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Regenerate Wind Power by Designing Bi-Directional Blades with 230V CFL Load Activation

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ABSTRACT:

Today's wind turbines are manufactured in a wide range of vertical and horizontal axis types.This project is Vertical axis wind turbines (VAWTs), which may be as efficient as current horizontal axis systems, might be practical, simpler and significantly cheaper to build maintain than horizontal axis wind turbines (HAWTs).They also have other inherent advantages, such as they are always facing the wind, which might make them a significant player in our quest for cheaper, cleaner renewable sources of electricity. VAWTs might even critical in mitigating grid interconnect stability and reliability issue currently facing electricity producers and suppliers.

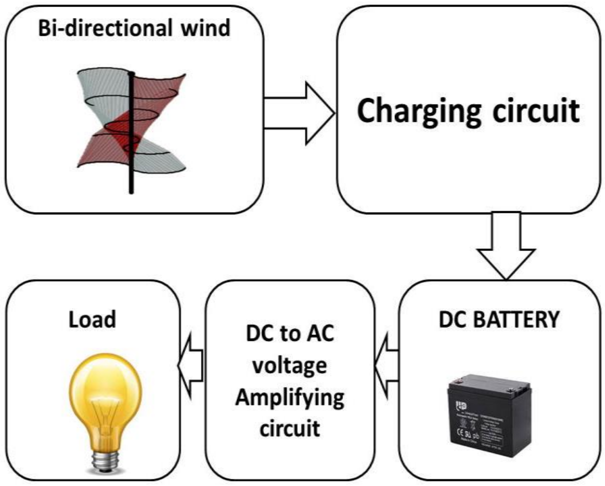
KEYWORDS: ***bidirectional wind, wind power, mechanical wind turbine design, designing if vertical blades.***

INTRODUCTION

A wind turbine is a popular name for a device that converts kinetic energy from the wind into electrical power. Technically, there is no turbine used in the design, but the term appears to have migrated from parallel hydroelectric technology (rotary propeller). The correct description for this type of machine would be aero foil-powered generator.

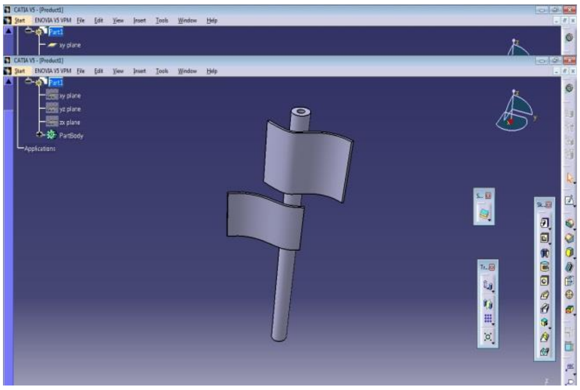
Today's wind turbines are manufactured in a wide range of vertical and horizontal axis types. The smallest turbines are used for applications such as battery charging for auxiliary power for boats or caravans or to power traffic warning signs. Slightly larger turbines can be used for making contributions to a domestic power supply while selling unused power back to the utility supplier via the electrical grid.

BLOCK DIAGRAM:



Vertical-axis wind turbines (or VAWTs) have the main rotor shaft arranged vertically. One advantage of this arrangement is that the turbine does not need to be pointed into the wind to be effective, which is an advantage on a site where the wind direction is highly variable. It is also an advantage when the turbine is integrated into a building because it is inherently less steerable. Also, the generator and dynamo can be placed near the ground, using a direct drive from the rotor assembly to the ground-based ball bearing, improving accessibility for maintenance.

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. These wind turbines can be used to provide constant lighting. In most cities, bridges are a faster route for everyday commute and in need of constant lighting makes this an efficient way to produce natural energy.



THE POWER IN THE WIND

The power in the wind can be computed by using the concepts of kinetics. The wind mill works on the principle of converting kinetic energy of the wind to mechanical energy. The kinetic energy of any particle is equal to one half its mass times the square of its velocity.

Kinetic Energy =½ mv^2.

Amount of Air passing is given by

$$m = \rho AV$$

Where

m = mass of air transversing

A=area swept by the rotating blades of wind mill type generator

ρ= Density of air

V= velocity of air

Substituting this value of the mass in expression of K.E.

$$= ½ \rho AV.V^2 \text{ watts}$$

$$= ½ \rho AV^3 \text{ watts}$$

Second equation tells us that the poweravailable is proportional to air density (1.225 kg/m^3) & is proportional to the intercept area. Since the area is normally circular of diameterD in horizontal axis aero turbines, then,

$$A = \pi D^2/4 \text{ (Sq. m)}$$

Put this quantity in equation second then

Available wind power Pa = $\rho\ \pi D^2 V^3/8$ watts

The forces and the velocities acting in a Darrieus turbine are depicted in figure 1. The resultant velocity vector, $\vec{W}$, is the vectorial sum of the undisturbed upstream air velocity, $\vec{U}$, and the velocity vector of the advancing blade, $-\vec{\omega} \times \vec{R}$.

$$\vec{W} = \vec{U} + \left(-\vec{\omega} \times \vec{R}\right)$$

Thus the oncoming fluid velocity varies during each cycle. Maximum velocity is found for $\theta = 0^\circ$ and the minimum is found for $\theta = 180^\circ$, where θ is the azimuthal or orbital blade position. The angle of attack, α, is the angle between the oncoming air speed, W, and the blade's chord. The resultant airflow creates a varying, positive angle of attack to the blade in the upstream zone of the machine, switching sign in the downstream zone of the machine.

From geometrical considerations, the resultant airspeed flow and the angle of attack are calculated as follows:

$$W = U\sqrt{1 + 2\lambda\cos\theta + \lambda^2}$$

$$\alpha = \tan^{-1}\left(\frac{\sin\theta}{\cos\theta + \lambda}\right)$$ [2]

where $\lambda = \frac{\omega R}{U}$ is the tip speed ratio parameter.

The resultant aerodynamic force is resolved either into lift (F_L) - drag (D) components or normal (N) - tangential (T) components. The forces are considered acting at the quarter-chord point, and the pitching moment is determined to resolve the aerodynamic forces. The aeronautical terms "lift" and "drag" refer to the forces across (lift) and along (drag) the approaching net relative airflow. The tangential force acts along the blade's velocity, pulling the blade around, and the normal force acts radially, pushing against the shaft bearings. The lift and the drag force are useful when dealing with the aerodynamic forces around the blade such as dynamic stall, boundary layer etc.; while when dealing with global performance, fatigue loads, etc., it is more convenient to have a normal-tangential frame. The lift and the drag coefficients are usually normalised by the dynamic pressure of the relative airflow, while the normal and tangential coefficients are usually normalised by the dynamic pressure of undisturbed upstream fluid velocity.

$$C_L = \frac{F_L}{1/2\,\rho A W^2}\ ;\ C_D = \frac{D}{1/2\,\rho A W^2}\ ;\ C$$

A = Surface Area R = Radius of turbine

The amount of power, P, that can be absorbed by a wind turbine:

$$P = \frac{1}{2} C_p \rho A \nu^3$$

Where C_P is the power coefficient, ρ is air density, A is the swept area of the turbine, and ν is the wind speed.

Advantages of vertical axis wind turbine over horizontal axis wind turbine.

There are several reasons why we would choose a vertical axis wind turbine over a horizontal axis windmill.

1. They are mounted lower to the ground making it easy for maintenance if needed.
2. They start creating electricity at speeds of only 6 mph. And
3. Third, they may be able to bebuilt at locations where taller structures, such as the horizontal type, can't be.
4. Higher power utilization-- 20% higher than HAWT.
5. Lower noise level--only 27-37 DB, suitable for your living condition.
6. Safer operation--Spin at slower speeds than horizontal turbines, decreasing the risk of injuring birds and also decreasing noise level.
7. Simpler installation and maintenance-- besides the traditional installation site, it can be ounted directly on a rooftop, doing away with the tower and associated guy lines.
8. Not affected by orientation variation—no matter the wind blow from any orientation, VAWT can work without regard to its face.
9. Economical and practical-Although one-time investment expenses are larger, but you don't have to pay higher tariffs forever.

Advantages

- It is a renewable source of energy.
- Wind power systems are non-polluting so it has no adverse influence on the environment.
- Wind energy systems avoid 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 the wind - no need for steering into the wind.
- Have greater surface area for energy capture - can be many times greater.
- Are more efficient in gusty winds – already facing the gust.
- Can be installed in more locations - on roofs, along highways, in parking lots.
- Can be scaled more easily - from mill watts tomegawatts.

Conclusion

Our work and the results obtained so far are very encouraging and reinforce the conviction that bi-directional 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 nationsand settings or with very low tech local materials and local skills in less developed countries. The bi-directional wind turbine designed is ideal to be located on top of a bridge or bridges to generate electricity, powered by wind. The elevated altitude gives it an advantage for morewindopportunity. With the idea on top of a bridge, it will power up street lights and or commercial use. In most cities, bridges are a faster route for everyday commute and in need of constant lighting makes this an efficient way to produce natural energy.

Future Developments

The development of effective alternators and dynamos can be used to harness wind energy from relatively small winds. The use of materials like Acrylic Plastic Sheets can be used to develop low cost VWAT.

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