

Review Article on Growing Market of Green Energy

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Abstract—There has been considerable interest recently in the topic of renewable energy. This is primarily due to concerns about environmental damage (especially acid rain and global warming) resulting from the burning of non renewable fossil fuels. However, investing in renewable energy is controversial for several reasons. First, not all scientists agree on the degree of environmental damage that can be attributed to fossil fuels. Second, fossil fuels are relatively abundant and cheap energy sources, and have contributed significantly to economic growth. Abandoning inexpensive fossil fuels for more expensive renewable ones will have major economic ramifications. Indian Renewable Energy Market grows at faster rate with Solar, Wind, Biomass & micro Hydro plants. The paper will illustrate the different aspects & statistics of Renewable sources in India.

1. INTRODUCTION

The importance of electrical energy increases day to day with the increase of technology. The revolution for electrical energy become earlier at 18th century when British scientist Michael Faraday discovered the basic fundamentals of Electricity Generation. At late of 18th century the supply of electricity made publically. The industrial revolution that began in the second half of the 18th century changed the world, with new methods of machine-based manufacturing leading to a profound increase in economic growth, population growth, and quality of life. At the time, the long-term consequences could not even be conceived of, much less felt; however, the burning of vast quantities of fossil fuels, such as coal and oil, has caused a great deal of harm[1] to the environment. Most climatologists agree that the use of fossil fuels has contributed significantly to global warming. This term refers to the measured increase in the Earth's surface temperature since the late 19th century and the environmental effects of this change.

Green energy is energy that is produced in such a way as to minimize its negative impact [2] on the environment. Traditional energy sources, most notably fossil fuels, produce greenhouse gases that are believed to be the primary cause of an effect known as global warming or climate change. Sources of green energy, such as solar, wind, geothermal, and hydro energy, are developed and promoted as alternative sources that make little or no contribution to climate change. Even nuclear

energy is sometimes considered a green energy source, because some types of nuclear technology produce much less waste than oil and coal.

2. FORMS OF GREEN ENERGY

Research into renewable, non-polluting energy sources is advancing at such a fast pace, it's hard to keep track of the many types of green energy that are now in development. Here are 6 of the most common types of green energy:

Solar Power-The most prevalent type of renewable energy, solar power [3][4] is typically produced using photovoltaic cells, which capture sunlight and turn it into electricity. Solar energy is also used to heat buildings and water, provide natural lighting and cook food. Solar technologies have become inexpensive enough to power everything from small hand-held gadgets to entire neighborhoods.

Wind Power-Air flow on the earth's surface [5] can be used to push turbines, with stronger winds producing more energy. High-altitude sites and areas just offshore tend to provide the best conditions for capturing the strongest winds. According to a 2009 study, a network of land-based, 2.5-megawatt wind turbines [6] in rural areas operating at just 20% of their rated capacity could supply 40 times the current worldwide consumption of energy.

Hydropower-Also called hydroelectric power, hydropower is generated by the Earth's water cycle, including evaporation, rainfall, tides and the force of water running through a dam. Hydropower depends on high precipitation levels to produce significant amounts of energy.

Geothermal Energy-Just under the earth's crust are massive amounts of thermal energy, which originates from both the original formation of the planet and the radioactive decay of minerals. Geothermal energy in the form of hot springs has been used by humans for millennia for bathing, and now it's being used to generate electricity.[7][8] In North America

alone, there's enough energy stored underground to produce 10 times as much electricity as coal currently does.

Biomass-Recently-living natural materials like wood waste, sawdust and combustible agricultural wastes can be converted into energy with far fewer greenhouse gas emissions than petroleum-based fuel sources[9]. That's because these materials, known as biomass, contain stored energy from the sun.

Biofuels-Rather than burning biomass to produce energy, sometimes these renewable organic materials are transformed into fuel. Notable examples include ethanol and biodiesel. Bio fuels provided 2.7% of the world's fuels for road transport in 2010, and have the potential to meet more than 25% of world demand for transportation fuels by 2050.

3. WORLD'S MARKET REVIEW FOR GREEN ENERGY

Renewable energy provides 21.7% of electricity generation worldwide as of 2013. Renewable power generators are spread across many countries, and wind power alone already provides a significant share of electricity in some areas: for example, 14% in the U.S. state of Iowa, 40% in the northern German state of Schleswig-Holstein, and 49% in Denmark. Some countries get most of their power from renewable, including Iceland (100%), Norway (98%), Brazil (86%), Austria (62%), New Zealand (65%), and Sweden (54%).

Wind power is growing at the rate of 30% annually, with a worldwide installed capacity of 282,482 megawatts (MW) at the end of 2012, and is widely used in Europe, Asia, and the United States. At the end of 2012 the photovoltaic (PV) capacity worldwide was 100,000 MW, and PV power stations are popular in Germany and Italy. Solar thermal power stations [10] operate in the USA and Spain, and the largest of these is the 354 MW SEGS power plant in the Mojave Desert. The world's largest geothermal power installation is The Geysers in California, with a rated capacity of 750 MW. Brazil has one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugar cane, and ethanol now provides 18% of the country's automotive fuel. Ethanol fuel is also widely available in the USA.[11]

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.

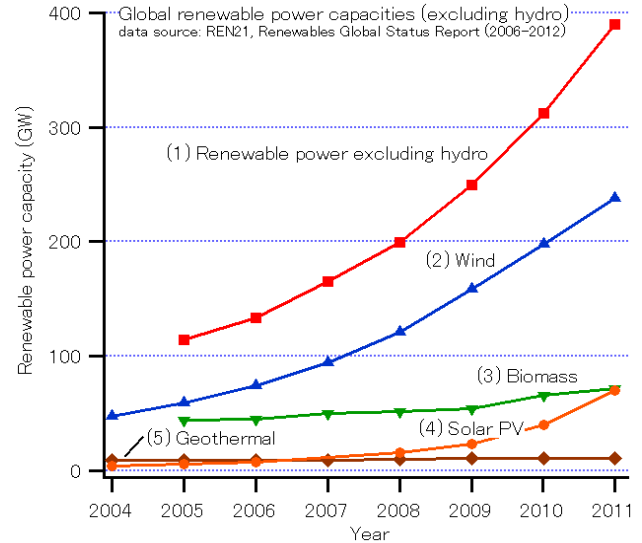


Fig. 1: Global Growth of Renewable Energy

The scenario for Renewable Energy changes day to day as the growth of globalization. Due to its clean and easily accessible properties, Investments in this field increases rapidly.

Global new investment in renewable energy

data source: Bloomberg New Energy Finance, UNEP SEFI, Frankfurt School, Global Trends in Renewable Energy Investment 2011

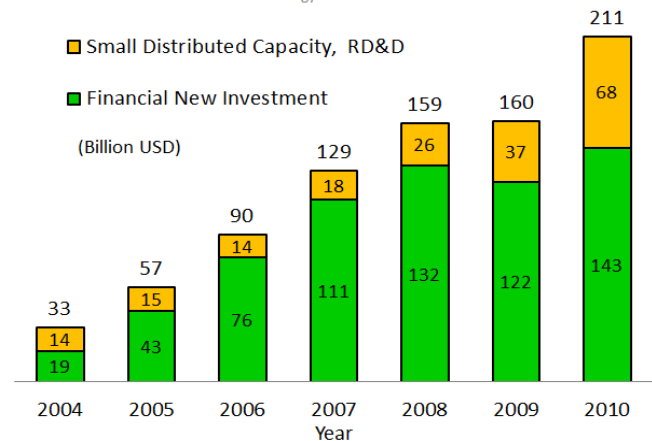


Fig. 2: Global investment in renewable energy

4. GREEN ENERGY: INDIA OVERVIEW

India is one of the largest and fastest growing economies in the world, as well as an expansive populace of above 1.1 billion people. There is a very high demand for energy, which is currently satisfied mainly by coal, foreign oil and petroleum, which apart from being a non-renewable, and therefore non-permanent solution to the energy crisis, it is also detrimental to the environment. The price of crude oil has risen sharply over the last few years, and there are no signs of a change in this trend. Thus, it is imperative that India obtains energy security without affecting the booming economy,

which would mean that alternative energy sources be found. This would mean that the country must switch from the nonrenewable energy-crude oil and coal-to renewable energy.

In the shadows of Worlds Renewable energy market India is no longer behind. It's step up so quickly to meet the target of Power Demand which growing rapidly.

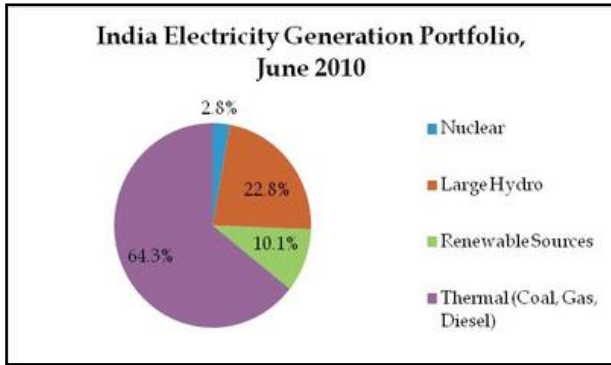


Fig. 3: Indian Electricity Generation source: mnre.gov.in

India is determined to becoming one of the world's leading clean energy producers. The Government of India has already made several provisions, and established many agencies that will help it achieve its goal. Renewable Energy, excluding large hydro projects already account for 9% of the total installed energy capacity, equivalent to 12,610 MW of energy. In combination with large hydro, the capacity is more than 34%, i.e. 48,643MW, in a total installed capacity of 144980 MW.[12]

Renewable energy in India comes under the purview of the Ministry of New and Renewable Energy. India was the first country in the world to set up a ministry of non-conventional energy resources, in early 1980s. India's cumulative grid interactive or grid tied renewable energy capacity (excluding large hydro) has reached 29.9 GW, of which 68.9% comes from wind, while solar PV contributed nearly 4.59% of the renewable energy installed capacity in India.

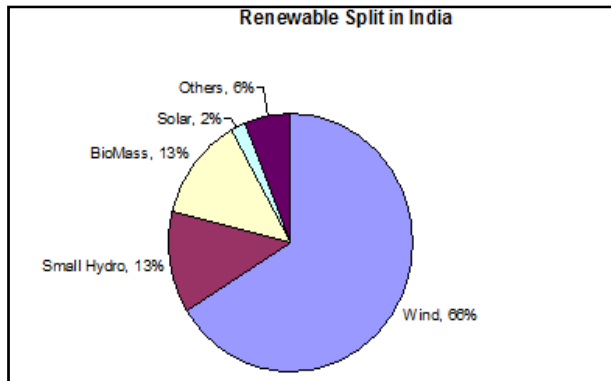


Fig. 4: Renewable split in India source mnre.gov.in

As In the Fig.3 it shows India's split of renewable energy and we can see the wind energy have a significant part in that. The development of wind power in India began in the 1990s, and has significantly increased in the last few years. Although a relative newcomer to the wind industry compared with Denmark or the US, domestic policy support for wind power has led India to become the country with the fifth largest installed wind power capacity in the world. As of December 2013 the installed capacity of wind power in India was 20149.50 MW, mainly spread across Tamil Nadu, Maharashtra, Gujarat , Karnataka & Rajasthan shows in Fig. 5. It is estimated that 6,000 MW of additional wind power capacity will be installed in India by 2016[12]. Wind power accounts for 6% of India's total installed power capacity, and it generates 1.6% of the country's power. In its 12th Five Year Plan (2012-2017), the Indian Government has set a target of adding 18.5 GW of renewable energy sources to the generation mix out of which 11 GW is Wind Energy.

Electricity generation from renewable represents about 3% of all electricity generation in India. India produces a huge quantity of biomass material in its agricultural, agro-industrial, and forestry operations. According to some estimates, over 500 million tons of agricultural and agro-industrial residues alone are generated every year. This quantity, in terms of heat content, is equivalent to about 175 million tons of oil.

Top 10 states producing energy from renewable sources

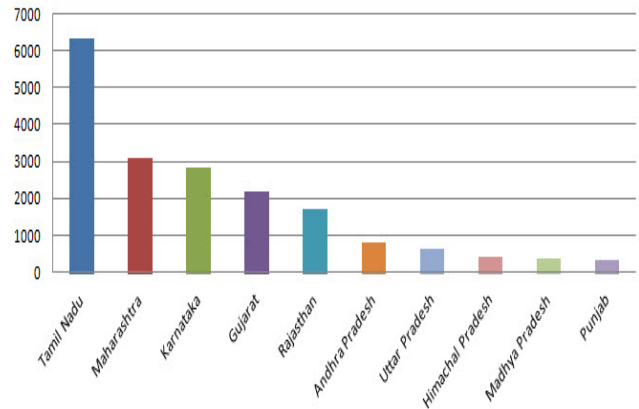


Fig. 5: State wise division for Renewable Energy

Every year, about 55 million tonnes of municipal solid waste (MSW) and 38 billion liters of sewage are generated in the urban areas of India. In addition, large quantities of solid and liquid wastes are generated by industries. Waste generation in India is expected to increase rapidly in the future. As more people migrate to urban areas and as incomes increase, consumption levels are likely to rise, as are rates of waste generation. It is estimated that the amount of waste generated

in India will increase at a per capita rate of approximately 1-1.33% annually. This has significant impacts on the amount of land that is and will be needed for disposal, economic costs of collecting and transporting waste, and the environmental consequences of increased MSW generation levels. Waste Energy in India

5. FUTURE OF INDIA IN GREEN ENERGY

India is said to be one of the seven largest consumers of energy, but the growing gap between consumption and domestic output is a cause of concern. India's share in global oil reserves is about 0.5 per cent, whereas its share in global consumption is about 3 per cent. India is still dependent to the extent of 30 to 35 per cent on non-commercial fuel sources like cow dung, firewood, agricultural waste, etc. The growing energy needs of the emerging economics, specifically India, risks enhanced environmental damage from conventional carbon based sources of energy. The pressure on petrol is mounting and we have to concentrate on conservation of petroleum. Towards conservation of petroleum consumption, the government has to ration supplies of cooking gas, kerosene and petrol; improve power generation; focus on alternative source of energy such as solar, wind and bio-fuels; setup energy standards for all vehicles and a mass awareness for conservation. As the country's petroleum bill grows, and future supplies look volatile or insecure, alternatives need to be explored. Ethanol is an environment-friendly oxidant additive to gasoline. Energy majors are determined to tap biofuels. Special attention is being paid to jatropha cultivation. The corporate sector too is focusing on the biofuels sector. It is estimated that globally about one million hectares would cater to biofuels over the next four years, with an estimated 300,000 hectares contributing each year to biofuels in South East Asia, India and Southern African countries. India will itself produce 2 million tones[13] of biodiesel by 2016.

By 2040, China's energy use will be double the U.S. level; India's a little more than half despite its faster GDP growth

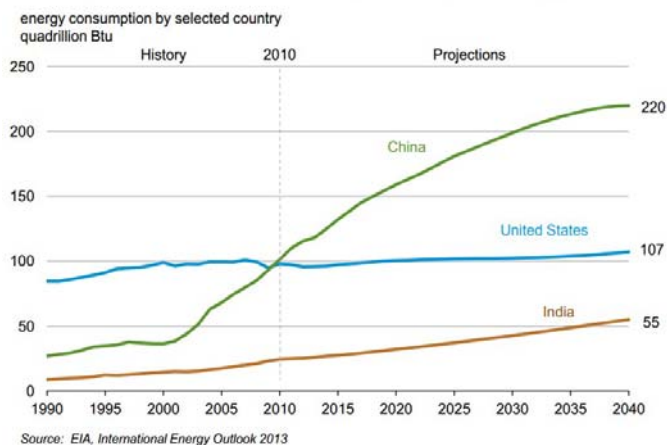


Fig. 6: India , China & United State's Future Energy prediction.

Power and Energy sector is in a positive mood and is leaving no missed opportunity to make hay of it, while the sun shines. India has set up a target of 20000 MW of installed capacity by 2022 for harnessing solar energy. It is leaving no stone unturned to become a solar hub in the world. With such earnest efforts, India's mission to tap solar energy is not a pipe dream.

The report cites growth in the developing world as a primary cause for the increased energy demand, with over half of the total world increase attributable to China and India

6. CONCLUSION

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 a nation of extremes. Poverty remains in areas with no energy services, while wealth grows in the new business hubs. Coal fired generation currently provides two thirds of the generation capacity, and hydropower supplies the other third. Yet, India is blessed with vast resources of renewable energy in solar, wind, biomass and small hydro. In fact, the technical potential of these renewable exceeds the present installed generation capacity. 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. The development and deployment of renewable energy, products, and services in India is driven by the need to.

Expanding electrical capacity is essential. Renewable energy remains a small fraction of installed capacity, yet India is blessed with over 150,000MW of exploitable renewable. It makes sense to the authors that all efforts and investment should consider accelerating these sustainable energy resources before committing to the same fossil fuel path as western nations. The fossil fuel strategy will surely bring price volatility from dwindling supplies and added pollution from carbon combustion. 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. This Article is meant only as an overview in hopes that it will encourage even more rapid and extensive development of the renewable energy resources on the Indian subcontinent.

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