© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I9-1715867

# Design And Analysis of Air Core Generator

DINESH PAWAR[1], JAYDEEP BHALEKAR[2], RISHIKESH RAUT[3], YOGIRAJ JAGDHANE[4], PROF. P. A. MAHALLE[5]
[1, 2, 3, 4, 5] *JSPM's Rajarshi Shahu College of Engineering*

***Abstract-*** ***This project focuses on the design and development of an Air Core Generator, which generates electrical energy without using a ferromagnetic core. The system operates on the principle of electromagnetic induction, where a rotating magnetic field induces voltage in stationary coils. Unlike conventional generators, the absence of an iron core reduces core losses such as hysteresis and eddy current losses, thereby improving efficiency. The air core generator is lightweight, has reduced heating, and provides better performance at high frequencies. It can be used in applications where efficiency, speed, and reduced energy losses are important. This project demonstrates a cost-effective and eco-friendly approach to power generation using simple mechanical and electrical components.***

***Keywords-*** ***Air Core Generator, Electromagnetic Induction, Core Loss Reduction, Eddy Currents, Renewable Energy, Electric Generator, Sustainable Powers.***

## I. INTRODUCTION

The increasing demand for electrical energy and the need for efficient power generation systems have led to the development of advanced generator technologies. Conventional generators use iron cores to enhance magnetic flux, but they suffer from energy losses such as hysteresis and eddy current losses, which reduce overall efficiency.

To overcome these limitations, the concept of an Air Core Generator is introduced. In this system, the magnetic circuit does not use any ferromagnetic material, and the magnetic field interacts directly with air. This eliminates core losses and reduces heating problems.

The generator works on the principle of electromagnetic induction, where a rotating magnet induces voltage in stationary coils. Due to the absence of a core, the system is lighter, more efficient at high speeds, and requires less maintenance.

This project aims to design and develop a simple air core generator model to demonstrate efficient energy conversion and highlight its advantages over conventional generators.

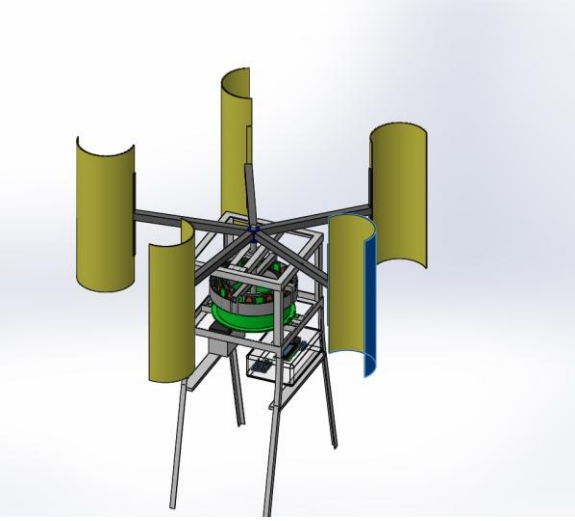

Fig 1.1 Air Core Generator

LITERATURE SURVEY

1 Many researchers have studied generator efficiency and methods to reduce energy losses. The use of air core technology has gained attention in recent years due to its ability to eliminate core-related losses.
2 C. C. Chan (2007) discussed advancements in electrical machines and emphasized improving efficiency in energy systems. His work highlighted the importance of reducing losses in electrical devices.
3 J. Larmenier and J. Lowry explained the working principles of electric generators and the importance of magnetic field design in improving performance.
4 Several studies have shown that air core systems can operate efficiently at high frequencies and reduce heating effects. These systems are particularly useful in modern applications such as

wireless power transfer and high-speed generators.

5 Based on previous research, it is clear that air core generators offer significant advantages in terms of efficiency, weight reduction, and performance.

## II. METHODOLOGY

The methodology of this project involves the design, fabrication, and testing of an air core generator system.

### 2.1 Component Selection

The main components selected for the project include permanent magnets, copper coils, a rotating shaft, bearings, and a supporting frame. A DC motor is used to rotate the magnets.

### 2.2 Mechanical Assembly

A base frame was prepared to support the generator setup. The shaft was mounted on bearings to allow smooth rotation. Permanent magnets were fixed on the rotating part.

### 2.3 Coil Arrangement

Copper coils were wound and placed around the rotating magnets. These coils act as the stator and are responsible for generating electrical energy.

### 2.4 System Integration

The rotating magnets create a changing magnetic field, which induces voltage in the coils. The output is collected through connecting wires and measured using electrical instruments.

### 2.5 System Testing

The generator was tested under different rotational speeds. Output voltage, current, and efficiency were observed and recorded.

### Working Principle

The air core generator works on the principle of electromagnetic induction. When the magnets rotate, they create a changing magnetic field around the coils. According to Faraday's Law, a changing magnetic field induces an electromotive force (EMF) in the coils. This EMF generates electrical current when the circuit is closed.

Since there is no iron core, losses due to hysteresis and eddy currents are eliminated. This results in improved efficiency and reduced heat generation.

## III. EXPERIMENTAL SETUP

### 3.1 Voltage Generation

The induced voltage depends on the speed of rotation and the strength of the magnetic field. Higher speed results in higher voltage generation.

### 3.2 Current Output

The current produced depends on the load connected to the generator and the number of coil turns.

### 3.3 Efficiency Analysis

Due to the absence of a core, the system shows reduced losses and improved efficiency compared to conventional generators.

### 3.4 Performance Observation

The generator was tested at different speeds, and it was observed that output increases with speed while maintaining low heat generation.

The experimental analysis of the hybrid electric bicycle was carried out to evaluate the performance of the motor, battery, and auxiliary charging systems. The main objective of this analysis was to determine the energy consumption, charging efficiency, and overall system performance.
charged.

## IV. RESULTS AND DISCUSSION

The experimental results show that the air core generator operates efficiently with minimal energy losses.

The absence of an iron core eliminates hysteresis and eddy current losses, which are common in conventional generators. The system also showed reduced heating and smoother operation.

The output voltage increased with the speed of rotation, confirming the principle of electromagnetic

induction. Although the output power is lower compared to conventional generators, the efficiency and simplicity of the system make it suitable for specific applications.

The results demonstrate that air core generators are lightweight, efficient, and environmentally friendly.

## V. CONCLUSION

The Air Core Generator developed in this project demonstrates an efficient and innovative method of generating electrical energy without using a ferromagnetic core.

The system successfully eliminates core losses, reduces heating, and improves efficiency. It is lightweight, simple in design, and requires less maintenance.

Although the output power is comparatively lower, the advantages of reduced losses and better high-speed performance make it suitable for modern applications. Overall, this project highlights the potential of air core technology in developing efficient and sustainable energy systems.
future.

## REFERENCES

[1] C. C. Chan, “The State of the Art of Electric Vehicles,” Proceedings of the IEEE, vol. 95, no. 4, pp. 704–718, 2007

[2] J. Larmenier and J. Lowry, Electric Vehicle Technology Explained, John Wiley & Sons Ltd., 2012.

[3] N. Beemkumar et al., “Experimental Investigation on Air Cooler with Thermal Storage,” IEEE Transactions on Energy Conversion, 2010.