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Solar Powered Coreless Generator

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***Abstract*—This effort aims to get the best of solar and wind power together. Solar being more consistent requires huge land area while wind which is less consistent requires high altitude. Our device brings the best features of both and further enhanced by reduced friction. The observations indicate that this device has huge potential as it is easily scalable and perform even in poor weather conditions. The input required is minimal due to its 'point friction' design.**

Keywords—Neodymium magnets, solar power, coreless generator, stator, rotor, solar panel, Buck convertor

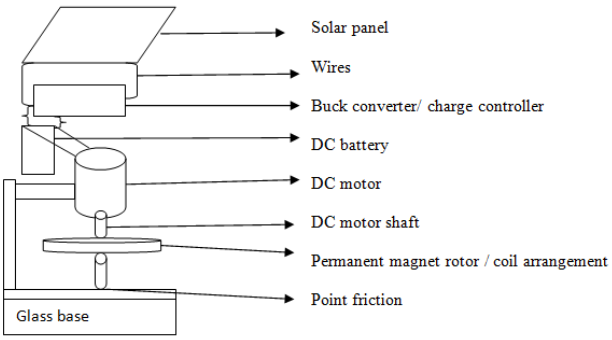
INTRODUCTION

In the current scenario of depletion of natural resources one has to delve on the possibilities of alternative energy resources and devices to derive energy from them. Wind energy, solar energy and wave energy appear to be among the current and favorable options. The prime need is to procure energy from these alternative resources and one need to develop some feasible devices. These devices should be easy to assemble, operate, cost effective, and provide continuous enhanced supply of net output of power. Some of the devices developed in the recent past include induction generator, doubly fed induction generator, electrically excited synchronous generator, permanent magnet synchronous generator etc. Of these devices permanent magnet synchronous generator are gaining popularity among inventors, investors and researchers because these are relatively advantageous in terms of higher power density, better controlling limits and better reliabilities, [1]. Lukasz and Wlodzimierz, found that axial-flux devices are relatively better in performance in low speed power generators systems like wind and water turbine, for heating requirements in local power generator permanent magnet generator is preferable as it is cost effective [2]; axial-flux permanent magnet devices that have coreless stator are relatively more efficient for distribution of power because ironless stator do not cause direct attraction between stator and rotor; this gives such machines an upper level of efficiency in comparison to the conventional ones. Further, due to compact and discoid profile of these devices these become more compatible for mechanical integration with wind turbine, [3]. They further predicted that because of the cost effectiveness these devices are likely to be exploited in domestic and house hold applications. Chung and You have proposed that coreless axial-flux permanent magnet generators are low speed devices enhances output of power; these devices are well equipped with simpler structure, higher efficiency with wide operating speed range, higher energy yield and light weight and these find application in varied technologies [4].

By providing a suitable solar panel the continuous supply of current can be maintained to the set of battery. This connection is interrupted by a buck converter. The application of additional buck /booster battery charger, as it helps to decide to ensure stable operation. Falin and Li, mentioned that a typical voltage of a solar cell is 0.7 V. A solar panel may range from one cell to many, therefore, one can able to produce effective wide range of voltage as per the need [5]. Basically a booster buck converter having a capacitor in the circuit allows the output voltage drop below the input voltage and an additional inductor keeps the output at an average voltage (potential) [6].

In this report we are presenting our device as a design consisting of permanent magnet generator and solar panels. We have used coreless generator in our assembly due to its simple construction and powerful output capacity. The prime feature of this device is that the friction of the rotor plates is reduced to its minimum level. This prevents loss of energy via friction resulting in increased production of energy.

SOLAR POWERED CORELESS GENERATOR



Flow chart representation of solar powered coreless generator

Our current design has the following features

- The solar panels charge a deep cycle battery which is connected to a DC motor.
- The motor has minimal opposing forces and directly connects to the coreless generator through its shaft.
- The coreless generator has no bearings except the point at which it touches the glass base and has its minimal inertia to overcome whilst turning to produce electricity.
- The deep cycle battery (in our experiment 6v, 4.5a) was able to run the rotor plates continuously for more than 48 hours on a full charge.

- The coreless generator along with the motor uses the principle of 'centre of mass' and hence all its weight gets centered on one point only. Thus only its inertia has to be overcome to rotate. This motion is further eased by using glass as a base which provides one of the smoothest surfaces making it almost frictionless.
- The output in our design gets greatly enhanced in comparison to just the solar panels and wind powered coreless generators independently. Furthermore, this design is able to perform with a minimal input which gets replenished by the solar panels even in cloudy conditions.

Below is a working model demonstration of the setup without the solar panels

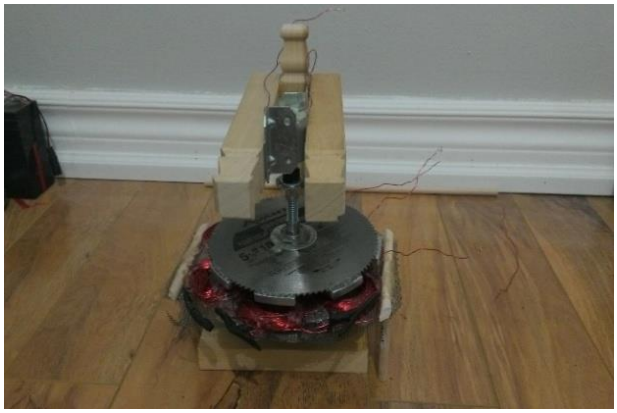


Fig 1 - Point friction coreless generator

Fig 2 - Generator without stator coil

Fig 3 - Rotor plates

Fig 4 - Rotor plates and shaft assembly

THE DESIGN OF THE PRESENT DEVELOPED "SOLAR POWERED CORELESS GENERATOR"

This picture shows the full set up of the point coreless generator. One can see that entire rotor is resting at one point on glass plate. Fig-2 shows the point coreless generator without the stator coil; the designed coil is located in a slit formed between the two plates of rotor and is made to rest on specific stand. This arrangement facilitates pushing in and out of the coil independently without disturbing the rotor and set up.

Fig 3 shows the independent rotor plates. In this case two magnetic plates are used which uses 8 arc neodymium magnets arranged in an alternating north – south polarity. This is easily scalable

- In the current set up magnets rotate around the stator coil, these rotational movements are facilitated by only one ball bearing.
- The bearing has only one point of contact on glass which reduces the friction to its minimum level. The center of gravity of the rotor is matched so that the entire weight of the rotor plates is only on one point; hence, this idea is termed as "point friction".
- Under this set up the rotor has to overcome its own inertia and 'miniscule friction' resulted by the bearing and glass.
- This is evident because the set up is rotated by using small solar powered motor connected to the solar panel. This reflects on the need of very low force to rotate the rotor.
- The present set up has been designed to negate the discrepancies of the models available and efficiently combines the concepts from wind and solar power in order to have consistent and controlled energy output.

THE STATOR COIL ANALYSIS

Below is a table of various single coil constructions

PLEASE NOTE THESE ARE READINGS FOR A SINGLE COIL. STATOR COILS USUALLY HAVE 24 TO 36 OR MORE SUCH COILS CONNECTED IN STAR OR DELTA FORMATION.

AWG	# OF TURNS	Output Volts	Output amps	Input volts	Input amps
22	50	2 v AC	8 MA	1.39 V DC	1.25 AMPS
22	100	1.8 V AC	20 MA	1.33 V DC	1.20 AMP
18	50	0.35 V AC	14 MA	1.39 V DC	1.26 AMP
18	100	1.8 V AC	25 MA	1.35 V DC	1.21 AMP
16	50	0.22 V AC	13 MA	1.33 V DC	1.20 AMP
14	50	0.25 V AC	14 MA	1.31 V DC	1.18 AMP

PHOTO DEMONSTRATIONS

Demonstrative photo of the generators available in the market running with a DC input is given below and a demonstrative photo of the new working model.

Fig 5 – Shows working of coreless generators being used currently in markets. With battery input and AC output in volts (147.5).

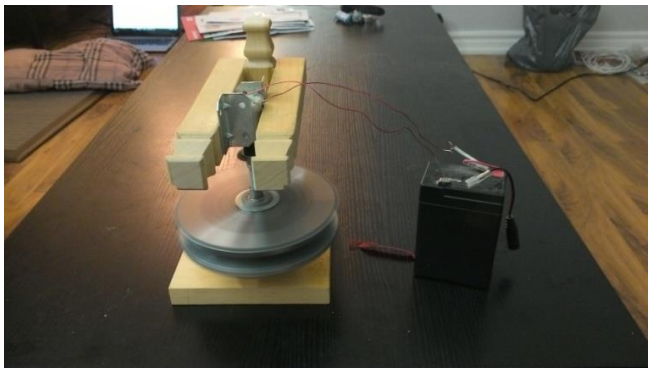


Fig 6 – Shows the current design as a demonstration.

DIFFERENCES BETWEEN CURRENT CORELESS GENERATOR AND OUR NEW DESIGN

Fig-7 External View

Fig-8 Internal view showing magnet slots on the rotor plates

In fig-8 and 9 rotor plates with the shaft and bearing are displayed while fig-10 is displaying the internal arrangement of coil and the shaft.

Fig-9 Rotor plates with the shaft and bearings

Fig-10 View of the coil and shaft

Currently coreless generators are use in wind power generation. Two rotor plates containing strong neodymium magnets are arranged in attraction against each other. A copper magnet coil (stator) is placed between the two rotor plates. The stator coil does not touch the rotor plates. Figure 7 shows an external view; figure -8 shows the internal view of the set up, there are specific slots for the magnets on the inner side of the rotor plates. Fig 9 and 10 show the arrangement of the internal setup of the generator.

Point of distinction	Regular coreless generator	Solar powered coreless generator
Weight	Very bulky	(actual generator is)10- 15 times lighter in comparison
Application	Needs high altitude	Can be set up at ground level
Requirements	Requires long blades	Only requires area of direct sunlight for the solar panels
Friction	Uses two bearings containing 6 – 9 ball bearings each	No bearing only one point of contact
Input	Uses only wind power which is inconsistent at ground level	Uses solar power which is relatively more consistent than wind.

CONCLUSION AND PROSPECTS

In this presentation, the regular coreless generator is modified in order to enhance its workability to meet the requirements as per its application. An effort is made to reduce loss of energy so that its efficiency can be increased. Since its size is scalable it can be used to generate electricity for charging other appliances as well using AC transformers.

CONFLICT OF INTEREST**:** Authors declare no conflict of interest.

Both authors have contributed equally.

REFERENCES

[1] D Ahmed, and A Ahmed, “An optional design of coreless direct drive axial flux permanent

magnet generator for wind turbine”, J of Physics, conference series,

6th Vacuum and surface science conference for Asia and Australia, Vol, 439, 2013, 012039;

DOI: 10.1088/1743-6596/439/1/012039

[2] D Lukasz and K Wlodzimierz, “Permanent magnet disc generator with coreless windings,

COMPEL-The Int J for computation mathematics and electric and electronics engineering”,

Vol, 31-1, pp, 108-118, 2008; http://dx.doi.org/10.1108/033216412111-84850

[3] S M Hosseini, M Agha-Mirsalim and M Mirzaei, “Design, prototype and analysis of low cost

Disc permanent magnet generator with rectangular flat shaped magnets”, Iranian J Sci Technol,

transaction B, Engineering, Vol, 33-B3: pp,191-203,2008

[4] D W Chung and Y M You, “Design and performance analysis of coreless axial-flux permanent

magnet generator for small wind turbines”, J Magnetics, Vol, 19-3, pp, 273-281, 2014

http://dx.doi.org/10.4283/JMAG2014.19.3.273

[5] J Falin and W A Li, “A solar power buck/boost battery charger”, High performance analog product,

Analog Application Journal, Vol, 20:2012

[6] E Williams, “Russian hacker multiplies value of boost converter”, 2015

Link: https://hackaday.com/tag/buck