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# Comparative study of efficiency of Solar, Ambient noise and Wind energy for Hybrid Car

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**Abstract**

Electric vehicles are very environment friendly as they have very smooth noise-free operation and have more efficiency as compared to the conventional SI and CI engines. The main issue with the electric driven vehicle is that after travelling few kilometers the battery gets discharged because there is no source of recharging the battery so vehicle remains dependent upon some other form of energy to charge. Solar energy, wind energy and sound energy can be used for charging because availability of sun light during day time. Battery of vehicle can still be charged harvesting the wind faced by the moving vehicle using fan. There can also tertiary source of energy which can add to the battery charging modes based upon the surrounding noise so that maximum amount of noise can be converted in to the battery charging options. The hybrid model having all these three types of energy including solar, wind and noise pose a blend of charging options which is not only more efficient as compared to engine based vehicles but also more environment friendly being more economical at the same time. In this research paper the solar panel is mounted at the top of the vehicle so that maximum amount of sunrays strikes it for charging the battery. The blades of the fan are to be mounted at the front of the vehicle for making the maximum use of the wind faced by the vehicle at the moving time. The noise based transducers are mounted at the both sides of the vehicle in a fashion to make use of maximum surrounding external and internal noise and concluded that efficiency of solar system is more as comparison to other two ambient noise system and wind system but in case of wind and ambient noise system, wind system has less efficiency.

**Keywords:** hybrid car, solar energy, wind energy, noise pollution

## INTRODUCTION

Present automobile industries are considered to enhancement of hybrid models due to lack of scarcity and availability of the sources of energy. Engine drive vehicle like petrol , diesel, LPG and CNG based fuel continuously release immense amount of Green-house gases which not only adds much to the pollution but also hazardous for humans, animals and other natural resources.

This model is designed based upon few concepts considering the more environment friendly use of the resources and the minimum amount of pollution related issues. Apart from being more a green-vehicle in terms of zero pollution, this will also be more economical and efficient as compared to engine driven vehicles.

## MAIN COMPONENTS OF HYBRID VEHICLE

**Photovoltaic solar panel** solar power is the viable and cleanest type of conventional energy. Photovoltaic are silicon type semiconductor similar to transistor and produce electricity by converting the solar energy generated from the sun in the form of either visible light, ultra-violet radiation or infra-red radiation into a direct current by using the photovoltaic action of the cell without the use of any moving parts. Solar electricity is also very environmentally friendly, as it produces no pollution or waste by-products, no air or water pollution and is completely silent making it ideal for a greener future.

**Electric Motor** Wind Energy is one of the most important renewable energy sources and wind turbines which are necessary for producing wind energy with the right bridge rectifying converter. An electric motor can operate in four quadrants of motion.

The electric motor has the ability to act as a motor in both forward and backward direction by readjusting voltage and current supply or act as a generator in the forward and backward direction. An electric motor can change its speed and torque by simply readjusting its voltage and current supply.

**Noise-based Transducer** The self-generated sound, noise of large vehicles passing by, people talking, or any other surrounding noise including the horns of the vehicles can all be picked up by a set of microphones and electrical charge Noise energy can be converted into viable source of electric power by using a suitable transducer. This can be done by using a transducer by converting vibrations caused by noise into electrical energy using a crystal or oscillator based transducers. A set of speaker and a transformer are used to convert noise produced by car horn and other noise signals into electrical energy. The vibrations created by noise can be converted into electrical energy through the principle of electromagnetic induction. The received signal is stepped up using a transformer.

**Energy Storage System** The primary energy source for the vehicle is the battery bank. The battery bank usually consists of a number of individual batteries connected in series or parallel. Each battery in the bank is typically 6 or 12Volt and multiple batteries are connected in series or parallel to obtain

the desired system voltage. For the most efficient operation of the drive system, the battery voltage is chosen so that the motor controller can operate with minimal PWM (reduced switching losses) at the maximum desirable speed of the car. For this reason, the nominal battery voltage is usually chosen so that the lowest possible battery voltage is able to sustain a reasonably competitive speed. Several battery modules will be incorporated to store the solar energy produced through the photovoltaic panels. By using multiple modules, the energy storage capability can be easily increased, thereby improving reliability.

**Figure1.** Hybrid Car

**Ferdous *et al.*** the main drawback of an electric vehicle is the lack of sufficient energy efficiency to drive the vehicle for long periods of time. This capacity of battery in electric vehicle is relatively small in relation to conventional fuel used in contemporary automobiles.

Performance, efficiency and operation of electric vehicles (motor driven) are even better than other engine operated vehicles as well as electric vehicles are eco friendly with the environment. In fact, electric vehicles are falling in the automobile industry due to the energy storage problem.

A detailed aerodynamic analysis of the vehicle structure with flow mechanism and wind fans/ turbines in the project has been presented. Some technologies are also proposed to keep the drag imposed by the application of the turbines as low as possible. The main concerns of various design norms / standards and the speed of the vehicle is set. With the same concept, it can be possible to increase the mileage of electric vehicles up to 25% -30% and it will also reduce the charging period of the battery.

**Awal *et al.*** in this research, vehicle mounted wind turbine (VMWT) is a fixed horizontal axis wind turbine system. This project proposes the design and implementation of VMWT to generate electricity from the vehicle. VMWT has several other potential features, including high turbine RPM, low weight, practical size and portability. In addition, this project evaluates the VMWT performance in terms of power generation. It has been shown that with proper designing, VMWT can generate about 200Watt of electricity at 80 km / hr. Many designs have been considered for designing VMWT to ensure that it is working properly in a practical environment.

**Safdar *et al.*** the problem related to the environment is considered as a contemporary issue and in order to fulfill it, there has been a revolutionary change in various techniques in the vehicle transport sector. Efforts have been made to introduce hybrid vehicles to make the vehicle engine efficient with reducing emissions and reducing low fuel dependency. In a nutshell, trends of solar electric cars have been reviewed in different countries.

Feasibility analysis: By increasing the battery energy storage capacity for a specific round travel distance between two cities i.e. Rawalpindi and Islamabad, compared to the hybrid vehicle and viability of the fuel cost analysis i.e. simple hybrid vehicle and solar modules equipped with two cases. The third case, i.e. proposed solar electric car model.

Charging and discharging is calculated for the third position required to carry five person weights (70kg each) with the selection of solar modules with battery and desired battery. In addition, its assembly from total carbon dioxide emissions analysis, car material production has been done for each case solar module and nickel-metal hydride batteries.

In the third case for the specific distance, in the first two cases relative to the electric outlet, the annual carbon dioxide emitted from the fuel has been analyzed. On a large scale, emissions analysis for 100 car of 100 case of each case has been done. By calculation, it has been found that in the third case, the total emissions in comparison to other cases are comparatively lower to the other cases of large scale and include its physical production, assemblies, solar modules and battery manufacturing perspectives.

**Vashisht *et al.*** this paper presents the concept of hybrid automobile using energy harvesting system. In this work solar energy, wind energy, ambient noise and suspension energy harvesting systems have been used. The system hardware prototype has been made and its efficiency has been calculated. The proposed system can prove to be a trend changing and very efficient in this time of depleting non-renewable resources.

**Ovaiz *et al.*** this project reports for sources of energy which are less popular. Sound energy (including noise) can be transformed into the useful source of electrical power using the appropriate transducer. It can also be achieved by using the transducer that changes the vibration caused by noise in electrical energy such an application which uses speaker and transformer to change the noise produced by various parts of machines through electromagnetic induction principle in electrical energy. The signals obtained by transformer can be increased.
A similar setup can be placed at some distance from the generator or induction motors. The concept places light on the concept of clean and readily available sources of energy.

**Gupta *et al.*** this project demonstrates the techniques of conversion of sound energy and technologies for its electrical equivalent conversion technology. It emphasizes its viability and its ground-zero application. The future prediction of further development of such energy sources is promoted as the idea of enhancing efficiency besides traditional known forms like solar, bio-product and energy. It shows that converting sound energy into electrical energy, it can also charge our phones on the mobile by interacting with friends.

## DESIGN AND WORKING

This hybrid vehicle is based on a very simple design structure. The metal pipe used in the chassis has weight bearing capacity of minimum 85 kg. The rack and pinion type of steering is used. Drum brakes are installed in the rear set of wheels. As it is a motor driven model, the battery gives a thrust to the rear set of wheels. A toggle switch is available to opt for whether forward or backward drive which change the direction of the rotation of the motor in forward or backward motion. Total weight of the vehicle is 35 kg without driver and the maximum weight bearing capacity is of 85 kg. A set of 4 Li-on batteries with power rating of 12 Volt& 2.5 Amp each are connected in series to power the motor with a total of 48 Volt with 2.5 Amp current producing the thrust for maximum speed of up to 30 km/hr. Set of batteries takes 4-5 hour to get completely charge and takes the vehicle to a distance of up to 20 km. A power supply of 50 Volt and 2.5 Amp is required to charge this battery. As it is a hybrid vehicle, a solar panel of 55 Volt output power is mounted at the top of the vehicle to charge the battery and drive the vehicle at the same time. Additionally, a generator with power rating of 30 Volt and 2.5 Amp which converts the wind faced by the vehicle to produce electricity with the help of rotation of the blades/fins by the wind. The fan in turn rotates the motor and the electricity is produced for the charging purpose of the battery. To add another source of charging the battery, a set of microphone/speaker and transformer is deployed to convert the noise from different available sources to generate electricity. The set of microphones are installed in such a fashion so as to harvest the maximum amount of available internal and external noise.

All these three sources of power are connected to a battery of 48 Volt and 2.5 Amp which can be charged from any of these sources depending upon which source of energy are available.

## EXPERIMENTAL RESULT CALCULATION

Tested the prototype in our campus and got the following experimental results.

Initial Voltage = 48 Volt

When the vehicle moves 12.2 Meter, the voltage was recorded as 46.356 Volt.

Hence, Change in voltage = 1.644 Volt.

For every 10 meters the vehicle moves, battery consumption is 1.293 Volt.

**Table 1.**Efficiency comparison of solar energy, Sound energy and Wind energy

| **Solar Energy** | **Sound Energy** | **Wind Energy** |
|---|---|---|
| Model with the solar panel in sunlight for 32 minute, the chargeable battery was recorded as 46.709 Volt.<br><br>For 32 minute<br>Difference in voltage<br>= 48-46.709 = 1.291 Volt<br><br>For 60 minute<br>Difference in voltage<br>=(1.291/32)*60<br>=2.420 Volt<br><br>Final Voltage = difference in voltage for one hour<br>Efficiency=(Final voltage/Initial voltage)*100<br>= (2.420/48)*100<br>= 5.041% | After 5 minute 32 second sound track with moderate volume, the voltage again drops to 46.592 Volt.<br><br>Difference in voltage<br>= 46.709 – 46.592<br>=0.117 Volt<br><br>For 60 minute<br>Difference in voltage<br>(0.117/5.53)*60<br>=1.269 Volt<br><br>Final Voltage = difference in voltage for one hour<br>Efficiency=(Final voltage/Initial voltage)*100<br>= (1.269/48)*100<br>= 2.643% | For 100 rotations<br>Difference in voltage<br>= 46.592-45.402<br>= 1.19 Volt.<br><br>Final Voltage = difference in voltage for 100 rotation<br><br>Efficiency=(Final voltage/Initial voltage)*100<br><br>Efficiency for 100 rotations<br>= (1.19/48)*100<br>= 2.479 % |
| 5.041% | 2.643% | 2.479 % |

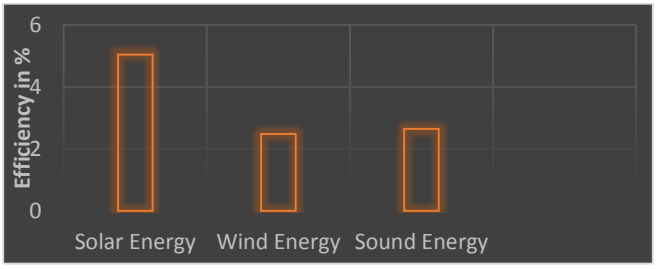


**Figure 2.** The bar graph shows the efficiency comparison of various forms of energy

## CONCLUSION

In present research when the non-renewable resources of energy are getting exhausted very quickly, not only they pose harmful effects to the mankind but also is the biggest threat to the nature, animals and our climate. Use of renewable energy sources like solar, wind and ambient noise harvesting system can be effectively used to run automobiles. With the help of prototype designed using these systems can significantly improve the efficiency significantly by charging the battery in scarcity of fuel in emergency conditions. Also being friendly with the environment, the system is also more economical as compared to the convention systems.

1. Efficiency of solar system is the highest as comparison to other two wind and ambient noise system.
2. But in case of ambient noise and wind system, efficiency of ambient system is more as comparison to wind system.

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