

# Design and Implementation of Hybrid Power Generation Using Solar Panels and Vertical Axis Wind Turbine

Ankita G. Birkhede<sup>1</sup>, Harshada B. Tekade<sup>1</sup>, Simran S. Sarode<sup>1</sup>, Ruchika S. Marghade<sup>1</sup>, Puja D. Ingle<sup>1</sup>, Monu B. Thakre<sup>1</sup>,  
Prof. Piyush Bahad<sup>2</sup>

<sup>1</sup>BE Scholar, Department of Electrical Engineering, Jhulelal Institute of Technology, Nagpur, Maharashtra,  
India

<sup>2</sup>Assistant Professor, Department of Electrical Engineering, Jhulelal Institute of Technology, Nagpur,  
Maharashtra, India

## ABSTRACT

The principal goal of this investigation is Rural Electrification through a hybrid framework which incorporates wind and sun powered vitality. We will likely plan a wind turbine sufficiently reduced to be introduced on rooftop tops. So we chose to structure a vertical axis wind turbine (VAWT) over the Horizontal Axis Wind Turbine (HAWT). Points of interest of VAWT over HAWT are smaller for same electricity age, less clamor, simple for establishment and upkeep and response to wind from all bearings. The wind turbine intended to produce electricity sufficiently adequate for local use. The electricity created will be put away in the battery and after that given to the heap. This task underscores on zap of remote zones with least cost where load shading still must be done to fulfill with the need of urban regions. Novel ideas of vertical axis wind machines are being presented, for example, the helical sorts especially for use in urban conditions where they would be viewed as more secure because of their lower rotational velocities staying away from the danger of sharp edge discharge and since they can get the wind from all bearings.

**Keywords:** Vertical Axis, Wind Turbine, Horizontal Axis, Solar Panel

## I. INTRODUCTION

Presently in this day and age situation rivalry between the different nations is developing immensely. This prompts increment in the utilization of petroleum products at a quick rate. One day these non-sustainable power source assets will exhaust and furthermore builds the contamination issue. Electricity is regularly required in our everyday life.

So far the electricity is created utilizing the steam energy. The steam is created utilizing the different petroleum derivatives, for example, coal, diesel,

flammable gas and furthermore utilizing the atomic energy. In any case, because of the different issues, for example, treatment of perilous atomic waste, fiery remains dealing with is increments and furthermore, it is in all respects exorbitant. So thinking about this, we need to discover other energy assets which give us the nonstop and contamination free supply of energy. There are numerous non-sustainable power source assets like wind, solar, geothermal, tidal and so forth are accessible. Among this for the extraction of geothermal energy needs an appropriate site and expensive gear, so an option in contrast to this source, solar and wind energy assets are a great one. Hybrid

power age framework is the blend of the two energy assets which produces control. It conquers the impediment of an individual framework and produces control persistently.

In this proposed framework solar and wind energy are consolidated to exploit their occasional reliance. Such a framework could give dependable, contamination free power supply requiring little to no effort. Vertical axis wind turbines are supported as being equipped for getting the wind from all bearings, needn't bother with yaw components, rudders or downwind coming. Their electrical generators can be situated near the ground, and thus effectively available.

The financial improvement and practical utilize horizontal axis wind turbines would later on be restricted, halfway because of the high-pressure stacks on the expansive cutting edges. It is perceived that, albeit less productive, vertical axis wind turbines don't experience the ill effects of the always changing gravitational burdens that restrain the span of horizontal axis turbines.

This venture is to build up an ideal structure of a hybrid wind-solar energy plant, where we can utilize both the wellsprings of energy sources to create the power with a primary objective to limit the plant foundation cost, to use the land utilized for the equivalent in most appropriate route and to give earth a sound domain by utilizing this sustainable wellspring of energy. The proverb of the undertaking is to create the energy in an eco-accommodating path by utilizing sustainable wellsprings of energy.

The solar energy blocked by the earth is about MW. Solar panel introduced are very incapable in the shady and stormy season, so a mix of wind and solar energy gives the nonstop supply of energy all through the season. Toward the finish of 2013 around 640 terawatt hours energy could have conceivably spared by the introduced all the turbine around the world.

So such a hybrid framework can give us persistent supply of energy in great climate condition and in an effective way.

With populaces expanding exponentially and our regular assets being stressed by increments popular, it could really compare to ever to put resources into the sustainable power source. Our utilization of petroleum derivatives as energy has been followed to be the main source in ecological issues. The side-effect of petroleum derivative utilization is carbon dioxide, which has been named to be an essential constituent prompting Global Warming. The measure of carbon dioxide that a person or thing produces is known as its "carbon impression." The media has been concentrating on this issue and many green developments have begun to attempt and decrease our "carbon impression."

There are just a couple of sorts of energy that don't create carbon dioxide. These are atomic power and sustainable power sources, for example, wind, solar and hydro control. Sustainable power sources are the cleanest form of these sources, in light of the fact that there is no waste shaped as results of these sources. Atomic energy produces atomic waste which could take up to however not restricted to 100 years until it tends to be discarded legitimately. Wind turbines have been utilized all through the world to create electricity from seaward wind ranches to private littler scale wind turbines.

Wind control gadgets are utilized to create electricity, and ordinarily named wind turbines. The introduction of the pole and rotational axis decides the order of the wind turbines. A turbine with a pole mounted horizontally parallel to the ground is known as a horizontal axis wind turbine or (HAWT). A vertical axis wind turbine (VAWT) has its pole typical to the ground.

The two setups have in a flash recognizable rotor plans, each with its very own ideal qualities. Vertical-

axis wind turbines (VAWT) can be isolated into two noteworthy gatherings: those that utilization streamlined drag to separate power from the wind and those that utilization lift. The upsides of the VAWTs are that they can acknowledge the wind from any heading. This disentangles their plan and wipes out the issue forced by gyroscopic powers on the rotor of a conventional machine as the turbine tracks the wind. The vertical axis of pivot additionally allows mounting the generator and drive train at ground level.

The drawbacks of this sort of rotors are that it is very hard to control yield by pitching the rotor cutting edges, they are not self – beginning and they have low tip-speed proportion. Horizontal – axis wind turbines (HAWT) are conventional wind turbines and improbable the VAWT is not omnidirectional. As the wind alters course, HAWTs must alter course with it. They should have a few methods for situating the rotor as for the wind.

Electricity is most required for our everyday life. There are two different ways of electricity age either by ordinary energy assets or by non-traditional energy assets. Electrical energy request increments in the world so to satisfy request we need to produce electrical energy. These days electrical energy is created by the traditional energy assets like coal, diesel, and atomic and so forth. The fundamental disadvantage of these sources is that it produces squander like fiery debris in coal control plant, atomic waste in atomic power plant and dealing with this wastage is in all respects exorbitant. What's more, it additionally harms nature. The atomic waste is extremely hurtful to the individual too. The regular energy assets are draining step by step. Before long it will totally disappear from the earth so we need to discover another approach to create electricity. The new source ought to be solid, contamination free and affordable.

The non-customary energy assets should be great elective energy assets for the ordinary energy assets. There are numerous non-traditional energy assets like the geothermal, tidal, wind; solar and so on the tidal energy has disadvantages as it can just be executed on ocean shores. While geothermal energy needs very ale venture to remove heat from the earth. Solar and wind are effectively accessible in all condition. The non-traditional energy assets like solar, wind can be a great elective source. Solar energy has the disadvantage that it couldn't deliver electrical energy in the blustery and shady season so we have to conquer this downside we can utilize two energy assets with the goal that any of source falls flat another source will continue creating the electricity. What's more, in great climate condition we can utilize the two sources consolidate.

### **A. Wind Energy**

On the off chance that the effectiveness of a wind turbine is expanded, at that point, more power can be created in this way diminishing the requirement for costly power generators that reason contamination. This would likewise decrease the expense of intensity for ordinary citizens. The wind is truly ready for whoever gets there first and doesn't cost any cash. Power can be produced and put away by a wind turbine with next to zero contamination. On the off chance that the proficiency of the normal wind turbine is improved and across the board, the everyday citizens can curtail their capacity costs tremendously. The sorts of wind turbines are the Horizontal axis wind turbine, Vertical axis wind turbine. The vertical axis wind turbines are absolutely works dependent on the drag drive. Be that as it may, in horizontal axis wind turbines, lift and drag powers assumes the jobs to work the wind turbines. The vertical axis wind turbines have less effectiveness than horizontal axis wind turbines. Be that as it may, it has high support cost and venture cost. To conquer these issues the vertical axis wind turbines are the best decision for wind energy age with ease.

## B. Solar Energy

"Photovoltaic" is a marriage of two words: "photograph", which means light, and "voltaic", which means electricity. Photovoltaic innovation, the logical term used to portray what we use to change over solar energy into electricity, creates electricity from light. We utilize a semi-transmitter material which can be adjusted to discharge electrons, the adversely charged particles that structure the premise of electricity. The different sorts of PV Panels are single, poly, slender film amorous silicon panels

## C. Hybrid Energy System

Hybrid energy framework is the blend of two energy hotspots for offering the capacity to the heap. In another word it can be characterized as "Energy framework which is manufactured or intended to remove control by utilizing two energy sources is called as the hybrid energy framework." Hybrid energy framework has great unwavering quality, proficiency, less discharge, and lower cost.

## II. IMPLEMENTATION DESIGN

The Solar component of Hybrid power generation system comprises of two basic components: The Solar Panel and Solar Tracking system. Both these parts are connected to the control unit which constantly monitors and sends commands to control the functioning of both of them. In this type of combination, the Solar Panel is not the lone source for electricity production. Even the Solar Tracking system is capable of producing electricity. So, we have two sources side-by-side to produce electricity—which means less effort and more electricity.

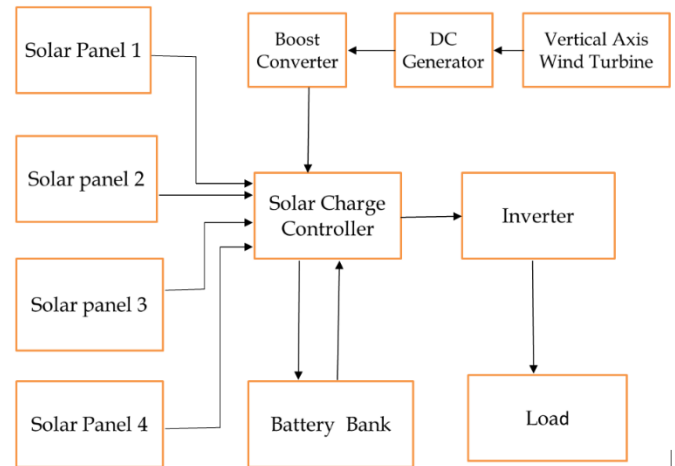


Figure 1. Block Diagram Of Hybrid Power Generation Using Solar Panels And VAWT

### Solar Panel

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A photovoltaic (PV) module is a packaged, connect assembly of typically 6×10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 watts. The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. There are a few commercially available solar modules that exceed 22% efficiency and reportedly also exceeding 24%. A single solar module can produce only a limited amount of power; most installations contain multiple modules. Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect.



Fig 2. Solar Plate

The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The cells must be connected electrically in series, one to another. Operating silently and without any moving parts or environmental emissions, PV systems have developed from being niche market applications into a mature technology used for mainstream electricity generation. A rooftop system recoups the invested energy for its manufacturing and installation within 0.7 to 2 years and produces about 95 percent of net clean renewable energy over a 30-year service lifetime.

#### Description of Solar Tracking System:

One of the most promising renewable energy sources characterized by a huge potential of conversion into electrical power is the solar energy. The conversion of solar radiation into electrical energy by Photo-Voltaic (PV) effect is a very promising technology, being clean, silent and reliable, with very small maintenance costs and small ecological impact. The interest in the Photo Voltaic conversion systems is visibly reflected by the exponential increase of sales in this market segment with a strong growth projection for the next decades. According to recent market research reports carried out by European Photovoltaic Industry Association (EPIA), the total installed power of PV conversion equipment increased from about 1 GW in 2001 up to nearly 23 GW in 2009.

#### Principle:

The continuous modification of the sun-earth relative position determines a continuously changing of incident radiation on a fixed PV panel. The point of

maximum received energy is reached when the direction of solar radiation is perpendicular on the panel surface. Thus an increase of the output energy of a given PV panel can be obtained by mounting the panel on a solar tracking device that follows the sun trajectory. Unlike the classical fixed PV panels, the mobile ones driven by solar trackers are kept under optimum insolation for all positions of the Sun, boosting thus the PV conversion efficiency of the system. The output energy of PV panels equipped with solar trackers may increase with tens of percent, especially during the summer when the energy harnessed from the sun is more important. Photo-Voltaic or PV cells, known commonly as solar cells, convert the energy from sunlight into DC electricity. PVs offer added advantages over other renewable energy sources in that they give off no noise and require practically no maintenance. A tracking system must be able to follow the sun with a certain degree of accuracy, return the collector to its original position at the end of the day and also track during periods of cloud over. The major components of this system are as follows.

Light dependent resistor

Micro-controller

Output Mechanical Transducer.

### III. HYBRID POWER GENERATION SYSTEM

Hybrid models have been an effective means of producing generating electricity throughout the world. Lots of research work has been done and continuing the accommodate new advances in this system. This paper reports the probabilistic performance assessment of a wind, Solar Photo Voltaic (SPV) Hybrid Energy System. In addition to this solar/wind system with backup storage batteries were designed, integrated and optimized to predict the behavior of generating system. This paper proposes a hybrid energy system combining solar photovoltaic and wind turbine as a small scale alternative source of electrical energy where conventional generation is not practical.

The LDR first detects the sunlight. The Resistor then identifies the direction of sunlight and sends back the signal to the Tracking Control Unit (T.C.U). The IC in the T.C.U receives this signal and processes this input. It uses a C-Program in order to process this signal. This signal is then transferred to the driving unit. This unit then processes this signal in order to form a command. This command is called as the driving command.

This driving command generated by the driving IC is transferred to the DC motor. The DC motor, acting upon this command, rotates accordingly to align the solar panel attached to it. Due to the rotation of DC Motor, the solar panel moves until it again reaches the maximum irradiation position.

The solar panel is now set and the current generated due to the rotation of the shaft of DC motor is transmitted and stored in the battery.

The combination of solar power and wind power coming from the Solar Panels & VAWT are stored in the 12V Battery. A switch is used to regulate the power supply between the battery and the inverter. A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC). The inverter consists of MOSFET & Step up transformer to increase the voltage of the incoming charge so as to light a 15W bulb. When the switch is ON, the circuit is closed and current passes to the bulb lighting it. In this way, the bulb is lighted up. Its approximate glowing time depends upon the amount of sunlight incident upon the setup i.e. irradiance and the type of wind flow. For more irradiance and wind flow, we get more illumination time for the bulb. Availability of higher capacity batteries also could help increase the illumination time due to increased storage of power within those batteries.\

The strategy embraced for testing the Hybrid System has been partitioned into two fragments:

#### A) Working Analysis for Solar Unit:

For surveying the capacity to create solar power, the solar unit is put under sun for the duration of the day. It is started under nil battery condition. For the principal hour (i.e., from 10 am-11am), it acknowledges solar energy and producing control. This power is all the while put away in the battery. The solar power produced amid this hour is noted down. In the following hour (for example from 11am-12pm), the battery is totally depleted to such an extent that the charge progresses toward becoming nil once more. This is done as such as to independently decide control created in each particular hour. The ideal opportunity for complete battery release is roughly 50 minutes. In the following hour (12 pm – 1 pm), the solar panel is again made to acknowledge energy and create the control. This power is put away in the battery. The power created during the current hour is noted down. A similar strategy for on the other hand charging and releasing battery and noticing down the power produced while charging for each individual hour is pursued.

This testing strategy is considered very viable as it surveys the power age for consistently with a decent measure of exactness. Depleting out of battery builds the dimension of precision in the evaluation of intensity age.

#### B) Working Analysis of Wind Power Generation Unit:

For dissecting the execution of the wind control age unit, a similar strategy did for evaluating the solar unit is pursued. In the main hour, the turbine is made to pivot and creative control and, in the following hour, the battery is totally released. This technique is rehashed and the estimations of intensity produced for each individual hour are noted down.

Along these lines, the examination has been done upon the two frameworks and the results have been

consolidated so as to think about the accessibility and effectiveness of each source in that specific zone.



Figure 3. Implemented Design

#### IV. CONCLUSION

Considering the worldwide energy emergency, utilization of the non-ordinary energy assets must be expanded. By consolidating such a framework, viability is increment and furthermore, the regular reliance of the individual frames can be overwhelmed by the utilization of hybrid energy framework. Likewise, the different preferences of the vertical axis wind turbine make it reasonable to use in such a framework. Vertical axis wind turbine can be made at exceptionally ease by utilizing different methods and furthermore by shabby material, for example, wood, aluminum, excited steel and so forth. Savonius VAWT can likewise be manufactured by cutting empty metallic or plastic barrel. Such a framework can be executed in remote territories just as in the street divider utilizing VAWT. So this framework is practical, proficient and non-contaminating. It likewise has a long life expectancy with less upkeep. In general, it is a dependable answer for energy emergency crosswise over the globe.

Our work and the outcomes got so far are extremely reassuring and strengthen the conviction that vertical

axis wind energy transformation frameworks are reasonable and conceivably contributively to the generation of clean sustainable electricity from the wind even under not exactly perfect siting conditions this venture will be useful in rustic territories where the electricity supply is rare. Additionally, in many urban communities, spans are a quicker course for the ordinary drive and needing consistent lighting makes this an effective method to deliver energy .

The hybrid power framework demonstrates the relatively preferred execution over the individual exhibitions of both wind turbine and solar panels the solar power framework delivers the power continually for the duration of the day time and the wind turbine creates the power and at whatever point the wind speed picked up by it the pinnacle esteem delivered by the structured hybrid framework is 70W and the lower esteem delivered will be 12W so the hybrid power framework will demonstrate the gigantic effect in the energy preservation. These Solar-wind energy frameworks can significantly be diminishing of our capacity necessity in country zones. The power age through Vertical VAST and PV hybrid framework accomplished the general proficiency of 22% for the independent framework for electricity age because of the choice of the wind turbine and the hybrid framework

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