WIND JET TURBINE

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ABSTRACT

Through the next several decades, renewable energy technologies, thanks to Environmental, economic and social values, will grow increasingly competitive with Traditional energy technologies, so that by the middle of the 21st century, renewable Energy, in its various forms, should be supplying half of the world's energy needs." so as to begin thinking towards power generation through clean sources such as wind. One such method of improving turbine efficiency is a Diffuser augmented wind turbine (DAWT) as an improvement to the conventional horizontal axis wind turbine (HAWT). DAWTs are simply a HAWT with a trumpet-bell-shaped diffuser surrounding the rotor blades and extending aft. A DAWT is claimed to have a greater efficiency than conventional HAWTs, even possibly higher than the Betz limit, because the diffuser allows for a greater pressure drop across the rotor blade. Only one DAWT has been commercially produced,Vortec7 DAWTs offer additional advantages in addition to increased augmentation, including minimal tip speed losses; a small rotor diameter that increases RPM, and being less yaw sensitive than HAWTs. However, there are many issues with DAWTs that need to be addressed to fully understand them before their greatest power output can be achieved. One of the most current DAWTs it the Wind Tamer DAWT created by Jerry Brock of Future Energy Solutions Inc. of Lavonia, NY. This DAWT incorporates data from past researchers, and also includes a newly innovative bypass region.

Keyword: Renewable Energy Technologies, Turbine Efficiency, Diffuser Augmented Wind Turbine (DAW)

I. INTRODUCTION

Many different methods of alternative energy are being evaluated in order to address the current crisis arising from the depletion of non-renewable resources. Wind energy represents a viable alternative, as it is a virtually endless resource. One of the more promising concepts in the wind energy field is the development of the Diffuser Augmented Wind Turbine (DAWT). These configurations use an additional diffuser to improve performance. The DAWT geometry concept has been analyzed using Clarkson's m Rotor code with a focus on the Wind Tamer DAWT of Future Energy Solutions Inc of Livonia, NY. Preliminary calculations based on optimizing the original Wind Tamer geometries, indicate power coefficients peaking at Cp = 0.39, using commercial sizing. An optimization analysis in m Rotor has indicated that power coefficients of nearly Cp = 0.5 for lower wind speeds, and even higher at faster wind speeds, can be achieved with minor design modifications.

Full scale testing of this concept is underway at the Clarkson Wind Turbine Test site and will continue for several months. It is becoming necessary to fully understand how to improve wind turbine efficiency, as energy consumption and cost reaches record-breaking levels. The cost of oil and non-renewable resources is skyrocketing, and the depletion of these resources will require a sustainable and environmentally friendly energy source. An improvement to wind turbine efficiency will allow the limits of today to be surpassed, and someday be able to extract all of the energy from the wind with only a few improvements in technology. A greater number of these high-efficiency turbines would lower the cost of energy, powering the world for less.

1.1 JET Turbine

The jet turbine design, which draws on technology developed for jet engines, circumvents a fundamental limit to conventional wind turbines. Typically, as wind approaches a turbine, almost half of the air is forced around the blades rather than through them, and the energy in that deflected wind is lost. At best, traditional wind turbines capture only 59.3 percent of the energy in wind, a value called the Betz limit. Jet turbine surrounds its wind-turbine blades with a shroud that directs air through the blades and speeds it up, The new design generates as much power as a conventional wind turbine with blades twice as big in diameter. The smaller blade size and other factors allow the new turbines to be packed closer together than conventional turbines, increasing the amount of power that can be generated per acre of land.

The idea of enshrouding wind-turbine blades isn't new. But earlier designs were too big to be practical, or they didn't perform well, in part because the blades had to be very closely alined to direction of jet--within three or four degrees. The new blades are smaller and can work at angles of up to 15 to 20 degrees away from the direction of the wind. From the front, the wind turbine looks something like the air intake of a jet engine. As air approaches, it first encounters a set of fixed blades, called the stator, which redirect it onto a set of movable blades--the rotor. The air turns the rotor and emerges on the other side, moving more slowly now than the air flowing outside the turbine.

The shroud is shaped so that it guides this relatively fast-moving outside air into the area just behind the rotors. The fast-moving air speeds up the slow-moving air, creating an area of low pressure behind the turbine blades that sucks more air through them. It's plausible that such a design could double or triple a turbine's power output, Part of the increase comes simply from guiding the air to the turbine with the shroud. But we notes that it also helps to use the wind surrounding the turbine to speed up the airflow, because the power produced by a wind turbine increases with the cube of the wind speed. The key question is whether the new turbines can be buit maintained at a low-enough cost. Maintained at a low-enough cost.

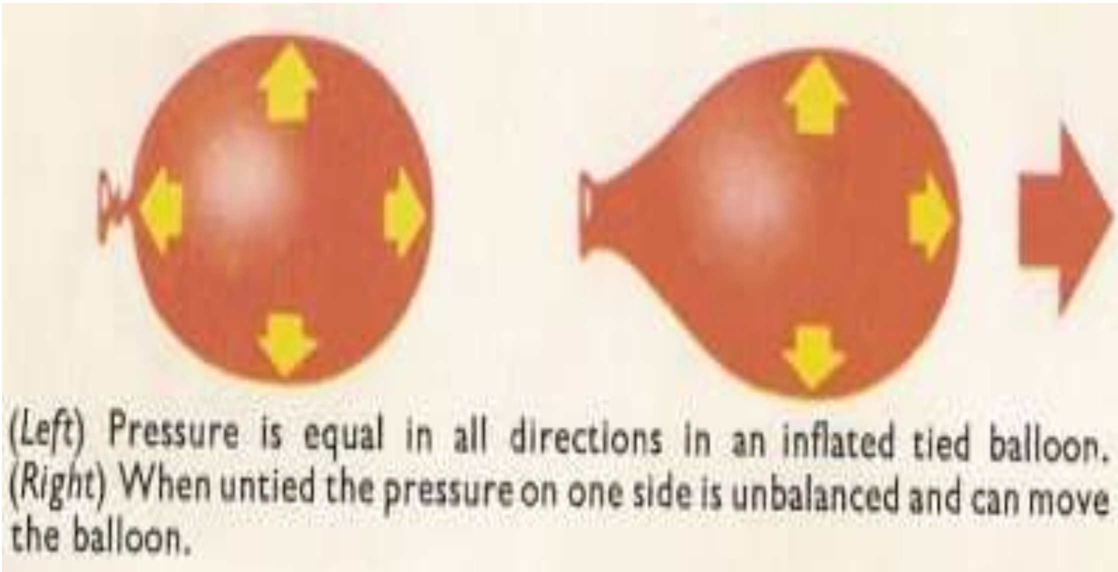

Fig.1 The balloon jet and Newton's third law

An engine that works by expelling a fluid jet backward so that the reaction to this exhaust propels the vehicle forward. Both the jet engine and the rocket engine are types of reaction engine, but whereas the rocket engine is self-contained and can work in a vacuum a jet engine can only function in the atmosphere Thomson principle by which all jet engines (and rockets) work is the third of Newton's law of motion, namely that for every action (force in one direction) there is an equal and opposite reaction (force in the opposite direction). A toy balloon demonstrates this idea very simply.

If an inflated balloon is untied and released it flies across a room. It may be thought that the balloon is moving because the stream of escaping air is pushing against the atmosphere, rather as a row boat is propelled by the oars pushing back against the water. But this is not so. The balloon would fly just as well in a vacuum where there was nothing for the escaping air to push against; in fact it would fly better. The explanation lies in the fact that the pressure of the air in an inflated balloon is equal and constant in all directions. It was not, the balloon would be continually moving in the direction in which the pressure was greatest. When, however, the neck of the balloon is opened there is nothing for the compressed air to push against at that point and so it is able to escape. But the pressure on the opposite side of the balloon is still there and, since there is no longer any counter pressure to balance it, it can move the balloon. Thus the balloon flies across the room in the opposite direction from the escaping air.

1.2 Wind Turbine Jet

In order to extract energy from a larger area of the approaching wind, smaller, sturdier, and faster blades can be used. We try to design a new idea about the shape of fin, cowl, lobed mixer, rotor and stator. There are some of important parts in this new design of wind turbine jet. The new design of our wind turbine can be smaller than conventional turbine but can generate more power. Based on the concept of the jet engine's turbine, component can be divided into: Rotor cowl, lobed Mixer, Blades, Stator jet engine shaped wind turbine is designed to be an amazingly 3 to 4 times more efficient than standard wind turbines. Present day wind turbines only capture 50% of the air flow, cannot stand high winds, have high building standards, require many trucks to deliver parts for 1 turbine and have to be built tall and away from habitable areas. Due to their large size, the large turbines force air around it instead of through it and during high winds they are usually turned off or break due to their huge slow spinning blades.

Wind jet turbine is designed to be made simple and small, giving it the ability to handle high wind velocities due to its effectiveness to handle off axis flow and turbulence. Slow air on the inside flares out while the fast air on the outside is deflected in. When the two flows meet at different angles they create a rapid mixing vortex. A "fin" placed on top of the wind jet turbine has the ability to automatically align to wind direction.

Fig. 2 Slow air on the inside flares out

Fig.3 mixing of air

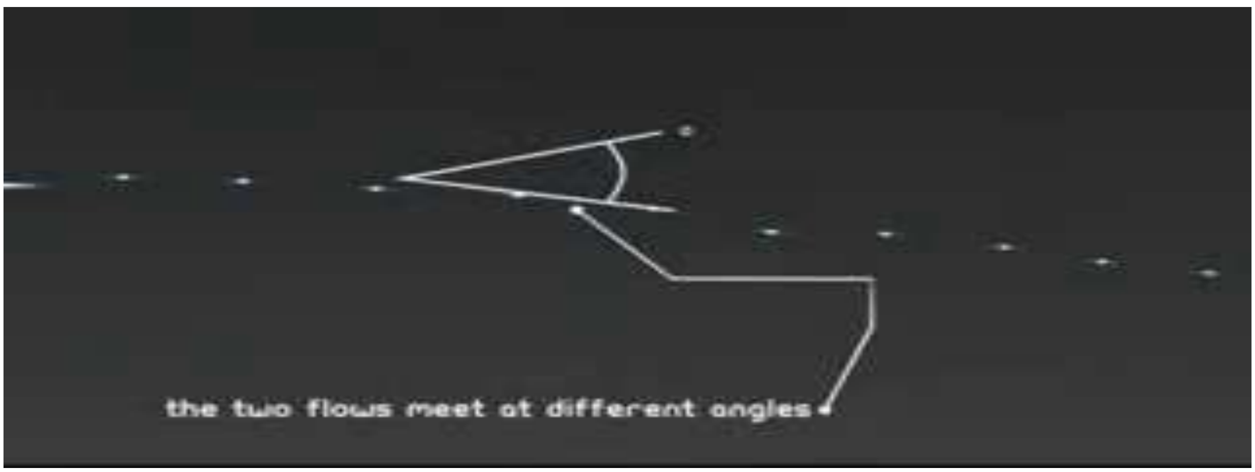

Fig.4 Angle of airflow

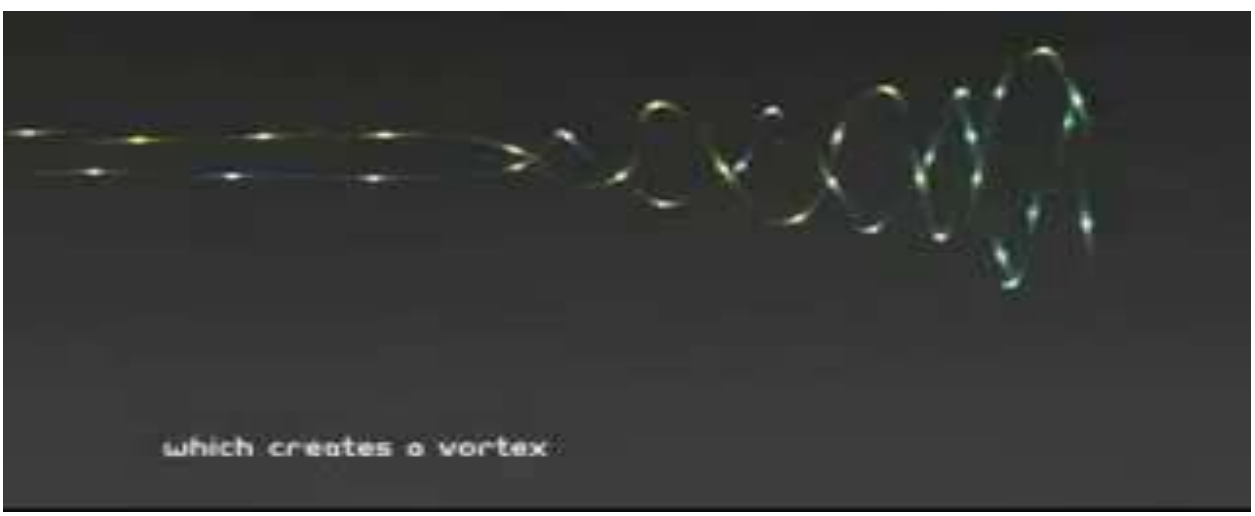

Fig.5 Vortex creation

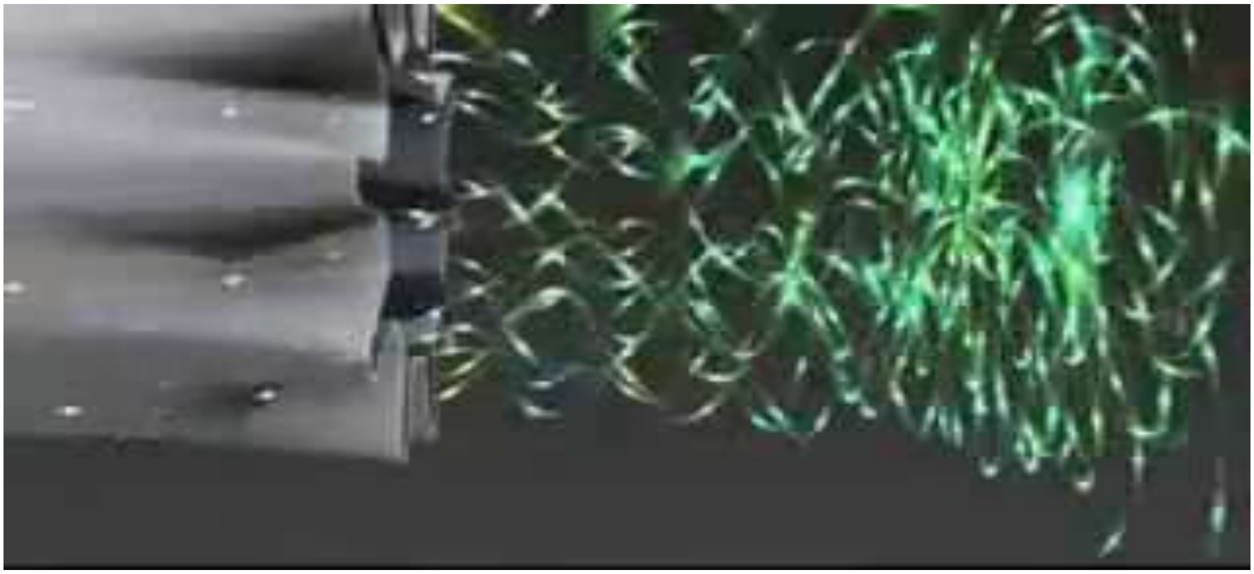

Fig. 6 Fast moving air

In addition, it can be disassembled to fit in one truck vs the traditional wind turbines which will need several trucks to just deliver parts to 1. With the costs estimated to be 25-35% less and the added ability to place these turbines closer together.

II. CONCLUSION

In future, further development in the direction of wind energy will make the power cheaper. India stands fifth in rank of power produced by wind energy. After studying wind jet turbine, It is concluded that performance of wind jet turbine will be more than tradition wind mill, It has following advantages

1) Clean source of energy.

2) No fuel costs.

3) Inexpensive.

4) Local transmission.

5) Using of small wind turbine will make residential societies independent from other sources of power.

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