkey	0.5	-	-
Hungary	-	-	363
France	-	-	5
Total	1872	1649	1281

**III. ENERGY CONSUMPTION**

The global energy consumption at the end of 2003 was 9741 million tonnes of oil equivalent (MTOE). Although

80% of the world's population lies in the developing countries, their energy consumption accounts to only 40% of the world's total energy consumption. The high standards of living in the developed countries have been the main reason for the higher energy consumption. In industrialized nations, people use four to five times more energy than the world average and nine times more than the average for the developing countries. Table gives the global as well as the Indian pattern of energy usage.



Fuelwise installed generating capacity in India (as on May 31st 2010)

**Types of fuel and their consumption pattern**

Type of Fuel	% Energy consumption	
	Global	India
Oil	37.5	30.2
Gas	24.3	8.9
Coal	25.5	55.6
Nuclear	6.5	1.4
Hydro	6.3	5.2

**A. ELECTRICITY**

India is presently the sixth-greatest electricity generating country and accounts for about 4% of the world's total annual electricity generation. India is also currently ranked sixth in annual electricity consumption, accounting for about 3.5% of the world's total annual electricity consumption. Overall, annual electricity generation and consumption in India have increased by about 64% in the past decade, and its projected rate of increase is estimated as 8-10% annually.

**B. SECTOR-WISE ENERGY CONSUMPTION**

The commercial energy consumption in India has grown by about seven times in the last four decades. The major commercial energy consumers of the country are industry, transport, residential and agriculture. The percentage of the consumed energy of these sector is shown below.

**IV. Present Energy Scenario in India**

India is said to be one of the seven largest consumers of energy, but the growing gap between consumption and domestic output is a cause of concern. India's share in global oil reserves is about 0.5 percent, whereas its share in global consumption is about 3 percent. India is still dependent to the extent of 30 to 35 percent on non-commercial fuel sources like cowdung, firewood, agricultural waste, etc. The pressure on petrol is mounting and we have to concentrate on conservation of petroleum. As the country's petroleum bill grows, and future supplies look volatile or insecure, alternatives need to be explored. Ethanol is an environment-friendly oxidant additive to gasoline. There is a growing interest in biodiesel or ethanol blend. Energy majors are determined to tap biofuels. Special attention is being paid to jatropha cultivation. With an estimated 300,000 hectares contributing each year to biofuels in South East Asia, India and Southern African countries. India will itself produce 2 million tones of biodiesel by 2012. India has setup a target of 20000 MW of installed capacity by 2022 for harnessing solar energy. Renewable Energy technologies like solar, biomass, hydro, etc are deployed both in rural and urban areas to curb the growing gap between the demand and supply of power, which is due to increase in the per capita energy consumption. At 10464 MW, India presently ranks fifth in the world in wind power generations.

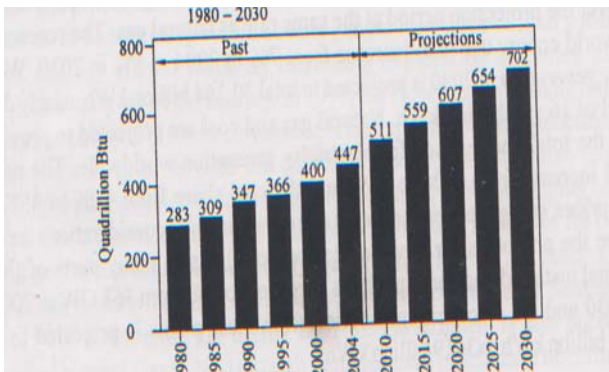
Indian clean development mechanism, projects broadly cover a range of sectors viz., power generation from renewable energy, particularly wind and hydro power, biomass applications, waste heat and energy recycling.

## V. World Energy Scenario-Consumption of Energy

The world energy scenario depicts a picture of concern. The adverse effects on environment caused by the production and consumption of energy have resulted in severe environmental impacts across the globe. The supply of energy is expected to remain adequate in coming years. According to estimates, energy consumption in developing countries is only one-tenth of that in the developed countries. The major sources of energy in the world are oil, coal, natural gas, hydroenergy, nuclear energy, renewable combustible wastes and other energy sources. Renewable sources of energy are gaining popularity. However fuel prices and regulatory policies of different countries play an important role in the development of renewals. In Asia there has been a projection of 3.7% growth in renewable energy sources over the ten year period from 2000 to 2010.

## VI. FUTURE ENERGY SCENARIO

World's total consumption of commercial energy is projected to increase from 447 quadrillion Btu in 2004 to 702 quadrillion Btu in 2030; a 57% projected increase.



## VII. Global commercial energy consumption.

Fossil fuels will continue to supply much of the increment that will take place in the commercial energy use worldwide throughout the projection period. Coal's share of total world energy use was 26% in 2004 and its share is projected to increase further to 28% in 2030. Natural gas consumption will increase by 1.9% per year on average over the projection period, from about 100 trillion cubic feet in 2004 to 163 trillion cubic feet in 2030. The use of hydroelectricity and other grid-connected renewable energy sources is expected to expand over the projection period at the same rate as natural gas. Worldwide, electricity generation in 2030 is projected to total 30,364 billion kWh. World's total installed nuclear capacity is expected to rise from 368 GW in 2004 to 481 GW in 2030 and the electricity generation from the plants is projected to increase from 2619 billion kWh to 3619 billion kWh.

## VIII. Future Energy Scenario in India

The rising population, expanding economy and in search for improved quality of life, the per capita energy usage in India is expected to rise to around 450 kgoe\*/year by 2010. With a targeted GDP growth rate of 7 to 8 percent, the energy requirements of India are expected to grow at around 6 percent per annum over the next few years. India currently ranks as the world's eleventh greatest energy producer, accounting for about 2.4% of the world's total annual energy production, and as the world's sixth greatest energy consumer, accounting for about 3.3% of the world's total annual energy consumption.

## IX. Conclusion

There is a strong two-way relationship between economic development and energy consumption. As a responsible world's citizen, we should start looking for alternate energy solutions, like solar energy, nuclear energy, renewable energy and conventional and non conventional energy employing these alternative power solutions is extremely feasible and cost effective.

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