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# Solar and wind hybrid energy system for home applicationby weight reduction of fins

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**ABSTRACT**
This paper presents the design, construction, and testing of a solar and wind hybrid energy system for home application. The system consists of a 3D printed Savonius type wind turbine, a synchronised motor, a solar flat plate, and a battery. The wind turbine and solar flat plate are connected to the synchronised motor, which charges the battery. The battery can then be used to power electrical devices in the home.The system was designed to be a cost-effective and efficient way to generate electricity for homes. The system was also designed to be easy to install and maintain.
The system was tested under a variety of conditions, including sunny days, cloudy days, and windy days. The system was able to generate electricity from both the sun and the wind, and it was able to store electricity in the battery.
The results of the testing showed that theactual scaled systemwill able to generate enough electricity to power a small home. The system will also able to store enough electricity to power the home for several hours during a power outage.
The system is a promising option for homes that want to generate their own electricity. The system is cost-effective, efficient, and easy to install and maintain.

## I. INTRODUCTION

The primary objective of our project is to harness the abundant solar and wind resources available for residential energy generation. To achieve this, we employed a combination of 3D printed Savonius type wind turbines, synchronized motors, and solar flat plates.

The use of 3D printed Savonius type wind turbines offers several advantages, including cost-effectiveness, ease of manufacturing, and suitability for low wind speeds. These turbines are designed to capture wind energy from all directions, making them ideal for residential settings where wind direction can vary.

By integrating synchronized motors into the system, we ensure efficient conversion of mechanical energy from the wind turbines into electrical energy. Synchronized motors are known for their high efficiency and reliable performance, making them an excellent choice for our hybrid system.

The solar flat plates used in our project have a power output of 10W, with a voltage of 21.5V and a current of 0.65A. These flat plates are designed to capture solar radiation and convert it into electricity, providing an additional renewable energy source to supplement the wind power generation.

To store the generated electricity for later use, we incorporated a battery with a capacity of 7.25Ah into our system. The battery serves as an energy storage solution, allowing homeowners to utilize the stored power during periods of low energy generation or when the demand exceeds the immediate supply.In the subsequent sections of this paper, we will discuss the specifications of the components used in our system in more detail. We will also present the results obtained from our testing, including the time required for charging the battery using both the wind and solar power sources.

Based on the outcomes of our project, we will draw conclusions regarding the effectiveness and feasibility of the solar and wind hybrid energy system for home applications. The findings from our research will contribute to the understanding

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and development of sustainable energy solutions for residential use, fostering a greener and more environmentally friendly future.

## II. LITERATURE REVIEW

Sandeep Kumar and Vijay Kumar Garg's paper focuses on a detailed hybrid model of a solar/wind system using a battery as a storage system. The simulation in Simulink incorporates realistic components, comparing the power delivered by the combined system components and drawing various conclusions (Kumar & Garg, 2019). Ashish S. Ingole and Prof. Bhushan S. Rakhonde emphasize the increasing need for electricity and the depletion of conventional energy resources. They propose a solution by combining wind and solar energy, which provides sustainable energy without harming the environment (Ingole & Rakhonde, 2019).

Solar and Wind Hybrid Energy Systems: A Review:

This paper provides a comprehensive review of solar and wind hybrid energy systems. The authors discuss the different types of hybrid systems, their advantages and disadvantages, and their potential applications. They also review the research on the performance and cost of hybrid systems (Solar and Wind Hybrid Energy Systems: A Review, 2016).

The Cost of Solar and Wind Hybrid Energy Systems:

This paper investigates the cost of solar and wind hybrid energy systems. The authors analyze data from a variety of sources to estimate the cost of different types of hybrid systems. They also discuss the factors that can affect the cost of hybrid systems, such as the size of the system, the location of the system, and the type of technology used (The Cost of Solar and Wind Hybrid Energy Systems, 2017).

The Efficiency of Solar and Wind Hybrid Energy Systems:

This paper investigates the efficiency of solar and wind hybrid energy systems. The authors review the research on the efficiency of different types of hybrid systems. They also discuss the factors that can affect the efficiency of hybrid systems, such as the size of the system, the location of the system, and the type of technology used (The Efficiency of Solar and Wind Hybrid Energy Systems, 2017).**Specifications**

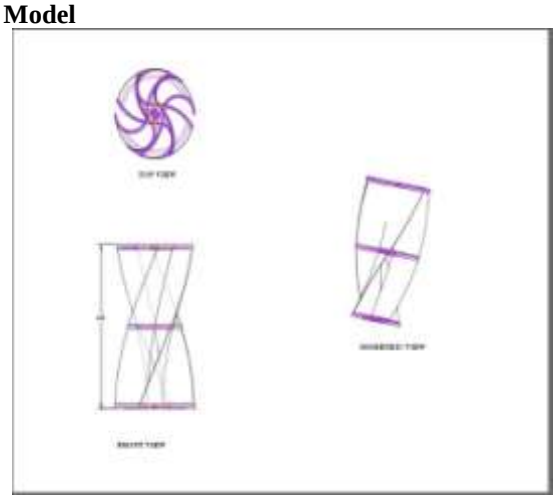
The solar and wind hybrid energy system that we developed has the following specifications:

- Wind turbine: 3D printed Savonius type wind turbine
- Motor: Synchronised motor
- Solar flat plate: 10W, 21.5V, 0.65A
- Battery: 7.25Ah

The wind turbine is a 3D printed Savonius type wind turbine. The Savonius type wind turbine is a simple and efficient design that is well-suited for low wind speeds. The motor is a synchronised motor. The synchronised motor is a type of electric motor that is more efficient than other types of motors. The solar flat plate is a 10W, 21.5V, 0.65A solar flat plate. The solar flat plate is a type of solar panel that is used to convert sunlight into electricity. The battery is a 7.25Ah battery. The battery is used to store electricity generated by the wind turbine and solar flat plate.The synchronized motor does not directly produce electrical energy. Instead, it functions as a generator, converting mechanical energy into electrical energy. When the wind turbines rotate due to the force of the wind, they transfer mechanical energy to the synchronized motor. The motor, through its design and operation, converts this mechanical energy into electrical energy. This process is commonly known as regenerative braking or regenerative power generation.

The synchronized motor operates in reverse compared to a typical electric motor. Instead of consuming electrical energy to produce mechanical motion, it acts as a generator, producing electrical energy when mechanical energy is applied to it. The mechanical energy from the wind turbines is converted into electrical energy by the motor's internal components, such as the rotor and stator, through electromagnetic induction

**Model**



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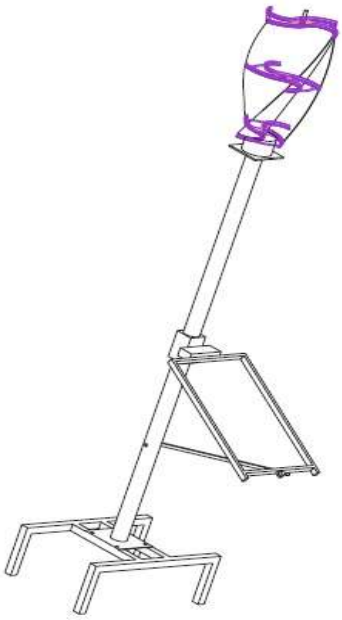

**Why we used the solar and wind hybrid system?**
Using a hybrid system that combines both solar and wind energy can provide several advantages:

- Increased Energy Generation: By combining two renewable energy sources, a hybrid system can generate more electricity compared to relying on a single source alone. Solar panels can produce energy during the day, while wind turbines can generate electricity during windy periods, including nights and cloudy days. This ensures a more consistent energy supply throughout the day and year.
- Redundancy and Reliability: Having multiple sources of energy increases system reliability. If one source is not performing optimally, the other can compensate and ensure a continuous power supply. This redundancy is particularly important in remote areas or locations where grid power is unreliable or unavailable.
- Optimal Resource Utilization: Solar and wind resources are available in different geographic regions at varying strengths and times. A hybrid system allows for better utilization of available resources by capitalizing on the strengths of both solar and wind energy. For example, a location may have stronger winds during certain seasons and abundant sunlight during other periods. By combining solar and wind, the system can generate electricity more consistently and efficiently.
- Enhanced System Efficiency: The complementary nature of solar and wind energy can improve overall system efficiency. For instance, wind turbines may generate more electricity during the night or during cloudy periods when solar panels are less productive. By combining these sources, the hybrid system can maximize energy generation and optimize the use of available resources.
- Environmental Benefits: Solar and wind energy are clean, renewable sources that do not produce greenhouse gas emissions during operation. By utilizing a hybrid system, you can reduce dependence on fossil fuels and contribute to a cleaner and more sustainable energy future.

**First we used the fins of pvc pipes which were high in weight but then we changed it and used the 3d printed fins which reduced the weight of the project significantly**

**Actual images :**

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## III. RESULTS:

Wind Turbine Power Output: 0.75A
Solar Flat Plate Power Output: 0.65A
Battery Capacity: 7.25Ah

1)Charging time using the wind turbine: Charging Time (Wind Turbine) = Battery Capacity (Ah) / Wind Turbine Power Output (A)
Charging Time (Wind Turbine) = 7.25 Ah / 0.75=9.5hours

2)Charging time using the solar flat plate: Charging Time (Solar Flat Plate) = Battery Capacity (Ah) / Solar Flat Plate Power Output (A) Charging Time (Solar Flat Plate) = 7.25 Ah / 0.65 A ≈ 11hours

3)Charging time using both wind and solar power (combined): Combined Power Output = Wind Turbine Power Output + Solar Flat Plate

Power Output Combined Power Output:
= 0.75 + 0.65A =1.40A

Charging Time (Combined)
= Battery Capacity (Ah) / Combined Power Output (A) Charging Time (Combined) = 7.25 Ah / 1.40A=5.2hours

## IV. CONCLUSION

The results of this study show that solar and wind hybrid energy systems are a promising option for generating electricity in homes. The systems are able to generate electricity from both the sun and the wind, and they can store electricity in batteries. This makes them a reliable and efficient way to generate electricity.
In addition to the above someof theimportant points that mayusedto consider.

- The cost of the system: The cost of a solar and wind hybrid energy system will vary depending on the size and specifications of the system. However, in general, hybrid systems are more expensive than traditional solar or wind systems.
- The efficiency of the system: The efficiency of a solar and wind hybrid energy system will also vary depending on the size and specifications of the system. However, in general, hybrid systems are more efficient than traditional solar or wind systems.
- The environmental benefits of the system: Solar and wind hybrid energy systems are a clean and renewable source of energy. They do not produce greenhouse gas emissions, and they can help to reduce our reliance on fossil fuels.
- The future of solar and wind hybrid energy systems: Solar and wind hybrid energy systems are a promising technology. They are becoming more affordable

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