

DESIGN AND FABRICATION OF ECO FRIENDLY VEHICLE

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ABSTRACT

The paper presents the next generation of power energy systems using solar- and wind-energy systems. The power is generated from the kinetic energy of the wind and the solar energy. As the vehicle moves the electricity is produced in the two ways. One forms the turbine and the other from the solar. It is stored in the battery for the running of the vehicle. The DC motor is used for the operation. This project gives information about where and how these components should be installed to produce maximum power. As the gear box and the engine is eliminated in the vehicle the weight of the vehicle is been reduced.

INTRODUCTION

We are in a world which largely depends on power which is obtained from various sources where contribution of conventional, non-renewable source is much more. Because of this reason consumption of conventional and non-renewable sources is very high. If the same rate is maintained, then in the near future these sources will not be available. In this situation we will be left with only one option of using renewable sources. So we should control the use of non-renewable energy sources and at the same time use renewable energy sources so that these resources can be balanced. This project deals with utilizing kinetic energy of wind and the energy from the solar in a fast moving vehicle and explains the process and methodology to be followed.

There have been many reasons why the developing countries have not started to use renewable and no contaminant energy supplies for electricity generation, the most important being the cost and the lack of technology adaptation. For this reason this work presents the first stage of a modular electricity generation system development based on the use of wind, solar and thermal (from gas produced by biomass) energies, with a low output power level, addressed to small users, dispersed in rural areas (either in isolated farms or in small villages). This system uses car alternators as generating components. This choice can look peculiar given the wide range of electric generators present in the market, but it is made because, at least in Latin America, the widespread use of cars and trucks in all regions means the existence of spare parts supplies and skilled technicians in many localities, while car alternators are locally manufactured in several countries. All this can be used to develop a technological network that will cope with the installation and maintenance of the wind generators. Without this network, the introduction of these renewable and no contaminant energy systems will not be successful, as it has happened till now.

METHODOLOGY

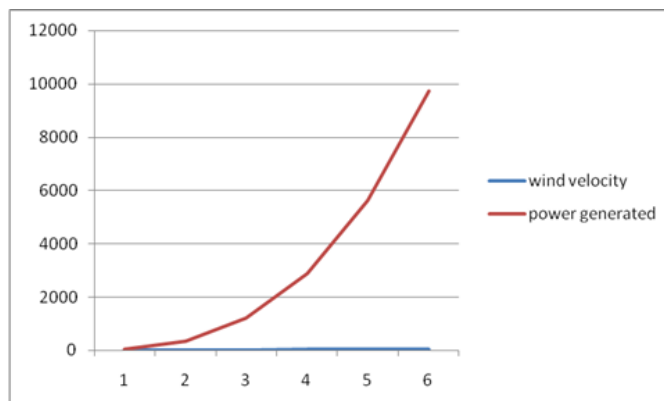
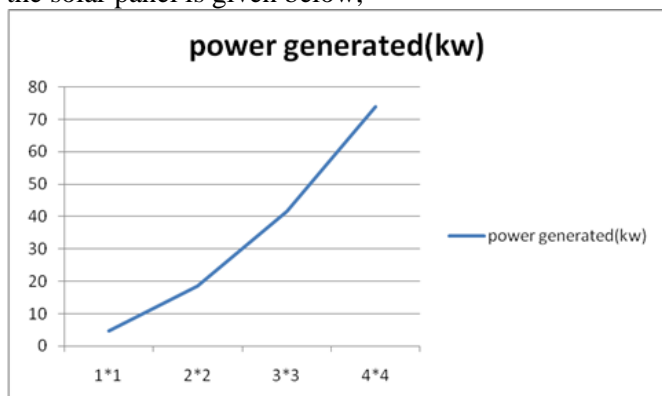
The main objective of our project is to convert wind energy and the solar energy into electric energy. For this the alternators are been operated by the turbines and the power produced in the alternator is stored in the battery. The solar panels produce the power from the sun light and store the power in the battery in the form of electrical energy. As the vehicle moves the turbine in the vehicle rotates and operates the alternator which produces the electrical energy. The rotational speed of the turbine varies with the velocity of the wind. Some of the characteristics of the alternators is given below integrated rectifier with power zener regulation. Diodes set in aluminum heat sinks for high cooling efficiency. Integrated field regulator for constant voltage self-excitation and simplified installation and service. Long duration brushes protected against dust and dirt. High efficiency integrated blower providing high cooling capacity for extended high load operation. Precisely balanced rotor block for smooth operation and long bearing life High load ball bearings. Self lubrication with high temperature greases to ensure long ball bearing life. High strength low weight aluminum case. Heavy duty stator winding with high overload capacity. Wide temperature operating range from 40° F to 200° F. Able to operate in both rotating senses. Some models are available in brushless configurations.

The solar panels get the solar energy from the sunlight and convert it into the electrical energy. The energy produced is converted and stored in the battery. The power in the battery is utilized to run the DC motor. As the DC motor runs the vehicle operates.

SOLAR ENERGY

The whole Earth, which has a cross section of 127,400,000km², approximately receives solar power of 1.740×10¹⁷ W and reflects about 30% of the power back to space. The annual incoming solar radiation at the top of the atmosphere is about 5.5×10²⁴ J, and 60% of the energy reaches the surface. The total annual downward solar energy at the surface is about 3.3×10²⁴ J, which is 6800 times more than the world's annual energy consumption. Even by excluding the water surface (70%) and assuming a solar energy conversion efficiency of 10%, the usage of solar energy over 0.5% of the land Surface can meet the current global energy demand. The downwards solar radiation at the surface depends on time, latitude, atmosphere, aerosols/clouds, and surface conditions. Solar energy

can be converted directly or indirectly in to other forms of energy, such as heat and electricity. PV energy results from the conversion of sunlight into electricity through a PV cell, commonly called a solar cell. The PV cell uses a part of solar radiation for generating electricity. Power generated from the increasing area of the solar panel is given below,



Total power generated by the total area of the solar panel,

Area of the panel, $A = 2.217 m^2$

Power = 50 Watt

Total Power Generated = Power \times Area of the panel
 $= 2.217 \times 50$
 $= 110 \text{ k watt}$

WIND ENERGY CONVERSION

A wind driven generator (alternator) is based on the first law of thermo-dynamics (Daniel and Gaunden, 2001) which states that energy can neither be created nor destroyed and it can only be transformed from one form to another. In this working model, wind energy is being utilized to produce electrical energy. The wind which strikes the blades has greater kinetic energy with respect to the wind on the other side of the turbines. The energy lost by the wind is transferred to the blades, as a result of which they get rotated. As the shaft is fixed to the axle of blade, the rotation of blades causes rotation of the shaft of the alternator. In this system, there are two stages of energy transformation. In the first stage wind energy is being transformed into mechanical energy, as a result of which turbines get rotated. In the second stage mechanical energy gets transformed into electrical energy which produces current. Power generated by wind- gen depends upon these three factors:

- Air density, C .
- Area swept by the fan, A .
- Velocity of the wind, v .

Power produced by a wind-gen depends directly upon the density of the wind. The density of wind may vary from place to place. It may have higher values in coastal areas where air has higher moisture content and it may be less in dry places like deserts. On an average the value of air density is around 1.23 Kg/m^3 . It has been found that power output is directly proportional to the area swept by the turbines. Also, the area swept by the turbines is proportional to the square of length of the turbines. So, turbines of greater diameter are preferred. But there are certain limitations to the dimension of the turbines. Larger turbines may unbalance the system on which they have been installed. They may make the system bulkier which may create huge problem in their rotation. Experimentally, it has been investigated that as the wind velocity gets doubled, the output power increases by eight times. So, it can be easily concluded that power output is proportional to cube of the wind velocity (Rizk and Nagriak, 2010). Power output is expressed by Eq.(1)

$$P = (1/2) C A v^3 \quad (1)$$

The wind turbine torque (T) can be calculated from the equation (2) of power. $T = P / \omega$.

$$= (1/2) C A (v^3 / \omega) \quad (2)$$

In 1919, a scientist named Betz calculated that there is a limit to how much power a turbine blade can extract from the wind. Beyond the Betz Limit of 59.26 % energy extraction, more and more air tends to go around the turbine rather than through it, with air pooling up in front. Hence, 59.26 % is the absolute maximum that can be extracted from the available power.

TECHNICAL DESCRIPTIONS: The technical design specification has been reflected in table,

Module/Unit	Specifications
Wind Driven Gen	Gen Voltage (12V)
Wind Speed Range	40 kph
Battery Charger	12V, 4Amp
Battery	12V, 36Ah
Automobile	Four wheeler

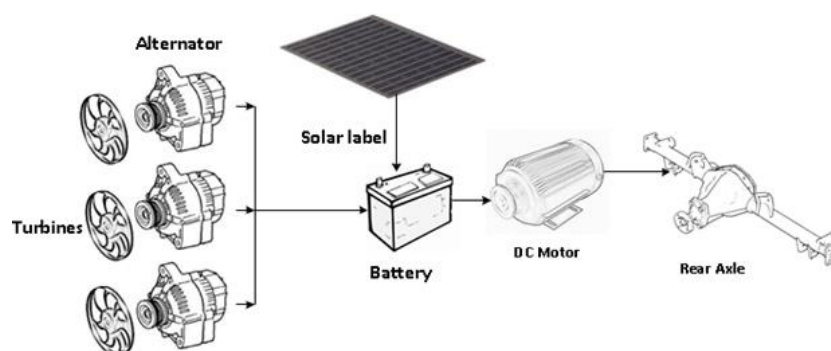
ALTERNATOR SPECIFICATIONS:

Type	A
Rated voltage	12V
Nominal Voltage	40A@13.5V
No load speed	1100rpm
Setting voltage	14.2-14.8
Polarity	Negative ground
Rotation	Clockwise

DC MOTOR SPECIFICATIONS:

HP	Base rpm	Arm Volt	Nema Frame	ENCL.	FV. Amps	Weight	Serve factor	App. Weight
1/4	1750	12v(DC)	56C	TFEC	21	9in lbs	1.0	18in lbs

BLOCK DIAGRAM



REQUIREMENTS OF THE TURBINE

Since working fluid in the turbine is air so first requirement of turbine is it needs to be light weight. In a water turbine, water is the working medium which has a higher density compared to air. That turbine cannot be used here because of air density. Turbine material should be selected such that it has high strength and light weight. High weight of the turbine will result in major loss of power during operation. Second requirement of the turbine is that it should be perfectly balanced. Since this turbine will be used on the roof of a vehicle moving at an average speed of 50 Km/Hr. So small amount of vibration can cause serious damage. This can affect not only the housing but the whole vehicle movement can be disturbed. To avoid this type of issue, perfect balancing of the turbine is a must.

BENEFITS

1. Since this power developed is without any additional input energy, this method is very efficient.
2. In this project, the working medium is air, so there is no corrosion of blades of turbine.
3. Air utilized by the turbine can be exhausted directly into the open environment.
4. Since air is a renewable source of energy, there is no limitation on using this apparatus

CONCLUSION

Initial cost of this project is high, but as it uses wind energy which is a renewable source of energy, it is a good alternative for generating power. It can be implemented at present so that the fossil fuel consumed by the vehicle can be utilized in a more efficient way. This project can also be used in cars so that they can generate electricity not in large amounts but sufficient for smaller mechanisms.

- 1) The initial results obtained in the test platform show that the use of a car alternator as the electric generator in a wind turbine set is technically possible.
- 2) The initial results obtained in the test platform show that a number of different power conditioning modules can be fed simultaneously from the generator output, tailoring the wind driven system to different load requirements.
- 3) The initial results obtained in the test platform show that generator performance is not significantly different when operating with continuous or pulsed excitation modes.

4) The initial results obtained in the test platform show that the standard output voltage controller used in the car alternator can be used in the new application.

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