THE PROBLEMS AND LIMITATIONS OF UTILIZATION OF UNTRADITIONAL ENERGY RESOURCES

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No doubt, energy manifests the whole cosmos. The existence of fire was realized when it sparked from stone friction. Since then it become an integral part of our livelihood (*Khoshoo, 1988*). Need is the mother of invention. Human life become rich due to his creativity, many ideas came in reality due to its innovations. Journey of this invention begins from many years' back. Man needs many things to live. As human society developed, man's needs are also increased. These essential needs to serve all material are available in the nature. If these materials are not utilized then those materials are one of the things in the nature. When these materials are used to fulfill human needs then known as resource. Any element in the natural environment, which is utilized for the fulfillment of human needs and progress, called natural resource. Resources are not, they become. Various natural resources have been in use from many years ago. But, in ancient period natural resources are available in abundance. Due to population explosion today natural resources are inadequate. Due to their surfeit utilization. These resources are come to end. 2500 years ago, wood was used as energy resource in Greek. At that time they used olive tree for that purpose. After that many trees and forests are cut down. These people have utilized gas and solar energy as energy resource also.

In the 19th century along with wood, coal, mineral oil, natural gas etc. were used in large quantity. All living beings have to get or to use various kinds of energies to live. These energy resources can be used once or can be used repeatedly. The problems regarding energy resources are arise due to wrong methods of their utilization. To avoid this wrong use and conserve them is essential. At the beginning of 19th century natural gas and mineral oil were discovered. By their internal combustion they are used to run engines. Further at the end of 19th century radioactive elements were discovered. By fission or fusion reactions in a short period by chain reaction tremendous amount of heat energy radiation's comes out. By reducing the speed and controlling this chain reaction scientist are successful to get energy long time in 1940.

For the production of hydel power big capital expenditure and long construction period required. Also for the production of atomic power large capital investment required and there is possibility of nuclear leakage. Due to that every country feels that production of energy from mineral oils and natural gas is less dangerous and cheapest way. Therefore, these resources are used extensively. Large use of them becomes the symptoms of the developed countries. Consciousness about the pollution due to production and combustion of coal and disel and petrol is created in 1950. After that this sense is increased more. In 1973 OPEC have raises the prices of oil. Due to that European countries feel trouble and they are in puzzle. Due to continuous rise in prices of oil European countries diverted towards the development of untraditional energy resources. Otherwise, solar, wind, tidal, geothermal and bio energies etc. are the energy resources never come to end and can be used repeatedly. Recently their use is increased. They are known as untraditional energy resources. There is no adverse effect on the environment due to their use. Due to this importance of untraditional energy resources were being increased. We can classify available energy resources as traditional and untraditional. On the earth natural resources are unequally distributed. Some resources occur in abundance whereas some resources found in limited areas.

Discussion—Natural resources can be classified as renewable and nonrenewable energy resources.

Renewable energy resources —In the nature accumulation of some resources are inexhaustibly available. Due to the human interaction these resources never destroyed. But some what difference merely in proportion of some resources. Such resources never come to end known as renewable resources as shown in Fig.

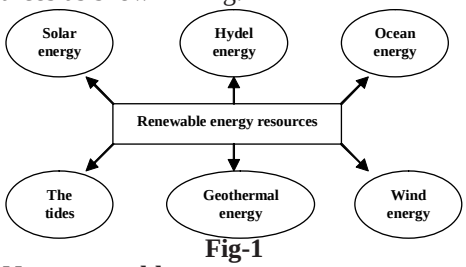

Fig-1

Non-renewable energy resources

In the nature accumulation of resources are in the limited forms. In this type of energy resources due to continuous use were come to end after some period therefore such resources are known as nonrenewable energy resources listed as in the Fig. 2.The existing energy resources can be classified as shown in the Fig. 3. The traditional and untraditional

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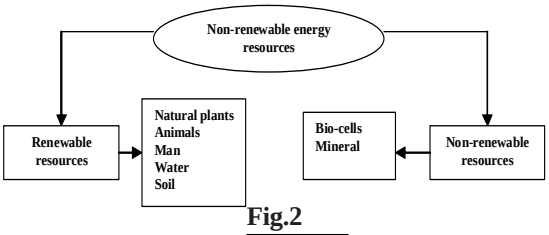

Fig.2

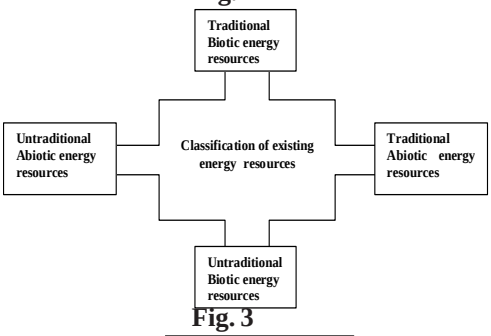

Fig. 3

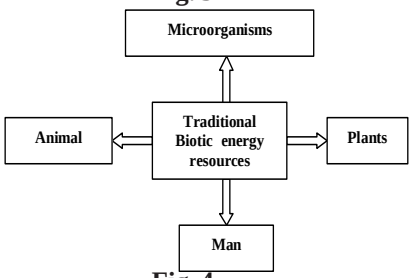

Fig. 4

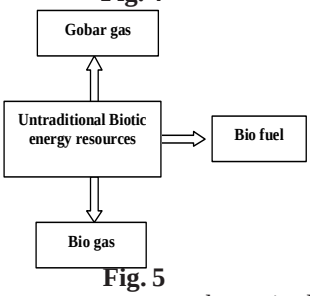

Fig. 5

biotic energy resources are shown in the Figs. 4 and 5. Whereas abiotic energy resources are as shown in the Figs. 6 and 7.

Some energy resources can be generated repeatedly are called renewable resources. These resources can be generated by natural cycles or by human being in specific period. In nature process of generation of such resources will be continuous but if the rate of utilization is greater than rate of production then there is shortage of such resources e.g., plants, soil water, animals, oxygen etc. Some resources are come to end after once use. It is impossible to generate them. Similarly some resources take very long period for their recreation such resources are known as nonrenewable resources e.g., minerals, coal,

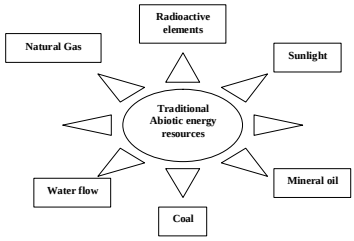

Fig. 6

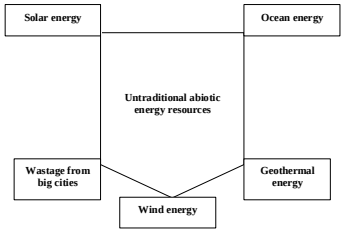

Fig.7

mineral oil, metals etc. Use of untraditional abiotic energy resources increased in 1765, after the European industrial revolution. For mainly this revolution various kinds of machines were developed and used. The steam engine was firstly used which works on the power of water steam. For generation of steam coal was used. In 19^{th} century electrical generators were investigated. In this way the man for his needs utilized various kinds of energies.

Untraditional energy resources Solar energy

Sun has the most unlimited source of energy. It is due to constant nuclear reactions going on in the sun. A total of 35 % energy is reflected by air molecules, dust, cloud etc., present in the atmosphere and also through surface reflections. Total energy present on the earth surface ($3´ 10^{24}$ J/year) comes from the sun at the rate of $173´ 10^{12}$ Kwatts, of which about 0.1% energy is utilized by plants which results in net annual production of $2´ 10^{11}$ tons of organic matter having energy content of $3´ 10^{12}$ J. Total annual energy used is the order of $3´ 10^{20}$ J (Hall, 1978, 1979). There are three routes of solar energy utilization:

1] Solar thermal route, 2] Photovoltaic route and 3] Biological route.

Energy received from sunrays is known as solar energy. Tremendous amount of solar energy comes

towards the earth. Use of this solar energy now being started by human. This energy is everlasting and cheap. Solar collectors collect this energy. For use of solar energy as non-conventional energy resources following devices are developed as listed below.

Solar ponds, Solar power towers, Ocean solar collectors, Solar tanks, Solar cookers, Solar water heater, Solar water pumps, Solar thermal power, Solar refrigeration, Solar distillation, Solar vehicles Plate 1 shows conversion of solar energy into electrical energy.

Limitations of production of solar energy—An initial investment is more. Clean climate is necessary. In rainy season the atmosphere is cloudy. So, at that time this technology is not useful. The life of the solar cell is not long. Skilled technicians are required to fit solar unit.

Wind energy—Much importance is for wind energy to solar energy. With the help of natural wind, this energy will be obtained. This energy would be utilized to run the floor mills, electric generators, wind mills, to bail out the water etc. By using wind power electricity is produced. Such energy is known as wind energy. Long ago man knows wind power. Man uses wind power effectively to paddle (to row) the ships in the sea. To bail the water, wind power had been used. Today by establishing windmills electric generators has been operated. A small form of windmill, which operates on wind, will produce 1 Kwatt electricity. Some times natural limitations comes on the production of wind power. When wind flow is very weak, it blows very slowly then wind power is not utilized.

Plate-2

Plate-3

For the production of wind power, the wind flow should be very fast. But, such condition will not available as always. The windmill should be established in the high hill areas e.g., on the top of the hills, mountains, in the coastal areas where there should be as minimum as possible obstacles. Therefore windmills in above mentioned areas wind power are utilized to produce wind energy. Near about 50 paisa per unit expenditure is to produce electrical energy when wind flows with speed about 25 Km/hr. Geographical conditions are favorable to produce electricity from wind power in India. In 1985 at Mandvi in Gujarat India's first commercial electric power station is established to produce electricity using wind power. According to scientists opinion India can produce 20,000Mwatt electricity using wind power.

Energy from wind can also be utilized by technological break through. National Aeronautical Ltd., Banglore is engaged in research and development of power generation through windmills. In many states of India, windmills have been setup for irrigation purposes. By using wind energy power generation plants can also be setup. Much work is to be done on utilization of wind energy.

One of the best benefits of wind power is that electricity produced by windmills is pollution free. There is no adverse effect on environment. According to nonconvetional energy resources ministry approximately 200 Kwatt windmill can generate average about 400000 Kwatt electricity per year. To produce this amount of energy 120- 200 tons of coal is required in thermal power stations. Again from its combustion harmful gases released in the environment causing pollution. In world USA, Germany, France Denmark is ahead in producing electricity from wind power. Plate 2 and 3 shows windmills

Limitations of Producing wind energy—Wind cannot flow continuously 24 hours. It can be produced at the top of hills, mountains, and coastal areas by establishing windmills, where wind flows with speed more than 25Km/hr. When speed of wind flow is less than 25 Km/hr, wind energy cannot produce. Initial cost is more to establish the windmills. In India there are very few areas where more than 10 hours speed of wind is more than 25 Km/hr.

Hydel energy

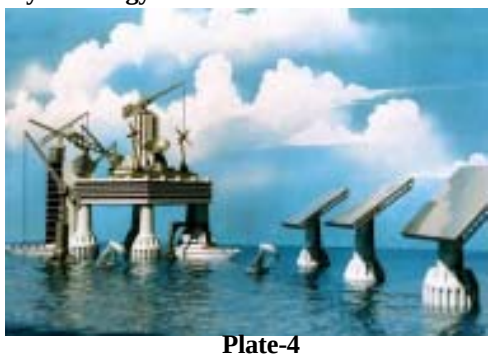

Plate-4

In 19th century water flow had been used to grind and to cut wood in Europe. 19th century hydel energy is used to operate water mills in USA. Hydel energy is used near riversides. By using water hydel energy

have been produced. For the production of hydel energy it is essential that rivers flow all year round as well as waterfall on such rivers. Hydel energy can be produced in the high hill areas, high rain fall areas and on the dams etc. After the discovery of turbine engines and cement it is possible to convert hydel power into electricity. Big dams are built on the big rivers to produce electricity. This energy is clean energy due to that there is no question of pollution. Today in India hydel power is generated at the Bhakaranagal, Hirakud, Chambal, Nagargunsagar, Koyna, Periyar etc. Big hydel energy projects are working in the world. Japan and Korea are recognized as leading countries in producing hydel power. Today in USA, Sweden, Norway, Switzerland produce hydel power in the world also.

Table 1 shows the waterpower potential in India.

Location	Potential (MWatts)
Ganges Basin	4890
Indus Basin	6580
Brahamputra Basin	12490
Central India	4290
South India	12930
Total	41180

Tidal energy—Energy has been produced from ocean tides. In 1984 in the Bay of Bengal near Madras experiments are made to produce electricity-using tides in India. In seawater 500 Km from the shore tide controlling and producing mechanism was installed. According to one deduction in India about 175 to 200 Mwatt electricity can be produced. According to intensity of seawater tides, tide divider and tide controller wall has created. From all types of tides electricity can be generated.

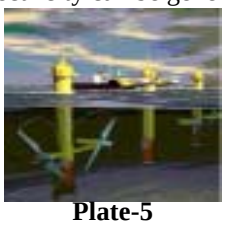

Plate-5

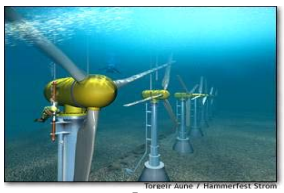

Plate-6

The tides are generated continuously in coastal region. During the neap and spring tides big tides are collides on the shower. Here water level increases. In gulf region the high of tides are 15 meters. To produce electricity from tides, the height must be 8 meters. At the time of tide, tide water, fall down like a waterfall. On this down flow of water, turbines are used to produce electricity. The plates 4,5,6 shows Hydel Energy plants

Jeffrey has estimated that the rate of tidal energy dissipation for the world is about $3' 10^{6}$ Mwatts. Hubert has completed the available information on favorable locations and the tidal power, which can be generated from each of them, and estimates that a maximum capacity of 63800 MW can be harnessed. The first commercial tidal power station in the world was constructed in France in1965 across the mouth of the La Rance estuary.it has a capacity of 240 MW. The average tidal range at La Rance is 8.4m.The variations of the tidal range at four possible sites in India is given in the table2.

Site	Spring tide Range in (m)	Neap tide Range in (m)	Average Range in (m)
Bhavnagar	10.29	3.60	7.00
Navlakhi	7.77	3.74	5.45
Kandla	6.32	3.68	5.00
Sagar	4.71	1.40	3.06

Table-2

Limitations of producing hydel energy—This technology is not sophisticated. Many times in the absence of neap and spring tides, the height of tide is less than 8 meters at that time it is impossible to generate electricity by using them. To builds the damps near the mouth of gulf is very expensive. But, this is one of the alternatives to produce non-conventional energy particularly in the coastal areas.

Nuclear Energy—In recent years, we have many hopes for getting nuclear energy. It is made available through the two processes.

Nuclear fission—In this process, where a nucleus of an element is broken into two nuclei or more and releases sufficient amount of energy. For getting energy of this kind, nuclear reactors are set up in the developed and some of developing countries like India.Energy are generated from Uranium for the peaceful work.

Nuclear fusion—This is the process in which energy is released as a result of joining of two very small nuclei. This method of nuclear generation is still in infantry stage. It may take more than 50 years to be developed. The Plate 7 shows the nuclear power plant.

The table 3 shows nuclear power potential in India in 1993.

Location	Capacity (Mwatts)
Tarapur (M. S.)	320
Ranapratap Sagar (Raj.)	440
Kalpalckam(Tamil Nadu)	470
Narora (U. P.)	470
Kakarapara (Guj.)	235
Total	1935

Table-3

Plate-7

Limitations—In spite of development of nuclear waste management technology, still there is fear for the disposal of radioactive nuclear waste. Radioactive

chemicals are long lived, and if entered into human systems it can cause death also.

Fossil fuel energy—The living plants buried during the carboniferous period have been a source for fossil fuels. Coal is the major reserve followed by oil and natural gas. It is widely distributed and occurs in high quantity. It may reach its peak of production in another 150 years (*Mc Mullan et al 1976*). Oil stands second to coal; its price is increasing day by day due to high cost of extraction and purification. In the 1973, when oil producing countries in the Middle East, decided to reduce the oil production and raised the oil price, there has been very significant effect on the economies of non-oil producing nations. With the onset of oil crisis, most of the countries became aware of their total dependence on only on form of energy. It was soon realized that mankind had been living in a petroleum society and that this crisis threatened the life style, as also the national security because most of the defense systems use petroleum as energy.

Non-fossil fuel energy—The sun, the earth, the moon and water and wind are the other sources of energy owing to which our existence is possible. Global power potential of some of renewable resources is given in the table 4.

Resources	Total Watts (W)		Useful power Watts		Potential (quards* per year)
Wind	1. 3	10^{15}	1. 3	10^{14}	3900
Hydro	9. 0	10^{12}	2. 9	10^{12}	86
Waves	7. 0	10^{13}	2. 7	10^{12}	80
Ocean thermal	5. 0	10^{13}	2. 0	10^{12}	59
Geothermal	2. 7	10^{13}	1. 3	10^{11}	4
Tidal	3. 0	10^{12}	6. 0	10^{10}	1.9
Current	1. 0	10^{11}	5. 0	10^{10}	1.6

Table-4

Energy from tides and geothermal one have least contribution. Recently in Gujarat the central electricity authority at the Katch tidal power project, Navalakhi is investigating for the possibility of electricity generation from tidal wave energy along specific areas of Indian coastline. It is hoped that 900 Mwatts electricity can be generated. Investigations for the assessment of tidal power potential in the Gulf of Kutch were conducted by the NHPC in association with NIO, GSI and CWPRS.

Geothermal energy—Because of non-homogeneities of the earth crust, there are numerous local hot spots just below surface where the temperature is in fact much higher than the average value expected ground water comes into contact with the hot rocks in some of these locations and as a result, either dry steam or wet steam water are formed. A well drilled to these locations causes steam to emerge at surface where its energy can be utilized either for generating electricity or for space heating. Geothermal energy is the energy coming out of the molten interior of the earth towards the surface .The average rate at which this heat emerges is about 0.05 W/m^2 while the radial temperature gradient which causes this heat flow is about 0.03/m.

Wadia Institute of Himalayan Geology, National Geographical Research Institute and GSI are conducting investigations on geothermal energy potential in some part of UP. No details are yet available except at Tapovan and Badrinath. Works on geothermal energy wood be fruitful in remote places were both fuel and hydroelectric power being difficult to supply. **Plate-8**

The first geothermal power plant was set at Larderallo in Italy 1904. The largest concentration of geothermal power stations is in the Geysers area in California, USA. Here, the installed capacity in 1992 was 2212 MW. For the world as a whole the total installed capacity in 1992 was 5092 MW. And estimate amount of the electricity which could be generated from geothermal dry or wet steam sources all over the world was made by White P.E. This is about 62500 MW could be generated for the period of 50 years. In India geothermal sources in the form of steam and hot water are exist along the West Coast, in Ladhak and some parts of Himachal Pradesh, however, no firm estimate of their potential for generating electricity is available. The Plate 8 shows Geothermal Power plant.

Bio-energy—Scientist Melvis Calvin has predicted that petrol and diesel can be obtained from *Euphorbia latheris*, *Compykhera multijuga* plants. *Euphorbia latheris* plants are cut and dried. After specific chemical treatment their extract being obtained, from that oil could be obtained which can be used as a fuel to run vehicles. *Compykhera multijuga* plants are found in Brazil from their stems oil can be obtained. Also the plants *Pittosporum rancyforam* occur in Philippines oil is obtained and used as fuel. As per the limitations of accumulations of mineral oils it is wiser that to give attention at proper time towards the option of bio-energy. By giving attention, India has adopted the policy to enhance the generation of alternative fuel by studying the various options like untraditional energy, biotic energy, and biotic fuel. To produce bio-fuel Jetropha is the best plant. Thought, it is American by origin it grows very fastly in Asia and Africa. The oil extracted from Jetropha seeds successfully used to run the diesel engines. Bio-diesel gets from transistification process doing on oil, which extracted from plants. In this process 100 parts oil, 10 parts methanol in the presence of catalysts at specific temperature get methyl ester 190 parts of plant oil. Also 10 parts of Glycerin will produce as a byproduct. The experiment of using this oil in diesel engines is successful. Due to transistification process density of oil is reduced and characteristics of methyl ester matched with diesel. Use of bio diesel increases the life of engine because lubricant capacity of this oil is very good also the boiling point of bio diesel is higher than mineral oil.

Limitations of producing bio -diesel—Bio diesel

can be produced from any kind of plant oil. The oil produced from edible oil is not beneficial because it is too costly. Today in India the consumption of mineral oil is about 4 crore tons per year. Such much quantity of bio diesel production is very costly.

Energy from organic substances—Today particularly in rural area firewood, cane, cotton sticks, husk and other farm wastage are used as fuel. In big cities massive amount of solid wastage has produced. By burning it heat can be produced and used to make steam to operate the turbines to produce electricity. To produce 10Mwatt electricity 25 crore rupees expenditure is expected. In one district production of 70 Mwatt electricity is possible by using above mentioned wastage. All over India numbers of sugar industries are formed. If they produce electricity by using baggas produced in those industries, they can produce 10 - 30 Mwatt electricity. This is one of the best alternatives for the production of electricity, from organic substances. If 1000 sugar industries commercially produce electricity they can produce 10-30 thousand Mwatt of electricity.

Bio-gas—In 1776, for the first time the Italian physicist, Voltas demonstrated methane in the marsh gas, generated from organic matter in bottom sediments of ponds and streams. Under anaerobic conditions the microorganisms converts organic matter into gases and organic fertilizer (sludge). The mixture of gases is composed of 63% methane, 30% CO_2, 4% nitrogen and 1% hydrogen sulphide and traces of hydrogen, Oxygen and CO. Methane is the main constituent of Biogas. It is called biofuel (Da Silva, 1981). About 90% energy of substrate is retained in methane. Biogas is generally used for cooking and lighting purposes in rural section. But in addition there are many other advantages in installing Biogas plants. It can be used in internal combustion engines to power water pumps and electric generators. It is used as fuel in fuel type refrigerators. Sludge is used as bio fertilizer. The most economical benefits are minimizing environmental pollution and meeting the demands of energy for various purposes. India is one of the pioneer countries in Biogas technology where Biogas research and plant construction has been carried out. Biomasses from animals are cattle dung, poultry manure, and slaughter house and fishery waste. In most of biogas plants cattle dung is used for gas production. Beside cattle dung, agricultural waste containing cellulosic and lignocellulosic materials are also being used. Table 5 shows the major biogas plants with their production capacity.

Biogas Plants in India	**Capacity (per Day)**
Rajapurwa biogas plant kanpur (U.P)	$55m^3$
Sewage plant at Okhla (New Delhi)	$17000m^3$
Dadar sewage treatment plant (Mumbai)	$2800m^3$
Sonepat (Hariyana)	$50m^3$

Table-5

Plate-9

Plate-10

Plate 9 shows Biogas Unit while plate 10 shows process of biogas production.

Conclusion—Limited availability of traditional resources, probability of end of these resources in future, use and development of untraditional resources very slow up till now, emergence of various dangers of pollution's during use of traditional resources, minimum expenditure, minimum pollution and maximum safety energy could be produce considering all above-mentioned things. One conclusion can be drown that produced energy should be utilized economically for useful and productive works and not utilized for unnecessary purposes. Utilization of available energy and energy resources economically and efficiently means energy conservation. This is not the responsibility of individual or particular factor. This is the social responsibility and should be obey by the every factor of the society. Then and then only we can over come the problems of the energy crises.

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