

## Impact of battery driven vehicle on the electricity of Rajshahi city, Bangladesh

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### Abstract

*Bangladesh is one of the under developing third world country. Power crisis is one of the major problems in the country. As a division Rajshahi city plays a vital role in the developing of the country as well. It is a big city with almost 8 lacks people. In recent days battery driven auto rickshaw become the main transport for communication in Rajshahi. According to our research there are more than 15 thousands auto rickshaw are available in the city. But only around 10 thousands have valid license according to (RCC). To drive these auto rickshaws they need to charged everyday which consume a lot of power. For this reason there occurs serious power cut almost every day. Most of these auto rickshaws do not have valid licenses. As a result there is no accurate data about the consumption of electricity which cause a huge system loss of total electricity. The system loss fluctuates between 13 to 15 percent during the month of March to August. According the report of Bangladesh Power Distribution Board (BPDB), the total power requires for Rajshahi city is around 250 MW. But the auto rickshaws consume around 20 MW, which is about 7 to 9 percent of total amount.*

Keywords: Battery driven vehicle, power crisis, electricity, environment pollution.

### 1. Introduction

Electricity is one of the prime concerns of the development of a country. A country's socio-economic development mostly depends on the generation capacity of electricity. Bangladesh as a third world under developing country, the generation capacity of electricity is less than demand. So we need to ensure its proper use for sustainable development. Rajshahi is one of the biggest cities of Bangladesh. Now-a-days its internal transportation system mostly depends on the battery driven auto bike. Battery operated auto-rickshaw popularly known as 'Easy-bike'. Battery operated auto-rickshaw is a newly added para transit mode in urban transportation system of Bangladesh. The mode, being introduced in 2008 in Bangladesh attains much popularity among urban passengers since it involves lower travel cost than other locally available transport modes as well as provides reasonable safety and comfort to the users during travel. This popularity, in turn results rapid growth of the mode in urban areas of Bangladesh. Now, the mode has become inseparable part of urban people's mobility network, especially in small-compact towns. These batteries are charged with electricity taken from the domestic or commercial lines which indirectly burdens the national grid. Because of significant amount of electricity is used for charging the batteries of these vehicles, so, the country is experiencing tremendous shortage of electricity. As a result load shading is very common today. These electrically charged vehicles run almost all over the cities and districts of Bangladesh. So, huge number of Easy-bikes enhanced the load shading problem. Bangladesh Power Development Board (BPDB) claims that these electrically charged vehicles consume approximately 4MWhr<sup>[1]</sup> of electricity every day for charging their batteries. Before 2008, rickshaw was the major transport vehicle in Rajshahi City Corporation (RCC) area for travelling short distance but now battery run auto rickshaw has become popular for easy travelling and cheap cost. According to a private survey, there are nearly than 15,000 battery operated auto-bike, 7000 auto-rickshaw in Rajshahi Metropolitan area. According to the RCC sources, there are more than 10,000 auto-bike and 5000 auto-rickshaws moving in the city area and the RCC officials claimed that they have license to 10,000 auto bike and 4000 auto rickshaws<sup>[2]</sup>. But there are also so many others battery driven vehicles (auto bike and auto rickshaw) which are roaming around the Rajshahi city without any license. For this reason, this city is fully jam packed with these vehicles. These vehicles need a long time to be fully charged, which is one of the causes of power crisis in Rajshahi city. Here Table 1. Shows the number of auto vehicle for every 1000 people in past 5 years. Which clearly shows the rapid increasing rate of auto which definitely have a bad impact in many sector.

Table 1. Increasing rate of auto for past 5 years in Rajshahi City

Year	No. of auto	Population (million)	No. of auto for every 1000 people
2011	6000	0.65	9.2
2012	7500	0.68	11
2013	9500	0.72	13.19
2014	12000	0.77	15.85
2015	15000	0.81	18.51

Source- Rajshahi City Corporation (RCC), [Transportation sub section]

Fig.1. shows the graphical view of the table 1.

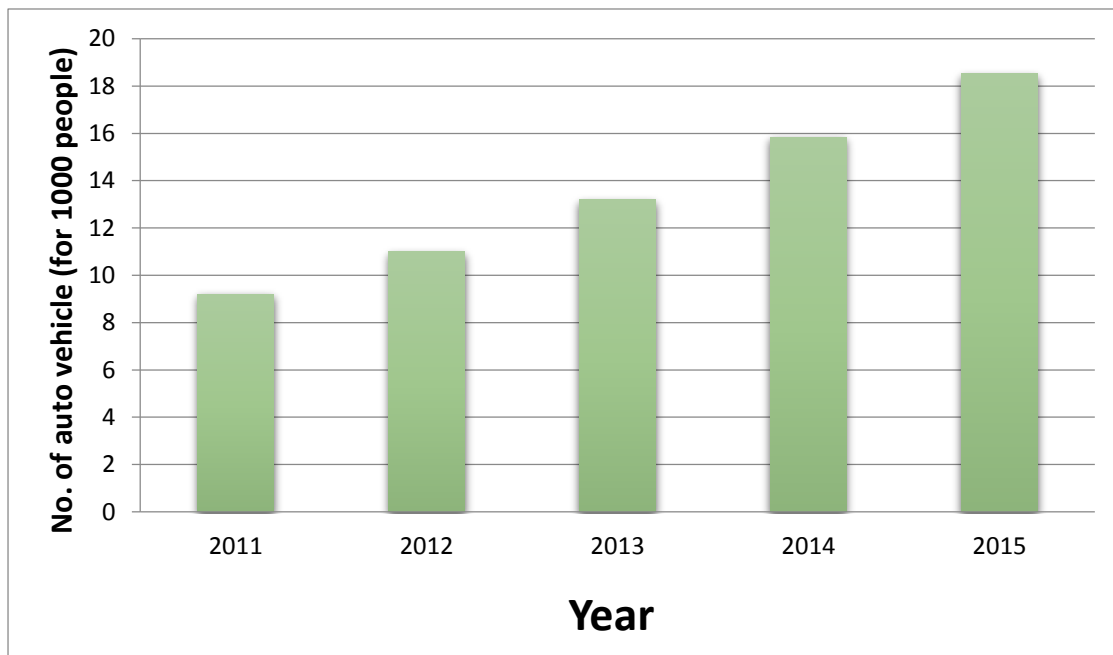


Fig.1. Number of auto vehicle for 1000 people by year

## 2. Overview of Battery driven vehicle

Batteries have advantages of being quick responsive, useful in a wide range of power levels, efficient, simple to install and easy to maintain. The Easy-bikes are built on small chassis and three small wheels. The chassis is generally made from mild steel and the body is with GI pipes. The front face is slightly aerodynamic shape, the overall dimensions are 287×105×178 cm depending on different manufacturers. The space is suitable for 6 passengers. A water-proof dc motor, powered by lead acid batteries, is used as source of power and the output of the motor is about 1000-1250 watts. The cost of Easy-bike ranges from BDT 130,000 to 160,000. Generally, 5 batteries of 12 volts in some cases 4 or 6 batteries of 12 volts totaling 60 volts and 140 amps are used. Batteries need approximately 8 hours for charging at new condition but it needs 10-12 hours after using 8-12 months. Each battery costs about BDT 20,000. The various models of Easy-bikes are now present in Bangladesh. The common models are: XINGE, DOWEDO, JET FIGHTER, MAINBON GROUP, GANGCHILL, XINGEBANG and JT TRICYCLE. Fig.2. Shows the view of a battery driven vehicle.



**Fig.2.** Battery driven vehicle

### **3. Negative impacts of battery driven vehicle**

#### **3.1 Illegal recharge point**

As day by day the numbers of auto vehicle are increasing rapidly, so demand of more recharge point is also increasing. To fulfill the demands so many recharge points are established at every corner of the city. But the main problem is most of the recharge point does not have any legal electricity connections which clearly a huge problem for any city. As a result the amount of power requirement is increasing rapidly which affects the national power grids.

#### **3.2 Less driving speed**

The battery driven vehicles are not as powerful as the diesel or petrol engine driven vehicles. So, the speed of is battery driven vehicles is much lower & is normally 35-40 Km/hr. It takes much time to reach at our destination. It will create more difficulties during the time of Traffic jam.

#### **3.3 Longer recharge time**

It takes more time to fully recharge than the petrol or diesel driven vehicles. Even most of the battery driven vehicles need to recharge twice a day. These vehicle need to be charged 8-10 hours daily. This causes hazardous situation at the filling stations as well as the national power grids.

#### **3.4 Silence**

Technology is so developed that sound proof car is available in present days for enrich passengers comfort level. Like others it also does have some bad sides. For example the fully silence car might cause more accidents, as it is difficult to detect from which side they are coming. Fortunately or unfortunately battery driven vehicles are also included within this category.

#### **3.5 Traffic jam**

According to the statistic of Rajshahi City Corporation (RCC) the total population of rajshahi city is around 8 lacks <sup>[3]</sup>. So the amount of total battery driven vehicles (auto bike and auto rickshaw) is more than the requirements. The annual growth rate of traffic is 6.1%. So the excess amount of these vehicles causes serious traffic jam at different points of Rajshahi city especially at saheb bazar, kajla and laxmipur. Fig.3 & fig 4 Shows the present scenario of traffic jam in the different places of Rajshahi city (Laxipur mor & Shaheb bazar )

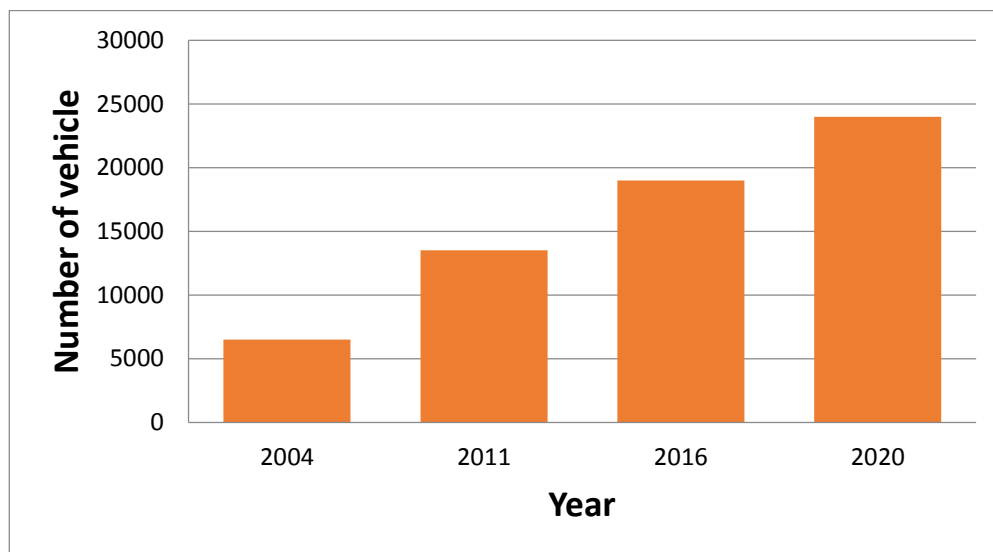


**Fig.3.** Traffic jams in Rajshahi city (Laxmipur mor)



**Fig.4.** Traffic jams in Rajshahi city (Shaheb bazar).

If this condition can't be controlled in a proper way then the amount of traffic jam will be increased rapidly and which might be uncontrollable. Fig.5. Shows an approximate traffic forecast for some previous and upcoming years if this situation is going on like this.



Source- Rajshahi City Corporation (RCC), (Transportation sub section)

**Fig.5.** Traffic forecast by years.

#### **4. Negative impacts of batteries used in vehicle**

In the Rajshahi city every auto bike & auto rickshaw is driven by battery. The battery which is used in those vehicles is lead-acid batteries. These lead-acid batteries is responsible for various problems such as-

##### **4.1 Environmental concerns**

These batteries causes numerous environmental damages on short scale. The lead present within the battery is one of the major reasons. These batteries require proper maintenance from time to time to avoid these environmental damages caused by Lead.

##### **4.2 Corrosion Issue**

Lead acid batteries are vulnerable to corrosion which frequently occurs either due to electrolysis or overfilling. Corrosion may decrease batteries life time & must be avoided through proper maintenance.

##### **4.3 Acid Fume**

Lead batteries in some cases releases hydrogen gas. Gas can cause numerous health issues in terms of long-term exposure. Normally wet cells have vents open allowing gas to escape.

#### 4.4 Sulfation

Lead Sulfate is a common problem causing major battery damage. Lead sulfate if formed causes increased level of resistance present within the battery.

#### 4.5 Cost

The costs of these batteries are also high. The initial cost of battery almost 20 thousand BDT. Also the batteries need to be changed after one year.

#### 4.6 Imbalance

Proper balancing is a prime safety concern in automobile sector. But these 3wheeler vehicles are not properly balanced. The passenger's seat is not properly arranged too. These increase the risk of accidents in the city.

### 5. Power crisis due to battery driven vehicle

Total numbers of Auto Rickshaws at Rajshahi city in Bangladesh are 15,000.

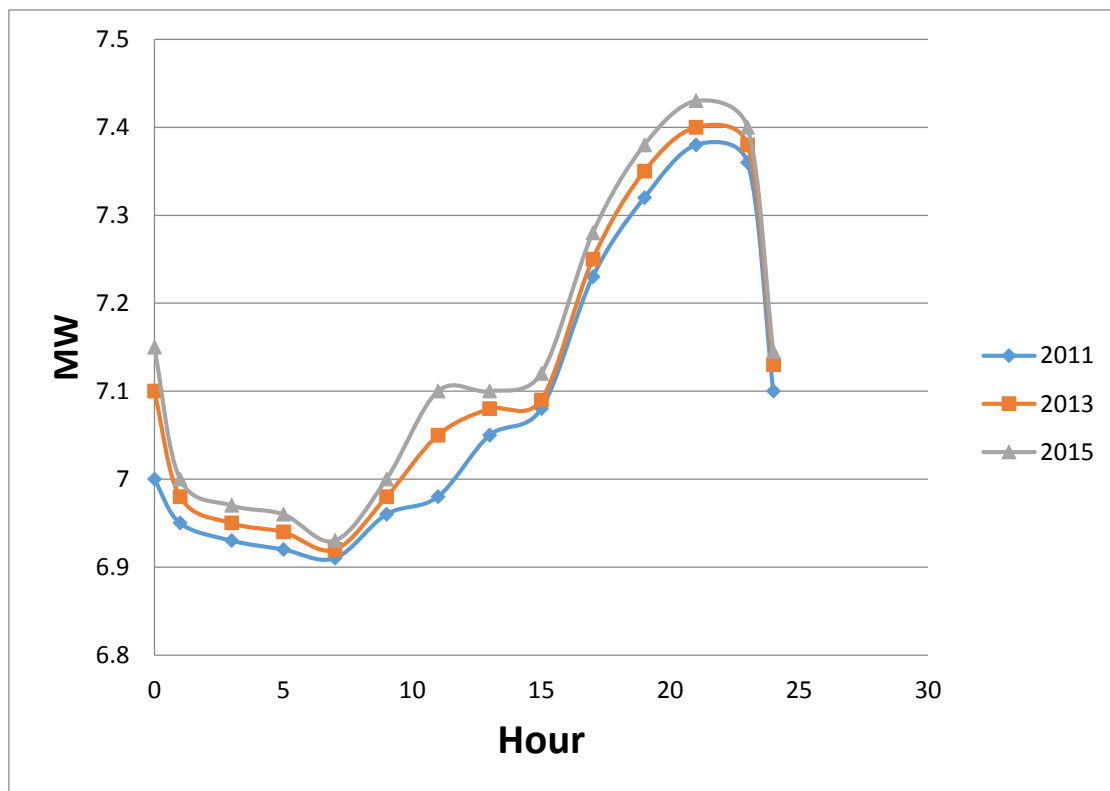
Rated power consumption:

Total voltage =  $12 \times 5 = 60$  volt.

Total power consumed =  $5 \times (12 \times 140) = 8.4$  kWh = 8.4 units

By direct observation the actual power consumption is 10 kWh. The transmission loss is 16% of actual power consumption =  $10 \times 16\% = 1.6$  kWh

So, total power supplied by the power plant = 11.6 kWh A single Auto Rickshaw needs minimum energy 11.6 kWh per day. In Rajshahi city total numbers of Auto Rickshaws are 15,000. So Auto Rickshaw consumes energy 174 MWh per day i.e. 21.75 MW<sup>[4]</sup>. Moreover by following this rule the total amount of electricity consumed by auto rickshaw is around 5 MW and the average load at Rajshahi city in Bangladesh is 250 MW<sup>[5]</sup>. The total amount of electricity consumption by auto bike and auto rickshaw is 26.75MW which 10.7% of the total load at Rajshahi city in Bangladesh. Fig.6. shows the daily load curve, which clearly indicates that for the



Source- [www.bpdb.gov.bd/rajshahi/](http://www.bpdb.gov.bd/rajshahi/)

Fig.6. Load curve

increasing number of auto vehicle the demand for power is also increasing. Demand should be lesser from 00:00 to 8:00 but as most of the drivers recharged their vehicle at that time the demand is increasing which obviously left bad impacts in power system.

## 6. Recommendation

- The number of auto vehicle must be decreased.
- Rechargeable battery should be modified.
- Legal action must be taken against unlicensed vehicle.
- All recharge points must have legal connections.
- Renewable energies should be introduced to recharge the batteries such as solar panel & modified wind turbine in the roof top of the vehicle.
- Disposal of batteries could be reduced by proper disposal system.

## 7. Conclusion

Rajshahi city was taken as an experimental area for this research type work. But it was difficult to calculate the actual amount of battery driven vehicle. Some important data were taken from some reliable source such as the website of BPDB. According to our research and authentic statistic, 3000-4000 auto bike and 2000 auto rickshaw will be perfect for human transportation within the city. It may save around 18MW. Which may be used in another sustainable development works.

The maintenance system must be improved and the numbers of auto rickshaw need to be controlled in proper administrative way, otherwise it will not possible to minimize the power crisis.

## 8. Acknowledgement

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