New Era Wind Turbine Design

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Abstract – Through the next several decades, renewable energy technologies, thanks to their continually improving performance and cost, and growing recognition of their 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." The main aspects of this New Design to achieve maximum output with less maintenance ,less cost ,less space, less material cost and greater safety

Keywords- CWAT, Compact wind acceleration turbine, DAWT, Diffuser augmented wind turbine, HAWT, Horizontal axis wind turbine, MEWT, Mixer-ejector wind turbine

I. INTRODUCTION

A wind turbine is a device that converts kinetic energy from the wind into mechanical energy. The working of wind mill is very simple as the air comes in the structure the working blades rotates which is connected to main rotor shaft by the supporting arms the main rotor is coupled to a generator from where we can get the output. The power in the wind can be extracted by allowing it to blow past moving wings that exert torque on a rotor. The mount of power transferred is directly proportional to the density of the air, the area swept out by the rotor, and the cube of the wind speed.

Traditional wind turbines-Horizontal axis wind turbine dominates the majority of the wind industry. Horizontal axis means the rotating axis of the wind turbine is horizontal or parallel with the ground. In big wind application, horizontal axis wind turbines are almost use.

However, in small wind and residential wind applications, vertical axis turbines have their place. The advantage of horizontal wind is that it is able to produce more electricity from a given amount of wind. The disadvantage of horizontal axis however is that it is generally heavier and it does not produce well in turbulent winds.

Traditional wind turbine is neither maintenance free nor practically reliable However, the fact that highly reliable propeller engine is built for air craft suggest that the present trouble could be overcome by new design [2].

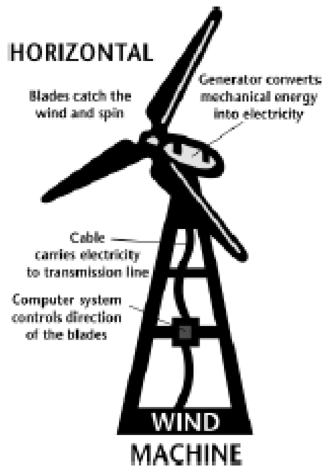


Figure show Traditional wind turbine

Traditional wind turbine, Area of blade is more and air goes around it instead of through it .Due to which blade are build at great height , slow spinning speed and also large gear box.

New era wind turbine design-

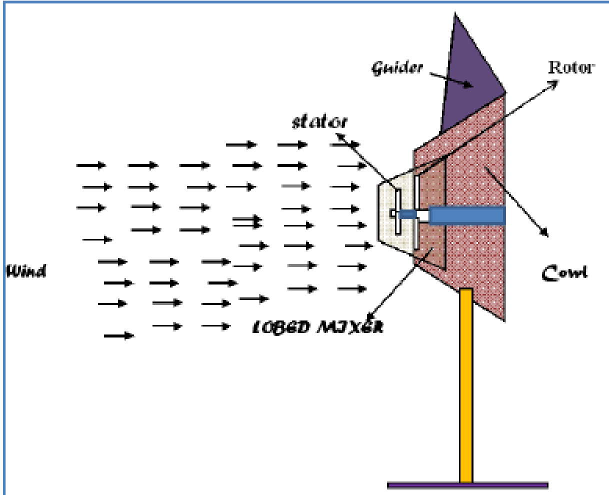


Figure show basic layout of new design

II. COMPONENT OF NEW ERA WIND TURBINE DESIGN

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, our wind turbine's component can be divided into:

Rotor :

The Rotor contains number of blades mounted on the it, which rotates when the wind strikes on the blade guided by the stator. The rotor is attached to the generator shaft to generate electricity.

Cowl:

The cowl is a flat circular cone type cover. It is the outer case of the lobed mixer.

Lobed Mixer :

The Lobed Mixer is used for two directional flow of wind after wind passing from it and creating low pressure (vacuum) behind mixer which allows rotor to suck more wind and produce more output as compare to conventional wind mill.

Fin or guider :

It is flat rectangular plate which is mounted on the cowl. It is used for the movement of the cowl towards the direction of the wind flow.

Stator:

The Stator consist of fixed number of blades which guides the wind flow to strikes wind in perfect direction on the rotor so that it does not vibrate and moves smoothly with less resistance.

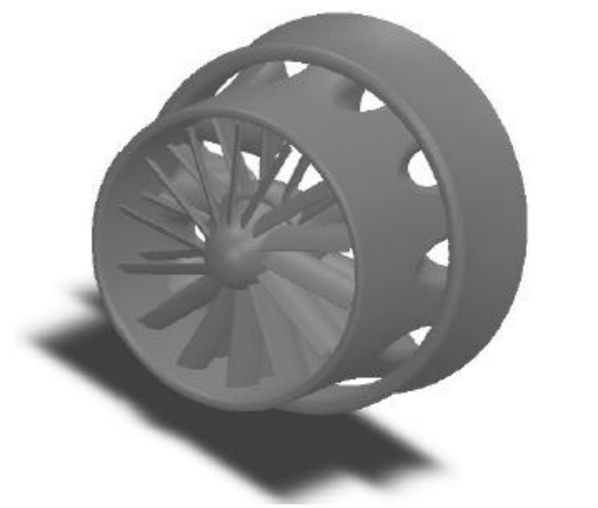
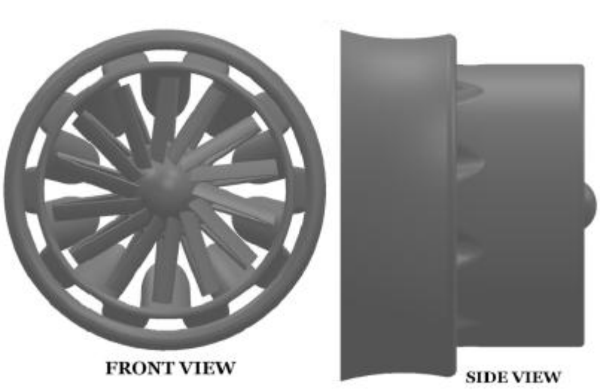


Figure show 3D model of New Design

The air at high velocity strike first to the stator now this stator defect this air to rotor, now due to striking of air to the rotor blade it rotate the rotor ,now due to this air velocity get reduce as show in yellow, Now fast air from out side deflect in as show in blue colour.



Working

"The Design model venturi is essentially a hole in the wall in front of a moving air mass. Venturi's discovery was that air moving through a venturi would gain speed. Much has been developed over the past two centuries in compressed air engineering to exploit the property.

The drawings suggest that FloDesign has reached deeper into their experience and knowledge to increase the low-pressure area behind the generator blades. The double ring look suggests that the flow models offer a deeper low pressure and some compensation for the blade and generator blockage in the inner annulus or hole."

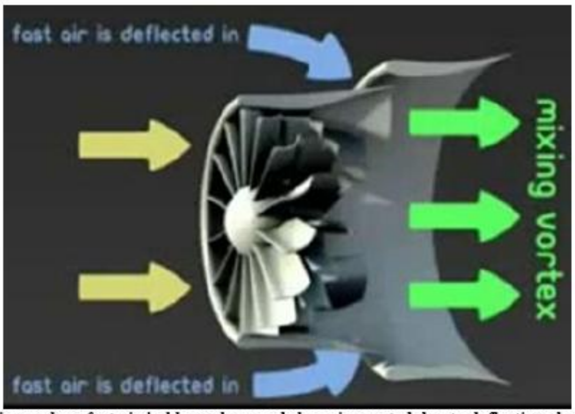


figure show fast air in blue colour and slow air created due to deflecting show in yellow colour

Figure show fast air from out side deflect in

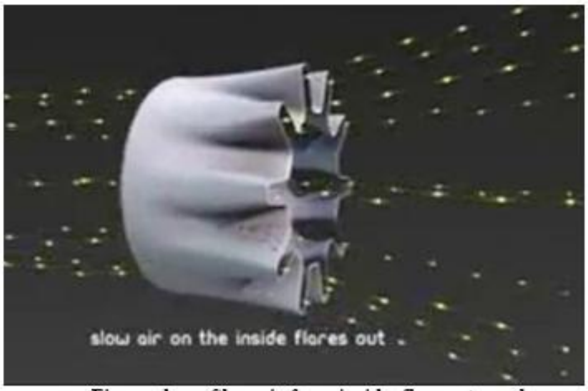


Figure show Slow air from inside flow out word

now due to this it create turbulence and hence wind move out very fast.

Flodesign's MEWT (mixer-ejector wind turbine, another CWAT variation) is differentiated from previous DAWT's by using a lobed two stage diffuser (Grumman and Vortec machine were also two stage, but conical instead of lobed) to equalize the pressure over the exit area of the diffuser. The theory is that creating a uniform pressure distribution with the lobes and the injection of external flow will prevent boundary layer separation in the diffuser thereby allowing the maximum acceleration through rotor. Werle and Presz's (Flodesign's chief scientists) paper, AAIA technical note Ducted Water/Wind turbines revisited - 2007, details the theory behind their design. Maximum acceleration detailed in their paper is 1.8× the ambient velocity from which they derive that 3-5 times more power is available at the rotor than for an unshrouded turbine. When referred to exit area this multiple drops to between parity and 2.1 times the HAWT power. Flodesign's turbine based on released images and CAD's appears to be substantially similar to the Vortec and Grumman machines except for the lobed inner annulus. This would indicate that its drag characteristics can be expected to be similar.

The science of wind acceleration around a structure, as well as the vortex shedding benefits of a shroud/diffuser, are well understood and tested. From Bernoulli forward, science has substantially vetted these concepts and there is general academic consensus as to their veracity and their potential impact on wind power production. DAWT's however have the classic boundary layer separation problem experienced by airfoils at a "stall" angle of attack. This significantly reduces the acceleration achievable by a DAWT relative to the theoretical rate indicated by its exit to area ratio, per Flodesign paper mentioned above. It is generally thought that since the amount of power produced by a wind turbine is proportional to the cube of the wind speed, any acceleration benefit is potentially statistically significant in the economics of wind. As noted though this is an inaccurate as it ignores the impact of the exit to area ratio and is therefore an apples to oranges comparison. In the case of a typical CWAT/DAWT the power result in perfect theoretical operation once adjust for the area of the shroud is actually the square of the velocity at the rotor. As the CWAT/DAWT diverges from theoretical function the power increase drops significantly according to the formula derived from mass conservation,

$$\text{Power ratio}_{\text{DAWT to HAWT}} = (A_{throat}/A_{intake})(v_{throat}/v_{freestream})^3$$

$$\text{Power ratio}_{\text{DAWT to HAWT}} = (1/2.75)(27.5\text{ms}/10\text{ms})^3 = 7.56 \text{ increase}$$

So for example a DAWT operating at theoretical function of 1.8 with a 2.75 area ratio per Flodesign,

$$\text{Power ratio}_{\text{DAWT to HAWT}} = (1/2.75)(18\text{ms}/10\text{ms})^3 = 2.12 \text{ increase}$$

For the highest claimed velocity increase in a DAWT of 1.6 x freestream

$$\text{Power ratio}_{\text{DAWT to HAWT}} = (1/2.75)(16\text{ms}/10\text{ms})^3 = 1.48 \text{ increase}$$

Not significant enough to offset the associated costs. The problem with optiwind is even more severe since the system only covers a fraction of the swept area available to a HAWT of the stack height.

The challenge has always been, and remains, installing, operating, and maintaining these structures for a cost that is less than the incremental value gained by their presence. Recent developments in material science, installation methodology and overall system integration have led to the far more realistic view that we are very close to this advent and the dawn of a new, highly sustainable class of wind turbine if the issues elucidated above can be dealt with which still remains highly questionable for the DAWT geometry.

Among the recent DAWT designs that appear to have a definitive positive power, if not cost, comparison to HAWTs is the Enflo turbine. Based on its rotor: exit ratio and the published power performance this turbine appears to have a confirmed 2 times increase in power output over a HAWT of the diameter of the exit area. It is still unlikely that this machine can scale to larger ratings but based on published data the Enflo appears to be the best performing DAWT/CWAT yet built.[3]

III. CONCLUSION

From above project we conclude that New Era Wind Turbine Design is the most practical form of wind energy conversion at a very reliable cost the efficiency of New Era Wind Turbine Design is about 45% compare to the conventional wind turbines of 35 % hence it is nearest to the Betz efficiency 59%In future the development of wind turbine will be must because of clean source and cheapest method of energy generation, easily transportable & compact in size

IV. REFERENCES

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