Airborne Wind Energy System

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Abstract: *The entire architecture of a standard wind turbine is replaced in this Airborne technology by an Energy Kite that traces the course of a turbine's tip, removing 90% of its weight.Turbines or DC motors are mounted on the Kites' boards, which use the circular trajectory to create electricity. The load on the lines increases dramatically when a kite is flying swiftly in a crosswind. As a result, Kite is connected to the ground station by a robust carbon fibre cable. The energy generated by the Kite on board while in its circular trajectory is sent to the ground station through a high-voltage wire embedded in the tethering material. According to current projections, the life cycle cost of this technology will be between 0.5 and 1.5 cents per kilowatt hour, vs 5 to 12 cents per kilowatt hour for conventional wind turbines. By utilizing air at great altitudes, the utilization of Energy Kites opens up a whole new universe of possibilities in the realm of wind power generation. If this technique is widely used, the use of power plants that burn traditional fuels might be significantly reduced, resulting in reduced air pollution. The day of electric cars is not far off, according to Energy Kites, when electric power will be available at lower prices.*

Keywords: DC motor, kite, airborne, power.

I. INTRODUCTION

The entire architecture of a standard wind turbine is replaced in this Airborne technology by an Energy Kite that traces the course of a turbine's tip, removing 90% of the weight. On the Kites' boards, turbines or DC motors create energy by using the circular trajectory. When a kite is flying fast in a crosswind, the stress in the lines immediately increases. As a result, Kite is linked to the ground station through a robust carbon fibre wire. While in its circular trajectory, the energy created by the energy Kite on board is conveyed to ground through a high voltage wire placed into the tethering material to the ground station at the same time. This technique eliminates the need for a gearbox, simplifying the system and lowering its weight. Energy Kites are also known as on-board power generators since they generate electricity while in flight using the motors on the kite board. When compared to those on the ground, which have an average turbine height of 50 metres, is about two orders of magnitude higher. In comparison to a standard wind turbine, the magnitude of wind velocities increases dramatically at the height at which Energy Kites soar.The entire architecture of a standard wind turbine is replaced in this Airborne technology by an Energy Kite that traces the course of a turbine's tip, removing 90% of the weight. On the Kites boards, turbines or DC motors create energy by considering the use of the circular trajectory. When a kite is flying at its maximum speed in a cross wind, the stress in the lines increases considerably. As a result, a robust carbon fibre cable connects Kite to the ground station. While in its circular orbit, the energy created by the energy Kite on board is sent to ground via a high voltage wire implanted into the tethering material to the ground station.

Fig : 1 sample view of energy kite

This technique eliminates the need for a gearbox, simplifying the system and lowering its weight. Energy Kites are also known as on-board power generators since they generate electricity while in flight using the motors on the kite board. When compared to those on the ground, which have an average turbine height of 50 metres, the available wind energy density at 400 metres is about two orders of magnitude higher. In comparison to a standard wind turbine, the magnitude of wind velocities increases dramatically at the height at which Energy Kites soar.

II. LITERATURE SURVEY

A paper by yash muthe [1] has proposed a energy kite system where Turbines or DC motors are put on the Kites' boards, which generates energy by considering its advantage of the trajectory.

A project by H.zhang[2] demonstrates ,the tension in the lines increases dramatically when a kite is flying at a high speed in a cross wind direction.

High altitude wind power is garnering more attention for its better strength and constancy, according to a paper by antelllo cherubinia and Andrea Papinia [3].

Massimo Canale[4] describes it in a paper. The kite's flight is managed by adjusting the pulling power on each string.

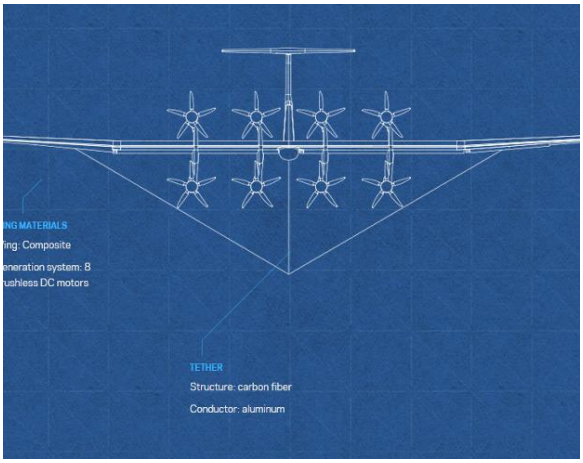
The aerodynamic surface of a kite turns wind energy into kite motion, according to a work by L.Loyd[7]. By driving turbines on the kite, this motion can be transformed into useful power.

Ms. Ahmed's paper [6] The goal of this research is to look at a kite-based system as an example.

A article by james[8] examines the Blackshouldered Hawk's hunting behaviour as well as its time and energy budget.

III. BACKGROUND OF ENERGY KITE

In the 1970s and 1980s, an American engineer named Miles Loyd looked into the possibility of generating power with tethered Kites flying in a crosswind direction. He devised two methods for generating power, named lift mode and drag mode, respectively. When a huge kite connected to the ground flies in a crosswind direction after reaching a certain altitude, it follows a circular path, similar to a paper kite. The strain of a tied rope (lift mode) or the use of motors on the Kite are employed to generate electricity along this trajectory (drag mode). A drag-mode kite is referred to as an Energy Kite.

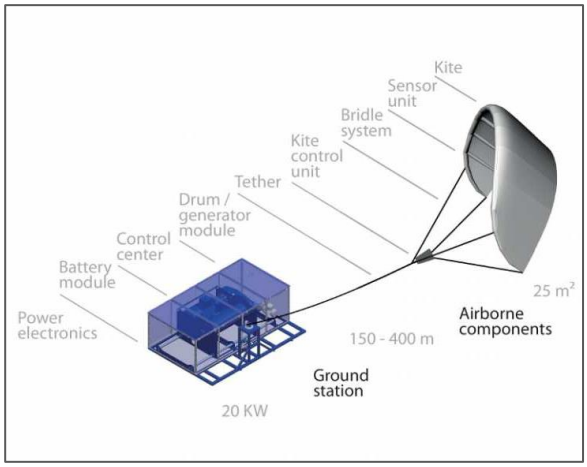


Crosswind kite power is derived from a class of airborne wind-energy conversion systems (AWECS, aka AWES) or crosswind kite power systems (CWKPS), which are defined by a kite system with energy-harvesting parts that fly transverse to the ambient wind direction, i.e. in crosswind mode; in some cases, the entire wing set and tether set are flown in crosswind mode. Without the need of towers, these systems can be used as high-altitude wind power (HAWP) or low-altitude wind power (LAWP) devices at scales ranging from toy to power-grid-feeding. A tethered wing collects wind power from an area several times larger than the wing's own area while flying in crosswind at many times wind speed. Crosswind kite power systems provide several benefits over typical wind turbines, such as access to a more strong and consistent wind resource, a high capacity factor, the flexibility to deploy on and offshore at comparable prices, and the lack of a tower.Furthermore, the CWKPS wings' aerodynamic efficiency may vary; cross winding tethered wings' movement is sometimes compared to the outer regions of standard wind turbine blades. A crosswind kite power system, on the other hand, employs a typical traverse-to-wind spinning blade set hoisted aloft in a kite-power system and cutting to crosswind. "Crosswind Kite Power," by Miles L. Loyd, was published in 1980 and furthered research on crosswind kite power systems. Some think Payne and McCutchen invented crosswind kite power in their 1975 patent No. 3,987,987; nevertheless, crosswind kite power had been employed long before that invention, for example, in target kites for war-target practise.where the crosswinding power allowed for high speeds to give gunners practise.

IV. CONSTRUCTIONAL DETAILS OF KITE SYSTEM

Energy Kite system consist of three main components

- Energy Kite
- Tether
- Ground system



Flying an Energy Kite in a crosswind is a difficult control challenge that necessitates advanced technologies in order to maintain a stable orbit. To direct the Kite to the flight route and sustain it in the greatest winds for maximum energy generation, a computer system with GPS and other sensors, as well as hundreds of real-time computations, is necessary.

IV.1. ENERGY KITE :

The kite is the most important part of the complete airborne on-board power generating system since it is equipped with miniature turbines that create power while in flight by harnessing the high-altitude wind velocity and sending it directly to the ground. The design of a kite is vital, as is the choosing of light and sturdy materials. A Kite with more than one rotor is mounted to achieve more efficient power generation. The basic goal of putting the most rotors on the Kite is to generate the most power. Increases in rotor size result in a large rise in power production.The drag force is the primary force that the Kite must overcome. The drag force on the Kite rises as the tether distance increases. As the drag force grows, so does the rate of power generation, which, if it surpasses a certain threshold, can cause minor system instability. Multiple Kites are utilized to address the challenge of long tethering distances and obtain efficient power generation at short tethering distances.

IV.2. TETHER

A tether is made up of conductive wires that are encased in a strong covering. In the case of energy Kites, the tether serves two purposes: 1. It provides as a link between the Kite and the ground.

2. Used to send energy generated by the energy Kite to the ground station.

Tether length is an important aspect to consider when altering kite rotation speed and drag on both the kite and the tether. A tether is best formed of high-strength composite fibre wrapped around a strong aluminium wire.

IV.3. GROUND STATION

When the energy Kite is not in flight, it rests at the base station, which also retains the tether. Traditional wind turbines take up a lot of room on the ground, but the ground station takes up a lot less. The length of the tether to which the Kite may be tied is determined by the ground station's strength.

V. WORKING PRINCIPLE OF ENERGY KITE:

The on-board rotors attached to the Kite, which are driven by energy from the ground station, first lift the Kite to a great height. These rotors lift Kite to a proper height, where it enters a circular crosswind trajectory and encounters high-velocity winds. When Kite moves in a circular manner after this step, the same rotor provides energy. Setting a Kite in its ideal trajectory need the assistance of a professional ground station operator.

VI. ADVANTAGES

- They exert an average of 60% more force and produce 95% more power than small sails or windmills of equal blade surface.single kites can capture and generate more power (up to 25 to 100 MW) because of flying at higher altitudes
- Require less of the weighty tower and blade hardware.
- Generate less noise, and be less of a bird hazard.
- The steadier output is due to the significantly higher wind capacity factors (60-90%) than the 30-55% achieved from 80-120-m towers supporting wind generators today.

VII. DISADVANTAGES

- More windmill generators are presently in operation than power-generating kites or sky sails.
- Less experience and far fewer reliability data.
- The area under and air space around the moving kite tether, which may need to be made of limited access to ground and aircraft activity, for both normal operation and in case of kite malfunction, is larger than the restricted area or air space near a wind turbine.
- Power generation presently may require the kite to forcefully release tether cable against the generator load.

VIII. LIMITATIONS

- Our product may not be able to detect some gaudy looking number plates properly.
- Our product may not be able to detect the number plate of the cars travelling at very high speeds.
- Image processing might be a challenge for the prototype at times.

IX. CONCLUSION:

In compared to ordinary wind turbines, which now cost between 5 and 12 cents per kilowatt hour, current best estimates for this technology predict a life cycle cost of 0.5 to 1.5 cents per kilowatt hour. Energy Kites bring up a new world of possibilities for wind power generation by exploiting air at high elevations. If this method is widely used, the use of power plants might be drastically decreased, resulting in lower air pollution. Thanks to Energy Kites, electric power will become more inexpensive, and the day of electric cars is not far off.

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