



DESIGN AND DEVELOPMENT OF ELECTRO-MAGNETIC SOLAR INTEGRATED SYSTEM ON HIGHWAYS

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Abstract

Demand for energy is an increasing criterion that all developing nations are facing today. Thus the scarcity of energy has to be satisfied for the healthy development of the nation. As the non-renewable sources are depleting day by day, the world is moving on the renewable sources to satisfy the peak demand value of energy. Hence we planned to utilize the wind energy impact generating on highways/expressways. When we stand aside of the road, we feel the impact of wind on us as the vehicle passes by us. . Similarly this wind impact energy can observe on the highways. However the wind impact is sheer on Highways as vehicles travelling at greater speed. Hence this impact of energy cannot be wasted; it has to be utilized to produce energy into other form, which can be easily consumable. For this we have designed a System which works on the principle of electro magnetism and solar energy, placed on the divider to generate electricity.

INTRODUCTION

India cost for wind turbines is greater than that of conventional fossil fuel generator per Mw installed. Noise is produced by rotor blades, so that wind farms have to build in the location where wind can be entrapped. Today we are adding 2000-3000Mw of renewable energy capacity every year. 12th five year plan targets 6000Mw annually and to meet our national action plan on climate change (NAPCC) target, we need more than 15000Mw every year. We all know that India is an energy deficit country and our per capita power consumption is 3rd of china and a 5th of US. There is a lot of latent demand and as India grows, our deficit-current estimated of 10% on installed base of 200Gw will likely go up if no new investment is made in power

capacity and in improving distribution. We need to add generation capacity from as many source as possible renewable can help bridge this gap. It has shorter lead time for capacity creation and proximity to load centre. On keeping, prime focus on the crisis of three imperative components in the world like energy, food and water we have done an experimental investigation on the highways/expressways, so as to find the method that how these highways can be used as a hub of generating electricity by harnessing the available energy in better efficient way. Two types of energy are available from wind flowing through these highways:-1) natural wind energy and 2) impact wind energy. But our experimental investigation is concentrated on behaviour or characteristics of impact wind energy, as lots of advanced research work has already been done or going on harnessing of natural wind energy.

Objectives: The aim of the project is to design an Electro Magnetic Solar Integrated (EMSI) system that is to be implemented on highways for energy production. It will generate energy by capturing the following things.1) Impact wind energy generated by vehicles on highways.2) Solar energy from the Sun.

Research

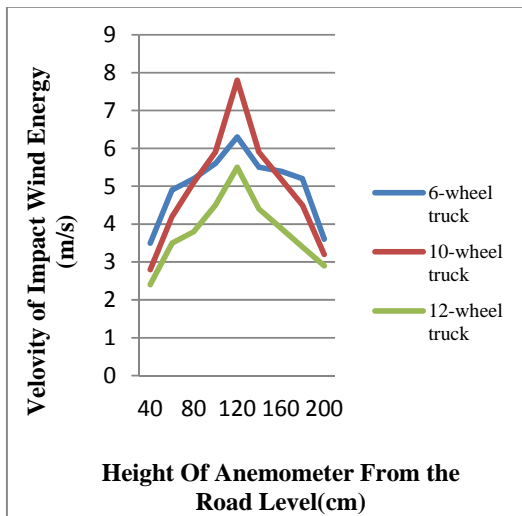
The process of development of the system involves following stages.

Stage 1: Determination of Wind impact in the form of Induced pressure through wind analysis

Wind Analysis: The project depends on the principle of Faraday's law of Electro-magnetic induction. Since the current can produce by the movement of the magnet inside the coil or movement of the coil over the magnet. Hence in the project we used magnetic ball to move inside

the copper coil placed in a pipe where the potential to move the ball is given by wind energy impacts produced on highways due to the movement of automobiles. To determine the wind impact on the EMSI system, wind analysis is necessary on a particular location. Since the major factor for the initiation of EMSI system is wind. The height takes an important role for wind impact on the system, as it is placed on the divider of highway. We used a wind analysis instrument- **Anemometer** for the analysis. The analysis is carried on the divider of highway, NH4 (National Highway) of Bangalore to Pune. The analysis involves different types of vehicle such as from 6, 10 and 12 wheel truck against difference in height of the anemometer placed on the divider.

The velocity of impact wind energy versus Height of the anemometer above the road level is represented in the following graph:



Analysis carried on the side of the divider of highway for different vehicles as shown in the figure:



As per the result of the graph, the peak value is at the height of 80~120cm above the road level

and it goes on decreases when we increase the height above 120cm. Thus the optimum level of wind energy impact is in 80~120cm which is a suitable height to place the system above the level of the road. We also observed that, when automobiles move on Highways/expressways, there is a creation of **front and back pressure** column on both sides of the road. This pressure column difference is due to **imbalance of high pressure/low pressure energy band** created by automobiles. Due to this pressure band, wind flow creates the **pressure thrust**. The wind pressure thrust depends on different factors as follows; a) The intensity/frequency of the **traffic**; b)The **size** of the automobiles; d)The **speed** of the automobiles; e)**Distance** between the EMSI system and vehicles; f)**Angle** of impact; g)Velocity of **natural wind**.

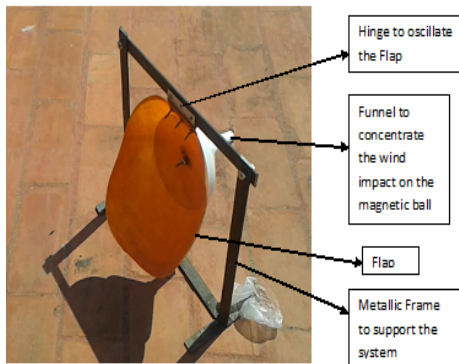
From the experimental investigation, by converting velocity of the wind impact to induced pressure, the amount of pressure can induced on the EMSI system at the height of 80~120cm shown in table below,

Sl. no.	Type of vehicles	Induced pressure (in gm.)	Induced Pressure (in N)
1	12-wheel truck	250	2.5
2	10 wheel truck	200	2
3	6 wheel truck	150	1.5

The result of the wind analysis is that, the highways can provide us a wind energy impact of about 1.5 to 2.5 N alternately depending on the type of automobile.

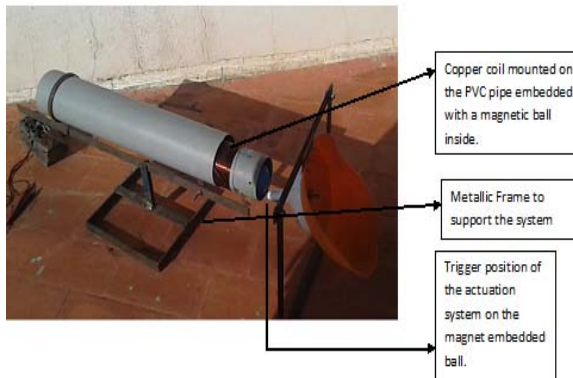
Stage 2: Actuation system

Conversion of energy is necessary to utilize the available wind impact energy to generate electricity. To bridge the gap between these energies the role of an actuation system is humongous. The actuation involves a trigger system which converts the wind impact to movement of the magnetic ball inside the coil. It includes locally available hinge, funnel and a waste plastic pot which is bisected in the form of a flap. The actuation system is shown below,



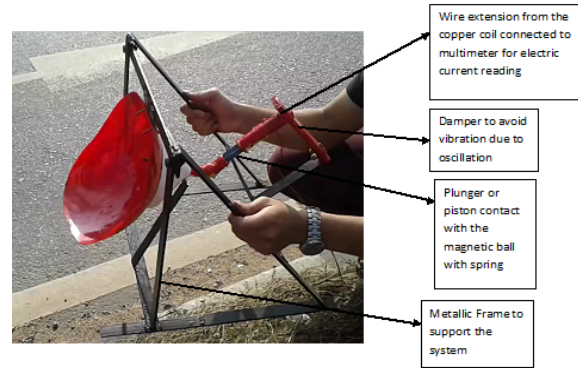
Stage 3: Development of flow path for magnetic ball followed by actuation system

The conversion according to Faraday's principle is achieved by incorporating copper coiled on a locally available waste PVC pipe around 2-3 feet, embedded with magnetic ball. The flow of energy of wind impact is triggered by the actuation system on the magnetic ball to allow it to cause to and fro motion inside the copper coil.



Stage 3: Alteration of the model to obtain efficiency

Since the Length of the pipe was huge, it was implausible to attain greater moment of magnetic ball. Hence the generated electric current was too small in the multimeter reading. It is also due to the indefinite clearance between the magnet and the coil. To increase the efficiency, we compact the model as one unit. This involves reduction in the dimension of the cylindrical pipe and the magnetic ball. Consequently, actuation system is connected with a plunger or piston for the definite movement of the magnet inside the coil. A spring is installed in the Cylinder for compression and extension which leads to oscillate the ball when impact generates.



Efficiency: The obtained Model undergone several iteration as explained above to increase the output required. The current generated as per the Multimeter reading is 0.2-0.45V. This can be increased by further refining the model such as increase in the number of turns in the coil, oscillation of Magnetic ball inside the coiled cylinder, etc. The surface area required is feasible due to its compatibility. The generated current can be stored in the battery and then it is utilized.

Integration of Solar energy: The efficiency can be further increased by integrating the model with Solar panel at the top. This modification is still in process. The dual energy can produce more electricity than alone. The whole EMSI system is Eco friendly i.e. it does not damage the plants grown on the divider of the highway.

Additional application

This mechanism or system which we have adopted is on highways. It can also be incorporated in Railways and other expressways with suitable design such as wind analysis, compatibility and design optimization.

Benefits: The system is based on the utilization of wind and solar energy which are renewable free source of energy. The electric current can be stored in batteries. The space utilization to install requires minimum area on the divider.

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