Open access Journal International Journal of Emerging Trends in Science and Technology

Wind Power Generation System Using Railway – A Prototype Model

Authors

Sagar Ingle[1], Dipak Gawande[2], Bhushan Rakhonde[3]

[1]DES'S College of Engineering & Technology, Dhamangaon (Rly), Amravati (MAH.)
Email: *sagaringle91717@gmail.com*

[2]DES'S College of Engineering & Technology, Dhamangaon (Rly), Amravati (MAH.)
Email: *gawandedipak851@gmail.com*

[3]DES'S College of Engineering & Technology, Dhamangaon (Rly), Amravati (MAH.)
Email: *bhushan.descoet@gmail.com*

Abstract

Since the conventional power generation involved natural resource which are depleting day by day, the use of non-conventional source can be a better alternative in generation of electricity. Wind power is a major source of power if used in generation of power using the fast train, can contribute power to the grid. On such a model is designed and built up on small scale and tested in laboratory is presented here as a U.G. level project. A method is used to generating electricity by using railway. Fast moving vehicles (Train) are induced wind on opposite direction of train motion. This air pressure are used to rotate the wind turbine on the roof of train. Turbineare used to convert wind energy into mechanical energy and generator are used to convert mechanical energy into electrical energy. Turbine and generator are coupled to each other and generated power is used to electrical equipments in train couch.

Keywords: *Wind Turbine, Wind, Train, Railway etc.*

1. Introduction

Energy is a main component to our daily lives, and every day we use energy or power in some form or another. Energy consumption in human life is increases day by day and its effect on source and fossil energy are reduces at very fast rate. Hence need to find new energy source and harnessing from various non-conventional energy sources. Is a most aspect of energy production conservation and utilization in the world. Wind energy is a renewable energy source in all over world. It is sustainable and use of wind energy as an auxiliary source of energy. A new idea for generating electrical power by harnessing the wind energy created by the fast moving train and generated power is used to run various electrical equipment in couches. Either simultaneously or by charging DC battery which can used later as a source for electrical equipment in train. The turbine system arrangement over the roof of train couches.

2. Wind Power Generation (Principle)

The fixed wind power generation system are used up till, But it depends on the wind force and wind direction. All time throughout the year wind is not available at all place. There for the need of a system generating the electricity wind induced by moving train. Which available at all place and with wind force. There for this invention provided a solution on problem of power generation.

This invention method using high wind pressure generated by fast moving train in the direction of wind turbine for generating electricity. Fast moving train generate the wind on the front of it and pushes the wind on the wind turbine blades. The kinetic energy is used to rotate the wind turbine and used to generate the electricity by using DC generator.

3. Object of Work

The main invention in this method generating electricity using easily available wind energy induced by moving train. The other object of the invention is using this free renewable input wind to providing this method for generating the free electrical energy by using high wind pressure generated by moving train. The variation in direction and wind speed is independent of seasonal wind. The necessary force of wind to operate wind turbine to generate electricity as required

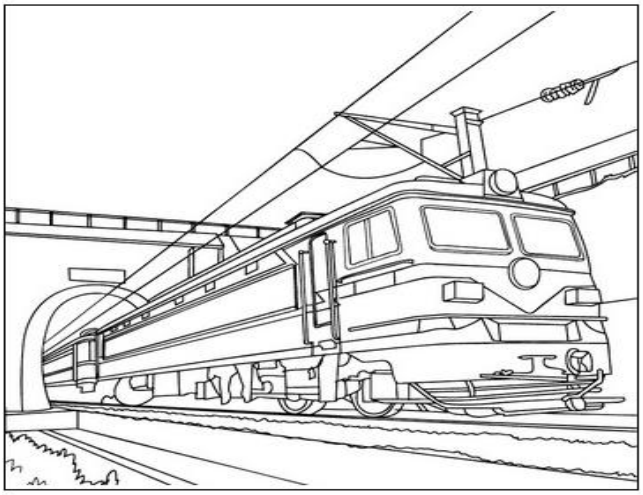

Figure 3.1. Train Model

4. Description of Work

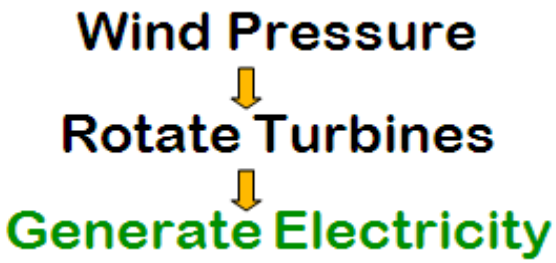

Figure 4.1. Flow Diagram

A. Capturing and Routing Wind Induced by Train

The moving trainwhich running on railway track. The wind energy produce by train is unique as it does not depend on any natural source. Generated wind directed towards the wind turbine and generate electricity. At list one pyramid shaped housing toward the blades of the wind turbine. Aerodynamics is study of physical low of the behavior of object in an air flow and force produce by air flow. The aerodynamics shape of blades profile is decisive for performance. Even minor change in the shape of the profile can more effect on power curve and noise level. Therefore a blade designer does not only sit down and outline the shape when new blades made by designing.

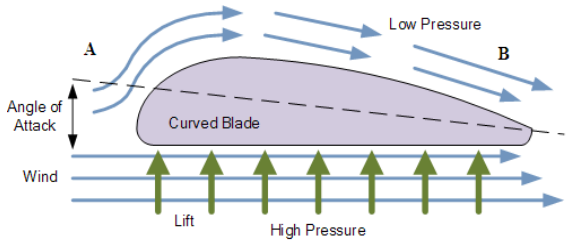

Figure 4.2. Aerodynamics of wind flow

The aerodynamic profile is formed on rear side is more curved as show in figure by point B than the front side facing by point A the wind flow. The air molecules are separate at point A and again point B. but the air flow more on rear side on point B compare to the front point A. The rear side has to travel longer distance from point A to point B than the air flowing at front side at point A. the velocity is higher at rear side. This pressure drop produce by rear side at point B. And this pressure drop are produce the left. The wind turbine rotated slowly at starting time and then greater speed at more accelerate fast. The speed increases From slow to fast acceleration by the effect of aerodynamic Shape and left greatly increases. The rotation of blades depending on the direction of plane. And also depend upon the type of wind turbine blades used or turbine design. Turbine are connected to the generator to generate the electrical power. This generated electrical power are used to electrical equipment in train couches.

B. Convert Wind Energy into Mechanical Energy by Using Wind Turbine

The two physical principle by which energy can be extracted from the wind. These through creation of either left or drag. Left is primary due to the physical phenomena known as Bernoulli's low. This physical low state that speed is increaseover the surface the pressure will drop. Where normal feels that the pressure increases when wind also

increases. This is also true when the air flow blowing directly against a surface. So the turbine capture wind energy produce by the train. The different models of turbine for in different place of train. The turbine is placed at top of the train and turbine coupled with generator have not any gear arrangement for rotated the generator. Turbine and generator are directly coupled to the each other.

C. Converting Mechanical Energy into Electrical Energy by Using Generator.

The generator is used to convert mechanical energy into electrical energy. The turbine blades transfer the kinetic energy from the wind into rotational energy and the wind turbine is used to exaction of generator. With the help of turbine exaction generator generate the electrical power. The wind turbine coupled with generator. This power is generate using generator. And this power is stored in DC battery. And this generated power is used to run electrical equipment inside the train.

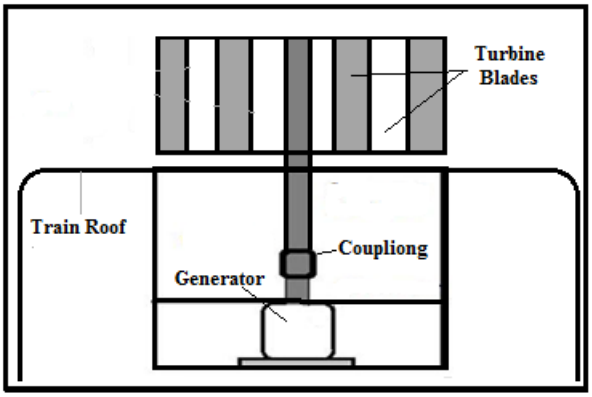

Figure 4.3. Front view of Turbine setup.

5. Electrical System

In electrical system electrical devices which will generate the electricity from the rotational energy of the turbine shaft. The system consists of a DC generator, which produces a DC current of voltage rating between 10.5-12 V. The DC generator produces DC current which is fed into the 12V battery through a switch. The battery is then connected with an Inverter which converts 12V DC to 12 V AC supply and connected into step up transformer. It step up the voltage 12V to 110V AC current which will run the electric components inside the train. Given below is the block diagram of the proposed system

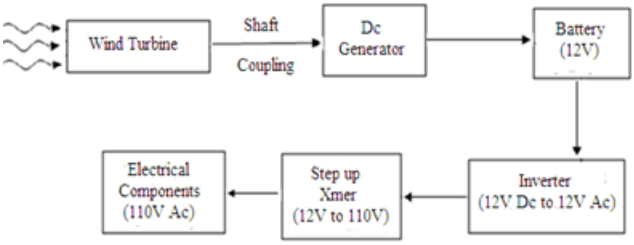

Figure 5.1. block diagram of the proposed system

6. Production of Power (Prototype Model)

The kinetic energy of the wind is used the driving force of wind turbine. Under the constant acceleration, the kinetic energy of the wind can be depicted by the formula.

$$E = ½ (m)(v)^2$$

Where,
E = the kinetic energy (J)
m = the mass (weight) of air (Kg)
v = the velocity of the wind (m/s)

The power in the wind is given by the rate of change of energy. Hence, from the equation, the power can be defined as. The formula used for calculating the power in the
Wind is shown below.

$$P = ½ [\rho(A)(V)^3]$$

Power = (density of air x swept area x velocity cubed)/2
Where,
P is power in watts (W)
ρ is the air density in kilograms per cubic meter (kg/m3)
A is the swept rotor area in square meter (m2) &
V is the wind speed in meter per second (m/s)[4].

7. Calculations Based on Proposed Data

For the prototype of model running train, we take,

Vavg = 60 Km/hr = 16.67 m/s
r = Blade Length = 10 cm = 0.1 m
$A = \pi r^2 = \pi \times (0.1)2 = 0.0314$ m2
ρ = Air Density = 1.23 Kg/m3 at the sea level.

$P = ½ [\rho(A)(V)^3]$

$P = ½ [1.23 \times 0.0314 \times 16.67^3]$

$P = 17.89$ W

8. Result

Table 1: RPM v/s voltage generated.

Sr:no	Speed of Turbine (rpm)	voltage (volt)
1	100	8.92
2	150	12
3	200	18
4	250	24
5	300	28

The above table shows the different voltage rating with respect to the turbine (rpm).The power output depend on the load and for Continuous and smooth operation it load should below 13W

Table 2: Output power when loaded.

Sr:no	Voltage (volts)	Current (amper)	Power (watts)
1	12	0.8	10.3

9. Expected Outcome of The Project

In this technology expected new opportunities is to create wind in low-speed areas. Turbine capture wind from any direction and convert win energy to electrical energy at very high efficiency. Mean components are located at train roof. It requires less maintenance and wind turbines have long life span. Today renewable energy technology and wind turbines are most developed.

10. Application of Project

The generated power can be used for both AC as well as DC loads using of inverter.

Generated power by this method used effectively for lighting and fans in train.

11. Advantages

- To generate more power can be used Small turbines.
- This setup are required less space in comparison withothers.
- Yaw mechanisms are not require in this method.
- The long distance transmission line are Eliminates.

12. Conclusion

The rail network in the would may contribute lot of energy harnessed from wind as a natural resource. This project model concept of electricity generating using fast moving train, which can further be extended on long scale.

Acknowledgment

Special thanks to Prof. N.B.Wagh head of electrical department and teaching staff of Department of Electrical Engineering, DES's College of Engineering and Technology Dhamangaon rly. (MS) India for his valuable guiding for the project.

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