

Review on Micro-generation of Electricity Using Rooftop Turbine Ventilator (R.T.V)

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ABSTRACT: This paper presents that review on micro-generation using Rooftop Turbine Ventilator (R.T.V). Various methods have been presented previously [1-4] like Axial Flux Permanent Magnet (AFPM), Permanent Magnet Synchronous Generator (PMSG), AC-Generator and AC Synchronous Generator which are driven by Rooftop Turbine Ventilator (R.T.V). Comparative study have been made in this paper for above mentioned method with respect to roof top ventilator. Energy generated from this concept is stored in batteries for further use.

KEYWORDS: RTV, AFPM, PMSG, HAWT, VAWT, Micro-Generation.

I.INTRODUCTION

We know that day by day the demand of electricity in India is increasing. To meet that demand the various renewable and non-renewable energy sources are used to generate electricity and meet the demand. Other Hand by using conventional energy sources the pollution is increasing and this effect the global warming .The conventional energy sources are destroyable energy sources. All countries have becomes interested in the renewable energy sources. The solar, wind, water, ocean waves can play important role in production of electricity. But the some problems arises in the development of energy power generation like, high construction cost, difficulties in maintenance, space for plant installation and power distribution. Therefore in India begin to develop a micro power station to improve such problems [1].

The India is in the tropical zone. There is high humidity and warm weather present in all of year. Specially march, April, may .The day time temperature may be increasing to 42⁰C or the average temperature in India is (32⁰ -40⁰) in most of interior [1] so this increasing temperature is affect's on the worker to work in various and this effect's on the work efficiency of worker and also on productivity of company. Because of high intensity of sunlight and high room temperature the ventilation is necessary in workshop's, industries or factory building .Therefore the rooftop ventilator's are used for ventilation purpose because this ventilator are work on without using electric energy. This technology is popularly installed on the roof in workshop's, industrial buildings, ware houses and also in residences. [Figure.1] The main function of this ventilator is that when the air flow on the top of roof or the hot air that lifting under the roof that called ventilator. The ventilator suck the hot air from building and through outside the building and maintain the building temperature [3]. The another function of roof top ventilator is to convert wind's kinetic energy to electrical energy



Fig. (1)

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II. ROOFTOP TURBINE VENTILATOR

Wind turbo ventilator is a wind driven ventilator that is installed on the roof of building to provide effective ventilation. It is used in all types of industries, workshops, warehouse. The air ventilation works on the simple principle of wind assisted rotation and stack effect. The main function of the free spinning is to provide fresh air in roof space and living area. Air is free around 24 hours of a day on all year. The additional function of this product is to produce the electrical energy from the roof ventilator that will spin the wind is exist.[2]

Roof ventilators have two types

- Roof ventilator with motor driven
- Roof ventilator with natural air driven

In this paper second type is preferred. Roof ventilator consists of stationary part and rotational part. The stationary part is composed of base and fixed shaft and rotational part is composed of fan blades and bush put on the fixed shaft on stationary part [3]. The construction of roof ventilator shown in following figure:2



Fig: 2 Construction of RTV

Also there are two rotating principles of the ventilator. The first principle is hydromechanics that can air flow high temperature area to low temperature area to motivate blades to rotate. In that time when the turbine rotates the high temperature air will be discharged from the room so the air density in the room can be reduced, then the outdoor cold air enters in the room to achieve the goal. The second principle is the air convector it relies on the breeze air to rotate its blades [1]

III. WIND GENERATION

Wind power is extracted from air flow using wind turbines or sails to produce mechanical or electrical power. Wind power is an alternative to fossil fuels is plentiful, renewable widely distributed clean, produces no greenhouse gas emissions during operation and uses little land. The net effect on the environment is far less problematic than those non-renewable power sources [website]

Wind turbine can rotate about either a horizontal or a vertical axis this former being both older and more common. They also include blades. There are two types

- Horizontal Axis Wind Turbine (HAWT)
- Vertical Axis Wind Turbine (VAWT)

1. Horizontal Axis Wind Turbine (HAWT)

HAWT have main rotor shaft and electrical generator at the top of tower and must be pointed into the wind the small turbine are pointed by a simple wind vane, while large turbines generally use a wind sensor coupled with a servo motor. Most have a gear box which turns the slow rotation of the blades into a quicker rotation that is more suitable to drive an electrical generator.

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2. Vertical Axis Wind Turbine (VAWT)

VAWT have the main rotor shaft arranged vertically one advantages of this arrangement is that the turbine does need to be pointed into the wind to be effective which is an advantage on a site where the wind direction is highly variable. It is also the one advantage when the turbine Is integrated into a building because it is inherently less steerable
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Fig:3 HAWT&VAWT

IV. METHODOLOGY FOR ROOFTOP TURBINE VENTILATOR(R.T.V)

For the generation of electricity by using RooftopTurbine Ventilator(R.T.V).The following methods are most preferred.

- Axial Flux Permanent Magnet (AFPM)
- Permanent Magnet Synchronous Generator (PMSG)
- AC-Generator
- AC Synchronous Generator

1. Axial Flux Permanent Magnet (AFPM)

The main component of the system is the AFPM generator. It will convert the kinetic energy from wind into electrical energy. The AFPM machine is used where low speed is require .The AFPM design have higher power density The AFPM machine have many unique features.it is more efficient. Figure [4] shows the schematically diagram of AFPM machine it consist of two outer rotor disc and one coreless stator in between.As it can be seen the Nd-Fe-B magnets are glue onto thinner surface of the two rotor discs .The poles of the rotor are arranged in opposite direction (N-S Type) and the stator winding of the machine has no iron core and the surface winding of the stator is perpendicular to the machine shaft .The diameter and thickness of the Nd-Fe-B permanent magnet is 20mm and 5 mm respective .

The main system construction of this system is shown in [figure.4] it contains the ventilator and the AFPM generator.The AFPM generator is assembled at the ventilator base when the ventilator rotates the flux of the permanent magnet rotor part moves across the air gap and includes the emf [1].The prototype of this system shown in following figure.5 figure

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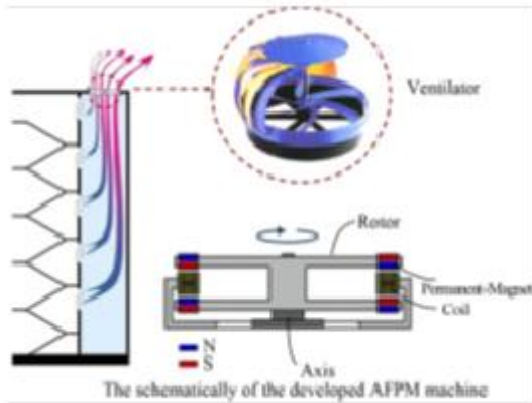


Fig: 4 Constructional diagram

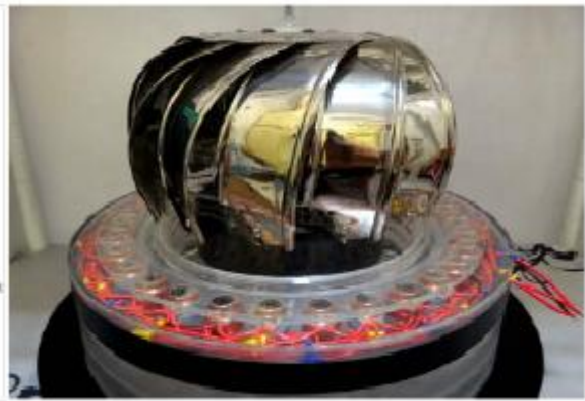


Fig: 5 Prototype

2. Permanent Magnet Synchronous Generator (PMSG)

Permanent Magnet Synchronous Generator is a best solution which is based on variable speed operation. With permanent magnet there is no need for DC excitation. In Permanent Magnet Synchronous Generator(PMSG) the permanent magnet produce field current of the exciter. Thus the use of Permanent Magnet Synchronous Generator(PMSG) make the excitation of the main generator completely independent of external supplies. Following fig:6 shows the construction

Permanent Magnet Synchronous Generator is multiple synchronous generator it is possible to operate at low speed and without gearbox. The main component of the system is the PMSG generator. It will convert the kinetic energy from the wind to the electricity for our usage. The generated electricity then will go though the AC-DC converter to convert it to Direct Current (DC) voltage .Inverter is use to convert from DC to AC for our AC load usage .

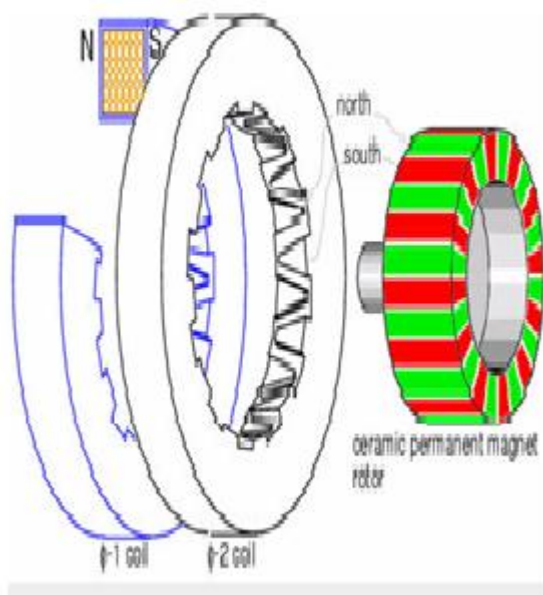


Fig: 6 Construction

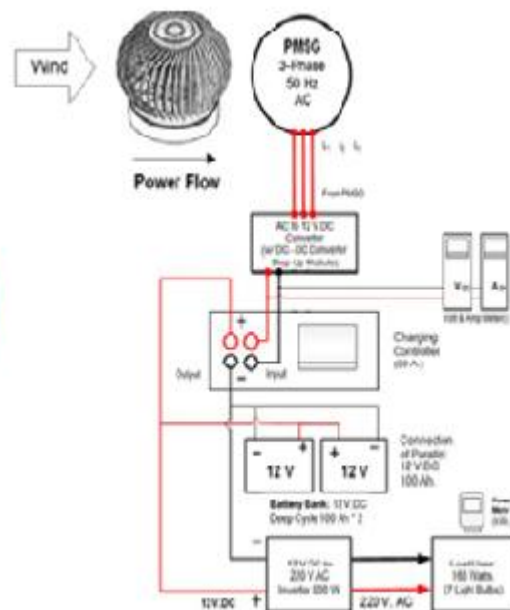


Fig: 7 Prototype

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The design aims to extract maximum energy at at low-speed wind (wind intermittent resources) by keeping the turbine turning by which can hold more moment of inertia from its spinning body [4]

3. AC-Generator

The main components of the system is the auxiliary current generator [fig. 8].it will convert the kinetic energy from the wind to the electricity for our uses. The generated electricity then will go AC-DC rectifier to convert it to direct current(DC) voltage. This free electricity has to use the battery charger to allow the charging process running. This to ensure that there will be no back –flow current if the roof ventilator not functioning. The inverter is use to convert from DC-AC for our AC load uses The Flowchart of the full system of power generator roof ventilator is installed in figure.9

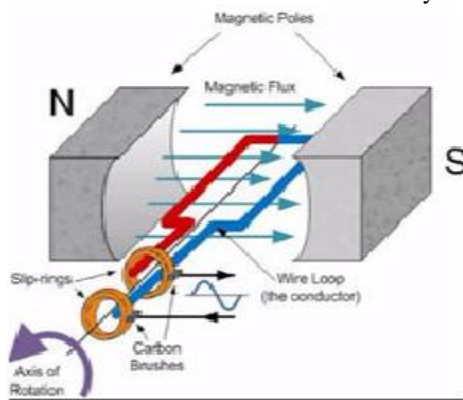


Fig: 8 Constructional diagram



Fig: 9 Flowchart

AC generator is a solution where it manage to meet the objective of the product .the important specification of the generator is the torque must be low to the unable it to start the low speed.The rubber belting is attach to moving object of the roof ventilator .The AC generator is connected to the belting area by using a small plastic wheel .In the Wind blows on the fins and generate enough drag forces the roof ventilator will rotate .The plastic wheel of AC generator and moving roof ventilator will spin synchronously to generate electricity. [2]

4.AC Synchronous Generator

In three phases AC Synchronous Generator consist of two main part first is stator and second is rotor [fig.10]. The stator is the stationary part of the generator the stator carries the armature winding in which the voltage is generated. The output of the generator is taken from the stator. The second part is rotor the rotor is the rotating part of the rotor. The rotor produces the main field flux.[3]The prototype is shown in fig.11

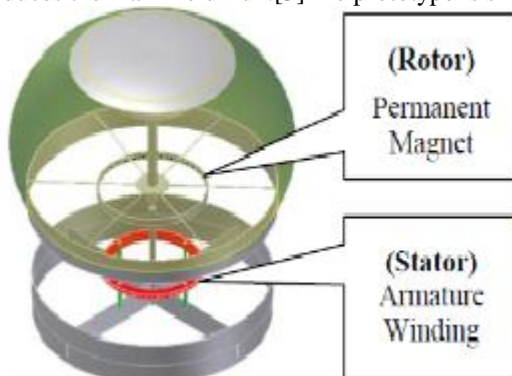


Fig: 10 Construction



Fig:11 Prototype



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V.COMPARISION

SR. No.	Comparison Points	Permanent Magnet Synchronous Generator (PMSG)	AC-Generator	Axial Flux Permanent Magnet (AFPM)	AC-Synchronous Generator
1	Construction	Simple	Complicated	Simple	Simple
2	Working & Principle	-	Faraday's Law of Electromagnetic Induction	-	Faraday's Law of Electromagnetic Induction
3	Types	Single Sided Rotor Double Sided Rotor	AC-Synchronous & AC-Induction	Single Sided Rotor Double Sided Rotor	-
4	Excitation	No Excitation Required	Excitation Required	No Excitation Required	Excitation Required
5	Slip-rings	Present	Present	Present	Present
6	Brushes	Not Present	Present	Not Present	Not Present
7	Losses	Less	More	Less	More
8	Efficiency	Better	Less	Less	Less
9	Cost	High	Less	High	Less
10	Maintenance	Less	High	Less	High

VI. CONCLUSION

In this paper, various types for R.T.V have been presented. Different methods for R.T.V driven generator has been compared for review, from operational, constructional and performance analysis point view from above comparison and analysis of methods PMSG method is better among all.

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