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Electricity Generation Using Vertical Axis Wind Turbine

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ABSTRACT: The rapid growth of renewable energy generation is increasing to meet the demand for electricity. Solar and wind both are renewable energy sources. . Wind energy is considered the fastest growing clean energy source, however; it is limited by variable natural wind. Highways can provide a required amount of wind to drive a turbine due to high vehicle traffic. This energy is unused. The objective of the project is to design a wind turbine to recapture wind energy from vehicles on the highway. When the vehicle passed on the highway, it produces a considerable amount of air due to its speed. This air tangentially strikes on the blade of the vertical axis wind turbine and it makes a rotation of the turbine in only one direction. The generator with the gear mechanism is connected to the shaft of the vertical axis wind turbine to generate electricity. The electrical output of vertical axis turbine and the solar system is stored in a battery. This stored energy which can be further used for street lighting, toll gates, etc. Hardware implementation of the vertical axis wind turbine (VAWT) is presented.

KEYWORDS:- Vertical axis wind turbine, electricity generation, savonius turbine, renewable energy source, battery system, highways.

I. INTRODUCTION

One of the prime commodity in modern civilization is energy. The amount of energy consumption has become the indicator of the standard of living and the degree of industrialization. At present, nearly ninety percent of the world's energy come from the combustion of fossil fuels, i.e. coal, petroleum oils, natural gas, etc. People use fossil fuels to meet nearly all of their energy needs, such as powering vehicles, producing electricity for light and heat, and running factories. On the other hand, energy resources from earth's fossil energy are limited and also the global production of petroleum oils will come beyond their peak in the next decades. The population growth will make the need of energy becomes higher and also the price of fossil fuels. At the same time there is a problem with the global climate change as a result of carbon-dioxide and sulphur-dioxide emission from the burning of fossil fuels. Using renewable energy as a cost-effective and reliable, low carbon energy sources is becoming an important objective of energy policy in the world. Renewable energy is a climate-friendly energy due to the absence of emission detrimental to the environment. The International Energy Agency reported that only a very small proportion of the energy comes from nuclear and hydropower, and a much smaller portion of renewable energy sources such as solar, wind, biomass, geothermal and tidal waves.

Wind power has become one of the fastest emerging, renewable energy technologies for electricity generation, and the total installed capacity has reached 487 GW (about 4% of the global electricity) by the end of 2016 (Kumar et al., 2018). The development of an effective wind turbine (WT) design, especially in an urban area, is critically needed to increase the penetration of wind power technology in cities and semi-urban areas. Substantial wind is blown into urban areas with a potential of power, viz. highway, railway track, and between/around the high-rise buildings. The

wind is blowing continuously with varying intensity in all these areas, and an effective turbine design must include all the site specific changes in the wind speed, direction, and turbulence. Two main types of WTs: horizontal axis and vertical axis. Horizontal axis WTs (HAWTs) are widely used in large wind farm applications in remote and offshore areas where the clean and an undisturbed wind is available. Wind patterns in urban areas are more chaotic, less predictable, and full of turbulence, which makes HAWTs relatively ineffective. The Vertical Axis Wind Turbines (VAWTs) might be an effective option in all these areas due to their low cut-in wind speed, no yawing requirement, less structural support, and no noise concerns. Numerous small-scale wind turbine designs have been suggested, tested and implemented in many urbanized areas where the wind is gustier and inconsistent. The efforts have also been undertaken in several countries on VAWT to make them a viable technology.

The main aim of this project is fabrication of a highway windmill. This project converts wind energy into electrical energy. A wind turbine is a device that converts the wind's kinetic energy into electrical energy. This highway windmill uses wind energy generated by the moving vehicles and converts into mechanical energy. The DC generator converts the mechanical energy into electrical energy. The Inverter converts direct current into Alternating current. The turbines are used for applications such as battery charging for vehicles, power traffic warning signs and various applications.

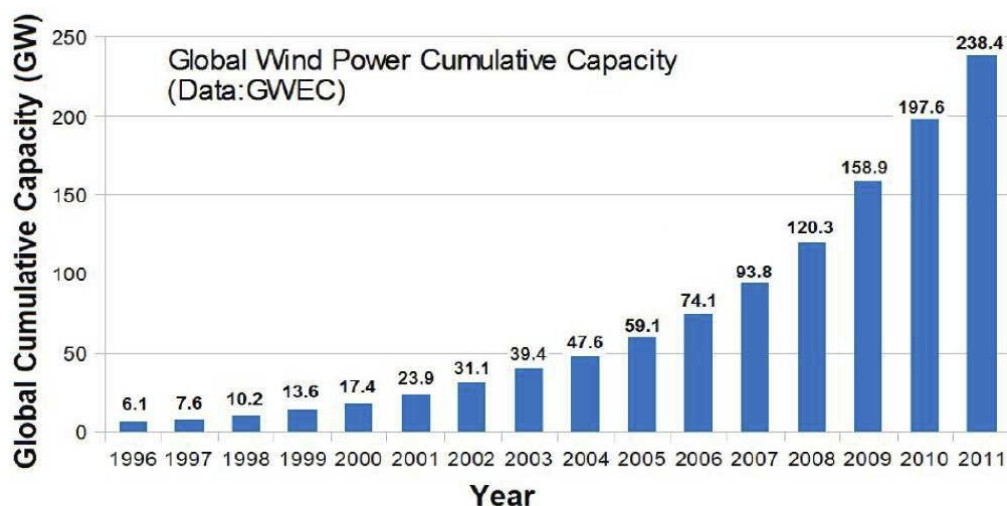


Figure 1.1 Global wind power cumulative capacity

II.PROBLEM STATEMENT

The wind forces from moving vehicles is getting useless, therefore, there exists an immense need of a system for generating electricity from wind induced by moving vehicles. The problem arises in designing the exact number of blades for wind turbine, which is rectified by the amount of wind speed and voltage. Whenever the vehicle moves on both the sides of the highway, then some pressurized air is produced due to the speed of the vehicle. This pressurized air strikes the blades of the turbine and makes the rotation. The shaft of the turbine is coupled to the generator. The electricity generated by the generator is alternating quantity. The output of the generator is rectified by the rectifier and stored in the battery.. The electricity

generated is stored in batteries. Stored energy is converted in Ac and is used for street lighting and domestic purpose.

III.METHODOLOGY

Fabrication of vertical axis wind turbine (Savonius type) consists of different parts which are needed to be fabricated as parts of main assembly.

Following are the parts of VAWT, to be fabricated:

Base- Fabrication of base aims at providing a strong support to the turbine against the high speed wind. It is designed in such a way as to reduce the vibrations of the turbine due to turbulent winds. The base holds the rotor with fixed shaft perpendicular to the rotor. The base also holds the power generating unit.

Frame-The Two six feet long pipes are attached perpendicular to the base. Two four feet long pipes are attached parallel to the base. These rectangular pipes are attached using L clamps with suitable nut and bolts. The frame is designed in such a way as to provide the required strength and support to the turbine against the rotation of blades and force of wind.

Blades- The blades are approximately 3mm thick. Five blades of equal length are being used. The analysis is made using a set of three, four and five blades. These blades are attached perpendicular to the rotor [cycle wheel] using clamps with nut and bolt arrangement.

Generator- Dynamo of car is used to produce electricity of 12 volts.

Drive system- Gear drive system is used to transmit the power from turbine to the generator. Gear ratio of 4 is used.

Variables: Wind speed: This is very important to the productivity of a windmill. The wind turbine only generates power with the wind. The wind rotates the axis (horizontal or vertical) and causes the shaft on the generator to sweep past the magnetic coils creating an electric current. Blade length: This is important because the length of the blade is directly proportional to the swept area. Larger blades have a greater swept area and thus catch more wind with each revolution. Because of this, they may also have more torque.

Base height: The height of the base affects the windmill immensely. The higher a windmill is, the more productive it will be due to the fact that as the altitude increases so does the wind speeds.

Base design: Some base is stronger than others. Base is important in the construction of the windmill because not only do they have to support the windmill, but they must also be subject to their own weight and the drag of the wind. If a weak tower is subject to these elements, then it will surely collapse. Therefore, the base must be identical so as to insure a fair comparison.

Tip speed ratio: The tip speed ratio is very important. The tip speed ratio is directly proportional to Fabrication of vertical axis wind turbine (Savonius type) consists of different parts which are needed to be fabricated as parts of main assembly.

IV.EXPERIMENTAL WORK

Time	Air Velocity (m/s)	Time	Air Velocity (m/s)
10.00 AM	4.0	3:30 PM	3.5
10:15 AM	4.9	3:45 PM	5.1
10:30 AM	4.4	4:00 PM	5.7
10:45 AM	5.3	4:15 PM	6.3
11:00 AM	6.3	4:30 PM	4.1
11:15 AM	5.0	4:45 PM	4.4
11:30 AM	6.9	5:00 PM	8.7
11:45 AM	7.1	5:15 PM	11.3
12:00 PM	6.5	5:30 PM	4.0
1:03 PM	4.6	5:48 PM	4.7
1:08 PM	5.0	5:50 PM	4.2
1:18 PM	5.3	5:59 PM	8.6
1:20 PM	6.6	6:08 PM	8.4
1:39 PM	4.9	6:13 PM	9.8
1:40 PM	7.0	6:39 PM	4.2
1:43 PM	6.2	6:41 PM	5.3
1:46 PM	4.5	6:46 PM	5.1
2:06 PM	7.7	7:04 PM	6.6

We performed a survey on two different locations on different time to get input data.
Table no 1 air velocity

V.RESULTS

The following results were obtained from calculations

Table No 2 Result Table

Air Velocity (m/sec)	Angular velocity (rad/sec)	Torque (Nm)	Flow power (watt)	Turbine Power (watt)
7	45	1.7313	141.659	77.9125
8	51.428	2.261	211.456	116.3008
9	57.8571	2.862	301.077	165.6923
10	64	3.53	413	227.15
11	71	4.25	550	302.5
12	77.1428	5.0881	713.66	392.5152
13	83.57	5.915	907.361	499.0485
14	90	6.9255	1133.272	623.2996
15	96.42	7.9502	1393.875	766.6312
16	102.8571	9.0455	1691.648	930.4064

VI.CONCLUSION

Conclusively, extensive data is collected on wind patterns produced by vehicles both sides of the highway. Using the collected data, a wind turbine is designed to be placed on the medians of the highway. Although one turbine may not provide adequate power generation, a collective of turbines on a long strip of highway has potential to generate a large amount of energy that can be used to power streetlights, other public amenities or even generate profits by selling the power back to the grid. This design concept is meant to be sustainable and environmentally friendly. Additionally, a wind turbine powered by artificial wind has a myriad of applications. Theoretically any moving vehicle can power the turbine such as an amusement park ride. The highway wind turbine can be used to provide power in any city around the globe where there is high vehicle traffic.

REFERENCES

- 1] Prof. Sachin Y. Sayais & Pankaj G. Patil, "Power Generation On Highway By Using Vertical Axis Wind Turbine & Solar System", International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 03 Mar-2018
ISSN: 2395-0056
- 2] N. Venkata Subbaiah, "Power Generation By Using Highway Vertical Axis Wind Mill, International Journal Of Creative Research Thoughts", Volume 5, Issue 4 December 2017, ISSN: 2320-2882
- 3] Frederikus Wenehenubun & Andy Saputra, "An Experimental Study On The Performance Of Savonius Wind Turbines Related With The Number Of Blades", 2nd International Conference on Sustainable Energy Engineering and Application, ICSEEA 2014, ISSN : 2125-2656
- 4] Somnath S M & Abhishek G, "Power Generation On Highway Using Vertical Axis Wind Turbine And Solar Energy", International Journal Of Engineering Sciences & Research Technology, ISSN: 2277-9655



- 5] Sahishnu R. Shah a & Rakesh Kumar, “Design modeling and economic performance of a vertical axis wind Turbine”, ELSEVIER.
- 6] Vinit .V. Bidi , Devendrappa .M & Chandan .S , “Highway Power Generation Using Low Cost Vertical Axis Wind Turbine [VAWT]”, International Journal of Engineering Science and Computing Volume 7 Issue No.5.
- 7] Mithun K K and Ashok S “Wind Turbine for Highway Wind Power Generation” IJEEE, Volume 07, Issue 01, Jan-June 2015.
- 8] S.Selvam, Edison Prabhu .K, Bharath Kumar M.R, & Andrew Mathew Dominic “Solar and Wind Hybrid power generation system for Street lights at Highways” International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 3, March 2014.



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