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"Hybrid power electric bike charging station"

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***Abstract*—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 nonconventional 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. Hybrid power generation has a huge scope in present as well as in future also because of limited supply of conventional energy sources like Petrol, Diesel, Coal, Natural gas,etc.**

***Key words*— hybrid energy, wind energy, non-conventional, charging station.**

I. INTRODUCTION

Electricity is most needed for our day to day life. There are two ways of electricity generation either by conventional energy resources or by non-conventional energy resources. Electrical energy demand increases in word so to fulfil demand we have to generate electrical energy. Now a day's electrical energy is generated by the conventional energy resources like coal, diesel, and nuclear etc. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly. And it also damages he nature. The nuclear waste is very harmful to human being also. The conventional energy resources are depleting day by day. Soon it will be completely vanishes from the earth so we have to find another way to generate electricity. The new source should be reliable, pollution free and economical. The non-conventional energy resources should be good alternative energy resources for the conventional energy resources. There are many non-conventional energy resources like geothermal, tidal, wind, solar etc. the tidal energy has drawbacks like it can only implemented on sea shores. While geothermal energy needs very lager step to extract heat from earth. Solar and wind are easily available in all condition. The non-conventional energy resources like solar, wind can be good alternative source. Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that any one of source fails other source will keep generating the electricity.

Hybrid energy system is the combination of two energy sources for giving power to the load. In other word it can defined as "Energy system which is fabricated or designed to extract power by using two energy sources is called as the hybrid energy system." Hybrid energy system has good reliability, efficiency, less emission, and lower cost.

A. Solar Energy :

Solar energy is that energy which is gets by the radiation of the sun. Solar energy is present on the earth continuously and in abundant manner. Solar energy is freely available. It doesn't produce any gases that mean 8 it is pollution free. It is affordable in cost. It has low maintenance cost. Only problem with solar system it cannot produce energy in bad weather condition. But it has greater efficiency than other energy sources It only need initial investment. It has long life span and has lower emission.

B. Wind Energy:

Wind energy is the energy which is extracted from wind. For extraction we use wind mill. Ii is renewable energy sources. The wind energy needs less cost for generation of electricity. Maintenance cost is also less for wind energy system. Wind energy is present almost 24 hours of the day. It has less emission. Initial cost is also less of the system. Generation of electricity from wind is depend upon the speed of wind flowing.

The major disadvantages of using independent renewable energy resources are that unavailability of power for all time. For overcoming this we use solar and wind energy together. So that any one source of power fails other will take care of the generation. In this proposed system we can use both sources combine. Another way is that we can use any one source and keep another source as a stand by unit. This will leads to continuity of generation. This will make system reliable. The main disadvantages of this system are that it needs high initial cost. Except that it is reliable, it has less emission. Maintenance cost is less. Life span of this system is more. Efficiency is more. It is a form of renewable energy resource that is some measure Competitive with fossil fuels. Hydro power is the force of energy of moving water. It provides about 96% of the renewable energy in the United States. Hydroelectric power plants do not use any resources to create electricity or they do not pollute the air. The sun is a hydrodynamic spherical body of extremely hot ionized gases (plasma), generating energy by the process of the thermonuclear fusion. The temperature of interior of sun is estimated at 8*10^6 k to 40*10^6 k, where energy is released by fusion of hydrogen and helium.

II. LITERATURE REVIEW:

1] Studied hybrid wind/solar systems using battery banks and developed an optimal model for designing such systems. The stand-alone system was designed to power a telecommunication station along the coast of China. The slope angle of the photovoltaic (PV) array was studied to find the optimal power-producing angle, as well as the optimal values of other variables such as the number of wind turbines and battery capacity. The annualized cost of the system was minimized while meeting the specified loss of power supply probability (LPSP). The model was solved using a genetic algorithm, and good complementarity between the two energy sources was reported. Efren et al. [4] studied an optimal sizing procedure for a similar system in Turkey.

2] Ahmed et al. [5] presented a hybrid system model that included fuel cell generation along with wind and solar power. The fuel cell system was used as a backup resource, where as the main energy sources were the solar and wind systems. Results demonstrate that the system is reliable and can supply high-quality power to the load, even in the absence of wind and sun. Omar et al. [6] also designed fuel cell systems hybridized with solar and wind energy which are well-suited to gridindependent applications.

3] Yang et al. [7] used a genetic algorithm to develop an optimal sizing method for a hybrid wind/solar system that optimizes its configurations with the use of battery banks. The optimal sizing method was then used to calculate optimal system configurations that achieve a given loss of power supply probability (LPSP) while at the same time minimizing the annualized cost of the system (ACS). The feasibility of meeting the energy demand of a seawater greenhouse in Oman using a hybrid wind/solar energy system was assessed by Mahmoud et al. [8] by 11nalysing hourly wind speed and solar radiation measurements. Elhadidy and Shaahid [9] assessed the feasibility of providing power to and meeting the load requirements of a typical commercial building using a hybrid solar-wind.

4] Power Generation by Using Highway Vertical Axis Wind Mill By. N. Venkata Subbaiah Kumar, M.L.S Deva (IJCRT 2017)

III. PROBLEM STATEMENT:

In the current systems used for Charging of Electric Vehicles we find that the Power used is either produced by Non Renewable source or it is only produced by using only one Renewable source for eg. Only Solar or Wind Energy. The problem with using only one Solar Energy is we can't get power at night and Solar fails during Night, Rainy season & Cloudy Climate and using only Wind Energy we can't get power when the speed of the Wind is low. So we want a Power source which can produce power at both Night and Day.

IV. OBJECTIVES:

1. To find and design a most efficient Wind Turbine that produces more power in less space.
2. To design and access the performance of a wind and solar hybrid system for power generation and using it for charging of electric bike.

V. Methodology:

We started the work of this project with literature survey. We gathered research papers which are relevant to this topic. After going through these papers, we learnt about hybrid energy system.

2. After that the components which are required for our project are decided.
3. After deciding the components, the 3D model and drafting is done with the help of CATIA software.
4. Later we designed the components that we required for project.
5. After designing the experimental testing were carried out.
6. Assembly of components and Testing of model is conducted.

VI. Wind Turbine Design:

According to Betz's law, no turbine can capture more than 16/27 (59.3%) of the kinetic energy in the wind. The factor 16/27(0.593) is known as Betz's coefficient. Practical utility scale wind turbines achieve at peak 75-80% of the Betz's limit.

➢ Overlap (e)= 0.15-0.3 times H =0.15(H) or 0.3(H) =0.3(450) =135 mm Taking e =130mm

➢ Rotor aspect ratio =H/D =450/370 =1.216 …. (1 < (H/D) < 1.5)

➢ Thickness of rotor = 0.8 mm ISB&M COLLEGE OF ENGINEERING, PUNE-05. [B. E. MECHANICAL] 28 Hybrid Power Electric Bike Charging Station

➢ Overlap relation = e/d = 130/250 = 0.52 …. (0.50 < (e/d) < 0.75)

➢ Cut-in speed = 2 m/s ➢ Cut-out speed = 12 m/s

➢ Blade Arc Angle 180 Degree …. (Selected from the standard Savonius Rotor)

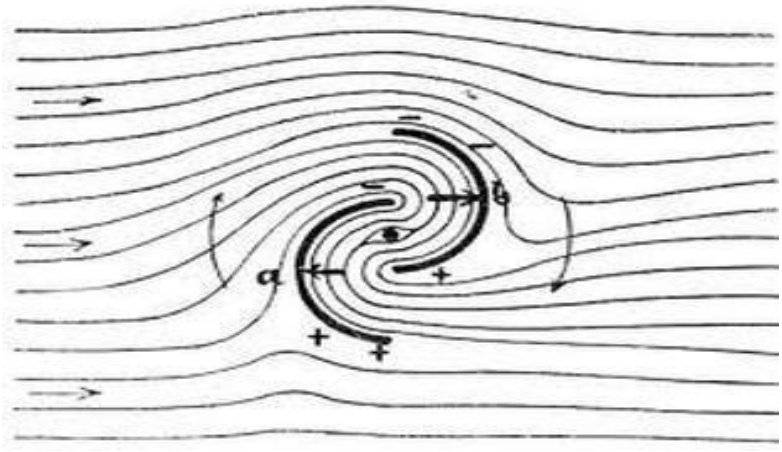

Fig.Wind Pattern for the Savonius Rotor

Savonius turbines are one of the simplest turbines. Aerodynamically, they aredrag-type devices, consisting of two or three scoops. Looking down on the rotor from above, a two-scoop machine would look like an "S" shape in cross section. Because of the curvature, the scoops experience less drag when moving against the wind than when moving with the wind. The differential drag causes the Savonius turbine to spin. Because they are drag-type devices, Savonius turbines extract much less of the wind's power than other similarly-sized lift-type turbines. Much of the swept area of a Savonius rotor may be near the ground, if it has a small mount without an extended post, making the overall energy extraction less effective due to the lower wind speeds found at lower heights.

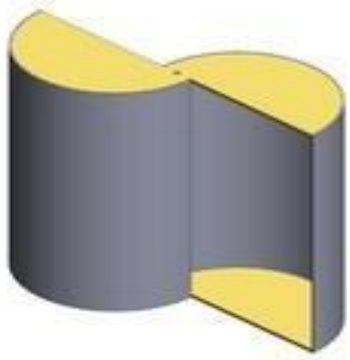

Fig. CAD Model of turbine

VII. Sample Calculations (for 3.5 m/s Wind Speed):

$P = 1/2 * \rho * A * V^3$

$=1/2*1.135*0.1665*(3.5)^3$

$=4.05$ watts

Where,

ρ = kg/m^3 ρ at 38^{0}C=1.135 kg/m^{3}V

= m/s = 3.5 m/s

Area swept (A) = $H_r * D$

$= 0.45*0.37$

$= 0.1665 m^2$

Wind torque (T_w) = $1/4*\rho*As*D*v^2$

$=1/4*1.135*0.1665*0.250*(3.5)^2$

$= 0.14468$ N/m

Wind Power (P_w) = $(1/2)pAV^3p$

= 1.135 kg/m^3 at 38 ^{o}C

$P_w = (1/2) * 1.135 * 0.1665 * (3.5)^3$

$= 4.051$ W

Power output (P_{out}) = VI

$= 2.5 * 0.23$

$= 0.575$ W

Efficiency of the Turbine

Efficiency = $(P_{out}/P_w)*100$

$= (0.575/4.051)*100$

$=14.19\%$

Actual Time for Battery Charging:

It is observed that there are losses in solar panel and the power produced isless than rated power actual.

Actual power produced by 4 solar panel in 1 hr at 38^0C at 3:00 pmP(solar) = 4*9.045W per panel

= 36.18 W

- Power produced by wind turbine at wind velocity 5 m/s at 38^0CP(wind) = 5.5 volts*0.54 ampere=2.97 W
- Total power output from both sourcesP(total) = P(solar) + P(wind)

  = 36.18 W + 2.97 W

  = 39.15 W
- Total time required for charging battery 200 WTime(total) = Battery wattage/ P(total)

  = 5 Hrs 6 Min.

VIII. Energy Payback Period:

- Annual Power Produced by Solar Energy:

  = 36.18 x 8 x 365

  = 105.65 KW
- *Annual Power Produced by Wind Energy (avg. 3.5m/s):*

  = 2 x 24 x 365

  = 17.52 KW
- *Annual Power Produced by Hybrid system:*

  = 105.65 KW + 17.52 KW

  = 123.17 KW

➢ *Energy Payback Period for System:*

= 9000 / (123.17 x 10)

= 7 Years 4 Days

As the Life of the Solar Panel is 25 Years and the Turbine and other components ifmaintained at regular intervals can give a good life.

As the energy payback period is much less as compared to the life of the system.It gives good returns on investment.

IX. Components :

1. Solar Panel: A solar cell (photovoltaic cell or photoelectric cell) is a solid-state electrical device that converts the energy of light directly into electricity by the photovoltaic effect. The energy of light is transmitted by photons-small packets or quantum of light. Electrical energy is stored in electromagnetic fields, which in turn can make a current of electrons flow.

Solar cells, which largely are made from crystalline silicon work on the principle of Photoelectric Effect that this semiconductor exhibits. Silicon in its purest form- Intrinsic Silicon- is doped with a dopant impurity to yield Extrinsic Silicon of desiredcharacteristic (p-type or n-type Silicon). When p and n type silicon combine they result in formation of potential barrier.

Fig. Solar Panel

2. Dynamometer: Dynamometer, device for measuring mechanical force, or power, transmitted by a rotating shaft. Since power is the product of torque (turning force) and angular speed, all power-measuring dynamometers are essentially torque-measuring devices; the shaft speed is measured separately.

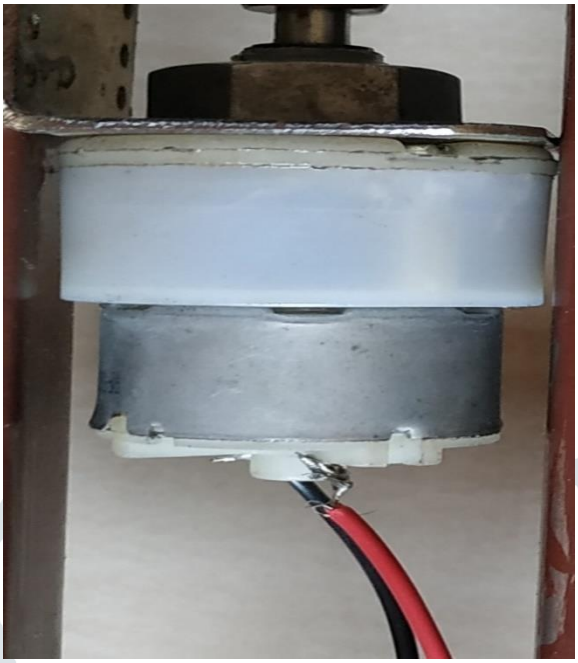

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Fig. Dynamometer

X. Instruments Used:

Voltmeter : A voltmeter, also known as a voltage meter, is an instrument used for measuring the potential difference, or voltage, between two points in an electrical or electronic circuit. Some voltmeters are intended for use in direct current (DC) circuits.

Fig. Voltmeter

XI. Project Layout:

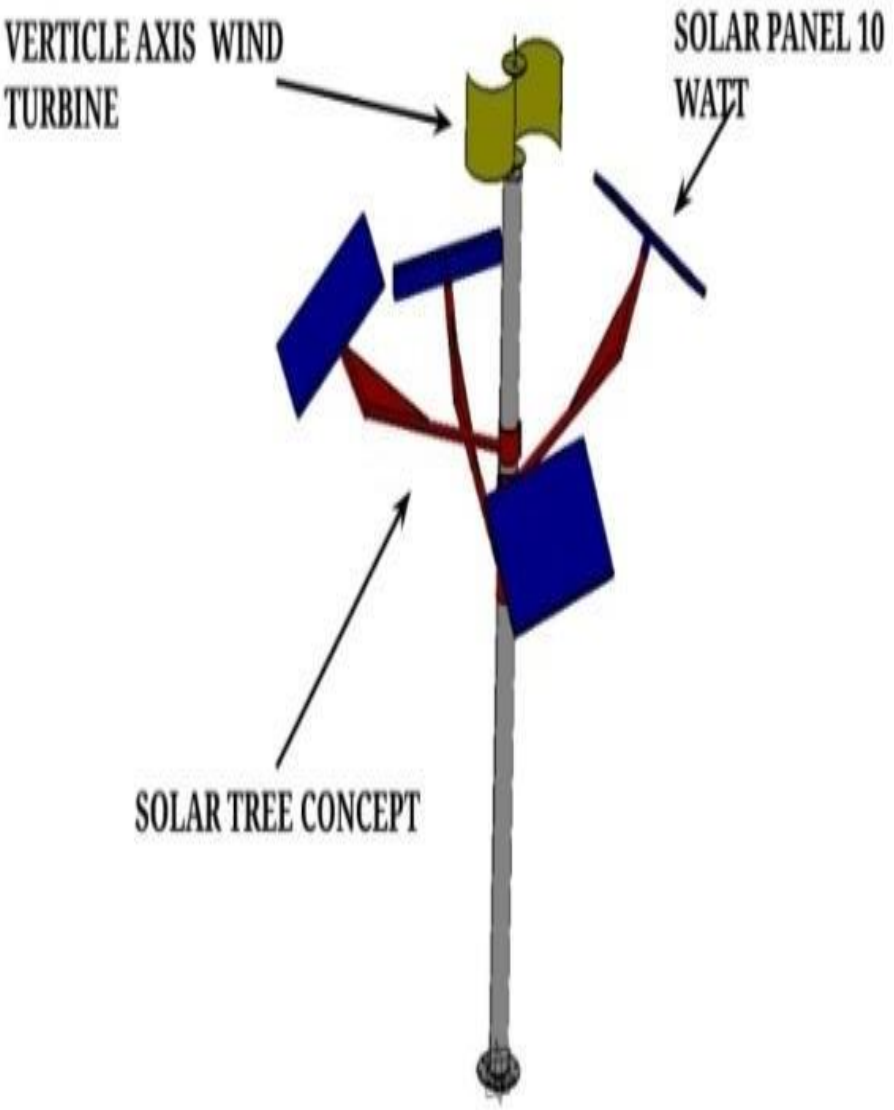

Fig. Project Layout

XII. FUTURE SCOPE:

1. The wind solar hybrid system can be installed in the area where there is sufficient sunlight throughout the day and average wind speeds in the range.

2. Every individual who had an electric bike can use this power station with an affordable price.

3. It can be also used for the household application purpose to generate electricity in order to avoid power load shedding.

4. As this power generation system eliminate the use of fossil fuel so it will help to reduce pollution and provide total eco cycle system for power generation.

CONCLUSION:

As per observation it's seems like that actual power produced by solar energy source with help of 4 solar panel in 1hr. at 38℃ at 3:00 pm is 36.18 watt and actual power produced by wind energy source with help of Savonius wind turbine at wind velocity 5 m/s at 38℃ P(wind) = 5.5 volt*0.54 ampere = 2.97 watts. From above calculation we can conclude that total power output from the both solar and wind enery source is P(total) = P (solar)+P(wind) = 39.15 W and total time required for charging battery of 200W is Time(total) = Battery wattage/ P(total) = 5 Hr.6 min.

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