

Automotive revolution towards the carbon free world

D. Dey¹ and S. Sharma²

¹Department of Engineering Physics, Tripura Institute of Technology, Narsingarh, Tripura (W)-799009, India

²Centre for Electronics Design and Technology, Indian Institute of Science, Bangalore-560012 INDIA

dh_dey@rediffmail.com

Abstract

The carbon emission is one of the main causes of global warming which is leading to drastic climate change. There has been compulsion for India to minimize carbon emission by at least 25% and it was the main issue of Copenhagen Climate change meets 2009. Electric bike (ebike) is one solution to reduce the carbon emission in the automotive world. This paper reports about the history, necessity, technical details, advantages & disadvantage along with word wide and national scenario of ebike sector.

Introduction

Global warming has been the concern especially after increasing the risk of climatic disaster such as Tsunami and other cyclones like Katrina, Ayala, Thane etc (www.mit.edu). The rise of sea water level is an endangered alarm to the low lying countries viz. Bangladesh, Maldives etc (www.janercture.com/ocean_warming). The increase of wild fire and desert area are the other warning signs of ascending temperature scale. Carbon emission is the main cause of global warming which necessitates significant reduction for human survival. Emission of carbon is mainly due to the industrial emission (*J. Env.Health Res.* 9[1], p-43) and emission from the automobiles (*N.Engl. J. Med.* 2006, July 6,355[1]). The automobile industry has to move towards new technology for reducing emission hazards.

E-bike are bicycles with a electric motor that runs with the help of battery carried along with the bike i.e. the pedaling is substituted by electric power motors (www.greenrides.com). E-bike is the most remarkable solution to the problem which not only decreases the emission of carbon but also economical. These are self-powered and electric battery charger recharges the battery. The technical details and other features are discussed elsewhere in the article.

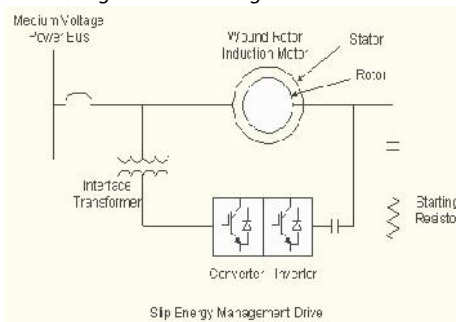
Journey of ebike

The advent of ebike is surprisingly far back to the 19th century, around 1890's Orden Bolton Jr. first designed a battery powered bicycle (www.ebikes.ca/sustainability). It had no gear and the motor had brush and commutator that could draw around 100 A of current from a 10 V battery (www.batteryspace.com). Later on, around 1897, Hosea W. Libby & G. Lafree modified the motor. Thereafter, with the development of mopeds and small motor cycles, ebikes lost its importance. The gasoline-powered bikes in 1930s were widely sold until 1970s. In 1969, G. A. Wood Jr. devised a high power e-bike with a series of gears. At the end of 20th century, Takada Yutky and Vector Service Ltd. Co. introduced power controls of highly efficient ebikes with Ni-Cd batteries. The production of ebike booms since then (around 1990) to till date with massive commercialization and cost effectiveness. Now ebikes are lighter, have higher battery capacity and has increased range of speed even to a speed of 80km/hr (www.nextbigfuture.com).

Fig.1. Outer look of Ebike



Fig.2. Motor along with circuit



Technical features of ebike

An ebike mainly contains: a) The outer body or the peripheral, b) Electric motor, c) Electronic controller unit, d) Storage Batteries, e) Charging Unit. The outer body of ebike varies from normal bicycle look to a heavy scooter look. It is made up of steel or plastic as needed for power or speed. Eventually, ebikes of very light body with elegant look are also available. Fig 1 shows the picture of ebike with outer look as scooty. The main part of the ebike is the electric motor hub used to drive the rear wheel of the bike. There are two types of electric motor: A) DC Brush Motor and B) DC Brushless Motor. The DC brushless motors are widely used nowadays. It has two parts i) Permanent Magnet Stator, ii) Wound Rotor (Fig. 2). The electronic controller of the bike controls the power supply to the motor and other parts in accordance with the

accelerator and other switches. The basic circuit of the control unit is shown in Fig. 3. The batteries are the main power station of ebike. The battery specifications are mostly 24V– 12Ah and 18V-20Ah or 60V-20Ah. The types of batteries that are used are: i) Sealed Lead acid batteries, ii) LI-ion battery, iii) Ni-Cd, Ni-Mh batteries. The charging unit is a rectifier circuit and it converts 230 V AC to DC of 48 V or 24V. Some chargers are inbuilt and others can be carried along with the bike and can be charged by inserting in the household plug points.

Advantages and disadvantages of ebikes

The main advantage of using an electric bike is contributing a bit towards creating a green earth. The other benefits are as follows: No fossil fuel burning therefore no carbon emission, Low fuel or charging cost i.e. economical and Very little maintenance cost. Apart from all the advantages there are also some disadvantages. Some of them are: 1) Low speed ride around 20-30 km/hr. 2) Charging time is very long (about 6 to 8 hours). 3) Only 50 km/charge so problem in long distance ride. 4) Moving uphill is too difficult (slope is a big problem). 5) More expensive in India in comparison with other gasoline bikes

Fig.3. Diagram of basic control unit

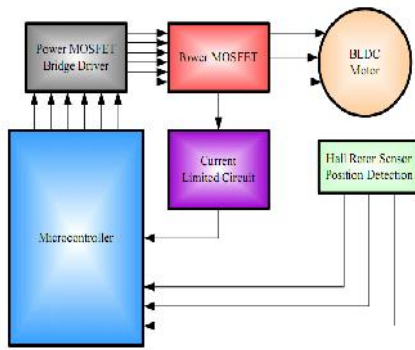
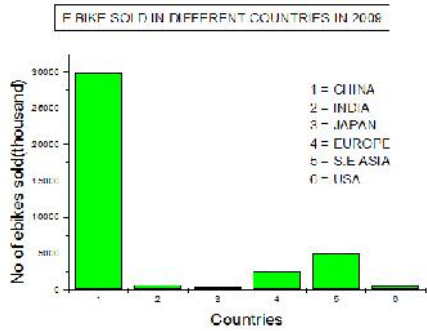


Fig.4. Graphical distribution of e-bike usage around the world



Worldwide status of ebike

In spite of many advantages, it is surprising to learn that apart from China, in no other countries e-bike is popular (www.nextbigfuture.com). Fig 4 shows the graphical distribution of e-bike usage around the world and hence China is the largest e-bike user in the world.

E-bike status in India

In India, ebike is not so popular due to subsidized low price of petrol and the petrol run vehicles are less expensive in comparison to the electrically powered bikes. The charging time is also a reason for Indian people who cannot wait. Another big hindrance is that most part of India is Hilly so riding in hilly roads with a low powered bike is not an easy task. Nowadays Honda, YO Bike, Hero Ultra, Yo smart companies are available which produce and sale bikes in India. Nevertheless, the market of E Bike is very bleak and therefore companies do not take interest coming to this field. In Auto expo, this year 3 models of e bike having high power and more efficiency was exhibited by Honda Electric. One of them has extremely low charging time about 1 hour. With different government steps, the ebike culture will really catch up and India will in one-day move towards green and carbon free world.

Conclusion

In conclusion, for creating world relieved from carbon pressure there is a need to reduce carbon emission. The usage of ebike is one of the elegant solutions as it is a low cost with low maintenance and of no emission. The government of different countries should take several steps to promote ebike for reducing global warming and save the future generation from ultimate eviction.