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INCIPIENT TRENDS IN ENERGY FORAGING: A REVIEW

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Abstract:-

The search for new alternative energy systems has increased greatly in the last few decades for the following reasons: The extra demand on energy within the next five decades will continue to increase in such a manner that the use of fossil fuels will not be sufficient, and therefore, the deficit in the energy supply will be covered by additional energy production and discoveries. Fossil fuels are not available in every country because they are unevenly distributed over the world, but renewable energies are more evenly distributed and, consequently, each country will do its best to research and develop their own national energy harvest. Fossil fuel combustion leads to some undesirable effects such as atmospheric pollution because of the CO2 emissions and environmental problems including air pollution, acid rain, greenhouse effect, climate changes, oil spills, etc. It is understood by now that even with refined precautions and technology, these undesirable effects can never be avoided completely but can be minimized. One way of such minimization is to substitute at least a significant part of the fossil fuel usage by renewable energy sources

Key words: - Renewable energy, solar, wind, bio mass, fossil fuel.

1. INTRODUCTION

Energy is essential to our society to ensure the quality of life and to underpin all other elements of our economy. 60% of total energy resources have been already used by us in last 200yrs, and the Remaining 40% will last for few decades only. Formation of fossil fuel takes million of years, so the shortage of energy comes in picture. Thus we are going face energy crisis in the future. Apart from energy crisis Petroleum is one of the key player in politics. The only way to get out of it is to introduce alternate methods using renewable sources. With the increasingly urgent energy issues, the world is great importance to begin the development of new energy and related technology. Thus Energy is critical for sustainable development. Energy is not only at the center of sustainable development, but also at the center of development itself. [1] At present, large-scale photo voltaic power generation and scale of renewable energy has become important parts of development strategy. Wind power has established itself as one of the most important renewable energy source over the past decades. Biomass is a renewable energy resource from organic material which has stored solar energy from sunlight in the form of chemical in the plants through photosynthesis process. Among the

many renewable energy alternatives, solar-hydrogen energy is regarded as the most ideal energy resource that can be exploited in the foreseeable future [2]

RENEWABLE ENERGY	NON RENEWABLE ENERGY	
solar	Traditional	Alternative
wind	Oil	Nuclear
hydro	Gas	Tar sands
Ocean	coal	Oil shale
Geothermal		Gas hydrate
biomass		

Table 1. Classification of energy resources

2. RENEWABLE ENERGY TRENDS ACROSS THE GLOBE

The current trend across developed economies tips the scale in favour of Renewable Energy. For the last three years, the continents of North America and Europe have embraced more renewable Power capacity as compared to conventional power capacity. Renewables accounted for 60% of the newly installed power capacity in Europe in 2009 and nearly 20% of the annual power production [6].

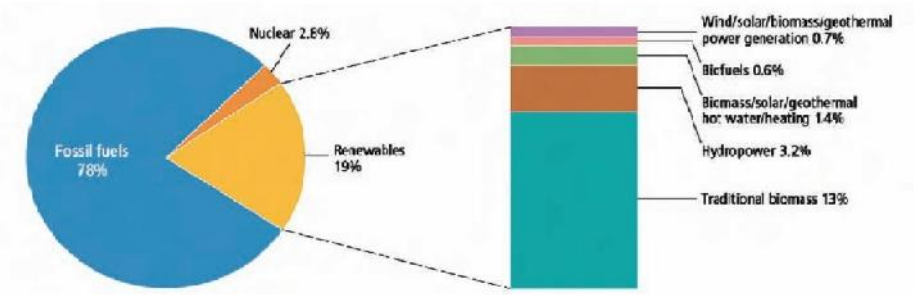

Figure 1: Global energy consumption in the year 2008[6]

As can be seen from the figure 1, wind and biomass occupy a major share of the current renewable energy consumption. Recent advancements in solar photovoltaic technology and constant incubation of projects in countries like Germany and Spain have brought around tremendous growth in the solar PV market as well, which is projected to surpass other renewable energy sources in the coming years. By 2009, more than 85 countries had some policy target to achieve a predetermined share of their power capacity through renewables. This was an increase from around 45 countries in 2005. Most of the targets are also very ambitious, landing in the range of 30-90% share of national production through renewables [6]. Noteworthy policies are the European Union's target of achieving 20% of total energy through renewables by 2020 and India's Jawaharlal Nehru Solar Mission, through which India plans to produce 20GW solar energy by the year 2022. [14]

3. WIND ENERGY

As present the total wind potential on earth during the entire year is approximately twice the world energy consumption from conventional sources. Steve Taube, an alternative energy analyst at Cambridge Energy Research Associates states that "Rising fossil fuel prices are making renewable energy more competitive in the power market" Not only does wind have a fixed cost to produce, it is also more efficient. As an example, A 60 watt Incandescent light burning for non-stop for one year requires 427 pounds of coal. As opposed to a single 600 kW wind turbine would only have to spin for 2.94 hours to power that light bulb for a year. Another point to take into consideration is Price Stability: "The price of electricity from fossil fuels and nuclear power can fluctuate greatly due to highly variable mining and transportation costs. Wind can help buffer these costs because the price of fuel is fixed and free."[11] The utilization of wind power has great benefit to protect the environment and it will become a trend. Compared to other power generation technologies, particularly the coal-fired power, wind power has absolute environmental advantages. Wind power only emits a small amount of C02 in its construction, which is negligible for the global carbon dioxide emissions. Therefore, the development and utilization of wind power has a very large positive effect to protect the atmospheric environment. [13]

Power generation technology	**The carbon dioxide produced by the different power generation stage**			
Conventional coal fired power generation	Fuel extraction	building	running	Total numbers
Fuel power generation	1	1	962	964
Natural gas fuel power generation	0	0	726	726
Ocean thermal energy	0	0	484	484
Geothermal steam to generate electricity	0	4	400	404
Wind power	0	7	7	7

Table 2. CO2 RELEASED BY DIFFERENT ENERGY SOURCES. [20]

Water is a valuable resource to human survivor, with increase world population and climate change use of water need to be wise, one major advantage in using non-fossil based fuel is water saving in full generation. 29% of the saving would come from the west side of the country. [15]

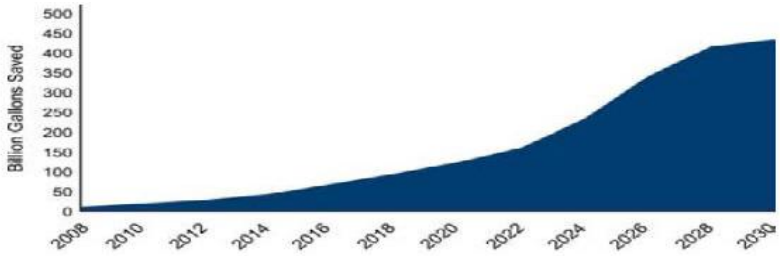

Figure-2 Annual water consumption savings due to deployment of wind Energy

There is good prospect for the development of the wind power. We should vigorously promote the use of clean energy, especially the use of wind energy resources, in order to promote stable and high-speed development Thus, wind power has great significance for the protection of environment and the large-scale development of wind power has become an inevitable trend. At present, the development of wind power across the world is rapid, which is quite substantial [10]

4. SOLAR ENERGY

Almost all the renewable energy sources originate entirely from the sun. The sun's rays that reach the outer atmosphere are subjected to absorption, reflection, and transmission processes through the atmosphere before reaching the earth's surface On the other hand, depending on the earth's surface topography, the solar radiation shows different appearances. The emergence of interest in solar energy utilization has taken place since 1970, principally due to the then rising cost of energy from conventional sources. Solar radiation is the worlds most abundant and permanent energy source. The amount of solar energy received by the surface of the earth per minute is greater than the energy utilization by the entire population in one year. For the time being, solar energy, being available everywhere, is attractive for stand-alone systems particularly in the rural parts of developing nations. Occurrences of solar energy dynamically all over the world in the forms of wind, wave, and hydropower through the hydrological cycle provide abilities to ponder about their utilization, if possible instantly or in the form of reserves by various conversion facilities and technologies. It is also possible that in the very long term, human beings might search for the conversion of ocean currents and temperature differences into appreciable quantities of energy so that the very end product of solar radiation on the earth will be useful for sustainable development. The design of many technical apparatuses such as coolers, heaters, and solar energy electricity generators in the form of photovoltaic cells, requires terrestrial irradiation data at the study area. Scientific and technological studies in the last three decades tried to convert the continuity of solar energy into sustainability for the human comfort. Accurate estimations of global solar radiation need meteorological, geographic, and astronomical data and especially, many estimation models are based on the easily measurable sunshine duration at a set of meteorology stations. Solar energy is referred to as renewable and/or sustainable energy because it will be available as long as the sun continues to shine. Estimates for the life of the main stage of the sun are another 4 – 5 billion years. The energy from the sunshine, electromagnetic radiation, is referred to as insolation. Wind energy is derived from the uneven heating of the earth's surface due to more heat input at the equator with the accompanying transfer of water by evaporation and rain. In this sense, rivers and dams for hydro-electric energy are stored solar energy. The third major aspect of solar energy is its conversion into biomass by photosynthesis. Animal products such as whale oil and biogas from manure are derived from solar energy. [5] The tapping of solar energy owes its origins to the British astronomer John Herschel. Who famously used a solar thermal collector box to cook food during an expedition to Africa. Solar energy can be utilized in two major

ways. Firstly, the captured heat can be used as solar thermal energy, with applications in space heating. Another alternative is the conversion of incident solar radiation to electrical energy, which is the most usable form of energy. This can be achieved with the help of solar photovoltaic cells or with concentrating solar power plants. A significant advantage of photovoltaic (PV) systems is the use of the abundant and free energy from the sun.

However, these systems still face major obstacles that hinder their widespread use due to their high cost and low efficiency when compared with other renewable technologies. Moreover, the intermittent nature of the output power of PV systems reduces their reliability in providing continuous power to customers. In addition, the fluctuations in the output power due to variations in irradiance might lead to undesirable performance of the electric network. The support of governments, electric utilities, researchers and consumers is the key to overcoming the aforementioned obstacles and enhancing the maturity of the technology in this field. [31]

5. HYDROGEN ENERGY

Hydrogen is the most abundant element on earth, however, less than 1% is present as molecular hydrogen gas H2; the overwhelming part is chemically bound as H2O in water and some is bound to liquid or gaseous hydrocarbons. It is thought that the heavy elements were, and still are, being built from hydrogen and helium. It has been estimated that hydrogen makes up more than 90% of all the atoms or 75% of the mass of the universe. Combined with oxygen it generates water, and with carbon it makes different compounds such as methane, coal, and petroleum.

Hydrogen exhibits the highest heating value of all chemical fuels. Furthermore, it is regenerative and environment friendly. Solar radiation is abundant and its use is becoming more economic, but it is not harvested on large scale. This is due to the fact that it is difficult to store and move energy from ephemeral and intermittent sources such as the sun. In contrast, fossil fuels can be transported easily from remote areas to the exploitation sites. For the transportation of electric power, it is necessary to invest and currently spend money in large amounts. Under these circumstances of economic limitations, it is more rational to convert solar power to a gaseous form that is far cheaper to transport and easy to store. For this purpose, hydrogen is an almost completely clean-burning gas that can be used in place of petroleum, coal, or natural gas. Hydrogen does not release the carbon compounds that lead to global warming. In order to produce hydrogen, it is possible to run an electric current through water and this conversion process is known as electrolysis. After the production of hydrogen, it can be transported for any distance with virtually no energy loss. Transportation of gases such as hydrogen is less risky than any other form of energy, for instance, oil which is frequently spilled in tanker accidents, or during routine handling. The ideal intermediary energy carrier should be storable, transportable, pollution free independent of primary resources, renewable, and applicable in many ways.

These properties may be met by hydrogen when produced electrolytically using solar radiation, and hence, such a combination is referred to as the solar-hydrogen process. This is to say that transformation to hydrogen is one of the

most promising methods of storing and transporting solar energy in large quantities and over long distances.

Among the many renewable energy alternatives, solar-hydrogen energy is regarded as the most ideal energy resource that can be exploited in the foreseeable future in large quantities. On the other hand, where conventional fuel sources are not available, especially in rural areas, solar energy can be used directly or indirectly by the transformation into hydrogen gas. The most important property of hydrogen is that it is the cleanest fuel, being non-toxic with virtually no environmental problems during its production, storage, and transportation. Combustion of hydrogen with oxygen produces virtually no pollution, except its combustion in air produces small amounts of nitrogen oxides. Solar-hydrogen energy through the use of hydrogen does not give rise to acid rain, greenhouse effects, ozone layer depletions, leaks, or spillages. It is possible to regard hydrogen after the treatment of water by solar energy as a synthetic fuel. In order to benefit from the unique properties of hydrogen, it must be produced by the use of a renewable source so that there will be no limitation or environmental pollution in the long run. Different methods have been evoked by using direct or indirect forms of solar energy for hydrogen production. [1][28]

These methods can be viewed under four different processes, namely:

1. Direct thermal decomposition or thermolysis
2. Thermo-chemical processes
3. Electrolysis
4. Photolysis

Large-scale hydrogen production has been obtained so far from the water electrolysis method, which can be used effectively in combination with photovoltaic cells. Hydrogen can be extracted directly from water by photolysis using solar radiation.

Photolysis can be accomplished by photobiological systems, photochemical assemblies, or photo electrochemical cells. Hydrogen has been considered by many industrial countries as an environmentally clean energy source. In order to make further developments in the environmentally friendly solar-hydrogen energy source enhancement and research, the following main points must be considered:

1. It is necessary to invest in the research and development of hydrogen energy technologies
2. The technology should be made widely known
3. Appropriate industries should be established
4. A durable and environmentally compatible energy system based on the solar hydrogen process should be initiated.

Veziroˇglu has suggested the following research points need to be addressed in the future to improve the prospects of solar-hydrogen energy:

1. Hydrogen production techniques coupled with solar and wind energy sources
2. Hydrogen transportation facilities through pipelines
3. Establishment and maintenance of hydrogen storage techniques
4. Development of hydrogen-fuelled vehicles such as busses, trucks, cars, etc.
5. Fuel cell applications for decentralized power generation and vehicles
6. Research and development on hydrogen hydrides for hydrogen storage and for air conditioning
7. Infrastructure development for solar-hydrogen energy

8. Economic considerations in any mass production
9. Environmental protection studies

On the other hand, possible demonstrations and/or pilot projects include the following alternatives:

1. Photovoltaic hydrogen production facility
2. Hydrogen production plants by wind farms
3. Hydro power plant with hydrogen off-peak generators
4. Hydrogen community
5. Hydrogen house
6. Hydrogen-powered vehicles

In order to achieve these goals, it is a prerequisite to have a data bank on the hydrogen energy industry, its products, specifications, and prices. Another important and future promising technology for applying solar photon energy is the decomposition of water. This is referred to as the Solar-Hydrogen Energy System by Ohta (1979) and Justi (1987). Photolysis does not mean technically only water decomposition by photon energy, but also any photochemical reaction used to obtain the desired products. [5][22]

6. BIOMASS

Overall 14% of the world's energy comes from biomass, primarily wood and charcoal, but also crop residue and even animal dung for cooking and some heating. This contributes to deforestation and the loss of topsoil in developing countries. Biofuel production is largely determined by the supply of moisture and the length of the growing season (Olesen and Bindi 2002). By the twenty-second century, land area devoted to biofuels may increase by a factor of two to three in all parts of Europe (Metzger et al., 2004). Especially, in developing countries biomass is the major component of the national energy supply. Although biomass sources are widely available, they have low conversion efficiencies. This energy source is used especially for cooking and comfort and by burning it provides heat. The sun's radiation that conveys energy is exploited by the plants through photosynthesis, and consequently, even the remnants of plants are potential energy sources because they conserve historic solar energy until they perish either naturally after very long time spans or artificially by human beings or occasionally by forest fires. Only 0.1% of the solar incident energy is used by the photosynthesis process, but even this amount is ten times greater than the present day world energy consumption. Currently, living plants or remnants from the past are reservoirs of biomass that are a major source of energy for humanity in the future. However, biomass energy returns its energy to the atmosphere partly by respiration of the living plants and partly by oxidation of the carbon fixed by photosynthesis that is used to form fossil sediments which eventually transform to the fossil fuel types such as coal, oil, and natural gas. This argument shows that the living plants are the recipient media of incident solar radiation and they give rise to various types of fossil fuels Biofuel crops, increasingly an important source of energy, are being assessed for their critical role in adaptation to climatic change and mitigation of carbon emissions . Biomass is generally divided into three categories: biogas, solid biomass, and liquid biofuels. [1]

Biogas: Biogas is obtained via an anaerobic process of digesting organic material such as animal waste, crop residues, and waste from industrial and domestic activities to produce the combustible gas methane.

Solid Biomass: Solid biomass includes agricultural and forest residues as well as organic household and industrial wastes for direct combustion or gasification to provide electricity or combined electricity and heat (cogeneration).

Liquid Biofuels: Liquid Biofuels, namely ethanol and biodiesel, are used to substitute petroleum-derived transportation fuels. Although there are alternatives, but they don't satisfy transportation needs, so concept of bio fuel was introduced for 1st time

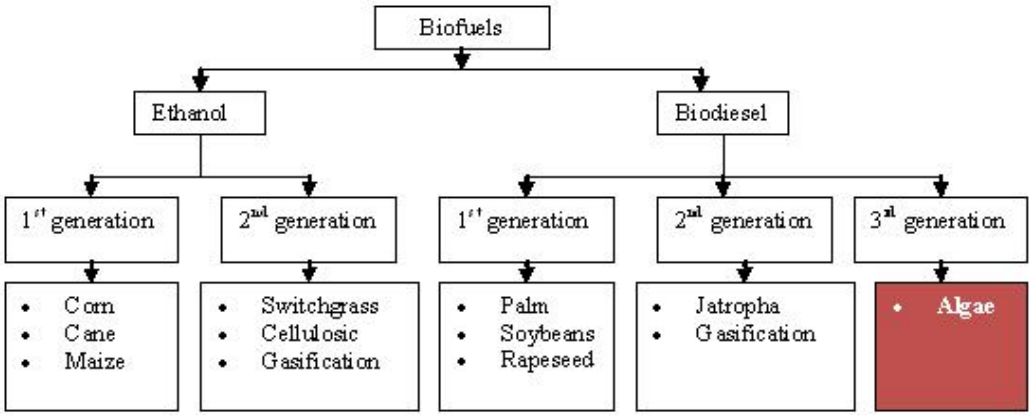

Figure-3 classification of Biofuels

'First-generation: Biofuel was made from sugar, starch, vegetable oil, or animal fats using conventional technology. The basic feedstock's for the production of first generation biofuels are wheat, or sunflower seeds. It has been criticized for diverting food away from the human food chain, leading to food shortages and price rises.[30] Second generation: Second-generation biofuel implementation from non-food crops. These include waste biomass, the stalks of wheat, corn, wood, does not divert food away from the animal or human food chain. This feedstock is abundant, but in some cases itself a significant disposal problem Third generation: "SOLAR BIOFUEL" is a biofuel from algae, also called oilgae. Algae are low-input, high-yield feedstock to produce biofuel. Relies on the fact that some algae naturally produce oil and this can be collected without killing the algae.[8]
Advantages of oilgae are as following:
1. Has superior yields
2. Not directly affecting the human food chain
3. Grown in places that are not suitable for agriculture
4. enhanced efficiencies or reduction in cost

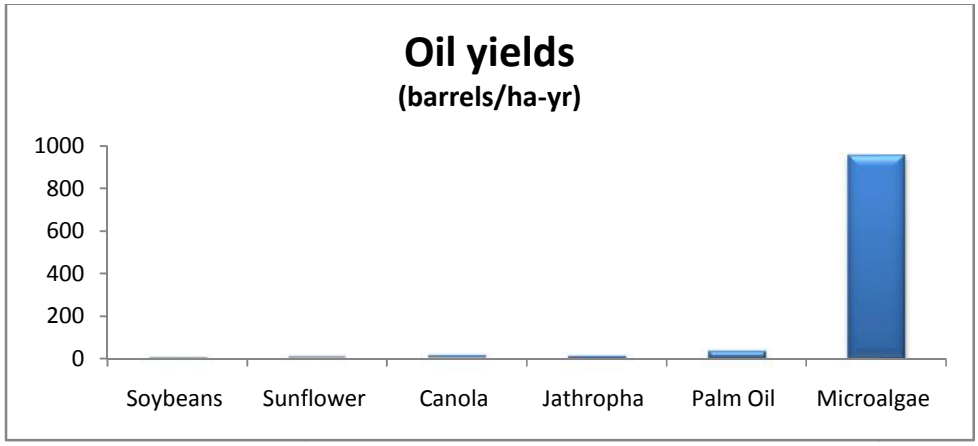

Figure-4 Oil yields of of biofuels

Algae are grown under conditions which are unsuitable for conventional crop production. Micro-algae are the fastest growing photosynthesizing organisms, under optimum growing conditions micro-algae are reported to produce up to 15,000 gallons of oil/acre/year. Solid waste from algae energy can be severed as feed for cattle. Extracted proteins can be used in human food chain. As it is a low cost waste water treatments Capable of fixing CO2 in the atmosphere, which are now considered a global problem. Algae biofuel is non-toxic, contains no sulfur, and is highly biodegradable. [24] It is the only renewable biodiesel that can potentially completely displace liquid fuels derived from petroleum. Economics of producing micro algal biodiesel need to improve substantially to make it competitive with petro diesel, but the level of improvement necessary appears to be attainable.[9]

CONCLUSION

The worldwide environmental problems resulting from the use of fossil fuels are the most compelling reasons for the present vigorous search for future alternative energy options that are renewable and environmentally friendly. The renewable sources have also some disadvantages, such as being available intermittently as in the case of solar and wind sources or fixed to certain locations including hydropower, geothermal, and biomass alternatives. Another shortcoming, for the time being, is their transportation directly as a fuel. These shortcomings point to the need for intermediary energy systems to form the link between their production site and the consumer location, as already mentioned above. If, for example, heat and electricity from solar power plants are to be made available at all times to meet the demand profile for useful energy, then an energy carrier is necessary with storage capabilities over long periods of time for use when solar radiation is not available The use of conventional energy resources will not be able to offset the energy demand in the next decades but steady increase will continue with undesirable environmental consequences. However, newly emerging renewable alternative energy resources are expected to take an increasing role in the energy scenarios of the future energy consumptions.

Strength	Weakness
Renewable Cost effective Mature Fossil free Clean	grid structure(i.e old) smart grid integration needed
Opportunities	**Threats**
Energy independency Climate change Need for sufficient R&D funds Possible new market	Slow planning Delayed action Short term support Traditional energy Political deal

Table 3.summary of renewable energy resources [1]-[9]

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