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## **GREEN ENERGY FOR GREEN EARTH – A REVIEW**

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### **ABSTRACT**

The contribution of conventional energy sources such as fossil fuels to global warming resulted in devastating effect on the earth's climate making it inhospitable for the future generations. Considerable progress is being made in the energy transition from fossil fuels to ecologically sustainable systems like renewable energy or green energy. The term green is used as a reference to living in a way that is environmentally friendly. Hence it is described as energy sources of power that are non - polluting and environmentally friendly, those remedy the effects of pollutants on our environment, as well as prevent future global warming. It is clean (alternative) energy which is renewable and will not exhaust finite supplies of fuel on the planet. It can be extracted, generated and consumed without any significant negative impact to the environment. According to U.S. Environmental Protection Agency green power is electricity produced from solar, wind, geothermal, biogas, biomass and low impact small hydroelectric sources.

There are three generations of renewable technologies which are essential contributors to sustainable energy. The combination of these technologies should be advanced as a solution to global warming, air pollution and energy security reducing dependence on fossil fuel resources and providing opportunities for mitigating green house gases. Renewable energy resources and significant opportunities for energy efficiency exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency, and technological diversification of energy sources, would result in significant energy security and economic benefits.

Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services. Renewable energy provides 21.7% of electricity generation worldwide as of 2013. Solar hot water makes an important contribution to renewable heat in many countries, most notably in China, which now has 70% of the global total.



Renewable bio fuels have contributed to a significant decline in oil consumption in the United States since 2006. Over 44 million households use biogas made in household-scale digesters for lighting and/or cooking, and more than 166 million households rely on a new generation of more-efficient biomass cook stoves. United Nations' Secretary-General Ban Ki-moon has said that renewable energy has the ability to lift the poorest nations to new levels of prosperity.

Renewable energy can be particularly suitable for developing countries. In rural and remote areas, transmission and distribution of energy generated from fossil fuels can be difficult and expensive. Producing renewable energy locally can offer a viable alternative. In view of meeting the growing power needs of the population and to minimize the negative effects of climate changes in the country India is bold and ambitious to emerge as a clean energy leader by enhancing the clean energy investments under current policies forecast to grow by 369% between 2010 and 2020.

**Key words:** Renewable energy, global warming, climate.

The contribution of conventional energy sources such as fossil fuels to global warming resulted in devastating effect on the earth's climate making it inhospitable for the future generations. Considerable progress is being made in the energy transition from fossil fuels to ecologically sustainable systems like renewable energy or green energy or sustainable energy or alternate energy. It is obtained from non-exhaustible resources, which serves the needs of the present without compromising the needs of future generations. The term green is used as a reference to living in a way that is environmentally friendly. Hence it is described as energy sources of power that are non-polluting and environmentally friendly, those remedy the effects of pollutants on our environment, as well as prevent future global warming. It is clean (alternative) energy which is renewable and will not exhaust finite supplies of fuel on the planet. It can be extracted, generated and consumed without any significant negative impact to the environment. According to U.S. Environmental Protection Agency green power is electricity produced from solar, wind, geothermal, biogas, biomass, tidal, wave and low impact small hydroelectric sources. These are technologies designed to improve energy efficiency.

There are three generations of renewable technologies which are essential contributors to sustainable energy reaching back more than 100



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years. First generation technologies originated in the 19<sup>th</sup> century during industrial revolution. Hydropower, biomass combustion, geothermal power and heat are some of the technologies still used widely.

Among these hydroelectric plants are clean with few emissions and were operated for more than a century. **Hydropower** allows societies to become more self sufficient since it is produced domestically. Being a product of water cycle hydroelectricity is sustainable.

**Biomass** is used as an alternative to charcoal in some developing countries like congo where any plant matter is converted into compressed briquettes having 70% calorific value of charcoal. The use of biomass has two advantages: provides energy and deals with sewage waste. The harmful products produced by the combustion of bio fuels are fewer than the other sources.

**Geothermal energy** is heat extracted from the earth and transferred to the household use. It is a byproduct of the natural decaying of minerals in the ground and the absorption of solar energy deep within the earth. The use of this energy was confined only to heating earlier while modern technology converts it into electricity. It is one of the cheapest energy sources available and can be extracted all year long. However, it is accessible only in limited areas of the world including US, Central America, Iceland, Philippines etc owing to competitive price in producing geothermal power or in other regions where resource is of lower temperature.

The second generation technologies include solar heating and cooling, wind power, modern forms of bio energy and solar photovoltaic. Oil crises of 1973 and 1979 prompted energy security concerns to research development and demonstration (RD & D) since 1980s leading to the development of these technologies.

**Solar power** is created through panels and other methods of collecting heat from sun and converting it into energy. Unlike fossil fuels it is an infinite source, free and renewable as long as the sun shines. The solar heat may be used to produce domestic hot water, space heating and for cooling purpose in industries.

**Wind energy** is a clean, alternative and renewable source of energy like solar energy. It is cost effective and good for environment

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and human health. It has high potential and relatively low production cost. Wind power accounts to 1.3% of total global electricity consumption. In Denmark it accounts to 20%, 9% in Spain and 7% in Germany.

Modern forms of bio energy include production of ethanol fuel from sugarcane and methane from cow manure. Brazil is the leading producer of ethanol in the world providing 18% of country's automotive fuel and recently reached self sufficiency in oil together with exploitation of domestic deep water oil source. In United States most cars run on blend of gasoline and ethanol ranging from 10% to 85% emerging into flexible fuel cars or hybrid cars.

Another renewable energy source that benefits both the environment and the farmer is methane which generates heat that can be used in cooking as gobar gas and also generating electricity in rural households. Since agricultural waste is a source of water and air pollution processing manure for the sake of energy production can counteract the problem. Methane itself being a green house gas its conversion into energy source can minimize global warming.

**Solar photovoltaic modules** provided remote area power supply in 1980's and early 90's. However from 1995 industry efforts have focused increasingly on developing 'building integrated photovoltaic and power plants' for grid connected applications. Currently the largest photovoltaic plant is in North America.

The third generation technologies include advanced biomass gasification, biorefinery technologies, concentrating solar thermal power, hot dry rock geothermal energy and ocean energy. They are not yet widely demonstrated or commercialized.

**Cellulosic ethanol** biorefineries, a new bio energy technique, is going to play a bigger role in the future. This bio fuel is extracted from the inedible cellulose fibers from the stems of most plants. corn stalks, wheat straw and rice straw, wood waste and municipal solid wastes are potential sources of cellulosic biomass.

Traditional photovoltaic cells are being replaced with thin film **nanosolar panels** which can create circuits from individual silicon molecules at much lower cost. In a research project on artificial



photosynthesis water can be split into hydrogen fuel using nanotechnology based solar energy. An “Artificial Leaf” was developed by Massachusetts Institute of Technology (MIT) in 2011, which is capable of splitting water into hydrogen and oxygen directly from solar power when dropped into a glass of water producing bubbles of hydrogen on one side and bubbles of oxygen on the other.

**Ocean energy** was produced from the first commercial wave farm established in Portugal in 2007. In Ireland world’s first submerged turbine using tidal power energy was installed to light thousand homes with minimal environmental impact.

A combination of these technologies should be advanced as a solution to global warming, air pollution and energy security reducing dependence on fossil fuel resources and providing opportunities for mitigating green house gases. Renewable energy resources and significant opportunities for energy efficiency exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency, and technological diversification of energy sources, would result in significant energy security and economic benefits.

Renewable energy can be particularly suitable for developing countries. In rural and remote areas, transmission and distribution of energy generated from fossil fuels can be difficult and expensive. Producing renewable energy locally can offer a viable alternative. In view of meeting the growing power needs of the population and to minimize the negative effects of climate changes in the country, India is bold and ambitious to emerge as a clean energy leader by enhancing the clean energy investments under current policies forecast to grow by 369% between 2010 and 2020. But renewable energy sources in India are different from those deployed in US and Europe and understanding the differences can bring out viable policies for brightening the future of India with sun and wind. The challenges faced by India are intermittency/variability, location specific potential and higher costs. However, there are specific differences and needs which further need to be analyzed for long term viability of renewable energy.

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rural (off-grid) energy services. Renewable energy provides 21.7% of electricity generation worldwide as of 2013. Solar hot water makes an important contribution to renewable heat in many countries, most notably in China, which now has 70% of the global total. Renewable bio fuels have contributed to a significant decline in oil consumption in the United States since 2006. Over 44 million households use biogas made in household-scale digesters for lighting and/or cooking, and more than 166 million households rely on a new generation of more-efficient biomass cook stoves. United Nations' Secretary-General Ban Ki-moon has said that renewable energy has the ability to lift the poorest nations to new levels of prosperity.

### **Green India for green earth**

India is a nation in transition. Considered an "emerging economy," increasing GDP is driving the demand for additional electrical energy, as well as transportation fuels. India is blessed with vast resources of renewable energy in solar, wind, biomass and small hydro. It has over 150,000MW of exploitable renewables. Tapping India's wind, solar, biomass, and hydro could bring high quality jobs from a domestic resource. Extending the electric grid between all states, and ultimately between neighbor nations will expand international trade and co-operation on the subcontinent. Unique in the world, India has the only Ministry that is dedicated to the development of renewable energies: the Ministry of New and Renewable Energy. This bodes well for the acceleration of renewable development throughout the nation -- both to meet the underserved needs of millions of rural residents and the growing demand of an energy hungry economy.

Being a game-changer for India Renewable Energy (especially solar and wind) has the potential to re-energize India's economy by creating millions of new jobs, achieve energy independence, reduce the trade deficit and propel India forward as a "Green Nation". This provides India a golden opportunity to solve three huge problems – reducing poverty, ensuring energy security and combating climate change. India can no longer afford to delay renewable energy deployment to meet its future energy needs and its contribution to the green earth<sup>1</sup>.

### **Conclusion**

Emphasis on awareness programmes on the use, advantage and need for green energy through mass media and in educational institutions as a part of curriculum is the need of the hour. There is also a greater



need to improve our skills and innovations in this area. There should be a dialogue among all the stake holders to make renewable energy sustainable. Research in this area needs to be encouraged with suitable incentives and support from the local governments. Issuing green energy certificates, tax exemptions and subsidies for promoting these technologies among stake holders will help India move ahead in exploiting the clean energy.

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