

Analysis of Highway Wind Energy Potential

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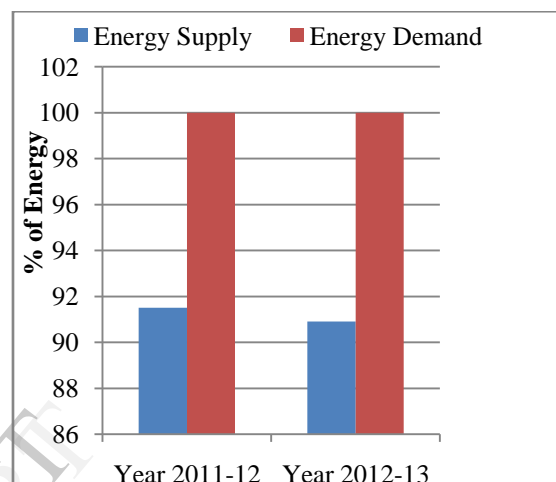
Abstract: - On keeping, prime focus on the crisis of three imperative components in the world like Energy, Food & Water. We have done an experimental investigation on the highways/expressways, so as to find the method that how these highways can be used as a hub of generating electricity by harnessing the available energy in a better efficient way. Two types of energy are available from wind flowing through these highways:-1) Natural Wind Energy & 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 the harnessing of natural wind energy.

As the automobiles moves on the highways, lots of impact wind energy is generated due to the wind pressure difference. A major hindrance in the growth of wind energy is fluctuation in the sources of wind energy. This problem of variability can't be omitted as it is happening naturally. So, one has to think how to extract constant source of energy from the variability, that is what we have to solve through research work.

Keywords:-Impact Wind Energy, Height of maximum velocity, Anemometer.

I. INTRODUCTION

Energy has been universally recognized as one of the most important inputs for economic development. There is a strong two-way relationship between economic development and energy consumption. On one hand, growth often economy, with its global competitiveness, hinges on the availability of cost-effective and environmentally available energy sources and on other hand, the level of economic development has been observed to be reliant on the energy demand. In current scenario, there is a huge gap between the demand and supply of electricity in the energy sector in India. This gap has to be bridged in order to sustain or maintain the economic growth of country. So, one has to search for the alternatives. Researchers and Innovators have to find out the way of harnessing energy available. Graph is presented regarding the problem.



To fill this gap, large investments are to be made in Non-conventional/ Renewable sources like Wind & solar. The energy from the wind is a green energy, pollution free. The existing gap in electricity generation indicates huge opportunity for Entrepreneurs to try out new ideas. The success of the investments depends on 1) Land 2) Water 3) Fuels, which are very scarcely in present scenario. Wind energy is considered to be the fastest growing clean source. A recent study has shown that wind can generate as much 60% of India's total power produced by renewable sources of India by 2050.

II. IMPORTANT TERMS

- a) **Impact Wind Energy:** - It is the wind energy which flows around the moving vehicles due to reaction of body motion; it flows towards the surrounding of highways and strikes the harnessing system, if such system is placed. Technically, study of this type of energy is called as Fluid Flow Dynamics.
- b) **Anemometer:** - It is the instrument used to measure velocity of fluid flow(air) in the surroundings.

III. EXPERIMENTAL INVESTIGATION

Extensive research work on wind flow patterns is required to determine the average velocity of the impact wind

created by vehicles running on the highways/expressways. We have investigated the potential of Impact wind energy because much more advanced work has already been done in harnessing the natural wind energy. But little work has been done for Impact wind. As the automobiles moves on highways/expressways, there is creation of front and back pressure column on both sides of the roads. The pressure column is created due imbalance of high pressure/low pressure energy band created by the automobiles. Due to this pressure band, wind flow and create pressure thrust. This Impact pressure thrust depends on different factors as follows:-

- The intensity/frequency of the vehicles traffic.
- The size of the automobiles.
- The speed of the automobiles.
- Distance between the harnessing system & vehicles.
- Angle of Impact.
- Velocity of natural wind.

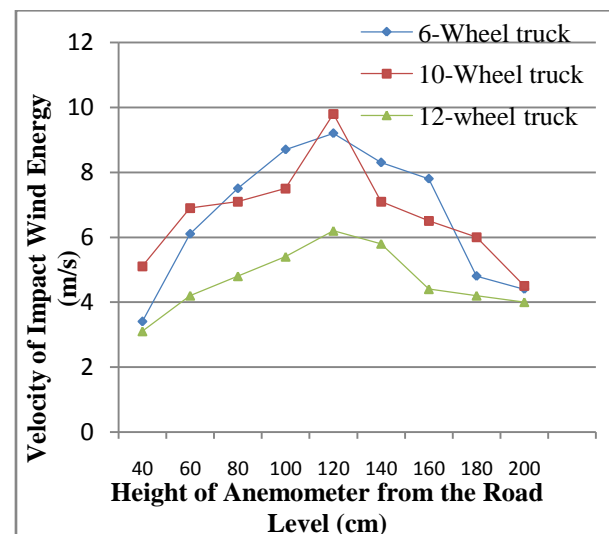
The pressure thrust of wind energy can be converted into mechanical and this mechanical energy can be converted into electrical energy with the help of placing harnessing system (Vertical Axis Wind Turbine) just nearby these highways sides and centre. The energy generated depends on different factors as mentioned before and can be stored in batteries simultaneously. The energy stored can be utilized at different application point in the form of clean energy.

A major hindrance in the growth of wind energy is fluctuation in the sources of wind energy. This problem of variability can't be omitted as it is happening naturally. So, one has to think how to extract constant source of energy from the variability, that is what we can called as innovative idea.

With concern to this, we have tried to investigate the pattern of impact wind energy available on highways/expressways. For this, we have done experiment on highways to predict the height of maximum velocity of impact wind energy from the road level on highways. To do this, we have used various measuring instruments at different heights. Below are the experimental investigation data:-

IV. EXPERIMENTAL DATA

S l N o	Types of Vehicles	Height of Anemometer from Road Level (cm)	Distance between Anemometer & vehicles (cm)	Velocity of Impact Wind Energy (m/sec)
1	6-wheel truck	40	25	3.4
2	10-wheel truck	40	25	4.6
3	12-wheel truck	40	35	2.9
1	6-wheel truck	60	30	5.7
2	10-wheel truck	60	20	6.9
3	12-wheel truck	60	20	5.4
1	6-wheel truck	80	35	6
2	10-wheel truck	80	25	6.7
3	12-wheel truck	80	20	3.1
1	6-wheel truck	100	20	8.7
2	10-wheel truck	100	20	7
3	12-wheel truck	100	20	4.8
1	6-wheel truck	120	20	9.2
2	10-wheel truck	120	20	9.8
3	12-wheel truck	120	20	6.2
1	6-wheel truck	140	25	7.9
2	10-wheel truck	140	20	7.1
3	12-wheel truck	140	20	4.4
1	6-wheel truck	160	20	7.8
2	10-wheel truck	160	20	6.5
3	12-wheel truck	160	20	5.8
1	6-wheel truck	180	20	4.8
2	10-wheel truck	180	20	6
3	12-wheel truck	180	20	6
1	6-wheel truck	200	30	5.5
2	10-wheel truck	200	25	3.6
3	12-wheel truck	200	30	4.5



Graph 2:-Comparison between Height of Anemometer & Velocity of Impact Wind Energy.

V. RESULTS & DISCUSSION

We haven't taken data below 40 cm, because in the vehicles there is an air-gap of 30 to 35 cm & pressure distribution (high pressure & low pressure) throughout the whole height of vehicles. It means that, we will get very low velocity of impact wind energy that is negligible or that of no use. So, we have started to take data from 40 cm. As we go above, we are getting greater value of impact wind energy velocity. But after 120 cm, velocity decreases. It means that, at a height of 120 cm, we are getting highest value of impact wind energy velocity. Hence, we have to design the harnessing system (Vertical Axis Wind Turbine) according to the above experimental data in order to maximize the efficiency of harnessing system, that is to be implemented on the highways/expressways and which will work on the principle of these highways.

VI. CONCLUSION

Highway wind energy has a lot potential in it and if properly harnessed then it can help in resolving the problem of energy crisis in the world. The study of Impact wind energy & its characteristics showed that how the harnessing system can be technically designed in order to get the optimum efficiency. According to the experimental investigation, we found that at a height of 120 cm, getting the maximum value of Impact wind energy available on highways.

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