Review on Hybrid Power Production Using Solar Wind Tree

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Abstract- *Any country's economic and social growth are dependent on energy. Indigenous energy resources must be established to their maximum potential in order to minimise dependency on foreign fuels, while taking into account economic, environmental, and social constraints.This is critical for an increase in research and growth, as well as investment in the renewable energy industry, in order to meet energy demand and reduce reliance on fossil fuels. Because of their abundance, portability, and ease of harnessing for electric power generation, wind and solar power are becoming more popular.The extension of the grid is currently unfeasible in reaching the non-electrified rural population because affiliation is neither economically feasible.Furthermore, rising oil prices, as well as the unacceptably negative effects of this energy supply on consumers and the environment, are gradually withdrawing traditional energy solutions, such as fuel-based systems, from agricultural growth agendas, in favour of "Hybrid Power Generation," i.e. solar and wind-based energy generation.The concept of a hybrid electricity generation system that uses both solar and wind renewable energy in a remote area that is unable to link to the grid is presented in this paper. Hybrid systems have proven to be the most efficient way of delivering "high quality" electricity.*

Keywords- Vertical Axis Wind Turbine (VWAT), Solar Panel, Collector tilt angle, Blade angle.

I. INTRODUCTION

This project is about designing and analysis of Hybrid Power generation Using Solar wind Tree. Vertical Axis Wind Turbine (VWAT)is a type of wind turbine which rotates on the horizontal axis. This turbine is one of the most under-estimated turbine. This turbine rotates irrespective of the wind direction and also at lower speeds.Solar panel are the device which converts the sunlight into electricity through photovoltaic cells. By combining both these renewable energy resources in a single plant to produce hybrid power. The following review papers are reviewed and the research gap as well as problems were identified.

II. LITERATURE REVIEW

A literature review was conducted in order to find the feasibility as well as understanding and gaining knowledge of the previous researches. The results of the review were listed below.

Abdul Jaleel K T et al., [1] (2020): This papers presents the design of hybrid power production and also provides the conditions for proper working of the wind tree and also discuss about the working of the Solar wind tree by using a rotating solar panel along with the turbine blades and the power from the solar panel is obtained through slip rings. This paper clearly explains the advantages and disadvantages of the H0079brid wind tree.

Dr. N. N. Wadaskar et al., [2](2020): This paper presents the design of hybrid electricity generation system by utilizing both solar and wind renewable energy to the domestic household in the remote area which is unable to connect to the grid. Hybrid systems have tested to be the most effective choice to deliver, "high quality" power.

Shaikh Mehfuz Rehman et al., [3] (2020): This paper introduces the concept of using a leaf-shaped turbine to produce the most energy for the least amount of money. Proper implementation would help to minimise load on other forms of electricity generation techniques as a solution to the demand for high electricity and its reliance on hydropower and natural gas.

Alfiya Siddiqui et al., [4] (2020): The use of air to produce electricity with the aid of a vertical axis wind turbine is the subject of this article. A vertical axis turbine can draw energy from the wind regardless of the direction of flow and can do so at any time of day or night. Power generation with vertical axis wind turbines would be advantageous in the future. The VAWT (Vertical Axis Wind Turbine) is a more profitable wind turbine. The IOT (Internet of Things) is used to provide the alert if any type of fault occur in generation and IOT is

also take action regarding to that fault. This paper deals with uninterrupted power generation by using VAWT and IOT.

Manoj M Koushik et al., [5](2018): In this paper, a novel approach is presented for harnessing wind energy from moving vehicles to produce electricity on highways, railway tracks, and truck applications. Turbine tree is a phenomenon in which a number of small vertical axis wind turbines (VAWT) are installed on a single arrangement and coupled to produce a large amount of electricity. Metals and composites are currently being used as blade materials.

N A Nader et al., [6](2018):VAWT blades for low average wind speed regions, such as Al Khobar in Saudi Arabia, are planned and implemented in this paper. The design and economic analysis take into account the performance and power generated. The efficiency of the Savonius VAWT is examined experimentally and theoretically.

Abdolrahim Rezaeiha et al., [7] (2018): The effects of blade number (n) and solidity (s) on the aerodynamic efficiency of Darrieus H-type vertical axis wind turbines with 2, 3, and 4 blades are investigated in this paper (VAWTs). Solidity levels range from 0.09 to 0.36. To gain a better understanding of the impact of s and n on the dynamic loads on blades, turbine efficiency, and wake, a large number of operational parameters, such as tip speed ratio (l), Reynolds number (Re), turbulence strength, and reduced frequency (K), are investigated.The simulations used are high-fidelity unsteady Reynolds-averaged Navier-Stokes (URANS) simulations that have been thoroughly tested with experiments. The current findings support the development of small- to large-scale VAWTs with optimal aerodynamic design.

Sujata Eresimi et al., [8] (2017): This paper explains that the power generated from wind tree is environmental friendly, mainly it generates power with least noise and it can be installed at different locations.

Dr.SubratSahu et al., [9](2017): This paper look into the diffusion process of new solar energy technologies in the Industry and shall analyse its business and marketing implications. The paper shall study the business and marketing practices of select national and international companies in terms of their technology enabled market offerings and shall comment on the sustainable business and marketing approach.

C.M.Vivek et al., [10] (2017): This paper focused on increasing the efficiency of using wind energy by producing large amount of electricity and reduces the space for installation. This can be accomplished by integrating a vertical axis wind turbine (VAWT) with a horizontal axis wind turbine (HAWT) in a single tower. The hybrid vertical and horizontal axis wind turbine lowers the cost of producing more energy in a larger amount.

Ali Mostafaeipour et al., [11] (2017): The feasibility of a modern wind power generation system for urban use in Iran's Hormozgan Province is explored in this paper. The wind turbine device used in this study is a tree-shaped wind turbine, which is a novel, aesthetically pleasing, noiseless, pollution-free, potentially cost-effective, and high-efficiency design (TSWT).

Waldemar Fedaket al., [12](2017): The optimum number of blades in a Cup-Bladed Vertical Axis Wind Turbine is determined in this paper. Costs can be cut by reducing the scale of the Vertical Axis Wind Turbine. The rotor's maximum power is chosen as the output target. The measurement of a single blade is used to determine the optimal number of Vertical Axis Wind Turbine blades.

Ragunath L et al., [13] (2016): The increase in power requirement causes power shut down in rural areas. This is mainly due to large power consumption by the factories and less availability of the non-renewable energy sources. From this it gives a clear picture of the importance of hybrid power generation system. It is more reliable and have higher efficiency when compared with the other systems. In this system a combination of wind energy and solar energy is used for power generation. While using only solar energy the energy can be harvested only during day time. But while combining the solar and wind energy, energy hidden in the solar and wind can be harvested during the day time and during night energy can produced by the wind turbine.

S.N Dr. Nader Sawalhi et al.,[14] (2016): The output of Savonius wind turbines is reviewed in this paper. This form of turbine is not widely used, but its applications for extracting useful energy from the air stream are still being considered. The VAWT- Savonius model has many advantages, including a low wind speed start-up, the ability to operate in any wind direction, and the reduction of noise.

Lucas Deisadze et al., [15] (2016): A study is conducted on placing a VAWT on the roof top. Different types of VAWT are being designed for maximizing the efficiency of the turbine. In this a detailed study conducted on the wind turbine design and making it suitable mounting in the roof top and reducing the vibration being transferred to roof top. In this project wind analysing software is used to analyse the existing wind data. Turbine vibration is being measured during wind tunnel test and impact test on scale-model test.

Balwinder Singh Surjan et al., [16] (2016): In this paper, a study of various WECS models, DFIG modelling, SSSA modelling, and methods for improving stability is discussed. The analysis of the energy system embedded with renewable energy sources such as wind power can be conducted by making sufficient assumptions to emphasize the impact to be examined, according to the results of this review.

Dr.Venkatesh Babu et al., [17] (2015): In this paper in order to increase the efficiency as well as to increase the power production rate, they have modified the system of vertical axis wind turbine to wind tree power generation in which number of wind turbines are coupled in a single arrangement and due to the reduced size of blades so they can be easily rotated due to the impact of forced air. With the help of generators power is generated and stored with the help of battery.

D. A. Nikam et al., [18] (2015): This review work examines various stages in the design and construction of an integrated vertical axis wind turbine, including the general wind energy scenario, various energy extraction methods, and design and aerodynamic performance analysis of vertical axis wind turbines.Optimization of design parameters of vertical axis turbine blades, taking into account various parameters such as geometry orientation in assembly, will be part of the project's work.

Abderrahmane Belghachi et al.,[19] (2015): In recent years, there has been a lot of research into developing high-efficiency solar cells that rely on new materials and structures. As a result of all of this, the maximum possible efficiencies have been consistently broken using various technologies.Since the invention of photovoltaic systems, the most pressing issue has been to eliminate all types of performance losses in order to avoid exceeding the physical limits. To address this stumbling block, rigorous investigations were conducted to monitor and uncover the source of the impediment in order to identify possible productivity gains. To measure the solar cell efficiency limit, a variety of thermodynamic methods were used, ranging from the ideal Carnot engine to the most recent detailed balance with its improved approach.

Dr. Shivaprakash Bhagwatrao Barve et al., [20] (2014): The important objective of this paper is to provide electricity to the rural areas. There is not a much difference between horizontal as well as vertical axis turbines so this paper choose vertical axis turbine. Based on the cost and Noise considerations Vertical axis turbine is far better than the horizontal axis turbine. The wind turbine is designed in such a way that it will extract energy even from a small wind. By combining solar and wind a hybrid system can be developed which can be utilised for power generation in rural areas.

B. Gopinath et al.,[21] (2014): This research looks at a wind turbine blade with improved aerodynamic properties. Vertical axis turbines are preferred because they are simple to install, quiet, and environmentally friendly.The turbine blades are analysed and simulated to enhance the performance of the turbine. This research uses V shaped blade Design in order to achieve high aerodynamics.

Abrarkhan Pathan et al., [22] (2014): This analysis paper aims to move forward in blade profile research by critically analyzing some articles. The aim of this paper is to analyses the twisting of blade air foil, angle of attack, wind blade material, Vibration on blade and selection of Blade air foil.

David Olinger et al.,[23] (2014): This project designed and discussed about several types of VAWT blades with the aim of maximizing the efficiency of the turbine. The project also studied roof mounting systems for turbines that are meant to dissipate vibrations to the roof structure. These turbines are tested under wind tunnel and impact test carried out in the small tunnel house.

Ulan Dakeev [24](2013) : This research provides an analytical method for developing a new technique in which a wind tunnel apparatus is used to increase the performance of a small scale wind turbine's power output. In order to monitor, evaluate, and interpret both incoming and outgoing wind velocity readings, a custom-designed wind tunnel attachment was built.

Nanchi et al., [25] (2012): The project's aim is to have the best possible collector tilt angle for low latitudes. Many factors influence the amount of solar radiation that reaches the planet. The strength of extraterrestrial solar radiation on the earth's horizontal and tilted surfaces is affected by clouds, dust, and shade, among other things.When designing solar equipment, the designer must pay special attention to harnessing the maximum amount of insolation possible for the equipment's best output.

Travis J. Carrigan et al., [26] (2012): The aim is to optimise torque while adhering to standard wind turbine design parameters including tip speed ratio, solidity, and blade profile. There is an air-foil cross-section and solidity for which the torque can be maximised by fixing the wind turbine's tip speed ratio.

Muhammad Mahmood Aslam Bhutta et al., [27] (2012): This paper examines the advantages and disadvantages of different VAWT configurations. In addition, the modelling methods used for VAWT design have been examined, as well as the performance. It was discovered that the coefficient of power (CP) varies depending on the configuration and can be optimised using the Tip Speed Ratio.

Javier Castillo et al., [28] (2011): The emphasis of this thesis was on the design of a small vertical axis turbine made of wood. The aerodynamics research is carried out in a mathematical computer programme using a momentum-based model. The research will focus on three turbine blades. It is achieved with the turbine's performance in mind.

Reid A. Berdainer et al., [29] (2010): This paper discusses a new sustainable power generation system that combines a vertical axis turbine and a photovoltaic cell. This fully integrated design builds on previous designs that addressed the combination of these energy-efficient technologies.The additive combination and assembly of readily available machine parts characterises currently available devices. Wind energy can now be harnessed from any direction thanks to the invention of a VAWT. The VAWT's Omni-directionality is boosted even further by the addition of several phase-offset rotor phases. This design also includes a unique feature that allows for the amplification of wind velocities through a converging housing portion, resulting in a higher rotor power coefficient and a lower cut-in wind speed.The wind funnelling effect is achieved through the synergistic combination of the lighting system's three key product components: wind turbine, solar panel, and light-emitting diode (LED) lighting.Computational fluid dynamics findings were used to aid in the creation of the rotor sizing parameters and the turbine housing. An LED light product was chosen to minimise the amount of power required from the energy production systems.

III. SCOPE FOR IMPROVEMENT

1. To design and fabricate a turbine tree using vertical axis wind turbine (VAWT) that could generate power under relatively low wind velocities.
2. Analyze how different geometry of the wind turbines would affect the output power of the wind turbine.
3. Compare the operation of turbines with respect to the numbers of attached blades in the turbine.
4. The conceptual model for wind tree is to be fabricated along with solar panel.

IV. CONCLUSION

From the above research papers it can be concluded that Due to less land requirement it require less land as compare to traditional PV system. So we require such a plant which can generate maximum energy using minimum land. Main problem is solar panel won't work in dark. Overcome this is very needy. As setup for solar tree is quite costly as compare to rational solar placement so this could be used so wind turbine on same setup. Wind turbines are rarely found in cities though it is also a free energy source of energy. In order to obtain power at any places with lower wind speeds and less land the only way is using a vertical axis wind turbine by increasing the number of turbines as well as combining it with solar panel can easily provide power to that places.Thus this Solar Wind Tree can serve its purpose of power production.

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