Application of Wind Energy in Two Wheeler

Shailesh K.Kokate[*], Prof N.N.Shinde[**], Madhuri B.Mulik[**]

[*] Department of Mechanical Engineering, Sharad Institute of Technology, Yadrav,Maharastra [India]
[**] Department of Technology, Shivaji University, Kolhapur, Maharashtra, [India]
[**] Department of Electronic Engineering, Sharad Institute of Technology, Yadrav, Maharashtra [India]

Abstract- This article study the application of wind energy for two wheeler. Two wheeler plays vital role in transportation. To reduce dependency on fossil fuels electric vehicles developed. This article particularly focuses on use of renewable source of energy for energy storage in battery. For this purpose vehicle speed taken in to consideration. On that basis wind power calculated. The generated power is a DC. That can easily used for storage in battery with negligible cost of grid.

Index Terms- Wind energy, Two wheeler, Energy storage, Vehicle speed.

I. INTRODUCTION

WIND ENERGY is a source of renewable power which comes from air current flowing across the earth's surface. Wind turbines harvest this kinetic energy and convert it into power. The electricity is sent through transmission and distribution lines to customers. Wind generation is one of the fastest growing sources of electricity and one of the fastest growing markets in the world today. With an average annual growth rate of more than 25% over the past decade, wind is the fastest growing sector of the energy industry all over the world. Wind power generation is the fastest growing energy conversion system since the last two decades, mainly due to the growing concerns about global warming, financial incentives from governments, and advancement in power electronic design and manufacturing. The world installed capacity of wind power generation has increased from 60 GW in year 2000 to 160 GW in June 2010, and it is estimated to be 460 GW by the end of year 2015 [1]

The greatest problem of wind power integration in the existing power system is the intermittent nature of wind power due to high correlation with stochastic non stationary wind speed. Wind integration imposes many challenges to system operators such as operational problems (maintaining system frequency, power balance, voltage support, and quality of power), planning and economic problems (including uncertainty in wind power in to unit commitment, economic load scheduling, and spinning reserve calculations), etc [2].

Wind energy conversion systems (WECSs) are rapidly developing as one of the most promising renewable energy resources around the world. Their penetration in existing energy systems is very important to solve the global warming and other fossil fuel issues. At the end of 2006, global wind electricity generating capacity increased to 74 223 MW from 59 091 MW in 2005[3].

By the end of 2020, it is expected that this figure will have increased to well over 1260 000 MW,which will be sufficient for 12% of the world's electricity consumption[4].

Advantages:

Wind power is the most mature and cost-effective renewable energy technologies available today, costing between 3 and 5 cents/(kW · h), depending upon the wind resource and financing of a particular project. It is competitive with traditional power plants. Unlike the electricity from fossil-fuel-powered sources, which depends on fuels whose prices are costly and may vary considerably, the cost of wind power is relatively stable.

Wind is a converted form of solar energy. Wind power is inexhaustible and requires no "fuel." Wind turbines do not produce greenhouse gasses that may cause global warming. Wind turbines can be erected on farms or ranches, thus benefiting the economy in rural areas. Farmers and ranchers can continue to work on the land because the wind turbines use only a fraction of the land.

Disadvantages:

Good wind sites are often located in remote areas; it may require significant infrastructure improvement to deliver the wind power to the load center. Although wind power plants have relatively little impact on the environment compared to other conventional power plants, there is some concern over the noise, aesthetic (visual) impacts, and, sometimes, birds have been killed by flying into the rotor blades. Most of these problems have been resolved or greatly reduced through technological improvement or by properly sitting wind plants[5].

II RESEARCH ELABORATION

1. Wind Theory: There is a significant amount of energy available in the wind, store as kinetic energy, which can be extracted as usable power.

When a turbine is used to extract power from a wind entering a turbine at U it removes energy from the wind turbine. This causes an expansion of the flow tube, The more power that is extracted from the column of air the more it must expand. Therefore, if all the energy could be extracted, there would be no wind exiting the turbine violationg the law of conservation of mass which states mass with rever be created, or destroyed.

In the 1920s (11), Albert Betz theoretically determined the maximum possible percentage of the power that can be extracted from a moving column of air, His calculations assumed an ideal rotor with no hub and perfectly axial flow. Additionally, the rotor analyzed was considered to be mass less, and the flow was considered to be incompressible. Using these assumptions, Betz determined that ideally 59.3% of the energy can be extracted

from wind entering the wind turbine. By this analysis, there is no possible way to extract more power in a wind system. The derivation suggesting the maximum power output is much lower when rotational flows are included in the analysis.

2. Energy in the Wind:

Wind is merely air in motion. It is produced by uneven heating of the Earth's surface by energy from the Sun. since the Earth's surface is made of different types of land and water; it absorbs the Sun's radiant energy at different rates. Much of this energy is converted into heat as it is absorbed by land areas, bodies of water, and the air over these formations.

The air has mass, though its density is low, and when this mass has velocity, the resulting wind has kinetic energy which is proportional to 1/2(mass x (velocity) 2] The mass of air passing in unit time is p AV and the kinetic energy passing through the area in unit time (power available in the wind) is where p s the air density (approx. 1.225 kg/m3 at the sea level). V is the velocity of wind (m/sec) and A is the area through which the wind passes normally (m2)

This is the total power available in the wind (approx 3.6 x 10 12 kW) obviously, only a fraction of this power can actually be extracted. The power extracted by a wind turbine can therefore be given as , Power in the Wind = k ½ρAV^3.Where, A is Effect of swept area, V is Effect of wind speed, ρ Effect of air density.

3. Two wheeler's importance to India: India is the World's fifth ranked country in terms of two wheelers per 1000 peoples. It is the 72.3 two wheelers per 1000 persons. The number of registered motor vehicles has grown at a CAGR of 10.6 per cent between 1951 and 2011 [6]. During the last decade, 2001 to 2011, the number of registered motor vehicles recorded a CAGR of 9.9 per cent [7]. Preponderance of two-wheelers with a share of about 72 per cent in India's total vehicle population as on 31st march 2011, followed by passenger cars (including jeeps& taxis) at 13.3 per cent and other vehicles (a heterogeneous category which includes 3 wheelers (Light Motor Vehicle (LMV) - Passengers), trailers, tractors, etc. at 8.4 per cent.

India had about 141.8 million registered motor vehicles in 2011[8]. According to Motor Transport Statistics, the annual rate of growth of motor vehicles in India was around 11 percent during the last decade.

A majority of motor vehicles in India are concentrated in urban centers and it is alarming to note that 32% of these vehicles are plying in metropolitan cities alone, which constitute just around 11% of the total population. It is interesting to note that Delhi, which contains around 1.4% of the Indian population, accounts for more than 7% of all motor vehicles in the country. There are already more than 2.6 million registered motor vehicles in Delhi and about 600 vehicles are being registered every day. Traffic composition in India is of a mixed nature. There is a wide variety of about a dozen types of both slow and fast-moving vehicles. The modal split indicates that in 1977, about 39% of total vehicles were two-wheelers, which increased to 69% in a span of just two decades .The share of two-wheelers is likely to increase continuously. Sustained economic growth has brought about expansion of the transport sector.

4. Energy storage in two wheeler:

Energy storage is one of the biggest market opportunities in clean energy, required for electric vehicles, integration of renewable and other grid applications. It is also one of the fastest-moving areas of innovation, with multiple technologies competing to outshine the others**.**

The apparent volatility of fossil fuel prices, the oil dependency and the predictable shortage of crude oil are driving concerns about the future security of energy supply.

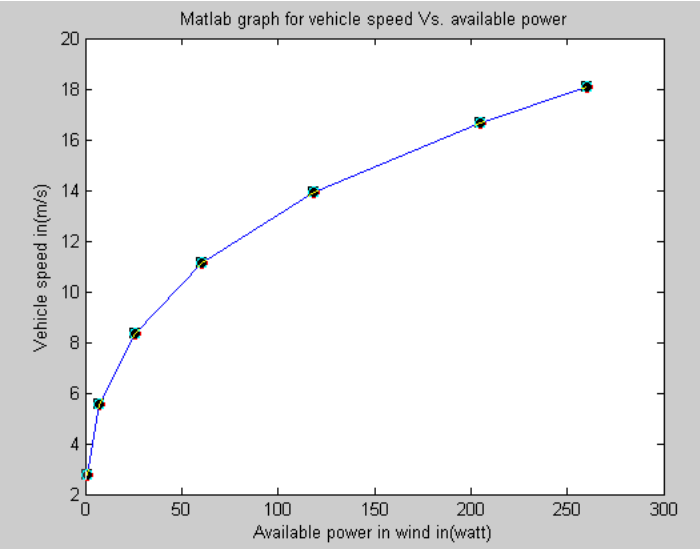
At the same time, greenhouse gas (GHG) emissions are causing severe changes of the world climate that are posing a serious threat for the environment and the human health. This situation is increasingly calling for non-fossil generation and efficient use of energy.1 Being both the major oil-consuming economic sector and the backbone of globally competitive industries in Europe, mobility and transport will thus soon undergo step changes of technologies, business models and user behavior.

Furthermore, fossil fuels will more and more be complemented by renewable, low-carbon alternatives like biomass, wind and solar power as sources of energy for transport. First automobiles running on alternative energies like bio fuel blends already exist, and some other modified or completely new power train concepts are currently under development, e.g. traction based on high degrees of bio fuels, hybrid, plugin-hybrid, and battery-electric vehicles, as well as hydrogen and fuel cell cars. There is still research needed to explore the best combination of fuel type and vehicle concept for a given condition, location and user profile. An over-all assessment has to consider factors ranging from GHG emission, air pollution and energy security to fundamental production items, as well as the availability and reuse of raw materials in well-two wheel studies and life cycle assessments. In most cases, battery electric vehicles powered by regenerative energy are obviously the best option**.**

III RESULTS

To cater the need of battery charging we adopted small wind mill system that can produce power which in turn to utilize to charge battery. For this purpose we used vehicle's speed for mathematical calculation of wind power. Here for calculation purpose rotor diameter considered as 304mm.The power available in wind is noted below:

Sr.No.	Vehicle Speed ,in m/s	Available Power in wind, in watts
01	2.77	0.94
02	5.55	7.569
03	8.33	25.59
04	11.11	60.71
05	13.88	118.39
06	16.67	205.103
07	18.05	260.37



Generally for two wheeler battery requirement is 12v,2amp battery is required. It means total wattage required are 24 watts.

IV CONCLUSION

We consider the application of wind energy for commercial or domestic power production. There we face the problem of grid connectivity. The proposed model provided on site application of wind generated power at cheapest cost with negligible cost of grid.

By using 304mm rotor diameter wind mill we can generate the required wattage i.e.24 watts power at 8.33m/s or 30 kmph speed of vehicle.

REFERENCES

[1] IEEE Transactions on industry applications, vol. 45, no. 6, NOVEMBER/DECEMBER 2009 2109 Combining the Wind Power Generation System with Energy Storage Equipment Ming-Shun Lu, Chung-Liang Chang, *Senior Member, IEEE*.

[2] IEEE Transactions on sustainable energy, vol. 3, no. 2, april 2012 awnn-Assisted Wind Power Forecasting Using Feed-Forward Neural Network Kanna Bhaskar, *Student Member, IEEE*, and S. N. Singh, *Senior Member, IEEE*]

[3] Global wind energy council (GWEC) global wind 2006 report. [Online] Available at: http://www.gwec.net/uploads/media/gwec-2006_ final.pdf 2011.].

[4] A.D.Hansen and L. H. Hansen, "Wind turbine concept market penetration over 10 years (1995–2004)," *Wind Energy*, vol. 10, no. 1, pp. 81–97, 2007.].

[5] "Energy efficiency and renewable energy web site," Wind Energy Topic. [Online]. Available: http://www1.eere.energy.gov/windandhydro/index. Html.

[6],[7] Basic Road Statistics Of India, **2008-09, 2009-10 & 2010-11, Ministry Of Road Transport And Highways Transport Research Wing New Delhi** ,August 2012.

[8] Road Transport YearBook,2009-10 & 2010-11, Transport Research Wing, Ministry of Road Transport & Highways, Government Of India. July 2012 .

AUTHORS

First Author – Shailesh K.Kokate,Mtech in Energy Technology, Currently working as Assistant Professor in Mechanical Engineering at Sharad Institue of Technology, Yadrav, Maharastra, India. shaileshkokate001@gmail.com

Second Author – Prof.Mr. N.N.Shinde , Phd [persuing], Working at Department of Technology, Shivaji University, Kolhapur, Maharastra, India.email address: Energyunishivaji10@gmail.com

Third Author –Madhuri B. Mulik, Mtech Electronic and Telecommunication. Working as a Assistant Professor at Sharad Institute of Technology, Yadrav, Maharashtra, India. and email address. Mulik_madhuri2002@yahoo.co.in

Correspondence Author – Prof. Shailesh K.Kokate,.
shaileshkokate001@gmail.com
shaileshkokate@gmail.com
Mob: +91-9881525644