Optimized power generation using hybrid wind and solar power

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Abstract: - **The foremost intent of the project is to afford oomph from renewable sources. Windmill is one of the renewable resources for oomph production, but there are some ticks and tacks that should be intended for unswerving energy. Unswerving oomph can be obtained for domicile embrace appliances with the anticipated design. The anticipated designs have some sophisticated features that defend the wind turbine and the battery from over assembly and charging of energy. This helps us to endow with stable oomph supply to the freight.**

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Introduction

Energy from the sun is driving force behind the weather. When sunlight is absorbed by the Earth, it heats the atmosphere near the earth's surface. Atmosphere heating is not uniform for the ocean and continents. The ocean circulates continuously, so the heat absorbed from the sun is distributed over a huge volume. Also, some of the energy of the sunlight causes evaporation rather than temperature increases. Sunlight falling on land masses is concentrated on the surface. The same amount of sunlight raises the land temperature more than the ocean temperature. When the surface temperature is high, the air above that surface is heated more than when the surface temperature is low. As a result, temperature difference arises between different portions of the atmosphere.

When air is heated, it expands and flows outward from the higher temperature region towards colder regions. In addition to this lateral movement, warm air moves in the atmosphere, which lowers the pressure near the planet surface. Conversely, cool air moves downward in the atmosphere which increases pressure near the surface. Thus additional flows of air, i.e., the wind blows.

Even though the nature of the wind is discontinuous, wind pattern at particular places remain remarkably constant year by year. In hilly and coastal areas, average wind speeds are greater than at inland. The wind tends to blow consistently over the surface of the water greater strength. Wind speed s increases with height. At the height of 60m, the wind speed is 30-60% higher than close to the surface. That is why, wind blades are placed at a height so that they can tuned continuously by the wind.

Power in the Wind:-

Wind energy because of its motion. Any Device capable of slowing down the total mass of the moving air can extract this part of energy and can be used to do useful work. Conversion of kinetic energy of the wind energy in to mechanical energy can be utilized to run a wind mill which in turn, rotates the generator to produce electricity. When the wind blows against these blades, they rotate about their axis and this rotational motion is extracted performing work. The wind energy conversion device is mainly called the rotor.

There are basically three factors that the output from wind energy conversion system.

a) The wind speed
b) The cross section of the windswept by the rotor.
c) The overall conversion efficiency of the rotor, transmission system generator or pump.

Theoretically it is possible to get 100% efficiency by halting and preventing the passage of air through the rotor. However, no device can extract all of wind energy and only able to decelerate the air column to one third of its free velocity. Hence a 100% efficient wind generator is able to convert maximum up to 60% of available energy in wind into mechanical energy. In addition this, losses incurred in the generator or pump decreases the overall efficiency of power generation to 35%.

A wind mill works on the principle of converting kinetic energy of the wind to mechanical energy. Now, power is

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equal to energy per unit time. Energy that is available in the wind.

Kinetic energy in the particle =

$$Power = \frac{K.E.}{time} = \frac{\frac{1}{2}(mass) \times (velocity)^2}{time}$$

We know that

$$\frac{mass}{time} = density \times area \times velocity$$

Putting the value

$$Power = \frac{1}{2}(density) \times area \times (velocity)^3 = \frac{\rho A V^3}{2}$$

Where ρ = air density

A = area swept by wind mill rotor

V = wind speed in m/sec

This equation tells that the power available is proportional to air density (1.225 kg/m3 at the sea level). Due to pressure

and temperature change, it may vary 10-15 % during a year. Water content present in the air does not affect power in the wind. Equation also tells us that the wind turbine is proportional to the intercept area. Thus an aero turbine with a large swept area has larger power than a smaller area machine. Since area is normally circular of diameter D.
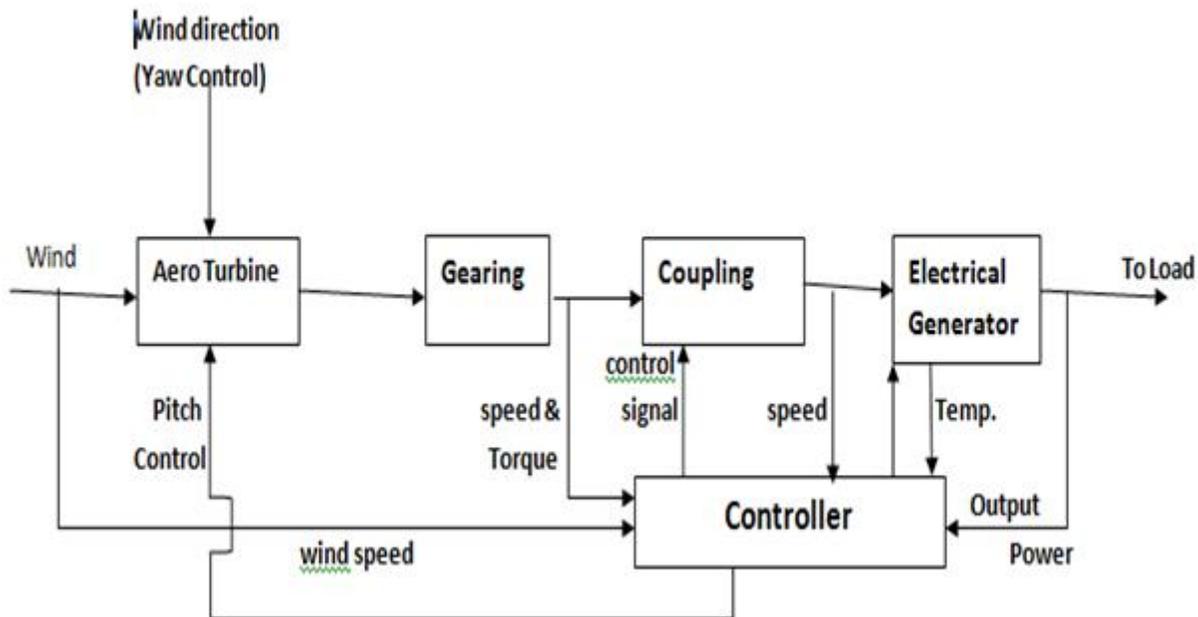
Then $A = (\pi/4)D^2$

Available wind power

$$P = (\pi/8)\rho D^2 V^3$$

This equation tells us that the maximum power available depends on square of the rotor Diameter. Thus doubling the die of rotor will result in a fourfold increase in the available wind power.

Existing System

Aero turbine are used to convert energy from moving air to rotary mechanical energy. For their proper operation they require pitch and yaw control. To transmit the rotary mechanical energy to an electrical energy, a mechanical interface consisting of a step-up gear and a suitable coupling is required. The generator output so connected to the load or power grid as the application warrants.

Proposed system

The concept of hybridizing renewable energy sources is that the base load is to be covered by largest and firmly available renewable source(s) and other intermittent source(s) should augment the base load to cover the peak load of an isolated mini electric grid system. Various renewable/alternative energy sources, energy storage and their Applicability in terms of cost and performance are discussed, it has been found that renewable/alternative energy sources will replace the conventional energy sources and would be a feasible solution for distribution of electric power for standalone applications at remote and distant locations.

The existing model uses Hydraulic brake to stop the working of the motor, when there is over-production of Electricity. But in this proposed method braking system is applied when the motor reaches RPM of 1400. This is possible by the use of LASER beam. The system is set-up in such a way that the beam falls on the LDR indicating one rotation. Thus 555 timer counts the RPM and it applies the brake when it reaches to 1400.
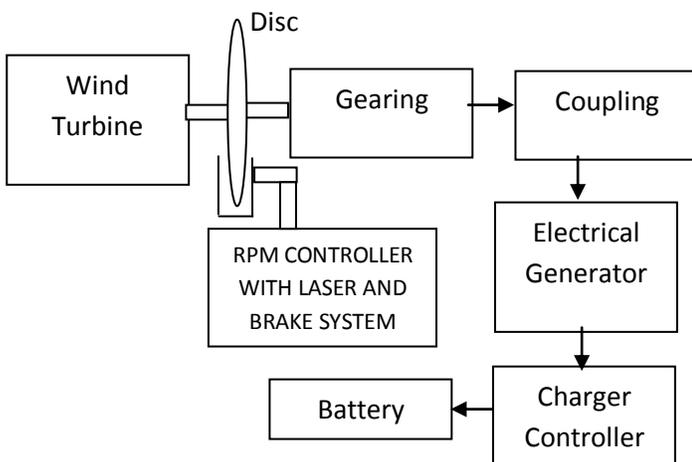
Blade Assembly

Blade assembly is composed of five blades mounted on a wheel disc. Wind drives the blade and transforms the wind energy to mechanical torque, which in consequences, forces the rotor to rotate against the stator inside the generator. Since blades are required to work in a hostile, high wind blowing, high rotating speed environment, therefore it is important to select the suitable material to fit for the needs. We put head cone in this group to prevent pollution/corrosive material getting to the wheel.

Generator

The function of generator is to convert mechanical energy to electric power. Inside the generator, the key central rotor rotates against the shell stator to induct current. JPS-200uses direct drive synchronous PM generator.

Nacelle

Inside the nacelle an IC circuit is designed to fit behind the generator. To rectify the generated AC to DC current. It also detects over current and send short circuit signal to trigger magnetic constrains on the generator.

Yawing/Slip ring

The combined yawing and slip ring design ensures the whole wind turbine unit will automatically face the wind to minimize the head-on wind blowing stress. The slip ring ensures the system rotates 360 degree freely to transmit power without wiring to joint.

Conclusion

With the help of the proposed system a unswerving energy is obtained. This proposed system is designed to generate maximum power up to 200W. RPM controller circuit protects the generator system from over production.

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