



# IJRASET

International Journal For Research in  
Applied Science and Engineering Technology



---

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume:** 14    **Issue:** III    **Month of publication:** March 2026

**DOI:** <https://doi.org/10.22214/ijraset.2026.78141>

[www.ijraset.com](http://www.ijraset.com)

Call:  08813907089

E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)

# Design and Development of a Multi-Source Hybrid Renewable Energy Generation System Using Solar, Wind and Piezoelectric Power

Dr.N.Padma,<sup>1</sup>V.Ramu<sup>2</sup>Sravya, Viruvuru Abhishek<sup>3</sup>, Muddapati Venkata Nikhil<sup>4</sup>, Arakonam Sesi Teja<sup>5</sup>, Mohammed Khadeer<sup>6</sup>

ME,(Phd),Department of-Associate Professor<sup>1</sup> Mechanical Engineering, Geethanjali Institute of Science and Technology Nellore, India

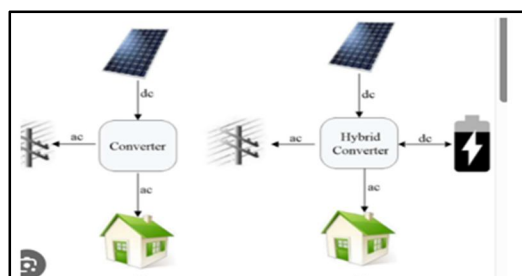
Assistant professor, Department of<sup>2</sup> Geethanjali Institute of Science and Technology, Nellore, India, Mechanical Engineering

<sup>3,4,5,6</sup>Students(B.Tech), Department of Mechanical Engineering, Geethanjali Institute of Science and Technology, Nellore, India

## I. INTRODUCTION

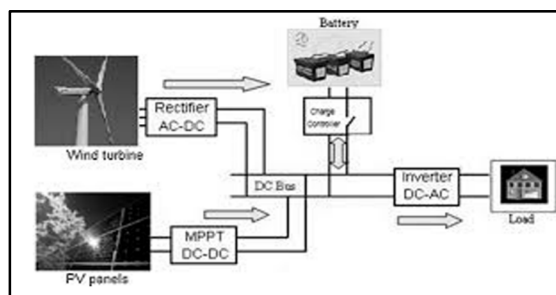
A hybrid power generation system equipped with a smart energy management unit and a high efficiency inverter. The system is designed to automatically select and switch between power sources based on availability, to optimize efficiency. Such a system not only improves energy reliability and quality but also enhances sustainability and operational cost effectiveness, making it suitable for rural electrification, backup power, and smart home applications.

Despite the potential of hybrid systems, efficient power conversion remains a key challenge. Traditional inverters used in these systems often suffer from low conversion efficiency, poor voltage regulation, and limited adaptability to varying input conditions. Therefore, there is a need for a high efficiency inverter system that can handle dynamic input from multiple sources and deliver a stable, reliable AC output.



## II. AIM & OBJECTIVE

This paper aims to introduce a novel hybrid power system combining piezoelectric materials, a 360° omnidirectional turbine, solar panels, and solar energy. Our objectives are to: Analyze the design and function of each subsystem (piezoelectric elements, omnidirectional turbine, solar panels). Explore strategies for managing and integrating harvested energy for grid connection or local use. Address challenges like power conversion efficiency and system optimization. Evaluate the system's environmental benefits and adaptability to diverse environments.



### III. WORKING SUMMARY

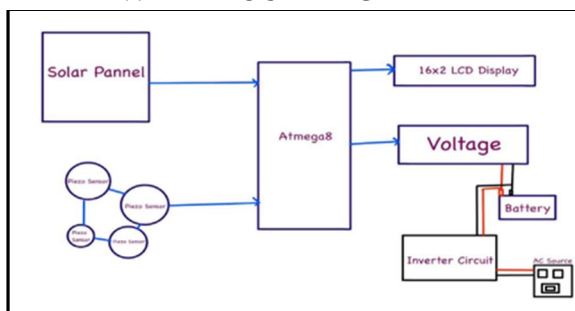
#### A. Energy Collection

captures Vibrations from wind, footsteps, or traffic cause the piezoelectric materials to generate a voltage. The 360° wind turbine captures power wind from any direction, rotating a shaft. Sunlight hits the solar panels, creating electricity through the photovoltaic effect. Conversion: The piezoelectric voltage might need processing to become usable DC electricity. The wind turbine's shaft rotation is converted into AC electricity by a generator. Solar panels produce DC electricity directly.

#### B. Integration and Distribution

Depending on the system design, DC electricity from piezo elements and solar panels might be converted to AC to match the grid. All generated AC electricity (from the wind turbine and potentially converted DC) is combined and managed by a power management system. This system regulates the overall power output and can be connected to the grid for distribution or used directly for local applications.

### IV. BLOCK DIAGRAM



### V. LITERATURE SURVEY

of electric and solar vehicles and provides an overview of a typical solar vehicle. The history and future of solar-powered automobiles are discussed. Anoop kumar et al. (2017) tells

focuses on an idea about solar car technology and its integration into society which solves the major problem of pollution and fuel in now days. A complete experiment of solar car has been prepared in this paper by using talk about the chassis technology earlier to the 1980s had been progress as a technology of mechanical engineering field of that time

vehicle control present fault detection and isolation is becoming one of the most important aspects in vehicle system design. In order to achieve this FDI schemes, particular vehicle subsystems integrated with a controller have been pro

### VI. MATERIALS REQUIRED

- WIND MILL
- SQUARE TUBE
- SPUR GEAR
- SOLAR PANEL
- WIRE
- DYNAMO MOTOR
- MULTIMETER
- SENSOR PEZIOELECTRIC
- DC TO AC CONVERTER
- BEARING
- BEARING BUSH

#### A. Windmill

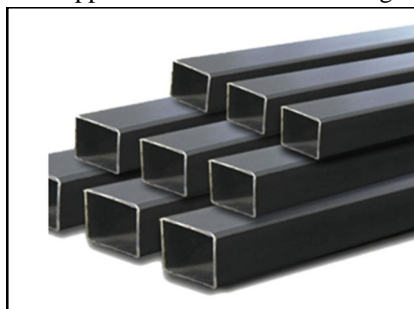
pump water, generate electricity, or drive other machinery. Windmills were used throughout the northwestern during the 9th century, and the vertical windmill first appeared in Persia appeared in first a panemone windmill or

.in the 12th century Europe



### B. Square Tube

tube steel or box section. Circular HSS are sometimes mistakenly called Rectangular and square HSS are also commonly called dsteel pipe, although true steel pipe is actually dimensioned and classed differently from HSS. Square tubes are generally use maintenance and structural purposes. Some examples of applications would be building construction, railings, and sign posts for.



### C. Spur Gear

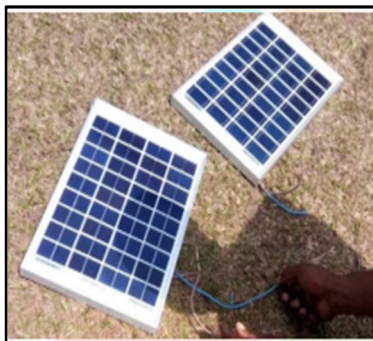
straight, parallel Spur gears are one of the most popular types of precision cylindrical gears. These gears feature a simple design of e gear is teeth positioned around the circumference of a cylinder body with a central bore that fits over a shaft. In many variants, th .machined with a hub which thickens the gear body around the bore without changing the gear face.



### D. Solar Panel

#### Specifications Of The Solar Panel:

- Material : Silicon.1
- Wattage : 10W.2
- Type : Polycrystalline.3
- Q4.No of cells: 64
- Output Voltage: 20V.5
- Q6.Voltage at maximum power: 16.5V
- Tolerance: 5%.7



**E. Wires**

transmitting electrical power between the components of a hybrid power generation system, such as the solar panel, wind turbine, battery, inverter, and controller. Wire connections are essential for the system.

**F. Dynamo Motor**

A gear motor is usually a simple DC electric motor with a gear mechanism attached to it  
Volts 12 – RPM 1000 – DC Motor

**Specifications and Features**

- RPM (revolutions per minute): 1000
- DC 12 volt Operating Voltage
- Gearbox: Plastic (spur) Gear attached
- Internal hole with 6mm shaft dia
- cm): 0.5-Torque (kg
- (Current with no load = 60 mA (Max
- (mA load current (Max 300



**G. Multimeter**

A multimeter is a test device used to quantify at least two electrical qualities, basically: voltage (volts), flow (amps) and obstruction (ohms). It is a standard symptomatic device for specialists in the electrical/electronic businesses.

**H. Piezoelectric Sensor**

some The piezoelectric transducers work on the principle of piezoelectric effect. When mechanical stress or forces are applied to certain materials along certain planes, they produce electric voltage. This electric voltage can be measured easily by the voltage measuring instruments, which can be used to measure the stress or force.



**I. DC to AC Convertor**

can easily convert DC to AC power, which is the electric current for all inverter generators. An inverter, including those found in -directionally, a component called an H-ows in one direction to a current that flows biappliances. To change a current that only fl bridge constantly alters the current’s flow several -Bridge within the inverter changes the polarity. Powered by transistors, the H alternating current output times a second to achieve the desired.

**J. Bearing**

aces bearing separation between the to maintain the balls that uses element bearing-rolling is a type of ball bearing A. loads. It achieves this by using at least two axial and radial. The purpose of a ball bearing is to reduce rotational friction and support races to contain the balls and transmit the loads through the balls.

**K. Bearing Bush**

is a simple, cylindrical component NG B used to reduce friction plain bearing or sleeve bearing. Bush also known as a Bearing outer surface, and a lubrication film between them. Bearing between two moving parts. It consists of a cylindrical inner surface, an bushings are often made from materials like bronze, brass, steel, or polymer composites.



**VII. PROJECT IMAGE**



**VIII. CONCLUSION**

approach offers the potential for enhanced energy source-The proposed system presents several potential advantages. The multi s, the security and reliability by mitigating dependence on specific weather conditions. Furthermore, by relying on renewable source based power generation, contributing to a more-l fuelsystem significantly reduces its environmental footprint compared to fossi directional -sustainable future. Additionally, the ability to utilize a variety of energy sources, including ambient vibrations, omni in diverse environments, both remote and urban wind, and sunlight, enhances the system's adaptability for deployment.

**REFERENCES**

[1] lectronics andNitashree, et.al., “Foot Step Power Generation Using Piezoelectric Material,” International Journal of Advanced Research in E Communication 15Oct 20 ,2506-Engineering, vol. 4, pp. 2503

[2] Prof. Namrata J. Helonde, Punam Suryawanshi, ArunAnkita Bhagwatkar, Arun Wagh, Pradhnya Vetal<https://www.ijraset.com/research-power-paper/footstep> Publisher Name : IJRASET9653 -sensor: 2321-piezoelectric-using-generation

[3] 18-09-Retrieved 2015 .11-06 -ion Prototype". Earthship Biotechure. Archived from the original on 2022Vertical Axis Wind Power Generat

[4] 2020.2303209-2-Footstep Power Generation Using Piezoelectric Sensor<https://eudl.eu/pdf/10.4108/eai.27>



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)