

Renewable Energy Sources- The Ultimate Source of Survival & Management of resources

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Abstract: Energy is the primary and most universal measure of all kinds of work by human beings and nature. Whatever happens in the world is only the expression of flow of energy in either of its forms. Out of the known World petroleum reserves, only a part may be technically economically feasible to explore. This fact, coupled with the present and expected consumption rates implies that these reserves may not last beyond the next 30 years. For India, the situation could be even more difficult. Given limited reserves, present known stocks may not last even 10 years at the current consumption rate.

At one end, the rapid industrialization has led to increased use of fossil fuels such as coal, oil etc, to meet its power and steam requirement. For which, the developing nations like India are paying huge import bills putting stress on economy. At other end, a naturally available energy sources such as solar, wind, biomass, biogas etc are not effectively used. India has potential to generate 45,000 MW from wind energy, 19,000 MW from biomass energy, 15,000 MW from small hydro projects. In addition to it the urban areas in India produce @ 30 millions of solid waste and 4400 Million cubic meters of liquid waste every year. The same can be exploited to generate power and meet a part of the ever increasing demand of urban areas.

Therefore, the need of the hour is to conserve petroleum by its judicious use, substituting it by other resources wherever techno-commercially feasible and restricting its use only to the essential needs. In this paper we will see that even though the resources are depleting, but we cannot stop using them, therefore we will explore the data through which we can understand how the renewable sources of energy can be used and applied effectively.

Key words: Energy, Renewable, Solar energy, Wind energy, Biogas, Geothermal energy etc;

1 Introduction:

Currently the energy requirement of the world is fulfilled by the conventional resources, the percentage of the currently used sources can be seen from the table below:

S.No.	Sources	Available in (%)
1.	Oil	31
2.	Coal	26
3.	Natural Gas	19
4.	Hydro Electricity	6
5.	Firewood & Crop waste	12

Table 1: Currently used conventional sources

The development of infrastructure is an important factor to sustain economic growth. The power sector is one of the most important constituents of infrastructure. The achievement of energy security necessitates diversification of our energy resources and the sources of their supply, as well as measures for conservation of energy. So far, we were dependent on conventional sources of energy like thermal, hydro (large hydro) and nuclear. Fortunately, India is blessed with the third largest coal supplies in the world, although not of the best quality but we cannot use them indefinitely. The increasing prices for petroleum products, projection that petroleum resources would be exhausted in a relatively short period of time and the use of fossil fuel resources for political purposes will adversely affecting worldwide economic and social development. The impact of the energy crisis is particularly felt in developing countries like India, where an ever-increasing percentage of national budgets earmarked for development must be diverted to the purchase of petroleum products. After independence large hydroelectric projects have been executed, some of them

are still under construction and some have been planned for future. The inherent drawbacks associated with large hydro are; large gestation period, large area along with vegetation has to be submerged, shifting of people etc. from the sites. Political and environmental implications have made planners to think for some other alternative to the large hydro. For nuclear power plants also there is a problem of getting proper fuel, processing and safety from radiations. In addition, global warming caused largely by green-house gas emission from fossil fuel generating systems is also a major concern. To overcome the problems associated with conventional sources of energy, most countries including India have shifted their focus to develop non-conventional renewable sources of energy. Among these resources are solar energy, wind, geo thermal energy, biomass and small hydropower. 263 districts in 16 states and one Union Territory have so far been covered under the Integrated Rural Energy Programme of government of India, which aims at providing a cost effective energy mix of non-conventional sources to meet the energy need of the rural areas. With the various initiatives taken by the government, a healthy power sector would emerge in the country which would pave the way for fast industrialisation, growth in agricultural production, rural development and a better quality of life through non-conventional renewable energy sources.

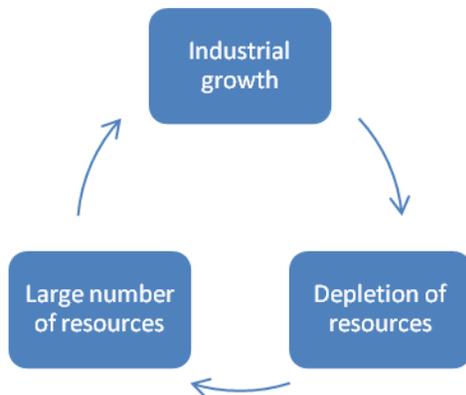


Chart 1 : relationship between industrial growth & resources

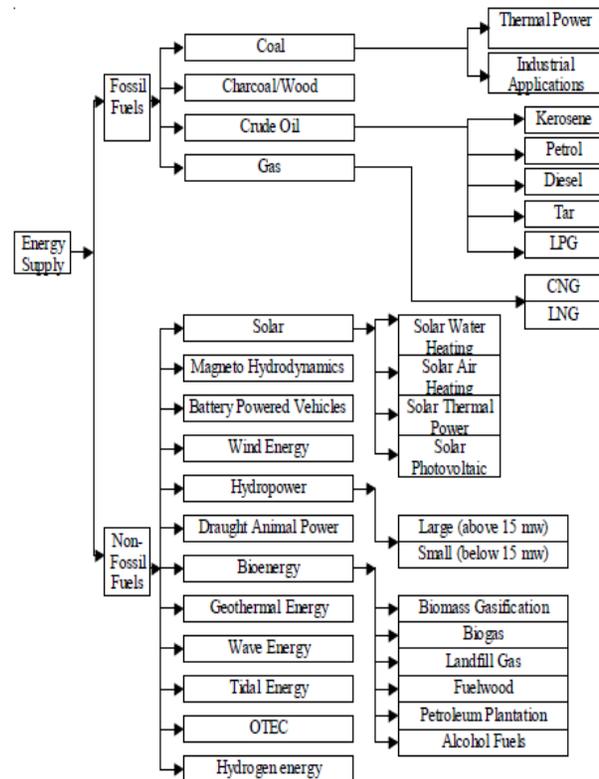


Chart 2 : current sources of energy

2. Renewable Energy Scenario:

In India the potential of renewable energy source is about 81.200 MW out of which only 5594 MW i.e. 6.9% has been harnessed so far. The potential and capacity harnessed so far is given in Table 1 [1]. India's need for power is growing at a prodigious rate, annual electricity generation and consumption in India have both nearly doubled since 1990, and it's projected 2.6% (low end) to 4.5 % (high end). Annual rate of increase for electricity consumption (through 2020) is the highest for any major country. India is currently the seventh greatest electricity consuming country (accounting for about 3.5% of the world total annual electricity consumption) but will soon overtake both Germany and Canada in that regard. India now faces an electricity shortages conservatively estimated at 11% and as high as 18% during peak demand periods

Sl. No.	Renewable Energy Sources	Potential (MW)	Potential harnessed so far (MW)
1.	Wind	45,000	2980
2.	Small Hydro Up to (25 MW)	15,000	1693
3.	Biomass	3,500	727
4.	Gasifiers	16,000	62
5.	Urban & industrial Waste	1700	46.5
6.	Solar Photo Voltaic (S.P.V.)	20/SQ km	86
TOTAL		81,200	5,594

Table 2: Potential and Installation of Renewable Energy Systems

3. Renewable Energy Technologies

3.1 Solar Energy

Solar energy has the greatest potential of all the sources of renewable energy and if only a small amount of this form of energy could be used, it will be one of the most important supplies of energy specially when other sources in the country have depleted energy comes to the earth from the sun. This energy keeps the temperature of the earth above than in colder space, causes current in the atmosphere and in ocean, causes the water cycle and generate photosynthesis in plants. The solar power where sun hits atmosphere is 10^{17} Watts, whereas the solar power on earth's surface is 10^{16} Watts. The total worldwide power demand of all needs of civilization is 10^{13} Watts. Therefore the sun gives us 1000 times more power than we need. If we can use 5% of this energy, it will be 50 times what the world will require [3]. Electricity can be produced from the solar energy by photovoltaic solar cells, which convert the solar energy directly to electricity. The most significant applications of photovoltaic cell in India are the energisation of pump sets for irrigation, drinking water supply and rural electrification covering street lights, community TV sets, medical refrigerators and other small power loads.

3.2 Wind Energy

Wind energy, which is an indirect source of solar energy conversion, can be utilized to run windmill, which in turn drives a generator to produce electricity. Wind can also be used to provide mechanical power such as for water pumping. In India generally wind speeds obtainable are in the lower ranges. Attempts are, therefore, on the development of low cost, low speed mills for irrigation of small and marginal farms for providing drinking water in rural area. The developments are being mainly concentrated on water pumping wind mill suitable for operation in a wind speed range of 8 to 36 km per hour. In India high wind speeds are obtainable in coastal areas of Saurashtra, western Rajasthan and some parts of central India [5]. Among the different renewable energy sources,

wind energy is currently making a significant contribution to the installed capacity of power generation, and is emerging as a competitive option. India with an installed capacity of 3000 MW ranks fifth in the world after Germany, USA, Spain and Denmark in wind power generation. Energy of wind can be economically used for the generation of electrical energy. Wind energy equipments are modular in nature and the investment requirement for these equipments as compared to conventional energy equipments is not large and the industry is able to attract private investment thereby reducing the burden on the encourages such investment.

3.3 Biomass and Biogas Energy

The potential for application of biomass, as an alternative source of energy in India is large. We have plenty of agricultural and forest resources for production of biomass. Biomass is produced in nature through photosynthesis achieved by solar energy conversion. As the word clearly signifies Biomass means organic matter. In simplest form, the process of photosynthesis is in the presence of solar radiation. Biomass energy co-generation programme is being implemented with the main objective of promoting technologies for optimum use of country's biomass resources and for exploitation of the biomass power generation potential, estimated at 19500 MW. The technologies being promoted include combustion, gasification and cogeneration, Either for power in captive or grid connected modes, or for heat applications.

3.4 Ocean Thermal Energy Conversion

This is also an indirect method of utilizing solar energy. A large amount of solar energy is collected and stored in tropical oceans. The surface of the water acts as the collector for solar heat, while the upper layer of the sea constitutes infinite heat storage reservoir. Thus the heat contained in the oceans, could be converted into electricity by utilizing the fact that the temperature difference between the warm surface waters of the tropical oceans and the colder waters in the depth is about 20 – 25 K. Utilization of this energy, with its associated temperature difference and its conversion into work, forms the basis of ocean thermal energy conversion (OTEC) systems. The surface water, which is at higher temperature, could be used to heat some low boiling organic fluid and the vapours of which would run a heat engine. The exit vapour would be conducted by pumping cold water from the deeper regions. The amount of energy available for ocean is replenished continuously. All the systems of OTEC method work on a closed routine cycle and use low boiling organic fluids like ammonia, Propane, R – 12, R – 22 etc.

3.5 Tidal Energy

The tides in the sea are the result of the universal gravitational effect of heavenly bodies like sun and moon on the earth. Due to fluidity of water mass, the effect of

this force becomes apparent in the motion of water, which shows a periodic rise and fall in levels which is in synthesis with the daily cycle of rising and setting of sun and moon. This periodic rise and fall of the water level of sea is called tide. These tides can be used to produce electrical power which is known as tidal power. When the water is above the mean sea level, it is called flood tide and when the level is below the mean sea level, it is called ebb tide. To harness the tides, a dam is to be built across the mouth of the bay. It will have large gates in it and also low head hydraulic reversible turbines are installed in it. A tidal basin is formed, which gets separated from the sea by dam. The difference in water level is obtained between the basin and sea. By using reversible water turbines, turbines can be run continuously, both during high tide and low tide. The turbine is coupled to generator, potential energy of the water stored in the basin as well as energy during high tides used to drive turbine, which is coupled to generator, generating electricity.

3.6 Geo Thermal Energy

This is the energy, which lies embedded with in the earth. According to various theories the earth has a molten core. The steam and the hot water comes naturally to the surface of the earth in some locations of the earth. Two ways of electric power production from geothermal energy has been suggested. In one of these heat energy is transferred to a working fluid which operates the power cycle. This may be particularly useful at places of fresh volcanic activity, where the molten interior mass of earth vents to the surface through fissures and substantially high temperatures, such as between 450 to 550 C can be found. By embedding coil of pipes and sending water through them can be raised. In the other, the hot geothermal water and or steam is used to operate the turbines directly. At present only steam coming out of the ground is used to generate electricity, the hot water is discarded because it contains as much as 30% dissolved salts and minerals and these cause serious rust damage to the turbine.

3.7 Small Hydropower

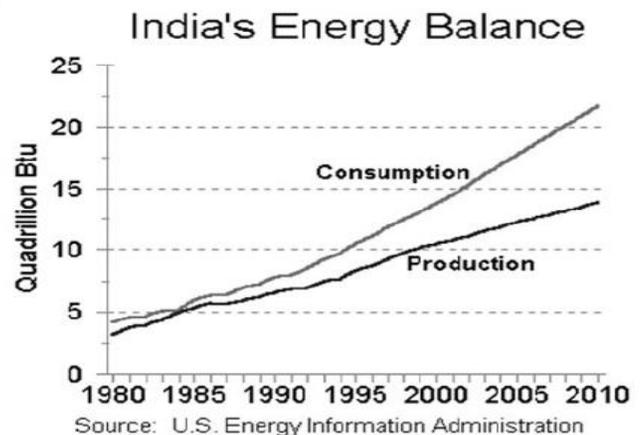
Energy from small hydro is probably the oldest and yet, the most reliable of all renewable energy sources. The term 'small hydro' has a wide range in usage, covering schemes having installed capacities from a few kW to 25 MW. In India small hydro schemes are further classified as micro hydro up to 100 kW plant capacity, mini hydro from 101 kW to 2000 kW and small hydro up to 25000 kW plant capacity. The advantage of this resource is that it can be harnessed almost everywhere in India from any nearby stream or canal – in the most environmentally benign manner, and without encountering any submergence, deforestation or resettlement problems which are generally encountered in the development of large hydro power development. Small hydropower development can reduce the load on conventional sources

of energy. Small hydro technology is mature and proven. Civil works and installation of equipment involve simple processes, which offer ample employment opportunities to local people and use locally available material. Gestation period is also short. Simple and proven design concepts suit local conditions. The development of small-scale hydropower in India started almost in the pace with the world's first hydroelectric installation in 1882 at Appleton USA. The 130 KW installations in Sidrapong (Darjeeling) in the year 1897 was the first installation in India. The other installations were Shivasamundram at Mysore (2000 kW).

3.8 Hydrogen Energy and Fuel Cells

In recent years hydrogen has been receiving worldwide attention as a clean and efficient energy carrier with a potential to replace liquid fossil fuels. Significant progress has been reported by several countries including India in the development of hydrogen energy as an energy carrier and an alternative to fossil fuels. Serious concerns relating to energy security. Depleting fossil fuel reserves, green house gas emissions and air quality are driving this global transformation effort towards a hydrogen-based economy. Hydrogen has high-energy content, when burnt, it produces only water as a by-product and is, therefore, environmentally benign. At present hydrogen is available as a by-product from several chemical processes, plants or industries.

4.Steps Towards Energy Anagement:



Taking the overview of these forecasts it is observed that in each and every area demand is more and the supply is less. If this situation persists no conventional source will remain to supply energy.

The draft renewable energy policy of the Govt. of India sets the following targets to be achieved.

- 30 million more households to have improved cook stoves

- 3 million more family-size biogas plants to be set up 5 million solar lanterns
- Decentralized electricity, including village grid tail-end injection systems, to be provided to one-quarter of these villages in the following manner, through power plants with an average installed capacity of 100 kW per plant:
 - 500 solar photovoltaic plants
 - 2000 biomass gasifier-based power plants
 - 1000 small hydro power plants
 - 2 million solar home systems
 - 5 million square metres of collector area for low-temperature solar water-heating systems,

5. Conclusions

1. The renewable sources are cost effective, user-friendly, so that they can easily beat the fossil fuels
2. By promoting renewable energy sources we can avoid, Air pollution, soil pollution and water pollution
3. Country's Economy will increase
4. Due to technological advancement vehicles are made with improved fuel efficiency and also perfect hybrid vehicle are made
5. Throughout the year these sources are available without affecting the Environment

6. References

1. Solar Energy
- By Suhas P. Sukhatme
2. Non-Conventional Energy Sources
- By G. D. Rai
3. Non-Conventional Energy Sources – Principles, prospects and progress
- By K. M. Mital
4. Annual Report, 2004-2005, Ministry of Non-Conventional Energy Sources, Govt. of India, New Delhi, 2005.
5. Sharma M.P., Saini R.P., "SPV based electrification of remote rural area", National Symposium on recent advances in RET's, Shivaji University Kolhapur, Aug 13-14, 2002
6. www.wikipedia.com/non-conventionalresources.Php