International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET2310123

# Design and Fabrication of Wind-Powered Laptop and Mobile Charger

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**Article Info**

**Publication Issue :**
Volume 10, Issue 1
January-February-2023

**Page Number :** 202-205

**Article History**
Accepted : 10 Jan 2023
Published: 30 Jan 2023

**ABSTRACT**

Urban areas lack the average wind speed needed to operate horizontal axis wind turbines (HAWT), so vertical axis wind turbines (VAWT) are in demand. Savonius (Drag) and Darrieus (Lift) types of vertical axis wind turbines are both used. The comparison of the coefficients of performance (COP) of Savonius and Darrieus types of vertical axis wind turbines is the main focus of the current study. ANSYS Fluent-Computational Fluid Dynamics (CFD) software is used to numerically analyse the aforementioned VAWTs. Both turbines' blade designs are selected to provide the best output possible given the available input. The wind turbines' output parameters are obtained separately and compared for the same input parameters. This comparison provides a basis for choosing the type of VAWT to be implemented according to the function.

**Keyword:** VAWTs, Battery, Solar Panel, Plug Port.

## I. INTRODUCTION

In a vertical-axis wind turbine (VAWT), the main rotor shaft is oriented transverse to the wind (though not necessarily vertically), and the main parts are situated at the base of the turbine. This configuration makes it possible for the generator and gearbox to be situated close to the ground, making maintenance and repairs easier. Because VAWTs don't have to face the wind[1][2], they don't require wind-sensing or orientation systems. Early designs (Savonius, Darrieus, and giro mill) suffered from significant torque variation or "ripple" during each revolution as well as significant bending moments on the blades. Later designs swept the blades helically to address the torque ripple issue (Gorlov type).[3]

A vertical-axis wind turbine has an axis that is vertical to the ground and perpendicular to the wind streamlines. The terms "transverse axis wind turbine" or "cross-WIND FLOW wind turbine" are more inclusive and encompass this choice. The first Darrieus patent, US Patent 1835018, for instance, covers both possibilities.

Savonius rotors and other drag-type VAWTs, as opposed to lift-based VAWTs like Darrieus rotors and cycle turbines, typically operate at lower tip speeds.

## II. EFFICIENCY

The quantity of air entering and leaving a turbine must be equal in order to comply with the law of conservation of mass. Accordingly, Betz's law states that a wind turbine can only capture up to 16/27 (59.3%) of the total kinetic energy of the air passing through it.

The maximum theoretical power output of a wind machine is thus 16/27 times the kinetic energy of the air passing through the effective disk area of the machine. If the effective area of the disk is A, and the wind velocity is v, the maximum theoretical power output P is: where ρ is the air density.

Efficiency can decrease slightly over time, one of the main reasons being dust and insect carcasses on the blades which alter the aerodynamic profile and essentially reduce the lift-to-drag of the airfoil. Analysis of 3128 wind turbines older than 10 years in Denmark showed that half of the turbines had no decrease, while the other half saw a production decrease of 1.2% per year. Ice accretion on turbine blades has also been found to greatly reduce the efficiency of wind turbines, which is a common challenge in cold climates where in-cloud icing and freezing rain events occur. Vertical turbine designs have much lower efficiency than standard horizontal designs.

## III. HOW WIND POWER IS GENERATED

The terms "**wind energy**" or "**wind power**" describe the process by which the wind is used to generate **mechanical power or electricity**. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity to power homes, businesses, schools, and the like.


CONSIDERATION OF WIND POWERED MOBILE & LAPTOP CHARGER

| S.No | Particular | Wind Based Charger |
| --- | --- | --- |
| 1. | Pollution | Low |
| 2. | Fuel | No Fuel Used |
| 3. | Cost | Low |
| 4. | Maintenance | Low |

## IV. ENVIRONMENTAL CONCERN

Although wind power plants have relatively little impact on the environment compared to fossil fuel power plants, there is some concern over the **noise** produced by the rotor blades, **aesthetic (visual) impacts**, and birds and bats having been killed (**avian/bat mortality**) by flying into the rotors. Most of these problems have been resolved or greatly reduced through technological development or by properly sitting wind plants.

## V. CONCLUSION

Working on this project helped me to go through the various steps of a project, such as brainstorming, designing, planning, and executing. It has also taught me a lesson that various things might go differently from the original plan due to various reasons, and as an engineer, you should expect it all the time. The resulting design of the module can be built and marketed at less than Rs.15000 in rural areas. It is a good working charger powerful enough to harvest the wind power and store energy required to charge mobile phones and laptops. This product would be a good starting step in developing communication systems in rural areas. Even though the wind and Peltier module need further improvement as explained in the previous chapter, with the developments in the field of science and technology, we are not that far to have an improved DC generator powerful enough to charge mobiles and laptops or to have a cooling system fast enough to reduce the temperature of the cold side of Peltier. Overall, this project meets the goal of providing phone and laptop chargers for rural areas through the use of renewable energy.

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**Cite this article as :**

R. Palani, V. Ajay, A. Praveen, J. Praveen, "Design and Fabrication of Wind-Powered Laptop and Mobile Charger ", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 10 Issue 1, pp. 202-205, January-February 2023. Available at doi : https://doi.org/10.32628/IJSRSET2310123
Journal URL : https://ijsrset.com/IJSRSET2310123