

# How can e-scooter better contribute to a sustainable transport system?

## Insights from the e-SPARK project

Frances Sprei<sup>1</sup>, Khashayar Kazemzadeh<sup>1</sup>, Anne Faxér<sup>2</sup>, Elin Einar Lindvall<sup>2</sup>, Jenny Lundahl<sup>2</sup>, Joakim Rosell<sup>2</sup>, Kateryna Melnyk<sup>2</sup>, Kristina Holmgren<sup>2</sup>, Shiva Habibi<sup>2</sup>, Susanne Stenberg<sup>2</sup>, Stefan Pettersson<sup>2</sup>, Johan Wedlin<sup>3</sup>, Henrik Engdahl<sup>4</sup>  
<sup>1</sup>Chalmers University of Technology, <sup>2</sup>RISE, <sup>3</sup>Tånggudden, <sup>4</sup>Nimling

This project is granted by the Swedish Energy Agency (Dnr 2020-011467)

Based on current usage patterns the carbon benefits of e-scooters are questionable despite the fact that companies have systematically been improving the vehicles and operations for safety, durability and carbon footprint. The models currently used by sharing companies are designed for sharing; they are significantly heavier than those used initially, they are more robust which has increased safety and durability of the scooters. They are also easier to repair. For operations, the switch to e-scooters with swappable batteries has enabled large reductions in emissions from the collection for charging. The heavier scooters require more materials and hence have a larger environmental footprint from the production phase, but if the scooter also can perform more kilometers during its lifetime, the environmental footprint per passenger-kilometer can decrease. However, also with a significant decrease in g CO<sub>2</sub>eq/passenger km, shared e-scooters have a quite high carbon footprint compared to active modes and public transport.

Cities need to understand how regulations affect how much e-scooters are used and their lifetime. Regulating the use and parking of e-scooters is central, however, these regulations should be carefully designed not to reduce the utilization rate of the e-scooters or shorten their lifetime. There is e.g. a large risk that shifting from free-floating to more station-based will decrease the usage of e-scooters. Cities should thus follow up on how new regulations affect e-scooter usage and lifetime, and thus the environmental footprint of the e-scooters.

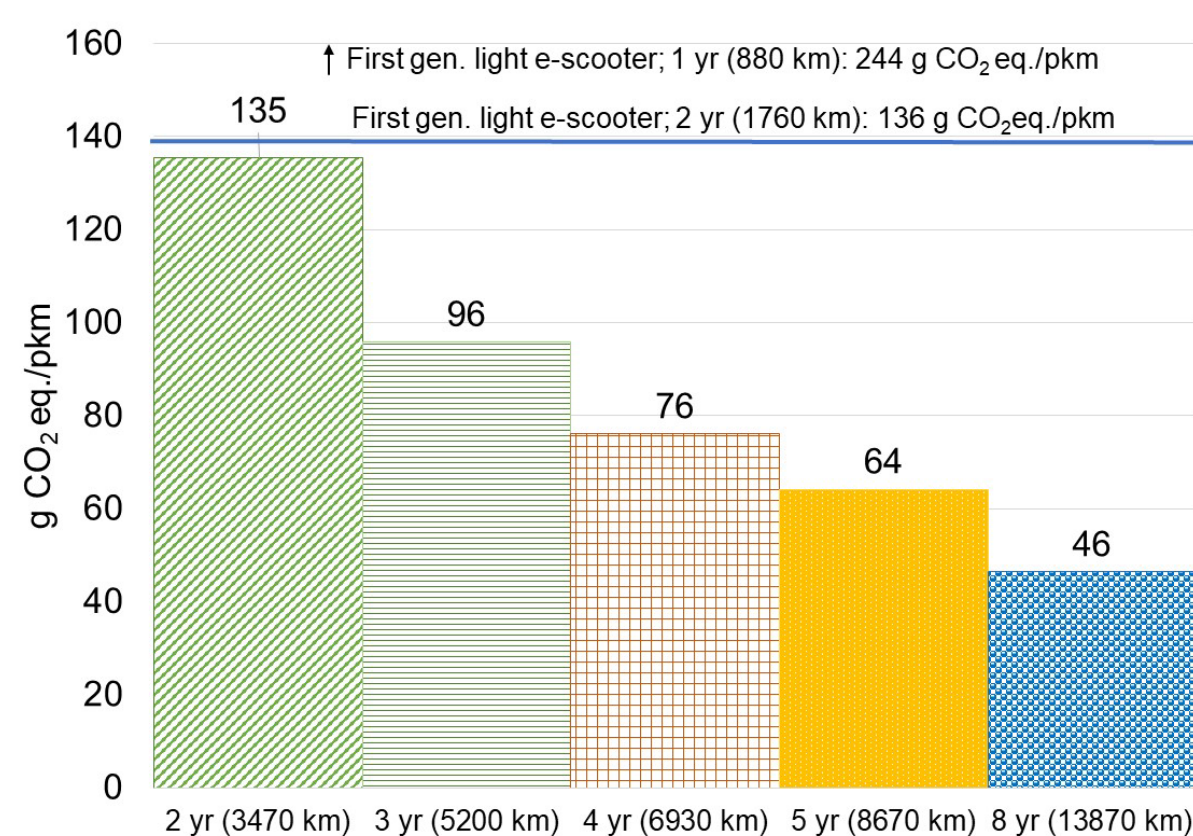


Fig 1. The climate impact from a life cycle perspective for the heavier e-scooter model with varying assumptions regarding lifetime (lifetime mileage). As a comparison the estimated climate impact of the first generation (lighter) scooters is given for two different lifetime cases (lifetime mileage).

E-scooters are being used by mobile people in areas with a lot of activities.

Frequent e-scooter users are men, middle age, with children between 7 to 12, having a driving license, and a high-income job. They are often frequent car users and/or hold a public transport card. Thus, it is not fully clear what mode is substituted. Figure 2 illustrates the demographic characteristics of the participants.

For frequent users, there is about a 50% probability that a trip under 4 km will be substituted with an e-scooter. Moreover, sunny weather and work trips make the substitution more likely. Also, the mood of the user, i.e. that they are not tired increases the likelihood of modal substitution. The graphical representation in Figure 3 presents the marginal effects associated with various variables.

Shared e-scooters are used in areas characterized by lots of activities as well as areas of trip generation or attraction potentials. Areas with bike-sharing stations, financial hubs, and night activities (such as restaurants and clubs) are among the ones that have the highest numbers of e-scooter sharing demand. Leveraging this information, we have the capacity to develop suitable service areas for e-scooter-sharing services in new cities. By predicting the service areas for e-scooter sharing, city planners and service providers can make more informed decisions when introducing these systems to new locations.

E-scooters could alleviate congestion both for cars and in public transport in central areas in cities with heavy traffic but may increase traffic on bike lanes. One core issue is thus how public space is allocated in cities. Allowing for more space for active modes and e-scooters can benefit the substitution away from car use. Currently, e-scooters share space with pedestrians and cyclists, creating potential safety hazards. This is due to the varying navigational characteristics of e-scooters, such as their speed compared to walking and cycling. Additionally, their relatively compact size and agility might increase the likelihood of interaction with other road users. There is thus a double concern: an increased risk of accidents and a reduction in usage of e-scooters which in its turn will increase the carbon footprint of the e-scooters.

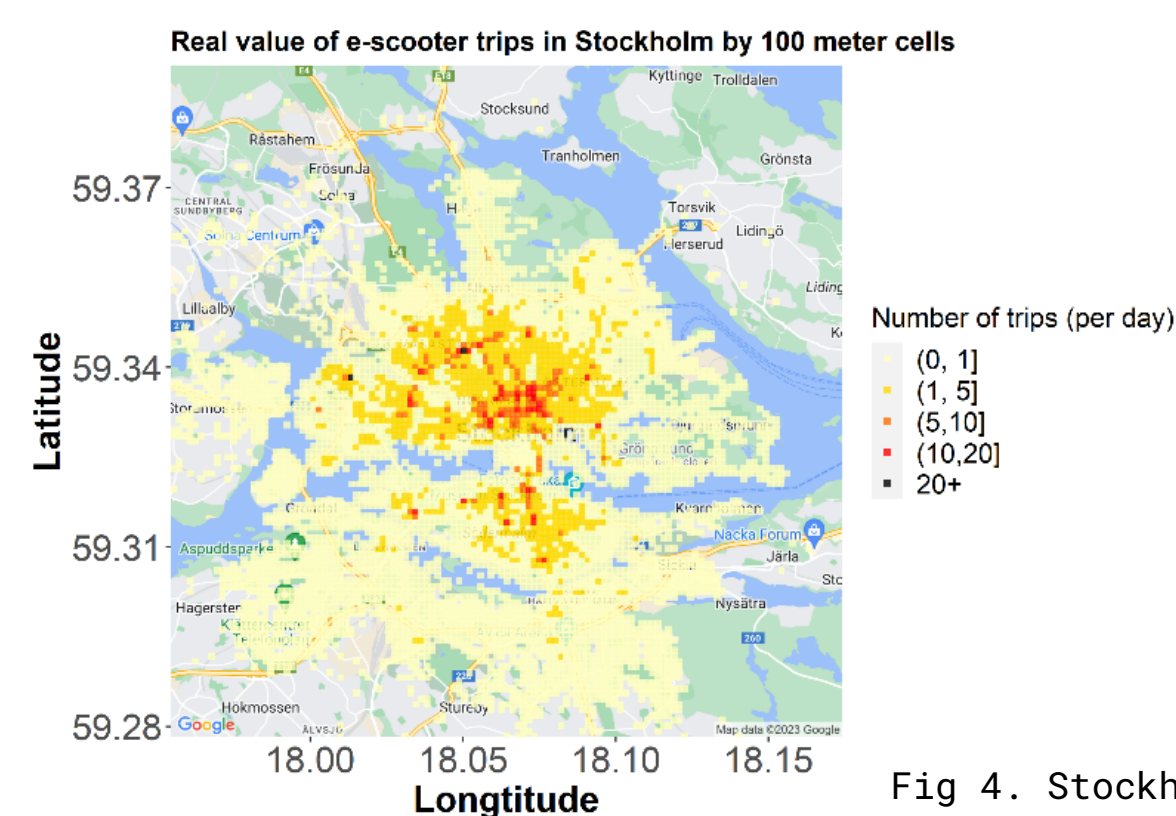


Fig 4. Stockholm

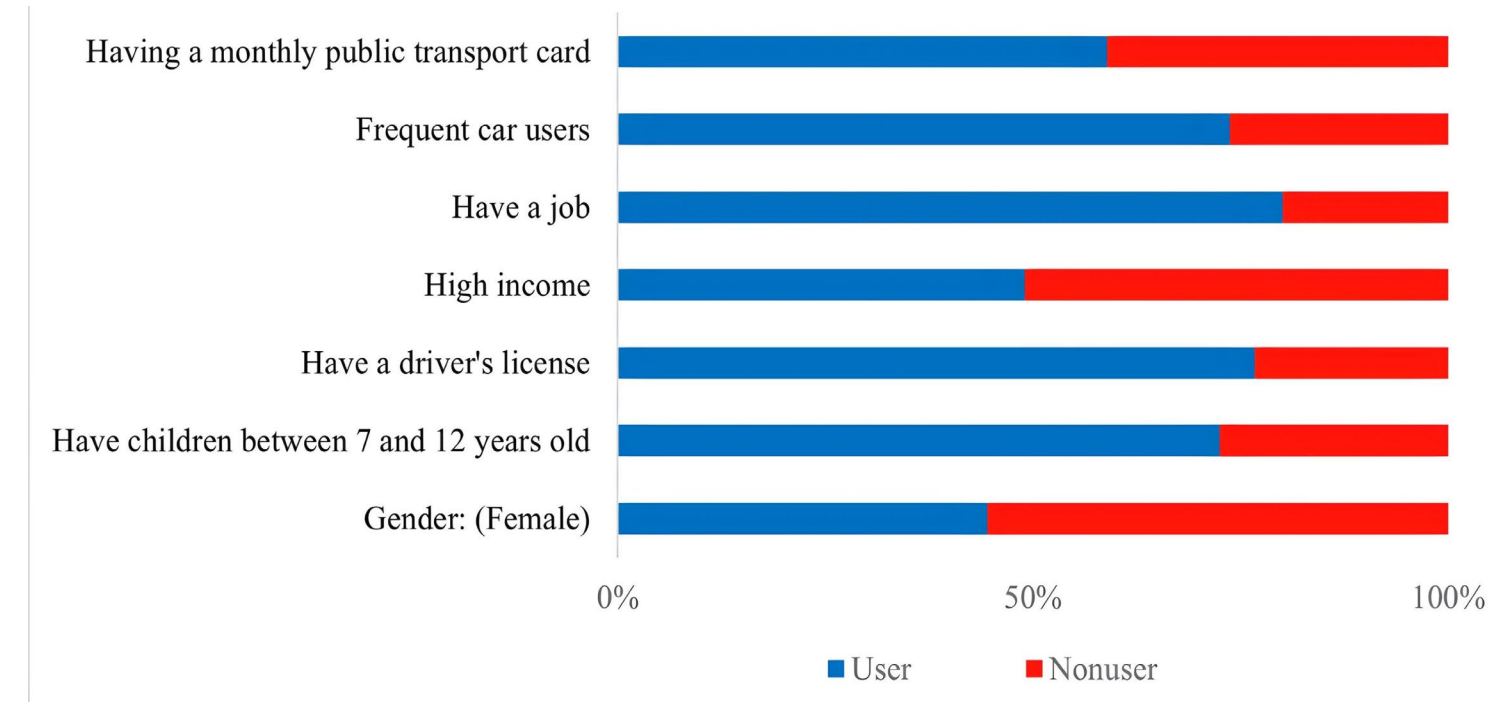


Fig 2. Graphical representation of participants' demographic characteristics

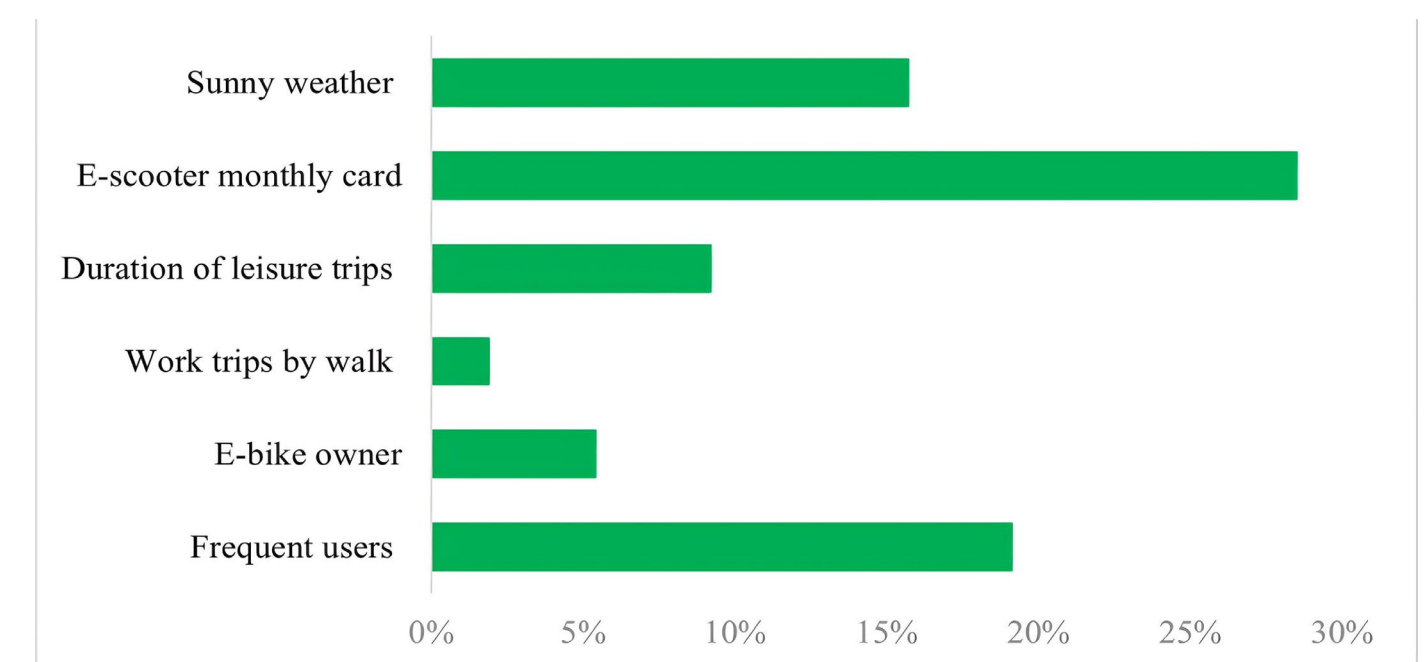


Fig 3. Marginal effects on modal shift to e-scooters

**E-SPARK** examines the e-scooter's role in the fossil fuel free transport system from 1) the use perspective, 2) the energy and resource perspective, and 3) the policy and regulation perspective. It is a collaboration between Chalmers and RISE and the project starts in January 2021 and ends in July 2023.

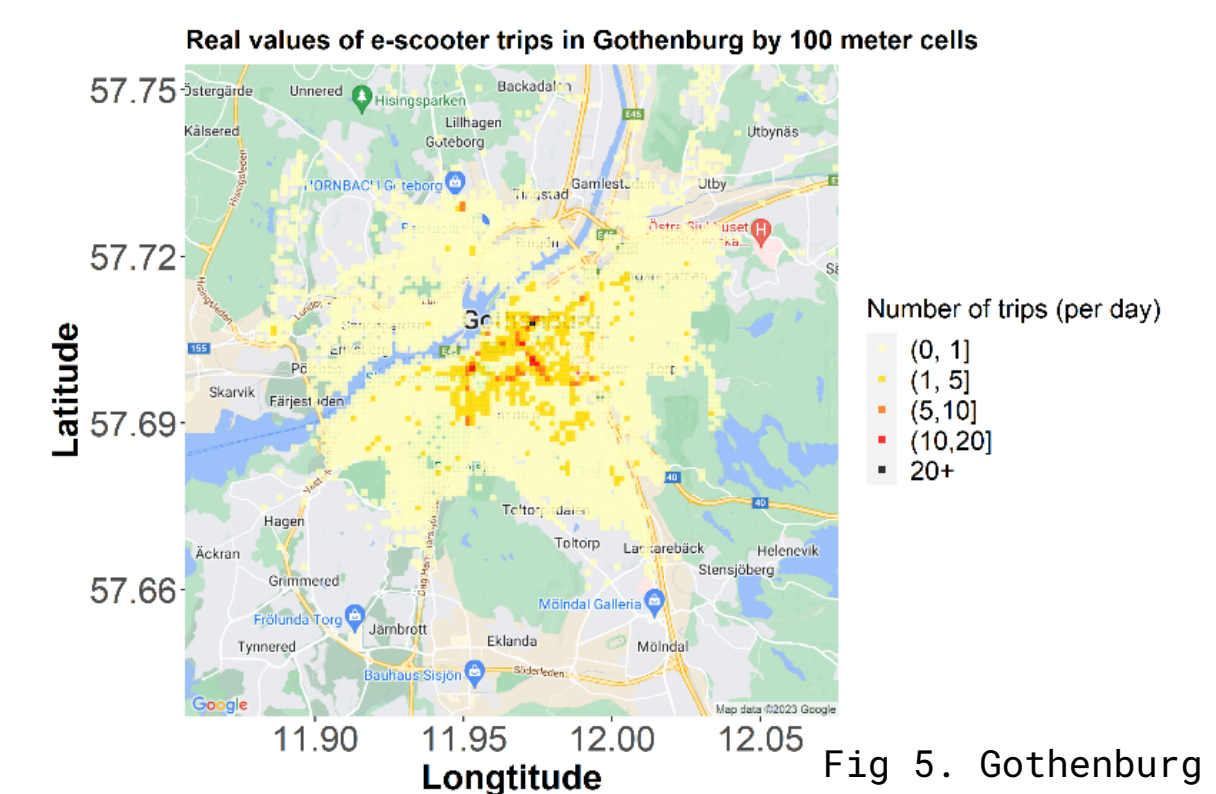


Fig 5. Gothenburg