Chapter 13
Life Cycle Analysis of Electric Vehicles

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ABSTRACT

Due to growing environmental issues, including climate change, urban pollution, and the anticipated scarcity of fossil fuels, societal and political interest in electric mobility has surged recently. When switching from internal combustion engines to alternative drivetrain technologies, such as electric vehicles (EV), there is expected to be a decrease in the usage of fossil fuels and environmental effects. Several nations have already started initiatives to introduce electric vehicles to the market or set goals for the future share of these vehicles. For instance, the European Union wants to reduce the number of vehicles with internal combustion engines in half by 2030 and phase them out entirely in cities by 2050 and by 2030. China and Norway acting as the main drivers. The current chapter examines the LCA studies on electric vehicles and their corresponding batteries that have been published in the previous ten years. Also, the suitability of the employed assessment techniques for addressing the criticality of resources is confirmed.

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1. INTRODUCTION

Due to growing environmental issues including climate change, urban pollution, and the anticipated scarcity of fossil fuels, communal and governmental concern in power-driven mobility has surged recently. When switching from internal ignition engines to substitute electric driven equipment, such as electrical vehicles, there is expected to be a decrease in the usage of fossil fuels and environmental effects (EV). Several nations have already started initiatives to introduce electric vehicles to the market or fixing aim for the forthcoming stake of these means of transportation (Vassileva & Campillo, 2017; Tchetchik el al., 2020). For instance, the European Union wants to reduce the number of automobiles with internal ignition engines 50% by 2030 and shut them out entirely in towns by 2050. Global sales of electric vehicles are rising, with Norway and China acting as the main pillars (Brdulak et al., 2020).

The main reason for people's concerns regarding the mass market introduction of electric vehicles is the increased demand on resources, such as the usage of lithium in lithium ion batteries (Ghasemi-Marzbali, 2022; Hopkins et al., 2023). The necessity for greater resource efficiency and the industry's rising material consumption are concerns that have received a lot of attention recently. The global patterns of resource usage will change significantly when electric vehicles (EV) replace conventional automobiles (Agusdinata & Liu, 2023; Dlugosch et al., 2022). The demand in particular for the materials needed to produce batteries such as lithium, cobalt, graphite and rare earth elements, is anticipated to rise significantly. The demand for lithium-ion batteries is projected to surge seven folds by 2025 and by 11–13 folds by 2030. A lack of these resources could have an impact on employment and economic growth (Richa et al., 2014; Shafique el al., 2023).

A technique called life cycle assessment (LCA) can be used to look into the environmental effects of different drivetrain systems' resource usage (Mendoza et al., 2020). Quite a few studies have examined the environmental effects of alternative drivetrain technology in comparison to traditional internal combustion engine-powered automobiles over the last ten years. Many techniques have been developed and integrated into LCA to evaluate the resource efficiency of product systems (Zheng & Peng, 2021; Sharma et al., 2011).

The current article offers a summary of Life Cycle Analysis on electric vehicles and their corresponding batteries that have been published in the previous ten years. It examines if and how the assessed publications deal with the "resources" effect category. The publication's primary emphasis is on metals and mineral resources. In order to do so, we looked into the resource use impact assessment techniques used and the general findings of means for electromobility. Furthermore, the suitability of the employed assessment techniques for addressing the criticality of resources is confirmed.