

Usage of Electric Vehicles to Deliver Groceries to End Customers

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Abstract

Concerns about global warming caused by emissions from fossil fuels, as well as the depletion of energy sources, have prompted governments to encourage new transportation alternatives. As a result, new technologies such as Electric Vehicle (EV) technology have emerged. In comparison to conventional internal combustion engine vehicles (ICEV), the operation of an EV can be distinguished by zero CO₂ and NO_x emissions, reduced noise, and higher energy efficiency. However, this is only true if electricity is generated through renewable sources only. Otherwise, it's a transfer of emissions from the transport sector to the energy sector. The demand for good delivery is fast increasing with a rising urban population and the explosive growth of E-commerce. As the number of delivery increases, so will the associated emissions. This establishes Electric Freight Vehicles (EFV) as a viable alternative to conventional internal combustion engine-powered freight vehicles. However, the inherent technical constraints of EV technology make adaptation more difficult. The biggest implementation challenges are expensive acquisition and maintenance costs, the restricted range per charge cycle, charging time and capacity constraints. The adoption of EVs for urban freight in developing nations is hindered by a lack of charging infrastructure and the variability of the freight vehicle mix, which poses operational challenges.

This study assesses the economic and environmental sustainability of deploying electric freight vehicles for last-mile delivery in developing countries. The electric car routing problem is evaluated using a genetic algorithm-based approach, and the model is tested in a case study in Colombo, Sri Lanka. According to the studies, the use of electric freight vehicles is economically feasible, and the assessment of environmental feasibility is subjective. If the transport sector is considered in isolation, then the adoption of EVs is more environmentally friendly, but in reality, energy is not carbon-free in Sri Lanka and thus, environmental feasibility is questionable under the current energy mix.

Keywords: *Electric Vehicles, Last Mile Delivery, Freight, Sustainable Transport, Optimum Routing*

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