IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 6, June 2022
Impact Factor: 6.252

Hybrid Power Generation System

Satyam Londhe[1], Manish Landge[2], Runal Rairikar[3], and Pooja Kapse[4] Prof. S.R. Nimbalkar
Students, Department of Mechanical Engineering[1,2,3,4]
Professor, Department of Mechanical Engineering[5]
Pravara Rural Engineering College, Loni, Mahaashtra, India

Abstract: *Due to limit of use of conventional energy sources, these days emphasis is given on to the use of non-conventional sources of energy. Among them is the very popular wind energy source, in which wind energy is converted into mechanical form of energy first and then with the help of a generator this mechanical energy available is converted into electrical energy thereafter this form of energy become ready to be used by the users. Though this form of energy is abundantly available the problem is today's machinery. In its simple construction a vertical axis wind mill is constructed instead of it being rest on a thrust bearing it is levitated in air using magnetic property of same pole repelling each other. One magnet is fitted into the wind mill while the other is fitted in to the hoist. Generator is coupled with is wind mill thereby generating the electricity efficiently and at a larger capacity. The electricity generated from this type of wind mill is also very large compared to the conventional wind mills. Wind energy turbines are not that kind of efficient to produce continues & sufficient power so that, to overcome the problem associated with conventional turbines we are introduces to make hybrid electricity generation system along with Solar panel as a new breed being developed. This has motivated for combining two or more renewable energy resources i.e., hybrid power generation. The project deals with the study and design of hybrid system of solar and wind energy for rural area's applications.*

Keywords: Solar, wind, hybrid power, higher electrical output

I. INTRODUCTION

Hybrid Renewable Energy System (HRES) are becoming popular as stand-alone power systems for providing electricity in remote areas due to advances in renewable energy technologies and subsequent rise in petroleum products. A hybrid energy system, or hybrid power, usually consists of two or more renewable energy sources used together to provide increased system efficiency as well as greater balance in energy supply. Most of us already know how a solar/wind power generating system works, all these generating systems have some or the other drawbacks (considering standalone system), like Solar panels are too costly and the production cost of power by using them is generally higher than the conventional process, it is not available in the night or cloudy days. Similarly, Wind turbines can't operate in high or low wind speeds. Solar hybrid power systems are hybrid power systems that combine solar power from a photovoltaic system with another power generating energy source. This would create more output from the wind turbine during the winter, whereas during the summer, the solar panels would produce their pea output. Hybrid energy system often yield greater economic and environmental returns than wind, solar, geothermal or tri-generation stand-alone systems by themselves.

Our projects 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. When one sources, say solar energy is not available in abundance during monsoon, wind energy comes to the rescue and similarly opposite will be the case during the time when the winds are not intense enough. Also, it includes the analysis of the VAWT, so that max power and efficiency can be obtained.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 6, June 2022
Impact Factor: 6.252

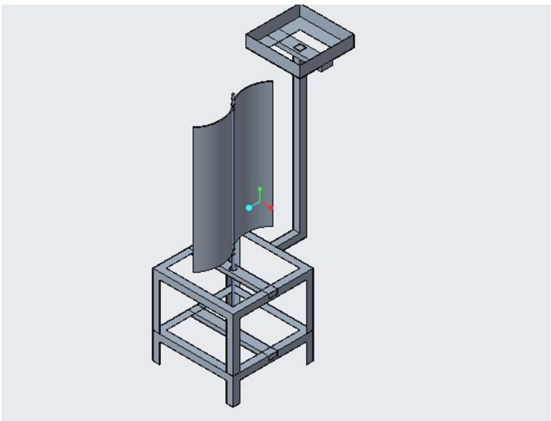

Fig: Hybrid Power Generation System

II. LITERATURE REVIEW AND OBJECTIVE

The followings are some of the objectives behind development of hybrid power generation system given below:

1. The main objective of this project is to assess the feasibility and economic viability of utilizing hybrid Solar–Wind–battery based standalone power supply systems to meet the load requirements.
2. To make nonconventional system which will give continues & sufficient power in all working conditions.
3. To make energy efficient hybrid power generation system as a low-cost alternative to conventional one.
4. To optimize usage of electricity by substituting its hybrid mode of generation.
5. To develop a small-scale model for assessing feasibility of system.
6. To design the system this is cost effective, reliable and also efficient.
7. To carry out the performance analysis of hybrid power generation system the analysis of VAWT.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 6, June 2022
Impact Factor: 6.252

III. MATERIALS AND METHODS

3.1 Solar Panel

The photo- voltaic effect can be observed in nature in a variety of materials that have shown that the best performance in sunlight is the semiconductors as stated above. When photons from the sun are absorbed in a semiconductor, that create free electrons with higher energies than the created there must be an electric field to induce these higher energy electrons to flow out of the semi-conductor to do useful work. A junction of materials, which have different electrical properties, provides the electric field in most solar cells for the photon interaction in a semiconductor. A solar cell consists of,

1. Semi –conductor in which electron hole pairs are created by the absorption of incident solar radiation.
2. Region containing a drift field for charge separation.
3. Charge collecting front and back electrodes.

Fig 1: Solar Panel

3.2. Solar Charger

The power charge regulator is also known as charge controller, voltage regulator, charge-discharge controller or charge-discharge and load controller. The regulator sits between the array of panels, the batteries, and the equipment or loads. By monitoring the voltage of battery, the regulator prevents overcharging or over discharging. Regulators used in solar applications should be connected in series: they disconnect the array of panels from the battery to avoid overcharging, and they disconnect the battery from the load to avoid over discharging. The connection and disconnection is done by means of switches which can be of two types: electromechanical (relays) or solid state (bipolar transistor). Solar chargers should never be connected in parallel. In order to protect the battery from gasification, the switch opens the charging circuit when the voltage in the battery reaches its high voltage disconnects (HVD) or cut-off set point. The low voltage disconnects (LVD) prevents the battery from over discharging by disconnecting the load. The most modern regulators are also able to automatically disconnect the panels during the night to avoid discharging of the battery

Figure 2: Solar charger circuit

3.3. Battery

The batteries are used as a storage device for solar energy which can be further converted into electrical energy.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 6, June 2022
Impact Factor: 6.252

Specification of Battery

- Battery type – lithium-ion (Li-On)
- Battery Charging time - 1 to 1.5 Hours

Fig 3: Battery

3.4. DC Motors

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commentator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

Specification:

- DC supply: 12V RPM: 60 at 12V
- Shaft diameter: 6mm

Fig 4: DC Motors

3.5. Ball Bearings

This type of bearing consists of i) a cast iron pedestal, ii) gun metal, or brass bush split into two halves called “brasses”, and iii) a cast iron cap and two mild steel bolts. The detailed drawing of a pedestal bearing is shown in image below

Fig 5: Pedestal bearing

3.6. Shaft

Shaft is a common and important machine element. It is a rotating member, in general, has a circular cross-section and is used to transmit power. The shaft may be hollow or solid. The shaft is supported on bearings and it rotates a set of gears or pulleys for the purpose of power transmission.

Fig 6: Shaft

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 6, June 2022
Impact Factor: 6.252

IV. RESULTS AND DISCUSSION

4.1. Advantages

The advantages covered by the propose system are listed as,

Overcoming disadvantages of standalone renewable electrical energy generation system

1. Producing much more efficiency as two or more renewable energy generation system working together in the terms of electrical energy generation.
2. Since, the system doesn't complexity of system testing and understanding became easy in terms of difficulties.
3. System maintains is remarkably reduced and becomes easy.
4. Renewable energy sources like, sun, wind, are utilized so, no waste production.
5. Producing clean, friendly to environment, renewable energy.
6. Once the system is designed and developed or manufactured, the installation of system is easy.
7. Within certain time period the installation cost gets covered.
8. If the system gets damaged in case, no need of changing entire system or subsystem. Just, changing a damage component will work out.

4.2. Application

Some of the applications for the purpose system are listed follow,

1. The system is used for domestic purpose.
2. Street lighting, Traffic signals.
3. Various monitoring systems.
4. Powering up for communication system.
5. Pump irrigation Systems.
6. Small Boats like yacht.
7. As per requirement of electrical energy the system can be either designed or updated for higher energy requirement.
8. When AC mains supply is not available, the proposed system can be used as emergency system with only few changes.
9. So, it can be used for almost every electronic, mechanic, viz. system needing/ require electric energy to work on.

VI. CONCLUSION

While concluding this report, we feel quite fulfil in having completed the project assignment well on time, we had enormous practical experience on fulfilment of the manufacturing schedules of the working project model. We are therefore, happy to state that the in calculation of mechanical aptitude proved to be a very useful purpose. Although the design criterions imposed challenging problems which, however were overcome by us due to availability of good reference books. The selection of choice raw materials helped us in machining of the various components to very close tolerance and thereby minimizing the level of balancing problem. Needless to emphasis here that we had lift no stone unturned in our potential efforts during machining, fabrication and assembly work of the project model to our entire satisfaction. The model develops by us fulfil the required objectives & hence we are satisfied with our project work.

ACKNOWLEDGEMENTS

This research project was supported and guided by Prof. S.M. Nimbalkar and the Mechanical Engineering department of Pravara Rural Engineering College, Loni.

NOMENCLATURE

A	Frontal area of rotor	[m^2]
AR	Aspect ratio	--
C_D	Drag coefficient	--
α	Angle of attack	(^{o})

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 6, June 2022
Impact Factor: 6.252

ρ	Density of air	[kg/m^3]
ω	Rotor rotational speed	[rad/s]

REFERENCES

[1]. Varad Bagwe, Abhijeet Thoke, Charchit Vatsa, Dibyanshu Pandey, Sangeeta Kotecha, Integration of Solar and Wind Energy System for Hybrid Power Generation, International Conference on Innovative and Advanced Technologies in Enginnering (March-2018), Volume 8, pp.11-15.

[2]. Dr. Recayi Pecen, Dr. MD Salim, Dr, Marc Timmerman, A Hybrid Solar-Wind Power Generation System as an Instructional Resource For Industrial Technolgy Students, Journal of Industrial Technology • Volume 16, Number 3 • May 2000 to July 2000.pp.1-7.

[3]. Swapneel kaurav, Prof.P.Yadav, Hybrid Power System Using Wind Energy and Solar Energy, International Journal of Innovative Research in Science, Engineering and Technology,Vol. 5, Issue 1, January 2016,pp.54-58.

[4]. By Medugu,D. W. & Michael, E., Integrated Solar – Wind Hybrid Energy Gnerating System for Residential Application, Global Journal of Researches in Engineering: F Electrical and Electronics Engineering Volume 14 Issue 4 Version 1.0 Year 2014, pp.1-9.

[5]. Bartosz Ceran, Qusay Hassa, Marek Jasczur and Krzysztof Sroka, An analysis of hybrid power generation systems for a residential load, E3s Web of Conferences, Energy and Fuels2016,pp.1-10. Design & development of hybrid charging station. College Name Page 26

[6]. Ghassan HALASA & Johnson A. ASUMADU, Wind-Solar Hybrid Electrical Power Production to Support National Grid: Case Study – Jordan, Energy and Power Engineering, 2009, pp.72-80.