Sustainability of Shared e-Scooter Services in Riga

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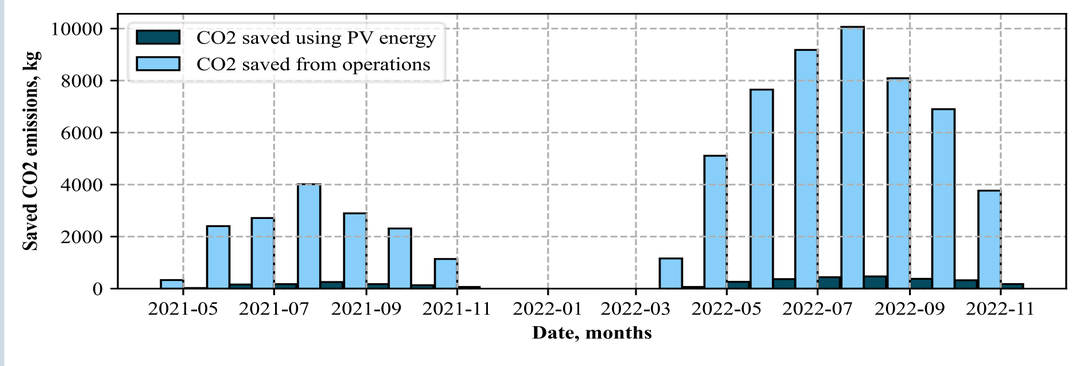
Using locally produced PV energy could potential reduction in CO_2 emissions by 34%, or by 18.05 gCO_2 per passenger kilometer.

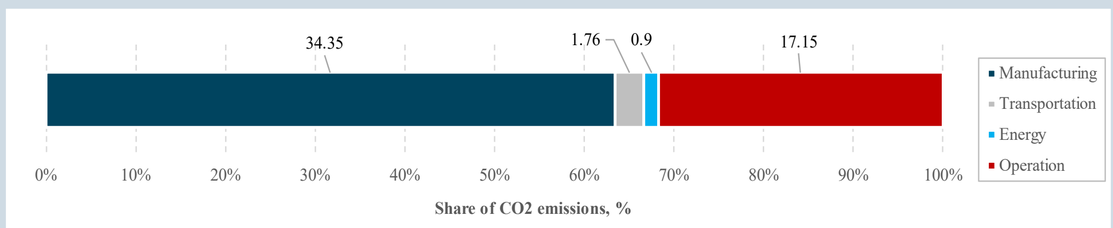
This study examines the shared electric scooter usage patterns in Riga across 2021 and 2022 and assesses the potential for reducing greenhouse gas emissions in the city's urban transport system.

Over two years, with 3.9 million scooter trips analysed, the study found a threefold increase in shared scooter usage with a tendency towards shorter rides. Averaging 7 km per scooter per day, this led to emissions on average of 54.16 g CO_2 per passenger kilometre.

Thus, shared scooters contributed 163.3 tonnes to Riga's CO_2 emissions in 2022: a net increase of 49.2 tonnes in the city's transportation-related CO_2 emissions.

Using localised PV charging, could eliminate electricity CO_2 emissions and scooter relocation CO_2 emissions, that way hypothetically could be saving 71 tonnes CO_2 emissions from electric scooters annually, and leading to 11 tonnes net CO_2 emission reduction from transportation in Riga



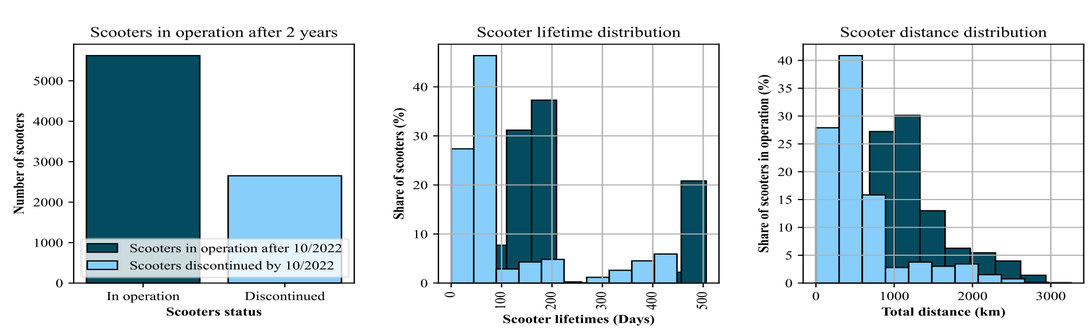


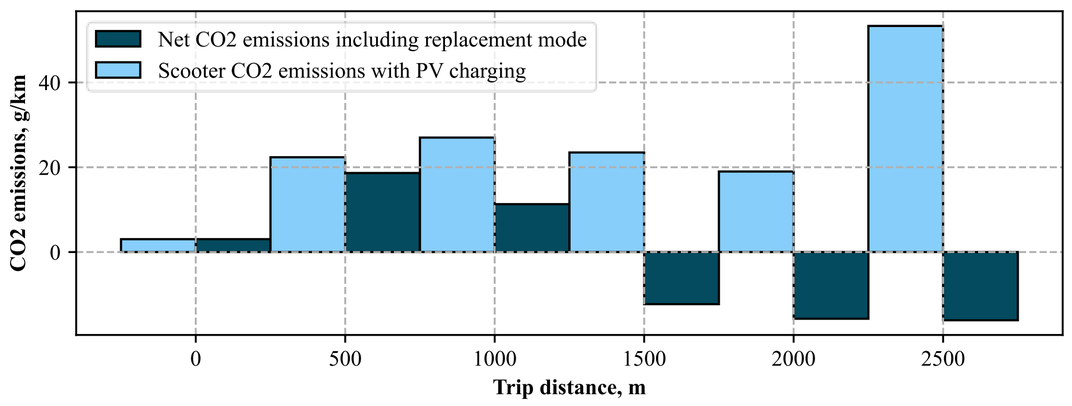
Introduction

Transportation is one of the main sources of CO_2 emissions in EU that still does not show signs of reduction despite all the activities aimed to support emissions-free vehicles. The electic scooters are often hailed as way to decrease CO_2 emissions from urban transportation, however the numbers quoted by scooter operators are lower than those from independent researchers, especially taking into account the replacement transportation mode CO_2 emissions by a factor or 10.

Using on-site generation of renewable electricity, such as PV panels at scooter parking locations, would not only ensure a sustainable power supply for the scooters but also eliminate the necessity for scooter transport to charging, thus substantiating the veracity of environmental sustainability claims.

Results





Methodology

The total net scooter CO2 emissions depends on which other transportation modes are replaced by scooters:

$$\sum CO_2 e^{Net}_{Scooters} = \sum CO_2 e^{Gross}_{Scooters} - \sum_i CO_2 e^{Gross}_{ReplMix_i}$$

$[CO_2 e^{PV}_M + CO_2 e^{PV}_T + CO_2 e^{PV}_I]$ is an amount of fixed CO_2 emissions, which must be amortised over distance driven per scooter lifetime, to obtain emissions per km, dividing by:

s_L - distance driven during scooter lifetime (km)

n_p - average number of passengers per ride (p), which in case of scooters is 1.

Two variable components of emissions are:

$CO_2 e^{PPK}_U$ - CO_2 emissions for scooter use ($gCO_2e \cdot (p \cdot km)^{-1}$)

$CO_2 e^{PPK}_O$ - CO_2 emissions $gCO_2e \cdot (p \cdot km)^{-1}$ for scooter operator services.

The total lifespan and distance driven during lifetime affect the CO2 emissions per km the most.

$$CO_2 e^{PPK}_{Scooter} = \frac{374002}{\bar{s}^{Day}_{Scooter} * \bar{N}_{Scooter}} + CO_2 e^{PPK}_U + CO_2 e^{PPK}_O$$

Variable CO_2 emissions can be set to 0 using locally produced PV.

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