

## **Licensing and Technology Transfer Opportunity: Manipal University**

**Title of Technology Available:** AN AERIAL POWER GENERATION SYSTEM

### **Brief Description of Invention:**

The present invention relates to the field of power generation and specifics of a system that utilize a velocity augmenting device produce electrical energy from wind energy using a lighter than air apparatus

### **Brief Background of Invention:**

The present invention relates to the use of a conventional horizontal axis wind turbine in a velocity augmenting shroud made airborne by a GNVR shaped aerostat. The present invention specifically is related to the wind energy production. The wind energy production in modern times is a vast unexplored field with endless possibilities due to advanced methods of manufacturing. This is one of the main reasons that harnessing wind energy had not been attempted until 1887 in Scotland. Even after the first attempt, wind energy was harnessed more on an experimental basis than on a commercial front due to a high economic footprint in investing in the research and due to the vast availability of fossil fuels at the time.

A multitude of approaches have been developed and experimented with, such as creating a lighter than air system, or drones to convert tension on the tether caused by their flight to electricity. Kites have also been used where the angle of attack of the kite was changed and the resulting flight path was used to create tension and produce electricity by virtue of converting the mechanical energy thus produced into electrical energy.

The present invention attempts to fully utilize the advantages of Aerial Wind Energy while trying to mitigate some of the disadvantages/challenges faced. The invention comprises of:

- An aerodynamically optimized rotor system that is housed in a velocity augmenting apparatus.
- A lighter-than-air blimp that is used to carry the system to an optimum altitude.
- Control surfaces on the blimp to achieve directional control and stability to point the turbine towards the flow at all times.
- A tethering system to link the system to a ground system.

### **Describe the final product:**

The present invention consists of a high-altitude aerostat coupled with a velocity augmenting device which encloses a conventional horizontal axis wind turbine. The two subsystems are coupled using a shaft with a symmetric airfoil cross-section in addition to several reinforcement structures. The present invention increases the capacity factor as compared to conventional wind turbines which leads to an increase in the power generated, while reducing the material required for manufacturing as well as a marked reduction in the size of the system. The aerial system is tethered to the ground using a dual function tether, which also conducts the electricity from the aerial generator to the ground system. The portable ground system comprises of relevant electronics that enable it to transfer the electrical energy to the grid or store it onboard.

### **Technological Domain (Keywords):**

Aerial wind energy, Horizontal axis wind turbine, Velocity augmentation, high altitude wind, LTA system, Diffuser

**Proof of Concept:**

This disclosure aims at utilizing the various advantages of existing wind energy systems. One of the characteristic features of the degree of energy extracted from a wind turbine stems from the wake of the rotor system. The present invention utilizes a velocity augmenting apparatus that affects the wake of the aerial wind turbine, thereby increasing the energy produced by the system. A low pressure is created by a gradual expansion in the wake pattern aft of the horizontal axis wind turbine, which further helps overcome the Betz – Joukowski limit on the power produced.

Horizontal axis wind turbines have for long faced problems of orienting the rotor plane perpendicular to the direction of wind flow. In addition to this, conventional systems also face sporadic wind patterns as well as low mean wind speeds. To limit the effect of the drawbacks, the present invention utilizes a lighter than air system which keeps the power generation system fixed at an operational altitude higher than ground level, where the mean wind speeds are relatively high and consistent. This high-altitude deployment helps increase the efficiency and output power of the system. Furthermore, the lighter than air system has been provided with a host of control surfaces ensuring dynamic stability. The size and portable nature of the present invention make this system useful for urban as well as rural deployment. Moreover, this system can also be used in disaster struck regions as well as areas where conventional wind turbines cannot be deployed.

**Stage of Development:**

Experimentation and validation

**Provide Information on Competitors who manufacture and/or sell similar products:**

NA

**What are the unique advantages your innovation has compared to the competition?**

The mobile wind energy generator developed by MIT manipal is a one-of-a-kind innovation that generates consistent energy from high-altitude operation using a light-than-air (LTA) gas such as helium for sustained buoyancy. By removing the material required for the tower, and replacing metal based manufacturing with polyvinyl and polyester materials, we have achieved a 60% reduction in cost of material and manufacturing, thereby reducing the overall cost of the wind energy system. At high altitudes wind density is stronger and hence more power production from less mass flow of wind.

**A few potential companies who might be interested in this technology:**

Vestas India, Regen Powertech Pvt, Suzlon Energy limited, GE wind energy ltd, National Institute of Wind Energy

**Intellectual Property Status:**

Indian Patent application with number 201941051949 filed in 2019