# Design of an eco-charger using wind turbine concept

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**ABSTRACT** – The increasing cost and deprivation of sources for fossil fuels sparks the needs for alternative source of energy. Thus, Eco-Charger is a type of charger that uses the concept of renewable energy, in the form of wind energy. Most of the current researches mainly focusing on large scale wind turbine. In this conceptual design, a small scale wind turbine is designed specifically to produce electrical power at low speeds. Kinetic energy obtained from a moving vehicle will generate electrical power and will be used to recharge portable device. Eco-Charger is designed by using the concept of wind turbine with specified blades. The shape of the blades is designed with three blades of horizontal axis wind turbine, so it can rotate continuously at any direction of the wind. This will ease the portable-device user to recharge their device when travelling as no electrical socket is needed to be plugged in. This renewable energy source charger can reduce problems regarding environmental pollution compare to the non-renewable energy. The designs review complete picture of wind turbine blades and shows the dominance wind turbine using horizontal axis rotors. The aerodynamic principles of the modern wind turbine blade design are detailed, including blade shape, quantity, aerofoil selection and optimal attack angles.

## 1. INTRODUCTION

In the era of the future, renewable energy will be the fundamental sources to replace the non-renewable energy [1]. Renewable energy is the energy that came from the surrounding and from natural sources that will not polluting the environment. Wind energy is an example of renewable energy, where it is usually used in industry to generate electricity by using wind turbines. The designs and efficiencies have been improved from time to time to increase the power generation as the population increases. In this modern generation, portability of the necessities is important. A portable-device user sure needs a power source to recharge their device such as laptop or smartphone. Eco-Charger is designed to ease the portable-device user as it will use wind energy to recharge their devices, which mean portable-device user can recharge their device without having to plug in into any electrical socket and can use their device while travelling.

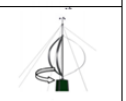
The wind system is influenced by regional and local effects, and depends on seasonal and short-time variations [2]. Modern wind turbines are mostly constructed as fast running machine with horizontal shaft, upwind arrangement and preferably three, five or seven rotor blades. In this design, to erect a wind energy system, a realistic expertise to predict the wind velocity distribution and its average at the relevant place is of foremost importance. Eco-Charger is applied at a moving vehicle, so that the turbine will rotate when there is a presence of wind. DC generator is used to convert kinetic energy of the wind turbine blade into electrical energy. DC generator of 3000 rpm is used with maximum voltage of 12 Volts. As the speed of the vehicle increases voltage generation also increases [3].

Table 2.1 Speed of Vehicle and Voltage Generated

| Speed of vehicle | Voltage generated |
|---|---|
| 10 km/h | 1.2 volts |
| 30 km/h | 3.8 volts |
| 40 km/h | 5.3 volts |
| 50 km/h | 6.4 volts |
| 60 km/h | 7.5 volts |
| 70 km/h | 8.4 volts |

Over the centuries many types of design have emerged, and are listed in Table 2.1. The Persian windmills, utilizing drag by means of sails made from wood and cloth, were principally similar to their modern counterpart the Savonius rotor which can be seen in use today in ventilation cowls and rotating advertising signs. Similar in principle is the cup type differential drag rotor, utilizing today by anemometers for calculating airspeed due to their ease of calibration and multidirectional operation. The American farm windmill is an early example of a high torque lift driven rotor with a high degree of solidity, still in use today for water pumping applications. The Dutch windmill is an early lift type device utilizing for grinding corn which has now disappeared from mainstream use. The Darrieus Vertical Axis Wind Turbine (VAWT) is a modern aerodynamic aerofoil blade design which despite extensive research and development has so far been unable to compete with the modern Horizontal Axis Wind Turbine (HAWT) design, although recent developments could see a resurgence of this rotor type. Due to its efficiency and ease of control, the aerofoil three bladed HAWT has become the wind turbine industry benchmark, with a fully established international supply chain securing its dominance for the foreseeable future.

Table 2.2 Examples of Rotor Designs [4]

| Design | Orientation | Uses | Propulsion | Peak Efficiency | Diagram |
|---|---|---|---|---|---|
| Savonius rotor | VAWT | Historic Persian windmill to modern day ventilation | Drag | 16% |  |
| Cup | VAWT | Modern day cup anemometer | Drag | 8% |  |
| American farm windmill | HAWT | Farm use for pumping water, grinding wheat, generating electricity | Lift | 31% |  |
| Dutch windmill | HAWT | Use for grinding wheat | Lift | 27% |  |
| Darrieus rotor | VAWT | Electricity generation | Lift | 40% |  |
| Modern wind turbine | HAWT | Electricity generation | Lift | 50% |  |

## 2. RESEARCH METHODOLOGY

Three conceptual designs of the prototype were proposed using AutoCAD.

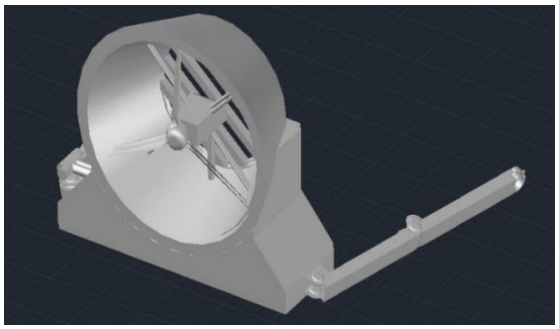


Figure 3.1 First Conceptual Design

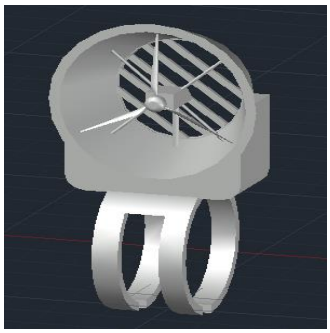


Figure 3.2 Second Conceptual Design

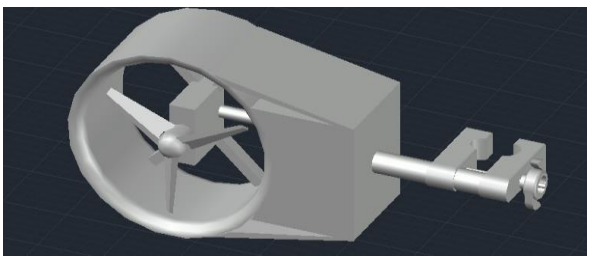


Figure 3.3 Third Conceptual Design

## 3. RESULTS AND DISCUSSION

It is known that power has been extracted from wind over hundreds of years with historic designs, known as windmills and constructed from wood. The idea of Eco-Charger has been studied to use the difference angle, dimension and number of blades to increase the efficiency. The conceptual designs of the Eco-Charger can enable a larger amount of wind to be captured. This prototype is expected to generate more electricity within an average speed of a vehicle. It is expected that when the DC generator of the wind turbine will obtain a speed at around 70 km/h and is able to generate voltage up to 5 Volts.

## 4. SUMMARY

As years goes by, the non-renewable energy sources kept on decreasing to the level. Hence, initiatives are taken to preserve the world for the future generation, which is by using renewable energy sources. By using renewable energy sources, problems such as environmental pollution can be reduced. Eco-Charger is designed using the concept of wind energy, where it is much easier to capture wind, when there is a moving vehicle and from kinetic energy, can be changed into electrical energy.

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