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Energy Resources and Environment

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Abstract:
There is wide agreement that "the energy problem" meaning the assuring of adequate energy supplies for the future, is one of the most serious challenges facing the world today. There is no question that supplies of fossil fuels are limited and changes in our postwar patterns of energy consumption are inevitable. In reflection of this, many studies have appeared within the past few years, which provide a comprehensive analysis of the nature of the problem and draw conclusions as to recommended energy development policies for the years ahead. In order to give the maximum attention to renewable and semi-renewable energy options, certain aspects of the overall energy problems are identified. However, these conclusions often differ considerably and one of the main areas of differing opinions concerns the extent to which non-conventional or alternative energy resource use is feasible by the year 2023 AD. Given the diversity of expert opinion, it is not surprising that both decision makers and the general public are uncertain as to what course of action is the best.

Keywords: consumption, conversion, conventional, energy, renewable, resource, supply

I. INTRODUCTION

Civilization depends on energy. Stated more fully, the advancement of human civilization, including not only the process of industrialization, but also improvements in standard of living, public health and even the development of arts and recreation, has historically depended upon a steadily increasing supply of energy. This is a fact of life that leaves us feeling rather uncomfortable today, as traditional forms of energy give evidence of being increasingly in short supply. Can the current pace of human advancement be maintained? If so, how much energy will be required to accomplish this? Should we develop new forms and sources of energy? Due to intensive use of the earth's fossil fuel resources, the conventional forms of energy will become increasingly expensive. It is important to stress at the outset that the global energy problem does not in any way involve an absolute shortage of potential energy resources. There are several renewable energy resources available on earth that could supply all human needs forever, if they could be harnessed. The problem is that these energy resources, as they exist in nature are not in a form that is useful for meeting human needs. Thus, another aspect of the long term energy challenges is to find ways to efficiently and inexpensively effect the conversion of this renewable energy into useful forms.

II. TYPE OF ENERGY SOURCES

Energy resources are commonly classified as renewable or non-conventional and non-renewable or conventional. Solar energy, wind energy, biomass or plant matter, organic wastes are usually considered renewable since they will last indefinitely, while coal, oil, natural gas etc. are considered non-renewable as they are limited. The efficiency with which energy contained in any fuel is converted to useful form varies widely depending on the method of conversion and the end use desired. When wood or coal is burnt in an open fire place, less than 20% of the energy is radiated into the room; the rest escapes up the chimney. A well designed home furnace, on the other hand, can capture up to 75% of the energy in the fuel and make it available for space heating. Thermal energy can heat water and buildings and provide heat for industrial processes. Electrical energy can power home applications. Different kinds of energy can be combined. For example, heat produced by burning garbage or wood chips can run a turbine to help generating electricity, which can then be used to heat a building. The successfulness of conservation of energy in each instance depends upon the matching the energy resources to end uses. Making this match is a matter of assessing available energy sources, suitable applications and current technologies.

III. CONVENTIONAL ENERGY RESOURCES

Of the conventional energy resources, fossil fuels have evolved to become one of the major issues of world's energy conservation. There are two main problems with fossil fuel: they are limited and they are unevenly distributed. The former condition means that almost every nation in the world must sooner or later confront the need to develop alternative energy resources and for some, the need is immediate and pressing. The uneven distribution of fossil fuels has left many countries, especially, those of Western Europe, Japan and United States with two potentially severe international problems – dependency and economic imbalance.

Fossil fuels may be grouped in to three categories:-

1. Traditional primary fuel (coal, oil, natural gas)
2. New primary fuel (oil shale, tar stands, geo pressured gas)
3. Secondary fuel (liquefied and gasified coal or biomass)

The future of all these forms depends on two primary considerations – economic cost and environmental cost. The

increased use of any of the fossil fuels will involve environmental trade-offs. This is particularly true in the case of coal, which is generally the "dirtiest" form of the fossil fuels. However, even if clear-burning a fuel as natural gas, used in power plants will produce significant amount of oxides of nitrogen. One component of higher cost of energy in the future will be the cost of simultaneously keeping our air and water at acceptable levels of cleanliness. There are a number of ways that existing fossil fuel supplies can be extended and utilized more effectively both in quantitative and qualitative terms. These include technological improvements in the processes by which we utilize our presently available resources and programs currently being advocated under the banner of 'synfuels', which could create new forms or sources of fossil fuel resources, for example, new types of engines to give more miles per gallon of gasoline consumed, electric or battery operated motors, more efficient lighting systems, better design and insulation of refrigerators etc. Some techniques of extending existing fossil fuel resources are discussed below:-

1. Fluidized Bed Combustion

In this process, coal is mixed with lime stone and is burnt above a bed of high temperature. Inert particles which are suspended are fluidized by high pressure air forced up from below. Thus, less fuel can be used, the plants can be smaller in size and less costly to build. Variety of low grade solid fuels are burnt at high efficiency without the necessity for expensive fuel preparation. Its most visible benefit is reduction in harmful emissions such as nitric oxides and sulphur oxides.

2. Topping Cycle

A topping cycle involves a high temperature gas turbine which can utilize gases at temperatures double those possible in a conventional steam generator. The gases existing the gas turbine are then at a temperature that can be used to make steam for a conventional steam turbine operation of the type now in use at all fossil fuel plants. Thus, by simply burning the fuel initially at a higher temperature, two sources of electrical generation are possible at a given plant side rather than one. This could raise the overall efficiency of the power plant to 40-50% as compared to about 35% for existing plants.

3. Bottoming Cycle

Bottoming cycle, also known as "waste heat to power", is a process wherby waste heat from an existing process is used to produce electricity. A bottom in gcycle has the primary energy source applied to a useful heating process.The reject he at from the process is then used to generate electrical power. The typical bottoming cycle directs was teheat from a process to a waste-heat-recovery boiler that converts this ther malenergy to steam which is supplied to a steamt urbine, extracting steam to the process and also generating electrical power.

4. Magneto Hydrodynamics

Magneto Hydrodynamics principle is applied for generating power from coal fired or reactor plants. Magneto Hydrodynamics generator plant does not require any turbine and does not have any generator shaft. In a Magneto Hydrodynamics generator, the thermal energy in plasma is directly converted to electrical energy. When an electric conductor moves across a magnetic field, a voltage is induced in it, which produces an electric current. In the generator, the solid conductors are replaced by a gaseous conductor, an ionized gas. If such a gas is passed at a high velocity through a powerful magnetic field, a current is generated and can be extracted by placing electrodes in suitable position in the stream. The conversion efficiency of Magneto Hydrodynamics system can be around 50% much higher compared to the most efficient stream plants. Still higher efficiencies are expected in future around 60% -65% with the improvements in experience and technology. It has no moving parts, so more reliable. The size of the plant is considerably smaller than conventional fossil fuel plants. It has been estimated that the overall operational costs in a Magneto Hydrodynamics plant would be about 20% less than conventional steam plants.

5. Synfuels

'Synfuel' is a generic name given to hydrocarbon fuels produced from natural gas, coal or biomass. It refers to some primary energy forms like Oil-shale or Tar-sand and to some secondary forms like coal gasification or coal liquefaction. An interesting paradox of 'oil shale' is that it is geologically not a shale and its valuable fossil fuel component is not oil. It is a layered grey brown sedimentary rock containing hydrocarbon known as kerogen and bitumen among other components. Extraction of a crude oil from the organic kirogen can only be achieved by high temperature heating usually to about 500°C. Tar-sands are naturally occurring sedimentary formations like sand-stone, lime-stone, silt-stone etc. containing hydrocarbon material termed bitumen. Synthetic fuels are produced by the chemical process of conversion known as carbonization, hydrogenation and thermal dissolution. Conversion method can be direct producing liquid transportation fuels or indirect, in which, the source substance is converted initially into syngas, which, then goes through additional conversion process to become liquid fuels. One concern commonly raised about the development of synthetic fuel plants is sustainability. Fundamentally, transitioning from oil to coal or natural gas for transportation fuels production is a great change from one inherently deplete able geologically limited resource to another. One of the positive defining characteristics of synthetic fuels production is the ability to use multiple feed stocks (coal, gas or biomass) to produce the same product from the same plant. This provides a forwarding path to a renewable fuel source with a compatible infrastructure and possibly more sustainable even if the original fossil feedstock runs out.

IV. NON-CONVENTIONAL ENERGY RESOURCES

It is the year 3047 AD, and the earth is swathed in clouds of carbon dioxide and gaseous acids. There is an overall resemblance to Venus, and not a single multicellular life form is to be seen on the surface. All over, there is the debris of a million floods, earthquakes, and destructive tsunami. One more of the universe's cradles of life and intelligence is dead, perhaps forever. The scenario depicted above is not taken from any science fiction novel. It is a very realistic picture of what could easily happen if man continues to pollute and defile his environment at the present rate. One of the prime culprits for this alarming degradation in the earth's environment is the use of non-renewable energy resources. Non-renewable energy sources, such as coal and petrol, generally fall into the category of carbon-rich fossil fuels, which are mined and then burnt to give

energy. This is a dual assault on the environment – we first denude large areas of land dislodging valuable topsoil and reducing fertility; and then we proceed to burn these substances using inefficient and unscientific methods, releasing lethal pollutants into the air. Under the present circumstances, the most sensible move would be a revamp of energy utilization patterns the world over, and a shift to renewable energy sources. This will not only ensure the protection of the earth's environment but will also take care of our energy needs for many generations to come.

1. Solar Energy

Ubiquities, renewable and free, it was the first energy resource to be utilized. It is the energy transported to the earth by solar radiation that support life through photosynthesis and respiration, which are central processes in the metabolism of plants and animals. It is the form of energy most accessible to the poor with the term including both individuals and societies. As the other forms of energy become scarcer and more expensive, the advantages of solar energy are becoming more widely appreciated. The utilization of solar energy can either be direct like flat plate collectors and water heating, space heating, photovoltaic electricity, solar cooker, solar drying etc. or indirect like solar power satellites, water pumping and irrigation, solar green house, solar ponds etc. The use of solar techniques in homes and buildings for space and water heating, space cooling and air conditioning has no real negative environmental impacts provided the solar systems are correctly designed and installed. However, one area that requires further study is the possible impact on weather and air pollution of large areas of solar collectors, which would capture some of the sunlight normally reflected from buildings back into the atmosphere. This might affect temperature gradients in the air, which are significant determinants of wind, cloud cover, atmospheric mixing and air quality.

2. Wind Energy

Wind energy may be utilized by conversion into linear or rotational motion. The generation of mechanical and electrical power by wind mills has emerged as a mature, modern and cost effective technology for large scale use in agriculture and electric power generation. Initially, two-bladed horizontal axis turbine which had a generating capacity of 1500 KW at a rated wind speed of 35 km/h was attempted in the United States. But, at a later stage, it was found that wind turbine generators of smaller ranges in a cluster are more effective than wind turbine generators of higher ranges. The wind turbine generators now being manufactured are with capacities ranging from 55 KW to 200 KW, 225 KW, 400 KW, 600 KW etc. In the present energy scenario, USA and Denmark are in the forefront with advanced technology, but countries like Germany, UK, Japan and India are making quick strides in the development of wind power generation.Wind energy development has been given top priority by the government and various promotional schemes have been formulated for the purpose. Liberalized policy, attractive incentives and government sponsored demonstration projects, financial assistance through soft loans by government agencies like IREDA and other institutions under a rationalized structure have created a conducive environment for private investment in wind power plants. Some of the incentives provided by the government are like exemption from payment of excise duty and sales tax, tax holidays as applicable in other power projects, 100% depreciation etc. Micro climatic modifications may occur in areas where wind energy is extensively exploited. The energy extraction from wind is accompanied by slowing down of the wind. This may lead to changes in precipitation and evapo transpiration patterns of downwind and conceivably changes in temperature and concentration of minor atmospheric constituents as well.

3. Bio-Fuels

Biofuels can be looked upon as a way of energy security which stands as an alternative of fossil fuels that are limited in availability. Biofuels burn than fossil fuels resulting in fewer emissions of green-house gases, particulate emissions and substances that cause acid rain such as sulphur. Additionally, bio-fuels are biodegradable, so if they do spill, less harm is done compared to when fossil fuel spill. Bio-fuels can be broken into two generations. First generation bio-fuels are also called conventional bio-fuel which are made from a feed stock that can also be consumed as a human food such as sugar, starch or vegetable oil. Second generation bio-fuels known as "advanced bio-fuel" are produced from sustainable feed stock. No second generation bio-fuel is also a food crop, though certain food products can become second generation fuels when they are no longer useful for consumption. Bio-diesel reduces CO_2 exhaust emissions by up to 80% and produces 100% less SO_x than petroleum. It also reduces exhaust smoke emissions by up to 75%, so the usual black cloud associated with a diesel engine can be eliminated. The smell of the bio-diesel exhaust is far more pleasant. Bio-diesel provides significant lubricity improvement over petroleum diesel fuel due to which the engines last longer and with the right additives, the performance of engines can also be enhanced. Overall, bio-diesel is ecofriendly, degradable, non-toxic, free from sulphur, lead etc. and contains no petroleum, but can be blended with conventional diesel fuel. Bio-gas typically refers to a gas produced by the breakdown of organic matter in the absence of oxygen. It can be produced from regionally available raw materials such as recycled waste, manure, sewage, green waste, plant material, crops etc. Bio-gas comprises primarily methane, carbon di-oxide and may have small amounts of hydrogen sulphide, moisture also. The gases methane, hydrogen and carbon di-oxide can be combusted with oxygen and the released energy allows bio-gas to be used as fuel for any heating purpose such as cooking or used in a gas engine to convert the energy in the gas into electricity and heat. Bio-gas produced from the anaerobic digestion of manure in small scale digestion facilities is called "gobar gas". It is estimated that such facilities exist in over two million house-holds in India. The digester is an airtight circular pit made of concrete with a pipe connection. The manure is directed to the pit, usually directly from the cattle-shed. The pit is then filled with a required quantity of waste water. The gas pipe is connected to the kitchen fire place through control valves. The combustion of this bio-gas has very little odor and smoke. Owing to simplicity in implementation and use of cheap raw materials in villages, it is one of the most environmentally sound energy sources for rural needs. Bio-mass is biological material derived from living or recently living organisms. In the context of bio-mass for energy, this is often used to mean plant based material, but bio-mass can equally apply to both animal and vegetable derived material. Many bio-mass fuels generate

lower levels of atmospheric pollutants such as sulphur di-oxide that contributes to "acid rain". The use of bio-mass fuel provides an economic incentive to manage woodland which improves bio-diversity.

4. Ocean Energy

The oceans cover 75% of the world's surface. It is the largest renewable energy source available to contribute to the security of energy supply and reduce green house gases emissions and other waste. Generation of electricity from the waves, the tides, the currents, the salinity gradient and the thermal gradient is predictable with potential to satisfy sustainability. There are three basic ways to tap the ocean for its energy:- (i) ocean waves (ii) ocean tides (iii) ocean thermal energy conversion (OTEC). Kinetic energy exists in the moving waves of the ocean and can be used to power a turbine. The wave rises into achamber and the rising water forces the air out of the chamber. The moving air spins a turbine which can turn a generator and produce electricity. When the wave goes down, air flows through the turbine and back into the chamber through doors that are normally closed. First patent on wave energy conversion was issued early in 1799 and taking advantage of wave movement, the turbines were possible to be put in action. Wave energy system comprises either "Shore line devices", which are easy to be installed and do not require long lengths of underwater electrical cable or "Off shore devices", which are more powerful wave regimes and concentrate on small modular devices. Considering tidal energy, two types of tidal facilities can be established namely tidal barrages and tidal steam generator. Tidal barrages make use of the potential energy in the difference in height between high and low tides. "La Rance Barrage" is the largest tidal power station in the world generating power with a pick rating of 240 mega watts. Supplied to about 240,000 homes. Tidal steam generators make use of the kinetic energy of moving water to power turbines in a similar way as wind turbines. Ocean thermal energy conversions (OTEC) uses the temperature difference between cooler deep and warmer shallow or surface ocean waters to run a heat engine and produce useful work, usually in the form of electricity. Power plants can also be built that use this difference in temperature to make energy. A difference of at least 38°F is needed between the warmer surface water and the cooler deep ocean water. Ocean resources are immense and have big potential to be more developed. In future, this could represent another solution in renewable sources of energy so that the management in this area could be a more sustainable business.

5. Geothermal Energy

Geothermal energy is simply the heat energy of the earth generated by various natural processes such as:- (i) heat from when the planet formed and accreted, which has not yet been lost (ii) decay of radio-active elements (iii) friction. Geothermal reservoirs can be suspected in the areas, where we find geyser, boiling mud pot, volcano or hot springs. The rising hot water and steam is trapped in permeable and porous rocks to form a geothermal reservoir, which can be discovered by testing the soil or analyzing underground temperature. The heat energy can be brought to earth surface by directly from hot springs/geysers or geothermal heat pump. Direct use of geothermal energy includes the following:-

- Hot springs using as spas
- Heating water at fish farms
- Providing heat for buildings
- Raising plants in green houses, drying crops
- Providing heat to industrial processes

Indirect use of geothermal energy includes electricity generation which can be achieved by three types of power plants:- (i) Dry steam plant (ii) Flash steam plant (iii) Binary cycle plant. Dry steam power plant Dry steam power plant is the oldest type, in which, geothermal reservoir containing both hot water and steam associated with pressure changing system is required. Binary cycle power plant is the worldwide accepted power plant, in which, in place of direct steam, vaporized hydrocarbons having lower boiling point are used to spin turbine. No harmful gas is emitted to the atmosphere because the underground water is never disclosed to outside.

Direct use of geothermal energy is absolutely cheaper than other energy sources. Cost of electricity generation depends upon certain factors such as temperature and depth of resource, type of resource, volume of resource and technology of the plant. The initial investment is high, but after certain time period, the cost of electricity becomes comparable to other sources of energy. Once the capital cost is recovered, the price can decrease considerably. In India, geothermal provinces like Himalayas, Sohana, West Coast, Cambay etc. are estimated to produce 10,600 MW of power. First operational commercial geothermal power plant is likely to come up in Andhra Pradesh with a capacity of 25 MW by Geo syndicate Pvt. Ltd. Overall, geothermal energy is a sustainable resource as it is available all the year around being independent of weather and does not involve any combustion of fuel. It can replace fossil fuel heating system in a particular area and annual cost of common heating purposes can be reduced by more than 60%. Geothermal energy appears to be a partial solution to our energy needs and potential exists to provide all energy requirements in future.

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V. CONCLUSION

Generally, the only truly effective energy option over the next few years is conservation. This term includes the elimination of waste, improvements in equipment efficiency, reduction in unnecessary energy use and the substitution of energy conserving techniques for more energy-consuming ones. Renewable energy systems have real advantages in terms of environmental impact and are expected to form a major part of the twenty-first century's strategy for sustainable development. However, it is only fair to point out that each renewable energy resource has its own drawbacks and pitfalls, which may include visual impact and loss of biodiversity to mention a few. Therefore, recognition of ways to incorporate environmental considerations into means of renewable energy use will go a long way in making the earth, a better place for mankind to live in.

VI. REFERENCES

[1]. Zooba Ahmed. F., Bansal R.C., (2011), "Handbook of Renewable Energy Technology", World Scientific Bhudaia

[2]. Chauhan D.S., Srivastava S.K., (2012), "Non-conventional Energy Systems", Wheelers Publication

[3]. Glaser P.E., Davidson F.P., Csigi K.I., “Solar Power Satellite, the emerging energy option”, (1993), New York

[4]. Kavang E., (2006), “Looking at Bio-fuels and Bio-energy”

[5]. Keppler F., Hamilton J.G., Brass M., Rockmann T.,(2006), “Methane emissions from terrestrial plants under aerobic conditions”

[6]. Khan B.H., (2006), “Non-conventional Sources of Energy”, TMH Publication

[7]. Kothari D.P., Singal K.C., RanjanRakesh, (2011), “Renewable Energy Sources and Emerging Technologies

[8]. Kribus A., (2002), “Thermal Integral Microgeneration Systems for Solar and Conventional Use”

[9]. Lepore J.A., Shore S., Lior N., (1978), “Retrofit of Urban Housing for Solar Energy Conversion”, Hous Sci.

[10]. Ramesh R., (1997), “Renewable Energy Technologies”, Narosa Publication

[11]. Rao S., Parulekar B.B., (2009), “Energy Technology”