GENERATION OF ELECTRICITY BY USING TURBINE MOUNTED ON TRAIN

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Abstract— *This paper aims at production of electricity by using the concept of the rotation of wind turbine due to the wind caused by the moving train. Wind turbine is provided with ventilated casing to reduce the large air pressure. The mouth of casing is provided with valve to control the wind flow. The blade is mounted on the roof of the train and total mechanical support is provided .The electricity produced will run the various loads connected to the train cabin. The excess power is stored in battery for further use. This will help to cut down the usage of non renewable sources which is on the verge of extinction and the entire process is non-polluting.*

Keywords- WindTurbine,Movingtrain,WindRotation,electricity.

1. INTRODUCTION :

Wind presents a vast source of renewable energy. Wind energy is in fact an indirect form of solar energy. Wind are generated due to heating of air by solar radiations during the day. Heated air rises up and cooler air replaces resulting in wind. Wind movement on the earth surface is influenced by the terrain, water ,reserve etc. Wind or air in motion contains the kinetic energy which is converted into mechanical power by means of wind turbine which is connected to a generator for producing electricity. At present there are many ways to generate electricity but these power generation techniques result in pollution and so power generation using renewable source in essential. This paper is thus a proper method to provide electricity using wind turbine mounted on a train at inclined position. Thus power produced can provide the electricity to the various loads connected inside the train. Wind energy is one of the fastest growing source of electricity and also one of the fastest growing market in the world today. The growth tends to be linked with the multi-dimensional benefits associated with wind energy such as green power, sustainable , affordable and economic development . Now a days , basically two wind turbines are used. They are : i) Vertical axis wind turbine (VAWT) ii) Horizontal axis wind turbine (HAWT) Vertical axis wind turbine has the vertical main rotor shaft. The main advantage is that the generator and gearbox can be placed at the bottom or near the ground. Turbine does not need to be pointed into the wind. ii) Horizontal axis turbine either have two or three blades. The three blades wind turbines are operated with blades facing into the wind. The other common wind turbine type is two bladed, down wind turbine. In HWAT the wind turns two or three aerodynamic blades mounted around a rotor shaft producing mechanical power. This power rotates the blades, and the shaft is connected to a generator normally a gear box which produces electricity.

Fig no.1 (vertical axis wind turbine)

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A. SELECTION OF WIND TURBINE :

- Selection of wind turbine The turbine should not pan on the oscillation or the vibration into the vehicle and the turbine weight should be balanced. For this method, a horizontal swiff turbine is used. Swift turbine is a structure or pole mountable wind turbine with a quit operation. Traditional wind turbine generates some noise as the wind travels the length of the blades, while the outer ring on swift actsas a diffuser. As the wind travels down the blades it is dispersed along the outer ring, significantly reducing the round.

B.ABBREVIATION:

- ALFC – Automatic Load Frequency Control
- AVR – Automatic Voltage Regulator
- Q-V – Reactive Power
- P-F – Real Power

C. Construction

Fig no.2 Placing of turbine.

This invention relates to a method for generating electricity using high wind pressure generated by fast moving vehicles channeling the induced wind in the direction of the wind turbine. A fast moving vehicle compresses the air in the front of it and pushes the air from its sides thereby creating a vacuum at its rear and its sides as it moves forward .The kinetic energy of the wind movement thus created can be used to generate electricity. The moving vehicles encounters wind may be railway trains or airplanes, will sweep off it, in a faster manner making heavy winds.

During this, when a wind turbine, if fit to the moving vehicle will generate adequate amount of energy. The air flow will cause turbine to rotate and thus electricity can be produced

2. OBJECTS OF THE INVENTION :

The main object of the present invention is to provide a method and a system for generating electricity using easily available wind induced by moving vehicles/airplanes in transit or in operation.

The other object of the invention is to provide a method and a system for generating electricity by using high wind pressure generated by moving vehicles, using this free renewable input namely air and independent of the vagaries of seasonal winds having the variation in direction and wind speeds when they do flow and that too neither at all times or places nor having the necessary force of wind to operate wind mill to generate electricity as required.

a.) Working :

- When the train moves with an average speed , the wind turbine attached to it also rotates.
- The turbine should be placed in such a way that the wind strikes the blades. This gives the turbine a rotational movement.
- The turbine is placed along the path of the wind flow path that is mounted on the train, then the blade rotates and energy is generated. When the train moves, the turbine rotates
- This loop controls the wind valve leading to the turbine .Speed sensor sense the speed of the turbine which is compared with the different speed and speed governor controls the speed of wind by closing and opening of the wind control valve. Therefore the high pressure is reduced.

b). Secondary ALFC :

- This circuit involves a frequency sensor that senses the frequency of the bus bar and compares it with Tie line power frequencies in the signal mixer. The speed changer gives the reference speed to the governor.

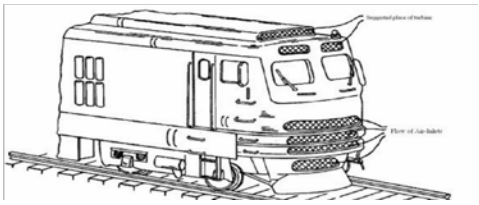

Fig3.Placing of components

- Thus , the two loops together help in controlling the speed which in turn controls the frequency , since N ∝ f.

c.)Storage of electrical energy :

- The rotational movement of the rotor blade is converted into electrical energy by the generator.
- For domestic purposes a permanent magnet generator is used.
- Permanent magnet generators use the highfield strength generated by magnets mounted on rotor. Variations on this design put magnets on the stator and let the coils rotate. The electric energy then can be used in for other domestic uses.

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3.Overcome of the previous model:

When the turbine rotates, there would be a reduce in efficiency of train (means the speed of train is reduced)

To avoid the reduce in efficiency ,there are many different kinds of generators that could be used in a wind turbine, right now I am going to just explain it using induction motor.

An induction generator is a type of electrical generator that is mechanically and electrically similar to an induction motor. Induction generators produce electrical power when their shaft is rotated faster than the synchronous frequency of the equivalent induction motor. Induction generators are often used in wind turbines and some micro hydro installations. Induction generators are mechanically and electrically simpler than other generator types. They are also more rugged, requiring no brushes or commutator.

Induction generators are not self-exciting, meaning they require an external supply to produce a rotating magnetic flux, the power required for this is called reactive current. The external supply can be supplied from the electrical grid or from the generator itself, once it starts producing power or can you can use a capacitor bank to supply it. The rotating magnetic flux from the stator induces

currents in the rotor, which also produces a magnetic field. If the rotor turns slower than the rate of the rotating flux, the machine acts like an induction motor. If the rotor is turned faster, it acts like a generator, producing power at the synchronous frequency.

The common down side of using an induction generator in a wind turbine is gearing. Typically you need an induction motors to run 1500+ RPM to meet the synchronous so a gearing is almost always needed.

4.POWERPRODUCTION:

The kinetic energy of wind :

The kinetic energy of the wind is the source of the driving force of a wind turbine.

E = f. .v^3 m/sec

In this formula: E = the kinetic energy m/sec =the specific mass (weight) of air v = the velocity of the moving air (the wind) f = a calculating factor without any physic meaning The power in the wind is proportional to:

a) the area of turbine being swept by the wind

b) the cube of the wind speed

c) the air density - which varies with altitude.

The formula used for calculating the power in the wind is shown below:

Power = (density of air x swept area x velocity cubed)/2
$P = ½.\ \rho(A)(V)^3$
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 meters (m2) & V is the wind speed in meters per second (m/s).

COSTECONOMICS:

However, the power output from the wind machine is proportional to cube of the wind speed and so a *increase in wind speed will mean a significant increase in power and a subsequent reduction in unit costs.

ADVANTAGES:

There are 14,300 trains operating daily on 63,000 route kilometers of railway in India. This technique would be capable of producing 1,481,000 megawatt (MW) of power in India alone.

There are some specially designed wind turbines. Traditionally wind turbines have three-blade, „open rotor" design.

A number of researches to overcome energy crisis against the exhaustion of fossil fuel, environmental pollution and global warming have been performed.

Typically, a number of studies on renewable energy, such as wind, photovoltaic generation, etc., are actively in progress. These types of generation have advantages that they do not use fossil fuel as an energy source and emit greenhouse gas.

Calculation:

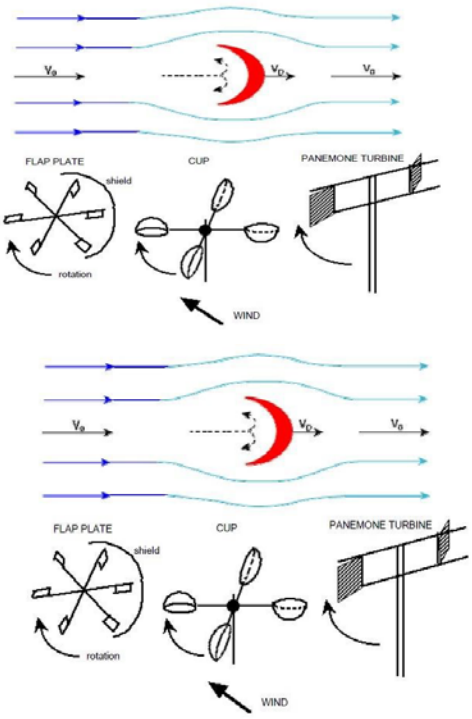

Fig no.4working diagram

A common method of this design is that even small turbines require a fast wind before they start operating. Small turbines can be used to generate more power and can be used for commercial applications as we store the retrieved energy ..

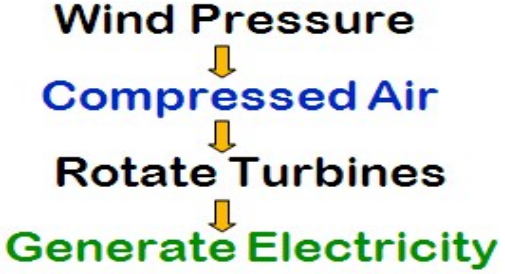

Fig 5. Flowchart

A. Capturing wind induced by moving vehicles:

The moving vehicles may be all types of light or heavy vehicles running on road, such as two, three, four wheelers or even bigger vehicles. The moving vehicles could be railway train running on railway track. The vehicles could also be aircraft moving on to the runway, taking off or landing; when testing the propellers in the workshops, proceeding to or standing bye in the holding area before taking off. These induces fast winds in all it direction of propagation.

B.Routing the induced wind in direction of the turbine:

If the wind is properly directed towards the wind turbine blades, optimum electricity may be generated. The desired direction of wind is obtained by a means for channeling wind in the direction of the wind turbine. Channeling of wind in a desired direction may be obtained by, at least one truncated cone or pyramid shaped housing or a pair of planar members converging towards the blades of the wind turbine.

Aerodynamics is the science and study of the physical laws of the behavior of objects in an air flow and the forces that are produced by air flows. The shape of the aerodynamic profile is decisive for blade performance. Even minor alterations in the shape of the profile can greatly alter the power curve and noise level. Therefore a blade designer does not merely sit down and outline the shape when designing a new blade.

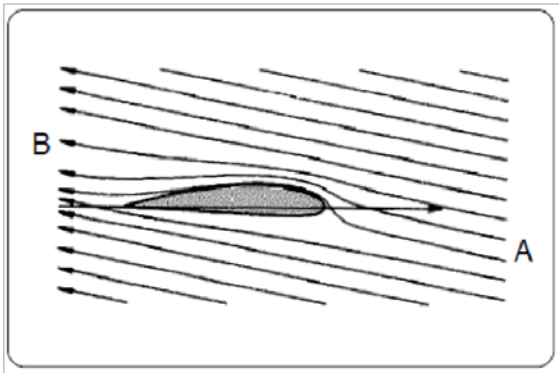

Fig no.6.Bernoulli's Principle

The blade is almost sucked forward by the pressure drop resulting from this greater front edge speed. There is also a contribution resulting from a small over-pressure on the front side of the blade. Compared to an idling blade the aerodynamic forces on the blade under operational conditions are very large. Most wind turbine owners have surely noticed these forces during a start-up in good wind conditions.

The wind turbine will start to rotate very slowly at first, but as it gathers speed it begins to accelerate faster and faster. The change from slow to fast acceleration is a sign that the blade's aerodynamic shape comes into play, and that the lift greatly increases when the blade meets the head wind of its own movement.The fast acceleration, near the wind turbine's operational rotational speed, places great demands on the electrical cut-in system that must capture and engage wind turbine without releasing excessive peak electrical loads grid.

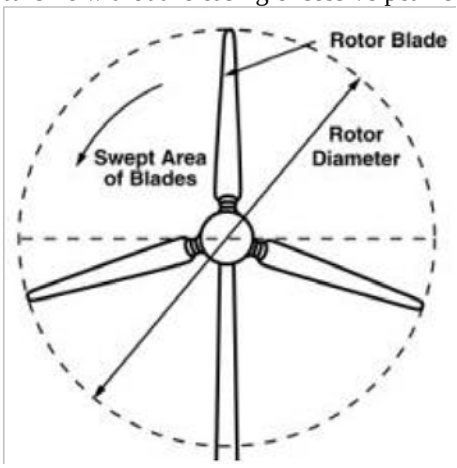

Fig no.7.Rotation of turbine

The desired direction may be transverse or parallel to the direction of plane of rotation of blades depending upon the type of wind turbine used or the direction of wind, or it the design of the wind turbines. The turbines are connected to electricity generator to generate electricity. The generated electricity may be used directly or stored in batteries which can be used at the time of need.

C. Converting the energy of the wind into mechanical energy by using wind turbine :

There are two primary physical principles by which energy can be extracted from the wind. These are through the creation of either lift or drag force (or through a combination of the two).

Drag forces provide the most obvious means of propulsion, these being the forces felt by a person (or object) exposed to the wind. Lift forces are the most efficient means of propulsion but being more subtle than drag forces are not so well understood.

Lift is primary due to the physical phenomena known as Bernoulli"s Law. This physical law states that when the speed of an air flow over a surface is increased the pressure will then drop. This law is counter to what most people experience from walking or cycling in a head wind, where normally one feels that the pressure increases when the wind also increases. This is also true when one sees an air flow blowing directly against a surface, but it is not the case when

air is flowing over a surface. One can easily convince oneself that this is so by making a small experiment.

> *Take two small pieces of paper and bend them slightly in the middle. Then hold them as shown in the diagram and blow in between them. The speed of the air is higher in between these two pieces of paper than outside (where of course the air speed is about zero), so therefore the pressure inside is lower and according to Bernoulli"s Law the papers will be sucked in towards each other.*

One would expect that they would be blown away from each other, but in reality the opposite occurs. This is an interesting little experiment that clearly demonstrates a physical phenomenon that has a completely different result than what one would expect.

D. Converting that mechanical energy into electrical energy by using a generating device:

The generator is the unit of the wind turbine that transforms mechanical energy into electrical energy. The blades transfer the kinetic energy from the wind into rotational energy in the transmission system, and the generator is the next step in the supply of energy from the wind turbine to the electrical grid.

The wind turbine may be connected to an electricity generator. The generated electricity may to be stored in pluralities of batteries from which energy may be used as per the need.

These turbines have been designed to power small units like compartments of train, recharging batteries, although we should mention that it is also quite easy to imagine how a specially designed wind turbine like this could sit on top of the train or at front and power its engine as you cruise along on the rail/road. This wind turbine was developed to be used as an alternative means to recharge communications equipmenttoo.

5.TABULATION: **Total Power Generated**

TURBINE	HORIZONTAL AXIS
Rated power output	1.5 kw
Annual power supply generator	Up to 200 kwh brushless PMG

6.CONCLUSION:

- There are huge potential for producing electricity from renewable sources. The achievement so far is about 10406.69 MW, as against global installed capacity of approximately 200000 MW of renewable electricity
- With this method, the whole unit can be supplied with electricity for lighting, fans etc.
- Advantageously, communication between the power ties facilitates sharing of resources and also facilitates the development of certain data types, such as block occupancy detection, distance to train, detection of broken rail etc.
- The technology is expected to contribute to the cause of the Environment as it helps to reduce carbon emission and also assists government in saving fuel. When implemented it will meet up the power requirements for future generation and this method is more reliable.

Thus this paper proposes an effective means of harnessing the wind energy by moving the train.

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