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Wind Energy Generation – Challenges & Developments

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Abstract

Wind energy has successfully developed world wide during the last years. Along with this good development, there have been continuous improvements of the working and manufacturing strategies used for the development of wind turbine. Present and future research is focusing on improving the forecasting of wind energy, especially in severe weather conditions where electricity generation can increase rapidly.

INTRODUCTION

Wind energy is the conversion of wind power into a useful form of energy i.e., electricity. Wind energy is one of the fastest growing electrical energy sources in the World. It is the cleanest way of getting energy because it doesn't produce pollution

Figure 1: Series of Wind Turbines [4]

Followings are the major challenges and developments for the wind energy generation:

1. Wind Conditions

Wind turbines operate over a limited range of wind speeds. If the wind is too slow, they won't be able to turn, no electricity generation, and if too fast, they shut down to avoid being damaged. Ideally, a wind turbine should be matched to the speed and frequency of the resource to maximize power production. Current techniques must be improved so that, the geographic coordinates of any wind farm, predictions with an uncertainty of less than 5 per cent can be made. Extreme wind speeds to produce an extreme wind map, including guidelines for the determination of the 20 year extreme wind speed and extreme statistics. Investigate and suggest the behavior of the wind profile above 90meter, measurements and theoretical parameters describing the wind profile in the entire area.

2. Higher Cost Issue

Another factor in the cost of wind power is the turbines distance from transmission lines. It is not unusual for remote areas to have high average wind speeds, but be too far from major electricity demand centers for the wind power to be used economically. Considerable wind energy development has taken place in recent years in Indian states like Jaisalmer and Barmer, which are not as windy all time as Tuticorin or Ratnagiri but have substantial transmission capacity. Wind turbines come in various sizes and shapes. The cost depends on the turbine size, installation, type of turbine, location, freight, measuring equipments etc.

The wind turbine that are manufactured for low wind localities have large rotor, whereas, for high wind sites small rotor turbine is mostly used. But the price of low wind turbines is higher than high wind turbines, because the low wind pressure they have to perform more for generating electricity. There are some other costs also like, cables, connections to the grid, turbine foundation, and transportation.

3. Administrative Steps

Required to optimizing the administrative procedure. Administrative steps for wind projects include wind resource assessment and expenses of site analysis,

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the price and freight of the turbine and tower, construction expenses, upgrades of utility system, selection of advance transf protection, and measuring operations equipments, warranty, repair, legal and consultation fees. Other factors that will impact are including financing costs, size of project and various taxes. A better management system and condition monitoring system is required. [1]

4. Operation and Maintenance

Operations and maintenance strategies that maximize energy generation while minimizing operations and maintenance costs are essential. The main objective is to optimize operations and maintenance planning in order to increase availability and system reliability. This becomes more crucial with offshore installation of wind power systems. Effective access systems will be essential for the operation and the safety of person involved. Grid compatibility is an essential part.

When the wind turbine is new its maintenance cost is low, but when it gets old the operational and maintenance gets so high. Studies were done in Europe on about

5000 wind turbines. These wind turbines were installed in 1975. After studies they got on conclusion that every new turbines generation had lower maintenance costly than the last generations. [2]
The most recent developments in the field of wind turbines are:

- Advanced blade design
- Alternative methods protection in extreme winds
- Adopting a specific on grid or off grid uses
- Wireless and software development
- Advanced designed for reliability standards

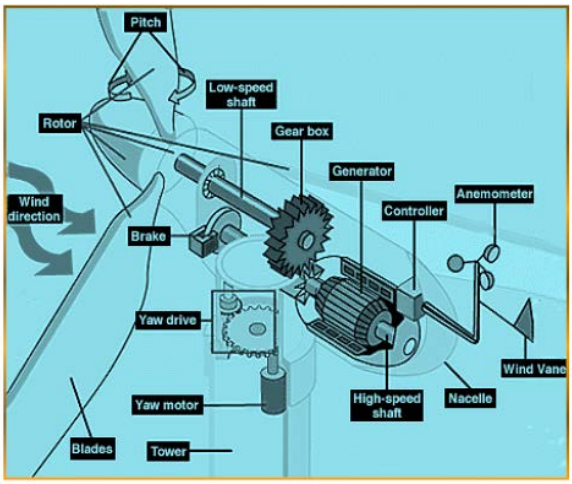

Figure 2: Basic Blocks of Wind Turbine [4]

- Boost up research, developments and manufacturing methods
- Advanced pitch control methods to maintain energy capture at very high wind speeds. [3]

CONCLUSION

The paper discusses the introduction and challenges of the wind turbine technology.

The development of modern wind turbine has been briefly reviewed. Wind turbine behavior/performance may be very much improved by using all discussed topics in this paper. Also it can be concluded the power scaling of wind turbines is important in order to be able to reduce the energy generation cost.

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