ANALYSIS OF ELECTRIC VEHICLE ADOPTION IN SRI LANKA: TECHNO-ECONOMIC AND ENVIRONMENTAL PERSPECTIVES

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Degree of Master of Science

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Declaration of the candidate & Supervisor

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Name of the supervisor: Prof. W.D.A.S. Wijayapala

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Signature of the supervisor: Date : 28.07.2025

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Abstract

As a developing nation in Asia, Sri Lanka has become increasingly reliant on fossil fuel-based energy since the late 1900s. The transportation sector, in particular, heavily depends on fossil fuels, contributing significantly to environmental degradation and rising fuel demand. While battery electric vehicles (BEVs) have emerged globally as a sustainable alternative, Sri Lanka has yet to experience a major shift in BEV adoption.

This study aims to theoretically assess the techno-economic and environmental feasibility of switching from internal combustion engine (ICE) vehicles to BEVs in the Sri Lankan context. It also compares the environmental impact of BEVs with hybrid electric vehicles (HEVs) and ICE vehicles available in the local market.

A techno-economic model was developed using survey data. The Nissan Leaf was selected as the representative BEV, while the Toyota Aqua and Toyota Vitz represented the HEV and ICE categories, respectively. Using the net present value (NPV**)** method, the levelized cost of mileage (LCOM**)** was calculated. Results showed that the Nissan Leaf had the lowest LCOM at 14.72 LKR/km**,** followed by the Aqua at 24.26 LKR/km, and the Vitz at 31.27 LKR/km**.**

The Toyota Vitz has the highest greenhouse gas (GHG) emissions, at 0.261 kg CO_2/km, according to the life cycle assessment, followed by the Toyota Aqua with emissions of 0.153 kg CO_2/km. However, despite higher production-phase emissions from battery manufacturing, the Nissan Leaf has the lowest emissions, measuring 0.108 kg CO_2/km. Over their lifetime, BEVs are the most environmentally friendly choice due to the notable decrease in operational phase emissions.

In conclusion, BEVs are both economically and environmentally advantageous**,** particularly if Sri Lanka can further decarbonize its electricity grid. A greener energy mix would enhance the sustainability and appeal of BEVs as a viable transport solution for the country.

Keywords : Techno-economic analysis, electric vehicles, environmental impact assessment

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List of Abbreviations

Abbreviation	Description
TCO	Total cost of ownership
ICE	Internal combustion engine
EV	Electric vehicles
BEV	Battery electric vehicle
PHEV	Plug-in hybrid electric vehicle
HEV	Hybrid electric vehicle
CNG	Compressed natural gas
GREET	Greenhouse gases, Regulated Emissions, and Energy use in Transportation
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
GHG	Greenhouse gas
NPV	Net present value
LCOM	Levelized cost of mileage
EOL	End of life
DMT	Department of Motor Traffic
EIA	Environmental impact assessment