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A Review on Wind Power Scenario in India

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Abstract—*With the rapid growth of population, energy demand is also increasing. This energy may be obtained primarily from two sources, broadly classified as renewable and non renewable energy sources. Environmental concerns and fuel cost uncertainties associated with the use of conventional or non renewable energy sources have resulted in rapid growth of renewable energy sources throughout the world. India has also set up a number of power plants where energy is obtained from renewable sources. There are many solar, hydro as well as wind power plants of various capacities, set up in various parts of our country.*
Like many other developing nations, India has embarked upon wind energy programs for areas experiencing high average wind speeds throughout the year. This paper reviews the development and scope of generation of wind power in India. It also highlights the future prospects of wind power development in India.

Keywords: *Wind power, wind energy, power generation*

1. INTRODUCTION

Winds are caused due to the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. The earth's surface is made of land and water which vary in terms of its location and other physical characteristics. These surfaces absorb the sun's heat at different rates, giving rise to temperature difference which gives rise to winds. During the day, the air above the land heats up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the winds are reversed because the air cools more rapidly over land than over water. In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles. Human beings use this wind flow for many purposes: sailing boats, pumping water, grinding mills and also generating electricity.

2. WIND ENERGY FOR POWER GENERATION

Wind Energy, unlike many other renewable energy sources is a free energy resource but is much intermittent. Wind speeds may vary within minutes and affect the power generation and in cases of high speeds may result in overloading of generator. Energy from the wind can be tapped using wind turbines. These turbines convert the kinetic energy in the wind into mechanical power which is then converted to electricity. A little research is required before setting up of these turbines like the amount of wind available in the place where the turbine is to be installed, the impact of community living nearby as well as on the environment around it.

2.1 Advantages

- Can be used for both distributed generation and grid interactive power generation.
- Ranges of power producing turbines are available. Micro-turbines are capable of producing 300W to 1MW and large wind turbines have typical size of 35kW-3MW.
- Wind turbine is suitable to install in remote rural areas.

2.2 Disadvantages

- The total cost can be cheaper than solar system but more expensive than hydro.
- Electricity production depends on- wind speed, location, season and air temperature. Hence various monitoring systems are needed and may cost expensive.
- High percentage of the hardware cost is mostly spent on the tower designed to support the turbine.

2.3 Technology

The range of wind speeds that are usable by a particular wind turbine for electricity generation is called productive wind speed. The power available from wind is proportional to cube of the wind's speed. So as the speed of the wind falls, the amount of energy that can be got from it falls very rapidly. On the other hand, as the wind speed rises, so the amount of energy in it rises very rapidly; very high wind speeds can overload a turbine. Productive wind speeds ranges between 4 m/sec to 35 m/sec. The minimum prescribed speed for optimal performance of large scale wind farms is about 6 m/s. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. Wind turbines are mounted on a tower to capture the most energy. At 100 feet or more above ground, they can take advantage of faster and less turbulent wind. Wind turbines can be used to produce electricity for a single home or building, or they can be

connected to an electricity grid for more widespread electricity distribution.

3. SCOPE OF WIND POWER GENERATION IN INDIA

In the year 2005 the World Wind Energy Association declared India as the fifth largest country in terms of installed wind capacity. Indian Wind Energy Association (INWEA) says India is blessed with a great natural platform with 45000MW of untapped potential in terms of wind energy.

Table 1: Country wise Installed capacity.

Country	Capacity Installed (MW)
Germany	16628
Spain	8263
USA	6740
Denmark	3117
India	2985
Italy	1125
Netherlands	1078
Japan	896
UK	888
China	764
Canada	444
Australia	379

4. GEOGRAPHIC LOCATION AND WIND POTENTIAL

The potential is far from exhausted. It is estimated that with the current level of technology, the potential for utilization of wind energy for electricity generation is of the order of 65,000 MW. India also is blessed with 7517km of coastline and its territorial waters extend up to 12 nautical miles into the sea. The unexploited resource availability has the potential to sustain the growth of wind energy sector in India in the years to come. Potential areas can be identified on Indian map using Wind Power Density map. Centre for Wind Energy Technology (C-WET), one of pioneering Wind Research organization in the country is leading in all such resource studies and has launched its Wind Resource map. In a step towards identifying and properly exploiting these wind resources, Ministry of New and Renewable Energy (MNRE) has estimated state-wise wind power potential in the country.

The map provided by C-WET, Chennai provides an insight of the probable wind energy capacity across the various states in India that can be exploited without any harm to the environment.

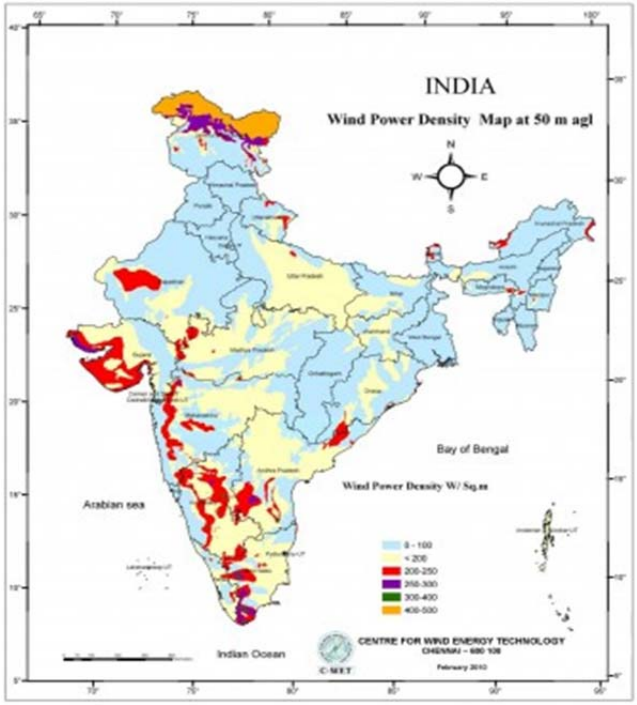

Figure 1: Wind Power Density

Source: Centre for Wind Energy Technology, Chennai

The states where wind power plant can be set up can be easily identified from the map provided. Tamil Nadu's wind power capacity is around 29% of India's total. In Muppandal wind farm, Tamil Nadu the total capacity is 1500MW, which is the largest in India. Maharashtra is one of the prominent states that installed wind power projects second to Tamil Nadu in India. Gujarat government's focus on tapping renewable energy has led to sharp rise in the wind power capacity in the last few years. Govt. of Madhya Pradesh has sanctioned 15 MW project to Madhya Pradesh wind farms Ltd. (MPWL), Bhopal at Nagda Hills near Dewas. The first wind farm of the state was set up 1997 at Kanjikode in Palakkad district in Kerala. Odisha being a coastal state has higher potential for wind energy. The Govt. of Odisha is actively pursuing to boost Wind power generation in the state. Comparing the map and the data available for various states where wind power plants have already been set up, we find that a substantial number of plants can be set up in the near future. The total installation in West Bengal is 2.10 MW till Dec 2009 at Fraserganj, Dist. South 24 Paraganas. More projects are coming up at Ganga Sagar, Kakdwip, and Distt - South 24 Paraganas. Both the project owned by West Bengal Renewable Energy Development Agency (WBREDA), Govt. of WB. The major states that have contributed to wind power generation in India are tabulated below.

Table 2. State wise installed capacity.

Country	Capacity Installed (MW)
Andhra Pradesh	1038.15
Gujarat	3642.53
Karnataka	2639.45
Kerala	35.1
Madhya Pradesh	876.7
Maharashtra	4437.9
Rajasthan	3308.15
Tamil Nadu	7456.98
Others	4.3
Total	**23439.26**

The data below gives an insight of the progress and increase in the number of wind power plants in various states of India. We see that there is a continuous increase in the number of plants set up from 2009 to 2015. This continuous increase in number shows that power generation is done at a satisfactory rate and in quite large scale. Some of these are also supplied to nearby houses in rural areas.

The data shows that there is a gradual increase in the amount of wind power generated throughout the country in various states. This shows that the importance of renewable sources of power generation had gained importance. Also it can be said that due to advancement of technology, setting up of wind power plants has been made possible.

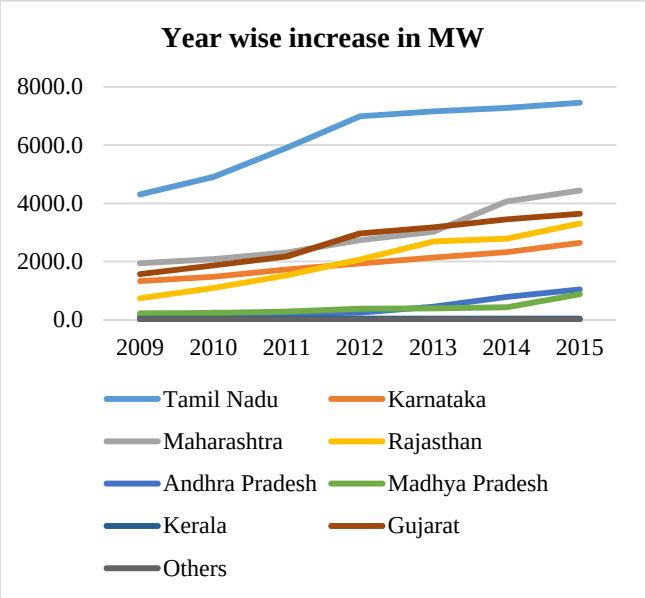

Figure 2: Year wise increase

Due to technological advancement, we find an increase in the number of wind power plants and hence the power generation from wind power in rural India. The government along with the help from local people has made the projects successful. The following table gives the future estimated wind power generation India is expecting to achieve by 2022. India is aiming to produce 60000MW by the year 2022.

Table 3. State wise Renewable power Target.

State / UT	Total Capacity (MW)
Rajasthan	8600
Northern Region	**8600**
Gujarat	8800
Madhya Pradesh	6200
Maharashtra	7600
Western Region	**22600**
Andhra Pradesh	8100
Telengana	2000
Karnataka	6200
Tamil Nadu	11900
Southern Region	**28200**
Other States	600
Total	**60000**

5. CONCLUSION

Wind energy can be obtained by modifying technology at an affordable price. This form of energy if used wisely can be exploited to the fullest. The potential for wind energy is immense, and experts suggest wind power can easily supply more than 20% of the world electricity. Wind energy can diversify the economies of rural communities. Unlike other forms of electrical generation where fuel is shipped to a processing plant, wind energy generates electricity at the source of fuel, which is free. Wind is a native fuel that does not need to be mined or transported; taking two expensive costs out of long-term energy expenses. Wind energy projects create new short and long term jobs. Related employment ranges from meteorologists and surveyors to structural engineers, assembly workers, lawyers, bankers, and technicians. Experts say wind energy power plants create 30% more jobs than a coal plant and 66% more than a nuclear power plant per unit of energy generated. A significant contribution to the worldwide energy mix can be made by small clusters of turbines or even single turbines, operated by local landowners and small businesses. Developing local sources of electricity means we import less fuel from other states, regions, and nations. Wind farms are spaced over a large geographic area, but their actual plant covers only a small portion of the land resulting in a minimum impact on crop production or livestock grazing.

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REFERENCES

[1] Ackermann T, Wind Power in Power Systems
[2] Gupta AK (1995), Wind power development in India
[3] Hiremath RB, Kumar B, Balachandra P, Ravindranath NH, Raghunandan BN (2009), Decentralised renewable energy: Scope, relevance and applications in the Indian context
[4] Mabel MC & Fernandez E (2008), Analysis of wind power generation and prediction using ANN: A case study
[5] Naidu B.K.S. (1996) Indian scenario of renewable energy for sustainable development
[6] Pillai GM (2006), Wind power development in India
[7] Rao KU & Kishore VVV (2009), Wind power technology diffusion analysis in selected states of India

Online References:

[1] http://www.windustry.org/pros_cons_wind_energy
[2] http://www.inwea.org/installedcapacity.htm
[3] https://en.wikipedia.org/wiki/Wind_power_in_India
[4] https://www.inwea.org
[5] http://www.eai.in/ref/ae/win/win.html
[6] http://www.mnre.gov.in
[7] http://www.wbreda.org/