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A REVIEW PAPER ON DEVELOPMENT OF MICROWIND TURBINE FOR AUTOMOTIVES

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ABSTRACT

In this study , the performance analysis of Micro wind Turbine (MWT) in automobile will be discussed. The analytical work is going to be carried out using ANSYS software. Experimentation consist an input parameters as wind speed(m/s), open circuit voltage(V_{oc}), current(A), voltage(V) and rotor frequency(Hz) for the responses such as kinetic energy, mass flow of air, wind power, power coefficient, rotor rotational speed, mechanical angular speed and Tip speed ratio (TSR) are considered. This proposed research work is aimed to decrease the fuel consumption and to improve the utilization of the renewable energy. In this study , design ,implementation, and power performance analyses of a micro wind turbine (MWT) system are presented. An original permanent magnet synchronous generator (PMSG) that reduced cogging torque was utilized for the MWT blades. power performance analyses of the MWT were carried out for different wind ranges. Moreover, it is used in vehicle interior like Head lamp, AC, Top light on body of vehicle.

Key Words: *Energy, Renewable energy, Wind energy, Micro wind turbine.*

1.INTRODUCTION

Recently wind turbine energy has become one of the mostly rapidly increasing renewable energy resources . One of the methods for converting electrical energy into wind energy is to use wind turbine (WTs). WTs are manufactured for different sizes and power. According to the IEC 61400-2 standard of the International Electro technical Commission (IEC) WTs are divided into two classes : Small WTs(SWT) and Large WTs(LWT).Commercially manufactured SWTs are analyzed in three classes : Micro WTs(MWT),Small WTs(SWT)and Small-Medium WTs(SMWT).On account of the installation costs of MWTs. it is basically consists of a generator, 3-5 blades, a tail, a tower, and electrical equipment. There are two types of blade axes MWTs: VAWTs and HAWTs .The cut-in of a VAWT is lower than that of a HAWT are perpendicular ,and the rotation axis is parallel to the direction of wind. There are upwind and down wind types of them. MWTs could be manufactured with gear mechanism and drive drives. Recently, a large number of them have been manufactured with direct drives.

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2. BETZ'S LAW

Betz' law was first formulated by the German Physicist Albert Betz in 1919. Betz' law says that you are limited to a maximum conversion of 16/27 (or 59%) of the kinetic energy in the wind to mechanical energy using a wind turbine.

2.1 BETZ'S LIMIT

Theoretical maximum energy extraction from wind = 16/27 = 59.3%
Undisturbed wind velocity reduced by 1/3.

3. APPLICATIONS OF WIND ENERGY

3.1 ENERGY-GENERATING WIND TURBINES

Wind turbines are installed to capture the power of the wind and be able to convert it to energy. This can be on a broad scale, such as the wind turbines found on wind farms or can be on a smaller scale, such as individual wind turbines people use to generate power for their home. Companies even want to take advantage of the wind.

3.2 WIND-POWERED VEHICLES

You've probably heard about this one recently. A car, powered primarily by wind (using kites), just completed a 3,100 mile journey across Australia. While it wasn't 100% powered by the wind, it was a good example of how cars can also be powered using alternative energies. It used a combination of wind, kite and batteries. In total, it reportedly used about $10-$15 of energy for the entire 3,100 mile journey.

4.DRAG FORCE

In fluid dynamics, drag (sometimes called air resistance or fluid resistance) refers to forces that oppose the relative motion of an object through a fluid (a liquid or gas). Drag forces act in a direction opposite to the oncoming flow velocity. Unlike other resistive forces such as dry friction, which is nearly independent of velocity, drag forces depend on velocity. For a solid object moving through a fluid, the drag is the component of the net aerodynamic or hydrodynamic force acting opposite to the direction of the movement.

4.1EQUATION OF DRAG FORCE

The drag equation calculates the force experienced by an object moving through a fluid at relatively large velocity (i.e. high Reynolds number, Re > ~1000), also called quadratic drag. The equation is attributed to Lord Rayleigh, who originally used L2 in place of A (L being some length).

4.2THE FORCE ON A MOVING OBJECT

The main objective of our project is to convert wind energy into electric energy. By installing this device as shown in figure we can run audio system, mobile charging application, etc. To run any electric system, electric power from a battery or engine power is essential, so by installing this device, we can save the engine power which can be further utilized to run the vehicle which also leads to saving of fuel and/or in turn charge the battery. As shown in Figure, the drag and thrust force acts on a moving vehicle. The drag force can be used for useful electrical energy generation which in turn may either be stored in a battery or used to run an electrical utility. The detailed drawing of a wind energy convertor system converting the drag force of wind into useful electrical power.

5. AEROFOIL

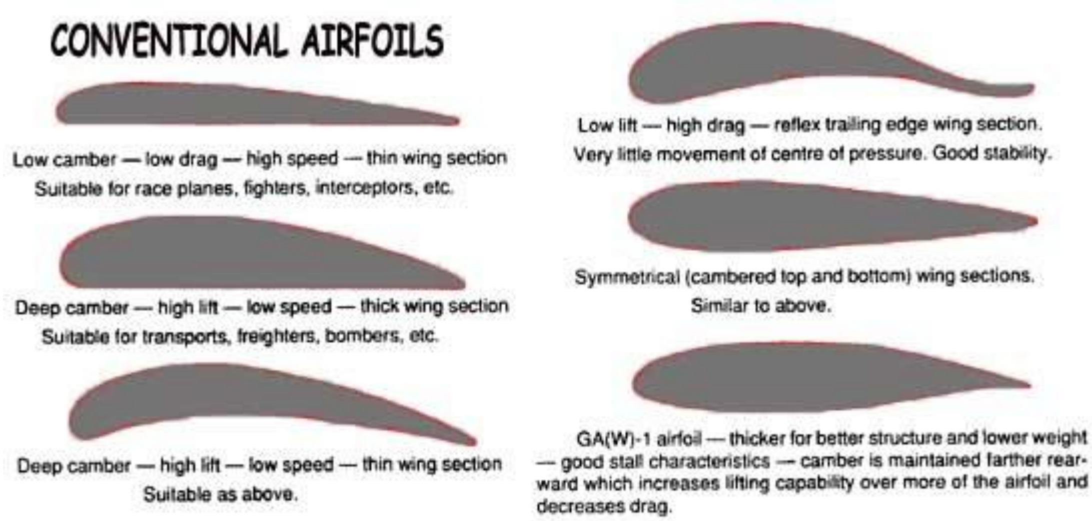
An airfoil is the shape of a wing blade or sail as seen in cross section.It is shape of a body moved through a fluid produces a forces perpendicular to the fluid called lift. Airfoils designed with water as the working fluid are also called Hydrofoils.

5.1TYPES OF AEROFOIL

i. Asymmetrical aerofoil.
ii. Symmetric aerofoil.

5.2 AEROFOIL SELECTION

Aerofoil for HAWT is often designed to be used at low attack angle, where the drag coefficient is usually much lower than the lift coefficient. A general aviation aerofoil shape is NACA series, and dedicated aerofoil shapes used in modern wind turbines are: S8 series developed by National Renewable Energy Laboratory (NREL) in USA, FFA-W series developed by FOI in Sweden, Ris0-Al series developed by Ris0 in Denmark, DU series developed by Delft University of Technology in Netherlands. It has been found in some applications that more than one aerofoil shape can be used for the wind turbine blade design, but there will be bending between these aerofoil, which may add toun certainties in the design process . For a stall-regulated wind turbine, it is better to choose an aerofoil shape to make sure that stall occurs gently after the maximum lift-to-drag point. Design a wind turbine for a specific site should not only include an optimum geometry with the maximum power coefficient but also the detailed power coefficient curve which is a function of wind speeds or the tip speed ratio. With more accurate aerodynamic coefficients at high attack angles, the more accurate design and performance prediction can be obtained. But the aerodynamic coefficients of a rotating aerofoil are different from the ones of a linear moving aerofoil. The coefficients from wind tunnel testing are acceptably accurate in steady flow, but in stall conditions, these coefficients are always lack of accuracy or there is no coefficient measured at very high attack angles at all. The low maximum lift coefficient, 21%thickness-to-chord ratio NREL 8809 aerofoil has been extensively used in HAWT, and the post-stall aerodynamic characteristics of 8809 have been investigated and published .It is also used as a base case in this paper. The modified lift and drag coefficients for steady-state and post-stall performance prediction are shown in Fig. These coefficients were presented with consideration of 3-dimensional flow [6, 7]. The lift coefficient for the 8809 aerofoil increases to1.32 at an attack angle of IS°, but then it decreases as attack angle increases. The drag coefficient increases after an attack\angle of 9°, and the maximum lift-to-drag ratio occurs at 8°.As the wind speed increases to high wind speed, the blade comes into deep stall regime; therefore a constant power can be achieved with a well-designed blade aerofoil.



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