DESIGN AND DEVELOPMENT OF HYBRID POWER GENERATION BY SOLAR AND WIND ENERGY

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Abstract - This In our study, we delved into designing an optimal model for a hybrid solar-wind energy plant, meticulously considering various design parameters such as the number of photovoltaic modules, wind turbine height, number of turbines, and rotor diameter. Our aim was to minimize costs while ensuring consistent energy production. Our findings unequivocally revealed a distinct complementary relationship: during summer months, solar arrays predominantly met energy demands due to abundant solar radiation and minimal wind energy, whereas in winter, with higher wind speeds and reduced solar radiation, wind turbines became the primary energy suppliers. This study highlights the significant potential of leveraging synergies between solar and wind energy in an optimized hybrid system, ensuring reliable energy production year-round. Moreover, our project focused on exploring the feasibility of installing roof-mounted vertical wind turbines of various types, including those with shrouded blades, to enhance turbine efficiency. One notable advantage of vertical axis wind turbines is their ground-level installation, facilitating easy maintenance. Additionally, their omni-directional nature eliminates the need for precise alignment with the wind direction to generate power. Our main objective revolves around designing a self-starting vertical axis wind turbine using CATIA V5, aiming to contribute to the advancement of sustainable energy solutions.

***Key Words*:** Renewable energy source, vertical axis wind mill, power generation,catia v5

1.INTRODUCTION

This document shows the suggested format and appearance of a manuscr The difficulty and expense of getting fuel to remote areas of the country to use as a source of energy and the threat of expanding pollution of air have forced many countries to switch to alternative energy sources, to meet their needs. It is only now after twenty years of cheap fuel, that the true cost of energy is really being felt. By far our biggest source of primary energy has been fossil fuels burned in homes, factories and in power stations to produce heat and electricity. Not only have hydrocarbons provided us with power, they have also given us liquid fuel for transport and have been used to produce the many types of plastics we use in our daily life. Energy has been and will still be the main stay of any economy. There are many different types of energy. Potential energy is the energy available because of the position between particles for example, water stored in a dam, the energy in a coiled spring, and energy stored in molecules (gasoline). Kinetic energy is energy available in the motion of particles wind energy is one example of this. There are many examples of energy: mechanical, electrical, thermal, chemical, magnetic, nuclear, biological, tidal, geothermal, and so on. A renewable energy revolution is our hope for a sustainable future. Clearly, the future belongs to clean energy sources and to those who prepare for it now. Solar and wind energy often provide least-cost options for economic and community development in rural regions around the globe, while supplying electricity, creating local jobs, and promoting economic development with clean energy resources. The future will be a mix of energy technologies with renewable sources such as solar, wind, and biomass playing an increasingly important role in the new global energy economy.

Aerodynamically, they are drag-type devices, consisting of two or three scoops. The differential drag causes the Savonius turbine to spin. Some designs have long helical scoops, to give smooth torque. Much of the swept area of a Savonius rotor is near the ground, making the overall energy extraction less effective due to lower wind speed at lower heights. The most ubiquitous application of the Savonius wind turbine is the ventilator which is commonly seen on the roofs of vans and buses and is used as a cooling device. ipt prepared for SPIE journals. Accepted papers will be professionally typeset. This template is intended to be a tool to improve manuscript clarity for the reviewers. The final layout of the typeset paper will not match this template layout.

2. Body of Paper

The main objective of the project is to design and fabricate a small scale vertical axis wind turbine.

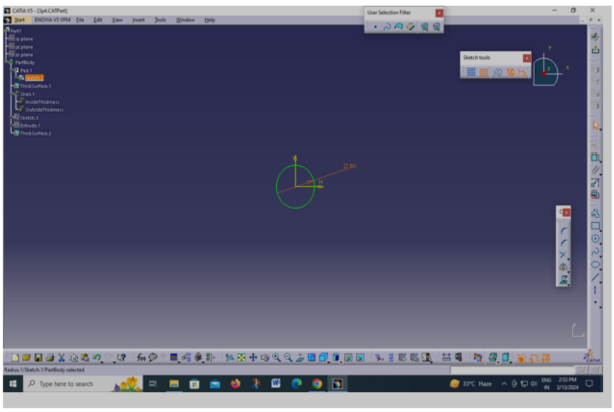

Fig -1

The above figure represents the design of the vertical axis wind mill by using the catiav5.

In this we designed the savonius wind turbine by the use of the catiav5 to show the design of the vertical axis wind mill. Choosing the right generator and transmition system to convert rotational energy of turbine electrical power efficiently.

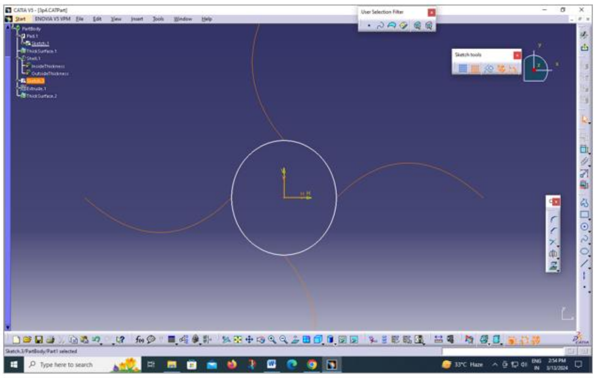

Fig -1.1

By using of the catiav5 tools we designed the blades of the vawt to be aerodynamically efficient to capture wind energy effectively.

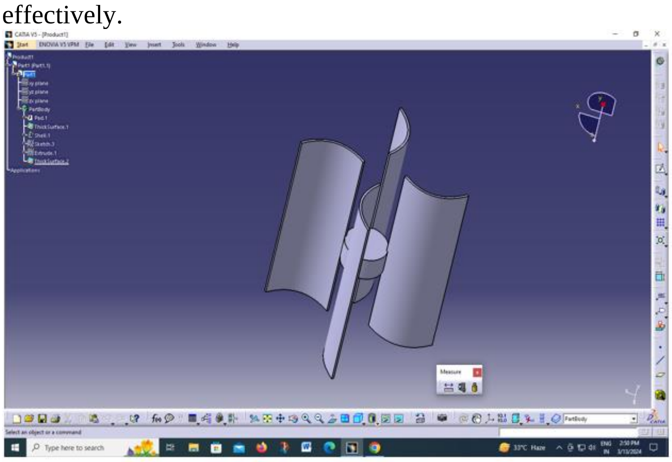

Fig -1.2

The above fig 1.3 represents the design of vertical axis wind mill (savonius type).

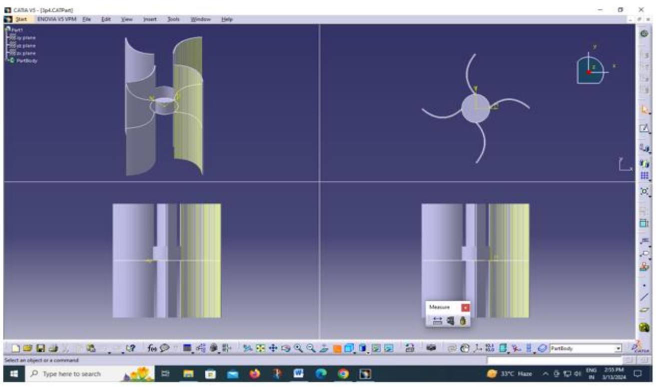

Fig -1.3

The fig 1.3 represents the overall design of the vertical axis wind mill (Savonius type).Utilizingcatiav5powerful modeling and simulation capabilities, you can design a vertical axis wind turbine of theSavonius type that meets your performance requirements and objectives.

2.1 Solar panel

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. A photovoltaic system typically includes a panel or an array of solar modules, an inverter, and sometimes a battery and/or solar tracker and interconnection wiring. Photovoltaic cells or panels are only one way of generating electricity from solar energy. They are not the most efficient, but they are the most convents to use on a small to medium scale. PV cells are made of silicon, similar to that used in computer "chips". While silicon itself is a very abundant mineral, the manufacture of solar cells (as with computer chips) has to be in a very clean environment. This causes production costs to be high.

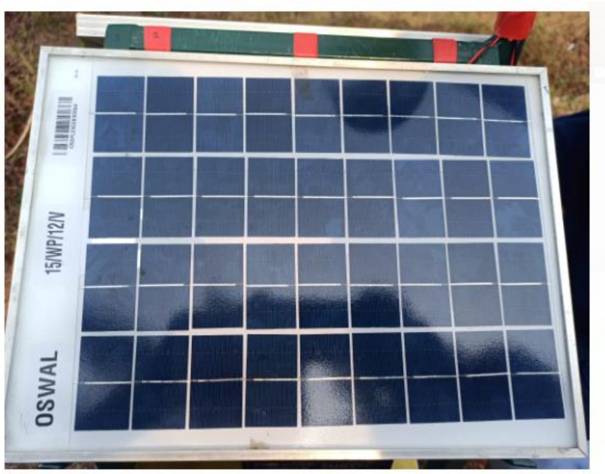

Fig -1.4 solar panel

2.2 Nema 17 stepper motor

A stepper motor with a 1.7 x 1.7 inch (43.18 x 43.18 mm) faceplate The NEMA 17 is larger and generally heavier than for example a NEMA 14, but this also means it has more room to put a higher torque. However, its size is not an indication of its power. A stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps Nema 17 Stepper Motor with 39mm body and 1.68A rated current, integrated with a 48.3mm Planetary gearbox of 50:1 gear ratio.

Fig -1.4 nema stepper motor

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2.3 solar charge controller

A solar charge controller is essential for regulating the voltage and current from solar panels to prevent battery damage from overcharging. It is particularly crucial for panels outputting around 16 to 20 volts, ensuring batteries receive the optimal 14 to 14.5 volts for full charging. While small maintenance panels may not require controllers, most battery-based systems benefit from controllers ranging from 4 to 60 amps. These controllers vary in type, from simple 1 or 2 stage controls relying on relays or transistors to more advanced 3-stage or PWM controllers like those from Morningstar or Xantrex. Indicators, such as LEDs or digital meters, are commonly included, with some newer models featuring built-in computer interfaces for monitoring and control.

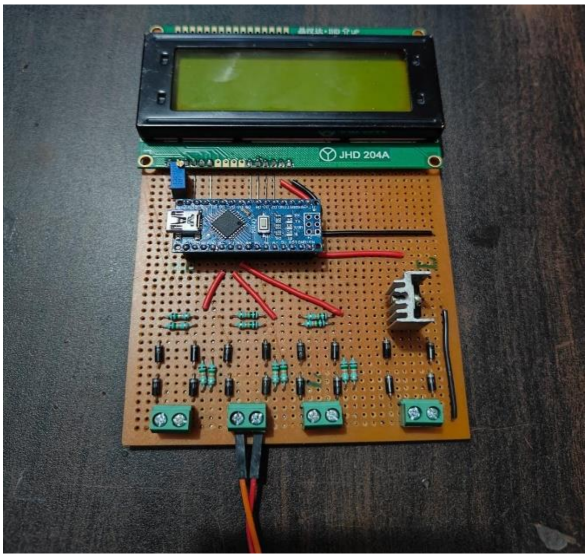

Fig -1.4 solar charge controller

3.Observation and result

An observation of a hybrid power generation system utilizing both solar and wind energy sources is the synergy achieved in energy production and reliability. Solar energy production tends to peak during daylight hours, while wind energy production can vary throughout the day and night based on weather conditions.In summary, the observation highlights the symbiotic relationship between solar and wind energy in hybrid power generation systems, leading to increased stability, reliability, and overall energy efficiency.

Fig -3.1power generation by solar& wind

4. CONCLUSIONS

In conclusion, hybrid power generation systems that integrate both solar and wind energy sources offer a promising solution to the challenges of renewable energy variability. By combining the complementary strengths of these two abundant resources, such systems can achieve greater reliability, stability, and efficiency in electricity production.The observation of such hybrid systems reveals their ability to smooth out the inherent intermittency of individual energy sources, providing a more consistent output over time. Additionally, the geographic diversity of solar and wind resources allows for optimization across regions, further enhancing the overall reliability of the system.Furthermore, hybrid solar-wind systems contribute to a more sustainable energy landscape by harnessing two clean and renewable sources of power, reducing reliance on fossil fuels and mitigating environmental impact.Overall, the continued development and deployment of hybrid solar-wind power generation systems hold significant promise in advancing towards a more resilient, low-carbon energy future

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