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Simulation of Technological, Energy and GHG Comparison between a Conventional Diesel Bus and E-bus: Feasibility to Promote E-bus Change in High Lands Cities

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Abstract : Renewable energy represented around 80% of the energy matrix for power generation in Ecuador during 2020, so the deployment of current public policies is focused on taking advantage of the high presence of renewable sources to carry out several electrification projects. These projects are part of the portfolio sent to the United Nations Framework on Climate Change (UNFCCC) as a commitment to reduce greenhouse gas emissions (GHG) in the established national determined contribution (NDC). In this sense, the Ecuadorian Organic Energy Efficiency Law (LOEE) published in 2019 promotes E-mobility as one of the main milestones. In fact, it states that the new vehicles for urban and interurban usage must be E-buses since 2025. As a result, and for a successful implementation of this technological change in a national context, it is important to deploy land surveys focused on technical and geographical areas to keep the quality of services in both the electricity and transport sectors. Therefore, this research presents a technological and energy comparison between a conventional diesel bus and its equivalent E-bus. Both vehicles fulfill all the technical requirements to ride in the study-case city, which is Ambato in the province of Tungurahua-Ecuador. In addition, the analysis includes the development of a model for the energy estimation of both technologies that are especially applied in a highland city such as Ambato. The altimetry of the most important bus routes in the city varies from 2557 to 3200 m.a.s.l., respectively, for the lowest and highest points. These operation conditions provide a grade of novelty to this paper. Complementary, the technical specifications of diesel buses are defined following the common features of buses registered in Ambato. On the other hand, the specifications for E-buses come from the most common units introduced in Latin America because there is not enough evidence in similar cities at the moment. The achieved results will be good input data for decision-makers since electric demand forecast, energy savings, costs, and greenhouse gases emissions are computed. Indeed, GHG is important because it allows reporting the transparency framework that it is part of the Paris Agreement. Finally, the presented results correspond to stage I of the called project “Analysis and Prospective of Electromobility in Ecuador and Energy Mix towards 2030” supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Keywords : high altitude cities, energy planning, NDC, e-buses, e-mobility
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