



## Wind Energy Potential Mapping in Ahmednagar District, Maharashtra, India

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**Abstract:** Currently, wind energy is one of the fastest developing renewable energy source technologies across the globe. Wind energy is an alternative clean energy source compared to fossil fuel, which pollute the lower layer of the atmosphere. It has the advantage of being harnessed on a local basis for application in rural and remote areas. In order to tap the potential of wind energy sources, there is a need to assess the availability of the resources spatially. Mapping potential sites for tapping wind energy in Ahmednagar, Maharashtra state is the focus of this study. The study employs the wind energy resources of in Ahmednagar, Maharashtra and analyze their variability considering spatial and seasonal aspects. Considering these, the present status of the potential is assessed and maps of locations suitable for tapping wind energy have been prepared. A spatial data base with data of wind velocities has been developed and used for evaluation of the theoretical potential through continuous monitoring and mapping of the wind resources. The study shows that the average wind velocity in Ahmednagar, Maharashtra varies from 0.5m/s in Parner to 8 m/s in Ahmednagar during the monsoon season. Shrigonda, in Ahmednagar district, has high wind velocity during the period May to September with a peak value of 9 m/s in July.

[Kelkar Gautam. **Wind Energy Potential Mapping in Ahmednagar District, Maharashtra, India.** *J Am Sci* 2020;16(9):99-103]. ISSN 1545-1003 (print); ISSN 2375-7264 (online). <http://www.jofamericanscience.org>. 9. doi:[10.7537/marsjas160920.09](https://doi.org/10.7537/marsjas160920.09).

**Keywords:** Ahmednagar, Access Energy, Wind velocity, Wind energy, Potential, Agroclimatic zones

### 1. Introduction

The wind is air in motion. It is caused by differential heating of land, water, hills and mountain slopes by sun rays. There is kinetic energy in wind. Even in ancient times the great sailors utilized kinetic energy of the wind in sailing their ships around the globe. The kinetic energy of wind is caused by its motion, the higher the velocity of wind the greater the kinetic energy in it. This velocity of wind is affected by solar radiation, which varies from season to season and from place to place. Strong winds blow in coastal plains and hill. The kinetic energy of the wind can be utilized by converting it into mechanical form. With this wind mills are operated. Large blades of wind mills can convert much of the wind energy into mechanical form. The installation of wind power generation system depends upon extensive survey, site selection, construction and machinery plantation. The continuous supply of electricity generated from wind power needs installation of electronically operated black – boxes which are very costly. At times, there may be no wind and the power generation may stand still.

Wind energy is ultimately a solar resource. Large scale wind systems are created mainly because of temperature differences between the earth's latitudes and deflection caused by the earth's rotation. Dry air

in the vicinity of 30 N and 30 S sinks and flows towards the equator, where it replaces rising hot air. At mid latitudes, between 30 and 70 north and south, air flows towards the pole and is deflected westwards Johansson et al., (1993). Wind speed, air density, latitudes, surface roughness, terrain, atmospheric pressure, average temperature, land use pattern etc. will significantly influence wind velocity.

The investigation region was selected for the present study for various reasons. First, the region has diversified the relief and amount of rainfall and the arid region to the east, the irrigated region to the north, and the tribal population to the west are in the study region. The northern part has sugar cane cultivation in the investigation region. Lastly, the researcher belongs to this investigation region, which is why he is familiar with the investigation area. So, this will assistance him to produce the vital data of the field according to the unconventional energy resources.

### 2. Objectives

The main objectives of the study are to:

- Assess the availability of wind energy resources in Ahmednagar, Maharashtra based on season wise and location wise data of wind velocity,

- Spatially map wind energy sources and
- Analyze wind potential according to agro-climatic zones.

### 3. Study Area

The study was conducted for Ahmednagar district is located partially in higher Godavari basin and partially in Bhima basin occupying in central west part in Maharashtra state. It extends from 180 10' to 200 00' north latitudes and 730 30' to 750 37' east longitudes (Fig.-1). It is flanked by Igatpuri, Sinnar and Yeola talukas in Nashik district in north, Vajapur, Gangapur and Paithan talukas of Aurangabad district and Georai, Beed and Ashti talukas of Beed district in east, Bhum and Paranda talukas in Osmanabad district and Karmala takuka in Solapur district in south, Junnar, Shirur, Daund and Indapur talukas of Pune district and Murbad, Sahapur talukas of Thane district in west. (DSA) of Ahmednagar (2011).

This investigation is focused on non-conventional energy resources and its potential of energy resources in Ahmednagar district. As the era of industrialization was begin the energy demand has been rapidly increasing.

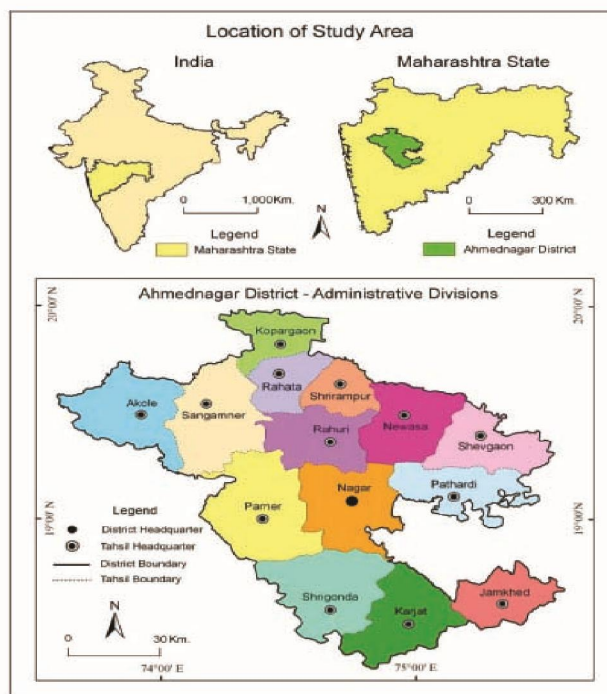


Figure 1: Showing location map of study area in Maharashtra State

### 4. Material and Methods

The ideal way to predict the wind potential of a region is to acquire long term records of wind speed from a large number of well exposed stations all over the region. Wind energy potential for various

locations in Ahmednagar is calculated based on wind data (annual average wind speed). Annual average wind velocity data for wind monitoring stations were collected from the IMD, Govt. of India, Pune.

In order to compare between different seasons, the data is summer from February to May, monsoon from June to September and from January to calculated from October to January to calculated). Season wise mean wind velocity and standard deviation were computed for the 29 wind monitoring stations.

### 5. Result & Discussions

Giving to the wind energy and their possible consequences are considered and discussed under systematically. The whole electricity is supplied by the Mahavitaran electrical board of Maharashtra. In Ahmednagar district, there are major three companies viz., Suzlon, Enercon, Ganesa is generating the wind electricity. Maharashtra Energy Development Agency is taking this energy and supply for the Indian Grid Network. Today wind Electricity in Maharashtra is 4500 MW in which Ahmednagar district is produce the 400 MW wind electricity. In this research, we are trying to study the wind energy potential of Ahmednagar district by Geographical attitude.

Ahmednagar is one of the pioneer districts for the wind energy. Out of the total wind electricity of the Maharashtra, 10% of the electricity is occur in this district. geographical condition is more suitable for the wind energy i.e. Western dhat and lava platform foundation, which can be gives the suitable support for the windmill. In this district, there is tropical dry Monsoonal climatic region. That's why wind density is suitable for the wind energy. Potential sites for the wind from in Ahmednagar – Kavda, Donger, Khandke, Kolgaon, Panpatta etc.

CLP India's Power Project at the Khandke, there was project start in 2006. This project is 50 MW. This was the first project of CLP. This electricity is taken by the MSEDCL. Turbines of windmill made by Enercon whose rated output is 800KW. SJVNL wind energy project is public sector Hydropower major Satluj Jal Vidyut Nigam. There are 56 Wind Power turbines which are developing 47 MW electricity at Khivire (Akola). This project is run by the Gamesa. Third project is located at Supa in Parner the wind turbine is made by Suzlon. At the Supa Bajaj Auto to set up 20 MW wind power project in which 20 wind generators of 1000 KW is working.

Kolgaon, taluka Shrigonda is one of the potential sites for the formation of wind energy. Another one of the expected sites is Kosegav then. In this district, there are strong wind are blowing in the Monsoonal period. that's why most of the electricity (70%) is generated in the month of the May to September. in

this district, there is continuous mountain region of the western dhat, who's height is averagely 600 to 700 meters from the ground surface that's why transportation activity is more suitable. Due to the less rainfall, these lands are barrel and less vegetation area. Nowadays there is 500 MW generation of the wind electricity in this district, but the potential capacity is more the 20 times. The Percentage of total feasible sites for wind resources in Maharashtra are shown below in graph details among different districts.

The most efficient site of potential for wind energy resources is Khandke, in the Ahmednagar, Kavadya Dongar in Parner and Kolgaon in Shrigonda talukas of Ahmednagar district has been observed. And details of this has shown below in graphs in details.

**5.1 Site suitability of Wind Resources**

The survey showing the possible sites in Ahmednagar district for probable wind suitable sites for wind energy resources are shown below in graphs respectively. Particulars of this has shown below in graphs in details for site suitability. The most efficient site of potential for wind energy resources is Khandke, in the Ahmednagar, Kavadya Dongar in Parner and Kolgaon in Shrigonda talukas of

Ahmednagar district has been observed. And one of the most working sites is Jamkhed has also great potential. This need to reintroduce or replace the old wind mills which has less power generating capacity by new ones with high power producing capacity.

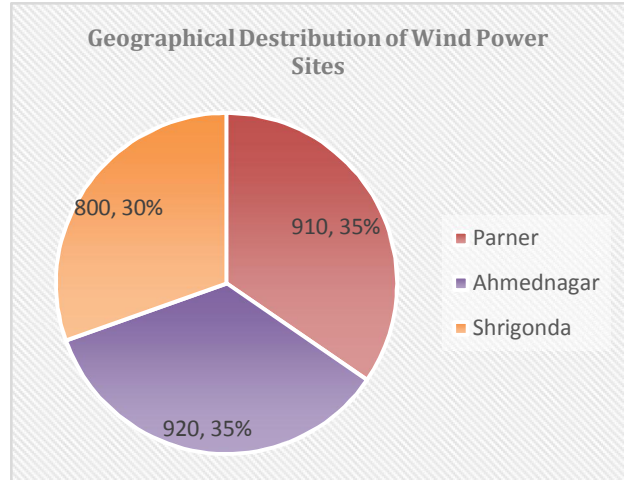


Fig. 2 Showing potential sites for wind resources in Ahmednagar district among different talukas

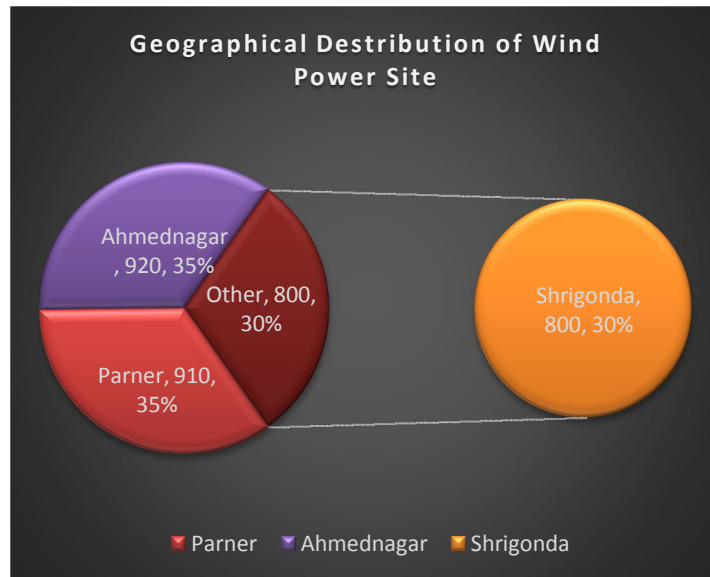


Fig.3 Showing potential sites for wind resources in Ahmednagar district among different talukas or tahsil

An annual mean wind speed less than 5m/s is not of much relevance to wind energy applications. have wind velocities greater than 5m/s during most of the months, i.e. the wind energy potential is high in these locations. Hence, these locations are recommended for construction of wind farms. The wind potential zone maps can be used easily to assist in making appropriate decisions. The Maharashtra Energy Development Agency (MEDA) and research has

identified major 28 feasible sites for wind energy generation in Maharashtra. These sites proposed to produce 750 MW by the end of 2007. Their district-wise percentage of feasible sites for wind power generation in Maharashtra, in the year 2001. Kelkar G.D. and Rathod V.R. (2016).

The Table 1 Elucidate the geographical details of wind power sites in Ahmednagar district for instillation purpose in M.S.L. So, this clearly gives the

probable land site suitability of wind Resources in Ahmednagar district.

Table 1: Geographical Details of Wind Power Sites in Ahmednagar district

Sr. No.	Taluka	Sites	Nearest station	Latitude	Longitude	Elevation (M.S.L.)
1)	Parner	Kavadya Dongar	Supa	19° 01'	74° 32'	910
2)	Ahmednagar	Khandke	Mehakari	19° 08'	74° 53'	920
3)	Shrigonda	Kolgaon	Baburdi	18 50'	74° 43'	800

Source: Survey conducted by research scholar The northern dry zone with the highest wind velocity is ideally suited for installing wind farms. Estimates show that if 2% of the wastelands (currently about 30–35% is either barren or uncultivable land in this zone) are used for harnessing wind energy about 0.75–2MW could be generated at many locations during some seasons. Therefore, harnessing a renewable source like wind at feasible sites would help in the eco-development of the region. Half dry region can be made the energetic i.e. Parner, Pathardi, Jamkhed, Karjat, Shrigonda and surrounding region as the Pathoda and Asti. Surplus electricity will be supply for the agro industry. Now a day lot of Industrial area are going to developing this electricity will be more applied.

In Maharashtra state, there is 50 Nodal agencies for the wind energy. For the purpose of more electrical development, there is “Maharashtra Energy Development Agency (MEDA). This wind energy is supply for the MSEB. Hence this wind energy will rotate the wheel of development in Ahmednagar district. The participation of private sector vindicates that the state has been progressing with rapid rate in wind power generation and in future it will be the main source to meet the ever-increasing demand for electricity. Among these nonconventional sources, though the wind energy shadowed for electricity generation. It may be noted that investments in these plans have mostly come from private sector. Kelkar G.D. and Rathod V.R. (2017).

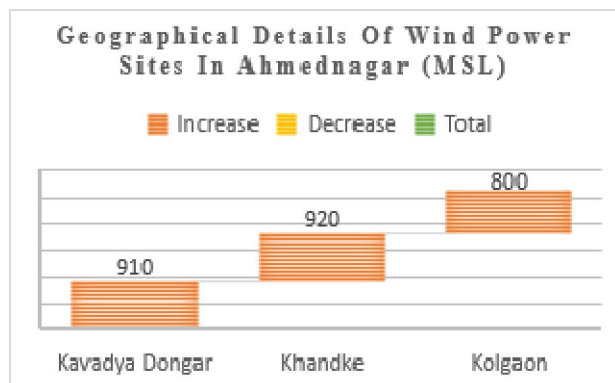


Fig. 4 Showing the potential sites of wind power in Ahmednagar district in elevation

Kelkar G.D. and Rathod V.R. (2018) Investigated the Maharashtra ranks second in the wind power production in India. The wind resource is mainly located in plateau and hilly region and scattered small pockets in the central plateau region of the state. Maharashtra state was declared attractive wind power generation policy, which provided better facilities to wind power project promoters.

Maharashtra is having 28 feasible sites for wind power generation out of which 10 sites have been in function in wind power generation. Today, Maharashtra is recorded with fast growth rate in installed capacity of wind power, wind turbines.

## 6. Conclusion

Wind power is one of most important renewable sources worldwide distributed and has a great potential of electricity. The non-conventional energy sources such as wind affected very less. Wind power is one of the most important energy sources available, free of cost, abundant in nature and pollution free green energy without any waste. Today wind industry is fastest growing industry all over the world and study area also not way from it. Wind energy is cyclic energy which is clean source of energy. It more pollution free energy source. Day by day the important of wind energy is increasing. There is lot variation in Ahmednagar district as natural and economic. With the help of wind energy, we could make the regional development.

## Acknowledgements:

I am thankful to the Jamkhed Mahavidhayala, Jamkhed, Ahmednagar for providing laboratory and library facilities.

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9/24/2020