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ENERGY RESOURCES FOR SUSTAINABLE GROWTH AND DEVELOPMENT

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ABSTRACT

Energy is the primary and most universal measure of all kinds of work by human beings and nature. The standard of living of a country can be directly related to per capita energy consumption i.e., Energy consumption is a measure of prosperity. Coal, natural gas, oil and nuclear energy are primary energy sources which provide a net supply of energy. These are non-renewable source of energy and they are depleting at faster rate. It is estimated that the total reserve of the natural wealth would lost another few decades. Due to increasing of population growth and standard of living of human beings, the available sources are not able to meet the energy requirements. The above facts have given one to understand easily that, unless specific programmes are evolved to conserve energy, there may be serious energy crisis in the near future. Therefore a quite alarming and it definitely needs the attention of all concern. The paper highlights the importance of energy and its sources, need for the conservation of energy and role of renewable energy sources which can meet and match the future energy demands.

Keywords: Energy Management, Solar Energy, wind Power, Tidal Power

I. INTRODUCTION

As energy plays a vital role in the world development, it represents country's prosperity as well as major challenge for sustainable development. Today, more than 80% of the primary energy consumption is based on fossil fuels and the share is likely to remain high in the future. Even if technology developments will reduce the specific consumption, the world energy demand is likely to increase in line with its population. Energy and material efficiency and the integration of the renewable resources will therefore have to play a major role for sustainable development. The challenge concerns not only the technologies at the conversion and useful energy level, but also the energy management and infrastructures. Exploitation of non-renewable resources (e.g. materials, energy, etc.) can create non-sustainable conditions and environmental degradation resulting in a significant loss of final product quality. In many industrialized countries, including the US, the heating, cooling, ventilation and lighting of buildings represent approximately 40% of the annual nation's energy consumption. Therefore, it is important to seek solutions that improve our quality of life, while reducing energy and environment consumption. In the past 20 years, interest has been growing to adopt new methodologies to effectively utilize renewable sources of energy since these represent sustainable environmentally friendly sources of energy. Though the abundance of nuclear energy is a good source as an alternative, the inherent

IJARSE
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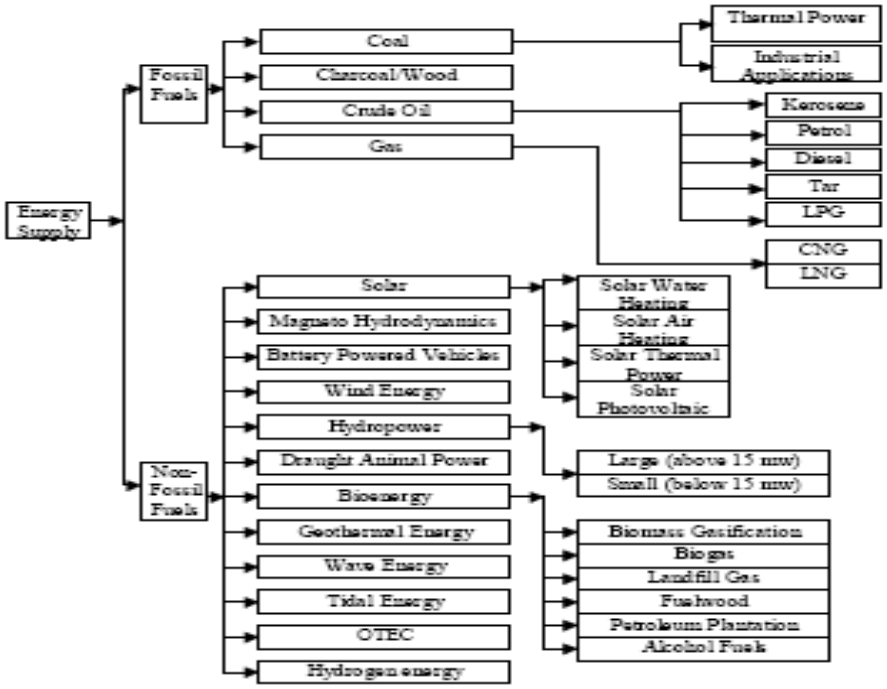
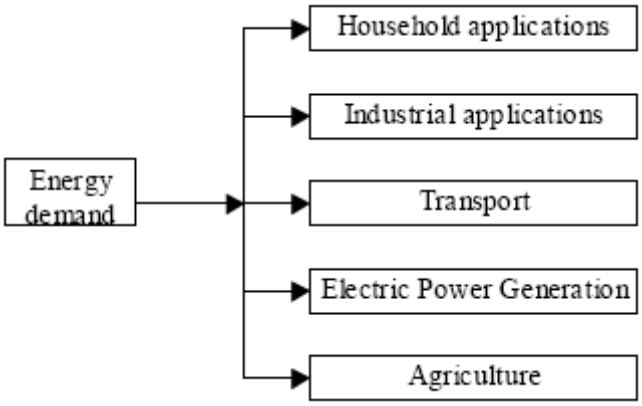
danger to humanity through regular doses of nuclear radiation causing diseases like cancer and deformities in birth, makes it to be either a secondary or no consideration at all. Systematic analysis of each renewable energy source will give an indication of the intensity for proper search.

II. ENERGY SUPPLY AND DEMAND

Sources of different forms of energy supply



Demand



III. THREATS ON THE ENVIRONMENT

Besides this the environmental implications of haphazard energy utilization also need to be closely studied. The process of energy generation, transport and utilization leads to environmental pollution. In-efficient use of energy has stretched the global environment to its limits as can be seen from the unprecedented and unpleasant responses of the nature in the past few years. Green house effect, global warming, acid rain, smog, deforestation, shift in climatic conditions, etc., are some of the indications. The Carbon Dioxide level in the atmosphere

IJARSE
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increased from 280 ppm in 1850 to 360 ppm at present. The average temperature of the earth's atmosphere is likely to increase by 1.5 to 4 ºC in the next 50 years. Such temperature rises may lead to unpredicted consequences.Implementation of an effective energy management program, as far as India is concerned, would lead to energy sufficiency and environmental safety.

IV. PRESENT SITUATION

Energy is the primary and most universal measure of all kinds of work by human beings and nature. Whatever happens in the world is only the expression of flow of energy in either of its forms. Energy is a crucial input in the process of economic, social and industrial development. Energy consumption in the developing countries is increasing at a faster rate. It is estimated that the total reserve of the natural wealth would last another 130 years or so from now. Thus, exhaustion of the finite reserve of these non-renewable sources creates a global problem for generation of energy through conventional method.

According to world energy report, we get around 80% of our energy from conventional fossil fuels like oil (36%), natural gas (21%) and coal (23%). In India, energy demand is increasing at the rate of 9% per annum and supply is not keeping pace. Present deficit of electrical energy is 8%.

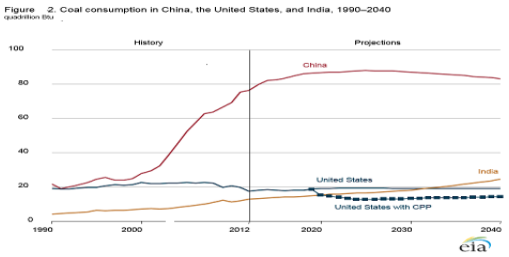
Following tables shows the demand and supply forecast for all the conventional energy sources mentioned above.

Table 1 Coal demand and supply forecasts for India (million tonnes)

	1997/98	2001/02	2006/07	2011/12
Demand	323	400	576	872
Domestic supply	298	360	484	652
Deficit	25	40	92	220

Table 2 Natural gas demand and supply in India (million cubic meters per day)

	1996/97	2001/02	2006/07	2011/12
Demand	52.1	117.8	167.1	216.4
Production	49.3	71.2	57.5	43.8
Gap	2.8	46.6	109.6	172.6



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

The increased power demand due to present and up-coming trends in industrial as well as business demands, strenuous competition, growing population, mechanized living styles,

depleting fossil fuel resources and growing environmental pollution have led the world to think seriously for other alternative sources of energy. Basic concept of alternative energy relates to issues of sustainability, renewability and pollution reduction. In reality alternative energy means anything other than deriving energy via fossil fuel combustion.

IJARSE
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V. BENEFITS OF ALTERNATIVE ENERGY OPTIONS

Alternative energy options enable local institutions to manage their own energy needs and thus provide rural development opportunities. This situation encourages decentralized decision making, which has far-reaching implications for the governance of a community. In addition, dissemination and popularization of energy-efficient devices and alternatives to conventional fuels can do the following:

☞ *Provide better lighting*: Better lighting enables the poor to stretch their period of economic activity; their children can help them in daily chores and then study in the evenings.

☞ *Help the environment*: Efficient use of conventional sources of energy or use of renewable energy helps save the environment from further degradation and gives it an
opportunity to regenerate.

☞ *Provide sustainable fuel systems***:** Afforestation and agro forestry, combined with the introduction of energy-efficient devices, can help to create a sustainable fuel-use system within the rural community and sustain the ecological balance of a region.

☞ *Benefit women***:** Lower dependency on fuel wood and other household fuel sources
reduces the drudgery of women by shortening or eliminating the distances they travel for fuel collection. The improved cook stove, for example, has been associated with an average net annual saving of seven person-days of labour a year in India.

☞ *Benefit human health*: Use of improved cook stoves and biogas plants, for example, helps reduce or eliminate health problems associated with using conventional cook stoves, including respiratory diseases and eye problems.

☞ *Enhance income*: Alternative energy sources can provide local employment opportunities through direct use of energy in small-scale industry and agriculture, through construction, repair, and maintenance of energy devices, or through the sale of energy to local utilities. In India, for example, biomass gasification systems are used to dry horticulture produce (such as large cardamom and ginger). Another example is the use of solar water-heating systems to meet the hot-water demand of hotels and hospitals.

VI. ALTERNATIVE ENERGY SOURCES

The demand for energy is increasing day by day. The ever increasing use of modern means of transport, changing lifestyles and mechanization of labour have lead to a sudden and very large spurt in energy requirement. There is still a considerable potential for alternative energy sources. Increased use of renewable energy sources for energy generation will not only meet the energy demand but also result in substantial environmental benefits. Various forms of alternative energy sources are solar, wind, biogas/biomass, tidal, geothermal, fuel cell, hydrogen energy, small hydropower etc.

6.1 Solar Energy

Solar energy is one the most resourceful sources of energy for the future. One of the reasons for this is that the total energy we receive each year from the sun is around 35,000 times the total energy used by man. However, about 1/3 of this energy is either absorbed by the outer atmosphere or reflected back into space (a process called albedo).

IJARSE
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Electricity can be produced from sunlight through direct heating of fluids to generate steam for large-scale centralized electrical generation (solar thermal electrical generation). Electricity can alternatively be produced from sunlight through a process called photovoltaic (PV), which can be applied, in either a centralized or decentralized fashion.

Solar Cell: The PV cell is the component responsible for converting light to electricity. Some materials (e.g., silicon is the most common) produce a photovoltaic effect, where sunlight frees electrons striking the silicon material. The freed electrons cannot return to the positively charged sites ('holes') without flowing through an external circuit, thus generating current. Solar cells are designed to absorb as much light as possible and are interconnected in series and parallel electrical connections to produce desired voltages and currents. Currently, solar cells have proved to be cost effective. Other than space satellites, the photovoltaic cells are being used in rural health clinics for refrigeration, water pumps for irrigation and for small-scale power generation.

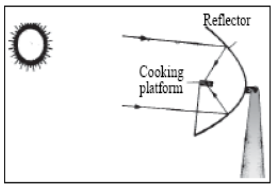
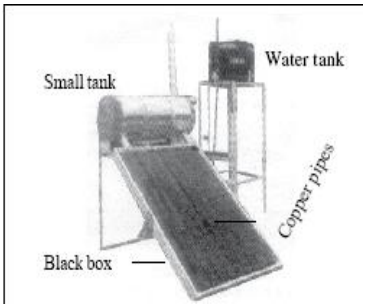


Fig1:Schematic representation of a solar concentrator used for cooking

India has started large scale use of solar energy to meet the increasing demand of energy, with the large production of solar cookers. In 1962, India becomes the first country in the world, to commercially produce solar cookers. Intense research has also been started for the increased use of solar cookers and for enhancing its efficiency. In Kerala, an organization ANERT (Agency for Non- conventional Energy and Rural Technology) propagates the use of solar cookers, solar panels and solar lamps.



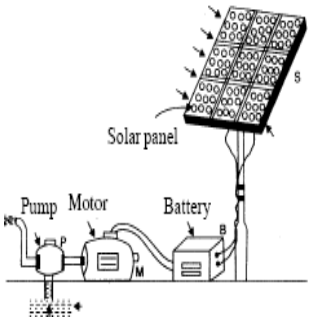


fig2:Solar water heater **fig3: Water pumped using solar panel** **fig4: Solar panel used in artificial Satellite**

6.2 Hydro Power: Hydro power through turning turbines produces electricity. Water is used for irrigation gives double benefit. Though this is the cheapest, on energy source point of view, expenses occur on social problems. But when we have tremendous recurring expenditure on fossil fuel with pollution, this expenditure in the long run will work out to be economical besides being renewable. To improve the efficiency and the cost of the machineries used for the generation of energy, research will have to be constantly done with newer materials and newer technologies. Integration of water resources will be a better answer wherever feasible.

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6.3 Tidal Power: Tides are caused by the gravitational pull of the moon and the sun, and the rotation of the earth. A large tidal range (about 4m) is required to produce energy economically. The simplest generation system for tidal plants involves a dam, known as a barrage, across an inlet; sluice gates on the barrage allow the tidal basin to fill on the incoming high tides and to empty through the turbine system on the outgoing tide, known as the ebb.

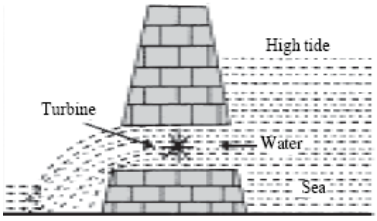

Fig4: Tidal energy generation

6.4 Wind Power: An estimated of 1% to 3 % of the energy from the Sun is converted into wind energy. This is about 50 to 100 times more energy than is converted into biomass by all the plants on earth through photosynthesis. Most of this wind energy can be found at high altitudes where continuous wind speeds of over 160 km/h (100 mph) are common. Eventually, the wind energy is converted through friction into diffuse heat all through the earth's surface and atmosphere. Wind possesses energy by virtue of its motion .Any device capable of slowing down the mass of moving air can extract part of the energy and convert into useful work.

Theoretically it is possible to get 100% efficiency by halting and preventing the passage of air through the rotor. However, a rotor is able to decelerate the air column only to one third of its free velocity. A 100% efficient wind generator is able to convert maximum up to 60% of the available energy in wind into mechanical energy. In addition to this, losses incurred in the generator or pump decrease the overall efficiency of power generation to 35%.

fig5:wind mill farm

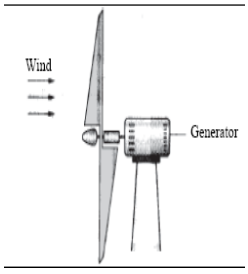

fig.6Generator working on wind energy

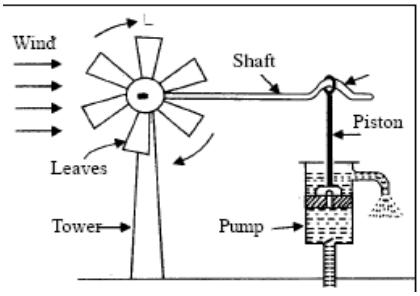

fig7:water pumped using wind energy

6.5 Energy from Biomass: A part of the energy from the sun is stored by plants and trees as chemical energy through photosynthesis. What we get from biomass is the energy stored in this manner. This is bioenergy. The biosubstances like cow dung cake which can be used as renewable sources of energy, are called biomass.

Biomass like animal excreta, vegetable wastes and weeds undergo decomposition in the absence of oxygen in a biogas plant and form a mixture of gases. This mixture is the biogas. Its main constituent is methane. This is used as a fuel for cooking and lighting.

IJARSE
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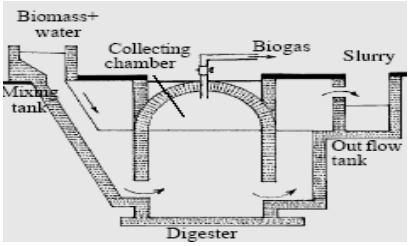

fig8: fixed dome biogas plant

VII. ENERGY CONSERVATION

Conservation of energy is considered most effective and simplest method to ease the ever increasing pressure and provide a possible relief. Here it is to be borne in mind that energy saved is energy generated. Saving of one unit of energy simply means that generation of one and half units. This theoretical finding can be translated into reality through demand side management in which role of consumer is quite significant. Energy conservation is achieved by:

1. Legislation and government decisions (e.g., co-generation, implementing recommendations of energy conservation audits, energy consumption standards for air-conditioners, energy construction standards, mandatory implementation of means of conserving energy in government offices);
2. Demonstration of new technologies (e.g., production of bio-gas, co-generation, lighting of office buildings);
3. Expanding communication activities to the general public as well as education in schools(such the consumers have to put off the switches when it is not needed, to use fluorescent tubes in place of incandescent bulbs, to use sun light as much as possible, to use light paintings on the walls etc).

VIII. ENERGY MANAGEMENT

Energy efficiency and reduction in use of energy have been improving steadily over recent years. It is reported that the UK reduces by around 30% and Europe by atleast 15%. At an individual level managing energy is about delivering savings which can provide positive benefits to a business in terms of its operating costs but also positive benefits to the environment in terms of carbon and other greenhouse gases emissions. Better still, far from being difficult to achieve these benefits can be easily realized by most business. The energy saver timer is an example of a good all around electrical energy efficiency device for commercial buildings, industrial situations, apartment blocks and houses and this is an example of a good energy management.

IX. CONCLUSIONS

1. Urgent and renewed efforts are required to promote sustainable development of renewable energy sources. At the same time, it is a must that one should save and conserve energy for present and future generation.
2. About 54% increase in world-wide energy consumption is estimated by the year 2025 and with cooperative efforts globally this can be achieved. The generation of energy to meet the global future demand and to substitute the existing fossil fuel is absolutely possible if world-wide work is undertaken exploring all the renewable resources like solar, wind, bio, wave etc., besides recovery of energy from waste and proper energy management

IJARSE
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3. Pollution if not controlled will create a danger to plant and animal kingdoms including human lives and this will be well taken care if renewable energy creation is fully undertaken which is possible.
4. Research and development activities on each renewable source of energy sector concentrating on processes, materials and storage devices must be globally done vigorously.

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BIOGRAPHAICAL DATA:

Prof. Hemalatha B.R ,She studied at P.E.S College of Engineering, Mandya for her B.E (Environmental Engineering) and graduated from Mysore University in 2001. She did M.Tech (Environmental Engineering) degree from the same college under Visveswaraya technological university, Belgaum in 2003. She is also a member of ISTE, Delhi. She served as 'Environmental Engineer' in City Municipal Council, T.Dasarahalli, and Bangalore for 2 years. At present, she is working as Assistant Professor at R.L.Jalappa Institute of Technology, Doddaballapur, and Bangalore Rural District. She attended many workshops, seminars and conferences. She published 3 papers in international journal.

Prof. Mahadeva M is working as assistant professor in civil engineering department form last 2 years and he also worked as assistant professor in K S institute of technology. He received is **B E** in **civil engineering** and **M.Tech** with specialization in **CAD structures** from Visvesvaraya technological university. He is member of MISTE. He is national advisory board member for international conference and he secured "***Active Young Research Award"*** in international journals for his continuous contribution in research field. His research interest is in the field of soil structure interaction, structural engineering, earth quake engineering and water resources.

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