



Public Transport Decarbonization: An Exploratory Approach to Bus Electrification

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Abstract: In 2020, only 0.9% of buses running in European Union countries were electric, with 93.5% still being diesel-powered. The Sustainable and Smart Mobility Strategy set out by the European Commission targets a reduction of at least 55% in greenhouse gas emissions by 2023 and the achievement of climate neutrality by 2050. These targets will only be met by a shift to sustainable mobility, which comprises the introduction of electric vehicles in cities and the adoption of battery electric vehicles (BEV) for urban public transport. Thus, a literature review on “electrification of bus fleets” was conducted, focusing on the practices adopted for the replacement of polluting buses with electric-powered ones. A total of 62 documents were included in the final investigation, and their results were used to conduct a SWOT analysis. It is possible to conclude that BEBs are an important asset for cities to decarbonize the transport sector and that they are more cost-effective than diesel buses. On the other hand, some attention needs to be given to the generation of energy that will feed the charging of batteries because the use of fossil fuel energy sources can jeopardize the environmental benefits of BEBs.

Keywords: public transport decarbonization; BEBs; BEB systematic review



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1. Introduction

In 2020, there were more than 684,000 buses in use in the European Union. However, 93.5% of them were diesel-powered, with only 0.9% relying on electric batteries [1]. The Sustainable and Smart Mobility Strategy set out by the European Commission targets a reduction of at least 55% in greenhouse gas emissions by 2023 and the achievement of climate neutrality by 2050, which will be reached by introducing more ambitious policies to reduce the transport sector’s reliance on fossil fuels [2]. Therefore, the electrification of road transport, combined with a modal shift towards public transport, is crucial to achieving the decarbonization of the transport sector [3,4].

The transport sector is ranked among the economic sectors responsible for most of the greenhouse gas emissions in the European Union [5]. It registered an increase of 7% in greenhouse gas emissions from 2021 to 2022 alone, making it the economic sector with the highest increase in this period [6]. Road transport still accounts for the highest proportion of overall transport emissions, emitting 76% of all European Union’s transport greenhouse gas emissions; thus, most of the state members’ focus on decarbonization is related to this matter [7].

The electrification of bus fleets in cities could bring benefits for transit agencies as well as the surrounding communities because electric buses are more energy efficient than diesel buses and have fewer moving parts, thus potentially decreasing fuel and maintenance costs. They also have a quieter operation and zero harmful tailpipe emissions [8]. However, large-scale deployment of e-buses requires significant incremental power capacity and a corresponding increase in renewable generation capacity [9].

Although the demand for energy consumption will increase when battery electric buses (BEBs) are implemented, adding to the high financial costs associated with the