Comprehensive Analysis of the Social, Economic, and Technical Impacts of an Electric Motorcycle in Bangladesh

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**Abstract.** Electric motorcycles are a cleaner, inexpensive alternative to conventional motorcycles, offering zero tailpipe emissions and reduced air and noise pollution. However, existing research has often overlooked practical aspects such as market dynamics, user acceptance, and rider income and real-world performance data. This study addresses these gaps by systematically evaluating technical specifications, user satisfaction, product comparisons, and the impacts of different motor and battery configurations on operational costs, CO₂ emissions, sustainability, and the and the financial outcomes for riders using motorcycles as a source of income. Data on battery capacity, motor type, speed, and range were collected from regional companies, service centers, and motorcycle operators engaged in passenger transport services. This dataset was further enriched through stakeholder interviews and social media analysis. The analysis reveals that the majority of electric motorcycles are equipped with 1500W BLDC hub motors and lead-acid batteries, offering an optimal balance between cost and performance. While larger batteries increase both range and power, higher motor output contributes to enhanced speed. Findings indicate that electric motorcycles can reduce daily CO₂ emissions by approximately 68.2% and lower operational costs by over 84%, leading to significant economic gains. Riders can save an estimated TK 3,500 per month—equivalent to 13–16% of monthly revenue, depending on geographic location. The study underscores the environmental, economic, and social advantages of electric motorcycles, particularly for low- and middle-income users in urban, semi-urban, and rural areas of Bangladesh, reinforcing their potential as a sustainable mobility solution.

# INtroduction

Motorcycles play an important function in transportation across Bangladesh. People usually use motorcycle for not only for personal mobility but also as a source of income. In both urban and rural areas, many riders carry passengers to earn money and support their families through this occupation. But there are certain problems with motorcycles that run on regular fuel. They need a lot of maintenance, cost a lot of money to run, and pollute the environment a lot by releasing a lot of CO₂. Electric motorcycles could be a viable alternative. The global adoption of electric vehicles is rising due to their lower maintenance costs and minimal environmental impact. These vehicles are more economical to operate and do not emit harmful gases. Electric motorcycles in Bangladesh may offer advantages in both urban and rural settings. Compared to auto-rickshaws, they provide greater flexibility and affordability. Individuals can reduce expenses by shifting to electric motorcycles. Riders engaged in passenger transport may also increase their earnings and improve their financial conditions.

The market for electric vehicles (EVs) around the world is increasing rapidly. There are more than 250 million electric two- and three-wheelers in the world, and most of them are in Asia. [1]. Several things contribute to this rise, including higher fuel prices, less expensive maintenance costs, government subsidies, and more worries about air pollution and carbon emissions. In India, for instance, electric motorcycles are predicted to make up 15% of total sales by 2025, due to programs like FAME-II and the growth of charging stations. [2]. There has also been an increase in the production of electric motorcycles in the country, which has made them cheaper and easier for more people to get. Electric motorcycles are a practical, affordable, and eco-friendly way to get around, particularly in regions with many people and much need for both personal and business transportation. Bangladesh depends significantly on motorcycles for moving around and earning money. It would benefit from employing similar approaches to promote electric mobility.



FIGURE 1. Conversion of a conventional motorcycle into an electric motorcycle at the IUB Formula E laboratory setup.

In the Formula E lab at the Independent University of Bangladesh (IUB), they converted a conventional motorcycle into an electric motorcycle, as seen in Fig. 1. This prototype shows what the research is really regarding, looking into how implementing electric motorcycles in Bangladesh will affect technology and the economy. Electromagnetic fields have large economic advantages because they cut down on fuel and maintenance costs by a lot. This is especially true for businesses that rely on passenger transit for income. This change corresponds with bigger national aims like protecting the environment, making sure we have enough energy, and reaching our sustainable development goals. Ahmed et al. (2021). [3] State that vehicles with internal combustion engines (ICE) are responsible for greenhouse gas emissions, which are a big cause of pollution. Egbue and Long (2012) [4] emphasized that, when backed by the right infrastructure and regulatory frameworks, electric vehicles offer a sustainable substitute for reliance on fossil fuels and urban air pollution. According to Bloomberg NEF (2023) [5], EVs made up 14% of all new car sales worldwide in 2022, and this significant rising trend is expected to continue over the next ten years. However, according to Karmaker and Ahmed (2019) [6], the adoption process in Bangladesh is still slow because of infrastructure issues, regulatory obstacles, and low public awareness. Mahobiya et al. [7] suggested a cheap way to convert regular motorcycles into electric ones using BLDC motors and lithium-ion batteries, concentrating on cost-effectiveness and environmental friendliness. Hanifah et al. [8] and Fitch [9] both noted that electric motorcycles could reduce the need for car trips and highlighted the importance of policy incentives in speeding up their adoption. Łebkowski [10] reported on the successful development and road testing of an electric motorcycle with incorporated PMSM motors and LiFePO₄ batteries, showing that efficient electric two-wheelers are technically possible. Starkey et al. [11] performed a life cycle research of electric motorcycles in Pakistan, finding that large emissions and pollution decreases are achievable, assuming there is access to a clean energy system and supportive government measures. Hossain et al. [12] looked at electric two-wheelers in Dhaka and found that they are a cheaper and better option for the environment than regular motorcycles because they lower running costs and make the air cleaner. Md. Al-Amin and Md. Sahabuddin [13] assessed the impact of electric auto-rickshaw adoption on Bangladesh's national grid and identified challenges in utilizing solar energy as a renewable alternative. Amit Kumar Podder et al. [14] reviewed the state of the art in vehicle charging systems based on renewable energy, with an emphasis on hybrid combinations of solar PV and biogas technologies, and evaluated their feasibility in promoting sustainable transportation for auto-rickshaws and easy bikes in developing countries.

These studies demonstrate that electric motorcycles are technically feasible, economically beneficial, and environmentally friendly. Key advantages include reduced fuel and maintenance costs, lower pollutant emissions, and improved air quality in urban areas. However, a common limitation across the existing literature is the lack of empirical user data, absence of comparative analyses between different motor and battery types, and the unavailability of comprehensive assessments regarding usability and cost-effectiveness from both individual and commercial user perspectives — especially within the Bangladeshi context. This study studies the gap by evaluating motor and battery configurations, their influence on usability, affordability, and environmental consequences, as well as their impact on real-world results for individual and commercial users. The study analyses economic benefits and CO₂ reductions using data from users, manufacturers, and service centers, providing actionable insights for consumers, manufacturers, and politicians contemplating Electric Motorcycle adoption.

**METHODOLOGY OF THE PROPOSED PAPER**

**Overview of the Electric Motorcycle Market in Bangladesh**

A market analysis was carried out to compare the available electric motorcycle models in Bangladesh. Data were collected from official websites, brochures, and product catalogs of leading local companies, including Akij Motors [15], Walton [16], and Green Tiger [17], which are prominent in offering models suited to both urban and rural use. The comparison focused on key specifications such as motor power, battery capacity, top speed, and mileage.

Battery Capacity vs. Range:

Range (km) = 2.07 × Battery Capacity (Ah) + 1.21 (1)

This model suggests that range increases approximately linearly with battery capacity, at a rate of 2.07 km per additional ampere-hour.

Motor Power vs. Top Speed (Theoretical and Empirical Observation):

Top Speed = V max × (1- ) (2)

Where, V max is the asymptotic maximum speed and k is a system-specific constant and P is the motor power (in watts, W). A power-law regression was used to better show the real market data, providing us:

Top Speed = 2.93 × P 0.932 (3)

This empirical model demonstrates sub-linear growth, which is what theory says should happen when power expands. Equations (2) and (3) together connect concepts from the concept with practical design limits seen in Bangladesh's electric motorcycle industry.

Battery Capacity vs. Motor Power:

Motor Power = 73.57 × Battery Capacity (Ah) – 575.00 (4)

This implies that motorcycles with larger batteries usually have more powerful motors. However, the negative intercept indicates that the linear model may not work outside of the range that has been looked at.

**Field Investigation and User Interaction**

Electric motorcycles in Bangladesh have a lot of different technical specifications and user-friendly features that have an enormous effect on how many individuals purchase them, how well they work, and how much they are worthy in real life. It is important to evaluate these characteristics in order to figure out how useful they are in everyday life, how reliable they will be over time, and how they will affect user satisfaction across various socioeconomic categories. Electric motorcycles are becoming an essential component of Bangladesh's changing transportation environment as more and more people in both cities and rural areas use them. This section provides a full look into important technical parts, like motor type, battery capacity, and range, as well as how people use the product and what riders say about it. Along with performance parameters, the study also examined the frequency of maintenance required and the availability of charging infrastructure to assess its usability in the real world. The insights come from many trips to dealerships and service centers, talks with people in the sector, and organized interviews with both private users and commercial riders in cities, suburbs, and rural areas. This mixed-methods approach utilizes both technical data and user perceptions to assess the overall usefulness of a vehicle. These data are a foundation for figuring out how electric motorcycles work in different situations and for finding out what users think about their economic and functional benefits.

**Manufacturer Engagement and Technical Data Validation.**

To confirm the observational data, personal contact was made with manufacturers and authorized service providers. Talking to corporate representatives and service staff in depth gave us much information about technical specs, product ranges, and common maintenance problems. More information was obtained from official brochures and company websites to double-check the system components and ensure that the technologies currently available in the Bangladeshi electric motorcycle industry were accurately represented.

FIGURE 2. Methodological Framework of the Study.

Figure 2 shows how the process works. The Methodological Framework of the Study begins with data collecting through showroom visits, manufacturer specifications, and user interviews across several locations. A technical study of battery and motor arrangements follows this. CO₂ emissions are then calculated using conventional emission factors, and annual running expenses are assessed based on energy use and maintenance. Finally, rider-level profit analysis considers revenue and expenses to estimate monthly profitability. Collectively, these processes provide a thorough understanding of the economic, environmental, and technical implications of electric motorcycles in Bangladesh.

**User Feedback and Customer Reviews on Electric Motorcycles**

Purposive sampling was employed to gather responses from a small group of electric motorcycle users, selected to represent diversity in motorcycle brands, battery types (lead-acid and lithium-ion), and operating conditions such as urban commuting and longer-distance travel.

Open-ended questions were used to explore the following key areas:

– Overall satisfaction and performance

– Battery life and charging experience

– Maintenance and service support

– Economic value and common technical issues

Responses were recorded manually during and after the interviews. A thematic analysis approach was applied to code and categorize the data based on recurring themes, positive feedback, and commonly reported issues.

**Estimation of CO₂ Emission Reduction**

This study estimates the potential reduction in CO₂ emissions and operating costs resulting from a shift from petrol-powered motorcycles to electric motorcycles in Dhaka and throughout Bangladesh. The analysis draws on transport statistics and motorcycle registration data obtained from the Bangladesh Road Transport Authority (BRTA) [18]. Indirect emissions from electricity consumption during charging were calculated using the International Energy Agency’s grid emission factor for Bangladesh, reported as 0.53 kg CO₂ per kWh [19].

The following assumptions were used:

* 1 million motorcycles in Dhaka and 3.5 million nationwide
* Average daily travel per motorcycle: 40 km
* Average CO₂ emission per petrol motorcycle: 0.1 kg/km

The Total CO2 (Petrol) = N × D × Ep  (5)

Where:

N = number of motorcycles

D = distance traveled per day (km)

Ep = CO₂ emission per petrol motorcycle (kg/km)

To estimate the CO₂ emissions from electric motorcycles, the following relation was applied:

CO2 Electric = E100 × × EF (6)

Where,

E100 = Energy consumption per 100 km (in kWh)

EF = Grid emission factor (kg CO₂/kWh)

Thus, the emission reduction potential per motorcycle is:

CO2 Reduction = CO2 (Petrol) - CO2 (Electric) (7)

**Economic Cost Comparison**

An economic analysis was conducted to compare the annual operating costs of petrol and electric motorcycles. A 72 V, 32 Ah (2.3 kWh) battery was selected as a representative mid-range configuration, common in models from Akij and Walton. A lab-modified motorcycle with a 60 V, 25 Ah (1.5 kWh) battery also provided supporting evidence. These setups were used to determine how much energy and money would be required to travel one kilometre. The findings are in the Results section. The research incorporates both energy and maintenance expenditures, which gives a better picture of the costs of owning something over time.

Annual Fuel Cost (Petrol) = D × FC × Pf​ (8)

Annual Electricity Cost (Electric) = D × EC × Pe (9)

Where:

* D = Total annual travel distance (in km)
* FC = Fuel consumption per km (in L/km)
* Pf​ = Fuel price (BDT/L)
* EC = Energy consumption per km (in kWh/km)
* Pe = Electricity price (BDT/Wh)

The expected annual cost savings from switching to electric motorcycles were estimated as

Annual Savings = Annual Cost petrol - Annual Cost electric (10)

Field data were collected from motorcycle riders in Dhaka (urban), Netrakona (suburban), and Kotwali Upazila, Mymensingh (rural) to capture geographic variations in usage and cost. Average daily travel distance and income were recorded. A profit analysis was conducted by subtracting monthly operational costs from riders’ earnings to calculate net monthly profit:

Net Monthly Profit = (Id × ND) - Cm (11)

Where:

* Id = Daily Income
* ND = Number of working days per month
* Cm = Total monthly operational cost (fuel/electricity + maintenance)

**RESULT & DISCUSSION**

**Analysis of Battery, Motor, and Speed Characteristics in the Context of Bangladesh’s Electric Motorcycle Models.**

This section displays the main performance trends seen in electric motorcycle models in Bangladesh, employing data from major manufacturers including Akij Motors, Walton, and Green Tiger. The methods section explains how technical information such as battery capacity, motor power, top speed, and range was obtained from authoritative sources. The table below provides a summary of selected specifications from various manufacturers and models, drawn from a larger dataset for clarity.

**TABLE 1.** Key Performance Specifications of Selected Electric Motorcycle Models in Bangladesh.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer (Model)** | |  | | --- | |  |  |  | | --- | | **Motor Power** | | |  | | --- | |  |  |  | | --- | | **Top Speed** | | **Battery Capacity** | **Battery Type** |
| Akij Motors (Ponkhiraj) | 1000 W | 45 km/h | |  | | --- | |  |  |  | | --- | | 48/60V 23 Ah | | VRLA |
| Green Tiger (GT-Fenix R) | 1000 W | 50 km/h | |  | | --- | |  |  |  | | --- | | 48V 1.2 kWh | | |  | | --- | |  |  |  | | --- | | Removable Lithium | |
| Walton (TAKYON) | 1200 W | 50 km/h  60 km/h | |  | | --- | |  |  |  | | --- | | 60V 38 Ah | | Graphene Lead-Acid Batter |
| Green Tiger (GT Elakta XR) | 1000 W | |  | | --- | |  |  |  | | --- | |  | | 60V 1.2 kWh | Portable Lithium |

These parameters show significant patterns in the market for electric motorcycles in Bangladesh.. Most manufacturers have a good balance between motor power and battery capacity. They generally pair more powerful motors with batteries that can store more energy to deliver the best performance and range. Lithium battery models tend to have higher energy density, which means they can go the same distance with less space. As lithium technology becomes more affordable, more people are expected to use it, especially in cities where space and efficiency are crucial. This selection illustrates how manufacturers tailor the design of electric motorcycles to suit the infrastructure, usage patterns, and cost of different regions. Furthermore, companies are starting to offer more options to fulfil the needs of both business users who want things that last and individual riders who care about comfort and looks. This strategic match between technological features and what customers want is a big reason why Bangladesh's electric two-wheeler market is growing.

Three meaningful connections were visualized and shown in order to better understand the trends in the technical performance of electric motorcycles in Bangladesh. These graphs show how the battery's capacity, the motor's power, and the vehicle's speed all work together to affect its total performance. Analysis of data from several models reveals distinct trends that underscore design choices employed by local manufacturers to enhance efficiency and usefulness. The regression lines and elevated R² values in the figures validate the robustness of these connections and the dependability of the underlying data.

1. (b) (c)

FIGURE 3. Performance parameter relationships in electric motorcycles in Bangladesh: (a) linear relationship between battery capacity (Ah) and range (km), (b) nonlinear relationship between motor power (W) and top speed (km/h), and (c) correlation between battery capacity (Ah) and motor power (W).

Figure 3 presents key performance correlations in electric motorcycles in Bangladesh.

(a) A linear relationship between battery capacity and range, as described by Equation (1), indicates that greater battery

Capacity leads to longer travel distance per charge. The graph demonstrates that as battery capacity increases, the travel distance per charge increases proportionally. The data fits almost perfectly, with an R² value of 1.0. This means that battery capacity alone can usually tell you how far one can travel. This strong consistency shows that battery size is still a good way to measure performance across the most common electric motorcycle models in Bangladesh.

(b) This figure highlights a slightly nonlinear correlation between motor power and top speed, represented by a power-law regression (Equation 3). The graph shows that while maximum speed increases with motor power, the rate of increase gradually declines, showing a sub-linear tendency. This trend corresponds with what theory says (Equation 2), which looks at things like aerodynamic drag and mechanical inefficiencies that get more severe at greater speeds, causing performance saturation. The model fit is strong, as shown by an R² value of 0.99, which means there is a strong correlation and the regression is reliable. The strong correlation between empirical data and the theoretical model reinforces the suitability of the power-law approach for predicting electric motorcycle performance, while also indicating that performance improvements decrease as motor power increases.

(c) A correlation between battery capacity and motor power, based on Equation (4), shows that manufacturers tend to pair higher-capacity batteries with more powerful motors. The trend demonstrates that manufacturers constantly put together larger batteries with more powerful motors to maintain the energy level stable while also making the performance better. The R² score of 0.997 shows that there is a strong connection, which means that the same design process was used on multiple models. This alignment ensures that electric motorcycles in the local market provide sufficient speed and range while maintaining energy efficiency.

**Battery and Motor Performance Trends**

Despite their shorter lifespan and greater weight, electric motorcycles primarily use lead-acid batteries because they are less expensive. Manufacturer’s data indicate that approximately 65% of riders prefer lead-acid batteries, while 35% choose lithium-ion batteries due to their longer cycle life and reduced weight, although the higher cost remains a considerable challenge. Battery replacement is a common problem among users, as confirmed by service centers**.**

1. (b)

FIGURE4. Battery types in electric motorcycles in Bangladesh. (a) Distribution by battery type count. (b) Market preference by battery type.

Figure 4 illustrates the distribution and market preference of battery types in electric motorcycles within Bangladesh. Lithium-ion and Valve-Regulated Lead-Acid Battery (VRLA) batteries are the primary technologies employed across various models. However, the pie chart reveals that lead-acid batteries still dominate customer preference, likely due to their lower cost and wider local availability, despite lithium-ion batteries offering superior performance and efficiency.

In Bangladesh, BLDC motors are widely used on electric motorcycles due to their higher efficiency, compact parameters, and excellent low-speed torque, rendering them suitable for urban road conditions. Their hub-mount configuration avoids gear transmission, hence reducing maintenance and attracting cost-sensitive customers. Conversely, induction motors show mechanical robustness and are more appropriate for high-speed, heavy-load applications; however, they demonstrate reduced efficiency at low speeds and require more intricate control systems. BLDC motors rely significantly on electronic controllers and may exhibit suboptimal performance under thermal stress, whereas induction motors have superior thermal resilience but are infrequently utilized in two-wheelers due to their reduced efficiency and challenges in managing stop-and-go traffic. In summary, BLDC motors offer a superior equilibrium of efficiency, cost, and performance for the Bangladeshi electric motorcycle market, whereas induction motors may fulfill specialized high-performance functions.

**User Feedback and Customer Reviews on Electric Motorcycles**

To get real-world data, a wide range of electric motorcycle users in Bangladesh were interviewed, including those using different types of batteries, manufacturers, and usage conditions. Participants involved individuals who ride bikes to work every day, deliver packages, and live in rural areas, which gave a wide range of views on performance and dependability. People liked that they had minimal running costs, were quiet, and were beneficial to the environment. They had concerns about issues like the restricted range, battery life, and charging infrastructure. These results help us understand what users want and add to the technical examination of how well electric motorcycles work.

FIGURE5. Customer sentiment distribution on electric motorcycles in Bangladesh based on primary data

Figure 5 presents the distribution of customer sentiments derived from this primary data. The majority of respondents expressed favorable opinions (73%), followed by neutral (18%) and unfavorable (9%) responses. This distribution offers a clear indication of overall user satisfaction while also highlighting specific areas that warrant further attention

Positive Features:

* Cost Effectiveness: Users mentioned extremely low running expenses, some traveling 100-250 km for just 30-40 BDT, far less than its petrol-powered equivalents.
* Comfort and Ride Quality: Riders mentioned the smooth and quiet ride, contributing to a less stressful ride.
* Environmental Impact: Users appreciated assistance towards reduced use of fossil fuels and cleaner air.
* Low Maintenance: Particularly in lithium battery variants, long-time users (4-6 years) cited fewer technical issues.

Common Challenges:

* Battery Degradation: A majority of users of lead-acid batteries experienced performance declines during the initial 6-8 months, prompting early replacement.
* Structural Durability: Consumers complained about frame strength, particularly on bumpy roads.
* Battery Replacement Cost: Replacement of lithium batteries was identified as a significant cost, although mitigated by reduced daily operating expenses.

**CO₂ Emission Reduction Results**

**TABLE 2.** Daily CO₂ emission reduction from switching petrol to electric motorcycles in Dhaka and Bangladesh.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Region** | **CO2 Emission (Petrol) (metric tons/day)** | **CO2 Emission**  **(Electric) (metric tons/day)** | **Reduction**  **(metric tons/day)** | **Reduction Rate**  **(%)** |
| Dhaka | 4000 | 1272 | 2728 | 68.2% |
| Bangladesh | 14,000 | 4452 | 9548 | 68.2% |
|  |  |  |  |  |

Table 2 presents the estimated daily CO₂ emissions from petrol and electric motorcycles in Dhaka and across Bangladesh, along with the corresponding reductions and percentage decrease. This study estimates that motorcycles in Dhaka emit approximately 4,000 metric tons of CO₂ per day, while motorcycles across Bangladesh contribute around 14,000 metric tons daily. However, replacing conventional petrol-powered motorcycles with electric alternatives could result in a substantial reduction in emissions—estimated at 1,272 metric tons per day in Dhaka and 4,452 metric tons per day nationwide. This transition would yield a net CO₂ reduction of 2,728 metric tons per day in Dhaka and 9,548 metric tons across Bangladesh, corresponding to an overall reduction rate of approximately 68.2% in both cases. These results underscore the significant environmental benefits of widespread electric motorcycle adoption, including a 68.2% reduction in CO₂ emissions. This decrease supports Bangladesh’s climate goals by mitigating urban air pollution and improving public health, while also offering concrete data to guide policy-making and infrastructure planning.

While the analysis assumes a complete transition from petrol to electric motorcycles, such a scenario may not be fully achievable in practice within Dhaka or across Bangladesh. Therefore, the CO₂ reduction values represent an idealized estimation. Nonetheless, the findings emphasize that electric motorcycles can significantly contribute to reducing national CO₂ emissions and advancing sustainable urban mobility.

**Cost and Profit Comparison**

This section presents a comparative analysis of the annual operating costs of electric and petrol-powered motorcycles in Bangladesh, based on actual usage conditions and representative specifications for batteries and fuel. The analysis of electric motorcycles focuses on a 72 V, 32 Ah (2.3 kWh) battery configuration, commonly found in mid-range models from Akij and Walton, with an estimated range of approximately 120 km per charge. To support this estimate, performance data were obtained from a laboratory-modified electric motorcycle equipped with a 60 V, 25 Ah (1.5 kWh) battery, which demonstrated an observed range of around 65 km under standard road conditions. The analysis for petrol motorcycles assumes a standard fuel consumption rate of 2.5 liters per 100 km and a gasoline price of Tk 130 per liter, reflecting average market conditions.

**TABLE 3** Estimated Monthly Operating Costs of Petrol and Electric Motorcycles (in BDT), Based on Data from Local Companies and a Laboratory-Converted Model.

|  |  |  |  |
| --- | --- | --- | --- |
| **Expense Type** | **Petrol Motorcycle (BDT/Month)** | **Electric Motorcycle  (Company based data)   (BDT/Month)** | **Electric Motorcycle  (lab based data)   (BDT/Month)** |
| Fuel/Electricity | 3024 | 245.052 | 247.846 |
| Engine Oil | 733 | 0 | 0 |
| Spark Plug, Chain, Clutch | 200 | 50 | 50 |
| Brake Pads & Tires | 150 | 150 | 150 |
| Battery Replacement | 50 | 200 | 200 |
| Total Monthly Cost | 4157 | 645.052 | 647.846 |

Table 3 summarizes the estimated monthly operating costs of petrol and electric motorcycles in Bangladesh, based on data from local companies and a laboratory-converted model. A comparative analysis was conducted to evaluate the monthly running costs of petrol and electric motorcycles. Based on company data, the total monthly cost of operating a petrol motorcycle was estimated at BDT 4,157, while that of an electric motorcycle was BDT 645.05, resulting in a monthly saving of BDT 3,511.95 and an annual saving of BDT 42,143.40. Similarly, based on laboratory test data of a converted motorcycle, the monthly electric cost was found to be BDT 647.85, leading to a monthly saving of BDT 3,509.15 and an annual saving of BDT 42,109.80 compared to the petrol counterpart. These results demonstrate that electric motorcycles provide a substantial economic advantage in daily operation, reducing annual running costs by over 84%

**TABLE 4** Net monthly profit and profit gain from electric motorcycles.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rider Name** | **Location** | **Travel Per day**  **(KM)** | **Monthly Income (BDT)** | **Petrol**  **Profit**  **(BDT)** | **Electric  Profit  (BDT)** |
| Rudra Sarker | Dhaka | 50-60 | 22,500-24,000 | 18,343-19,843 | 21,854.95–23,354.95 |
| Rokon Uddin | Dhaka | 60-70 | 25,500-27,000 | 21,343-  22,843 | 24,854.95–26,354.95 |
| Suranjit Sutradhar | Netrakona | 70-75 | 21,000-22,500 | 16,843-18,343 | 24,854.95–26,354.95 |
| Gias Uddin | Kotwali, Mymensingha | 100-150 | 27,000–33,000 | 22,843–28,843 | 26,354.95–32,354.95 |

Table 4 presents a comparison of net monthly profits for riders using petrol and electric motorcycles across different regions. Economic benefits from using electric motorcycles are evident across various regions. In Dhaka city, where monthly incomes typically range from BDT 22,500 to 27,000, riders save about BDT 3,511.95 per month in operating costs. Similar savings are observed in semi-urban areas like Netrakona, where incomes are lower (around BDT 21,000 to 22,500), making the savings represent a larger share of monthly earnings—up to 16%. In rural regions such as Kotwali Upazila, Mymensingh, where monthly incomes range between BDT 27,000 and 33,000, the same amount of savings still contributes significantly to the rider’s finances. These results demonstrate that electric motorcycles provide consistent and substantial cost savings across urban, semi-urban, and rural settings, improving financial stability for riders in different income groups.

This study highlights the technical, economic, and environmental benefits of electric motorcycles in Bangladesh, while also acknowledging certain limitations. The analysis is based on short-term data and currently available models, which may not fully capture long-term trends or evolving user behavior. Additionally, user feedback was obtained from a limited sample size. Future research should incorporate broader datasets, extended fieldwork, and an evaluation of the role of renewable energy, the availability of charging stations and enabling policies to more accurately assess the national potential for electric mobility.

**CONCLUSION**

This study examines the technical, economic, environmental, and social impacts of electric motorcycles in both urban and rural contexts in Bangladesh. Efficiency and viability were evaluated by analyzing motor types and the interrelationships among battery capacity, power, speed, and overall performance. Findings derived from company data and user feedback indicate that electric motorcycles can reduce CO₂ emissions by approximately 68.2% and lower monthly operating costs by over 84%, resulting in monthly savings of around BDT 3,500 for typical riders. However, the study is limited to currently available models, short-term usage, and a relatively small user sample. Future research should incorporate longitudinal studies, a broader range of vehicle categories, and emerging developments in battery and motor technologies. The integration of renewable energy-based charging systems and supportive regulatory frameworks could further accelerate the nationwide shift toward cleaner, more affordable transportation.

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