Feasibility Study and Implementation of Electric Vehicle Conversions for Motorcycles in Sri Lanka

H.D.S.M. Jayawardhana[1]*, K.U. Ranathunge[1], L.U. Bakmeedeniya[1], T. Wickramarathna[2]

[1]*Department of Mechanical Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya, 20400, Sri Lanka*
[2]*Ceylon Electricity Board, Colombo 2, 00200, Sri Lanka*
**salindamadushansalinda@gmail.com*

The transition away from fossil fuel dependency in Sri Lanka's transport sector is critical due to rising fuel costs and environmental concerns. As motorcycles dominate personal transport, this study evaluates the technical feasibility and economic viability of converting internal combustion engine (ICE) motorcycles to electric vehicles (EV). Conducted in collaboration with national energy sector experts, the primary objective was to develop a scalable, low-cost conversion model using the widely used Bajaj CT100 as a prototype. While previous local conversion studies have focused primarily on simulation or basic assembly without real-world context, this research establishes a novel, comprehensive framework by bridging the gap between rigorous technical testing, user-centric surveys, and detailed financial forecasting. The methodology integrated a market survey of over 100 riders to identify user preferences, followed by the selection of a 1000W brushless DC (BLDC) motor and a 48V controller system. A 3D model of the modified drivetrain and mounting brackets was developed using SolidWorks, and weight distribution calculations were performed to ensure vehicle stability. Physical testing was conducted in a laboratory environment using a regulated power supply to verify the responsiveness and mechanical compatibility of the conversion kit. Financial analysis revealed that the conversion offers substantial annual savings of over LKR 80,000 compared to petrol operation, with an estimated payback period of approximately two years. Technical results confirmed a safe weight distribution of 53.4% rear and 46.6% front, even with the added weight of the hub motor. Furthermore, to mitigate range anxiety, a novel plug-in hybrid configuration was conceptualized. This configuration proposes retaining the original ICE drivetrain components alongside the newly integrated rear-wheel electric hub motor, allowing the rider to manually switch between petrol and electric modes using custom switching relays and clutch-based control. The study concludes that EV conversion is a viable and cost-effective strategy for sustainable mobility in Sri Lanka. These findings provide a technical foundation for localized standardized conversion kits and highlight a significant market opportunity for cleaner transportation.

Keywords: EV conversion, sustainable mobility, cost-benefit analysis, BLDC motor, Sri Lanka

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