

Conceptualization and Design of Hybrid Wind and Solar System at the Rooftop of the Vehicle

Mr. Dhananjay Yograj Patil

Department of Mechanical Engineering

B.E. Student, Dr D. Y. Patil Institute of Technology Pune/Savitribai Phule Pune University

Abstract- A system for producing electrical energy from multiple renewable energy sources such as the wind and the sun, is disclosed which provides a compact, attachable, removable and lower maintenance source of electricity. A plurality wind turbines includes an electric generator apparatus for transforming the mechanical energy into a first source of electrical energy. A plurality of Solar cells, are adapted for transforming light energy into a second source of electrical energy. The two sources for generating electricity are contained in the same structure, and operate simultaneously yet independently of one another. In concern with conservation of fuel and taking advantage of renewable resources, this paper deals with the design of a hybrid model of a wind and a solar system without disturbing aerodynamics of vehicle. This produced electrical energy is used as an added energy source to charge the battery and drive the electric engine

Keywords- Renewable sources, Aerodynamics, Photovoltaic cells, wind turbine, Battery

I. INTRODUCTION

Renewable energies are sources of clean, inexhaustible and increasing competitive energy. They differ from fossil fuels principally in their diversity, abundance and potential. These sources of energy neither greenhouse gases, which leads to climate change nor polluting emissions. Their costs are also falling and at sustainable rate, whereas the general cost trend for fossil fuels is in the opposite direction in spite of their present volatility. According to IEA (International Energy Agency), world electricity demand will have increased by 70% by 2040. Renewable energy refers to those type of energy that never deplete while using. In other words, they can be produced repeatedly in short period of time. It is very essential to make optimum use of all available resources of power inside the nation and thus found that the New and Renewable Sources of Energy (NRSE) can contribute significantly towards power generation in forthcoming years. The combination of renewable energy sources, wind & solar are used for generating power called as wind solar hybrid system. This system is designed using the solar panels and small wind turbines generators for generating electricity. Hybrid energy system used here is a photovoltaic

array coupled with a wind turbine. As we are using solar panels and wind turbines to charge the same battery bank, we use a controller that can handle both the inputs. The wind and solar system cannot satisfy constant load demand as they are seasonal i.e significant fluctuations in the magnitude of wind speed throughout the year. Hence energy storage system is required which is expensive and size has to be reduce to minimum possible in order to get cost effective value of system. Hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and all-electric vehicles (EVs) typically produce lower tailpipe emissions than conventional vehicles do. Also in consideration with aerodynamic prospects of vehicle, it has less difficulty accelerating and can achieve better fuel economy numbers.

II. OBJECTIVES

- To provide an affordable and environmentally friendly alternative power source for a vehicle.
- To provide a wind and a solar powered Hybrid electric system that utilizes the Wind and the Solar Energy to generate electrical energy to provide power to and to recharge power cells contained within the vehicle.
- To provide a Wind energized electric vehicle having a plurality of Wind turbines positioned on the roof of a vehicle that are caused to rotate by wind impingent upon the vehicle.
- To provide Solar panels above the chassis of the vehicle in order to store electric energy generated by solar panels in the Battery of vehicle.
- To provide selectively removable Hybrid System on the roof of the vehicle without changing the structural aspects of the vehicle

III. DESIGN PROSPECTS

The portable Wind Power apparatus is shown positioned at a top of a roof of a vehicle utilizes wind impingent on the vehicle in order to provide power to the vehicle having an electric motor as well as to recharge power cells. The apparatus includes a plurality of wind turbines and a housing surrounding the Wind Turbines. The housing includes a first opening. The Wind turbines are positioned at the first

opening. The first opening allows wind to impact the Wind turbines. A second opening is positioned on a side of the housing opposite the first opening for allowing the wind passing through the housing to how out from the housing. The apparatus can be made integral with the vehicle or can be selectively removable from the vehicle. The Solar- generated electricity is called Photovoltaic (or PV). Photovoltaics are solar cells that convert sunlight to D.C electricity. The assembling of several modules will give rise to arrays of solar panels whose forms are electrically and physically connected together. These panels are fixed at upper part of housing and are made flexible with the contour of housing. Upon contacting the vehicle, the wind flows over the contour of the housing provided for turbines in accordance with the properties of aerodynamics. In addition to it, both forward edges of housing are slanted by the angle same as that of the windshield of the vehicle. The wind contacting the windshield of the vehicle is then guided into the first opening of the housing.

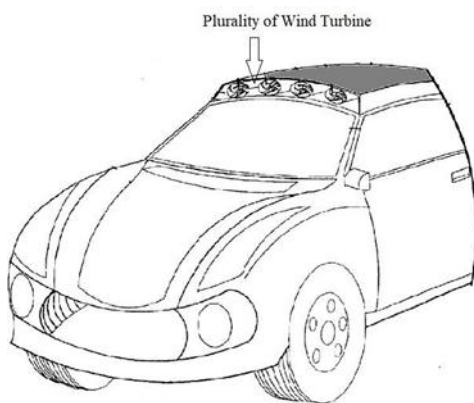


Fig.1 Number of Wind turbines fixed in the housing

IV. PROPOSED SYSTEM AND CONCEPTS

The proposed system consists of horizontal axis wind turbine, generator. The moving vehicle compresses the air in the front of it and pushes the air to its sides thereby creating a vacuum at its sides. Horizontal-axis wind turbines (HAWT) get their name from the fact that their axis of rotation is horizontal. They have the main rotor shaft and electrical generator. The rotational energy generated by the turbines through the gear box and causes rotation of a rotor of the generator. The generator converts the rotational energy from the wind turbines into electrical energy in a known manner. The gearbox is provided to control the rotation of the rotor and thus the conversion of the rotational energy into electric energy. The phase generators are connected in series with a plurality of charging diodes of the battery charger which are used to recharge the battery of the vehicle. The battery charger

is connected to a DC/AC Inverter which converts the DC current into AC current. The wind tracing the outer contour of the vehicle. The shape of the housing allows the vehicle to remain Aerodynamic and does not cause any unwanted drag by the addition of the apparatus to the vehicle. As all vehicles are shaped differently, the housing of the apparatus can be designed to maintain the desired aerodynamic shape of any vehicle to which the apparatus may be attached. The formula used for calculating the power in the wind is shown below:

$$\text{Power} = (\text{density of air} \times \text{swept area} \times \text{velocity cubed})/2 \quad P = \frac{1}{2} \cdot \rho(A)(V)^3$$

Where, P is power in watts (W), ρ is the air density in kilograms per cubic meter (kg/m^3)

The Solar-generated electricity is called Photovoltaic (or PV). Photovoltaics are solar cells that convert sunlight to D.C electricity. These solar cells in PV module are made from semiconductor materials and the panels formed by number of PV cells are made situate over the upper part of the housing. When light energy strikes the cell, electrons are emitted. The electrical conductor attached to the positive and negative scales of the material allow the electrons to be captured in the form of D.C current. The generated electricity can be used to power a load or can be stored in a battery. Lead-acid batteries are the most common in PV systems because their initial cost is lower and also they are readily available.

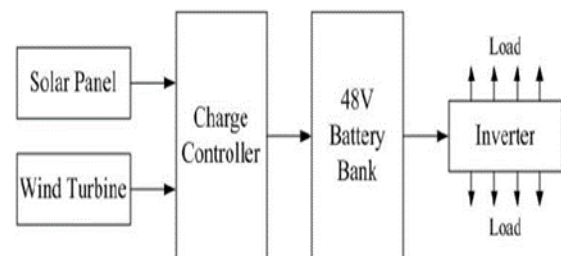


Fig.2 Block diagram of hybrid system

A hybrid arrangement of combining the power harnessed from both the wind and the sun and stored in a battery can be a much more reliable and realistic power source. The load can still be powered using the stored energy in the batteries of vehicle even when there is no sun or wind. A charge controller is provided with system to adjust current and voltages from different power sources. A charge controller is basically a current or a voltage controller to charge the battery and to protect the cells from overcharging. It directs the current and voltage coming from the solar panels and wind turbine to charge the battery. Hybrid systems are usually built for design of systems with lowest possible cost and also with maximum reliability. The high cost of solar PV

cells makes it less competent for larger capacity designs. The solar-wind hybrid system is more cost-effective and reliable when wind is taken as a source. Fig. 1 shows the block diagram of the hybrid system.

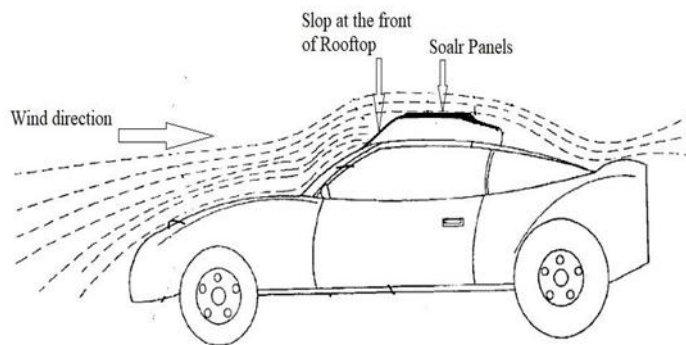


Fig.2 Side view of the vehicle with slop provide at the front of housing

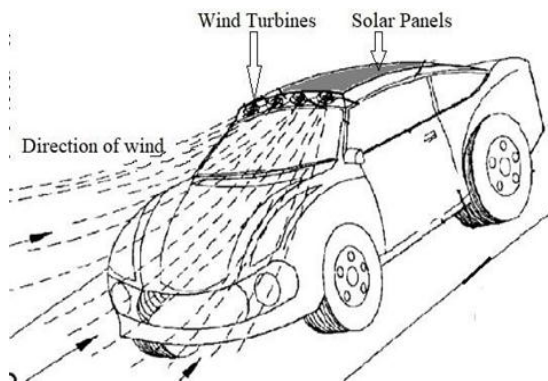


Fig.3 Front view of the vehicle

IV. CONCLUSION

This hybrid system assists the vehicle's structural or chassis characteristics without influencing the aerodynamics. Renewable energy sources are promoted by improving its feasibility and practical approach in the field of automotive engineering. This has helped in the dependence of the system on a single power source and has increased the reliability. The technology is expected to contribute to the cause of the environmental pollution as it helps to reduce carbon emissions carbon footprints.

REFERENCES

- [1] Wortham; Melvin (Chicago, IL), Hybrid solar-wind energy conversion system, 07/066,037, June 24, 1987
- [2] I.A. Adejumbi¹, S.G. Oyagbinrin², F. G. Akinboro³ & M.B. Olajide⁴, "HYBRID SOLAR AND WIND POWER: AN ESSENTIAL FOR INFORMATION COMMUNICATION TECHNOLOGY

INFRASTRUCTURE AND PEOPLE IN RURAL COMMUNITIES", IJRRAS

- [3] Quaschnig. "Understanding Renewable Energy Systems". Earthscan, London. (2005)
- [4] M. Hassan Hassan, Windermere, FL (US), "GREEN ELECTRIC VEHICLE UTILIZING MULTIPLE SOURCES OF ENERGY", Pub. No.: US 2011/0309786 A