

# Electricity Generated by Using Solar & Wind Energy

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## Abstract

*Now a day's electricity become a most essential need of human beings, from household to industrial work. All the conventional energy resources are depleting day by day. So we have to shift from conventional to non-conventional energy resources to produce electricity. Renewable sources do not have any detrimental effect on the environment. Renewable energy sources i.e. energy generated from solar, wind, biomass, hydro power, geothermal and ocean resources are considered as a technological option for generating clean energy. But the energy generated from solar and wind is much less than the production by fossil fuels, however, electricity generation by utilizing PV cells and wind turbine increased rapidly in recent years. Solar panels are used for converting solar energy into electricity and wind turbines are used for converting wind energy into electricity. Solar-wind hybrid system is basically involves the integration of solar energy plant and a wind energy plant that will give continuous power. A during bad weather conditions the production can be shifted from one plant to other plant with the help of a microcontroller. A microcontroller ensures the optimum utilization of resources and it also increases the efficiency of the combined system as compared to the individual mode of generation. This hybrid solar-wind power generating system can be used for both industrial and domestic applications. So, the purpose of the project is to generate electricity without using non-renewable resources and without damaging the nature balance.*

**Keywords** – Solar Energy, Wind Energy, PV Cell, Renewable Energy, Clean Energy, Hybrid Power System, Electrical Energy Generation.

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## Introduction:

The hybrid power means something which is made by the combination of solar & wind power with storage element. Hybrid energy generation is more important because the wind will not flow continuously and sun radiation is only present approx. 8 to 10 hours in a day. So for continuous power it is important to hybridize the solar and wind power with the storage batteries. The hybridization in India has large prospect because over 75 % of Indian household face the problem like power cut specially in summer.

For this research, solar energy system is integrated with wind turbine system to form a hybrid renewable energy system. Since the power output of these renewable energy is ultimately depends on climatic conditions such as temperature, solar irradiance, wind speed etc., the instability of the system output is compensated by adding a suitable energy storage system. These types of systems are not connected to the main utility grid. The best applications for these type of systems are in remote areas, such as rural villages, in telecommunications etc. The importance of hybrid systems has grown as they appear to be the right solution for a clean and distributed energy production. This project presents the Solar-Wind hybrid Power system that harnesses the renewable energies in Sun and Wind to generate and supply electricity to a private house, farm house, a small company, an educational institution or an apartment house depending on the need at the site where used.

## Methodology:

1. Project Selection
2. Concept Development
3. Data Collection
4. Data Analysis
5. Concept Design
6. Final Design
7. Material Procurement
8. Machining Process

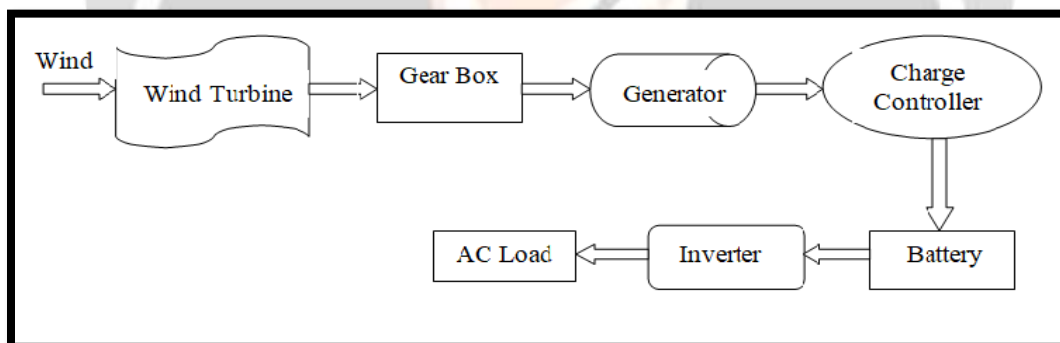
9. Complete Manufacturing
10. Testing
11. Documentation & Costing

### Objectives:

1. The main objective of this project is to generate electric power through the fabrication of Vertical Axis Wind Turbine and Solar energy.
2. To make non-conventional system which will give continuous & sufficient power in all working conditions.
3. To develop a small scale a hybrid solar vertical wind turbine model for assessing feasibility of system.
4. To design the solar-wind energy system is cost effective, reliable and also efficient.
5. In Remote areas implementing power systems units at each apartment.
6. To compare the power output of the hybrid system with the required electric load demand of domestic household.

### Wind Energy:

Wind is a renewable source of energy. The wind is available almost 24 hours in earth's eco system. Wind energy is the kinetic energy associated with the movement of atmospheric air. It has been used for hundreds of years for sailing, grinding grain and for irrigation. More recently, wind energy has also been used for electricity generation. Wind energy is the energy which is extracted from wind. For extraction we use wind mill. Wind power is basically electricity produced by a generator, which is driven by a turbine according to flowing air's aerodynamics.



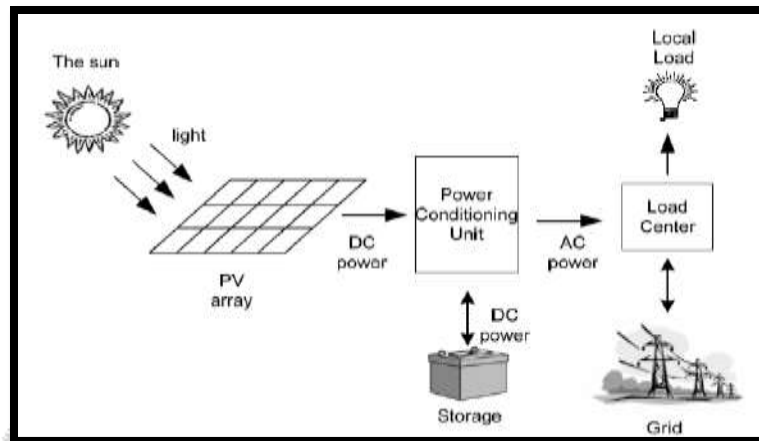
**Fig.No.1. Wind Energy Conversion System**

When air flows then it is having some kinetic energy with it which is known as wind energy. This kinetic energy is converted into mechanical energy by the wind turbine, which is used to rotate the shaft of the generator. Electric generator inside the turbine converts the mechanical power into the electric power. The initial investment of the system varies depending on the type of turbine used. The best part about producing electricity with the help of wind energy is that wind is available for almost 24 hours in day. Generation of electricity from wind energy is depend upon the wind velocity acting on the turbine. As the wind speed increases power generation is also increases. The power generated from wind is not continuous its fluctuating. For obtain the non-fluctuating power we have to store in battery and then provide it to the load

### Solar Energy:

Solar energy is that energy which we get from the sun in form of radiation. Solar energy is present on the earth continuously. By adopting the appropriate technology for the concerned geographical location, we can extract a large amount of power from solar radiations. Specially, in a country like India where sun shines for almost 300 days in a year, it is therefore a convenient mode of electricity production. Solar Energy is the conversion of energy from sunlight into electricity, either directly using photovoltaic (PV), indirectly using concentrated solar power, or a

combination. Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam.



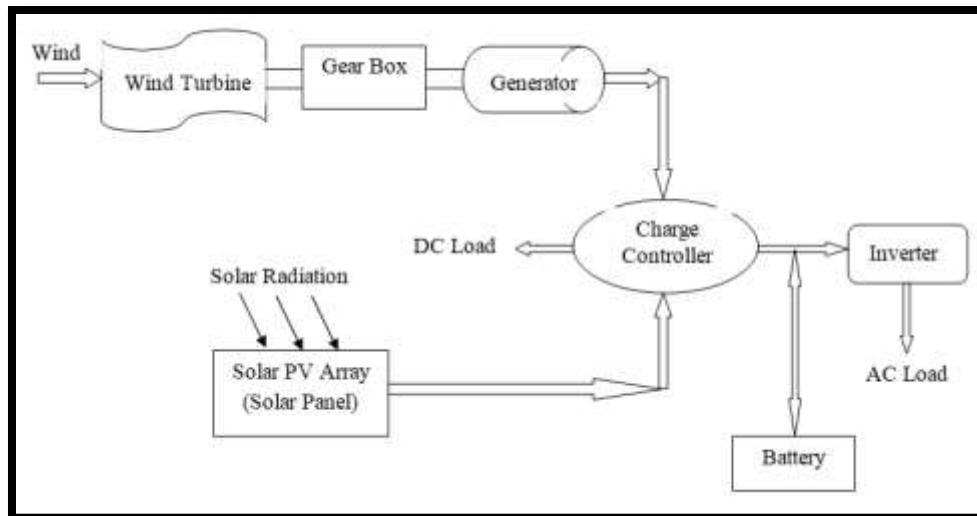
**Fig.No.1. Solar Energy Conversion System**

Solar power is converted into the electric power by a common principle called photo electric effect. When the sun light hits the semiconductor surface of a solar cell, electron springs up and attracted towards the N type semiconductor material. This will cause more negatives in the N-type and more positives in the P-type semiconductors generating a higher flow of electricity. This is known as the Photovoltaic effect. The generated electricity can be used to power a load or can be stored in a battery. The amount of electrical energy generated by a PV cell depends on its efficiency (type of PV cell), its size (surface area), the position and intensity of sunlight striking the surface.

#### ***Solar-Wind Hybrid Power System:***

The major disadvantages of using independent renewable energy resources are that unavailability of power for all time. For overcoming this we use solar and wind energy together. So that any one source of power fails other will take care of the generation. In this proposed system we can use both sources combine.

Solar-Wind hybrid Power system is the combined power generating system by wind mill and solar energy panel. It also includes a battery which is used to store the energy generated from both the sources, then this stored energy can be transmitted to local power stations. In this system wind turbine can be used to produce electricity when wind is available and solar energy panels are used when solar radiations are available. Power can be generated by both the sections at the same time also. By providing the battery uninterrupted power supply is possible when both sources are idle.



**Fig.No.3. Solar-Wind Hybrid Power System**

A hybrid energy system is defined as the combination of two or more types of power generation system. Solar energy is energy from the Sun. The wind turbine captures the winds kinetic energy in a rotor consisting of two or more blades mechanically coupled to an electrical generator. The turbine is mounted on a tall tower to enhance the energy capture.

In the proposed model, a charge controller is used to regulate the power generated by both solar panels and the wind turbine. It also simultaneously charges battery and gives power to the load. The controller has over-charge protection and short-circuits protection. A specifically chosen battery is used to store the generated power. A Charge controller, considered as a heart of solar generation system, is used to regulate the voltages and current coming from the solar panels and wind generator.

**Specifications of Components:**

Sr. No.	Components	Specification	Qty.
1.	Solar Panel	<ul style="list-style-type: none"> <li>• Material: Poly-Crystalline Silicon (c-Si)</li> <li>• Maximum Power: 10 W</li> <li>• Maximum System Voltage: 600 V</li> </ul>	1

		<ul style="list-style-type: none"> <li>• Maximum Power Voltage: 17.03 V</li> <li>• Maximum Power Current: .59 A</li> <li>• Short Circuit Current: 0.63 A</li> <li>• Open Circuit Voltage: 21.07 V</li> <li>• Weight: 1.35 Kg</li> <li>• Size: 300 x 350 mm</li> </ul>	
2.	Fasteners	<ul style="list-style-type: none"> <li>• Material: Steel</li> </ul>	20
3.	Storage Battery	<ul style="list-style-type: none"> <li>• Type: Lithium-Ion (Li-On)</li> <li>• Capacity: 12V</li> <li>• Charging Time: 1-1.5 Hours</li> </ul>	1
4.	DC Motors	<ul style="list-style-type: none"> <li>• Type: 12V DC Supply</li> <li>• Speed: 60 RPM at 12V</li> <li>• Shaft Diameter: 6 mm,</li> <li>• Shaft length: 22mm</li> <li>• Output Shaft: Centered</li> <li>• Total length: 46mm</li> <li>• Brush type: Precious metal</li> <li>• Gear head diameter: 37mm</li> <li>• Gear head length: 21mm</li> <li>• Gear assembly: Spur</li> <li>• Motor diameter: 36mm</li> <li>• Motor length: 25mm</li> <li>• Motor weight: 105gms</li> </ul>	1
5.	Spur gears	<ul style="list-style-type: none"> <li>• Material: Nylon</li> <li>• Type: Spur gear</li> <li>• Number of Teeth: 25</li> <li>• Module: 1.5 mm</li> <li>• Pitch Circle Radius: 18.75 mm</li> <li>• Clearance Circle Radius: 17.63 mm</li> <li>• Addendum Circle Radius: 20.25 mm</li> <li>• Dedendum Circle Radius: 16.88 mm</li> <li>• Angle: 3.6 deg.</li> </ul>	2
6.	Shaft	<ul style="list-style-type: none"> <li>• Material: M.S.</li> <li>• Diameter of Shaft: 10 mm</li> <li>• Length of Shaft: 1200 mm</li> </ul>	1
7.	Supporting Stand of Turbine	<ul style="list-style-type: none"> <li>• Material: Steel</li> <li>• Size: 460 x 460 x 460 mm</li> </ul>	1
8.	Supporting Stand of Turbine	<ul style="list-style-type: none"> <li>• Height: 1150 mm</li> <li>• Length: 260 mm</li> </ul>	1
9.	Turbine Blades	<ul style="list-style-type: none"> <li>• Material: Fiber reinforced plastic (FRP)</li> <li>• Type: Savonius type (S-shape)</li> <li>• Radius: 230 mm</li> <li>• Length: 720 mm</li> </ul>	2
10.	Ball Bearings	<ul style="list-style-type: none"> <li>• Type: Pedestal Bearing</li> <li>• Material: Cast Iron (C.I.)</li> <li>• Life of bearing: 200000 Hours</li> <li>• Bearing No.: 6200</li> </ul>	2

**Advantages of Solar-Wind Hybrid Power System:**

1. Efficiency of this system is more as compare to individual system. Because they can produce electricity in 24 hours in a day.
2. Construction is very simple and Suitable hence Easy to transport from one place to other.



3. The power can be utilize where it generated so that it will reduce the transmission losses.
4. This system is gives continuous power supply. Hence this will make system reliable.
5. They can be installed in urban area.
6. Life span of this system is more.
7. It can be used to generate electricity in hilly areas, where it is quite difficult to transmit electricity by conventional methods.
8. If the system gets damaged in case, no need of changing entire system or subsystem. Just, changing a damage component will work out.
9. Maintenance cost of this system is less as compared to other bulky systems.
10. Renewable energy sources like, sun, wind are utilized so, no waste production i.e. Producing clean, environment friendly energy.
11. In this proposed system solar and wind power is used for generating power. Both the energy sources have greater availability in all areas. Hence there is no need to find special location to install this system.
12. Once the system is designed and developed or manufactured, the installation of system is easy.
13. Electrical equipment can be placed at ground level hence system has compact size
14. Within certain time period the installation cost gets covered.

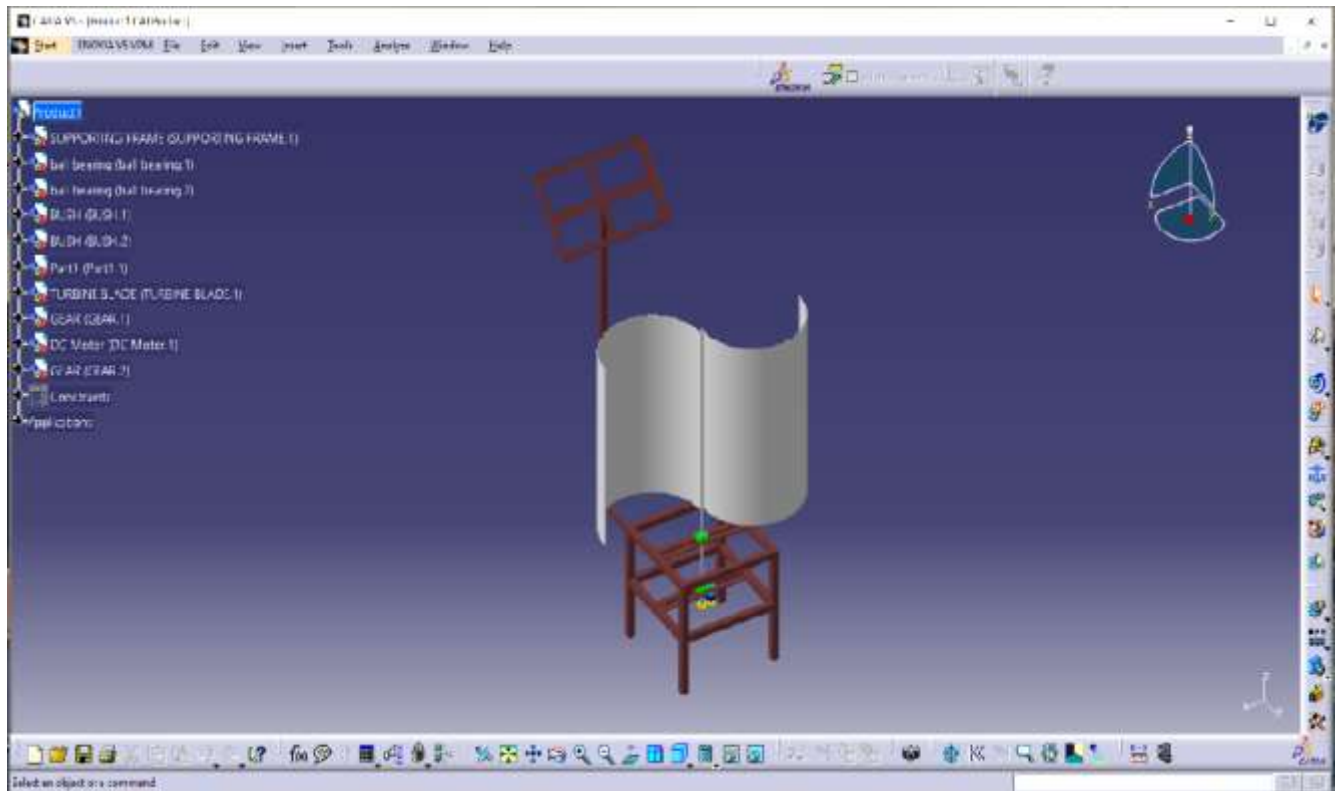
#### ***Limitations of Solar-Wind Hybrid Power System:***

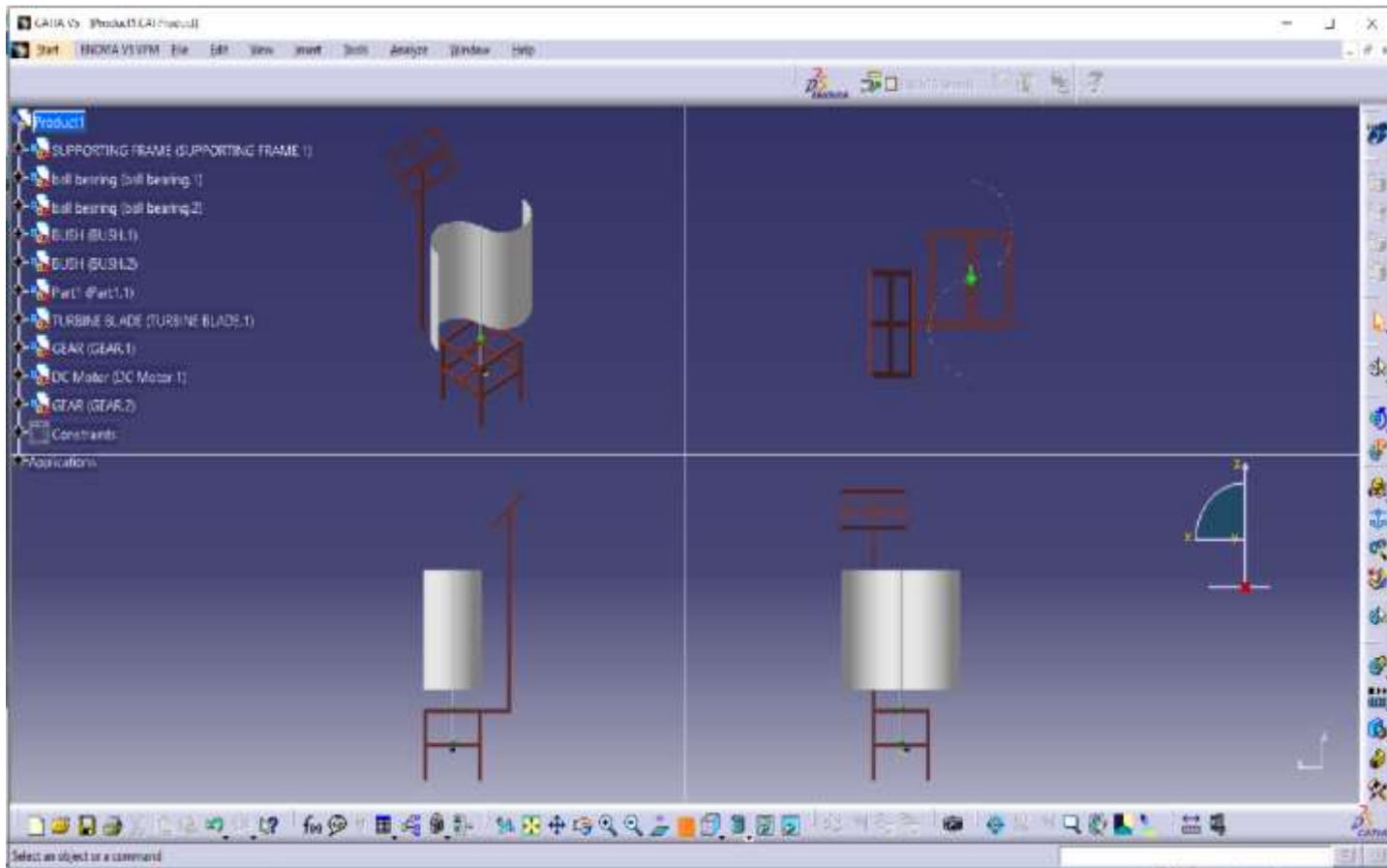
1. The first time installation cost is huge in terms of finance i.e. this system requires high initial investment.
2. The circuit designing complexity is more as there is no micro-computer for controlling action.
3. Checking batteries time to time.

#### ***Applications of Solar-Wind Hybrid Power System***

- The system is used for domestic purpose.
- The system is used for rural area electrification.
- It can be used to generate electricity in hilly areas.
- Street lighting, Traffic signals.
- Emergency power requirements.
- Portable power supplies.
- Various monitoring systems.
- Pump irrigation Systems.
- When AC mains supply is not available, the proposed system can be used as emergency system with only few changes.

**Modeling of Solar-Wind Hybrid Power System by Using CAD Software (CATIA V5):**





### **Conclusion:**

Developing hybrid systems is one of the most convenient and effective solution for producing electricity as compared to non-renewable energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. It is not only less costly but also highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. This paper focuses on design aspects and fabrication of hybrid power generation model. Hybrid model proposed here combines solar panels and vertical axis wind turbine and provides continuous supply. Our project is based on utilization of non-conventional sources of energy to satisfy basic Energy demand like powering street lights using wind and solar energy. The purpose of using two sources of energy like wind and solar is to eliminate seasonal dependency of the instrument and It has increased the reliability. Hence we could improve the efficiency of the system as compared with their individual mode of generation. Hybrid systems have proved to be the best option to deliver "high quality" community energy services to rural areas at the lowest economic cost, and with maximum social and environmental benefits. Overall it is good, reliable and affordable solution for electricity generation.

### **Future Scope:**

The efficiency can be increased by precise fabrication of prototype and also by designing the blades of the turbine more aerodynamically. The development of effective alternators and dynamos can be used to harness wind energy from relatively small winds. The use of materials like Acrylic Plastic Sheets can be used to develop low cost VAWT.

For future scope different time period has been use for calculating the power and efficiency. This method motivates the engineers to install small scale hybrid system in urban area. More and more governments understand the manifold benefits of wind energy and solar energy and are setting up favorable policies, including those that are stimulation decentralized investment by independent power producers, small and medium sized enterprises and



community based projects, all of which will be main drivers for a more sustainable energy system also in the future. Presently with the oil prices are on the rise, the cost of electrical power production is very high. The opportunity of a large wind and solar hybrid power production is being explored.

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