Airborne Wind Turbine to Produce More Power from High Altitude Winds

J.Sarathkumar Sebastin

Abstract*: This examination identifies a structure for the higher height Airborne Wind Turbines. Winds at high height are quicker than winds close to the world's surface and contain multiple occasions the power giving an amazing undiscovered vitality asset. Also, high height winds are accessible all the more reliably contrasted with close surface breezes. Henceforth, Airborne Wind Turbines produce a progressively unsurprising and uniform power yield bringing about twofold the vitality generation when contrasted with a traditional turbines. The higher elevation Airborne Wind turbines would at first fly at a tallness multiple times higher than ordinary breeze turbines by vertical take-off. The lift required for the Airborne Wind Turbine's vertical take-off is provided by engine generators associated with the turbines, at long last the all-out frameworks conveyed by helium expand. The breezes at high elevation moving through the turbines turn the generators at rapid. The power created by the turbines is transmitted to the ground by means of the strengthened composite tie that stays the Airborne Wind Turbine to the ground.

Keywords: Wind turbine blades, Altitude and wind speed, vertical take-off, helium balloon, reinforced composite tether, Conventional wind turbine.

I. INTRODUCTION

In the quickly developing universe of innovation and science, sustainable wellspring of vitality is a standout amongst the most significant parts that can be utilized viably for picking up vitality. The utilization of different inexhaustible courses like breeze, sun based vitality, and tidal vitality can demonstrate shelter of humanity. Wind power is great sustainable, spotless and free wellspring of vitality for power generation. A portion of the components deciding the financial matters of the utility scale wind vitality are: Wind Speed, Turbine design and construction, Rated capacity of the turbine, Exact Location, Improvements in turbine design, and Capita.

The breeze vitality industry needs progressive plans to expand the abilities of wind frameworks. Power age from twists for the most part originates from twists near the outside of the earth. Winds at higher elevations are more grounded and increasingly predictable. The intensity of wind motor firmly relies upon wind speed (to the third power). Low height wind (H = 10 m) has the standard normal speed of V = 6 m/s. High elevation wind is incredible and for all intents and purposes wherever is steady and consistent. Wind in the troposphere and stratosphere are ground-breaking and lasting. For instance, at an elevation of 5 km, the normal breeze speed is around 20 m/s, at a height 10 - 12 km the breeze may achieve 40 m/s. So the proposed structure gives the accompanying primary focal points. That are, High wind speed, Large power production capacity, Wind flow is strong and steady, Installation cost per unit energy is low, No propeller noise.

Description of Proposed system:

Wind turbines changes over the active vitality of the breeze into mechanical vitality first and afterward power if necessary. Here, the accompanying outline will clarify the calculated structure perspective on Airborne Wind Turbine model. (Fig. 1).

The turbine blades act as propeller to carry total weight initially by vertical take-off. At certain altitude, the wind turbine fixed and floated by helium balloon, at the same time, the propeller will acts as the turbine and ready to convert kinetic energy of air to mechanical energy. The mechanical energy is supplied to generator unit & it convert into electrical energy. The tethering cable used to work 2 function, the one is to anchor the wind turbine to the ground, and the other function is to transmit the electricity to ground via tethering cable. Finally the D.C. current convert into A.C. current, and used by various applications.

II. MATERIALS AND METHODOLOGY

Helium has a lifting power of marginally more than one gram for every liter. This lifting power originates from helium weighing not as much as air, bringing about an impact known as uprooting. Since the encompassing air has been uprooted by a substance with less weight per unit of volume, it is pushed away by the heavier substance. Helium is a component that is named a respectable gas since it is unscented, dismal and is made of generally few sections. Truth be told, helium has a nuclear number of 2; that is, there are just two protons that encompass the helium molecule's core. Helium essentially exists in vaporous structure on the grounds that the breaking point and solidifying focuses for it are on the outrageous sides of the scale. The reason helium inflatables buoy is on the grounds that helium is considerably less thick than the Earth's environment. This is alluded to as the Law of Buoyancy. Due to the Archimedes' rule, a lifting gas is required for aerostats to make lightness. Its thickness is lower than that of air (Helium's thickness is evaluated as .1786 grams for every liter).

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* corresponding author
*** J.Sarathkumar Sebastin,** Asst. Professor, Department of Aeronautical Engineering, Kalasalingam academy of Research and Education, Tamilnadu, sebastinaero@gmail.com

Just certain lighter than air gases are reasonable as lifting gases. Helium is the second lightest gas. Hence, it is an alluring gas for lifting also. A noteworthy preferred position is that this gas is noncombustible.

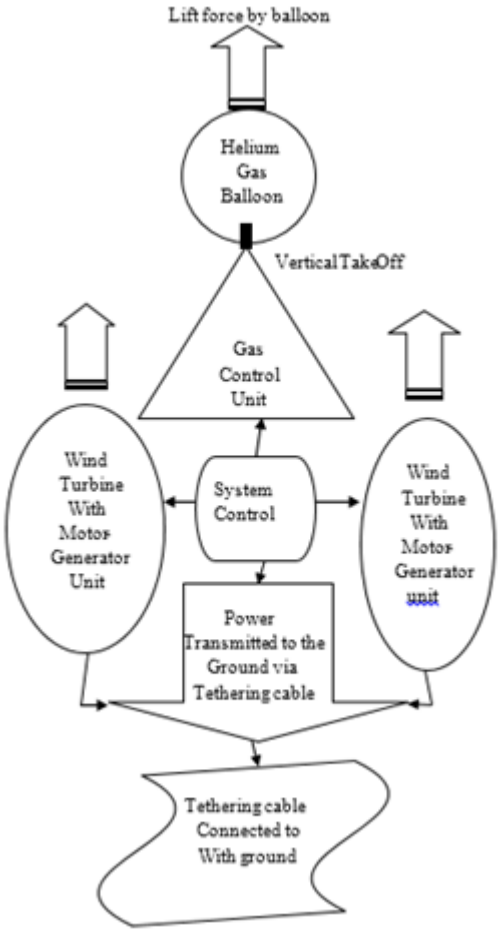

Fig. 1: conceptual design view of Airborne Wind Turbine

Table 1: Total weight estimation

parameter	weight (kg)
Balloon	130
Balloon Pressure controller	30
The rigging ropes and patches	20
tether cable	150
wind turbine blades	300
generator units	100
Total	750

GAS CONTROL UNIT:

Gas control unit is utilized to keep up the internal weight of the inflatable envelope, which is brought about by encompassing temperature, and weight change of the encompassing air. The gas control unit direct the inflatable weight and just as utilized in the piece of lifting framework.

TETHERING CABLE:

The Tether cable is about 20mm in diameter and comprises three different layers as shown in Fig.2.

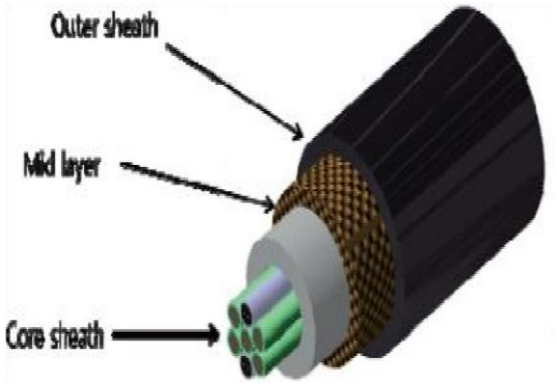

Fig.2. Tether Cable Construction.

The external sheath of the link is made of a polyurethane covering, which shields it from bright light and scraped spot and anticipates water assimilation. The center layer is made of engineered filaments, for example, aramid or vectran. The mid-layer conveys loads that are moved from the inflatable to the ground. The center layer is made of a metal wire, which is utilized for moving electric flow. The quantities of metal wires are 4-6. Three wires are utilized for moving flow and another is utilized for electric establishing and lighting security, the other wire is excess and it is utilized when a few links broken in task. A couple of correspondence links can be profoundly added layer for controlling and checking the inflatable and the airborne breeze turbine framework. On the off chance that a remote correspondence framework is utilized, these links can be discarded. At the point when the thickness of the tying link is 0.2kg/m, it turns out to be roughly 100kg for the 500m long queue.

III. RESULT & CONCLUSION

Power generation capacity:

The total wind power capacity can calculate by the following equation,

$$P= (1/2)*\rho A v^3 C_p$$

Where, C_p is the rotor efficiency, which is assumed as 0.3 in this study. If the proposed wind turbine system is used, it will generate a much larger energy. The power of wind engine strongly depends on wind speed (to the third power).

System control:

The info signal (wind turbine control signal) will send through tying link to framework control unit. The framework control unit contains the incorporated electronic controls that incorporates,

Wind speed & direction control sensor.

- Altitude sensor
- Weather sensor
- Power output indicator
- Wind turbine directional control
- Gas pressure control

The yield of framework controls are associated with gas control unit, wind turbine servo control unit, control transmission unit. Framework control is completely in charge of security of airborne breeze turbine framework.

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AUTHORS PROFILE

J. Sarathkumar Sebastin working as Assistant Professor in Aeronautical Engineering, Kalasalingam Academy of Research and Education. The author has published papers in the areas of Solid propellants, UAV and propulsion.