FLYING WIND MILL

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ABSTRACT

The present day conventional windmills have many drawbacks. My paper suggests an alternative to overcome the drawbacks. These alternatives are FLYING WINDMILLS .The wind is much steadier at altitudes, so you get even more advantage over conventional windmills in this NEW GENERATION WINDMILLS.

Flying windmills have advantages over their land-based counterparts which is because of factors such as contours of the land and daily heating and cooling patterns, often face either inadequate wind or turbulent winds, necessitating expensive designs. No such impediments occur in the jet stream, where air moves near-constantly and at several times the speed that it does at 100 feet off the ground, allowing much more energy to be captured from each square meter of wind

Flying windmills are even more advantageous as it has ad-hoc generation: devices with a reasonably simple tether-system do not have to be permanently installed in one place, They could be trucked out to any location that needed them.

Keywords: MARS, Flying Windmills.

I INTRODUCTION

Wind results from air in motion. The circulation of air in the atmosphere is caused by the non-uniform heating of the earth's surface by the sun. Despite the wind's intermittent nature, wind patterns at any particular site remain remarkably constant year by year. Average wind speeds are greater in hilly and coastal areas than they are well inland. The winds also tend to blow more consistently and with greater strength over the surface of the water where there is a less surface drag.

Fig .1. Conventional Wind Turbines

Wind speeds increases with height. They have traditionally been measured at a standard height of ten meters where they are found to be 20-25% greater than close to the surface. At a height of 60m they may be 30-60% higher because of the reduction in the drag effect of the earth's surface.

Conventional wind energy collectors are horizontal axis machines eg. Dutch type wind mill and vertical axis machines eg. Darrieus rotor.

In spite of their advantages, the conventional methods do suffer from several disadvantages. Some of them are as follows:

The turbines may create a lot of noise, which indirectly contributes to noise pollution.

1. Wind can never be predicted. Since wind energy will require knowledge of weather and wind conditions on long term basis, it may be impractical. Therefore, in areas where a large amount of wind energy is needed one cannot depend completely on wind
2. Many potential wind farms, places where wind energy can be produced on a large scale, are far away from places for which wind energy is best suited. Therefore, the economical nature of wind energy may take a beating in terms of new sub stations and transmission lines.
3. Wind turbines have a negative impact on birds, which can be killed or injured through collision with the rotating blades.
4. Wind turbines cause loss of habitat to wildlife due to the disturbance from its noise, movement of blades, subtle food chain changes and electromagnetic fields that in some animal species affects their sonar systems.
5. Wind turbines cause interference to nearby televisions (TV's within a couple of kilometers of the wind turbine).

The most important disadvantage of conventional types is that there is not always (enough) wind. Whereas at higher altitudes, wind conditions are much better.

II WHAT ARE FLYING WIND MILLS?

Fig.2.Flying Windmill

It is a windmill similar to a conventional one in its working principle but here the rotor and generator will be **floating** in air just like a hot air balloon. The generator will be enclosed in an **inflatable structure** and this structure is held by a **Tether** and tied to the ground. Canadian engineer Fred Ferguson, specialized in airships, proposed an innovative system called as Magenn Air Rotor System (MARS). Magenn's design is radically

different from other windmills on the market it would not use propeller blades. Instead, it would be a helium blimp, with Savories-style scoops causing it to rotate around motors at the attachment-points to its tether.

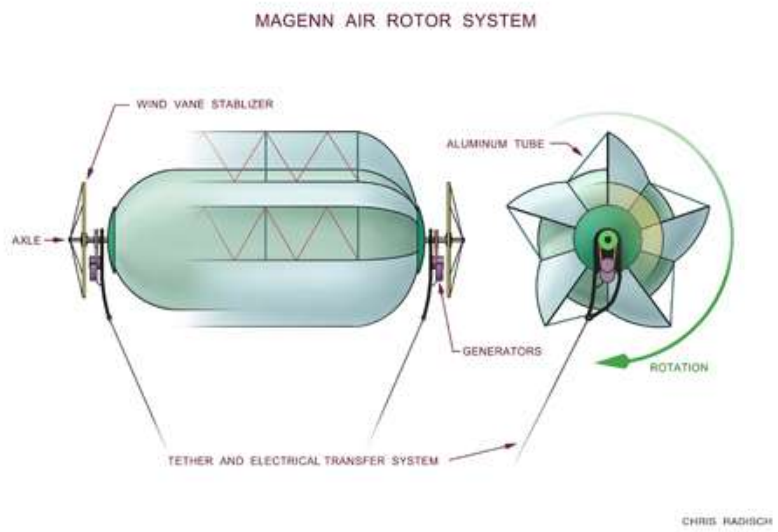

Fig.3.Magenn Air Rotor System

The helium filled MARS is a buoyant turbine made of vectran – a bulletproof material that is stronger than steel of the same thickness – and is connected to the ground by an insulated conductive tether. The unit can rise to a height of 300 to 1,000 feet to take advantage of more constant and higher wind speeds at higher altitudes that conventional wind turbines are unable to reach. While in the sky, the MARS turbine spins in the wind, generating electricity. The current is transferred down the tether for consumption, battery storage or transmitted to a power grid.

The MARS units will have an internal bladder system to maintain pressure. Helium leakage is not an issue under normal conditions; excess air turbulence and gusting might present a small risk but this craft has been designed to withstand challenges. Unlike in a child's balloon, helium leaks at a rate of only half of a percent per month in these designs.

Helium is a light inert gas and the second most abundant element in the universe. Helium provides extra lift and will keep MARS at altitude in very low winds or calm air. It is also plentiful, inexpensive and environmentally safe. Helium's inert quality over other lifting gases makes it very acceptable.

MARS will be constructed with composite fabrics used in airships today. The fabric will be either woven Dacron or Vectran with an inner laminated coating of Mylar to reduce porosity and an exterior coating of Tedlar which will provide ultra-violet protection, scuff resistance and color.

Over speed controls are built into the design of MARS. On the larger MARS units, excessive speed is controlled by moderating tether height. Pressure is constantly monitored and controlled. Rotation speed, wind speed, and generator functions are also monitored. Depending on size, either DC or AC generators will be used, with rectification as necessary.

MARS units must and will have lighting every 50 feet, and the lights must flash once per second. All MARS units must and will have a mechanism to quickly deflate in case a unit gets detached from its tether.

III LIFTING MECHANISM

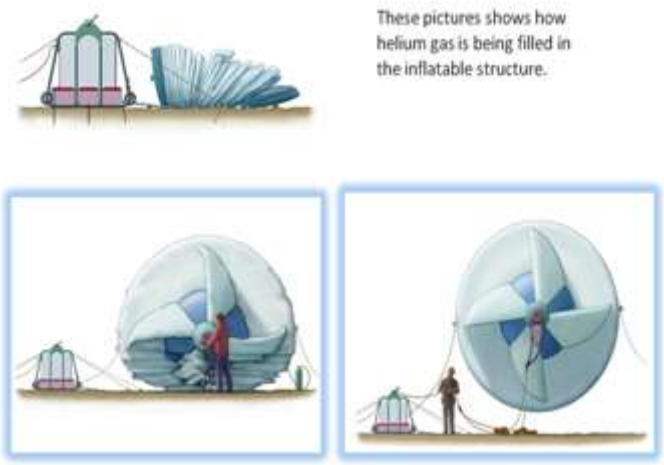

Fig.4.Helium Gas Filled In The Inflatable structure

The **Magenn Air Rotor System (MARS)** is the next generation of wind turbines with cost and performance advantages over existing systems. MARS is a lighter-than-air tethered wind turbine that rotates about a horizontal axis in response to wind, generating electrical energy. Helium sustains the Magenn Air Rotor System, which ascends to an altitude as selected by the operator for the best winds. Its rotation also generates the **"Magnus"** effect. This aerodynamic phenomenon provides additional lift, keeps the MARS device stabilized, positions MARS within a very controlled and restricted location, and finally, causes MARS to pull up overhead to maximize altitude rather than drift downwind on its tether.

MARS is filled with helium gas, which is inert and non-flammable. The lifting gas creates a lift force that is in excess of the total weight of the system. The helium provides at least twice the positive lift versus the overall weight of the MARS unit. Additional lift is also created when the rotor is spinning in a wind. The aerodynamic effect that produces additional lift is called the Magnus Effect

The combined lifting effect from buoyant (helium) lift and aerodynamic (Magnus) lift help stabilize the Air Rotor against "leaning" in the wind. In tests, an Air Rotor went straight up and held a near vertical position in various wind speeds, since the Magnus effect increases as the wind speed increases. Research indicates that maximum lean will never be more than 45 degrees from the vertical.

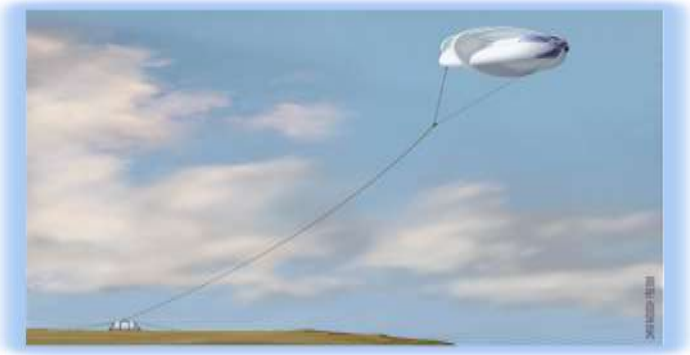

Fig.5.Arrangement of Mars

Helium is not the only thing that keeps the object aloft. Combined with its shape, the spinning generates lift using what is called the Magnus effect, which also tends to keep the craft overhead on its tether, rather than drifting downwind. The bigger the MARS unit, the easier it is to build heavier stronger structures, envelopes, and generators. As an example, the largest MARS units planned (100' x 300') will have tens of tons of buoyant (helium) lift. This is well in excess of the overall Air Rotor system weight.

IV HOW DOES IT WORK?

As the rotor of the windmill rotates due to high velocity wind it produces very high torque.. There is a step-up gear box which connects the low-speed shaft to the high-speed shaft and increases the rotational speeds from about 30 to 60 rotations per minute (rpm) to about 1200 to 1500 rpm. The electrical energy thus produced is transferred down the tether for consumption, or to a set of batteries or the power grid.

Fig.6.Floating of Mars

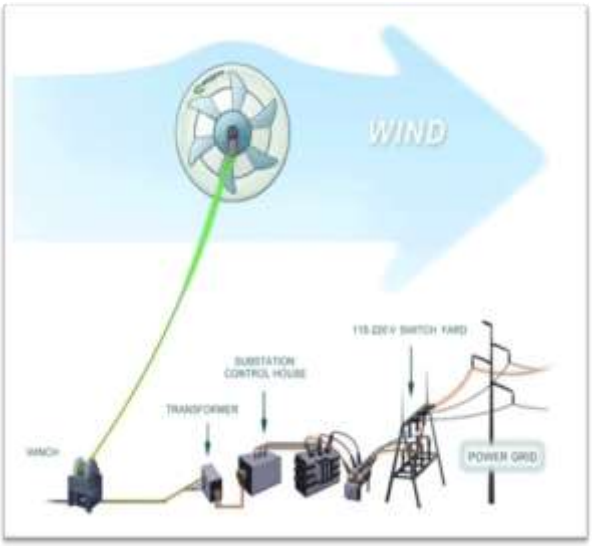

Fig.7.Working of Mars

Table.1.Specifications of 4kw Mars

Magenn Power Product	Model 4kW
Size (Diameter x Length)	4m*12m
Shipping Weight	Nearly 158kgs
Volume of Helium	170m3
Tether Height	200 ft standard - up to 800 ft optional tether length, in increments of 100 feet
Start-up Wind Speed	1 m/sec
Rated Wind Speed	12.5 m/sec
Rated Power	4000 Watts

Temperature Range	-40ºC to +60ºC
Generators	2 x 2 kW
Output Form	Various Options Available: 120 VAC 60Hz - 240 VAC 50 Hz - Regulated DC 12-120V
Warranty	5 Years
Life Cycle	15 Years
Price (USD) (Estimated)	$9,999

MARS 4kW (Estimated) Performance Specifications : MARS 4kW Performance

Estimated performance data is shown in the graph below.

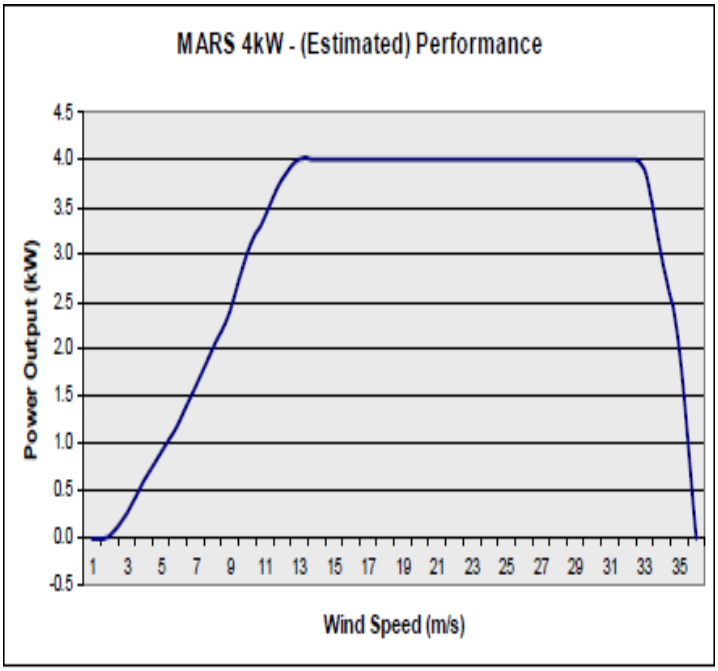

Fig.9.Performance Of Power Flow Mars

The Advantages of MARS

1. Low cost electricity – less than Rs. 5 per kWh.
2. Bird and bat friendly.
3. Lower noise
4. Wide range of wind speeds - 2 to more than 28 meters/second
5. Higher altitudes - from 200 to 800 feet above ground level are possible without expensive towers or cranes.
6. Fewer limits on placement location - coast line placement is not necessary.
7. Ability to install closer to the power grid.
8. Ideal for off grid applications or where power is not reliable.

9. They do not require land, wide roads and heavy machinery for assembly. MARS units remove these limitations because the units do not require cranes or special roads for installation.

Disadvantages

1. MARS units cannot be installed within five miles of the boundary of any airport.
2. Initial cost is high.
3. Another disadvantage of floating windmills is that they have to be taken down in extremely powerful winds, whereas common wind turbines are simply shut down.

Applications

1. Off grid for cottages and remote uses such as cell towers and exploration equipment.
2. Developing nations where infrastructure is limited or nonexistent.
3. Rapid deployment (to include airdrop) to disaster areas for power to emergency and medical equipment, water pumps, and relief efforts (ex. Katrina, Tsunami).
4. And military applications.

IV CONCLUSION

In case of flying windmills the MARS system is very simple to install, requiring minimal on-site work. Despite its large size, no cranes or oversized vehicles were required to deploy the system, nor are they expected to be required for larger units. High-altitude wind power using tethered wind turbine devices has the potential to open up a new wind resource in areas that are not served by conventional turbines.

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