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Research paper

Renewable electrical energy sources in northern and southern region of India:-an overview of installation, potential and initiatives

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Abstract

This paper highlights different literature surveys conducted by the authors and results indicates that the present scenario of unconventional energy sources in India. It is surveyed through various literatures and reported region wise; North and South of India [1]. The poten-tial and installed capacity of various unconventional energy is presented [1-2]. This research work is very much useful to go for the uncon-ventional sources of electricity as it is an alarming situation for the environment if we continue to use the conventional sources of energy. The unused sources of electrical energy can be taken up seriously and more research work in this field can help the world to progress to-wards a direction of free of global warming and ozone layer to be at safe zone. The tariff of solar plant is also reviewed year wise from 2010 -2016.

Keywords: *REES; WTGP; SPPP.*

1. Introduction

The renewable energy must gather at a level sufficient to meet our national energy demands. The paper appraises of the installed renewable electrical energy sources (REESs) in the northern and southern regions of India. In addition to the potential of solar energy the other sources are the biogas generators, small hydro plants, and wind mills. The non-conventional sources of electricity generations are generally essential remedies to reduce the greenhouse effect caused by the thermal plants or fossil fuels. Nuclear fuel plants are also causing hazardous situation for the health of human beings for thousands of years if not handled properly [5]. The world climate can depend upon the type of resources India take for production of electricity. Is it coal or solar? India's strengths are solar power and wind energy [3]. The production and installation of REESs in India is an issue that is gaining momentum. It is also a vast area for research for the buyers of India to accept of the REESs [7]. Various literatures survey of REESs can lead to a better understanding of the future India. The survey has been focused on the potential of REESs as well as the projects undertaken in India for the development of the REESs in energy sector. Solar PV Rooftop market potential for India has been assessed as 124 GW by taking the total area under urban settlements as 77,370 km2 [8]

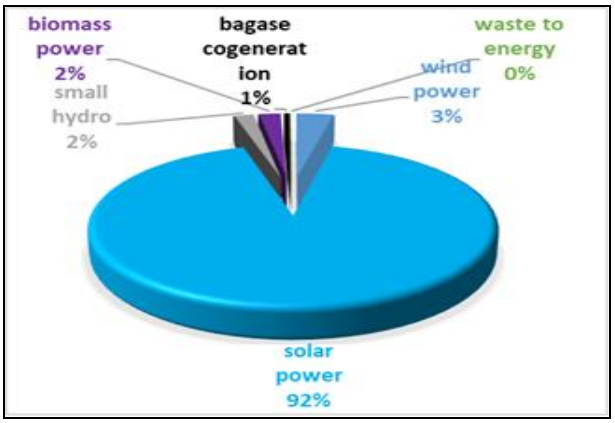

Fig .1: Total Potential of Reess in Northern Region of India [1].

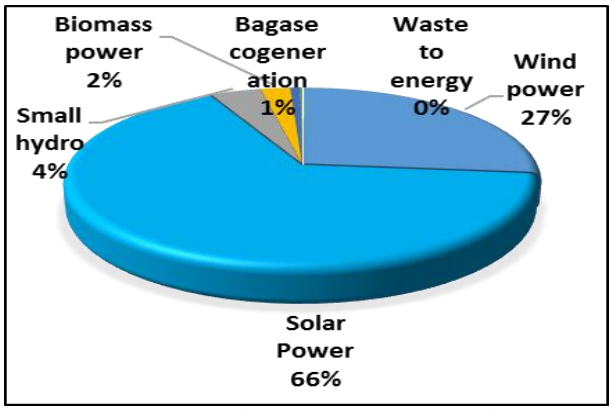

Fig. 2: Total Potential of Reess in Southern Region of India. [1].

2. Installation and potential of REESs in India

The potential of Solar Power Plant on Rooftop for Indian market has been assessed as 124 GW by taking the total area under urban settlements as 77,370 km^2 [8]. The electricity consumption by residential customers in 1990 being 32 GkWh, which gradually increased to 198 GkWh in 2013. It was targeted to increase to 1270 GkWh in 2040 [9].

The total REESs in Northern area of India is given in pie chart as shown in Figure 1. Similarly, the total REESs in southern part of India presented in Figure.2. The solar energy is dominating both Northern and Southern part of India. In Southern area, the wind power potential is more than Northern area

Literatures on installed plants in the northern parts of India are collected and presented in the table below. Seven states have got different REES. The total REESs capacity can be split into solar, wind, small hydro, bagasse and waste to energy. Thus the splitter form of this can be understood from the table given below. Rajasthan is at the highest with a potential of 148,518 MW and installed capacity of 6,628.61 MW implying a 4.46% of the total potential is being used. Similarly, Jammu & Kashmir having the second highest potential of 118,209 MW REES in northern sector but installed total of 158.85 Mw from six types of REESs. This accounts to be 0.13% which is very less. Also the other states like Haryana 5.65, Himachal Pradesh 2.3%, Punjab 17%, Uttar Pradesh 8.9% and Uttarakhand 2.7% are also in the line of generating electrical power.

2.1. REESs plants in northern parts of India

Table 1: Potential of Renewable Energy (in MW) in Northern Region of India [1&2]

Sl. No	State	Potential of renewable Energy(in MW)						Total Potential (in MW)	Installed capacity (in MW)
		Wind power	Solar power	Small hydro	Bio-mass power	Bagasse cogeneration	Waste to energy		
1	Haryana	93	4560	110	1333	350	24	6470	366.09
2	HP	64	33840	2398	142	--	2	36446	836.44
3	J&K	5685	111050	1431	43	--		128209	158.85
4	Punjab	--	2810	441	3172	300	45	6768	1205.92
5	Rajasthan	5050	142310	57	1039	--	62	148518	6628.61
6	U P	1260	22830	461	1617	1250	176	27594	2470.18
7	Uttarakhand	534	16800	1708	24	--	5	19071	526.88

Table 2: Potential of Renewable Energy (in MW) in Southern Region of India [1&2]

Sl. No	State	Potential of renewable Energy(in MW)						Total Potential (in MW)	Installed capacity (in MW)
		Wind power	Solar power	Small hydro	Biomass power	Bagasse cogeneration	Waste to energy		
1	Andhra Pradesh	14497	38440	978	578	300	123	54916	6543.97
2	Karnataka	13593	24700	4141	1131	450		44015	7773.47
3	Kerala	837	6110	704	1044	--	36	8731	330.59
4	Tamil Nadu	14152	17670	660	1070	450	151	34153	10686.88
5	Telengana		20410	--	--	--	--	20410	2393.36

2.2. REESs plants in southern parts of India

In the southern part of India the five states are undergone for literature review for REES.of these Tamilnadu possess the highly installed capacity of 10686.88 MW with respect to the total potential of 34153 MW indicating 31.3%. also the remaining states are bearing the installed capacity of 11.9%for Andhra Pradesh. Karnataka attained 17%, Kerala achieved 3.7% of total potential and Telengana acquired 11.72 %. In Andhra Pradesh both SPPP and WTPG have major share of potential. SPPPs have 38400MW potential [ ] similarly WTPG have 14497MW potential.

3. Solar tariffs in India

The rate of solar tariff in India is reviewed for the period of year 2010-2016 is presented in the table given below. It can be studied that the rate of tariff is being reduced from rupees 10.95 per KWH to Rupees 4.34 till July 2016. This will encourage the field of solar power generation.

Table 3: Tariff for Solar Power from 2010-2016 [6]

SL. NO.	MONTH/YEAR	Rs. / KWH
1	December 2010	10.95
2	December 2011	7.49
3	December 2012	7.28
4	August 2013	5.50
5	November 2014	6.46
6	September 2015	5.09
7	December 2015	5.00
8	May 2016	4.66
9	July 2016	4.34

4. Initiatives and achievements

Till Dec..2017 over 41.80lac solar lighting systems, 1.42 lac solar pumps, and power packs of 181.52MW have been installed in the country. Although the total installed power is 311 GW (conventional 250.02 and REESs 60.98 GW), thus REESs have a share of 18.37% towards generation of electrical power in India [1]. In addition to this Govt. of India has fixed a goal of installation capability of 175 GW from REESs by the end of 2022.this includes 60GW from WTG 100GW from SPPP, and 10 GW from Biomass power and 5 GW from small hydro power. Historic low tariffs for solar (₹ 2.44/unit) and wind (₹ 2.64/unit) achieved through transparent bidding and facilitation [1]. Projects comprise above approx. 9400 km transmission lines and substations of total capacity of approx. 19000 MVA to be accomplished by MARCH 2020. Bank loans up to a limit of RS 15 crores will be given to borrowers for purposes like solar based power generator, wind power system, biomass based power generators, micro hydel plants and for renewable energy based public utilities [4]. The total capacity of Muppandal wind farm of Tamil Nadu is 1500 MW which is the largest wind power plant in India. The first offshore wind farm is planned near Dhanushkodi in Tamil Nadu. But no offshore wind farm is under implementation as of December 2017.

5. Conclusions

In this paper, the REESs in the southern and northern region of India are reviewed. As the periodic characteristics of wind and solar are complementary to each other, a combination of both performs better than either wind or solar systems operating alone. SPPPs can produce a great deal of power in the summer as well as WTG produce more electrical energy throughout winters. Thus a balance of supply is achieved and the grid remains stable throughout the year. This type of systems can be very useful for the places where sunlight and wind flow both available in worthy volume. In the areas deserts where daytime are usually very sunny and coastal areas nights used to be very breezy. REESs will be very much useful for providing never-ending power supply to the buyers. The tariff study also reveals that the gradual reduction in the tariff structure will enable the SPPPs to go further.

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