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SMART WIND MILL

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Abstract: In this project Savonius type of wind turbine and Air core generator is used. Normally wind turbine are used in area where 12 meter per second velocity of air is available. In India generally the wind speed available is low so India is not suitable for wind turbine you can see few areas only where wind turbine is installed so we are developing a special type of smart generator which will sense the air velocity according to wind speed it will change the torque required to rotate the generator. The proposed generator is a radial flux permanent magnet generator with a dual rotor topology. The stator is ironless or 'air-cored', hence the name. This generator is a single phase generator and is basically designed for wind energy applications.

Keywords*- Air core, Generator, wind mill, Magnets.*

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I INTRODUCTION

The air core generator proposed generator is a radial flux permanent magnet generator with a dual rotor topology. The stator is ironless or 'air-cored', hence the name. This generator is a single-phase generator and is basically designed for wind energy applications. But according to Faraday's law of electromagnetic induction, the rate of change of flux linkage is equal to induced EMF. The Savonius wind turbine (VAWT) is used for rotating air core generator because a vertical axis wind turbine can be located nearer the ground, making it easier to maintain the moving parts. It also has lower wind start up speeds than the typical vertical axis wind turbine. This turbine may be built at locations where taller structures are prohibited. It is situated close to the ground can take advantage of locations where rooftops, mesas, hilltops, ridgelines, and passes funnel the wind and increase wind velocity. The air core generator has reduced iron loss since it is air cored. It also has low armature reaction. This reduces the cost and weight. So the maintenance is less and reduces the cogging effect. The turbine blades are manufactured by using pvc pipe and arms are made by using square tubes. The complete frame and mechanism are made of mild steel.

II PROBLEM STATEMENT

The normal wind turbine is suitable for min 10m/s wind velocity & they are using either Star or Delta type of winding for their generator so generator get only one output (pair of wire +, -). If wind velocity less than 10m/s this turbine cannot rotate generator because for starting generator torque is insufficient so in max. part of India we cannot install wind turbine.

III AIM

To design special type of generator which can even work on low torque so if wind velocity is 2m/s our turbine will generate power so we can use it in at low velocity also.

IV OBJECTIVE

- Objective of our project is to make a smart generator, i.e. according to wind speed it should change the required torque to rotate the generator.
- To increase the zones for installing the wind turbine by reducing the required air velocity for windmill
- To design a special type of circuit which will sense the air velocity and accordingly operate the relay (future scope)
- To make such a wind mill which will activate and deactivate the winding according to wind velocity.

To make the project in possible low cost

V INNOVATION

- The proposed generator is a radial flux permanent magnet generator with a dual rotor topology.
- The stator is ironless.
- This generator is a single phase generator and is basically designed for wind energy applications.
- But according to Faraday's law of electromagnetic induction, the rate of change of flux linkage is equal to induced EMF.
- We are using 10 different winding.
- According to wind velocity we are activating and deactivating the winding.
- If wind velocity is low torque is also low, then we will activate only one winding & if it is high then activate all the windings.
- So our wind turbine can produce power at any wind velocity.

VI LITERATURE SURVEY

H W Cho1, IOP (2018). In his paper, the design and analysis of the air-core superconducting (SC) generators are carried out. The results show that the total weight of the generator with actively shielded SC generator has lower weight compare with conventional magnetically shielded SC generator [1].

Zia Ullah and Jin Hur. MDPI, Energies. (2018). This paper reviews the recent advances in fault diagnosis techniques of the two most frequently occurring faults, namely inter turn short fault (ITSF) and irreversible demagnetization fault (IDF). ITSF is associated with a short circuit in stator winding turns in the same phase of the machine, while IDF is associated with the weakening strength of the PM in the rotor [2].

Mojtaba Eldoromi, TJECS (2018). In this study, an axial flux permanent magnet synchronous generator with unique features such as high power density is designed for small-scale wind turbines. The structure of generator includes a rotor and a stator. The generator is designed and then analysed by Flux 11.2 software. The analysis includes the effects of air gap distance change with considering wind speed variations. Sinusoidal waveform of induction voltage with the acceptable harmonic characteristics confirms the optimized design of the generator [3].

Ajay Kushwaha1, IJERST (2013). The paper provides cumulative modernization of wind turbine technology through literature survey of wind turbine configurations followed by discussion of different control schemes mainly of doubly fed induction generator (DFIG) wind turbine. This paper gives proper understanding of conceptual experiments conducted with DFIG and control schemes along with their characteristics and limitations [4].

VII METHODOLOGY

A. Construction

For construction of air core generator, we go through following procedures

- First we make mild steel frame for supporting whole assembly.
- Then making metal ring for rotor.
- We take cu wire and make coil as stator.
- Placing magnets in metal ring.
- Cu coil is going to place between two magnets and maintain clearance so that it generates more power.
- Then we assemble all components on frame.
- Wind mill is then attached with rotor shaft.
- With the help of multi meter we check generated voltage and current on different air velocity's.

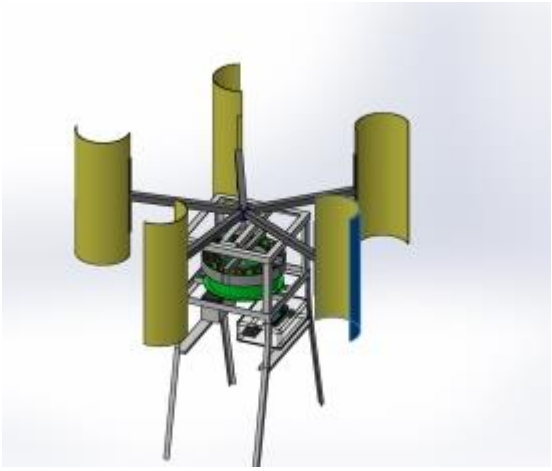

Figure 1 Air core generator on Savonius wind mill

B. Working

Here we are using 10 number of windings in air core generator now suppose if air velocity is only 2 m/s, so here wind turbine will not be able to put sufficient torque to rotate generator so smart generator will deactivate its 8 winding and only two winding will be activated so here the required torque for rotating The Air core generator will be lower down and generator will be rotated and power will be produced.

The inner and the outer rotor are attached to the same shaft. A wind turbine will be the prime mover. The prime mover rotates the inner and the outer rotor. Alternating poles in double rows are present on the rotor and the stator is in between the rotor. As a result of the resulting motion between the conductors and the magnetic field an emf is generated in the winding according to the faraday's laws. The terminals from each coil in the generator can be brought out either to form a series or a parallel connection. Hence the emf produced by the generator is the resultant of the series or the parallel connection as per the required voltage. The waveform of the flux density is sinusoidal in nature.

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VIII USING THE TEMPLATE

The fabrication of round generator body is done by using mild steel flat. In figure two generator assembly is shown as shown in generator assembly the permanent magnet is mounted on both the side of copper coil the air gap between copper coil on each side is 3 mm.

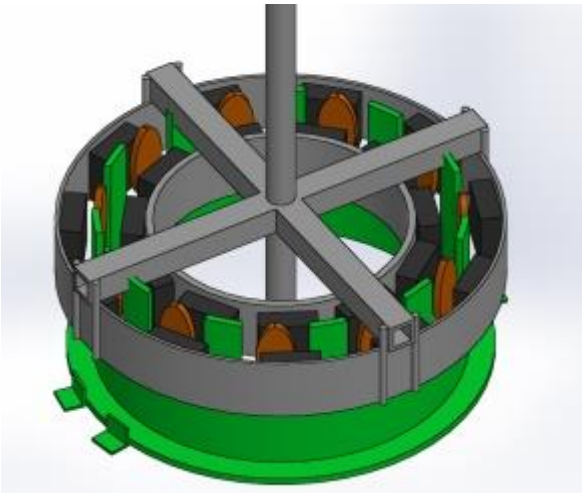

Figure 2 Generator assembly

The size of permanent magnet used in air cooled generator is shown in table and according to that size the copper coil is fabricated. The size of copper coil is slightly more than the size of magnet because in the middle of copper coil the gap is given for the transmission of flux due to which electricity is generated. The winding and of each coil is taken out separately and can be connected in series or parallel connection according to the requirement of voltage and current but the power remains same.

TABLE I: GENERATOR SPECIFICATION

Name	Symbol	Design
Output Voltage	*Ea*	12 V
Turbine average Speed	*N*	25 rpm
Poles	*P*	10 poles
Air gap	δ	3 mm.
Permanent Magnet size	$W \times L \times T$	(40x20x5) mm.
Permanent Magnet Magnetic density	*Br*	0.05 Wb/m2
Turns per coil	*Nc*	223 turns

IX RESULTS AND DISCUSSION

The flow analysis for the modified Savonius rotor is done for the range of wind velocity from 2 m/s to 8 m/s. For this wind velocity range calculating the power obtained by the experimental reading and compares it with the power of conventional Savonius rotor system.

TABLE II EXPERIMENTAL READING FOR SAVONIUS ROTOR SYSTEM

SR. NO.	AIR VELOCITY	SPEED	TORQUE	POWER
	m/s	Rpm	N-m	Watt
1	2	8	0.65	0.5
2	2.5	11	0.85	1.0
3	3	13	1.56	2.1
4	3.5	15	2.4	3.8
5	4	22	3.2	7.4
6	4.5	24	4.5	11.3
7	5	26	5.8	15.8
8	5.5	27	6.9	19.5
9	6	30	8.2	25.7
10	6.5	32	9.5	31.8
11	7	34	10.9	38.8
12	7.5	35	13.2	48.4
13	8	38	14.5	57.7

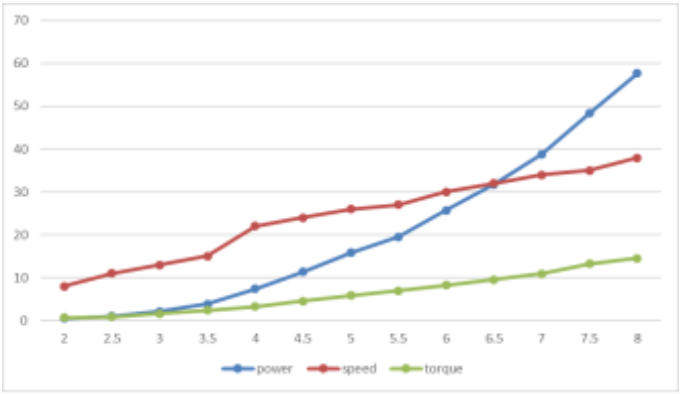

Figure 3 Graph for output Power, Speed and Torque at Air Velocity for conventional Savonius rotor system

X CONCLUSION

Wind is a renewable source of energy and wind is available free of cost. The generator is main part of the project. The air core generator is very much useful for low-speed power generation for wind turbine but initial cost of system is quite high but if we go for one-time investment in die then cost of production is going to down and efficiency and reliability is going to high. In future by designing proper winding and use of neodymium magnet we generate more power from same set up.

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