SuSMo

Climate-KIC

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cenex

E-SCOOTERS

Maximising the benefits of e-scooter deployment in cities

August 2020

Contents

Figure 1: E-scooter riders in Germany[1]

[1] https://www.ft.com/content/7adc822e-4ce2-11ea-95a0-43d18ec715f5

1 Executive Summary

Cenex believes that e-scooters have their place in the transport networks of the present and future, offering first and last mile travel solutions that are inclusive and sustainable. However, without appropriate implementation, management, and regulation they can disrupt the transport network, and the city as a whole, in a negative way.

The key learnings from this report are as follows:

- In Europe, cities were initially slow to react to e-scooter deployment with little or no regulation before their introduction. This led to issues such as over-deployment, dangerous use, safety concerns and street clutter. Since then regulation and policy has been brought in to mitigate the potential negative effects of e-scooters.
- Local authorities need to take an active role in the deployment of e-scooters in their regions, setting out regulations for operators in order to ensure that e-scooters meet their needs and ambitions. This could include parking regulations, speed limits, tenders for operator deployments, insurance, and environmental sustainability.
- In the UK, 58% of car journeys are fewer than 5 miles, and in urban environments 69% of car journeys are fewer than 3 miles. Given the typical distances of e-scooter trips of 1-5 miles there is a clear opportunity for e-scooters to replace car journeys within cities and help ease congestion.
- In Paris, the average inner city speed for the last mile of a journey was found to be 16 kph. With typical legal speeds of 20-30 kph, e-scooters have the ability to decrease journey times over short urban trips.
- E-scooters can benefit citizens of all socioeconomic status. Unlike passenger cars, where large amounts of capital investment are needed or expensive lease schemes, shared e-scooters can cost as little as £2/€2 for a 2 mile trip with no capital outlay.
- The carbon footprint of e-scooters is rapidly improving with technology advances and operational sustainability. Typical CO_2 emissions of e-scooters are 35-67 g per km over their life compared to 200-350 g per km for private petrol cars.
- Other forms of travel, such as active travel public transport, have lower carbon footprints than e-scooters and should form the backbone of sustainable urban mobility. E-scooter journeys should target replacing private car journeys and gaps in the transport system where public transport and active travel are not feasible.

- Cities have historically allocated a large proportion of public space to privately owned vehicles. This bias towards private cars reduces the potential for deployment of more sustainable modes. Reallocation of space prioritising sustainable transport is a must in decarbonising cities and enabling citizens to become less car dependant.
- Appropriate infrastructure should be provided by cities for e-scooters in the form of safe cycle lanes and appropriate parking facilities. This will aid in mitigating street clutter and improving safety of users.
- Cities should consider converting car parking spaces for micromobility provision, rather than taking away further pedestrian space. The reallocation of car parking spaces is relatively fast and cheap, with only signage, road paint and barriers needed. One car parking space can allow up to 20 e-scooters to be parked. Additionally, the decreased parking allocation for cars may increase demand for micromobility.
- E-scooters generate large amounts of data and cities should require data sharing from operators. However, cities need to first understand what they will use this data for and how it will be useful. Possible uses include analysing the full transport system to ensure e-scooters work in harmony with other modes of transport for the greatest positive impact.
- E-scooters should primarily enable first and last mile journeys to connect with other forms of sustainable travel or replace entire journeys that would ordinarily be covered in a private car. Cities and operators should work together to identify deployment sites that promote shared mobility travel over more carbon intensive modes, rather than compete against other sustainable transport services.
- Possible locations for e-scooter deployment that are likely to be suitable in most cities are train stations, bus stations, mobility hubs, retail hubs, technology industrial parks and universities, parks, and places of significant interest.

Overall, Cenex's view is that the potential benefits of e-scooters far outweigh the few negatives, and when managed appropriately these negative aspects can be fully mitigated. Through openness, planning and regulation, e-scooters represent a large piece of the puzzle in decarbonising urban transport, and the lessons learnt from e-scooter deployment can help prepare cities for future transport innovations.

2 Introduction

Cenex has produced this report as part of the Climate KIC project SuSMo (Sustainable and Shared Mobility).

Cenex was established as the UK's first Centre of Excellence for Low Carbon and Fuel Cell technologies in 2005. Today, Cenex focuses on low emission transport & associated energy infrastructure and operates as an independent, not-for-profit research technology organisation (RTO) and consultancy, specialising in project delivery, innovation support and market development.

Our independence ensures impartial, trustworthy advice, and, as a not-for-profit, we are driven by the outcomes that are right for our clients not by the work which pays the most or favours one technology.

The SuSMo project is a collaborative Climate KIC project that Cenex leads, working with Trivector, AESS, and Cleantech Bulgaria. The project brings together leading cities from across Europe (Sofia, Bologna, Stockholm, and Madrid) along with experts in the transport sector to provide decision makers with the tools and knowledge to better manage shared mobility solutions. The project is also creating a community that can find and test solutions to the challenge's cities face in providing low carbon, inclusive transport.

This paper is primarily written for local authority transport decision makers in continental Europe and the UK, as well as regional and national policymakers. It aims to inform cities how to manage and implement e-scooters to best serve their citizens as well as achieve decarbonisation targets. It details key areas that Cenex believes should be considered to create a safe and sustainable environment for e-scooters and the environmental impact of such services. This will inform policy and regulation as well as provide evidence to support future resource use by cities to support the uptake of e-scooters. The paper only considers shared e-scooter schemes, rather than private ownership.

E-scooters are a form of shared micromobility that has grown rapidly since their introduction in 2018, pioneered by Lime and Bird in the US. They are two wheeled scooters with small, electric motors and a platform to stand on whilst riding and can be spread around a city for the general public to use. Companies in this field have seen dramatic market growth and huge valuations: Bird for example became the fastest US company to a $1 billion valuation[2]. Established shared mobility companies such as Uber are among the biggest investors in e-scooter start-ups, investing in both Lime and Voi. However, negative headlines about vandalism, theft, safety concerns, and — in the UK — regulatory uncertainty, have prompted questions over the long-

[2] https://www.bizjournals.com/sanjose/news/2018/06/15/scooter-startups-break-unicorn-speed-records-to-1.html

term success and practicality of e-scooters as a sustainable and shared mobility solution.

E-scooters are predominantly dockless and rely on an app for use. Users unlock the scooter through an app at a cost (around 1 £/€) and then pay a charge per minute use (around 0.15 £/€) until they reach their destination. Dockless systems give users the convenience and freedom to start and end their journeys at any location, effectively traveling from door to door. However, this brings with it complications in logistics for the operators and makes vandalism and theft more common. A common approach to help mitigate this is for e-scooter providers to create a zone of operation, whereby if a vehicle travels outside of the zone it can no longer be operated.

E-scooters are intended as a sustainable method of 'first and last mile' transportation primarily targeting large towns and cities. The UK National Travel Survey 2018 showed that 58% of car trips are fewer than five miles and therefore could potentially be replaced by e-scooters. However, e-scooters typically compete with docked and dockless electric bikes and pedal bikes and therefore may not help cities alleviate congestion. Safety is often a concern along with street clutter, and in many places e-scooters have arrived before the much needed infrastructure, policy, and awareness to support them.

The common operating model for providers is to place e-scooters in central locations close to city amenities, other transportation hubs (such as train stations), or in high footfall areas. Throughout the day their charge will decrease due to use, and operators commission third party gig-workers to collect e-scooters that are low on charge in the evening and transport them to a facility where they can be recharged overnight. Once charged, units will be placed back in designated areas and the cycle starts again. Some operators employ swappable battery technologies which removes the need for gig-workers to transport scooters in vans and instead use other forms of low carbon transport, such as cargo bikes, to travel between each e-scooter. Cities should consider indirect carbon emissions associated with e-scooter schemes when planning or procuring services.

Like many forms of transport, e-scooters have positive and negative effects on cities. It is crucial that authorities understand these in order to limit the negative impacts and ensure this new form of mobility works for citizens, first and foremost, and the operators.

3 Policy in the EU and UK

As is often the case with disruptive technologies, e-scooters were launched before any specific policy or legislation was created. This often causes friction between cities and vehicle operators, and this has been no different for the deployment of e-scooters.

With no regulation or transport policy, some cities suffered from large scale deployment of e-scooters. In some cases, competing companies distributed units in high footfall areas with little concern for potential impacts on the city. Scheme users had little knowledge of how e-scooters should be used and best practice for where they should be ridden or where they could be left. This often led to safety concerns with other road users and pedestrians, and e-scooters were viewed by some critics as potentially dangerous.

Since then, countries and cities have caught up with the technology, started to understand the potential impacts of e-scooters, and opened up dialogue with operators looking to set up schemes in their jurisdiction.

Policy in EU Member States

Sofia, Bulgaria

Sofia is one of the leading European cities in safe, sustainable e-scooter deployment. It was one of the first cities to bring in specific regulation for e-scooters, both from an operator and end-user perspective.

Figure 2: Lime e-scooters deployed in Sofia, Bulgaria's capital[3]

[3] https://www.li.me/second-street/scooters-sofia-lime-first-launch-micromobility-bulgarian-capital

In August 2019, Sofia reallocated an initial 160 car parking spaces (now at over 200) for bicycles, mopeds, and e-scooters in the city centre, supporting the growing interest of citizens in alternatives to car travel in the Bulgarian capital.

E-scooters were required to be rental only and a maximum speed limit (25 km/h) was set, this has since changed to allow personal vehicle ownership as well. Potential operators were required to share captured data with the city in order to receive a license to operate within the city.

The Bulgarian Parliament announced in January 2020 that helmets are mandatory for riders under the age of 18 and the minimum riding age is 14, if the vehicle is used only on cycle lanes, and 16 if ridden outside them. Reflective elements are required on clothing when riding in the dark.

The preparation by the city prior to e-scooter companies operating in the area has meant that the city has been able to control vehicle numbers and ensure appropriate parking provision that has little effect on pedestrian footpaths.

There is much to be learnt from Sofia and many cities are now following a similar procedure in order to ensure the sustainable growth of e-scooters without causing detriment to their city. Policy and regulation both at a country-wide level and city-level should be at the heart of micromobility with clear benefits for the city, users, and operators.

Paris, France

Lime was the first operator to offer services in Paris, launching in June 2018. During the next 12 months the market grew rapidly with 12 operators in the city deploying 20,000 vehicles in total[4]. This was a major concern for the city as there was nothing in place to control the market and the streets became littered with vehicles, considered by many as an eyesore, along with an increasing number of accidents involving both pedestrians and other road users. This led to the creation of a framework of regulations for e-scooter companies and users by the city to try and improve safety and control deployment of vehicles. This included[5]:

- Fines for users riding e-scooters on the pavement – €135 – and for parking on the pavement – €35.
- Implementation of 2,500 parking spots dedicated to e-scooters.
- Obligation for the operators to sign a good conduct chart.
- Vehicle license fee in order to regulate the fleet size – €50/scooter/year.

[4] https://www.theguardian.com/world/2019/jun/06/paris-taking-steps-to-crack-down-on-electric-scooter-providers
[5] https://www.wired.com/story/paris-escooters-regulation/

Figure 3: Officers issuing fines in Paris[6]

However, these regulations were insufficient as the city still had relatively little ability to monitor the services quality and compliance to the local rulings. As such, Paris decided to tender for operators to run services in the city.

The tender offered three companies the right to operate up to 5,000 units each within the city's boundaries and the applications were marked according to three categories: User Safety (30% weighting), Operations – management, maintenance, and charging (30% weighting), and Environmental Responsibility (40% weighting)[7]. Through this tender Paris selected the best operators for their city providing a framework for sustainable mobility.

Berlin, Germany

Regulation in Germany allows 'small electric vehicles', which include e-scooters, to be used. These are limited to 20 kph (12.5 mph) and must have handlebars[8]. E-scooters must be used on the road or cycle lanes (where available), but not on the pavement. Users must have insurance and the vehicle must be registered, but a driving licence and helmet are not required.

Barcelona, Spain

E-scooters can use cycle lanes at speeds up to 10 kph (around 6 mph) and on the road at speeds up to 30 kph (18.6 mph) but cannot be used on pavements. They must be parked in designated spaces. The minimum age to use an e-scooter is 16. Users of private e-scooters that are between 25-

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[6] https://shared-micromobility.com/analysis-of-paris-escooter-rfp/

[7] https://shared-micromobility.com/analysis-of-paris-escooter-rfp/

[8] DfT, Future of Transport Regulatory Review: Call for Evidence, March 2020

50kg and commercial e-scooters require helmets and private insurance is recommended but not required[9].

Sweden

In Sweden if an e-scooter is limited to below 20 kph (12.5 mph) and the motor is below 250 watts it is classified as a bicycle and can utilise bike lanes and be used on public roads. This means that it is not in itself illegal to ride them while under the influence of alcohol, without a helmet, or on paths shared by pedestrians and bicycles. It is also not currently possible to impose parking rules on them without also affecting bicycles[10].

If an e-scooter runs faster than 20 kph (12.5 mph) or has a motor stronger than 250 watts is classified as a Class II moped. However, this requires certain technical requirements that e-scooters do not meet therefore making them illegal to use on public roads.

Policy in the UK

Prior to June 2020 e-scooters were illegal to ride on UK public roads, cycle lanes or pavements. However, privately owned e-scooters could be ridden on private land with the permission of the land owner. This is because e-scooters, at the time of writing, are classified as Personal Light Electric Vehicles (PLEVs), so they are treated as motor vehicles and are subject to the same legal requirements: MOT, tax, licensing, and specific construction.

Following the outbreak of Covid-19, the UK allowed cities to trial e-scooter hire schemes with temporary laws enacted to allow deployment and users to ride them legally. Private e-scooters are still banned unless used on private land with permission.

The trials will influence future laws covering use of e-scooters. Cenex expects that laws covering e-bikes would largely be repurposed to cover e-scooters. This would require insurance (covered by the e-scooter operator), a provisional or full driving license, speed restrictions and require their operation on roads and in cycle lanes, not on pavements.

[9] DfT, Future of Transport Regulatory Review: Call for Evidence, March 2020
[10] https://www.themayor.eu/en/swedish-authorities-are-looking-into-possible-new-rules-for-e-scooters

4 Impacts of E-Scooters

Congestion

Global vehicle numbers have grown from 127 million in 1960 to an estimated 1.4 billion in 2017, and continue to increase by around 80 million vehicles per year[11]. The effects of this growth are significant and increases the travel time for drivers in slow and stop-start traffic, especially during peak travel times during the morning and afternoon.

Congestion represents wasted time for drivers, with an average of 178 lost hours per year in the UK and an associated cost of £8 billion[12]. Lost time due to congestion is most prevalent in city centres where roads are often single lane and there is a high ratio of traffic crossings to road space. Due to the urban environment, expanding the road network is difficult, and often the only way to reduce congestion is to reduce the number of vehicles travelling through the city.

In the UK, 58% of car journeys are fewer than 5 miles, and in urban environments 69% of car journeys are fewer than 3 miles[13]. Similar trends are prevalent in other European cities and given the typical distances of e-scooter trips of 1-5 miles there is a clear opportunity for e-scooters to replace car journeys within cities and help ease congestion.

Figure 4: Drivers in Rome spend 254 hours stuck in traffic each year[14]

[11] Davis S.C. & Boundy R.G., Transportation Energy Data Book, Edition 38, April 2020
[12] https://inrix.com/press-releases/scorecard-2018-uk/
[13] DfT, National Travel Survey 2018
[14] https://www.wantedinrome.com/news/rome-worlds-tenth-most-congested-city.html

Journey Time

Congested roads in major cities reduce travel speeds and increase journey times by private cars. Additionally, limited parking in city centres can extend journey times, through drivers having to search for available parking spaces.

E-scooters are ideal for congested city centres due to their compact design and door-to-door operability. Manoeuvrability through traffic, with typical legal speeds throughout Europe of 20 kph (12.5 mph), means that short journeys can be much quicker than private car travel in city centres, with the additional ability of being able to park e-scooters at the destination due to dockless systems.

In Paris, the average inner city speed for the last mile of a journey was found to be 16 kph (10 mph)[15] clearly demonstrating the possibility of e-scooters providing a faster form of transport than private cars.

As e-scooters become more widely adopted congestion should begin to ease in city centres decreasing journey times for private cars. However, as e-scooters and other forms of micromobility increase in popularity, city planners may look to reallocate road space from cars to micromobility ultimately maintaining the status quo of slow inner city speeds for private cars.

Accessibility

E-scooters can benefit citizens of all socioeconomic status. Unlike passenger cars, where large amounts of capital investment are needed or expensive lease schemes, shared e-scooters can cost as little as £2/€2 for a 2 mile trip with no capital outlay. Through the integration of e-scooters services into the transport system this gives citizens greater accessibility to cheap transport.

E-scooters can also improve transport access in areas where public transport is limited. E-scooters provide the opportunity to bridge the transport network allowing vulnerable users in these areas, where there is little or no public transport, to travel into the city centre for a reasonable fee.

Environmental

For all mobility solutions sustainability and the environment must be at the forefront of decision making. Both the technology and the operators must support and commit to sustainability and minimising the environmental impact of the services provided.

[15] https://inrix.com/scorecard-city/?city=Paris&index=7

Providing a mobility service that deploys silent electric vehicles, and promotes modal shift away from private car use can help reduce greenhouse gas emissions (GHG), improve air quality and ease congestion.

There are, however, other issues that need to be considered when deploying e-scooters, not least the batteries themselves, how they are charged and what mode of transport they are replacing.

Operators first deployed off-the-shelf commercial products that were not originally fit for purpose – neither for sharing, nor riding rough cobblestone pavements as part of their daily routine. As a result of this, the first generation of e-scooters had a life expectancy of just a few months, which was not enough time for their operational GHG savings to outweigh their embedded emissions.

Battery recharging is another important issue to consider. E-scooters are typically collected by larger vehicles for their batteries to be recharged, usually during off-peak hours, at night. They are spatially dispersed due to the nature of their usage, which generates irregular and long travel patterns for those collecting the vehicles. During the initial deployment of e-scooters by operators, little thought was given to controlling the method of this collection with diesel vans often being the preferred method for gig-workers who charge the vehicles. The methods of collection can often be non-rationalised meaning collection routes do not follow an optimised route and so extra energy and fuel is used unnecessarily.

However, many operators are aware that cities are demanding sustainability from mobility solutions and have improved the lifecycle emissions performance of their products.

Figure 5: Collection of e-scooters by a diesel pick-up truck[16]

[16] https://www.autonews.com/mobility-report/texas-tech-hub-scooter-mania

E-scooters now have typical lifespans of up to two years in service thanks to improvements in design and battery technology. An increasing number of operators use replaceable batteries limiting the trip distance of workers who recharge the vehicles and ensuring vehicles stay in the field, increasing their usage and reducing their GHG emissions per km ridden.

Additionally, with the introduction of replaceable batteries, large diesel vans that were once required to transport the vehicles to and from recharging sites are no longer required, with operators implementing sustainable and low emitting cargo bikes. The carbon footprint of e-scooters has rapidly reduced since their initial implementation as demonstrated in the following figure produced by Voi Technology, showing a 70% reduction in CO_2 per km, down to 35 g CO_2 per km since January 2019.

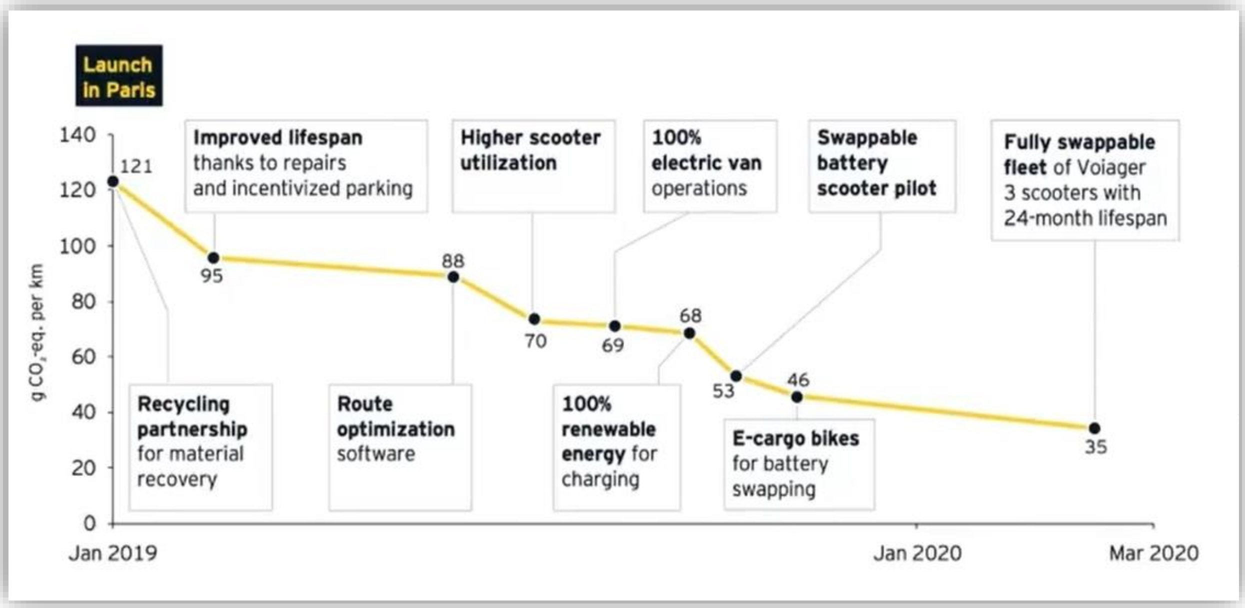

Figure 6: Life-cycle assessment of VOI e-scooters in Paris[17]

Improving the environmental performance of the vehicles can help maximise carbon emissions benefits, and even small innovations, such as route optimisation and making the vehicles more recyclable, can be effective.

Modal Shift

More important than decarbonising e-scooters is the modal shift of passengers towards micromobility and other forms of e-mobility. Though e-scooters have a low carbon footprint, that is reducing with every new development by operators, there are clearly modes of transport that have lower carbon footprints such as active travel; walking is considered to have a

[17] VOI Webinar: https://www.youtube.com/watch?time_continue=549&v=NIdaCVaHR0A&feature=emb_logo

carbon footprint of 0 g CO_2 per km and pedal bikes around 5 g CO_2 per km (ignoring calories burned)[18].

The following figure shows the carbon footprint range of various modes of travel including e-scooters, active travel, public transport, and private cars. It shows that e-scooters can play a large part in the decarbonisation of cars and diesel buses. With an ever decreasing carbon footprint it may not be long till e-scooters become competitive with electric buses, e-bikes, and the metro.

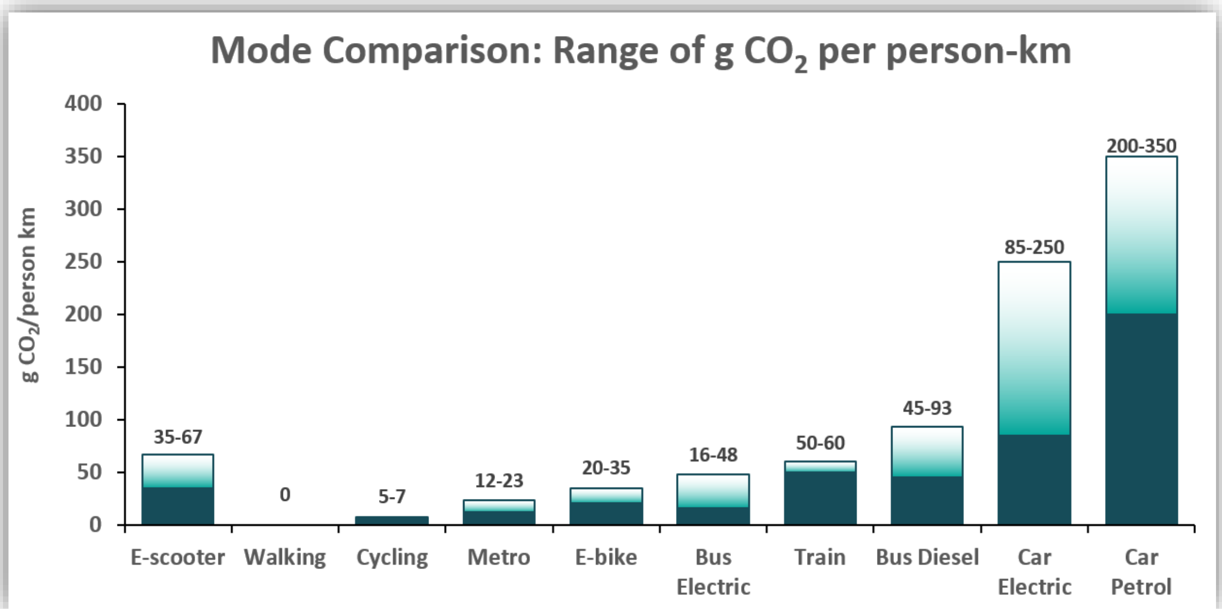

Figure 7: Life-cycle carbon footprint of various modes of transport[19]

In order to understand the true impact of e-scooters on decarbonising the transport network it is crucial to understand what modes of transport e-scooters are replacing.

Around 30% of e-scooter journeys replace car travel (a combination of private car use and ride-hail e.g. taxi, Uber or Lyft), with 50% of rides replacing active travel (walking, cycling or e-bike), 12.5% of rides replacing public transport and 7.5% of users would not have made the trip if e-scooters were not available[20].

As car journeys have the largest carbon footprint it is clear that the higher the percentage of e-scooter journeys replacing car travel, the greater the

[18] https://ecf.com/news-and-events/news/how-much-co2-does-cycling-really-save

[19] VOI Webinar: https://www.youtube.com/watch?time_continue=549&v=NIdaCVaHR0A&feature=emb_logo

[20] Modal shift % figures come from averaged figures from various studies:
- https://www.fleeteurope.com/en/last-mile/europe/features/do-scooters-replace-cars?t%5B0%5D=e-scooter&t%5B1%5D=Lime&t%5B2%5D=Uber&t%5B3%5D=Public%20transport&curl=1
- https://time.com/5659653/e-scooters-cycles-europe/
- Zagorskas J. et al., Challenges caused by increased use of e-powered PMVs in EU cities, Dec 2019
- https://www.forbes.com/sites/adeyemiajao/2019/02/01/everything-you-want-to-know-about-scooters-and-micro-mobility/#59a4d3915de6
- https://www.sae.org/binaries/content/assets/cm/content/topics/micromobility/sae-micromobility-trend-or-fad-report.pdf

environmental benefit. E-scooter rides that replace active travel, however, increase the carbon footprint of the transport network. A fine balance must be kept ensuring that e-scooters have an overall negative carbon effect.

Using the typical figures stated for modal shift (30% car, 50% active travel, 12.5% public transport, 7.5% no-trip) and calculating the overall CO_2 impact on the system, Cenex has calculated that e-scooters reduce CO_2 by 45% across all journeys. A breakdown of CO_2 contributions from each mode can be seen in the following figure.

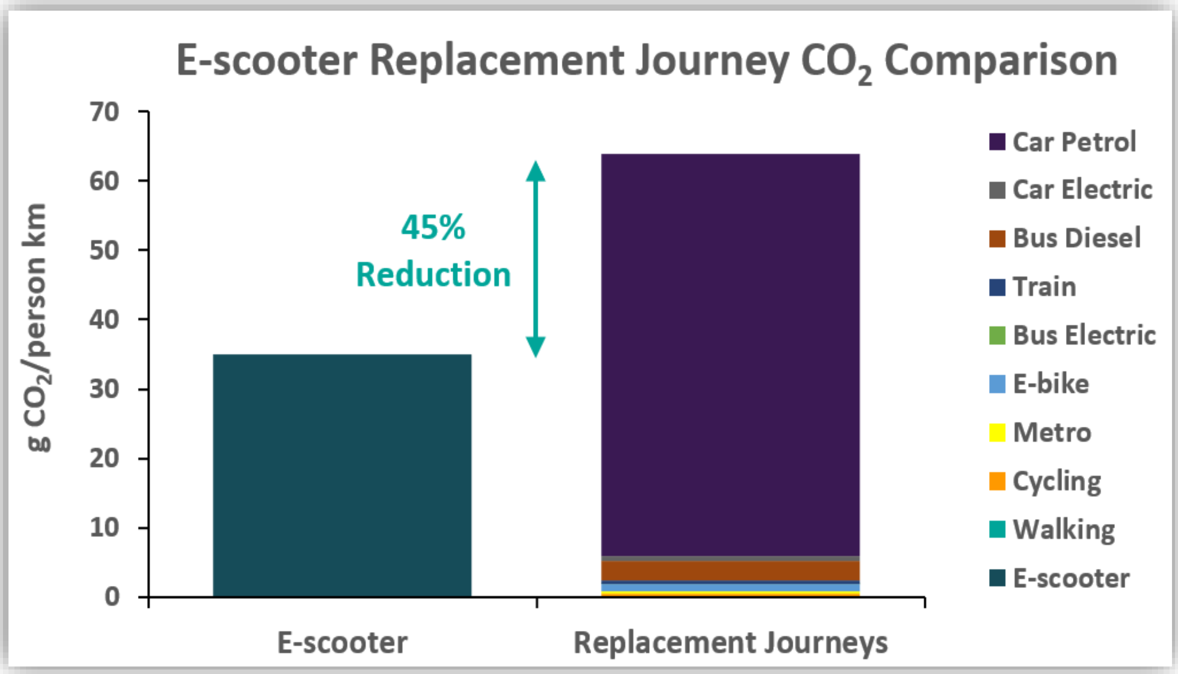

Figure 8: Calculated CO_2 impact across all e-scooter journeys

Whilst this clearly demonstrates the potential positive impact that e-scooters can have in reducing GHG emissions, more needs to be done to ensure a higher percentage of journeys are replacing private car use and not active travel and public transport. It is clear that the higher the ratio of car journeys replaced by e-scooters vs other modes of transport, the higher the overall CO_2 reduction of the system.

5 Key Considerations for Deployment

Good practice in the deployment of e-scooters is crucial to maximise the benefits. This section sets out guidelines for cities to follow.

Cooperation

Operators and local authorities must engage and collaborate with each other, and the community, to improve the sustainability of a city's transportation system.

Public authorities and private operators have to establish how to integrate e-scooter services into the city's transport system. Real, substantive cooperation, capable of providing a long-term solution to first and last mile travel must be established from the start.

Public transport and active travel should be the backbone of sustainable urban mobility, and shared micromobility services should support these modes rather than compete against them. This should be communicated to operators and dictate where e-scooters are placed to ensure they contribute to the city's sustainability objectives, and not just for the operators' business case.

Public Spaces

When ridden or parked on pavements, e-scooters can be an eyesore, create streetscape clutter or create hazards for pedestrians. Reasons for this include riders being afraid to use the road, legislation banning use on the road, and a lack of parking facilities. With or without helmets, riding licenses and reflective vests, e-scooter users are still vulnerable road users and if it is required that e-scooters use roads, they must be safe.

Cities have historically allocated a large proportion of public space to privately owned vehicles. This bias towards private cars reduces the potential for deployment of more sustainable modes. The reallocation of space for the safe use of active travel and micromobility is not about fighting private car use, but correcting a system that currently puts those who do not own a car at a disadvantage, and limits the ability of those who do own a car to change to more sustainable modes.

The rise of e-scooters and other micromobility has paved the way for cities to unlock their public space for other modes of transport and to enable citizens to become less car dependant.

Infrastructure

Infrastructure is a key consideration in the allocation of public space, from allocation of road space for cars, bikes and scooters to parking space and docking stations.

When looking at building suitable road space for micromobility one solution does not fit all; it is important to differentiate by road type. Does the road have multiple lanes? Are there high volumes of traffic at high speeds? Is the street wide enough whereby car lanes and cycle lanes could be separated? Is the street residential and the only option is for micromobility to share the road with other vehicles? Urban and transport planners should consider the impact and needs of micromobility on city roads.

Figure 9: E-scooter users riding in a cycle lane[21]

Provision of appropriate parking for e-scooters reduces the potential for street clutter as well as providing set space for operators to place vehicles. Cities should consider converting car parking spaces for micromobility provision, rather than taking away further pedestrian space. Locations should provide good visibility of the service: a hidden away car park with little footfall is not a good location. Reallocating parking spaces is relatively fast and cheap, with only signage, road paint and barriers needed. One car parking space can allow up to 20 e-scooters to be parked. Additionally, the decreased parking allocation for cars may increase demand for micromobility.

Dockless e-scooters can still raise challenges for parking provision at the end of a journey that is not in a high footfall area, as infrastructure cannot be

[21] DAVID PAUL MORRIS / BLOOMBERG / GETTY

provided at every location to which users want to travel. Mixed solutions must be considered so that dockless systems do not result in excessive cluttering of public space. This could involve requiring e-scooters to be parked in designated areas in dense, highly populated areas and full free-floating allowed in others. This should be discussed in depth with operators to ensure that GPS systems on the vehicles have enough precision to enforce these regulations.

Fees

In general, local authorities charge private services to use public space to conduct their business. Fees charged to e-scooter operators could feed into the general city budget, or be spent on relevant measures such as investment in infrastructure and traffic calming measures.

Data

E-scooters and other forms of shared micromobility generate large amounts of data. Many cities have mandated data sharing as part of a scheme's licence to operate. However, often cities are unsure what to do with the data once they have it or have data that provides no focus or purpose.

First and foremost, cities need to consider what the data will be used for. This will help to form the questions they have in terms of their capacity to analyse the data, what data they require and to what depth (remembering that operators cannot provide all data for operational, technical or legal reasons e.g. GDPR), and in what format the data should come.

The data produced typically falls into two main categories: user data and operational data. User data could include gender and age of users as well as information on what modes were substituted by e-scooter trips. Operational data could include start and end points, date, time, and duration. Both data sets can be useful in understanding travel and transportation in a city, however thought should be given to the end goal of a city and what data will be most useful to reach their strategic goals.

Data on operations is likely to be of greatest use when analysing transport systems and ensuring a network that works in harmony for the greatest impact in the city. When stored and analysed in time series, operational data will enable local authorities to visualise and better understand daily, weekly, and monthly e-scooter usage patterns. Namely, when and where traffic is more intense, and parking has more peaks. From this they will also be able to identify priority areas for improvement and, coupled with data from public transport and parking ticketing data, understand the impact on the transport network as a whole.

Location of Deployment

E-scooters should primarily enable first and last mile journeys to connect with other forms of sustainable travel or replace entire journeys that would ordinarily be covered in a private car.

Cities and operators should work together to identify deployment sites that promote shared mobility travel over more carbon intensive modes, rather than compete against other sustainable transport services.

The responsibility of site identification should lie primarily with the city. Operators coming into any city will not have in-depth local knowledge of the nuances of the transport system or wider initiatives that can affect travel. Cities need to share their own knowledge with operators so locations can be identified where the operators business case will work and where the city can benefit most; filling gaps in the transport network and ensuring a high proportion of e-scooter journeys are replacing car journeys. Sites that are likely to be suitable in most cities are train stations, bus stations, mobility hubs, retail hubs, technology industrial parks and universities, parks, and places of significant interest.

Figure 10: Example of a mobility hub including bus stop, e-scooters, and bike sharing[22]

[22] https://www.traffictechnologytoday.com/news/emissions-low-emission-zones/minneapolis-launches-low-carbon-mobility-hub-pilot.html

6 Conclusion

Cenex believes that e-scooters have their place in the transport networks of the present and future, offering first and last mile travel solutions that are inclusive and sustainable. However, without appropriate implementation, management, and regulation they can disrupt the transport network, and the city as a whole, in a negative way.

Local authorities need to take an active role in the deployment of e-scooters in their regions, setting out regulations for operators in order to ensure that e-scooters meet their needs and ambitions.

The starting point should be to facilitate dialogue between cities and operators to understand each other's requirements and aspirations. Through this, appropriate frameworks can be created that cover public space allocation, infrastructure, and location of deployment to enable modal shift.

Though operators are already taking action to reduce their carbon footprints, pressure should be exerted by cities and local authorities to improve sustainability. This could be achieved through a tender process that places a high weighting on environmental sustainability, or using data analysis to ensure e-scooters are most likely to replace car journeys and avoid replacing active travel.

Through careful planning and working cooperatively, e-scooters can benefit a high proportion of citizens within a city, allowing cheap and accessible transport that can provide first and last mile services for many journeys.

Overall, Cenex's view is that the potential benefits of e-scooters far outweigh the few negatives, and when managed appropriately these negative aspects can be fully mitigated. Through openness, planning and regulation, e-scooters represent a large piece of the puzzle in decarbonising urban transport, and the lessons learnt from e-scooter deployment can help prepare cities for future transport innovations.

SuSMo

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Cenex
Holywell Building,
Holywell Park,
Ashby Road,
Loughborough,
Leicestershire,
LE11 3UZ

Tel:	**+44 (0)1509 642 500**
Email:	**info@cenex.co.uk**
Website:	**www.cenex.co.uk**
Twitter:	**@CenexLCFC**
LinkedIn:	**Cenex**