NON-CONVENTIONAL ENERGY SOURCES NEW SCOPES

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Abstract : Energy is the key input to drive and improve the life cycle. Primarily, it is the gift of the nature to the mankind in various forms. That the human race faced an energy crisis became painfully obvious during the 1970s. Since that time the blatant obviousness of the problem has waned, but the underlying technical and political problems have not disappeared. Humanity continues to increase in number (the world population is, at present, in excess of five billion) and, despite major efforts towards improving the efficiency of energy consumption, the overall per capita use of energy continues to increase.

With ever growing population, improvement in the living standard of the humanity, industrialization of the developing countries, the global demand for energy is expected to increase rather significantly in the near future. The primary source of energy is fossil fuel, however the finiteness of fossil fuel reserves and large scale environmental degradation caused by their widespread use, particularly global warming, urban air pollution and acid rain, strongly suggests that harnessing of non-conventional, renewable and environment friendly energy resources is vital for steering the global energy supplies towards a sustainable path.

I. INTRODUCTION

1.1)Energy Sources

Originally, coal was the main source of energy. It remains so throughout the 18th century during the period of the rapid industry development. Later on, oil and naphtha began to be used as energy sources and their usage expanded especially in 19th century. A special feature of the above mentioned fossil fuels is their long creation period – requiring millennia. They are a result of rotting of different plant and animal kinds. In comparison to the period of their formation, the period of their utilization is far shorter. In accordance with a number of existing statistics about 2050 year it may be talked about a
depletion of the liquid fossil fuels, also, the world coal supplies are considered to last within the next 200 years.

Therefore, the development of nuclear power engineering is considered to be one of the alternatives to generate energy. Recently, the nuclear power energy generation has been denied in many countries because of the risks associated with its generation and because these risks have been confirmed by serious accidents throughout the World. The storage of worked nuclear waste is also a problem and risky. The renewable energy sources are another possibility to generate energy. Significant achievements have been made in the 20th century. Many of them need additional supplies of energy. The needs are especially high in the developing countries. Different kinds of energy sources known at present are shown in Figure 1.

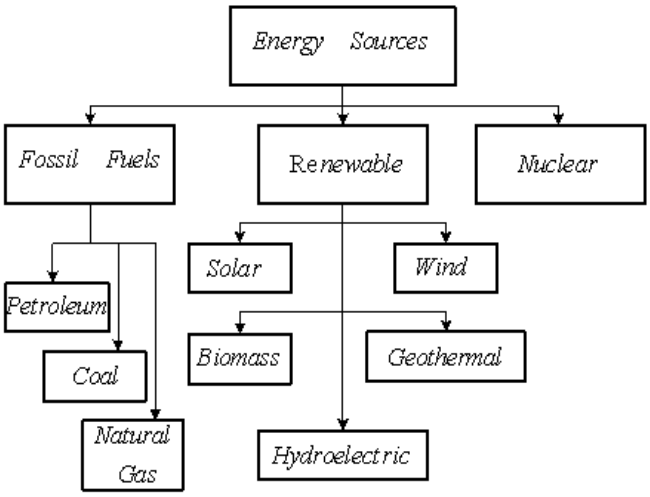


Figure 1.: Different kinds of energy sources

Fossil fuels supply most of the energy consumed today. They are relatively concentrated and pure energy sources and technically easy to exploit, and provide cheap energy.

Presently Oil 40%, natural gas 22.5%, coal 23.3%, hydroelectric 7.0%, nuclear 6.5%, biomass and others 0.7% provide almost all of the world's energy requirements.

However the reserves of fossil fuels are limited as under:

- Conservative predictions are that conventional oil production will peak in 2007.
- The pessimists predict a peak for conventional gas production between 2010 and 2020.
- There are today 200 years of economically exploitable reserves of coal at the current rate of consumption.
- The raw material for nuclear power i.e. uranium reserves will last for 50 years at the present rate of use(Though there are other alternatives raw materials such as thorium but this technology is yet to be Developed.)

II. CONVENTIONAL ENERGY

Petroleum, the most widely used energy source, is a fluid and is easily transportable with currently estimated worldwide reserves. In considering energy reserves it is wise to be cautious, because any estimate of the reserves of any material (be it oil, coal, uranium or breadfruit) depends on two factors: First, how well do we know the geology/geography of our planet and where the substance might be foxed? Second, how much is the resource worth? As energy sources become scarce, the price of energy will increase and sources that were once uneconomic to develop will become attractive. To compound this problem scarcity can result from depletion of the source material through use or from other human actions (politics, war, etc.).

As an added complication, petroleum is used for more than an energy source. It is used to make a variety of products, ranging from fertilizers to pharmaceuticals; and some thought needs to be devoted to this fact before all the available petroleum is burned to generate energy.

Besides the classical "oil well", additional sources of petroleum lie in tar sands and oil shale deposits. It is difficult to measure the amount of these additional sources of petroleum, but we shall estimate them to be 9.0 Q. To further complicate matters, the extraction of petroleum from tar sands and oil shale deposits is not, as yet, a practical matter—in other words, considerable engineering needs to be done. All-in-all, we have estimated reserves of oil of some 21.7 Q.

If burned to produce energy this amount will yield considerable carbon dioxide and other air pollutants (a 1,000 Mwe power plant burning oil emits over 158 tons of pollutants into the air each year).

Coal is our most plentiful fossil fuel energy source. However, it is a particulate solid and is, therefore, not easy to transport. Additionally, there are environmental problems, both where coal is mined and where it is bummed (among these problems are acid rain and the greenhouse effect). Estimated coal reserves are 31.3 Q world-wide [12].

The third fossil fuel is natural gas. This gaseous material is easily transportable, easily stored, but does, like coal and petroleum, lead to carbon dioxide and the greenhouse effect when bummed. Edmonds and Riles estimate [12] that approximately 10.8 Q of natural gas are potentially available on a world-wide basis.

III. NON -CONVENTIONAL ENERGY

Concept of Renewable Energy

3.1)Renewable energy sources also called non-conventional energy are sources that are continuously replenished by natural processes. For example, solar energy, wind energy, bio-energy - bio-fuels grown sustain ably), hydropower etc., are some of the examples of renewable energy sources

A renewable energy system converts the energy found in sunlight, wind, falling-water, sea-waves, geothermal heat, or biomass into a form, we can use such as heat or electricity. Most of the renewable energy comes either directly or indirectly from sun and wind and can never be exhausted, and therefore they are called renewable.

However, most of the world's energy sources are derived from conventional sources-fossil fuels such as coal, oil, and natural gases. These fuels are often termed non-renewable energy sources. Although, the available quantity of these fuels are extremely large, they are nevertheless finite and so will in principle ‘run out’ at some time in the future

Renewable energy sources are essentially flows of energy, whereas the fossil and nuclear fuels are, in essence, stocks of energy

3.2)Various forms of renewable energy

Solar energy
Wind energy
Bio energy
Hydro energy
Geothermal energy
Wave and tidal energy

3.3)Solar Energy

The remainder of the energy sources may all be classified as solar energy derived. The length of the casual chain between the nuclear fusion reaction occurring in the sun and our eventual use of some form of energy may very well vary, but all of these energy sources are dependent on the existence of the sun. Each hour the earth receives 173 x 10^^ kwh of energy from the sun. Over a year, this corresponds to 5,160 Q, a figure more than 12,000 times the current energy requirements of the human race. Not all of this energy reaches the surface of the earth. A portion is reflected by clouds, by the oceans and by the land. This amounts to some 1,570 Q [21]. An additional 1,120 Q. is employed in evaporating water from the oceans, lakes and rivers. The remainder, 2,490 Q, is available for such purposes as powering photosynthesis, warming the surface of the earth and providing energy for the human race. Utilizing land-based solar energy collector/converters alone, the potential solar energy supply available for use by man is in the neighbourhood of 1,100 Q. This value is still over two thousand times the

present energy requirements of the human race.

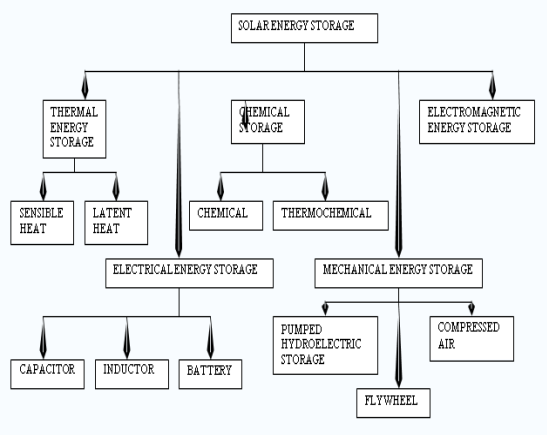


Figure 2: present energy requirements of the human race

Solar energy can be used in two ways:

- Solar heating.
- Solar electricity.

Solar heating is to capture/concentrate sun's energy for heating buildings and for cooking/heating foodstuffs etc. Solar electricity is mainly produced by using photovoltaic solar cells which are made of semi-conducting materials that directly convert sunlight into electricity. Obviously the sun does not provide constant energy to any spot on the

Earth, so its use is limited. Therefore, often Solar cells are used to charge batteries which are used either as secondary energy source or for other applications of intermittent use such as night lighting or water pumping etc. A solar power plant offers good option for electrification in areas of disadvantageous locations such as hilly regions, forests, deserts, and islands where other resources are neither available nor exploitable in techno economically viable manner. MNES has identified 18, 000 such villages to be electrified through non-conventional sources.

India is a vast country with an area of over 3.2 million sq. km. Most parts of the country have about 250-300 sunny days. Thus there is tremendous solar potential.

3.4)Wind Energy

Wind energy is basically harnessing of wind power to produce electricity. The kinetic energy of the wind is converted to electrical energy. When solar radiation enters the earth's atmosphere, different regions of the atmosphere are heated to different degrees because of earth curvature. This heating is higher at the equator and lowest at the poles. Since air tends to flow from warmer to cooler regions, this causes what we call winds, and it is these airflows that are harnessed in windmills and wind turbines to produce power.

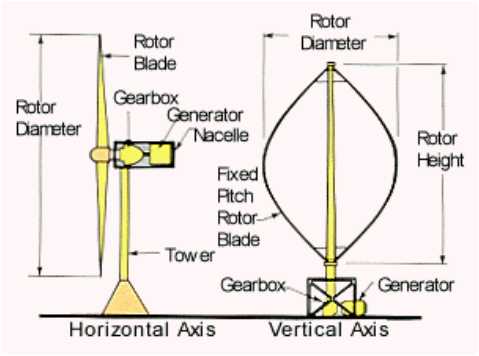
Wind power is not a new development as this power, in the form of traditional windmills -for grinding corn, pumping water, sailing ships – have been used for centuries. Now wind power is harnessed to generate electricity in a larger scale with better technology.

3.4.1)Wind Energy Technology

The basic wind energy conversion device is the wind turbine. Although various designs and configurations exist, these turbines are generally grouped into two types:

1. Vertical-axis wind turbines, in which the axis of rotation is vertical with respect to the ground (and roughly perpendicular to the wind stream),

2. Horizontal-axis turbines, in which the axis of rotation is horizontal with respect to the ground (and roughly parallel to the wind stream.)



3.5)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.

3.6)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 – 250K. 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.

3.7) 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.

3.8)Geo Thermal Energy

This is the energy, which lies embedded within the earth. According to various theories the earth has a molten core. The steam and the hot water come 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 this 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 5500C 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.

3.9)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 capacities. 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.

3.10)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.

IV. CURRENT TECHNOLOGIES FOR IMPROVING RENEWABLE ENERGY EFFECTIVELY

4.1) Metal Nanoparticles For Solar Cells: Current solar cells cannot convert all the incoming light into usable energy because some of the light can escape through the back of the cell. Additionally, sunlight comes in a variety of colours and the cell might be more efficient at converting bluish light than reddish light. The nanoparticle approach, described in a recent paper in Optics Express, describes a relatively new approach to solar cells – lacing them with nanoscopic metal particles to address these problems.

4.2) Organic solar cells are a step closer Recent experiments conducted by Dr. Greg Scholes and Dr. Elisabetta Collini at the Chemistry Department of University of Toronto, Canada, have provided new insights into the way molecules absorb and move energy. The chemists looked specifically at conjugated polymers, believed to be one of the most promising candidates for building efficient organic solar cells.

4.3) Organic nanotubes solar cell The University of Surrey, the United Kingdom, will develop carbon nanotube- doped organic solar cells under a three-year programme. Dr. Ravi Silva, Director, Advanced Technology Institute at Surrey, explains, "The best organic solar cells are currently 5-6 per cent efficient. We hope to be able to go up to above 10 per cent by the end of the project". A 10 per cent efficiency is viewed as the threshold, beyond which solar cells are commercially viable.

4.4) Robotic inspector for wind turbines Rotor blades of large turbines have to withstand a great deal of pressure and long-term exposure to the elements. Hence, regular checks are a must to ensure optimal operation and safety. But the general structure and size of these wind turbines can make inspection and maintenance quite a dangerous and tedious task.

4.5) Technology to maximize wind turbine efficiency The Switch, Finland-based provider of technology packages for wind power and other new energy applications, has launched technologies to enable wind installations to more effectively capture wind power and transform it to significantly higher energy production.

4.6) Tidal power inspired by wind technology Tidal Energy Limited, a renewable energy company in the United Kingdom, has teamed up with experts in ship propulsion to design a new marine turbine that is believed to be robust enough to withstand life in the harsh and choppy seas. The turbine will draw on the time-tested propeller technology of ships, albeit working in reverse.

4.7) Wave and wind power hybrid machine Bundling together the benefits of two eco-friendly forms of power generation, Green Ocean Energy Ltd. Of the United Kingdom has developed

a wave power machine that attaches to an off-shore wind turbine. Each unit of Wave Treader can generate up to 500 kW,

4.8)World's smallest working fuel cell The world's smallest working fuel cell, which measures just 3 mm across, has been created by chemical engineers at the University of Illinois at Urbana-Champaign, the United States. The 3 × 3 × 1 mm hydrogen-fuelled "micro fuel cell" is able to generate 1 mA

current without consuming any power, according to a New Scientist report

V. CONCLUSION

Keeping in view the reserves of the fossil fuels and the economy concerns, these fuels are likely to dominate the world primary energy supply for another decade but environmental scientists have warned that if the present trend is not checked then by 2100, the average temperature around the globe will rise by 1.4 to 5.8 degrees Celsius, which will cause a upsurge in the sea water levels drowning all lands at low elevation along the coastal lines. So the world has already made a beginning to bring about the infrastructural changes in the energy sector so as to be able to choose the renewable energy development trajectory. In developing

countries, where a lot of new energy production capacity is to be added, the rapid increase of renewable is, in principle, easier than in the industrial countries where existing capacity would need to be converted if a rapid change were to take place. That is, developing countries could have the competitive advantage for driving the world market.

However, strong participation of developed countries is needed since majority of energy technologies in use in developing countries have been developed and commercialized in developed countries first. Nevertheless, India must give more thrust to the research and development in the field of non-conventional energy sources not only to mitigate greenhouse effect but also to lessen dependence on oil/gas import, which consumes major chunk of foreign exchange reserve. It is also clear that an integrated energy system consisting two or more renewable energy sources has the advantage of stability, reliability and are economically viable. Last but not the least, it is for the citizens also to believe in power of renewable energy sources, and understand its necessity and importance.

In The presentation we are going to introduce various technologies present and which are implemented inoreder to use renewable energy sources for better energy generation . Technologies like nano technology smart grid technologies will be introduced besides many other technologies available for effective usage of renewable energy source

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