To Increase overall efficiency of Wind mill

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Abstract- **Electrical energy demand has been continuously increasing. Depleting fossil fuel reserves, environmental concerns, and insufficiency of conventional generation techniques in meeting growing demand, renewable energy use has been widely adopted in the world. When considering the application of renewable energy sources in the world, it can be seen that wind energy is mostly preferred over other renewable energy sources. In this study, a new prototype wind energy conversion system suitable for urban use is designed and manufactured. The proposed design is modular and has flexible structure. In the new design, an outer gear ring attached to turbine blades is used. In the design stage, both the number of blades and the number of outer gear rings are varied to analyze their effect on turbine performance.**

Index Terms- Wind mill, blade design ,Wind speed, Blade performance.

I. INTRODUCTION

Wind energy outshines all other renewable energy resources due to the recent technological improvements. Electrical energy generation from wind power has increased rapidly and due to the increased interest many studies on efficient wind turbine design have been performed.

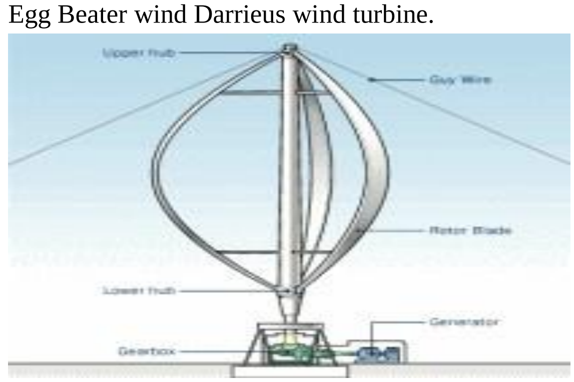
Wind turbines operate on a simple principle. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. The terms wind energy or wind power describes the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power.

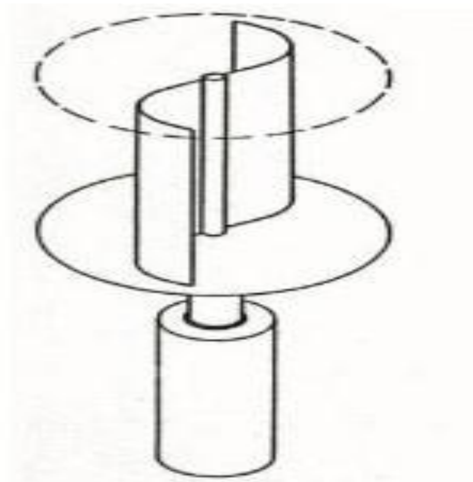
Types of Turbine

Harvesting small amounts of wind energy, on a large volume of scale provides a significant contribution toward global renewable energy. The energy process through commercially available small wind turbines includes blades that convert the wind energy into rotational mechanical energy on the shaft and an electric generator that is both simple in design and manufactured in small quantities by the wind turbine developer or retrofitted off-the-shelf general purpose machine.

There are several different design concepts for wind turbines. One basic classified is Horizontal Axis Wind Turbines (HAWT) and Vertical Axis Wind turbines (VAWT). Vertical axis wind turbines are a type of turbine where the main rotor shaft runs vertically. These turbines can rotate unidirectional even with bi-directional fluid flow. VAWT is mainly due to the advantages of this kind of machine over the horizontal axis type, such as their simple construction, the lack of necessity of over speed control, the acceptance of wind from any direction of the mechanical design limitations due to the control systems and the electric generators are set up statically on the ground. Generally, there have been two distinct types of vertical axis wind turbine that is the Darrieus and savonius types. For the Darrieus, there are three common blades that are Squirrel Cage Darrieus, H-Darrieus and Egg Beater Darrieus.

The machine is particularly suited to medium or low of wind speed which is inland area. The design of Egg Beater wind Darrieus wind turbine.





Darrieus wind turbine

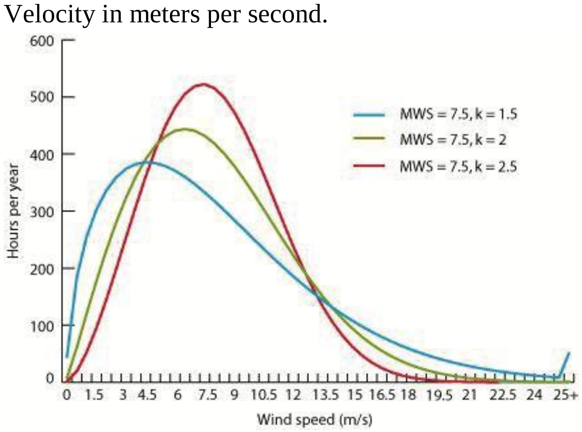
Calculation for wind Turbine

Calculating the energy available in the wind relies on knowledge of basic geometry and the physics behind kinetic energy. If the air mass is m and it moves with an average velocity V, the kinetic energy (KE) of the wind is (Joules).

The mass of air hitting our wind turbine (which sweeps a known area) each second is given by the following equation:

Mass hitting in wind turbine= V x A x p /second (2),Where V is velocity in meter per second, are in meter2 . p is the density of air (which at sea level is 1.2256 kgm-3). And therefore, the power in the wind hitting a wind turbine with a certain swept area is given by simply inserting the mass per second calculation into the standard kinetic energy equation given above resulting in the following vital equation:

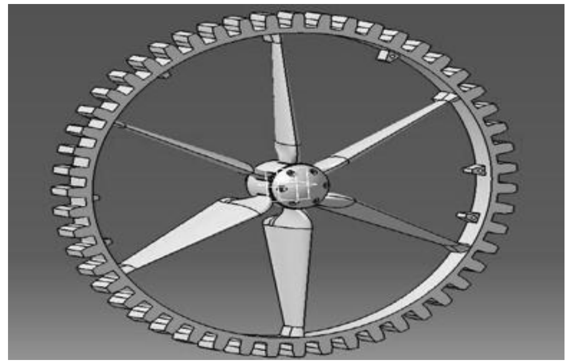
Power density = 0.5 x p x A x V3 (3) Where Power is given in Watts, the Swept area in square meters, the Air density in kilograms per cubic meter, and the Velocity in meters per second.



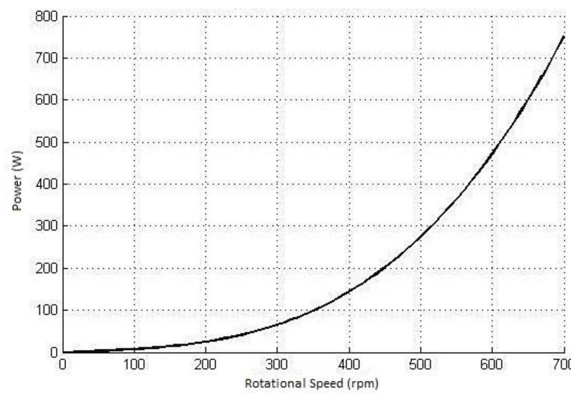
Wind speed m/s

Larger values of ‘k’ result in a more regular bell-shaped curve and lead to a higher mode, while the mean wind speed is unchanged.

Mini Wind Turbine concept



The realized wind turbine prototype is designed to obtain maximum output power with the smallest blades possible. The blades could be coupled to the outer gearwheel. Thereby, surface area could be increased to achieve higher output power. The outer gearwheel is flexible for variable blade numbers. This feature provides optimum system designs for different wind sites.



Output power of the generator increases rapidly over 200 rpm

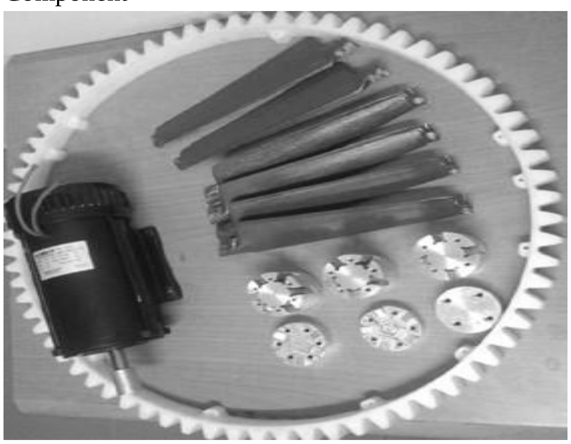
In the prototype study, the purpose is to manufacture light weight wind turbine components. For this purpose, the blades of the turbine is manufactured with a fiberglass reinforced composite material. Because of its high strength and thermal conductivity, fiberglass is minimally affected by environmental variations. Most commercial wind turbines, today are also manufactured with fiberglass reinforced composite materials.

For gears, polyethylene materials are used since these materials are not affected by variable ambient conditions. Additionally, polyethylene material is useful for reducing the noise problem. The gearwheel that surrounds the blades is produced by using CNC machines. Aluminum materials are preferred for fabrication of the turbine hub and its cover. The reason for this is the strength and light weight of aluminum. Thus, blades of the turbine could easily bear these components. Also, these components are manufactured by CNC machines.

The main advantage of the proposed system is its modular structure so that various blade numbers and gearwheel configurations can be used, thus allowing different working conditions to be analyzed. The platform of the prototype system is made of aluminum profiles. Three gearwheels could be used on this platform for synchronous applications.

II. FIGURE OF COMPONENT

Component



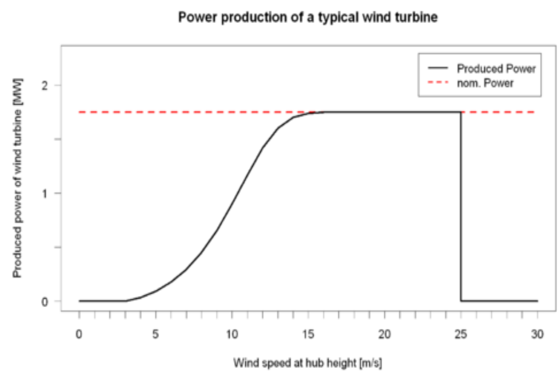
COMPARASION OF TEMPERATURE

The shape and dimensions of the blades of the wind turbine are determined by the aerodynamic performance required to efficiently extract energy from the wind, and by the strength required to resist the forces on the blade.

Wind rotor profile

The aerodynamics of a horizontal-axis wind turbine are not straightforward. The air flow at the blades is not the same as the airflow far away from the turbine. The very nature of the way in which energy is extracted from the air also causes air to be deflected by the turbine. In addition the aerodynamics of a wind turbine at the rotor surface exhibit phenomena that are rarely seen in other aerodynamic fields.

III. POWER CONTROL

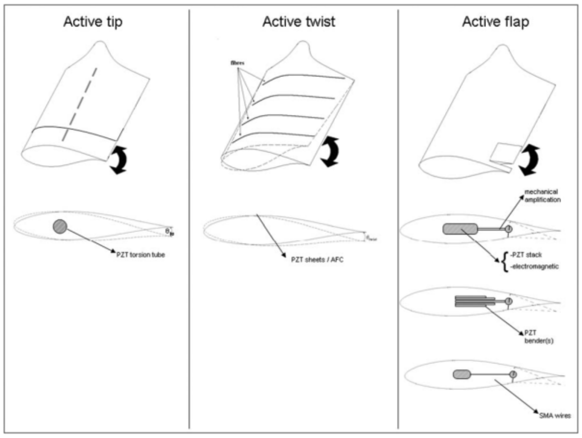


The speed at which a wind turbine rotates must be controlled for efficient power generation and to keep the turbine components within designed speed and torque limits. The centrifugal force on the spinning blades increases as the square of the rotation speed, which makes this structure sensitive to overspeed. Because the power of the wind increases as the cube of the wind speed, turbines have to be built to survive much higher wind loads (such as gusts of wind) than those from which they can practically generate power. Wind turbines have ways of reducing torque in high winds. A wind turbine is designed to produce power over a range of wind speeds. The cut-in speed is around 3–4 m/s for most turbines, and cut-out at 25 m/s. If the rated wind speed is exceeded the power has to be limited. There are various ways to achieve this.

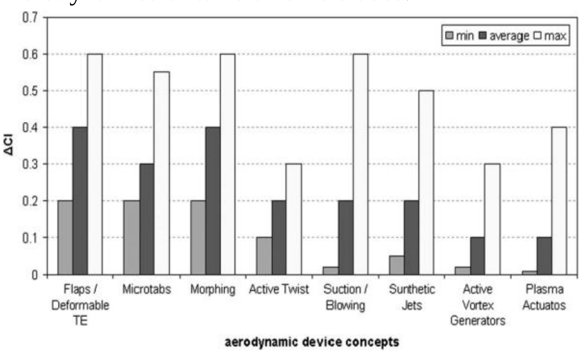
A control system involves three basic elements: sensors to measure process variables, actuators to manipulate energy capture and component loading, and control algorithms to coordinate the actuators based on information gathered by the sensors.

All wind turbines are designed for a maximum wind speed, called the survival speed, above which they will be damaged. The survival speed of commercial wind turbines is in the range of 40 m/s (144 km/h, 89 MPH) to 72 m/s (259 km/h, 161 MPH). The most common survival speed is 60 m/s (216 km/h, 134

MPH). Some have been designed to survive 80 metres per second (290 km/h; 180 mph)



Aerodynamics of wind turbine blades.



Comparison of Aerodynamics of wind mill

Smart actuator materials include conventional actuators, smart material actuators, piezoelectric andshape memory alloys. Traditional actuators probably do not meet minimum requirements for such concepts. Furthermore, proposed concepts of aerodynamic control surfaces (distributed along the blade span) require fast actuation without complex mechanical systems and large energy to weight ratios.

Promising solution for this purpose is the use of smart material actuator systems. By definition, smart materials are materials which possess the capability to sense and actuate in a controlled way in response to variable ambient stimuli. Generally known types of smart materials are ferroelectric materials and shape memory alloys. Piezoelectric materials and shape memory alloys are generally the most famous smart materials used in actuators in various applications. The development of their technology has reached a quite high level and commercial solutions are available and widely used. and Hu are specific fuel consumption, thermal efficiency and low calorific value respectively. It is to be seen in relation the specific fuel consumption is inversely proportional to thermal efficiency and accordingly, the efficiency will improve against the decreased specific fuel consumption. Quadratic regression was developed for orthogonal test to make the relation among four parameters and specific

IV.CONCLUSION

For reasons of efficiency, control, noise and aesthetics the modern wind turbine market is dominated by the horizontally mounted three blade design, with the use of yaw and pitch, for its ability to survive and operate under varying wind conditions. An international supply chain has evolved around this design, which is now the industry leader and will remain so for the immediate foreseeable future. During the evolution of this design many alternatives have been explored and have eventually declined in popularity. Manufacturers seeking greater cost efficiency have exploited the ability to scale the design, with the latest models reaching 164 m in diameter. The scale of investment in creating alternative designs of comparative size now ensures that new challengers to the current configuration are unlikely.

A comprehensive look at blade design has shown that an efficient blade shape is defined by aerodynamic calculations based on chosen parameters and the performance of the selected aerofoils. Aesthetics plays only a minor role. The optimum efficient shape is complex consisting of aerofoil sections of increasing width, thickness and twist angle towards the hub. This general shape is constrained by physical laws and is unlikely to change. However, aerofoil lift and drag performance will determine exact angles of twist and chord lengths for optimum aerodynamic performance.

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