Recent Trends in Renewable Energy Sources in India

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Abstract*—Recently in Electrical sectors particular for India, so many problems with power generation and least use of renewable energy sources are seen. The crises of energy have forced the world to develop new and alternative methods of power generation. This paper identified and helps the real use of renewable energy sources (RER) in tremendous amount and increase the economy of India. RER are on the world agenda either because of security of energy supply or due to environmental improvement. However, the new support system of the country involves very innovative elements and is expected to increase use of RER based electricity generation in future. This study concentrates on analysis of RER support system of the country. The role of new and renewable energy has been assuming increasing significance in recent times with the growing concern for the country's energy security.*

Keywords*— *Renewable Energy Resources (RER)

1. INTRODUCTION

Renewable Energy Sources are generated from natural sources such as sunlight, wind, rain, tide and geothermal heat energy. Why renewable energy for India? Because of power shortage, rising prices of oil and gases, ecological hazards etc. The ample resources and site available abundant sunshine, government initiative, increased financing options has boosted the use of power generation with alternative sources. The Indian power sector has an investment potential of USD 250 billion over the next 5-6 years. The opportunities in generation, distribution and transmission, India can initiate more and more research work in renewable energy sources [1]. All the states initiate the activity regarding renewable energy and also join in the campaign of "Make in India". 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. The broad aim of the Indian Ministry is to develop and deploy new and renewable energy for supplementing the energy requirements of the country. Energy self-sufficiency was identified as the major driver for new and renewable energy in the country in the wake of the two oil shocks of the 1970s. Many of these systems have been found useful in urban and semi urban areas also to conserve the use of electricity and other fossil fuels. Solar water heating systems have helped in demand side management of electricity in various cities and towns during peak hours. Standalone roof top SPV(Solar Photo voltaic) systems are getting popular for day time diesel abatement in areas where power cuts are very high. Government appreciates all the initiative regarding renewable energy for green generation.

2. RELATED SURVEY

A.Current status and trend of primary energy consumption

India is blessed with abundant natural resources and renewable energy potential, but millions of people still lack access to energy, electricity and clean fuels. Specifically, 3,700MW are currently powered by renewable energy sources (3.5 percent of total installed capacity).
The key drivers for renewable energy are the following [1]:

- The demand-supply gap, especially as population increases
- A large untapped potential
- Concern for the environment
- The need to strengthen India's energy security
- Pressure on high-emission industry sectors from their shareholders
- A viable solution for rural electrification

The Fig.1 shows that the real installed capacity in India of renewable energy [2].

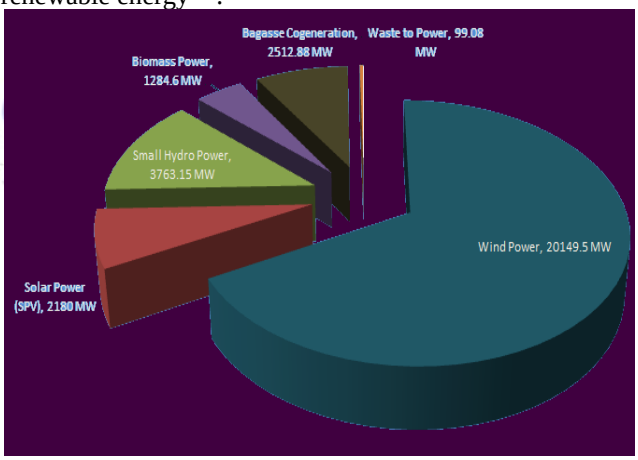

Fig.1

Also, with a commitment to rural electrification, the Ministry of Power has accelerated the Rural Electrification Program with a target of 100,000 villages. To better understand the current situation in India and the future of the renewable energy market, it is important to look at the trends in energy consumption, growth of the current grid, and the availability of transportation and equipment used.

3. DETAILS OF DIFFERENT KINDS OF RENEWABLE ENRGY

The actual scenario of installed capacity is more in wind power station. Also solar and others natural sources installed at various states in India. The various sources can be explained in details with following.

A. Wind Power

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 [1]. The largest wind farm of India is Muppandal in Tamil Nadu, which shown in Fig.2 [2]. As of December 2013 the installed capacity of wind power in India was 20149.50MW, mainly spread across Tamil Nadu (7162.18MW), Maharashtra (3021.85MW), Gujarat (3174.58MW), Karnataka (2135.50MW), Rajasthan (2684.65MW), Madhya Pradesh (386.00MW), Andhra Pradesh (447.65MW), Kerala (35.10MW), West Bengal (1.10MW), and all remaining states (3.20MW). It is estimated that 6,000MW of additional wind power capacity will be installed in India by 2012.Wind power accounts for 6% of India's total installed power capacity, and it generates 1.6% of the country's power.

Fig.2

B. Solar Power

The Fig.3 shows that the solar radiate tremendous amount of heat every day in terms of natural source, so government can initiate more and more projects on solar energy for generation [3].

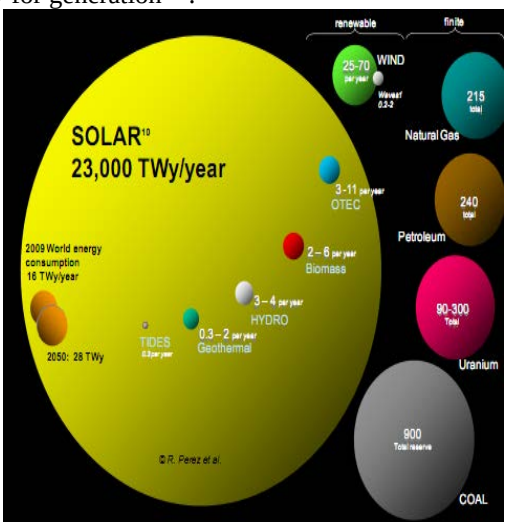

Fig.3

Rajasthan is one of the states of India in the field of solar energy. The total photovoltaic capacity has passed 500 MW, reaching 510.25 MW at the end of the 2012-13 fiscal years. It is one of a large number of solar parks expected to be built in a 35,000 km^2 area of the Thar Desert that has been reserved for solar power projects. Also the Canal Solar Power Project is a project launched in Gujarat to use 19,000 Kilometer long network of Narmada canals across the state for setting up solar panels to generate electricity. It was the first ever such project in India. This project has been commissioned by Sun Edison India, which shown in Fig.4 [5].

Fig.4

The big solar park also installed at village Charanka in Gujarat, and increases the capacity day by day. The government promotes all the initiative solar policy for generation. Also solar pump sets distributed at various villages of Gujarat for tube well under solar policy with subsidiary. Many of these systems have been found useful in urban and semi urban areas also to conserve the use of electricity and other fossil fuels. Solar water heating systems have helped in demand side management of electricity in various cities and towns during peak hours. Standalone roof top SPV systems are getting popular for day time diesel abatement in areas where power cuts are very high. In the Fig.5 shows state wise solar power generation.

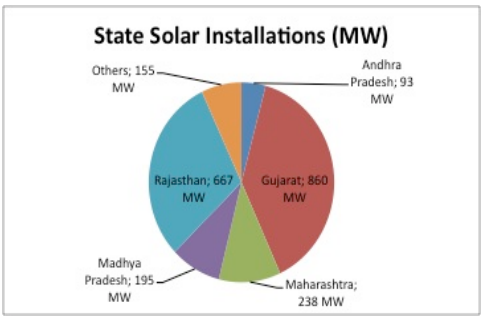

Fig.5

C. Small Hydro Power

The hydroelectric power refers to the energy produced from water (rainfall flowing into rivers). Consequently, rainfall can be a good indicator to investors looking for a location to implement or build a new hydroelectric power plant in India. The dominant annual rainfall is located on the north/eastern part of India: Arunachal Pradesh, Assam, Nagaland, Manipur and Mizoram, and also on the west

coast between Mumbai and Mahe. In India, small hydro is the most utilized renewable energy source for energy production.

These are the following Advantages of Hydro power [6]:

Some key figures concerning small hydro in India:

• Less than 25 MW is in the "small hydro" designation
• There is a potential of 15,000MW
• Installed is 1,520MW to date
• Technology is mature and reliable
• Two types of technology are used:
  i. High-head systems
  ii. Low-head systems
• Ministry of Non-conventional Energy Sources is focused on:

- Nation-wide resource assessment
- Setting up of commercial projects
- Renovation and modernization
- Development and up-gradation of water mills
- Industry based research and development

D. Biomass Energy

Biomass includes solid biomass (organic, non-fossil material of biological origins), biogas (principally methane and carbon dioxide produced by anaerobic digestion of biomass and combusted to produce heat and/or power), liquid biofuels (bio-based liquid fuel from biomass transformation, mainly used in transportation applications), and municipal waste (wastes produced by the residential, commercial and public services sectors and incinerated in specific installations to produce heat and/or power). The most successful forms of biomass are sugar cane bagasse in agriculture, pulp and paper residues in forestry and manure in livestock residues. It is argued that biomass can directly substitute fossil fuels, as more effective in decreasing atmospheric CO_2 than carbon sequestration in trees. The Kyoto Protocol encourages further use of biomass energy. Biomass may be used in a number of ways to produce energy.

The most common methods are:

- Combustion
- Gasification
- Fermentation
- Anaerobic digestion

India is very rich in biomass. It has a potential of 19,500 MW (3,500MW from bagasse based cogeneration and 16,000MW from surplus biomass). Currently, India has 537MW commissioned and 536MW under construction. The facts reinforce the idea of a commitment by India to develop these resources of power production.

Following is a list of some States with most potential for biomass production:

- Andhra Pradesh (200MW)
- Bihar (200MW)
- Gujarat (200MW)
- Karnataka (300MW)
- Maharashtra (1,000MW)
- Punjab (150MW)
- Tamil Nadu (350MW)
- Uttar Pradesh (1,000MW)

E. Tidal Energy

Tidal energy is generation based on tide of waves of sea and reservoir of water. It's also called wave energy. India has long bank of sea for this energy conversion. It's also beneficial to defense as well as ships power requirement in the sea.

4. COMMISSIONING NEW PROJECT OF RENEWABLE ENERGY IN INDIA

India is the leading country in Asia and one of the leading countries in the world in generating electric power through renewable energy sources [7]. Commissioning of various new projects based on renewable energy sources across the India will helpful to minimize the power generation crisis. Fig.6 shows the future prospect of different kinds of renewable energy sources.

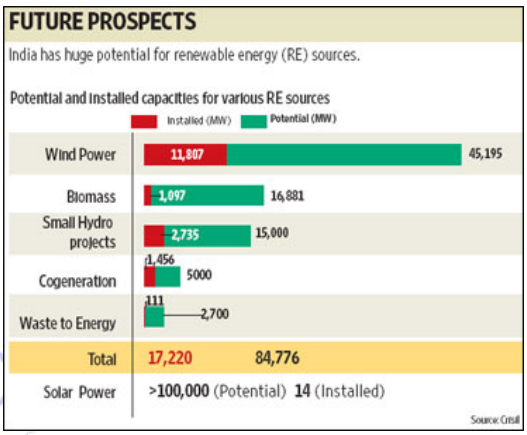

Fig.6

Table No.01 indicates the commissioning of various solar parks across the India [8].

Table No. 01

Commissioning of Solar Plant in India	Future Capacity (MW)
Auto Consortium Project, Tamil Nadu, India	50
30MW Solar PV Thin Film Plant near Jodhpur, Rajasthan, India	30
20MW Solar PV Thin Film Plant near Bikaner, Rajasthan, India	20
5MW Solar PV Single Axis Tracker Plant near Jodhpur, Rajasthan, India	5
2MW Solar PV Thin Film Plant at Luck now in Uttar Pradesh, India	2
2.34MW Solar PV Polycrystalline Plant near Mulugu, Andhra Pradesh, India	2.34
6.91MW Solar PV Polycrystalline Plant near Bap, Rajasthan, India	6.91

The Integrated Energy Policy Report (IEPR), prepared by the planning commission of India, has recognized renewable energy sources remain important to Indian's energy sector. With a concerted push and a 40 fold increase in their contribution to the primary energy, renewables may

account for only 5-6% of India's energy mix by 2031-32. The Table No.02 shows that the government planning for various innovative projects for natural resources.

Table No.02

Resources	Upto10th plan (MW)	11th plan (MW)	12th-13th plan (MW)	Total (MW)
Wind Power	700	10500	22500	40000
SHP	1960	1400	3140	6500
Bio Power	1037	2100	4363	7500
Solar Power	3	1000	20000	22000
Total	3700	15000	50003	76000

5. Conclusion

The Integrated Energy Policy Report (IEPR), prepared by the planning commission of India, has recognized renewable energy sources remain important to Indian's energy sector. With a concerted push and a 40 fold increase in their contribution to the primary energy, renewables may account for only 5-6% of India's energy mix by 2031-32. The Table No.02 shows that the government planning for various innovative projects for natural resources. India have a huge potential of renewable energy sources and from past few years due to government involvement there is sudden growth in Renewable sectors. Prospect of renewable energy are steadily improving in India with better future. The strategy for achieving these enhanced goals will mainly depend on the active participants of all players i.e. from government agencies of NGO's, from manufacture to R&D institution, from financial institution to developers and of course a new breed of energy entrepreneurs. To make sure we have plenty of energy in the future, it's up to all of us to use energy wisely.

We must all conserve energy and use it efficiently. It's also up to those who will create the new energy technologies of the future. All energy sources have an impact on the environment. Concerns about the greenhouse effect and global warming, air pollution, and energy security have led to increasing interest and more development in renewable energy sources such as solar, wind, geothermal, wave power and hydrogen. But we'll need to continue to use fossil fuels and nuclear energy until new, cleaner technologies can replace them.

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