ENERGY POTENTIAL, INSTALLATIONS AND CHALLENGES IN WIND TURBINE

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ABSTRACT

People ever in the seventh centaury have been utilizing the energy of wind to make lives easy. People firstly used wind to irrigate farm and crush grain and later the wind energy used to produce electricity. As we know wind energy does not produce any kind of pollution, uses less space during operation, widely distributed and is available free of cost. Over the years numerous researches has been done to improve efficiency of wind turbine. The number of blades has been reduces to 5-6 blades. The wind velocity has direct impact on the efficiency of turbine. The cost of power to common man can be reduced by increasing efficiency of wind turbine.

Keywords: Wind, Turbine, Components, Location, Wind Power and Wind Speed.

I. INTRODUCTION

Over the years to irrigate and crush grain windmills have been used for many centuries. After the development in the field of electrical and mechanical windmill disappear in beginning of this century. But, day by day the fuel availability is going on decreasing but demand is going on increasing. And also with increase in demand the cost is increasing and emission from these fuel are very dangerous for ozone layer. Wind energy is system transforms the kinetic energy of the wind into mechanical or electrical energy that can be used for practical use. Around the world, wind turbines of all sizes have become a familiar sight. Today, in the world wind turbines are producing great amounts of electricity. A wind turbine can be in different size from small 1 kW structures to large machines rated at 1.5 MW depending upon the requirement [1].wind is originates from the temperature difference between two positions. The lower layer of the atmosphere is known as surface layer and extends to a height of 100 m. In this layer, winds are delayed by frictional forces and obstacles altering not only their speed but also their direction. This is the origin of turbulent flows, which cause wind speed variations over a wide range of amplitudes and thus are reasons for movement of the wind. Additionally, the presence of seas and large lakes causes air masses circulation similar in nature to the geostrophic winds. All these air movements are called local winds. In India there is vast availability of renewable energy resources. The potential availability of different states is represented in tabulated form.

Table:- Different States with Potential of Renewable Resources of Energy

Strong potential states	Potential (MW)	Installed (MW)
Andhra Pradesh	8285	93
Gujarat	9675	173
Karnataka	6620	124
Madhya Pradesh	5500	23
Maharashtra	3650	401
Orissa	1700	1
Rajasthan	5400	61
Tamil Nadu	3050	990
West Bengal	450	1

This paper is organized as follows. The working principle is discussed in Section II. In section III, line diagram of wind turbine and in section IV wind energy and power is discussed. Conclusion is done in Section V.

II WORKING PRINCIPLE

Wind is a source of energy, since a long time that used for different applications. The concept of windmill originated in Persia. The Babylonians and the Chinese have used wind power for the pumping of water for irrigation of crops some 4,000 years back [5].And in addition to this, sailing boats were harnessing wind power long before that. It has been recorded that wind power was used in Europe in the middle Ages for other activities like grinding of corn. In fact, this is what has been attributed to the start of the term windmill. With the heating of the atmosphere unevenly by sun, some part of land become warmer than others and this is where warm patches of air rise. Then other air with less temperature starts blowing to replace them and this leads to start of wind blowing. The energy produced from the wind is used by a tall tower which has a large propeller on its top end. The propeller of the tower starts turning which in turn turns a generator to produce electricity. When numbers of such towers are built together then they are known as 'wind farm' for the production of electricity. The production of electricity is increased by using numbers of towers to turn more wind with larger propellers. It's better to build wind farms at coastal areas, open plains, tops of rounded hills and gaps in mountains where strong and steady wind is available . It is required to have at least an average wind speed of about 25km/h to generate electricity with wind power [5].Small wind generators are used in boats and caravans to charge their batteries.

Large propellers are used to extract maximum energy from wind power. To copes with varying speed of wind blades of turbine are angled to fine and coarse pitch. It is possible to turn the generator and propeller to face the wind, to get maximum wind power. There are some windmills with vertical turbines which do not have to be turned to face the wind. Towers are usually tall as the higher the propellers reach the stronger is the wind there. With this feature, the land beneath the tower is not wasted, and can be used for farming. When wind blows on blades to make them turn, wind energy is produced. These blades in turn a shaft in the nacelle, which

goes into a gearbox to increase the rotation speed of the generator. The rotational energy is converted into electrical energy with magnetic fields. This energy goes into a transformer to convert the 700V energy into the required voltage for distribution, 33,000V. This energy is transmitted around the country with the help of national grid. Wind power is not only used in large scale wind farms for national electrical grids but is also used in small individual turbines for providing electricity to rural residences and locations that are not reachable by grids. With wind power being renewable, widely distributed and clean, it reduces toxins and greenhouse gas emissions in the atmosphere [5]

III LINE DIAGRAM OF WIND TURBINE

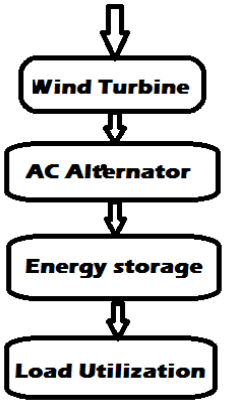

Figure:- Line Diagram of Wind Turbine Unit

On burning of coal, harmful particulate emissions are released that cause asthma and other breathing problems. In the form of emission sulfur dioxide are released which cause acid rain. Coal is one of the primary contributors of the carbon dioxide that causes mercury contamination of our lakes and global warming. Natural gas is a better option than coal, but it still produces considerable air pollution and contributes to global warming. Nuclear energy produces no particulate emissions, but it creates dangerous radioactive wastes which will require thousands of years of careful storage. All three sources--coal, gas, and nuclear power--are limited fuels. Today, they compose the bulk of our electric generation sources. Wind, on the other hand, is a completely renewable fuel source. As long as the sun shines, the winds will blow. And wind power produces no health risks and no air pollution. It is a renewable source of energy. Wind power systems are non-polluting so it has no adverse influence on the environment. Wind energy system avoids fuel provision and transport. On a small scale up to a few kilowatt system is less costly. On a large scale costs can be competitive conventional electricity and lower costs could be achieved by mass production. They are always facing some problems like no wind no energy. Energy transfer depends upon surface area. They can be installed in more locations - on roofs, along highways, in parking lots etc. Wind energy system can be scaled more easily - from milliwatts to megawatts. They have low maintenance downtime - mechanisms at or near ground level. Wind energy system produces less noise.[18]

IV WIND ENERGY AND POWER

The power in the wind can be computed by using the concept of kinetics i.e. it works on the principal of conversion of kinetic energy into mechanical energy.

So Power = $\frac{1}{2}*\rho*A*V^3 = (\frac{1}{2}*\rho*\pi D^2*V^3)/4$

From the above expression we come to conclusion that power is proportional to the cube of the wind speed.

Trial 1 For Velocity 5.0m/s Power $= (\frac{1}{2}*\rho*\pi D^2*V^3)/4 = (\frac{1}{2}*1.225*\pi*D^2*5.0^3)/4 = 60.10D^2$watt

Trial 2 For Velocity 6.0m/s Power $= (\frac{1}{2}*\rho*\pi D^2*V^3)/4 = (\frac{1}{2}*1.225*\pi*D^2*6.0^3)/4 = 103.86D^2$watt

Trial 3 For Velocity 7.0m/s Power $= (\frac{1}{2}*\rho*\pi D^2*V^3)/4 = (\frac{1}{2}*1.225*\pi*D^2*7.0^3)/4 = 164.92D^2$watt

Trial 4 For Velocity 8.0m/s Power $= (\frac{1}{2}*\rho*\pi D^2*V^3)/4 = (\frac{1}{2}*1.225*\pi*D^2*8.0^3)/4 = 246.18D^2$watt

Depending upon the value of D power from wind turbine can be calculated.

V. CONCLUSION

With awareness about wind energy and site selection hundreds of rural landowners throughout the Midwest have learned how to harvest the wind. Many of these people have been operating small turbines on their farms for years. Many others are just beginning to investigate the large wind turbines. As they would with any investment, these landowners must carefully weigh the benefits and risks and research just what a wind turbine on their property would involve. As a nation, we have decided that living more sustain ably with less pollution is a priority. When we account for the social costs of energy production, wind energy is the clear winner. Wind turbines can safely and efficiently turn wind into useable energy. We cannot afford to wait to do the right thing anymore. Wind power is an energy technology for today and the 21st century that we can all feel good about. And also conclude that wind machines intended for generating substantial amounts of power should have large rotors and be located in areas of high wind speed.

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