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Design and Analysis of Ducted Wind Turbine for Maximum Velocity

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ABSTRACT:

This research focuses on understanding the physics of fluid flow within the DWT delivery system and around it. The goal of this work is to improve the capability of the current system to catch more air by changing the inlet configuration. CFD review and validation was carried out with the experimental findings. Different inlet designs have been tested, and findings are promising compared to the previous design for producing more wind power. DWT is a wind supply system suited for harnessing wind power. One of its groundbreaking features is its ability to integrate multiple wind turbine generator system into the segment on venturi. Its first revolutionary feature is removing installed turbine tower. Secondly, DWT absorbs wind flow through an Omni directional intake or multi-unidirectional intakes and therefore there is no need for passive and active yaw control to orient the wind turbine. Third, it accelerates the flow inside a segment of shrouded venturi which is subsequently extended and released via a diffuser into the ambient atmosphere. When two or three turbines are in the venturi section, the wind power being harnessed by second and third turbines is lower than the conservation of the first turbine power. The result of the modified venturi segment shows higher wind power is possible with multi-stage turbine. Therefore, the total harnessed power of the machine increases even in ANSYS software, found experimentally and by study.

Keywords:DWT (DWT),CFD, Venturi, Inlet, and outlet velocity.

INTRODUCTION:

There are several power generation devices available that operate on various principles with complicated mechanisms that increase the cost of power generation and require more space. We are therefore planning to construct a simple building that raises the air velocity, thus spinning wind turbines at maximum speed. The title deals basically with the peculiar idea of increasing air velocity by DWT construction. DWT construction is simply a framework for wind capture and distribution that enables more control over engineering than ever before. It is the latest wind power harnessing concept that greatly outperforms conventional wind turbines with the same diameter and aerodynamic features in the same wind environment, providing higher performance at reduced cost. Today, because of the harm to human health from high-decibel low-frequency sound waves, propeller noise, optical flickering, and visual nuisances of large wind power plants, people have expressed strong opposition to conventional windmills. The DWT is simply a device for wind capture and distribution that enables more power over engineering than ever before. The groundbreaking features of the DWT (DWT) are as follows: the removal of tower-mounted turbines. The omni-directional intake absorbs the wind surge. Accelerate the flow in the veiled venture section and release the diffuser into the ambient area. It can be preferred more in agricultural land where the rate of air velocity is higher. For more than 3000 years, wind energy conversion systems have existed. Many different types of windmills have been invented since the appearance of the ancient Persian vertical axis windmills 3000 years ago. Initially, a feature was used to induce wind power, such as moving boats using sails, cooling houses by circulating outside air, operating machinery on farms, and even small production facilities. Due to its geometric characteristics, free stream wind is directed by the intake segment into the tapered double nesting cone where the wind is channelled. Furthermore, the wind is guided through the wind concentrator since the Venturi wind is naturally accelerated where the wind turbine is mounted, and power is extracted due to the decrease in cross section. The diffuser safely lets air into the environment. Wind velocity magnification is defined by the term speed ratio. The speed ratio is the ratio between the average wind velocity of the Venturi cross section

and the wind speed of the free stream. DWT is simply a method of wind capture and distribution that enables more acceptance of engineering than ever before. Although traditional wind turbines use large turbine-generator systems mounted on the top of the tower, wind power is fed by DWT to ground-based generators. DWT technology collects wind through a funnel mechanism instead of collecting bits of energy from the wind as it passes through the blades of a tall, erected rotor, and guides it through a tapering passageway that accelerates the wind flow.

OBJECTIVES:

The main aim of the project is to design, evaluate and develop a wind concentrator that can operate with additional omni-directional wind intake features as a source of power generation. Power generation tools available on the market performing above functions such as increasing speed are expensive. We can reduce the cost of such power generation devices and make them work better than wind by using simple condensed duct and Venturi principles.

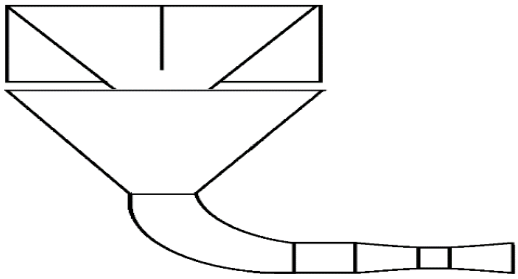


Fig.1. DWT Layout

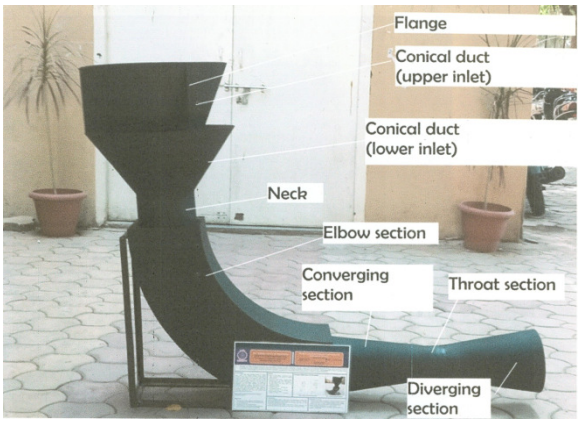


Fig.2 Manufactured DWT Model

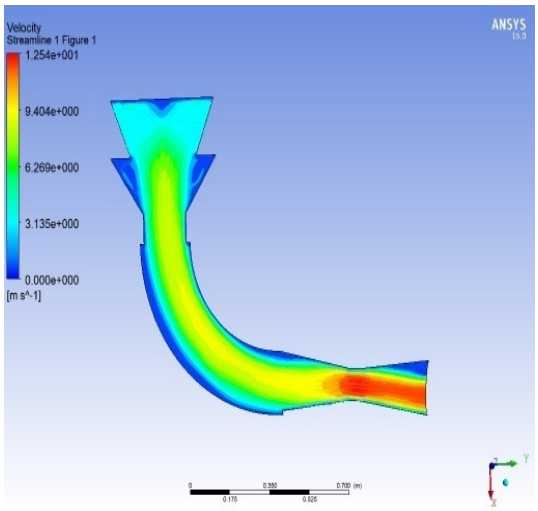
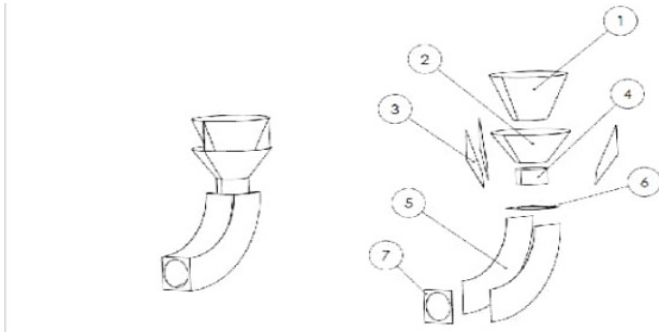


Fig 3 CFD Results

RESULT:

AREA	VELOCITY	Theorotical Calculation (m/s)	CFD Analysis (m/s)	Practical (m/s)
A_1	V_1	2	3.135	4.5
A_2	V_2	2.5175	4.321	5.9
A_3	V_3	2.6273	5.128	7.2



ITEM NO.	PART NUMBER	DESCRIPTION	AltPosition_Default_1/QTY.
1	upper inlet	upper inlet	1
2	Part2	lower inlet	1
3	Part3	connecting upper inlet to lower inlet	3
4	Part4	connecting lower inlet to duct	1
5	Part5	duct side wall	2
6	Part12	duct incloser	1
7	Part13	duct incloser 2	1

Fig 4.Parts of DWT

ADVANTAGES:

1.Generates six times more energy than traditional turbines.

2.Cost of producing of DWT is lower than that of traditional turbines.

3.Deivesr electricity with price that can compete with natural gas and hydropower.

4.DWT take a novel approach to wind power generation as it doesn't rely on high wind speed.

5.Omni directional air flow is possible in DWTNot any bad impact on environment.

DISADVANTAGES:

1. Large space is needed for the plant.
2. Its cost increases with respect to its capacity.

CONCLUSION:

We discovered that a wind can be captured from all directions by the Omni directional DWT system. For more power harnesses in the DWT System, we can position more than one in the venturi portion. We discovered that by increasing the mass flow rate or total pressure drop across the turbine, the extracted wind power P will increase. It is concluded that the power obtained by DWT is 5-6 times greater than the power obtained in terms of scale by conventional windmills. The environmental effect is not adversely affected. There is, therefore, no harm to the site. Unlike traditional windmills, there is no sound pollution caused due to DWT. Even at low wind velocity, DWT can generate power and can be built even in areas located in wind class zones 1 & 2.

FUTURE SCOPE:

It can be clearly predicted that DWT will certainly have a wider use in practical usage after looking at the results obtained. Investing large sums of money or getting financial support from a national or international research agency will certainly produce the best results from smaller inputs. The setup costs for DWT are lower and the performance is higher compared to the windmill. Although the space required for this configuration is more horizontal, setup is crucial and operation is very feasible, so DWT would be an alternative or replaceable application for the conversion of kinetic energy into electric energy soon. DWT is a versatile technology that is equally sufficient for use in large wind farms or settings of micro-generation. It can be used for a wide variety of services, including:

• Large to medium scale onshore wind farms

• Offshore wind farms

• Small wind applicable to commercial and residential buildings.

Micro-wind power generation systems suitable for military applications andconsumer products Not only can DWTs be installed on sites which able for traditional wind farms, but they can also be sited closer to urban centers of demand and used in tandem with natural gas to form a hybrid power plant.

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