Energy efficiency of electric scooters in different start modes

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Abstract. This article examines the energy efficiency of electric scooters in different starting modes. The influence of various start modes on the energy efficiency of electric scooters used in urban environments was analyzed. A comparison was made of the start performance using only the electric battery and the start performance combined with the battery and the physical strength of the electric scooter driver. In this case, the comparison was made with different types of surface on which the launch took place. The results of the analysis of the influence of various start modes on the energy efficiency of electric scooters can be used in research in the field of development of electric transport.

1 Introduction

Modern electric scooters are becoming an integral part of urban mobility. One of the main parameters for assessing the efficiency of operating electric scooters in urban environments is their energy efficiency. Assessing the influence of different start modes on the energy efficiency of electric scooters used in urban environments is an important element of research in this area. Urban mobility is experiencing global changes in the twenty-first century, one of the factors of such changes is the emergence of such types of vehicles as electric scooters. The advantages of electric scooters are zero impact on the ecology of cities, independence from traffic jams, no transport taxes, an expanded city network of parking lots where you can rent an electric scooter, which allows you to refuse to buy a personal electric scooter.

2 Materials and Methods

To obtain data on the influence of various start modes on the energy efficiency of electric scooters used in urban environments, five groups of measurements were carried out on various types of surfaces:

- first option – asphalt;
- second option – wood;
- third option – stone;
- fourth option – soil;

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• fifth option – plastic.

For the purpose of collecting and processing data on the influence of various start modes on the energy efficiency of electric scooters operated in urban environments, various methods were considered [1-18].

3 Results and Discussion

3.1 Results of the analysis of the influence of different start modes on the energy efficiency of electric scooters operated in urban environments on different types of surface

3.1.1 Measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on an asphalt surface

The results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on an asphalt surface are presented in Figure 1.

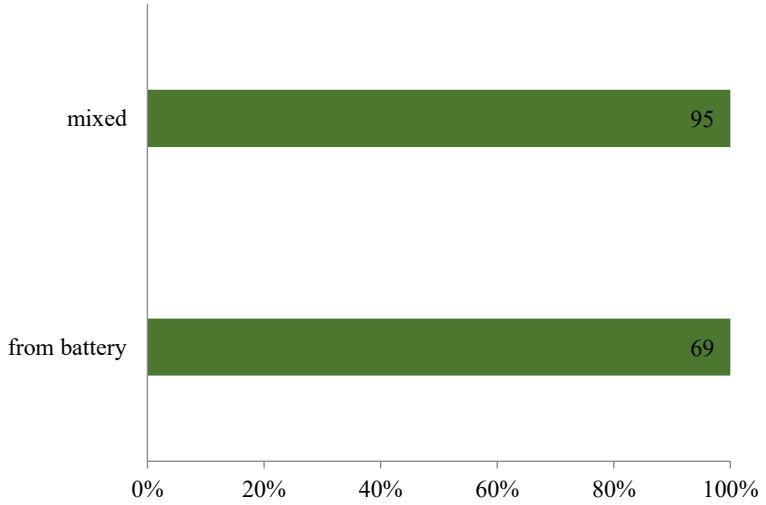

Fig. 1. Results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on an asphalt surface.

3.1.2 Measuring the influence of different start modes on the energy efficiency of electric scooters operated in urban environments on a wooden surface

The results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban environments on a wooden surface are presented in Figure 1.

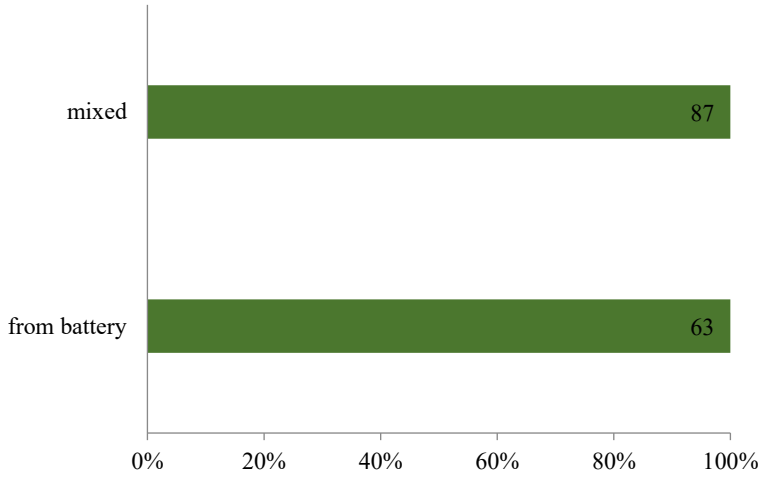

Fig. 2. Results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on a wooden surface.

3.1.3 Measuring the influence of different start modes on the energy efficiency of electric scooters operated in urban conditions on a stone surface

The results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on a stone surface are presented in Figure 3.

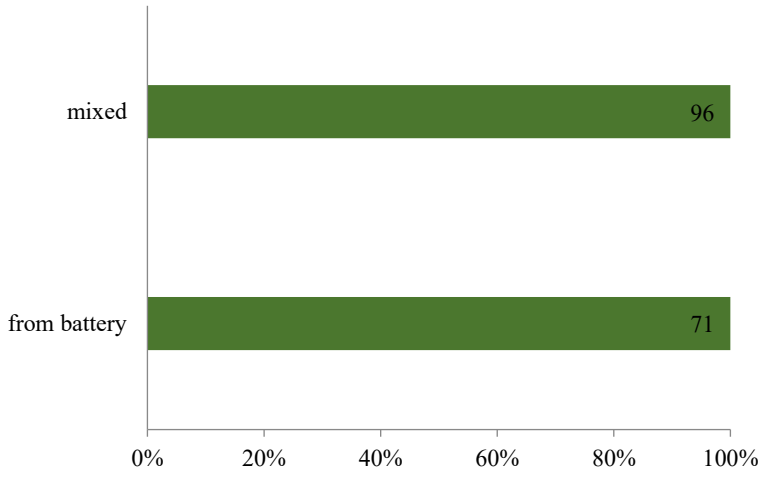

Fig. 3. Results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on a stone surface.

3.1.4 Measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on a dirt surface

The results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on a dirt surface are presented in Figure 3.

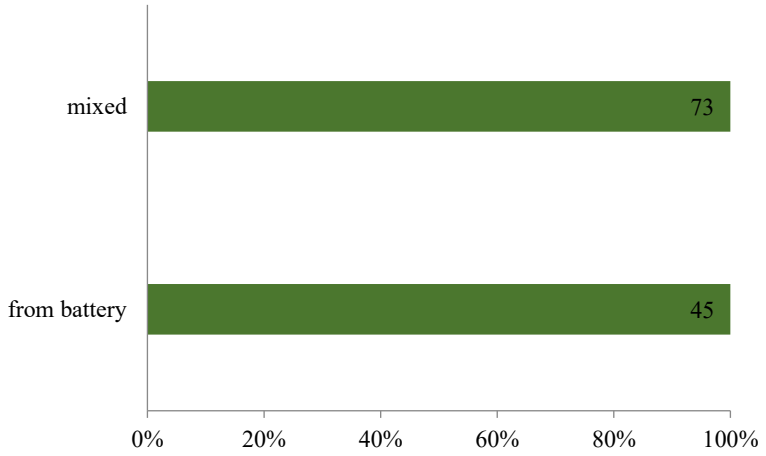

Fig. 3. Results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions on a dirt surface.

3.1.5 Measuring the influence of different start modes on the energy efficiency of electric scooters operated in urban environments on a plastic surface

The results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban environments on a plastic surface are presented in Figure 3.

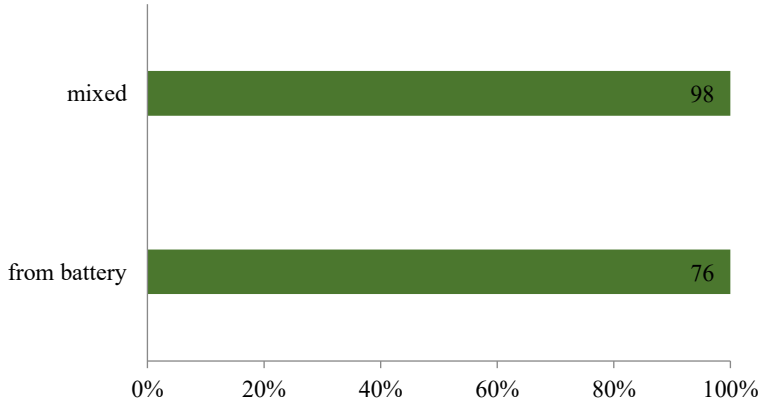

Fig. 3. Results of measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban environments on a plastic surface.

An assessment of the distribution of data in the results of a user survey measuring the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions was carried out according to the formula [19-21]:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)} \quad (1)$$

3.2 Discussion

The obtained results of changes in the influence of various start modes on the energy efficiency of electric scooters operated in urban conditions allow us to conclude that such an influence exists.

Based on the obtained data on the influence of various start modes on the energy efficiency of electric scooters used in urban environments. It follows that the median value of the increase in energy efficiency of electric scooters with a mixed start mode was 63 %.

4 Conclusions

This article examines the energy efficiency of electric scooters in different starting modes. The influence of various start modes on the energy efficiency of electric scooters used in urban environments was analyzed. A comparison was made of the start due to the electric battery and the start using the physical strength of the electric scooter driver. In this case, the comparison was made with different types of surface on which the launch took place. The results of the analysis of the influence of various start modes on the energy efficiency of electric scooters can be used in research in the field of electric transport.

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