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GLOBAL RENEWABLE ENERGY RESOURCES, SMART POWER GENERATION AND ENVIRONMENTAL IMPACTS

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ABSTRACT
In the view of upraised power demands and a dream of sustainable world development, effective utilization of renewable resources is an important issue now. Fossil fuel shortage and negative impact of fossil fuel on climate have forced many countries for designing and implementing a big plan, constructing renewable power generation system. Renewable energies are the most potential resources with environment friendly feature. Many countries are implementing renewable energy based power generation and planning for major share of renewable energy based power generation. This paper presents the potential of renewable energy based power generation systems.

Keywords: Energy, Renewable resources, Solar power generation, Environmental impact.

1. INTRODUCTION

Fossil fuel shortage, up raised fuel prices and global warming are of important concern now. Most of the world's energy is generated from fossil fuel. The way through which energy is generated and used is not sustainable. Fossil fuels are the main responsible factor for climate change (Hasanuzzaman et al., 2011 & 2012; Reddy et al., 2013). Nuclear energy is a threat itself for humanity. In the planet, territorial and local desertification is induced due to diminution of fuel wood. Only the renewable power generation system, a low carbon energy technology is the perfect option to ensure energy security with avoiding greenhouse gas emissions (Ahmed et al., 2013; Devabhaktuni et al., 2013). This is the only way to change the current path of the world, to reach greenhouse gas emission goals. Every nation of the world and every sector of the economy must be involved in such task. However, among the renewable energy, solar energy is the most abundant resource. Solar energy is of immense potential (Şen, 2004). Technologies are available to harness solar energy in to useful state. It has the technical potency to meet all present and predictable residential and also industrial energy needs. Already world is moving toward sustainable especially solar energy technologies. Solar photovoltaic (PV) system is growing so fast of all renewable technologies with an impressive rate. Recently solar concentrating system attracts the attention of many countries. Some countries already establish such type system and in some region of the world this system is under development. Today world stands at an exciting transition moment when renewable energy is competing head to head with fossil and nuclear energy. This article presents an overview of renewable resources based power generation.

2. RENEWABLE ENERGY RESOURCES

This planet has continually replenished some resources such as sunlight, wind, tides and waves, rain, warmth of earth. The energy is derived from these sources in a sustainable manner. Matured and upgrade technologies are available for exploiting these resources. Renewable resources, far cleaner than fossil fuels emit minute level of carbon and help to battle global warming by fossil fuels.

3. SOLAR ENERGY RESOURCES

Solar radiation, power from the sun is high temperature, high exergy energy source (Fernández-García, 2010). It is the most abundant and limitless resource. Solar energy could serve about one sixth of world's total low temperature heating and cooling by 2050 (Al-Ghandoor et al., 2008). Solar energy source is clean alternative to fossil fuels which is limited and pollute environment, threatening public health and contributing to global climate change. Due to copiousness and enormous power, the appeal of this resource is that it plays eminent role in our energy future. The sun ray, fuel for power the world strikes the earth and ninety minutes is enough to serve one-year energy needs of the entire world. Although solar energy is rich in amount, it shares a small fraction of the world energy mix. But now this is changing fast, action is taken globally to upgrade energy access and to make energy supply secured with lessening global warming. The demand for sustainable city planning, building design and construction are increasing. Already huge advance of utilising of solar technologies and strategies on urban planning and building design have been made in the last few years. Active and passive solar design principles have potency in securing energy supply with lowering energy demand, can meet thermal energy and electricity needs (Hagemann, 2005). Since 1980s, it is a dream to build a solar powered vehicle. Both American and African solar

challenge increase the interest for developing solar powered vehicles (NSC., 2008; SSC., 2008). Photovoltaic system can be used for producing auxiliary power to be used in air conditioning of the car, saving fuel with reducing carbon emissions. Aviation and marine transportation have good prospect for solar fuel. Solar hydrogen could be the best option for aviation (SE., 2011). Private and commercial buildings consume huge energy especially for lighting, hot water supplying, providing comfortable surroundings, cooking and electrically operated devices. Buildings expose significant amount of area to the sun also. Buildings can share thermal consumption by capturing solar radiation; also can share a big amount of lighting needs and this captured solar energy can be the substantial source of power. Moreover, enhanced utilization of thermal energy storage techs in buildings can improve demand flexibility and lessen the demand for expensive power storage (SE, 2011). Solar energy is very much anticipating for industrial applications such as industrial space heating, preheating, concentration, pasteurization, water desalination, sterilization, washing, cleaning, chemical reactions, food, non-metallic, building, textile industry and business concerned industry. Solar energy can improve the industry efficiency by progressing energy stability and sustainability (Mekhilef et al., 2011).

4. BIOMASS ENERGY RESOURCES

Biomass is a sustainable source of energy that diminishes carbon emissions, a prime contributor to climate change. Though biomass after burning emits carbon dioxide gas, it does not emit new carbon into ambiance as the fossil fuel burning does (RE.NREL., 2013). Recently most used biomass is home grown energy source. The biomass from wood like logs, chips, bark and sawdust and agricultural wastes like fruit pits, corncobs may form a significant resource for bio energy that could substantially contribute to the total energy supply (Scarlat, 2011). Agricultural wastes along with wood and wood wastes are widely used to produce energy. A major portion of biomass energy is developed from wood and wood wastes (64%) and agricultural waste (5%) globally (Demirbas, 2001, 2008; Deshmukh, 2008). Already, wood products show the benefits of using their saw dust and scrap for producing power (BM, 2010). At the same time, agricultural products are also anticipating to fulfil the raising energy and raw material needs for a society, making the society sustainable with lessening of global warming and upgrading of ecological system (Chandra et al., 2012). Biogas, produced by breaking down of organic matter with the help of anaerobic bacteria is one kind of renewable energy source (Walekhwa et al., 2009), promising for heating, cooking and electricity production. Biogas contains methane as a main element (Coskun et al., 2011; Rasi, 2011). Though it is very beneficial as an energy source, it is not harmless. New rules and regulations are required for safely collection and pollution control of methane gas. Moreover, methane has more powerful adverse effect than that of carbon dioxide. So, it is better to convert methane to carbon dioxide by burning (BM, 2010). Biogas can also be produced from agricultural, animal wastes or industrial wastes. Biogas disasters, air tight containers are used to ferment waste to methane rich biogas (Coskun, 2011; Rasi, 2011). And these disasters can be one of the best option for developing country due to very low cost. They can help in reducing air pollution, rampant deforestation and can provide safe, uninterrupted and clean energy for rural areas. Solid waste, also known as trash or garbage discarded by industry or public can be transformed to useable form of energy. Several technologies such as digestion, combustion, gasification, etc. have been developed for conversion of solid waste. Power stations, using trash, called waste to energy plants can produce energy much as coal fired plants do. But cost of power produced from trash is more than that of coal or other energy sources (BM, 2010). However, the main benefit of solid waste is that it holds the promise of reduction of climate changing greenhouse gases. Biomass utilization is cast for power sector, could generate 3000 terawatt hours of electricity globally by 2050. In 2050, this amount will be sufficient for satisfying 7.5% of world power needs (EH, 2012). As of May 2012, biomass produces about 10% of world's primary energy supply. Biomass is anticipating for progressing energy efficiency of buildings, could provide 20% of total world thermal energy needs in buildings by 2050. Thermal energy from biomass has become more and more significant in replacing carbon intensive fossil fuels. Burning biomass has legion environmental benefits over burning fossil fuel. In modern world, biomass can be used in more efficient ways. Through conversion to liquid fuel or gasification to biogas, biomass can add the reduction of global warming particulates with providing energy (EH, 2012).

5. GEOTHERMAL RESOURCES

Under the earth crust, there is a layer of hot and molten rock, where heat is continuously generated through the decay of radioactive materials. And these resources possess fifty thousand times more energy than all oils and natural gas resources (RE, 2013). The total energy of the earth is counted as 12.6×10^{24} MJ and that of the crust is 5.4×10^{21} MJ. This thermal energy can offer temperatures of 200 to 1000 ˚C at the base of the crust and at the centre temperature ranges from 3500 to 4500 ˚C (Bertani, 2009). So our earth really possesses an immense amount of energy which can be exploited for gaining clean, safe and secured energy. Geothermal resources can be categorized as low, medium and high enthalpy resources (Etemoglu, 2007). Using engineering technologies, these resources can be taped for space heating or cooling, electricity generation. Geothermal energy is a clean sustainable energy source which can be utilised economically in many parts of the world. It can be implemented for direct use

and electricity generation. The independency on weather condition and inherent huge heat storage capabilities make it promising for base load power plant and thus geothermal energy can be a partner with other intermittent resources or can be replacement of other sources.

A much more conventional means to exploit geothermal energy using ground source is the heat pump technology (Najafi, 2011). Recently, heat pump application, already showing feasible worldwide is the most rapidly growing and also major direct utile sector due to its economical installation (Lund, 2011). In the last few years, geothermal technologies have been improved dramatically. Cogeneration of electricity and heat is attaining importance or increased popularity, making better of overall efficiency (Gerber, 2012). Some countries have low enthalpy region in which also low temperature power generation with binary plant is possible. Advanced geothermal energy extraction technology by which more thermal energy can be extracted, more power can be produced with mitigating energy crisis (Yekoladio, 2013). If this technology can be implemented economically, then the potency of geothermal energy will be limitless.

6. WIND POWER AND WIND RESOURCES

Wind, a resource having energy blows often fast, often slow. In which region, wind blows enough, power can be generated by harnessing wind current. Power output of wind turbine, function of cubic of wind speed can provide eight times power if wind speed doubles (Argatov, 2009). Wind energy is clean and sustainable. Wind energy develops no toxic and heat trapping emissions. Wind energy has function in various sectors such as wind mill, water pump, sailing boats, electricity generation. Wind energy was first used for boat navigation and pumping water in wind mill. At the beginning of 21st century, wind mills were introduced and until 20th century wind energy is utilized in mechanically driven water pump (Şahin, 2004). In the past years, wind power is formulated and extended to industrial use. Wind energy which already showing good economy can be harnessed to generate clean electricity required for heating, refrigeration and other uses (Sharma, 2012; Şahin, 2004). Wind energy is good for environment, i.e. it is not harmful for wildlife. Wind power consumes no fuels, produces no air pollutants. But wind power station requires a large land area, which may be essential for other uses such as agriculture. There are reports of birds and bats mortality or injury due to artificial structure or turbine blades, tower, and transmission lines (Subramanian, 2012). Also negative report regarding noise come from people who live nearby wind farm (David, 2009). Although wind power produces no air pollutants, but has some risks related with construction, operation and maintenance of wind farm. While industrial sized wind turbine is installed, including operation and maintenance, injury or people deaths are common to wind power life cycle (Craig, 2013; Gipe, 2007a; Gipe, 2007b).

7. HYDROPOWER RESOURCE

Water, the fuel for hydropower is moving always in various states on earth, which states are combined known as hydrological cycle. Water evaporating from rivers, oceans, converting to clouds, falling out as rain and snow, assembling into streams and rivers and flowing back to the sea- all these movements offer a great chance to exploit useful energy.

Hydropower, gained by exploiting movements of water using diversion infrastructure or dams is the sustainable and non-polluting power which can reduce fossil fuels dependency and threat of global warming (Frey and Linke, 2002). Hydropower derived from flowing water is used to generate electricity or to power machinery. At the beginning, hydropower was utilised in mills, paper mills, saw mills, fullers, etc. During the ancient times, water wheels were utilised for grinding wheat into flour, and by the 1700s, water turbines were employed to harness the energy of flowing water. Today hydropower generates more electricity than other renewable resources in some developed countries (Zimny et al., 2013).

Though hydropower emits no air pollutants, construction and operation of diversion infrastructure or dams impose negative impact on natural feature. It greatly affects the flow of river, altering the ecosystem and affecting the wildlife (Kentel and Alp, 2013). It results a common feature that is fishes are blocked from moving up and down the river. Moreover, bottom portion near to dam is very dangerous for fish. This water remains cold and contains poor oxygen, so when released to river, may kill fish living downstream that having warmer and oxygen rich conditions. Another problem is that river and lakes are filled with sediment, affecting the water quality and aquatic life. Due to sedimentation, air is also polluted. Because, where water and sediment meet, methane is generated largely. Methane is more powerful than carbon dioxide, contributing more to global warming (RE, 2013).

CONCLUSION

Renewable energies are alternative sources and very much anticipating for sustainable development. It is renewable and not susceptible to significantly climate change. Among all the renewable energy resources, solar energy is more exploiting technologies. Power generation by solar energy technologies are not very complex. Both large and small scale power generation can be possible by solar systems that are very environment friendly. Considering the increased energy utilisation worldwide and to develop a sustainable or pollution free world, shifting to renewable energy conversion technologies will be viable move.

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