A REVIEW ON GREEN ENERGY IN INDIA

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Abstract

Green energy is at the heart of all ecological strategies because it affects companies in three vital areas: environmental, economic, and social. Globalization leads the modern world towards green sources of energy. Green energy is clean sources of energy that have a lower environmental impactcompared to conventional energy technology. Green energy plays a significant role in the strategic energy planning process for any country. Regarding energy resources, India plays an important part on the world scene. However, the energy systems of the different regions and territories varied on various parameters. Renewable energy sources such as biomass, wind, solar, hydropower, and geothermal can provide sustainable energy services, based on the use of routinely available, indigenous resources. This research not only provides confirmation that the energy management strategies are better than the traditional methods, but also aids the researchers and decision makers in applying the procedures.

Keywords:*Green energy, Renewable energy, Sustainable, Conventional energy, Energy scenarios, low environmental impact.*

1.Introduction

Renewable Energy RE is any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use. RE is obtained from the continuing or repetitive flows of energy occurring in the natural environment and includes resources such as biomass, solar energy, geothermal heat, hydropower, tide and waves, ocean thermal energy and wind energy. However, it is possible to utilize biomass at a greater rate than it can grow or to draw heat from a geothermal field at a faster rate than heat flows can replenish it. On the other hand, the rate of utilization of direct solar energy has no bearing on the rate at which it reaches the Earth. Fossil fuels (coal, oil, natural gas) do not fall under this definition, as they are not replenished within a time frame that is short relative to their rate of utilization.

Renewable energy sources are often considered alternative sources because, in general, most industrialized countries do not rely on them as their main energy source. Instead, they tend to rely on non-renewable sources such as fossil fuels or nuclear power. Because the energy crisis in the United States during the 1970s, dwindling supplies of fossil fuels and hazards associated with nuclear power, usage of renewable energy sources such as solar energy, hydroelectric, wind, biomass, and geothermal has grown.

Renewable energy comes from the sun (considered an "unlimited" supply) or other sources that can theoretically be renewed at least as quickly as they are consumed. If used at a sustainable rate, these sources will be available for consumption for thousands of years or longer. Unfortunately, some potentially renewable energy sources, such as biomass and geothermal, are actually being depleted in some areas because the usage rate exceeds the renewal rate.[1-4]

2. Wind energy

India has a vast coastal line which is a good resource of the fresh wind. Beside these there are other ways to generate the wind which need to get attention now. Highway wind turbine is the option for production of energy in India. India is the home of 1.25 billon people i.e. 17.5% of the total world population, which makes it second most populous country in world. India has the second fastest growing economy of the world. India's substantial and sustained economic growth over the years is placing enormous demand on its energy resources. When talking about clean technologies, there are two primary concepts of energy technologies: energy supply technologies, which refers to alternative sources of renewable energy (e.g., wind and solar power), and energy efficiency technologies, or those technologies which are hired to enhance energy use efficiency. The electricity sector in India had an installed capacity of 253.389 GW as of August 2014 [7].As of December 2013 the installed capacity of wind power in India was 20149.50 MW [8], mainly spread across Tamil Nadu, Maharashtra, Gujarat, Karnataka, Rajasthan, Madhya Pradesh, Andhra Pradesh, Kerala, West Bengal, other states [9]. Their share of distribution is shown with the help of this chart.

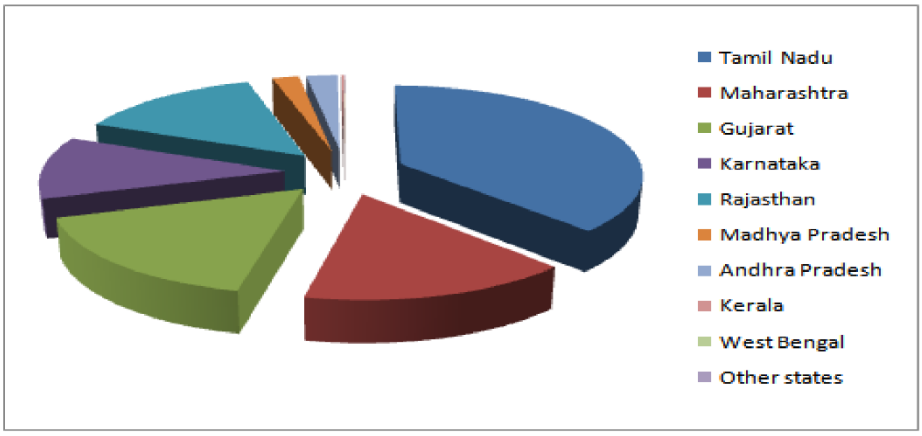

Fig.1. Distribution of wind energy production among states in MWs.

3. Solar energy

Solar energy is the ultimate energy source driving the earth. Though only one billionth of the energy that leaves the sun actually reaches the earth's surface, this is more than enough to meet the world's energy requirements. In fact, all other sources of energy, renewable and

non-renewable, are actually stored forms of solar energy. The process of directly converting solar energy to heat or electricity is considered a renewable energy source. Solar energy represents an essentially unlimited supply of energy as the sun will long outlast human civilization on earth. The difficulties lie in harnessing the energy. Solar energy has been used for centuries to heat homes and water, and modern technology (photovoltaic cells) has provided a way to produce electricity from sunlight. There are two basic forms of radiant solar energy use: passive and active. Passive solar energy systems are static, and do not require the input of energy in the form of moving parts or pumping fluids to utilize the sun's energy. Buildings can be designed to capture and collect the sun's energy directly. Materials are selected for their special characteristics: glass allows the sun to enter the building to provide light and heat; water and stone materials have high heat capacities. They can absorb large amounts of solar energy during the day, which can then be used during the night. A southern exposure greenhouse with glass windows and a concrete floor is an example of a passive solar heating system.

Active solar energy systems require the input of some energy to drive mechanical devices (e.g., solar panels), which collect the energy and pump fluids used to store and distribute the energy. Solar panels are generally mounted on a south or west-facing roof. A solar panel usually consists of a glass-faced, sealed, insulated box with a black matte interior finish. Inside 320 Energy Sci. & Tech. Vol. 1: Opportunities and Challenges are coils full of a heat collecting liquid medium (usually water, sometimes augmented by antifreeze). The sun heats the water in the coils, which is pumped to coils in a heat transfer tank containing water. The water in the tank is heated and then either stored or pumped through the building to heat rooms or supply hot water to taps in the building.

Photovoltaic cells generate electricity from sunlight. Hundreds of cells are linked together to provide the required flow of current. The electricity can be used directly or stored in storage batteries. Because photovoltaic cells have no moving parts, they are clean, quiet, and durable. Early photovoltaic cells were extremely expensive, making the cost of solar electric panels prohibitive. The recent development of inexpensive semiconductor materials has helped greatly lower the cost to the point where solar electric panels can compete much better cost wise with traditionally-produced electricity. Though solar energy itself is free, large costs can be associated with the equipment. The building costs for a house heated by passive solar energy may initially be more expensive. The glass, stone materials, and excellent insulation necessary for the system to work properly tend to be more costly than conventional building materials. A long-term comparison of utility bills, though, generally reveals noticeable savings. The solar panels used in active solar energy can be expensive to purchase, install and maintain. Leaks can occur in the extensive network of pipes required, thereby causing additional expense. The biggest drawback of any solar energy system is that it requires a consistent supply of sunlight to work. Most parts of the world have less than ideal conditions for a solar-only home because of their latitude or climate. Therefore, it is usually necessary for solar houses to have conventional backup systems (e.g. a gas furnace or hot-water heater). This double-system requirement further adds to its cost[2][4][5][6].

4. Hydropower energy

Hydroelectric power is generated by using the energy of flowing water to power generating turbines for producing electricity. Most hydroelectric power is generated by dams across large-flow rivers. A dam built across river creates a reservoir behind it. The height of the water behind the dam is greater than that below the dam, representing stored potential energy. When water flows down through the penstock of the dam, driving the turbines, some of this potential energy is converted into electricity. Hydroelectric power, like other alternative sources, is clean and relatively cheap over the long term even with initial construction costs and upkeep. India is fortunate to be endowed with all the primary energy sources such as coal, hydropower, uranium/ thorium, etc. However, among these, hydropower is the only renewable source of energy and has been recognized as economical and a preferred source of electricity due to its various benefits. Development of hydropower resources is important for energy security of the country. Hydropower is a renewable, economic and non-polluting source of energy. Hydropower stations have inherent ability of quick starting, stopping and load variations offering operational flexibility and help in improving reliability of power system. Hydro stations are the best choice for meeting the peak demand. The generation cost is not only inflation-free but reduces with time. Hydroelectric projects have long useful life extending over 50 years and help in conserving scarce fossil fuels. They also help in opening of avenues for development in remote and backward areas. In the north, in 1905, a 4 MW Mohora hydro station on river Jhelum was the first major hydropower development in the then princely state of Jammu and Kashmir. A few notable major projects were undertaken since independence that made significant strides in the subsequent few decades after the 1950s. Prime Minister Pandit Nehru was quite proud to proclaim some of the impressive dams and hydro as ‘‘the modern temples of India’’. Inter-alia, one can view a few from among a larger list[10] viz:

1.Bhakra Dam multipurpose project complex comprising Bhakra Dam and dam toe powerhouse – 450 MW, and two canal powerhouses – total 154 MW, in the then larger Punjab state (later divided into smaller states, Punjab, Haryana and Himachal Pradesh)

2.Rihand Dam multipurpose project – 300 MW in the then United Province, now Uttar Pradesh

3.Gandhi Sagar multipurpose project in the then Madhya Bharat, now Madhya Pradesh

4.Koyna Dam multipurpose complex project (with first major underground powerhouse) – 540 MW in the then larger Bombay state, now Maharashtra

5.Sharavati project – 891 MW in the then Mysore State, now Karnataka

6.Periyar project – 140 MW

7.Kundah complex project PHs I-60 MW and II175 MW in the then larger Madras state, now Tamil Nadu

8.Machkund – 120 MW, and the famous Hirakud dam multipurpose projects 308 MW in Orissa.

5. Bio-fuel energy

Biofuels are globally considered sustainable and ecofriendly source of energy to enhance national energy security and decrease dependence on imported fossil fuels. During the past one decade, Government of India (GoI) has initiated several measures to augment production and use of biofuels. The National Biofuel Mission launched in 2003 is the frontrunner of such efforts in the country. The 'National Policy on Biofuels' released in 2009, foresees biofuels as a potential means to stimulate rural development and generate employment opportunities, as well as aspires to reap environmental and economic benefits arising out of their large-scale use. One major reason why biofuels have attracted so much attention in recent years among the analysts, commentators and observers, of global food policy is their direct connection with food and feed availability and subsequent influence on market prices. The recent data suggest that a significant amount of food grains is being diverted for biofuel production by many leading producers in the world. In concurrence with the official biofuel policy, India produces biofuels only from non-edible feed stocks. Molasses, a major feed stock for bioethanol production, is a by-product of the sugarcane industry that produces edible sugar. Limited amounts of bioethanol are also produced through direct conversion of sugar cane juice and from other sources like sweet sorghum, tropical sugar beet, cassava, etc. but with no implications for food security. Biodiesel is mainly produced from nonedible oilseed crops like jatropha and pongamia, edible oil wastage and animal fats. Currently, jatropha, the major feed stock for biodiesel in India, occupies only around 0.5 million hectares of low-quality 'wastelands' across the country, of which 65-70 per cent are new plantations of under-three years. Currently, India's biofuel production accounts for only 1 per cent of its global production. India has about 320 distilleries with the production capacity of over 3.50 billion litres of alcohol every year.

There are several reasons behind the slow progress of India's national biofuels program towards its stated goals. The jatropha production program was started rather in haste without any planned varietal improvement program preceding it. In almost every state where it was implemented, conventional low-yielding cultivars were used for new plantings of feedstocks. Because of this reason, the producers are not comfortable with the yields of the crop, especially under low management conditions[12], as indicated by the field studies. Moreover, the longer gestation period (3-4 years) of jatropha also discourages the farmers in places where state support is not readily available. However, a financial assessment based on discounted measures[13] on long-term investment on jatropha cultivation has suggested promising prospects.

6. geothermal energy

Assessment of Geothermal resources was initiated in India, at the proposal of UNDP in 1973 for development of nonconventional energy resources. The Geothermal resource assessment in India is mainly based on the pioneer work of Krishnaswamyand Ravishanker (1982) who prepared an inventory 340 hot springs in India. Out of this 113 hotsprings were found suitable for exploitation and utilisation. The total resource potential of all the 113 hot springs was estimated to be 10,600 MW (Krishnaswamy &Ravishanker, 1982). Geothermal resources in

India, have been grouped into 10 provinces (Pitale&Padhi, 1995) based on geographical location and heat flow pattern. The stored heat potential of these 113 hot springs was estimated to be 40.91 x 10^{18} calories (Pandey & Negi, 1995).

Occurrence of the geothermal resources in India is mostly controlled by tectonic features. The main zone of geothermal resources is located in the Himalayas stretching from Puga in Jammu & Kashmir (Mandal 2003), Manikaran in Uttar Pradesh to Takshing in Arunachal Pradesh. Geothermal resources along Son-Narmada lineament at Anhoni-Samoni, Madhya Pradesh and Tatapani, Chhattisgarh form a most promising resource base in Central India.[17,18]

The investigation for geothermal resources in India is carried out mostly to shallow level i.e. <500 m depth, hence deep drilling is essential to know the deep reservoir parameters for assessing power generation potential in selected fields. The deep level assessment of potential will help in planning and development of geothermal resources in India.

The following measures need to be initiated for possible utilization of geothermal energy in India.[19,20]

a. The investigation carried out so far is mostly at shallow level creating a gap of data for planning power project. It is proposed that concerned authorities may drill deep boreholes at Puga, Tatapani, Parbati valley and West Coast hot spring area; to decipher characters of deep reservoir which will be useful to assess feasibility of the resources for power production (Sarolkar 2015).

b. Simultaneously, MT survey may be conducted to support the observations of geological and drilling data and study the reservoir structure at levels >1000 m, which will be useful for precise exploration planning.

c. Private parties consider geothermal exploration as capital intensive activity, hence, financial incentives may be announced to promote exploration for geothermal resources. Funding at exploration stage will motivate exploration agencies to take up geothermal energy projects for power generation and direct heat uses.

d. Government of India may encourage installation of demonstration geothermal plant at Puga and Tatapani, for establishing the geothermal power generation technology in India. Successful installation of power plant will attract the local entrepreneurs to take up more projects. The government has also proposed to encourage the use of geothermal energy for low temperature commercial applications and direct heat utilization. Government of India has formulated policy for development of geothermal energy and for streamlining of procedure for participation of Foreign Entrepreneurs in development of geothermal resources in India. It is suggested that government may offer financial incentives for use of geothermal energy, to reduce the emission of green house gases.

e. Government of India, MNRE, is planning for Geothermal capacity of 1000 MWth in the initial phase till 2022. The government is planning to encourage installation of demonstration projects to assess the technical viability. Government of India, Ministry of New and Renewable Energy (MNRE) contemplate initiatives in RDD&D of Geothermal technology specifically for the purpose of cooling, drying, Space heating, Greenhouse cultivation,

Industrial processes, Cold Storage, Poultry & Fish Farming, Mushroom Farming, Horticulture. (http://mnre.gov.in/schemes/new-technologies, 2016).

The different geothermal provinces in India are classified by the Geological Survey of India and are briefly described below[14,15,16]:

1.The N.E Himalaya Province

2.Cambay Province

3. West coast province

4. SONATA province

5. Bakreswar province

6. Godavari province

7. The Barren Island

The geothermal energy can be used to produce electricity and the steam or the hot water can directly be fed into the power plant for production of electricity.

7. Present Scenario of green energy in India

India, faced with twin challenges on energy and environmental front, has no option but to work towards increasing the role of renewable in the future energy systems. Renewable energy technologies vary widely in their technological maturity and commercial status. In India, renewable energy is at the take-off stage and businesses, industry, government and customers have a large number of issues to address before these technologies could make a real penetration. India with large renewable energy resources (solar PV, wind, solar heating, small hydro and biomass)is to set to have large-scale development and deployment of renewable energy projects.

8. Conclusion Or Disscussion

India has huge potential for producing power from Renewable Energy Sources (RES). Over the last few decades, in particular, Government of India has endeavored to lay the foundation for a broad-based renewable energy program and designed it specially to meet the growing energy needs, and to fulfill energy shortage and security concerns of the country. Considerable experience and capabilities exist in the country on renewable technologies. Although at present the contribution of renewable energy is small, but future developments might make RES technology more competitive to displace conventional energy sources. Prospects for RES are steadily improving in India towards a great future. It is destined to take a leading role in the global renewable energy movement aiming towards sustainable development. The strategy for achieving these enhanced goals will mainly depend on the active participation of all players i.e. from government agencies to NGO's, from

manufactures to R&D institutions, from financial institution to developers and of course a new breed of energy entrepreneurs.

We are rich in both hydro power and geothermal power and hence can opt for these types of energy in small scale basis for the clean development of the region. Instead of going to Mega hydro power projects small scale geothermal and hydro power projects are most suitable for this region due to high seismic activity. Foreign funding and technology transfer may be encouraged along with suitable financial incentives to attract private parties for development of geothermal energy in India. The geothermal energy may prove to be a good substitute to fossil fuels in low to moderate temperature uses.The importance of developing a strong biofuel industry to tackle the challenges of energy security and fuel selfsufficiency has been widely acknowledged in India. Wind energy is a great source to fulfill India's energy needs as well as develop its economy. Future and development of India depends upon many factors: one of them is being self dependent for its energy demands. It will free India from its dependency on other countries for nuclear energy generation.

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