

# **Vertical Blade Windmill Power Generation Using Multiple-Generator and Single Rotor**

Geethamani.R<sup>1</sup>, Adhithyan.H<sup>2</sup>, Gowtham.S<sup>2</sup>, Hari Prathap.P<sup>2</sup>

Assistant Professor, Department of Electrical and Electronics Engineering, SKCET, Coimbatore, Tamilnadu, India.<sup>1</sup>

UG Students, Department of Electrical and Electronics Engineering, SKCET, Coimbatore, Tamilnadu, India.<sup>2</sup>

**ABSTRACT:** Wind power is used to generate [electric power](#) using airflow through [wind turbines](#) to [mechanically generate power](#). Wind power, is an alternative to burning [fossil fuels](#), it is [renewable](#), widely distributed, [clean](#), produces no [greenhouse gas](#) emissions during operation, and uses little land. The net [effects on the environment](#) are far less problematic than those of [nonrenewable power](#) sources. The main aim of the paper is “to produce current using multi generator and single rotor”. This paper proposes multi-generator to address potential challenges: dimension, cost and reliability. The four electromagnetic induction generators are desired to share the single shaft through spiral bevel gears. These poles of the four generators will be changed as alternate to parallel. This paper discussed about the design procedure of gears, gear life and wind turbine rotors. The output current is stored in series of battery to appliances through converter and step up transformer. The Construction, working, parts of windmill, materials are discussed detailed in this paper.

**KEYWORDS:** Electromagnetic Induction Generator, Wind Turbine, Spiral Bevel Gear, Poles of Generator.

## **I. INTRODUCTION**

The wind energy is an environment-friendly and efficient source of renewable energy. The kinetic energy of the wind can be used to do work. This energy is harnessed by windmill in the past to do mechanical work.. To generate the electricity, the rotary motion of, the windmill is used to turn the turbine of the electric generator. The output of single windmill is quite small and cannot be used for commercial purposes. Therefore, a number of windmills are erected over a large area, which is known as wind energy farm. The each and every windmill is coupled together to get a electricity for commercial purposes.

Wind farms are created when multiple wind turbines are placed in the same location for the purpose of generating large amounts of electric power. There is still a lot of controversy surrounding the pros and cons of wind power and its local impact. The articles listed on this page explore news and information about wind farms. The three-bladed rotor proliferates and typically has a separate front bearing, with low speed shaft connected to a gearbox that provides an output speed suitable for the most popular four-pole (or two -pole) generators.

The author Fujin Deng used a variable speed wind turbine, where multiple permanent magnet synchronous generators (MPMSGs) drive-train configuration is employed in the wind turbine. Such arrangement has been made so that the output ac voltage having a selected phase angle difference among the stator windings of multiple generators. The multiple pole Permanent magnet synchronous generators are cost effective due to multiple pole it induces eddy current and Hysteresis losses so it is reduced by proposed method.

**II. MATERIALS AND METHODS**

**2.1 Windmill using multi generator:**

The Four electromagnetic induction generator are connected in both end of the shaft through coupling. The windmill rotor transmit the power to the four generator through spiral bevel gear. The power output of multi- generator used windmill will be four times of single generator used windmill.

**2.2 Principle of the method:**

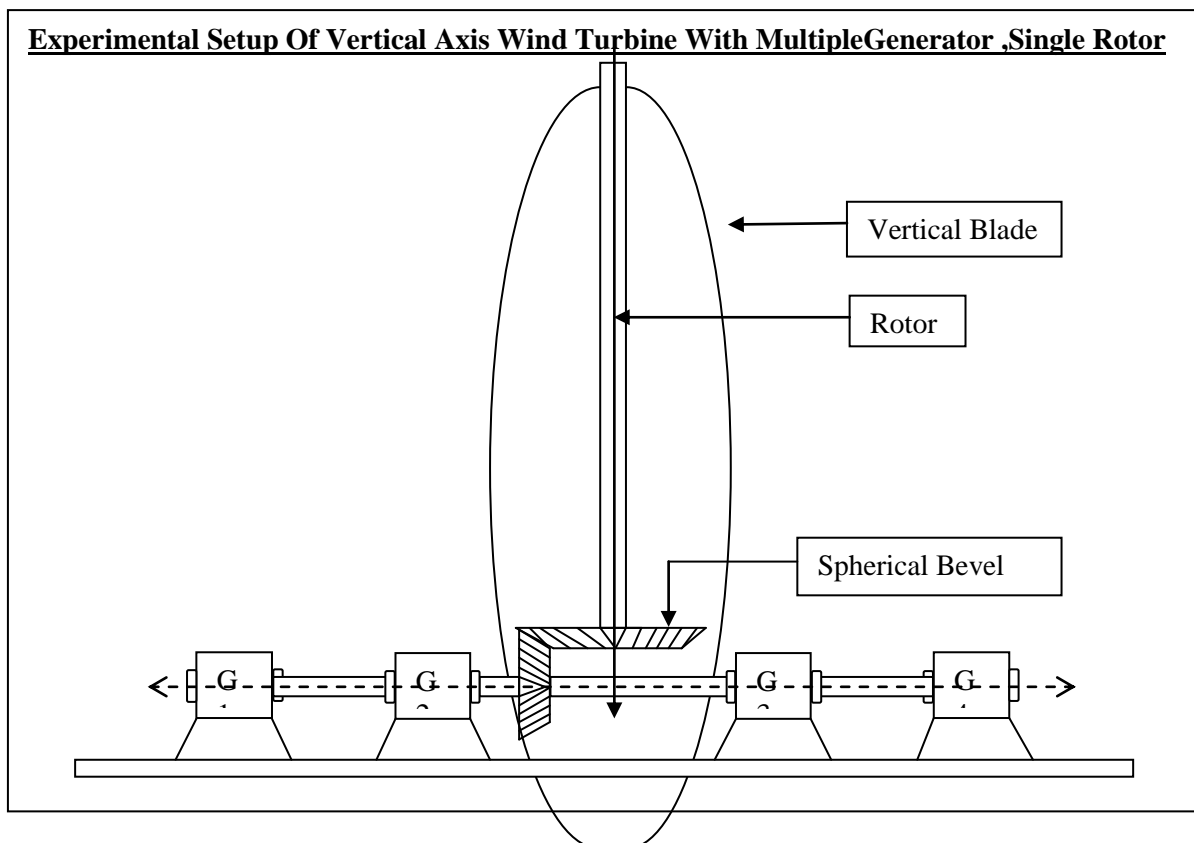
The windmill is works on the principle of generating power through the force of the nature (air). The blades of windmill are rotated due to the force of wind strikes them. The rotating blades are transmitting the power to the generator through the shaft and gear box and generate the electricity.

**2.3 Construction :**

In vertical blade wind turbine, the main parts are follows below:

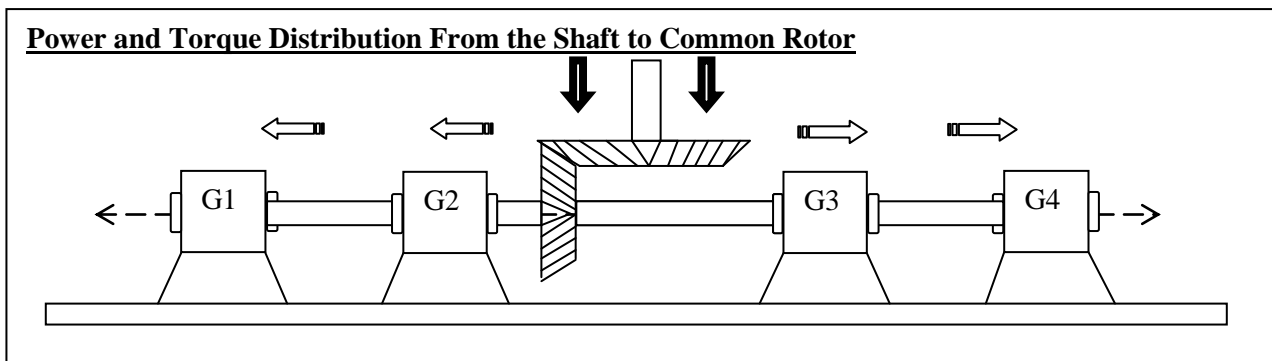
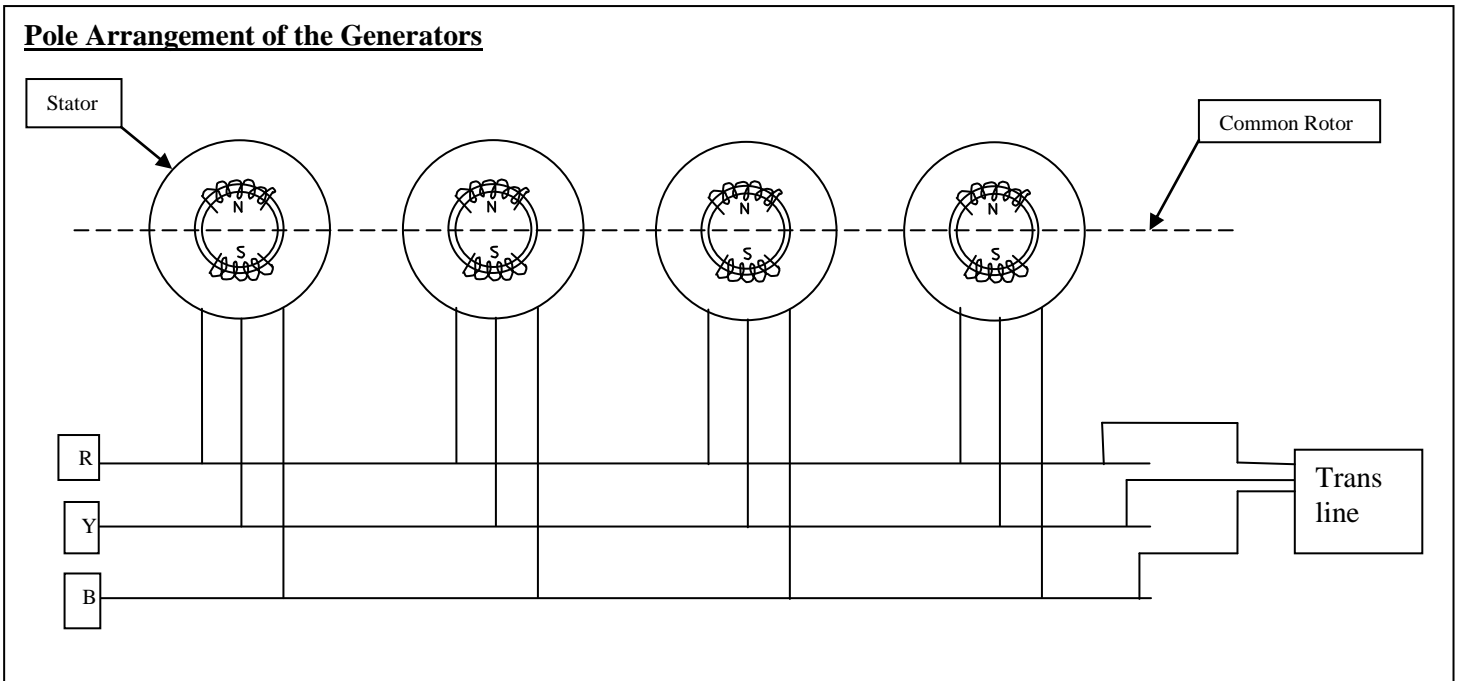
- Blades and rotor,
- Four Electromagnetic Induction Generator
- spiral bevel gear mechanism
- Shaft.

The blade is attached with rotor. The rotor connected with spiral bevel gear through shaft. The gear box consists of driver and driven gear. The one end of the low speed shaft is connected with driver gear and other end is connected with rotor turbine of the windmill. The long high speed shaft is connected at the center of the driven gear. The both end of the shaft is connected with four same generator through coupling.



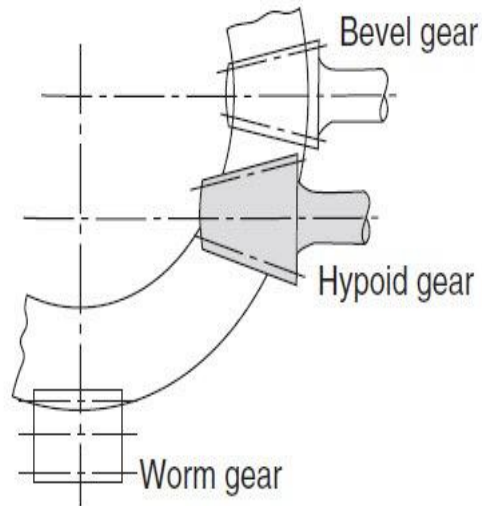
**3. Poles Arrangement of Generator:**

The generator arrangement consists of Electro magnets. The output is taken from the stator. The common Rotor has Electromagnets with small amount of dc supply feed to it. The three phase winding in the stator is used to get the output power.





Spiral bevel gear mechanism



Other types of gears

No	Type	Normal Ratio Range	Efficiency Range
1	Spur	1:1 to 6:1	94-98%
2	Straight Bevel	3:2 to 5:1	93-97%
3	Spiral Bevel	3:2 to 4:1	95-99%
4	Worm	5:1 to 75:1	50-90%
5	Hypoid	10:1 to 200:1	80-95%
6	Helical	3:2 to 10:1	94-98%
7	Cycloid	10:1 to 100:1	75% to 85%

## V. ADVANTAGES AND LIMITATIONS

### Advantages

- More power is generated.
- It is not necessary to connect the same generator and also connect different generator in serious shaft
- We will use all type of generators like permanent magnet D.C. generator, synchronous generator and induction generator
- Gear box is not used, only two spiral bevel is used .One acts as driver and other acts as driven gear.
- The power output is four times compared to single windmill.

**Limitations**

- Initial cost is high
- Efficiency low .
- Maintenance is important and high .
- Design is complex for gear and rotor turbine.
- It require lot of space.

**VI. CONCLUSIONS**

This paper presents a new methodology for power generation using four same generators of single rotor, further advantage of the method is cost efficient and generating high power with a same torque. Theoretical analysis and experimental work is carried out to confirm validity of the analytical work. we conclude that high power produced by single rotor which is the double of the one set of DC generator and rotor.

**REFERENCES**

1. S. N. Bhadra, D. kashtra, S. Banerjee (2005), wind electrical system, New Delhi: oxford university press, ISBN – 13: 978-0-19-567093-6; ISBN – 10: 0-19-567093-0.
2. Faculty of mechanical engineering (2011), design data book of engineering, Coimbatore: kalaikathir achagam page no.: 1.40, 8.1 – 8.53.
3. Fujin Deng, Zhe Chen (2010), wind turbine based on multiple generators drive-train configuration, E-ISBN: 978-1-4244-8509-3, Print ISBN: 978-1-4244-8508-6 page no.: 1- 8.
4. 4244-8509-3, Print ISBN: 978-1-4244-8508-6 page no.: 1- 8.
5. Siva Sakthi Velan<sup>1\*</sup>, G. Muthukumaran<sup>1</sup> S. Balasubramanian<sup>2</sup>
6. Windmill Power Generation Using Mult-Generator and Single Rotor
7. Shigley J. E., Mischke. C.R., Mechanical Engineering Design, Sixth Edition, Tata Mcgraw – Hill, 2003.
8. Ugural A. C., Mechanical Design An Integrated Approach, Mcraw – Hill, 2003.