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# WIND ENERGY FROM WIND MILLS – A CASE STUDY OF HARNESSING WIND ENERGY IN AREAS WHICH RECEIVE LIGHT BREEZE

**KEY WORDS:** Wind energy, Solar energy, Wind turbine,

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**ABSTRACT**

Mankind has been harnessing energy from wind using wind mills for decades. Generating electricity from wind has its cons, the area where the wind mill farms are to be set up must have high wind speeds. This case study proposes the idea of harnessing wind energy in regions where the wind speeds are low. The objective is to eliminate this con and maximise the potential of harnessing energy from wind. In this case study the slow-moving air is naturally compressed to increase the velocity of the wind and fans are placed which are connected toa turbine to harness the energy.

## BACKGROUND

Wind energy is a form of solar energy, wind is generated due to uneven heating of land and water bodies present on earth, due to difference in air pressure we get sea and land breeze. We can generate energy from sea and land breeze using wind mills, theenergy in the wind turns the blades thus creating electricity. The advantages of using wind as a source is that it's a clean source and does not produce any harmful by-products so it is considered as a clean fuel. Large amounts of electricity can be generated from wind using advance technology and using it judiciously empowers economic development of a nation.

| WIND ENERGY | SOLAR ENERGY |
|---|---|
| 1) Can be harnessed day and night | Can be harnessed only during the day |
| 2) Turbines produce more electricity | Solar panels produce less electricity |
| 3) Cost of infrastructure is comparatively less | Cost of infrastructure is more |
| 4) Consumes less energy and produces more output | Consumes more energy and produce less output |
| 5) Higher efficiency rate | Lower efficiency rate |

| WIND ENERGY | HYDRO ENERGY |
|---|---|
| 1) Low maintenance cost | High maintenance cost |
| 2) Requires less space for application | Requires a large space its application |
| 3) Speed of turbine is more because of kinetic energy of gas | Speed of turbine is less because of kinetic energy of liquid is less |
| 4) More output | Less output |
| 5) High efficiency rate | Lower efficiency rate |

However, generating energy from wind does have its cons as we are dependent on a constant and high wind speed and thus most windmill farms are designed and placed in hilly areas or areas which receive a constant wind speed but very few of these places exist and moreover setting up farms in these places are difficult due to geographic reasons and the cost of transportation of materials from the manufacturing site and site of implementation is very high.

## HARNESSING WIND ENERGY

The case study revolves around the idea of harnessing the wind energy in areas which receive low wind speeds this can be done by compressing the wind by passing it through system whose area of cross-section is decreased at a constant rate thereby increasing its velocity. This is based on equation of continuity and a series of wind turbines are placed to harness the wind energy which cultivates more output at a better efficiency rate and a steady supply of electricity is obtained. This process is autonomous.

## 1. PRINCIPLE

This method is based on equation of continuity. When air passes from a smaller curvature to a larger curvature it gets compressed when increases the velocity (as shown in calculations). The wind velocity is mainly dependent on the area of the smaller curvature and initial wind velocity. We can get the desired output by substituting the values of the variables. Wind possessing high velocity revolves the turbine at higher speed (than expected before the implementation of this process), which booms the magnitude of output rate and renew the demand of energy in that particular area. we can also use series of blades for deriving maximum amount of energy. No of blades used in setup depend on the intensity of wind in that particular area. So, it can be considered as a matter of practical approach. Attempt should be made to increase the number of wind turbines by selecting proper area of implementation and selecting required curvature of the setup for obtaining better efficiency rate.

## 2. CALCULATION

Ideal speed of wind to run wind turbine with required efficiency =18m/s(v1)
Expected minimal speed of wind in an area :0.2m/s(v2)
Area of larger curvature=12m^2(a1)
Area of smaller curvature=Am^2(a2)
=>applying equation of continuity
=> a1v1=a2v2
=>12x.2=18XA
=>A=2.4/18
=>A=1.3m^2

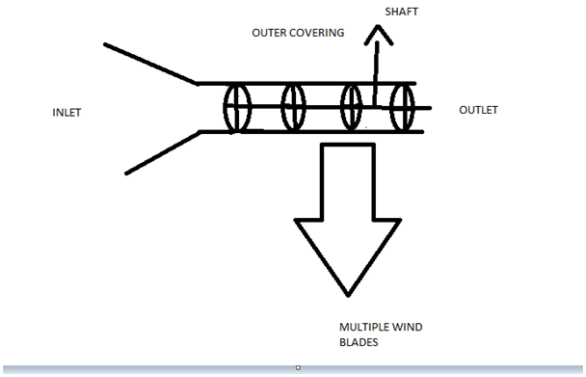
Required area of smaller curvature is 1.3m^2
By applying this method, we can get the desired speed of wind by substituting the desired values of area of curvatures and wind speed.

## 3. WIND TURBINE - DIAGRAM AND DESCRIPTION

The air enters the chamber at low speeds and as it passes the surface area decreases and as a result there is an increase in the velocity of the wind. This wind is then used to rotate multiple wind turbines. As the wind velocity entering is very high it is capable of turning more than one turbine (in this case study we have taken four wind mills as shown in the diagram. It is to be noted that as wind passes from one turbine to another lesser energy is imparted to the following wind turbines and hence lesser energy is produced from them to prevent this from happening all four turbines are connected to a shaft.) As the wind passes the turbines it move the blades, which spins the shaft the shaft of the turbine must be connected to a generator. The generator uses the turning motion of the shaft to rotate a rotor which has oppositely charge magnets and is surrounded by copper wire loops. Electromagnetic induction is created by the rotor spinning around the inside of the core, generating electricity.The electricity generated by harnessing the wind's mechanical energy must go through a transformer in

order increase its voltage and make it successfully transfer across long distances.

**Fig 1: Wind Turbine**




## CONCLUSION

Therefore, from the above case study we have highlighted the drawbacks of harnessing wind energy. To tackle the problem the above solution has been proposed. The implementation of the ideology might be hindered due to the cost of setting up the equipment but this can be overshadowed by its perks. As the system is able to produce clean energy efficiently in the presence of low speed winds. The options of physically implementing the idea vastly increases primarily as the requirement of high wind speed (as required by the conventional wind mill) is no longer needed. The given system is more efficient in producing energy and utilization of the same on a large scale by the government can help reduce the dependency the country has on coal.

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