DESIGN & CONSTRUCTION OF COMBINED AXIS WIND MILL TURBINE FOR MAXIMISE EFFICIENCY

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ABSTRACT

The use of wind energy for energy generation is one of the oldest methods for harnessing renewable energy. Use of renewable energy is an essential ingredient of socio-economic development and economic growth. Renewable energy sources such as wind energy, tidal energy etc. is abundant and can help in reducing the dependency on fossil fuels. With increased concern for environment now days led to the research for more environment friendly sources of energy and with this considerations wind energy can be considered as a viable option in this regard. Different configurations of wind turbines such as horizontal axis wind turbine and vertical axis wind turbines are mainly used for energy extraction. Horizontal axis mainly used in large scale applications and thus its implementation is generally a concern due to huge instalment setup and initial cost; whereas vertical axis wind turbines offer promising solution for smaller ruler areas or medium sized residential spaces. Energy generation from wind turbines will surely be affected by geometry of bade it is using and its orientation in turbine. For effective use of turbine both parameters should be optimally set and determined.

This is a general description and combination of horizontal axis wind turbines and vertical axis wind turbines. Main components of horizontal axis wind turbine are covered. Vertical axis wind turbines are presented along with various sub-types. The design procedure is covered with emphasis on the layout of the wind turbine, both horizontal and vertical. Next, a description of different wind farm layouts is covered along with studies on the subject. Finally, a short description on a decision making process is shown in how to combined vertical wind axis turbine & horizontal wind axis turbine. A simple diagram leads the customer through the decision making process, answering what wind turbine or turbines are best suitable according to the customer's needs.

Keyword : - *Vertical axis wind turbine, Horizontal axis wind turbine, Renewable energy , Wind Energy, Energy generation.*

1. Introducation

Over the recent years, the world has been concerned about greenhouse gasses, climate change and lack of energy sources. Consequences of the greenhouse effect include extreme weather, melting of glaciers and the poles, animal and plant expulsion, and spread of diseases.

[1].The world's necessity for new ways to harness energy is growing. An alternative is needed to reduce pressure on current sources of traditional energy like fossil fuel, which will probably be depleted and are not renewable. Renewable sources of energy can prevent permanent destruction of the environment. Renewable energy is energy generally defined as a substance of economic value that can be replaced or replenished in the same amount or less time as it takes to draw the supply down .

[2]. Renewable energy comes from the Sun or the Earth's interior. Types of energy originating from the Sun are sunlight, wind, rain, tides, waves and biomass. Renewable energy sources have the possibility to provide energy

with none or almost no emissions of air pollutants and greenhouse gasses. Knowledge in how to harness the energy has to exist to make it efficient as possible. Factors like if it is technically possible or technically feasible have to be considered. The fossil fuel period is far from over but their dominant effect declines. While demand for energy increases, the fossil fuel share is slightly decreasing globally. Renewable energy technologies, account for half of the new capacity installed to meet growing energy demand in recent years.

[3]. Increase in renewable energy fluctuates with price of oil. High oil prices result an in increase of the share of renewable energy in total energy input, especially wind and solar. Even though the price of oil is high, it does decrease the share of other fossil fuels like coal and gas while low oil prices result in a lower share of renewables

[4]. Wind energy is therefore gaining more popularity as a large-scale energy source as the price of oil increases.

[5] Wind turbines are either horizontal axis wind turbines (HAWT), or vertical axis wind turbines (VAWT). Both include some basic components: a base or foundation, tower, generator, gearbox, yaw motor, rotor, control system, and a transformer. If a wind turbine is a HAWT, then the rotation axis is parallel to the ground. HAWT rotors and generators are at the top of the tower and must be pointed into the wind. If a wind turbine is a VAWT, then the rotor shaft is vertical and the main components are located close to the ground, making service and repair easier, and they do not need to be pointed into the wind.Topics that will be addressed for both types are

➢ Factors affecting the performance of a wind turbine

➢ Presentation on HAWT and critical components

➢ Presentation on VAWT and various types of them

➢ Comparison of HAWT and VAWT, and the design procedure in wind turbine, with

➢ a special setup on the wind turbine layouts

➢ modeling, for both HAWT and VAWT.

➢ Presentation on the decision making process on how to choose a wind turbine for certain circumstances.

1.1 OBJECTIVES

➢ To increase the individual and overall efficiency of wind mill turbine.

➢ To obtain maximum individual and combined output power.

➢ To minimize overall and individual cost of a wind mill turbine.

➢ To reduce space requirement for installation.

➢ To achieve suitability for low and high wind speed.

1.2 SCOPE OF THE PROJECT

➢ To utilize the available wind resources and to reduce the usage of non renewable energy resources. Wind energy is by far the fastest-growing renewable energy resource.

➢ The wind energy industry so far has been supported by market incentives backed by government policies fostering sustainable energy resources.

➢ Large-scale wind facilities approaching the output rating of conventional power plants, control of the power quality is required to reduce the adverse effects on their integration into the network.

1.3 METHODOLOGY

➢ To study widely used HAWT and VAWT from available literature.

➢ To identify different suitable wind mill design for combining.

➢ To conduct study for performance analysis of identified wind mill design.

➢ Based on the outcomes of experimental study, to develop best possible model for efficient wind mill.

1.4 NEED OF PROJECT

➢ In this project we are use both horizontal and vertical axis wind turbine to increase the efficiency of turbine and reduces the cost of development of individual turbine.

➢ To transfer the power from rotor to generator smoothly and to minimize the noise. It economical and do not affects the nature. To produce electricity in any wind direction by using the yaw mechanism to minimize the risk for human and birds because blades moves at relatively low speeds.

➢ Particularly suitable for areas with extreme weather conditions, like in the mountains where they can supply electricity to mountain huts.

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1.5 PROBLEM IDENTIFICATION

➢ More space is required for installation of vertical and horizontal axis wind turbine separately.

➢ Velocity of wind availability in Aurangabad city is low for rotation of horizontal axis wind turbine.

➢ At which height and place to install wind turbine to receive feasible amount of wind.

➢ More cost is required for fabrication and installation of HAWT and VAWT individually.

➢ Material selection is difficult for design and manufacturing the blade of both wind turbines.

➢ Problem in balancing the masses of both wind turbines on single shaft.

2. HORIZONTAL AXIS WIND TURBINES

In order for a turbine to be defined as a HAWT, the rotor blades have to be connected to a horizontal shaft. These types of turbines are mainly for commercial usage. Critical components are the rotor, gearbox, anemometer, generator, yaw motor, control system and the foundation. The turbine can either be a rotor-upwind design or rotor-downwind design. An upwind rotor faces the wind while a downwind rotor enables the wind to pass the tower and nacelle before it hits the rotor. The rotor diameter, number and twist angle of rotor blades, tower height, rated electrical power, and control strategy are the main considerations in design.Upwind rotor design currently dominate the market . Even though the downwind rotor design adjusts automatically to wind direction, an important safety and operational feature, it does not adjust under abrupt or sudden changes in wind direction. This can be overcome with three-blade upwind rotor, making it more desirable than the downwind rotor . In order to optimize the power output performance, a selection of a ratio between the Rotor diameter and the hub height has to be considered carefully. In order to avoid damage to the structure, the control system must ensure that the rated power output of a wind turbine does not exceed the maximum power allowed for the generator .

HAWT usually have two or three rotor blades. A turbine with two rotor blades is often in downwind installations where, the rotor is downwind on the tower. It is faster and cheaper, but it flickers more than the rotor with three blades and is less efficient. Three blade rotors operate more smoothly and are therefore less disturbing. HAWTs is lift based which means that they have blades designed as airfoils similar to aircraft wings.

Fig -1 Hand Made HAWT Blades

.The main advantages is high generating capacity, improved efficiency, variable pitch blade capacity, and tall tower to capture large amount of wind energy. There are also disadvantages such as consistent noise, killing of birds, interference with radio, TV transmission and radar, land use, maintenance worker hazards and visual impacts .

Follwing are some components are used in HAWT

- TOWER
- FOUNDATION
- ROTOR
- ROTOR BLADES ANGLE OF TWIST, ANGLE OF ATTACK AND PITCH ANGLE
- Tip Speed Ratio
- ROTOR HUB
- CONTROL SYSTEM
- ANEMOMETER

3. VERTICAL AXIS WIND TURBINES

HAWT and VAWT have some common components but their configurations are not the same. One of the major advantages of the VAWT include the fact that they are cross-flow devices and therefore accept wind from any direction, so there is no need of yaw drive mechanism which is an expensive component used in HAWT. Also, the drive train, which includes the generator, the gearbox and the brake, is located at the ground of the base of the tower, making maintenance easier. When it comes to blade design, the blades can have a constant chord and no twist, making the blades simple and cheap to produce. They can be built lower, making them less visual and they can withstand harsher environments and do not need to be shut down in high wind speeds. But there are also disadvantages including the tendency to stall under gusty wind conditions . The blades are sensitive to fatigue due to the wide variation in applied forces during each rotation. Also, they have a low starting torque, dynamic stability problems and low installation height limiting operation to lower wind speed environments. HAWT and VAWT have some of the same components including the rotor, which converts the wind energy into mechanical power. Also, the tower, which supports the rotor, and a gearbox to adjust the rotational speed of the rotor shaft for the generator or the pump They also both have a control system that monitors operation of the turbine in automatic mode. And finally, the foundation to prevent the turbine to collapse during high winds. VAWT sometimes guy wires used with the foundation .

- **MATERIALS USED FOR COMPONENTS**

ANGLES & PIPE	MILD STEEL
BLADES	PVC & ALLUMINIUM
SHAFT	MILD STEEL
BEARINGS	1) NEEDLE BEARING 2) ROLLER BEARIING
BATTERIES & LIGHT	12 V , 10A BATTERY 12 V LED LIGHTS WIRING SYSTEM
MOTAR / ALTERNATOR	12V & 1000RPM

Fig.2 Component

4. Setup Diagram

5. RUSULT

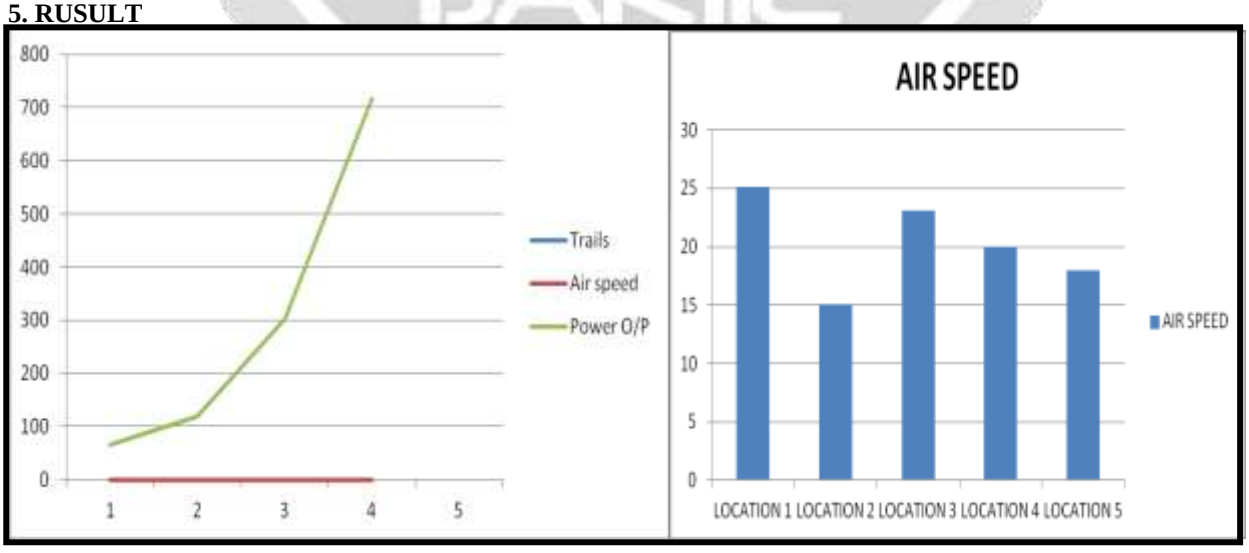

TABLE 1 & 2 POWER GENERATE IN WATT & AIR SPEED CHART

6. CONCLUSIONS

- Our work and the results obtained so far are very encouraging and reinforces the conviction that vertical axis wind energy conversion systems are practical and potentially very contributive to the production of clean renewable electricity from the wind even under less than ideal sitting conditions. It is hoped that they may be constructed used high-strength, low- weight materials for deployment in more developed nations and settings or with very low tech local materials and local skills in less developed countries.
- Electric power generated from the wind power can be variable at several different time scales such as hourly, daily or even seasonally.
- By using this clean source of renewable source of energy, not only will it reduce the money spent on electricity bills but also help our planet recover from the effects of pollution and therefore reduce emission of greenhouse gases to the ozone layer.

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