Battery electric vehicles bevs suva

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Industrialized countries, particularly China, are grappling with the challenge of mitigating air pollution amidst rapid urbanization. As per the International Energy Agency, China"s CO2 emissions in 2021 accounted for a staggering 33% of the global total, amounting to 11.9 billion tonnes. The transportation sector, a major contributor to China"s carbon footprint, is responsible for about 10% of its total emissions1,2. This environmental issue is particularly acute in China"s super-tier-1 cities, where air pollution significantly hinders socioeconomic growth and public health3,4.

In our study, we utilize large-scale real-world data to assess the impact of vehicle electrification on air quality, focusing particularly on China"s super-tier-1 cities, which predominantly rely on coal-based power generation. We analyze the relationship between BEV usage patterns--namely mileage and driving frequency--and air quality. This analysis draws upon data from Beijing, Shanghai, and Shenzhen, spanning from January 2019 to October 2020.

Our findings indicate that replacing fuel vehicles with BEVs yields substantial emission reduction benefits and impacts various air pollutants. The study reveals significant differences in the effects of different BEV models and categories on air quality. Higher-end BEV models and private passenger BEVs are shown to significantly improve air quality. Conversely, applications such as taxi BEV usage demonstrate less favorable environmental outcomes, suggesting a nuanced impact of BEV adoption on urban air quality.

Through this research, we contribute to the understanding of how BEV usage influences air quality, providing insights into the differential impacts of various BEV models and categories. This study not only highlights the emission reduction potential of BEVs but also underscores the importance of considering vehicle usage patterns in evaluating their environmental benefits.

Our analysis aims to provide a nuanced understanding of the interplay between BEV usage and air quality, offering valuable insights for shaping sustainable urban transportation policies in China.

Utilizing real-world driving data, our study demonstrates a notable carbon reduction effect when Battery Electric Vehicles (BEVs) replace fuel vehicles over equivalent mileages (refer to Fig. 1). We observed a consistent upward trend in emission reductions over the study period. In January 2019, the emission reduction per BEV was approximately 8.72 kg of CO2, which escalated to around 63.83 kg of CO2 by October 2020, averaging a monthly increase of 9.47% (details provided in Supplementary Data 1).

Comparative carbon emissions of gasoline vehicles and BEVs at equivalent mileages. Note: This figure illustrates the carbon emissions during the driving phase for both electric vehicles (BEVs) and gasoline vehicles over the same driving mileage. The monthly emission reduction per vehicle are calculated as the difference in carbon emissions between the gasoline vehicles and BEVs for equivalent mileages. The detailed formula used for this calculation is outlined in the "Models" section, and the specific data utilized can be found in Supplementary Data 2-1.

In terms of temporal patterns, BEVs exhibit optimal emission reduction performance during the months of May to July and September to November. This pattern correlates with the finding that BEVs achieve their lowest energy consumption at approximately 20 ?C, and the impact of temperature on energy consumption is markedly less pronounced at higher driving speeds (around 130 km/h)31.

The resumption of work and production, guided by the Central Leading Group for Responding to COVID-19"s "Guidance on Actively and Orderly Promoting the Resumption of Work and Production while Effectively Preventing and Controlling COVID-19", saw a return to pre-pandemic emission reduction trends from April 2020 onwards33.

This study delves into the emission reduction differences among various BEV models when they replace equivalent fuel vehicles (see Fig. 2). We found a consistent trend: the larger or heavier the vehicle, the more substantial the carbon emission reduction achieved when it is replaced with a BEV of the same category. This observation can be attributed to the higher energy release and larger displacement of larger vehicles, leading to notable emission reductions when substituted with equivalent BEVs34.

Monthly CO2 emission reductions per 100 km for Six BEV Types. Note: This figure displays the CO2 emission reductions per 100 km on a monthly basis for six different types of Battery Electric Vehicles (BEVs). The BEV types include A00-type, A0-type, A-type, B-type, C-type, SUV-type, and MPV-type BEVs. The data from January to October represent the total emission reductions for each BEV model across both 2019 and 2020. For November and December, the data shown reflect only the emission reductions for each model in 2019. Detailed source data can be found in Supplementary Data 2-2.