

Review of Power Generation through Renewable Energy in India

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ABSTRACT

India is one of the top countries in renewable power generation. The power generation in India is rapidly increasing as the growth of the country. In this paper a discussion on review of the growth of power generation of installed capacity through renewable energy and a comparison of demand availability of power in India for last few recent year.

Key words: - Renewable power generation analysis; distributed generation.

I. INTRODUCTION

In recent years availability of power in India has both increased and improved but demand has consistently outstripped supply and substantial energy and peak shortages prevailed in 2009-10 [1] India's electricity generation has been increasing continuously to meet the needs of the rapidly growing economic activity of the country [2]. Indian power sector is facing challenges and despite significant growth in generation over the years, it has been suffering from shortages and supply constraints [3]. In recent years, from an environmental point of view, the renewable energy resources are being looked at as unlimited, inexhaustible, environment friendly and sustainable sources. Direct and indirect ..of the electricity generation by renewable sources [4].

II. RENEWABLE ENERGY

In renewable power generation India stand on 5th position in global ranking. Renewable energy

uses energy sources that are continually replenished by nature—the sun, the wind, water, the Earth's heat, and plants. Renewable energy technologies turn these fuels into usable forms of energy most often electricity. As per records and reviews in India still most of the percents power are generating by the conventional sources and we are very much depending on conventional power generation methods and still we need to improve and depend in renewable energy sources.

III. POWER GENERATION SURVEY

India is rich country in renewable energy sources. Indian government has taken a great step ahead for electricity generation through renewable energy sources i.e. solar energy, small hydro power, wind energy, biomass energy, ocean and tidal energy etc. there are some states which highly depends their power generation through renewable energy sources. The bellow graph shows total power generation through renewable energy till end of year 2014:

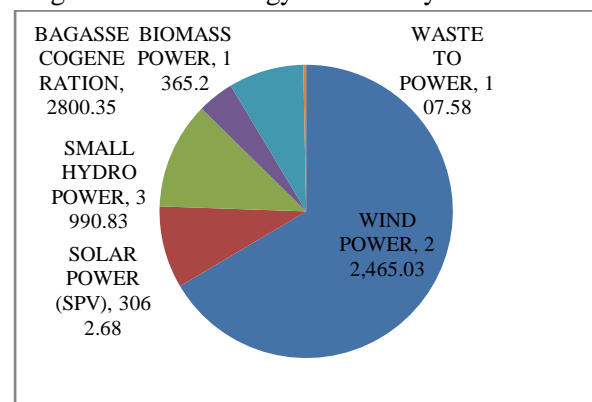


Fig.1 total generated capacity of renewable energy year 2014

(Source via cea annual report 2014)

IV. SOLAR POWER

Solar energy is a time dependent and intermittent energy resource. 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. Total power generated in year 2014 is shown in the bellow graph:

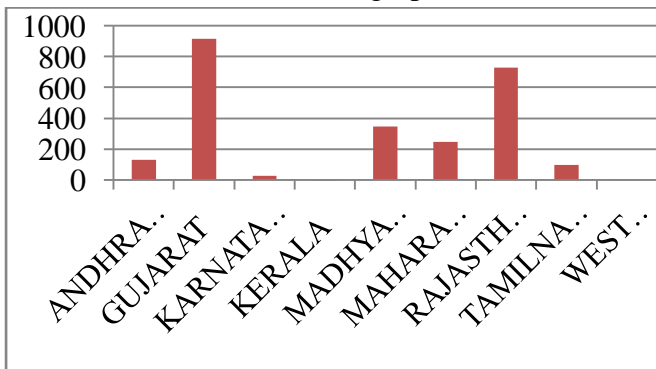


Fig.2 Total solar generated power in 2014
 Source: cea annual report 2014

From the graph it is seen that Gujarat is the one of the highest generating state in solar energy generation and Kerala is the lowest power generating state.

V. SMALL HYDRO POWER

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 a 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. The generated capacity of small hydro power till the end of 2014 is shown in the bellow graph:

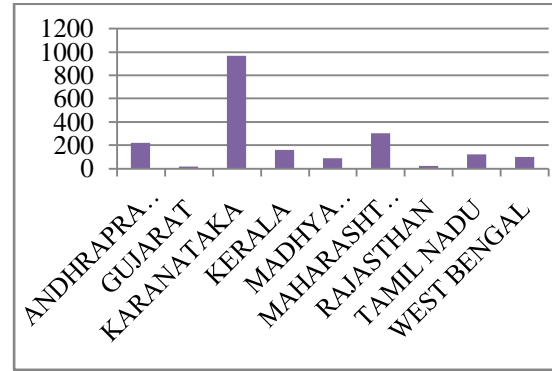


Fig.3 Total small hydro generated power in 2014
 (Source: cea annual report 2014)

VI. WIND POWER

Wind is the result of the sun's uneven heating of the atmosphere. Warm air expands and rises, and cools air contracts and sinks. This movement of the air is called wind. Wind has been used as an energy source for millennia. It has been used to pump water, to power ships, and to mill grains. Areas with constant and strong winds can be used by wind turbines to generate electricity. The total power generation through wind mill till the end of year 2014 is given by the bellow graph:

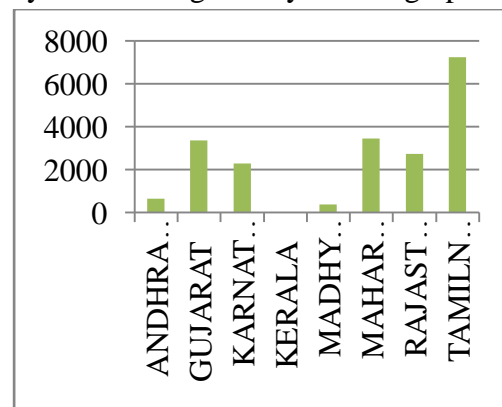


Fig. 4 Total generated wind power in the end of year 2014

Indian renewable energy status report 2014

VII. BIOMASS ENERGY

Biomass energy is the oldest energy source used by humans. Biomass is the organic matter that composes the tissues of plants and animals. Biomass can be burned for heating and cooking, and even generating electricity. The most common source of biomass energy is from the

burning of wood, but energy can also be generated by burning animal manure (dung), herbaceous plant material (non-wood), peat (partially decomposed plant and animal tissues), or converted biomass such as charcoal (wood that has been partially burned to produce a coal-like substance). The total installed capacity through biomass in end of 2014 is shown in bellow graph:

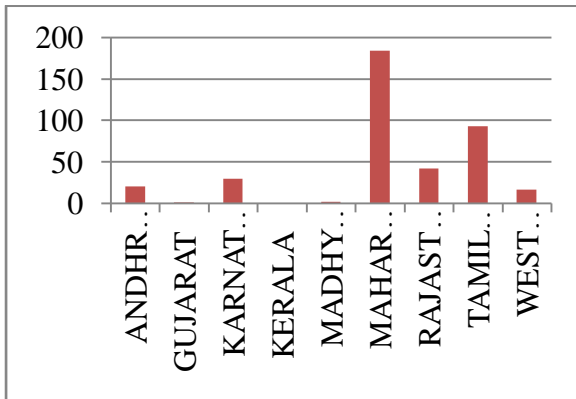


Fig.5 Total installed capacity of biomass in 2014

VIII. DEMAND AND AVAILABILITY

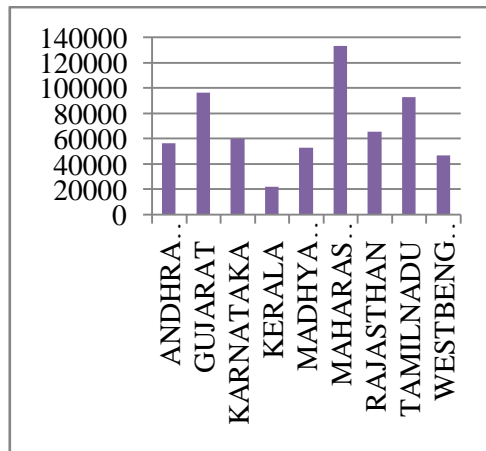


Fig. 7 Power availability in year 2014

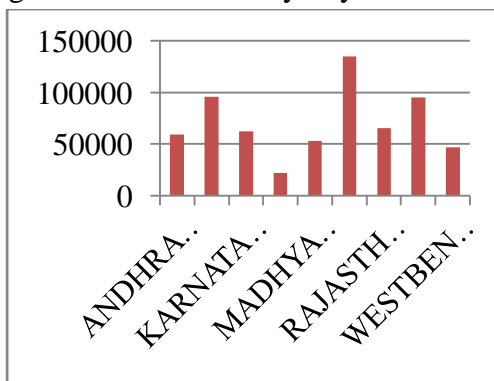


Fig. 8 Power demand in year 2014

From above both the graph we can say that power demand and availability in Maharashtra is higher then other state. and in Kerala it is lowest. Since power availability and demand is not equal in any state so from this survey we can implement the power generation methods.

IX. CONCLUSION

From all these survey we can say that Maharashtra is the state whose area is and its population is also higher then other states and power demand and availability is more then other state. We can also conclude from this survey that the Kerala is small area state in which power demand and availability is the lowest then other state.

X. REFERENCES

[1] FredeBlaabjerg and Ke Ma, Future on Power Electronics for Wind Turbine Systems iee journal of emerging and selected topics in power electronics, vol. 1, no. 3, september 2013.

[2] Olga Moraes Toledo, Delly Oliveira Filho, Anto`niaSo`niaAlves Cardoso Diniz, Distributed photovoltaic generation and energy storage systems: Elsevier A review, Renewable and Sustainable Energy Reviews, 506–511, 14 (2010)

[3] P. Garg, Energy Scenario and Vision 2020 in India, Journal of Sustainable Energy & Environment 3, 7-17 (2012).

[4] Ankur Omer, SmarajitGhosh, RajnishKaushik, Indian power system: Issues and Opportunities, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 3, March 2013

[5] R. K. Gera, DrH.M.Ra, YunusParvej and HimanshuSoni, Renewable Energy Scenario in India: Opportunities, and Challenges, Indian Journal of Electrical and Biomedical Engineering, Volume.1 Number.1, pp 10-16 January-June 2013.

[6] Lucian IoanDulau, Milhailabrudean, DorinBica, “Effects of distributed generation on electric power

systems". Elsevier The 7th International Conference Interdisciplinarity in Engineering(INTER-ENG 2013)

[7]E. Neria, B. Ruganib, E. Benettob, S. BastianoniaEmergy evaluation vs. life cycle-based embodied energy (solar, tidal and geothermal) of wood biomass resources, Elsevier Ecological Indicators) 419–430 36 (2014).

[8] RijulDhingra, Abhinav Jain, AbhishekPandey, and SrishtiMahajan, Assessment of Renewable Energy in India, International Journal of Environmental Science and Development, Vol. 5, No. 5, October 2014.

[9]Annual report of power ministry(2014-15) online available on link http://powermin.nic.in/upload/pdf/Annual_Report_2014-15_English.pdf

[10]Annual report of power ministry(2013-14) online available on link http://powermin.nic.in/upload/pdf/Annual_Report_2013-14_English.pdf

[11] F. Blaabjerg, R. Teodorescu, M. Liserre, and A. V. Timbus, "Overview of control and grid synchronization for distributed power generation systems," IEEE Trans. Ind. Electron., vol. 53, no. 5, Oct. pp. 1398–1409, 2006.

[12] B.H. Chowdhury, H.T. Ma, and N. Ardeshta, "The challenge of operation wind power plants within a microgrid framework", PECE Power and Energy Conference at Illinois, pp. 93-98, February 2010.

[13] Z. Chen, E. Spooner, Grid power quality with variable speed wind turbines", IEEE Trans on Energy Conversion, volume 21, June, pp.70, 2001

[14]<http://www.inwea.org/aboutwindenergy.htm>

[15]http://mospi.nic.in/mospi_new/upload/Energy_Statistics_2013.pdf

[16]<http://mnre.gov.in/mission-and-vision-2/achievements/>

[17]<http://africa-toolkit.reeep.org/modules/Module11.pdf>

[18]<http://www.ese.iitb.ac.in/~rb/Professional%20Activities/Rudicon2012.pdf>

[19][http://www.whrc.org/policy/pdf/India/Banerejee_Energy%20Policy%20\(in%20press\).pdf](http://www.whrc.org/policy/pdf/India/Banerejee_Energy%20Policy%20(in%20press).pdf)

[20]<http://ethesis.nitrkl.ac.in/5146/1/109EE0253.pdf>

[21]<http://www.eai.in/ref/ae/sol/sol.html>

[22]http://powermin.nic.in/upload/pdf/Annual_Report_2012-13_English.pdf

[23]http://powermin.nic.in/upload/pdf/Annual_Report_2011-12_English.pdf

[24]http://powermin.nic.in/upload/pdf/Annual_Report_2010-11_English.pdf

[25] <http://burnanenergyjournal.com/the-electricity-grid-a-history/>

[26] Mahalakshmi M, "Modeling simulation and sizing Of photovoltaic/wind/fuel Cell hybrid generation system", International Journal of Engineering Science and Technology, vol. 4, pp. 975-982, 2012

[27] Motin M. A, "Energy Efficient Modeling of Solar Wind Hybrid Power System for a Tourist Island", International Journal of Advanced Renewable Energy Research, vol. 1, issue1,, pp. 1- 7, 2012.

[28] Laxmi Jaya, "Modeling and control of hybrid photovoltaic wind Energy conversion system", International Journal of Advances in Engineering & Technology, pp. 2231-1963, 2012.

[29] Maherchandani I J, AgarwaChitranjan, "Economic Feasibility of Hybrid Biomass/PV/Wind System for Remote Villages Using HOMER", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering ,vol. 1,issue 2,pp.2275-2275, 2012.

[30] Singh Yandra, "Design and integration of renewable energy hybrid system", International Journal on Electrical Engineering and Informatics, vol.3,issue 3, pp.138-149, 2009.

[31] Hakimi S. M., "Optimal sizing of reliable hybrid renewable energy system considered various load types", AIP Journal of Renewable and sustainable energy 2011.

[32]Nicholas P. W. Strachan, and DraganJovicic "Improving Wind Power Quality using an Integrated Wind Energy Conversion and Storage System (WECSS)" Power and Energy Society General Meeting - Conversion and Delivery of Electrical Energy in the 21st Century, IEEE, pp. 1-8, 2008.

- [33] <http://www.downtoearth.org.in>
- [34] Raghu Raman, “Energy Efficiency Policy in India”
- [35] www.mospi.gov.in/engystatistics_2015
- [36] http://siteresources.worldbank.org/EXTENERGY2/Resources/Unleashing_potential_of_renewable_in_India produced by a World Bank team Gevorg Sargsyan, and supported by the Energy Sector Management Assistance Program (ESMAP)
- [37] Rai, G.D., Non-Conventional energy sources, Khanna Publishers, New Delhi, 2nd Edition, 2002.
- [38] Harish shenigarapu, Ramesh Lakavath, Sridhar Panthangi, Mallela Kishore “Improving the Stability and Reliability of Wind Power Grid-Connected System” Journal of Engineering Research and Applications ISSN : 2248-9622, Volume 3, Issue 6, Nov-Dec, pp.1734-1739 , 2013.
- [39] RamadoniSyahputra , Imam Robandi, and MochamadAshari “ Performance Analysis Of Wind Turbine As A Distributed Generation Unit In Distribution System” International Journal of Computer Science & Information Technology (IJCSIT) Volume 6, No 3, June. pp. 39-56, 2014
- [40] B. G. Rawn, P. W. Lehn, M. Maggiore, “A control methodology to mitigate the grid impact of wind turbines,” IEEE Trans. Energy Conv., vol. 22, no. 2, June, pp. 431-438, 2007.
- [41] L. Changling, H. Banakar, S. Baike, O. Boon-Teck, “Strategies to smooth wind power fluctuations of wind turbine generator,” IEEE Trans. Energy Conv., vol. 22, no. 2, June pp. 341- 349, 2007.
- [42] Dhillon, G.S., Sastry, V.V., “Appropriate Technology for SHP (Low head plants)”, Indian Indian Journal of Electrical and Biomedical Engineering Volume.1 Number.1 January-June 2013, pp.10-16 @ Academic Research Journals, (India) 16 journal of Power and River Valley Development, Oct.-Nov. 1992.
- [43] National Electricity Plan Vol 1 (Generation) Central Electricity Authority, Ministry of Power, GOI].
- [44] Debajit Palit, Renewable Energy in North East India; Issues and prospects, International Conference on Energy and Environmental Technologies for Sustainable Development, pp. 85- 93, Oct. 8- 10, 2003.
- [45] Overview of Renewable Energy Potential of India, Peter Meisen, President, Global Energy Network Institute (GENI) available at <http://www.geni.org>
- [46] Planning Commission, Govt. of India—Projections to 2020–2021, September 1995 & September 1996.
- [47] F. Zhou, G. Joos, C. Abhey, Voltage stability in weak connection wind farm.” IEEE PES Gen. Meeting, volume 2, June, pp. 1483-1488, 2005.



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