A Method for Generating Electricity by Fast Moving Vehicles

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***Abstract*—A method for generating electricity using high wind pressure generated by fast moving vehicles channelling the induced wind in the direction of the wind turbine; converting the energy of the wind into mechanical energy by using wind turbine; and converting the mechanical energy into electrical energy by using a generating device and can be used for applications.**

Keywords: Renewable Energy, Wind, Wind Turbines, etc.

I. INTRODUCTION

In this modern age more and more energy is required for daily consumption in all walk of life. Sources and quantum of fossil energy are dwindling day by day and getting exhausted at a very fast rate. Hence conservation, tapping new sources of energy and harnessing of the same from the various non conventional sources, is an important aspect of energy production/conservation and utilization all over the world.

The sky-rocketing price of crude oil has ruined the economy of many a country, hence there is a crying need for production of energy from non conventional sources at the earliest. The present concept is one of the answers to this problem, as the said induced wind into useable electric energy which can be utilized straight away or stored in batteries.

II. ENERGY REQUIREMENTS

World primary energy demand grows by 1.6% per year on an average between 2006 and 2030 - an increase of 45%. Demand for oil rises from 85 million barrels per day now to 106 mb/d in 2030 - 10 mb/d less than projected last year. Modern renewable energies grow most rapidly, overtaking gas to become the second-largest source of electricity soon after 2010.

With increasing environmental concern, and approaching limits to fossil fuel consumption, wind power has regained interest as a renewable energy source. This new generation of wind mills produce electric power and are more generally used for all applications, which requires power.

III. FIELD OF INVENTION

A. Back Ground

The fixed wind powered electricity generation systems in use, till now are dependent on wind direction and the force of the wind. But the wind is not available at all place and all time through out the year. Therefore, there exists an immense need of a system for generating electricity from wind induced by moving vehicles, trains or airplanes, which is available through out the year at various places and with sufficient force of wind. Therefore this invention provides a solution to the problem for generating electricity in this manner.

B. Method

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.

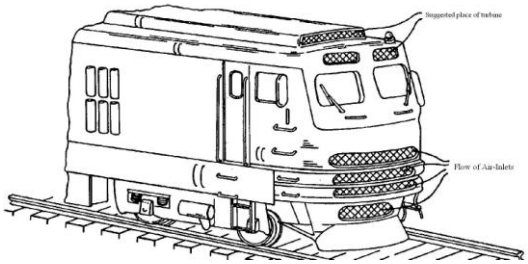

Figure 1. Typical Train Model

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.

IV. 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.

V. DESCRIPTION OF INVENTION

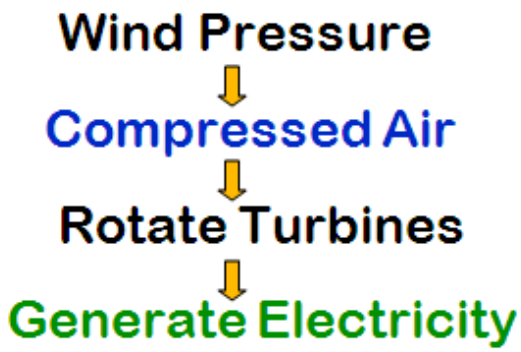

Figure 2. Basic flow diagram

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 the direction of the wind 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 channelling 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.

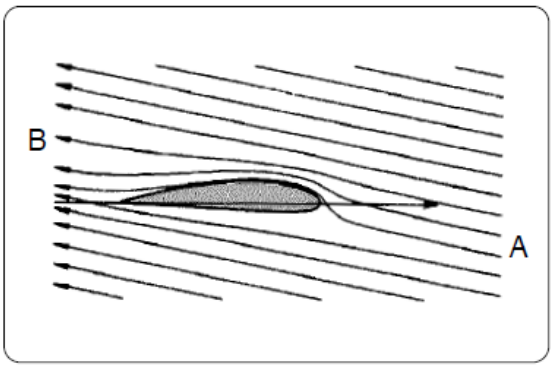

Figure 3. Aerodynamics of Wind

The aerodynamic profile is formed with a rear side, is much more curved than the front side facing the wind. Two portions of air molecules side by side in the air flow moving towards the profile at point A will separate and pass around the profile and will once again be side by side at point B after passing the profile's trailing edge. As the rear side is more curved than the front side on a wind turbine blade, this means that the air flowing over the rear side has to travel a longer distance from point A to B than the air flowing over the front side. Therefore this air flow over the rear side must have a higher velocity if these two different portions of air shall be reunited at point B. Greater velocity produces a pressure drop on the rear side of the blade, and it is

this pressure drop that produces the lift. The highest speed is obtained at the rounded front edge of the blade.

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 the wind turbine without releasing excessive peak electrical loads to the grid.

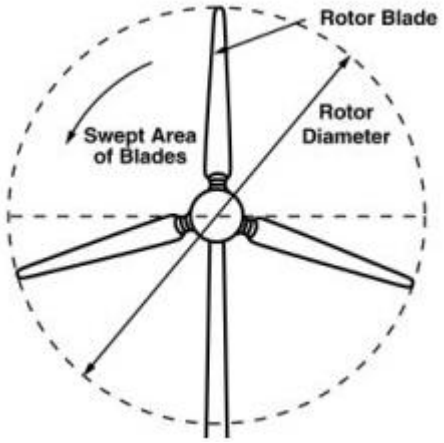

Figure 4. Rotation of rotor

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.

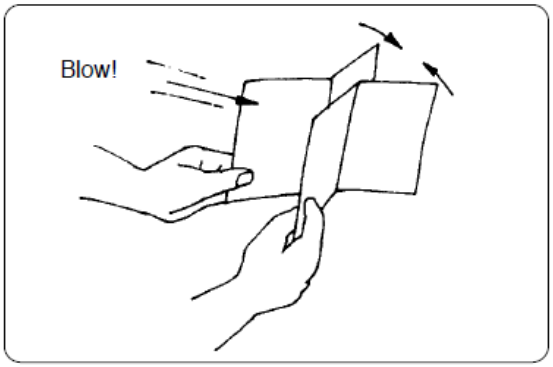

Figure 5. Bernoulli's Law

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 equipment too.

VI. POWER PRODUCTION

1) The kinetic energy of wind

The kinetic energy of the wind is the source of the driving force of a wind turbine.
That kinetic energy can be depicted by the formula

$$E = f.\ mspec\ .v3$$

In this formula:
E = the kinetic energy
mspec =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 windmill 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

$$P = \tfrac{1}{2}.\ \rho(A)(V)^3$$

Where,
P is power in watts (W)
ρ is the air density in kilograms per cubic metre (kg/m3)
A is the swept rotor area in square metres (m2) & V is the wind speed in metres per second (m/s).

VII. COST ECONOMICS

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.

VIII. 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 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 in batteries.

CONCLUSIONS

- 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 generation.
- With this method, the whole unit can be supplied with electricity for lighting, fans etc.
- The technology is expected to contribute to the cause of the environment as it helps to reduce carbon emissions and also assists the government in saving on fuel too…

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