

Small Scale Wind Turbine: As Alternative Energy System

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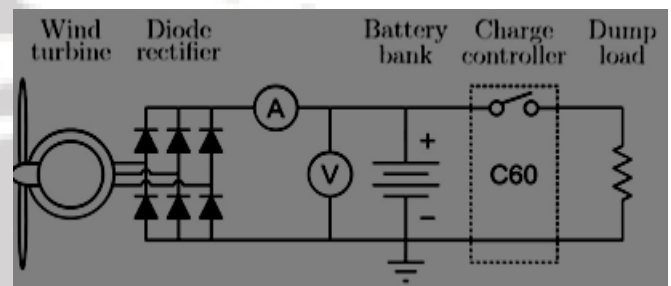
Abstract: Wind is renewable source of energy which has been used for power generation since many centuries because wind is unbounded, fresh and unlimited. Development of wind power technologies has made wind energy one of the leading renewable sources of energy. Small scale wind turbines, with 100 kW of rated power have been used for several applications. In this paper, we discussed about state wise status, challenges, development of wind power and market for small scale wind turbine system in details. Additionally, the problem related to wind turbine capacity and installation are detailed for wind technology in India. Besides, Case Study- C-WET wind turbine introduced in Tamilnadu is additionally done. Similarly, small scale wind turbine model is created by wind turbine, battery load, diode rectifier and C60 charge controller. MATLAB simulation is used to create mathematical model and power generation is calculated with respect to wind speed. The results are represented in tubular and graphical form.

Keyword: Wind turbine, MATLAB simulation, C-WET wind turbine, wind power, wind speed

1. Introduction

Small scale wind turbines, which are appraised under 100 kW, have been utilized within different various requisitions. This makes them a potential power supply alternative for spots found in great wind administrations searching for less expensive and less contaminating power supply choice. This turbine generates power for homes, business sector, villages, and cottages and provided telecommunication facilities in reserved area. Basically cut in speed of small scale wind turbine as low as 2.5 m/s and at most 10 m/s which are willingly accessible at most construction site location. In present year, increasing fuel cost and environmental pollution is most important issues for policy makers about energy generation. Renewable energy source are playing an important role in present electric power system due to their general use, public recognition, environment affability and mounting fossil fuel price. Wind power is competitive renewable energy source due to improvement of technology and their implementation scale. In this article, the effort has been made to appraise the wind technology potential in India. We also discussed about stage wise development issues and challenges of wind energy based small scale wind turbine.

Moreover, state wise installation and production utilization of wind power is also discussed. Proper case study of small scale wind power station has been ready to emphasize the development in this field. Additionally the current status and scope of work of renewable power is recapitulated. Small scale wind turbine model is created with wind turbine, diode rectifier and battery load.



By the help of algorithm, mathematical model is created to generate the power output with respect to wind speed. We represent here that the measurement of the power curve of a 3.6 meter diameter, horizontal-axis battery-connected wind turbine system following the IEC 61400-12-1 standard might lack consistency. This is due to characteristics specific to SWT. Moreover, the IEC standard is well detailed but comes without a practical example that could help to make it more accessible. This article fills in the gap. The MATLAB code for processing the measured data is also elaborated in this paper.

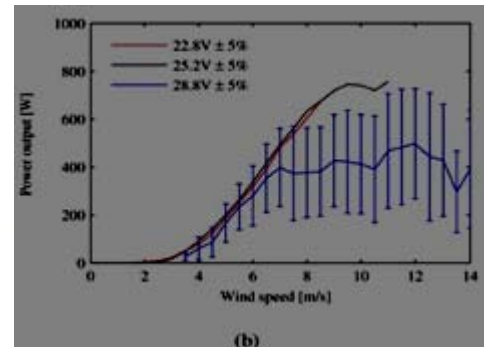
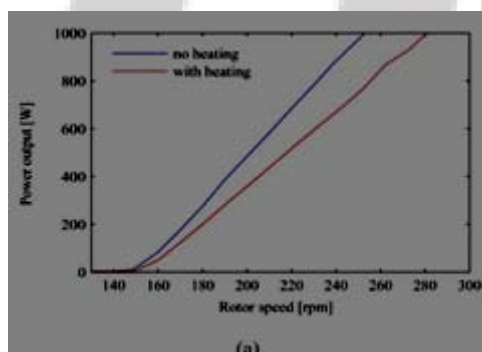
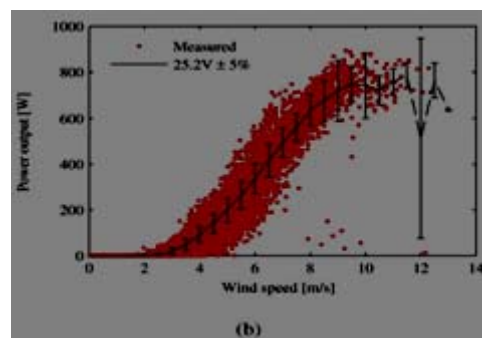
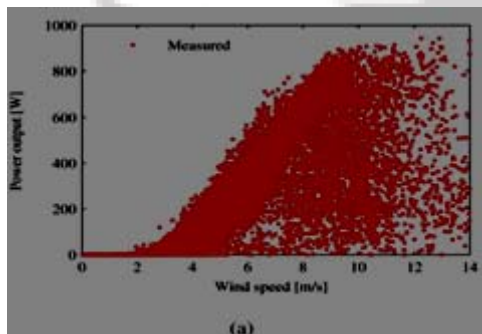
2. Methodology

- 1) **Wind Resource Assessment:** firstly measured direction of wind and hourly wind speed was taken at different hub height for four month period (march to June). Wind resources assessment are necessary for power low.
- 2) **Site Energy Demand:** onsite energy demand of equipment and appliances is needed for lighting heating and others using their power rating in kilowatts.
- 3) **Turbine Selection:** Turbine selection criteria (including power output, cost and reliability) are necessary to select a turbine to supply power to fulfill the necessity of site's lighting needs.
- 4) **Siting:** Ground mounting and tower crane-top mounting were analyzed as siting options.
- 5) **Costing:** By approximating the annual loan, repayment overall operation and maintenance expenses, property tax and insurance for the design lifetime to find the total life

time cost. The cost per kWh of electricity generated from the turbine is determined by total life time cost.

3. Literature Review

Wind referred to the motion of air with respect to surface of earth and it is caused by variable solar heating of the earth's atmosphere. Wind power converts wind energy into useful energy like electrical and mechanical form. Wind turbine is a device that converts kinetic energy of wind power into electrical energy. Small scale wind turbine have lower energy output than large commercial wind turbine and it is used for off grid residences, telecom tower, offshore platform and other small application. Over the years, many homes have resorted to generating their own electricity to Complement power received from the grid or because their homes are in remote location and therefore have no access to the grid. Diesel generator systems and solar PV systems have been the preferred or common options. However, with "miniature" wind turbines now readily available on the market, small scale wind power systems are growing in popularity.



Excess generation can even be fed into regional distribution lines and thereby strengthening the existing electricity grid and further providing additional income to the individual households. Thanks to the successes achieved by the large commercial wind turbine industry, significant advances have been made in the design of small wind Turbines thus making them more reliable, quieter and safer than those introduced in past decades.

4. Results

We have successfully done the case study of CWET to analyze the supply profile and strategy. This case study is implemented for the economic appraisal result. Wind resources data is used to determine the wind speed distribution for a full year. Wind speed is depend on the height of tower .the average wind speed is obtained at 6m to encourage the good wind power generation. CWET is good adequate to utilize wind turbine as supply technology option. The recommended turbine height is thirty meters (30 m).Small scale wind turbine reduce the load on power grid.

5. Future Scopes

- 1) In this paper we study about various data for small scale wind turbine that makes easy to take decision for small scale wind turbine to produce electricity for rural areas.
- 2) The results shown in form of graphical and experiment form that has been able to predict energy generation through small scale wind turbine. The future scope of small scale wind turbine is to produce electricity for rural areas and by this method we can easily fulfill the energy requirement for small level.
- 3) The small scale wind turbine could serves electrical power to people in off grid rural areas and delivering the power for small business, homes and telecommunication.

6. Conclusion

In this paper a study on the wind potential in India has been carried. The discussions have been made on issues and challenges of renewable energy in India particularly financial and technical context. Following are the salient points of the study.

1. The highest range of wind power density (400-500 W/m²) is found in some critical areas of Jammu & Kashmir state only.
2. A state wise comparison has been made for wind power development level. Maximum installed capacity of wind potential has been observed in Maharashtra and Gujarat.

3. Scope for research and development in the area of wind technology has also been identified for future work.

References

- [1] Zednko simic, juraj George Havelka, Maja Bozicevic Vrhovcak "small scale wind turbine-A segment of the wind power market" ELSEVIER September 2012.
- [2] Milivojevic N, Stamenkovic I, Schofield N." Power and energy analysis of commercial small wind turbine systems" ICIT IEEE 2010:1739e44.
- [3] National Research Council, Assessment of Research Needs for Wind Turbine Rotor
- [4] Materials Technology, Energy Engineering Board, National Academy Press, Washington.
- [5] Danish Wind Industry Association Guided Tour, 19 September 2003. URL
- [6] <http://www.windpower.org/en/tour/design/index.htm>
- [7] Aster Teleservices, Tower Designing, URL <http://www.astertele services.com/pdf/towerdesigning.pdf>
- [8] Kid wind Project, Wind Power Curves, 2004. <http://www.kidwind.org/pdfiles/windpowercurves.pdf35>

Author Profile



Meghakumari was born in Samastipur (Patna) Bihar on 20 may 1992.she did her B.Tech in electrical engineering under dual degree course and currently perusing M. Tech with energy engineering from Suresh GyanViharUniversity, Jagatpura, Jaipur. Her interest is in renewable energy source and she presently work on small scale wind turbine as alternative energy source. Her research includes the scope and potential of small scale wind turbine to maximize the electrical power and overcome the electricity requirement for future aspect.

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