Design and Fabrication of Hybrid Charging Station

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Abstract: ***A solar collector is a device that transforms solar radiation from the Sun into heat, which is then transferred to working fluid. The use of solar collectors reduces energy costs over time as they do not use fossil fuels or electricity like in traditional water heating. As well as in domestic settings, a large number of these collectors can be combined in an array and used to generate electricity in solar thermal power plants. There are a number of different types of solar collector designs that use the energy of the sun to heat working fluid. Parabolic dish reflector provides a better alternative way in order to generate higher temperatures with better efficiency. The parabolic dish reflector is a solar energy collector designed to capture the sun's direct solar radiation over a large surface area and focus or "concentrate it" onto a small focal point area, increasing the solar energy received by more than a factor of two. In the present project we will do the design & development of Parabolic Dish collector with automatic solar tracking for water heating application.***

Keywords: ***Solar energy, water heating application, parabolic dish collector, automatic solar tracking.***

I. INTRODUCTION

The concept of solar and wind energies dates back to nearly 7,000 years ago. However, in the late 1800s the Danes developed the first wind turbines to produce commercial electricity. In the early 1900s small-scale wind turbines became more widely used around Europe especially in the rural areas for producing electricity using old car generators and carved rotors. The wind power brought electricity to the rural areas and the electrical power was used to charge batteries to run radios and to draw water from deep wells. Except in Denmark where wind power production and research continued, wind power did not play any major role in the generation of electricity until the late 1900s. The rapid growth of solar and wind power is due in part to favorable global political climate towards these energies, efforts to reduce carbon dioxide (CO2) and greenhouse gasses (GHG) and other power plant pollutants, global awareness of climate changes, and the urgency to develop renewable energy sources. Other factors such as lucrative tax

incentives and legislation man-dating national renewable energy standards have accelerated the march towards solar and wind energies. For example in the US, some states have enacted “renewable portfolio standard (RPS)” law that requires utilities to sell a certain percentage of the energy from sustainable energy sources within reasonable stipulated times. Even Though Europe and North America have the largest in-stalled capacity of wind turbine capacity, China, India, and the developing world have the biggest potential for wind power.

Solar and wind hybrid generation is the most popular power generation method as these are available readily everywhere. This paper focuses on design aspects and fabrication of hybrid power generation model. Hybrid energy generation is turning out to be a more popular method of distributing electricity in rural areas and in urban areas as well where the land constraint play a major role. Hybrid model proposed here combines solar panels and vertical axis wind turbine and provides continuous supply with increased reliability. This Hybrid renewable Generation system can become the best solution for feeding the mini-grids and isolated loads in remote areas. The system can also provide an answer for the individual energy concern. Higher total energy 2 efficiency, improved operational performance, dispatch and operational control can be obtained through the proper technology selection and generation unit sizing. Researchers and engineers are developing different configurations to utilize the system component effectively. The figures below show such two kinds of arrangements used for the hybrid generation system. Horizontal axis wind turbine system, which is most of the time used in wind farms, produces energy generally in MW; but its installation and maintenance cost are high whereas the vertical axis machines are cost and size effective, hence useful for small scale applications.

Many countries are also providing funds and assistance for building it in order to satisfy the need for electricity. In India, central as well as state governments are spreading awareness and guiding people for its expansion. Maharashtra State Energy Development Agency (MEDA) is one of the government institutions, which promotes renewable energy systems. Following list shows year wise achievement of wind and solar hybrid systems and its progress in the state of Maharashtra, India.Solar energy and wind energy have been deemed clean, inexhaustible, unlimited, and environmentally friendly. Such characteristics have attracted the energy sector to use renewable energy sources on a larger scale.However, all renewable energy sources have drawbacks.Wind and solar sources are dependent on unpredictable factors such as weather and climatic conditions. Due to both sources' complementary nature, some of these problems can be overcome by the weaknesses of one with the strengths of the other. This brings us to the hybrid solar-wind power plant concept. Hybrid energy stations have proven to be advantageous for decreasing the depletion rate of fossil fuels, as well as supplying energy to remote rural areas, without harming the environment.

Hybrid Renewable Energy Systems (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 prices of 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 3 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 peak output. Hybrid energy systems often yield greater economic and environmental returns than wind, solar, geothermal or tri-generation stand-alone systems by themselves.

Our project is based on utilization of non-conventional sources of energy to satisfy basic needs. 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 source, 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

LITERATURE REVIEW:

Varad Bagwe, et.al.[1], done the work on, Integration of Solar and Wind Energy System for Hybrid Power Generation, according to his study,With the increased global warming concern it is becoming important to find an alternative to conventional energy sources causing less pollution and leading to sustainable use of available resources. Thishas encouraged renewable energy generation to become a leader in the energy sector but the main obstacle in its path is its cost effectiveness. This has motivated combining two or more renewable energy resources i.e.hybrid power generation. The paper deals with the study and design of hybrid systems of solar and wind energy for rural area's electrification.A hybrid power generation system is a better solution for power generation than conventional energy resources especially in rural areas where electricity is not stable or absent. The power generated can be utilized in situ thereby reducing transmission losses and cost. The designed hybrid system is very compact,easy to install and ensures no power failure by solar during the day and wind during the night. As the idea is in its initial stage, productive changes

may be implemented in later stages. It is highly safe for the environment having a long life span and only need initial investment thus overall it is good, reliable and affordable solution for electricity generation.

Swapneel kaurav, et.al.,[3]done the work on ,Hybrid Power System Using Wind Energy andSolar Energy, according to his study, Now a day's electricity is most needed facility for the human being. All the conventional energy resources are depleting day by day. So we have to shift from conventional to non-conventional energy resources. In this the combination of two energy resources is takes place i.e. wind and solar energy. This process reviles the sustainable energy resources without damaging the nature. We can give uninterrupted power by using hybrid energy system.Basically this system involves the integration of two energy system that will give continuous power. Solar panels are used for converting solar energy and wind turbines are used for converting wind energy into electricity. This electrical power can utilize for various purpose.Generation of electricity will be takes place at affordable cost. This paper deals with the generation of electricity by using two sources combine which leads to generate electricity with affordable cost without damaging the nature balance.Hybrid power generation system is good and effective solution for power generation than conventional energyresources.It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non-conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only need initial investment. It has also long life span. Overall it good, reliable and affordable solution for electricity generation.

Medugu, D. W. et.al.,[4]done the work on, Integrated Solar – Wind Hybrid Power Generating System for Residential Application,according to his study,A hybrid power system consisting of PV-arrays and wind turbines with energy storing devices (battery bank) and power electronic device was designed and constructed in this paper. The system is aimed at the production and utilization of the electrical energy coming from more than one source, provided that at least one of them is renewable. The efficiency of the designed power electronic device is about 95% and 73% for capacitive and 12 resistive loads respectively. The integration of the hybrid is to electrify a residential house and its surrounding in order to reduce the need for fossil fuel leading to an increase in the sustainability of the power supply. This approaches techno economically viable for rural electrification. A hybrid power generating system consisting of a PV array and wind turbine with energy storage device and power electronic converter was designed and constructed to take advantage of the seasonal wind and sunshine. The design is achieved as an efficient and cost competitive system configuration so that hybrid power source can improve the life of people especially in rural areas where electricity is not stable or is absent. The efficiency of the designed electricity generating machine (inverter) is about 95% and 73% for capacitive and resistive loads respectively. The wind turbine

performance showed a promising output, but there was a challenge with the generator at lower wind speed as can be seen from table 4.4 where only 0.77V was added to the battery's state of charge. This platform has been laid to harvest the wind energy and the abundant solar radiation availability in Mubi. The integrated solar-wind hybrid power generating system is environmentally friendly and maintenance free.

Pritesh P. Shirsath, et.al.,[5]done the work on ,Solar-Wind Hybrid Energy Generation System,according to his study,As the race for global industrialization begin late in 18th century, the developing technology made humans to depend on energy, so as the energy crisis begins, in this modern era, electricity become a most essential need of human beings, from household to industrial work. So, the purpose of the project is to generate electricity without using non-renewable resources and pollution. Since, renewable standalone energy generation system have disadvantages, which need to be overcame by hybrid systems. Wind and solar energy have being popular ones owing to abundant, ease of availability and convertibility to the electric energy. This work covers realization of hybrid energy system for multiple applications, which runs under a designed circuitry to utilize the solar and wind power. And a designed circuitry for more efficient results, and inverters to convert the electrical energy as per demand.

DESIGN

Analytical Design:

Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific function with maximum economy and efficiency. Hence a careful design approach has to be adopted. The total design work has been split up into two parts;System design mainly concerns with various physical constrains, deciding basic working principle, space requirements, arrangements of various components etc. Following parameters are looked upon in system design .Selection of system based on physical constraints. The mechanical design has direct norms with the system design hence system is designed such that distinctions and dimensions thus obtained in mechanical design can be well fitted in to it. Arrangement of various components made simple to utilize every possible space. Ease of maintenance and servicing achieved by means of simplified layout that enables quick decision assembly of components Scope of future improvement.In mechanical design the components are listed down and stored on the basis of their procurement in two categories, Designparts & Parts to be purchased. For designed parts detailed design is done and dimensions there obtained are compared to next dimensions which are already available in market. This simplifies the assembly as well as the post production and maintenance work. The various tolerances on work are specified.The process charts are prepared and passed to manufacturing stage. The parts to be purchased directly are selected from various catalogues and are specified so as to have case of procurement In mechanical designed at the first stage selection of appropriate material for the part to be

designed for specific application is done. This selection is based on standard catalogues or data books; E.g.:- (PSG DESIGN DATA BOOKS) , (SKF BEARING CATALOGUE) etc.

ADVANTAGES AND APPLICATION:

Advantages:

The advantages covered by the propose system are listed as,

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

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) Asper requirement of electrical energy the system can be either designed or updated for higher energy requirement.
8) WhenAC 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.

RESULT & DISCUSSION:

The idea to utilize the wind-solar power potential of the Hills area adjoining conceived keeping in view the availability of small wind-solar hybrid projects in future. Sun & wind normally complementeach other with sun energy being available for the period when wind energy is comparatively low and vice-versa. Thus, the combination of sun and wind provided an ideal solution.

The table shows thatpower produce by solar panel & wind mill it has to increases power output combine 2-4Wattapprox. in combination of working.Measurement Setup Panel voltage is measured at different intervals of sunlight peak hours. At 10:00 AM TO 3:00 PM. At that time corresponding panel & wind turbine voltage & power obtain is measured. The result shows the power produced by system given Below,

Table.5.1. Result of Power output of Hybrid charging system.

Sr. No.	Time	SolarPower V x I = P (Watt)	WindPower V x I = P (Watt)	Hybrid Power (Watt)
1	10 AM	15.9 X 0.67 = 10.65	2.81 X 1 = 2.81	13.46
2	11 AM	16.1 X 0.67 = 10.78	3.20 X 1 = 3.20	13.98
3	12 NN	16.3 X 0.67 = 10.92	3.57 X 1 = 3.57	14.49
4	1 PM	16.7 X 0.67 = 11.18	3.78 X 1 = 3.78	14.96
5	2 PM	17.4 X 0.67 =11.65	4.11 X 1 = 4.11	15.76
6	3 PM	17.5 X 0.67 = 11.72	3.65 X 1 = 3.65	15.37

CONCLUSION:

While concluding this report, we feel quite fulfill in having completed the project assignment wellon time, we had enormous practical experience on fulfillment 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 main objective of this project is to assess the feasibility and economic viability of utilizing hybrid Solar–Wind–battery based standalone power supply systems is fulfilling.We are success for making non-conventional system which will give continues & sufficient power in all working conditions.The design the system develop by us is cost effective, reliable and also efficient.The model develops by us fulfill the required objectives & hence we are satisfied with our project work. This system can produce 15-watt power combine.

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