



## CHALLENGES OF ADOPTING ELECTRIC BUSES IN URBAN PASSENGER TRANSPORT: A STUDY CARRIED OUT AT THE UNIVERSITY OF CAMPINAS

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### ABSTRACT

The transition to electric buses as a solution to environmental and climate challenges in urban transportation is recognized as an effective approach to reduce CO<sub>2</sub> emissions and to promote sustainable practices. This study aims to assess the impacts and challenges associated with the implementation of these vehicles, considering aspects such as public health, the environment, and quality of life, as well as understanding society's perspective on the issue. The research adopts a predominantly qualitative approach, complemented by a survey to collect data from the community of the State University of Campinas. The results reveal significant consensus on the environmental benefits of electric buses and the importance of service quality, while divergences are observed regarding preference for environmentally friendly options and economic issues associated with their adoption.

**Keywords:** Electric Bus; Public Health; Sustainability; Urban Transportation.

### INTRODUCTION

The growing awareness of the need to mitigate the effects of climate change and promote sustainable practices has been driving significant transformations in various spheres of society (Abbasi, 2018; Bepalyy and Petrenko, 2023; Bogacki and Bździuch, 2019; Borén, 2020; Flaris et al., 2023; Gabsalikhova, Sadygova, and Almetova, 2018; Maier et al., 2023; May, 2018; Singh, Gurtu, and Singh, 2021; Sunitiyoso et al., 2022), which includes the transportation sector. Therefore, the objective of this article is to evaluate the impacts generated for society and the inherent challenges in the implementation



of electric buses in passenger transport in urban centers. To achieve this, aspects related to public health, the environment, and quality of life will be addressed, as well as the opinion of the community at the State University of Campinas (UNICAMP).

## **MATERIALS AND METHODS**

Regarding the approach, this research is predominantly qualitative. It aims to understand, through a literature review, the impacts on society and the inherent challenges in implementing electric buses for passenger transportation in urban centers. Additionally, it employs a quantitative technique, the survey methodology, to study public behavior towards the adoption of electric buses, considering that users have the potential to influence the adoption of this transportation segment. The survey consisted of three stages, with a total of 21 questions: 3 in the first stage, 17 in the second stage, and 1 open-ended question in the last stage. The university has a built-up area of 705,215 m<sup>2</sup> and a total of 48,151 people distributed across its 6 campuses; the questions were electronically distributed to participants belonging to the community of the university in its main campus, in Campinas city.

## **RESULTS AND DISCUSSION**

This section aims to analyze the perspective of the respondent population regarding the challenges associated with the introduction of electric buses in urban passenger transportation concerning relevant issues such as public health, the environment, and quality of life. Before commencing the analysis, it is noteworthy that the survey of the research achieved a return rate of 39%, which can be considered sufficient, as according to the literature the research instruments sent to respondents typically attain an average return rate of 25%.

The first stage of the survey seeks to characterize the respondent's involvement at the university, the frequency of usage of the available services of campus shuttle buses, as well as the preference for the type of vehicle (diesel or electric). In this way, the majority of respondents in this research are students (50%), followed by technical/administrative staff (42%), and lastly, academic/research staff (8%). Among the total survey respondents, 91%



sporadically use the university's internal shuttle services, while 9% use them daily. Regarding respondent preference, regardless of usage frequency, 59% prefer the electric bus, and 41% stated indifference.

The second stage of the instrument addresses issues related to the topic, as well as their respective results from the survey application, as presented in Table 1. When analyzing the results of stage 2 of the survey, a notable consensus among the participants on most of the questions stands out, revealing a significant alignment of opinions. That is, in 82% of the responses, a convergence of perspectives is observed, indicating a solid understanding of the theme addressed by the participants.

Finally, in stage 3 of the survey, an open and optional question is addressed, offering participants the opportunity to provide additional information. However, limited participation is observed, and the responses received do not significantly contribute to the content of this work.

**Table 1.** Results of the Survey Application.

	Questions	Agree	Not Agree	I don't know
1	High CO2 emissions are related to the global transportation sector.	83%	4%	13%
2	Electric buses are advantageous for cities with air and noise pollution problems.	96%	0%	4%
3	The adoption of electric buses can be an environmentally friendly solution, potentially helping to reduce CO2 emissions.	92%	0%	8%
4	Electric buses are preferred by the population due to lower noise emissions, lower costs, and reduced energy consumption compared to diesel buses.	63%	8%	29%
5	The reduction of noise from electric vehicles can improve public health.	100%	0%	0%
6	Public transportation users generally view electric buses as reliable, beneficial, and pleasant options.	63%	0%	37%
7	The quality of service has a direct effect on public transportation user satisfaction.	100%	0%	0%
8	The predominant use of personal cars in metropolitan areas causes congestion and significant CO2 emissions.	100%	0%	0%



9	The public tends to prefer environmentally friendly options in public transportation.	50%	21%	29%
10	The air pollution, noise, accidents, and congestion caused by passenger road transportation are local problems.	46%	46%	8%
11	The high purchasing cost of electric buses is a reason for their slow adoption.	63%	4%	33%
12	Decisions regarding the deployment of electric buses are dominated by economic and technological considerations.	79%	0%	21%
13	Electric buses are appreciated by passengers and may have lower maintenance and energy usage costs.	50%	4%	46%
14	The perspective of public transport users should be considered when adopting electric buses.	79%	4%	17%
15	A sustainable transportation system should promote clean streets, environmental safety, and support the economy.	96%	0%	4%
16	The lack of noise in electric buses can create road safety issues.	21%	58%	21%
17	Safety measures, such as auditory alerts, are necessary in electric buses to ensure pedestrian safety.	75%	17%	8%

## CONCLUSION

An analysis of the responses not only highlights broad consensus but also the existence of varied perspectives. Thus, the study contributes to providing specific insights from the community on the adoption of electric buses, while highlighting points of convergence and of disagreement. This preliminary investigation may be useful to suggest guidelines for a future large-scale in-depth study of the Metropolitan Region of Campinas, with over 3 million inhabitants.

## ACKNOWLEDGMENT

The authors would like to thank the following organizations and programs for funding this research: CAPES; CNPq; São Paulo Research Foundation (FAPESP) with the grant #2021/11380-5 for CPTEn/FEEC; PPDG/PRP/UNICAMP; and CPFL, through ANEEL R&D Program on the project PD-00063-3043/2018.



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