

**Fully charged:
Powering up
the potential of
e-bikes in the
city regions**



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Executive Summary

Having steadily risen in popularity over recent years, e-bike sales in the past 18 months have rocketed across Europe, with the COVID-19 pandemic influencing changes in travel behaviour. Many European countries have seen e-bike growth of between 30 and 40%, compared to single-digit growth in [car sales](#). Industry experts have predicted that this growth will continue, with e-bike sales in Europe expected to increase from 3.7 million per year in 2019, to 17 million per year by [2030](#).

The UK has also witnessed this upward trend, although sales have been low compared to its neighbours in continental Europe with e-bikes accounting for just 3% of bikes sold in 2019 compared to around 10 and 30% of sales in other European countries, including those with less of an established cycling [culture](#).

In Germany, for example, e-bike sales have been growing for several years and by the beginning of 2020 one in nine German households owned an [e-bike](#). In 2020, around two million people bought new electric bikes in [Germany](#) and it is anticipated that e-bikes could soon account for half of all bicycles [sold in Germany](#).

In its 'Gear Change' vision for cycling, the Department for Transport describes how it would like to see half of all journeys in towns and cities being cycled or walked by 2030. Given that 68% of journeys in the UK are under five miles, there is, indeed, a huge opportunity for mode shift that e-bikes could significantly contribute to.

Commissioned by the Urban Transport Group (representing the UK's largest urban transport authorities), this report aims to quantify and understand the potential to increasing e-bike uptake in the UK and the benefits that could be realised as a result. Focusing particularly on the city regions, it also aims to support urban transport authorities to consider practical approaches to increasing e-bike uptake.

The report highlights that e-bikes widen the appeal of cycling to more users, including those with lower fitness levels, older people and people with disabilities. E-bikes help to overcome barriers set by the UK's often hilly terrain and enable longer trips to be made by bike, offering great potential for mode shift from the car.

The versatility of e-bikes for a range of users and trips is supported by the variety of models on the market – from standard pedal assist bikes to e-trikes and e-cargo bikes, the latter capable of carrying up to 300kg of goods or even passengers.

E-bikes are also a popular element of many bike share schemes. Data gathered for this report from shared mobility operator Beryl and its scheme in Norwich, shows that e-bikes are used two to three more times per day than standard bikes. This evidence also suggests that the wider the area of a bike share scheme, the further people will travel using e-bikes, highlighting the potential for e-bikes to facilitate connections between suburbs and city and town centres.

E-bikes offer an attractive alternative to the car for people living in urban, suburban and even rural areas as well as filling gaps in public transport networks for less well served areas, enabling people to cycle further or connect with transport hubs for onward travel.

An evaluation of e-bike [schemes](#) across continental Europe found that typically around half of e-bike trips replaced car trips and that in some cases, as many as 70% of e-bike trips were previously made by car.

This report also finds evidence that e-cargo bikes have the potential to revolutionise first and last mile travel and logistics, replacing up to a quarter of commercial deliveries in cities, 50% of commercial service and maintenance trips, and 77% of private trips (e.g. [shopping, child transport](#)).

The levels of mode shift that could be achieved through greater use of e-bikes could result in substantial carbon savings and congestion reduction as well as health benefits for users.

For the first time, this report seeks to quantify these potential benefits for the seven core UTG city regions (London, Greater Manchester, Liverpool City Region, South Yorkshire, Tyne and Wear, West Midlands and West Yorkshire).

Using the Government's Propensity to Cycle tool (PCT), it sets out two scenarios (for more details, see Chapter 4):

- the Government Target Scenario, where cycle mode share doubles compared to 2017 levels (plus an additional increase to account for positive behavioural change driven by the COVID-19 pandemic), and
- the Accelerated Growth Scenario, where cycle mode share increases above the Government Target Scenario due to a greater propensity for people to cycle (the 'Go-Dutch' scenario) with an additional uplift for greater e-bike adoption. This scenario shows what would happen if the Government at a national and local level took a more ambitious approach to facilitating e-bike take up.

The analysis returns the following results for each scenario. Benefits were calculated using the DfT's Active Modes Appraisal Toolkit.

Government Target Scenario

- E-bikes contribute to 2% of all trips in the UTG city regions or 250 million additional cycle trips per year. 103 million of these trips replace car and taxi journeys.
- 416 million car and taxi kilometres removed annually across the city regions.
- E-bike usage generates around £280 million annually in monetary benefits for the city regions, of which £130 million arises from mode shift benefits and £150 million from health benefits.

Accelerated Growth Scenario

- E-bikes contribute to 7% of all trips in the UTG city regions or almost 1.2 billion additional cycle trips per year. 646 million of these trips replace car and taxi journeys.
- 2.6 billion car and taxi kilometres removed annually across the city regions.
- E-bike usage generates around £1.5 billion annually in monetary benefits for the city regions, of which £800 million arises from mode shift benefits and £700 million from health benefits.

To achieve these levels of growth and tailor effective packages of measures, it is important to understand the key factors influencing e-bike take-up. Many of these factors also apply to cycling in general, such as the quality of infrastructure, safety and public perception. Others are more specific to e-bikes, not least the cost, with a typical e-bike costing in excess of £1,000.

The report draws upon emerging evidence to suggest six areas where local transport authorities can play a role in increasing uptake of e-bikes specifically (as opposed to cycling in general, which is well covered in the existing evidence base). These are:

1. **Financial incentives** – such as grant schemes and tax incentives, with a particular focus on under-represented groups.
2. **Changing public attitudes and increasing awareness** – through bicycle libraries; loan schemes; increased use by the public sector; better marketing and promotion, including joint working with the health sector and with businesses.
3. **Infrastructure improvements** – including better cycle routes and mobility hubs (particularly targeting suburbs and areas poorly served by public transport); Low Traffic Neighbourhoods; charging networks; training for designers and engineers; micro consolidation hubs using e-cargo bikes.

4. **Security, safety and convenience** – with the provision of secure cycle storage near homes and key destinations (especially important given the high value of e-bikes); e-bike maintenance services; cycle training.

5. **Research and monitoring** – to test and evaluate different approaches to incentivise the use of e-bikes.

6. **Shared e-bikes** – with local and transport authorities securing funding targeted to introduce e-bikes into bike share schemes; collaboration to provide targeted discounts; working with housing developers to incorporate e-bike share schemes.

The findings of this report serve to highlight the huge opportunity to power up the potential of e-bikes in the city regions and beyond to meet and exceed government targets for mode shift, revolutionise first and last mile travel and support wider policy goals. This potential is already being capitalised upon across Europe, with e-bike sales rocketing, even in traditionally more car dependent countries.

It is time to join the e-bike revolution and enable more people to cycle more often. We hope that this report will provide transport authorities with the evidence and tools they need to fully charge their approach to e-bikes as well as encourage government at national level to give this important mode its full support.

Introduction

1

Overview

In recent years in the UK there has been a resurgence in popularity of cycling, which is a low carbon, cost effective, healthy, and practical alternative to car travel, particularly for short trips. To support an uptake in cycle trips, there has been an increase in public funding to develop and implement high quality cycle infrastructure.

By attracting a wider range of potential users, e-bikes offer significant potential to increase cycle trips further. E-bikes broaden the appeal of cycling for all types of trips including commuting, leisure and shopping trips.¹

For typical daily trips, e-bikes enable attractive travel times compared to car travel without many of the associated constraints (e.g. traffic, cost, finding a parking space). In addition, compared to standard bikes, e-bikes allow many users to travel further in less time and with less effort. However, barriers which currently limit e-bike take up include higher purchase costs, weight of e-bikes and their battery range.

The Department for Transport's (DfT) Gear Change report² sets the vision for cycling and walking to become a natural first choice for journeys with half of them being cycled or walked by 2030. E-bikes can make a major contribution to support this target. However, recent (2019) take-up of e-bikes remains low in the UK, accounting for just 3% of bikes sold. This compares with 10-20% of sales in Italy, France, Sweden and Germany, and around 30% in the Netherlands, Belgium and Austria.³

The COVID-19 pandemic has accelerated sales and use of e-bikes around the world, with a 60% increase in sales of e-bikes in the UK in April 2020 alone.⁴ This was driven by lockdown restrictions on travel; reduced capacity and the need for social distancing on public transport; as well as increased provision of temporary cycle lanes and infrastructure. There has been an increase in the use of bike share schemes too: the CoMoUK Bike Share Users Survey 2020 revealed that bike share schemes attracted more new users than usual in 2020, underpinned by lockdown restrictions and the government advice to avoid public transport.⁵

Shimano's 2020 State of the Nation Report⁶ considered attitudes towards e-bike usage across 11 European countries and found that the main reasons for using an e-bike were to facilitate longer trips and to tackle steep climbs. The UK offers a huge untapped potential for e-bikes: most trips are relatively short with 68% under 5 miles which could be easily travelled by e-bike⁷.

E-bike use in the UK is growing, but remains a small proportion of all cycle trips, which in turn represent a small but growing proportion of all trips. In countries where cycling is already a more popular form of travel (such as the Netherlands and Germany), e-bikes are now mainstream (for example, in Germany e-bike use has become commonplace with one in nine households now owning an e-bike)⁸.



Study objectives

Urban Transport Group (UTG) has commissioned Steer to develop a report to support transport authorities to understand the potential of e-bikes to deliver a range of policy goals and to consider their options for supporting and increasing e-bike take-up in a way that maximises this potential and minimises negative impacts.

UTG is the UK's network of the city region transport authorities. The full members are Merseytravel, Nexus, South Yorkshire Mayoral Combined Authority, Transport for Greater Manchester, Transport for London, Transport for West Midlands and West Yorkshire Combined Authority. UTG aims to ensure that transport plays its full part in making city regions greener, fairer, happier and more prosperous places.

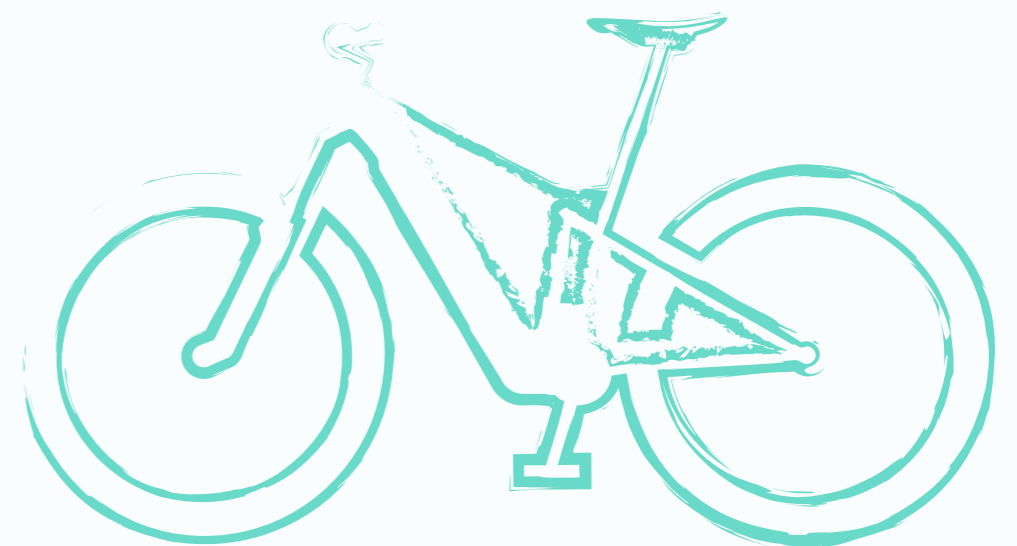
Towards the end of 2020, the DfT indicated that it plans to develop a national programme of support to increase uptake of e-bikes, with a significant funding pot to be made available for local authorities' applications.⁹ In the context of the indicated national programme of support for e-bikes, this study will help authorities be better informed about the potential benefits and disbenefits of e-bikes, consider potential options and actions to facilitate take up and be prepared to make use of any funding available.

Report structure

The report is structured as follows:

- Chapter 2 introduces e-bikes, including definitions and a broad typology, and provides an overview of UK regulation surrounding e-bikes;
- Chapter 3 explores a range of e-bike benefits for personal as well as business/freight use;
- Chapter 4 presents an estimate of the potential untapped audience/market for e-bikes in the UTG city regions and analyses the potential economic, environmental and health benefits of greater take-up of e-bikes;
- Chapter 5 summarises the key issues transport and local authorities need to be aware of when seeking to boost take-up of e-bikes; and
- Chapter 6 presents the potential options for transport and local authorities to maximise the benefits and minimise the risk of negative impacts.

The report is supported by examples and case studies of good and interesting practice around e-bikes from the UK and internationally.



Understanding e-bikes and their regulation in the UK

2

Introduction

In this evolving and emerging market, there are a range of different e-bike types available, each suitable for different purposes and users. Currently, only certain types of e-bikes are recognised by UK regulation. This section includes an exploration of both:

- types of e-bikes; and
- an overview of UK e-bike regulation.

Types of e-bikes

There are many different types of e-bikes available in the market. Most e-bikes can be described using the following classification:

- Pedal assist e-bikes;
- Speed pedal assist e-bikes; and
- Throttle based e-bikes (twist and go).

Pedal assist e-bike

With a pedal assist e-bike (also known as pedelec) the rider's pedalling is assisted by a small electric motor up to a speed of 15.5 mph. The rider gets no assistance while not pedalling or when the e-bike is above this speed.

Pedal assist e-bikes are the most common type of e-bike on sale in the UK at present.

Figure 2-1. Pedal assist e-bike



Source: <https://pedelecs.bike/urban/triumph-trekker-gt/>

Speed pedal assist e-bike

A speed pedal assist e-bike (also known as speed pedelec or s-pedelec), is an e-bike which can travel faster than 15.5 mph and/or have a motor more powerful than 250 watts. As with pedal assist e-bikes, pedalling is still required to enable motor assistance.

In the UK such vehicles are treated in law as mopeds (see an overview of UK e-bike regulation below), and while they are not common now in the UK, there is a growing interest in this type of vehicle.

Figure 2-2. Speed pedal assist e-bike



Source: <https://urbanebikes.com/>

Throttle based e-bikes (twist and go)

With a throttle based e-bike there is no need for the pedals to be used to engage the motor, it can solely be controlled by a throttle with a 'twist and go' mechanism. This form of e-bike can be an accessible option for anyone that may have a condition limiting their ability to engage in the pedalling action.¹⁰ However, since January 2016 "twist and go" e-bikes have required type approval before sale or first use and have, therefore, almost disappeared from the UK market (see overview of UK e-bike regulation, below).

Figure 2-3. Throttle based e-bike



Source: <https://electricbikeadvisor.com/electric-bike-without-pedal-assist/>

Other types of e-bikes

Other types of e-bikes, such as e-cargo bikes, e-trikes, folding e-bikes and converted e-bikes can be classified either as pedal assist e-bikes, speed pedal assist e-bikes or throttle based e-bikes depending on the characteristics of their motors and their use of pedals to power the e-bike.

Folding e-bikes

The attributes of folding e-bikes lie in the fact that they are compact and easy to take on public transport once folded. In terms of folding e-bikes available, similar to regular folding bikes, they typically come with either a step over frame or a step through frame.

Figure 2-4. Folding e-bike



Source: <https://www.brompton.com/bikes/brompton-electric>

There are numerous examples of successful implementations and trials of e-cargo bikes in the UK including but not limited to:

- ZED in Waltham Forest providing book deliveries by e-cargo bikes for the eight libraries run by the council - in a typical week around 1,200 books are delivered,¹¹
- Sainsbury's trial which involved a fleet of five e-cargo bikes delivering up to 100 orders per day with 97% of individual orders deliverable with a single bike,¹²

E-cargo bikes

E-cargo bikes vary in their design and weight carrying capacity, with smaller models able to carry loads of 100 kg and larger models up to 300 kg. E-cargo bikes can be used both by businesses and individuals who would like to move goods or people.

The design of an e-cargo bike can vary between carrying a front or rear load, having a flat top carrier, an open carrier or a closed carrier. Typical use of e-cargo bikes includes:

- transporting children on the school run;
- food delivery; and
- logistics and first and last mile delivery.

Figure 2-5. E-cargo bike



Source: <https://www.babboe.co.uk/>

- OXWASH, a laundry business based in Oxford, using a zero-emission fleet of e-cargo bikes to collect and deliver laundry to its customers,¹³
- Zedify, a cycle courier service based in Cambridge, which is a partnership between six independent e-cargo bike delivery operators, providing businesses with sustainable first and last mile deliveries including e-cargo bikes and electric vans; and
- Royal Mail trialling electric three-wheel trikes on delivery routes in three cities in the UK.¹⁴

E-trikes

An e-trike will typically have one front wheel and two rear wheels. Some e-cargo bikes have the opposite design with one rear wheel and two front wheels.

Figure 2-6. E-trike



Source: <https://jorviktricycles.com/>

Converted e-bikes

Demand for more affordable e-bikes has seen a growing range of e-bike conversion kits in the market. Electric bike conversion kits allow users to change their normal pedal bikes to electric bikes by fitting additional equipment.

There are various types of conversion kits available ranging from £150 to more than £1,000. The types of conversion kits include electric wheels powered by batteries, kits with the batteries fitted to bikes' frames or rear wheels, kits which can be fitted inside the frame and kits which can convert a bike into a throttle based e-bike.

Concerns about the safety, as well as the quality and effectiveness of conversion kits have been raised.

The [Bicycle Association's guide](#) on e-bike conversion kits published in July 2021 explains in detail some of the safety and legal/liability issues and risks around e-bike conversion kits both for end users and for retailers.

E-bike share schemes

Bike share can be broadly defined as any setting where bicycles are pooled for multiple users. Models include self-service on-street bikes or e-bikes which are either available at docking stations or without docking stations (dockless), folding bikes available from lockers, workplace pool bikes and peer to peer sharing.¹⁵

Initially, most bike share schemes in the UK were publicly funded docked schemes, although the market has since been disrupted by the arrival of dockless bike share schemes, hybrid schemes and the addition of e-bikes.

Public bike share schemes that include e-bikes in the UK (with several others being planned) include:

- nextbike Glasgow;
- Santander Cycles Leicester;
- Lime in London;
- Voi in Cambridge, Kettering, and Peterborough;
- Tier in York;
- Human Forest in London;
- Forth Bike scheme in Forth Valley;
- Co-bikes in Exeter;
- HireBike, Lincoln;
- B-Bike in Aylesbury;
- Embark Dundee; and
- Beryl in Watford and Norwich.



Overview of UK e-bike regulation

The UK effectively has a one-tier system of classifying personal e-bikes: they are either Electrically Assisted Pedal Cycles (EAPC) or not. E-bikes that meet certain requirements in terms of their technical design are classified as EAPCs. E-bikes which are not classified as EAPCs are classified under pre-existing moped or motorcycle regulations, which were not designed to consider the specific characteristics of e-bikes.

E-bikes which meet the EAPC classification

The criteria that needs to be met for an e-bike to be classified as an EAPC is as follows.¹⁶

- the bike must have pedals and the pedals must be used to propel the bike (a throttle can be used for speeds up to 3.7 mph);
- either the power output or the manufacturer of the motor must be shown on the bike;
- either the battery voltage or maximum speed must be shown on the bike;
- the continuous rated power of the electric motor must not exceed 250 watts; and
- its electric motor should not be able to propel the bike to more than 15.5 mph.

Both the Electrically Assisted Pedal Cycles Regulations 1983 and the Electrically Assisted Pedal Cycles (Amendment) Regulations 2015 apply to EAPCs as well as various provisions of the Pedal Cycles (Construction and Use) Regulations 1983 and the Pedal Cycles (Construction and Use) (Amendment) Regulations 2015. In terms of regulation on the user side, riders must be over 14 years old, and no licence, registration, taxation or insurance is required to ride an EAPC.

EAPCs are regulated in the same way as a regular bike and are not considered to be a motor vehicle under the Road Traffic Act 1988.¹⁷ This means they can be ridden on cycle paths and anywhere else where pedal bikes are allowed.

All e-bikes currently provided in public bike share schemes meet the EAPC classification.

E-bikes which do not meet the EAPC classification

Any e-bike that does not meet the EAPC rules is currently classed as a motorcycle or moped and needs to be registered and taxed. The user will need to have a driving licence, insurance and wear a helmet. In summary, they are subject to the following requirements:¹⁸

- bikes must be type approved before they reach the customer and have a corresponding type approval plate (typically done by a manufacturer or importer);¹⁹
- bikes must be registered with DVLA for use on a public highway;
- bikes must be registered for vehicle excise duty (although the charge would be £0 as it is an electric vehicle);
- bikes must undergo an MOT as per the schedule for other road vehicles; and
- users require:
 - insurance;
 - a legally certified helmet; and
 - a driver's licence.

As these e-bikes are currently classed as road vehicles, they cannot legally be used on cycle paths and cycle lanes. In other countries regulations are more accommodating to e-bikes which do not meet the EAPC classification.

Speed pedal assist e-bikes are amongst those vehicles that do not meet EAPC rules. Some elements such as obtaining type approval, insurance and an MOT are not readily available for this type of vehicle. In effect, this means that it is difficult to use speed pedal assist e-bikes in the UK.

Throttle based e-bikes (twist and go)

Type approval legislation which came into force in January 2016 means that e-bikes which have a throttle or similar control which can operate the motor at above 3.7 mph without the rider pedalling are classed as motorcycles or mopeds.

An automotive-style type approval must be obtained before sale or before the vehicle is being put into service. The requirement for this type approval before sale means that twist and go e-bikes have virtually disappeared from the UK market. Obtaining whole vehicle type approval (for large-scale sales) is generally not practical for manufacturers, but for one-offs or small batches there is a route to type approval via the Motorcycle Single Vehicle Approval process in the "250W LPM" category.

Since 2016, only a very few twist and go e-bikes have obtained type approval via this route.

"Grandfather rights" mean that twist and go EAPCs sold or put into service before 1st January 2016 can continue to be used without type approval.

Benefits of e-bikes

3

Introduction

E-bikes can provide a range of benefits including but not limited to the following:

- Health benefits: improving physical and mental health;
- Increase cycle journeys, attract new riders and encourage new types of trips;
- Supporting modal shift;
- Attracting wider demographics;
- Reducing carbon emissions; and
- Economic benefits.

Benefits of e-bikes

Health benefits: improving physical and mental health

Physical inactivity is the cause of one in six deaths in the UK.²⁰ Cycling reduces the risk factors for some of the main types of diseases, such as respiratory, cardiovascular, diabetes and some cancers.²¹ On average, people owning an e-bike cycle further and more often than those who use a regular bike, and therefore spend more time outdoors.²² A study on the physical benefits of e-bikes showed that a reduction in cardiometabolic risk factors was achieved with just four weeks of e-bike commuting.²³

Cycling also has a proven benefit for mental health, wellbeing and sleep quality.²⁴ Of those using an e-bike, 58% felt happier and 41% healthier, a finding of the DfT's Shared Electric Bike Programme report.²⁵ The CycleBOOM project also demonstrated a positive effect on cognitive processes and wellbeing in older people after taking an eight week bike and e-bike trial - with this benefit not only related to the act of exercising, but also engaging with the outdoor environment.²⁶

Increase cycle journeys, attract new users and encourage new types of trips

E-bikes allow users to cycle longer (time and distance), faster and over hillier geographies. One in three of the people using the Shared Electric Bike Programme's e-bikes stated that they rarely or never cycled before they started using the shared electric bikes.²⁷

It has been reported that 35% of regular riders used e-bikes to cycle because it allowed them to reduce their journey time. A further benefit of assistance is that it reduces the need to shower after a journey, so an e-bike can be used to travel to places without washing and changing facilities.²⁸

The CoMoUK Bike Share Users Survey indicates that bike share is a catalyst to re-engaging with cycling: in 2020, 55% of participants stated that joining a scheme was a catalyst to start cycling for the first time in at least a year.²⁹

The average length of an e-bike trip reported in the DfT's Shared Electric Bike Programme was five miles, greater than the three mile average of a standard bikes. Of participants, 33% stated that e-bikes allowed them to cycle up hills they previously would not have been able to cycle up.³⁰ Of all journeys undertaken by the participants of Go e-Bike regional e-bike share offer in Scotland, 30% were between two and five miles and those of five to ten miles trips accounted for about 22.5%³¹ - these lengths of journeys are often made by car and can be replaced by e-bikes.

By facilitating longer journeys by bike, e-bikes can enable alternatives ways to travel to the private car for people living in urban, suburban and rural areas, where the public transport network can be sparse and infrequent. For example, in Denmark, cycle routes designed for e-bikes link cities to towns and villages improving connectivity and accessibility of a range of facilities.

E-bikes appeal for both a wide range of journey purposes and a broad user demographic. Various studies and surveys demonstrate that older respondents and respondents with a physical limitation are more likely to use e-bikes for leisure trips while younger people and those without a physical limitation are more likely to use their e-bikes for commuting purposes. Shimano's *State of the Nation* Report³² states that leisure and family cycling is the main reason to use e-bikes (31%) with travel/commuting being a second most popular choice (28%) followed by sport/fitness (16%) and carrying heavy loads (11%).

Supporting modal shift

The evidence from various studies, trials and schemes suggests that e-bikes have potential to support modal shift from private cars by providing an alternative way to travel.

A survey of 1,800 e-bike owners³³ in the US found that 28% of respondents reported buying an e-bike specifically to replace car trips. It was reported that 76% of the e-bike trips would have otherwise been made by car. Many respondents also mentioned that they feel safer riding an e-bike than they do with a standard bicycle and they value an enhanced sense of safety.

GO e-Bike, a regional e-bike share offer funded by the regional transport body SEStran delivered five different e-bike share schemes in South East Scotland.³⁴ The programme has indicated the scope for a modal shift: participants stated that they were replacing car trips, with 33% of respondents previously travelling by car.

As part of the smart e-bikes project in Brighton, 80 employees were loaned an e-bike for a six to eight week period. Three quarters of those who were loaned an e-bike used them at least once a week. Across the sample, average usage was in the order of 15 to 20 miles per week and was accompanied by an overall reduction in car mileage of 20%.³⁵

The 2019 Case for a UK Incentive for E-bikes report,³⁶ states that their evaluation of e-bike grant schemes in Europe found that typically around half of e-bike trips replace car trips, although the proportion can be as low as 16% or as high as 70% depending on the country and local conditions. For example, in Austria, Germany, and Sweden, between 42% and 67% of journeys made by e-bike substituted a car journey.

Case study: Beryl bikes in Norwich

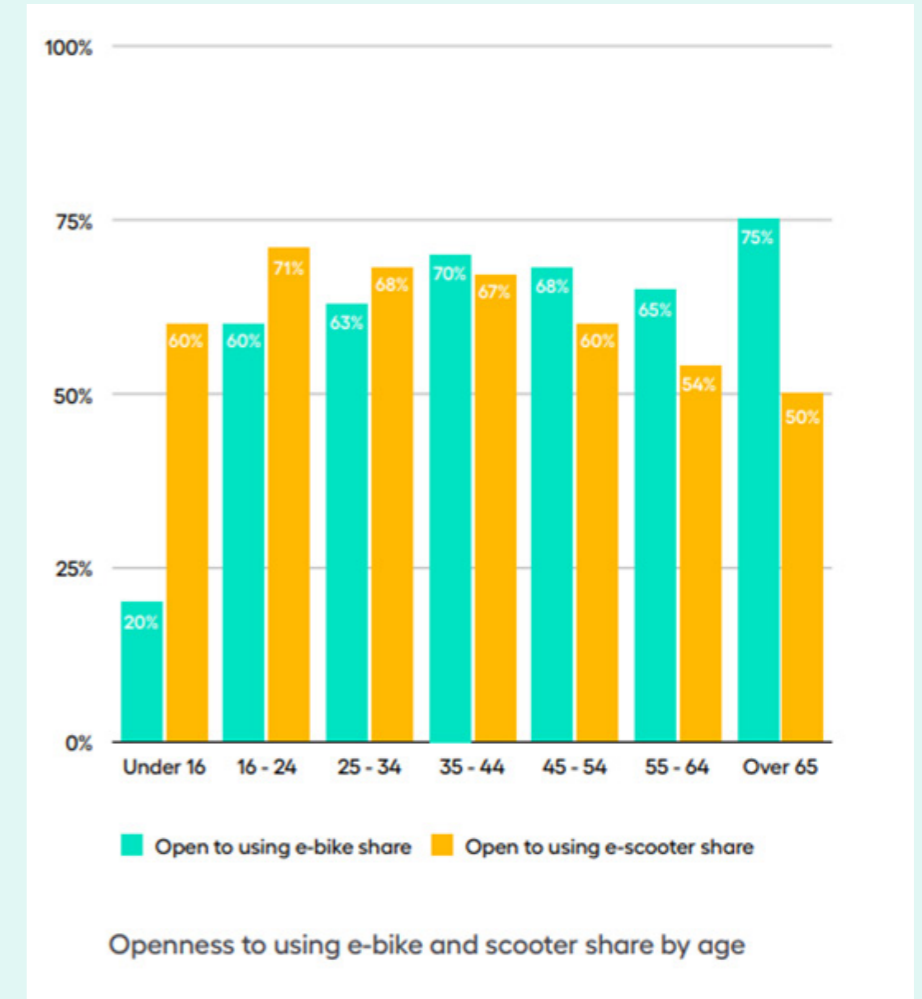
Beryl operates shared bikes, e-bikes and e-scooters in Norwich, UK. In total, 580 bikes are available including 110 e-bikes across 80 designated Beryl parking bays.

Data collected from September 2020 to April 2021 shows that e-bikes in comparison with standard bikes are used for longer journeys. For example, the median distance for bikes is 2.2 km and for e-bikes it is 3 km. Interestingly, e-scooter journeys were also used for 3 km journeys, which can be potentially explained by the novelty of shared e-scooters which has been recently added to the scheme as part of the shared e-scooter trials initiated by the DfT.

The data also shows that e-bikes are used 2-3 times more often per day than standard pedal bikes, which means more people are exposed to cycling.

In general, across all Beryl shared micromobility schemes, the biggest factor that influences the distance people will travel by e-bike is the size of the scheme itself: the wider the area covered by the scheme, the further people will travel using e-bikes. This highlights the role e-bike share schemes could play connecting suburbs and city and town centres.

In terms of demographics, older users are more open to e-bike share while younger users are more willing to try e-scooter share. There is less interest in e-scooters in general, with over a third of users stating they would not use them, compared to only 17% of users stating they would not use e-bike share.



Source: Beryl

Attracting wider demographics

The Shimano *State of the Nation* report found that e-bikes appeal to women more than standard pedal bikes but there is no real gender difference in appetite for e-bikes, as women are typically under-represented for cycling more generally.³⁷

The 2020 CoMoUK Bike Share Survey³⁸, found that the gender split between bike share users is more balanced than for general cycling³⁹: 53% of the shared bike users were men and 44% women. The demographics showed that there were no significant age differences between e-bike riders and the whole group. The DfT's Shared Electric Bike Programme also found that e-bikes attracted a wider demographic of cyclists and supported normalising cycling for females to a greater extent than standard bikes.

The assistive nature of e-bikes makes cycling more accessible for those with a lower level of fitness and for groups such as older people and people with disabilities. Assisted cycling has also been used as a rehabilitation tool for those with injuries to get active again supporting people in returning to regular cycling.⁴⁰

The DfT's Shared Electric Bike Programme included case studies of participants using e-bikes: 26% of regular e-bike riders agreed with the survey statement: "I have been able to cycle – I previously struggled to use a regular bike for fitness/health reasons".⁴¹ E-bikes also raised cycling confidence in those who have not cycled for a long period of time and in demographics such as the older people.

Case study: CycleBOOM project⁴²

The CycleBOOM project, led by Oxford Brookes University, ran for three-years from October 2013 to September 2016 and included both e-bikes and standard bikes. The average age of the 236 participants was 63 years. The evaluation and findings demonstrated that re-engaging with cycling for older people has a positive effect on cognitive processes, wellbeing and physical health through increased physical exercise and time spent in the outdoor environment.

The following positive feedback was collected from e-bike users reporting the following:

- the feeling of joy and thrill of e-biking;
- e-bikes provided them with an opportunity to cope with physical ailments that made standard cycling challenging;
- riding an e-bike felt safer compared to a standard bike;
- ability to cover more distance in less time and the freedom to discover new routes in their local area;
- a sense of getting healthy exercise outdoors, weight loss, increase in fitness, improved leg strength and endurance, better sleep and improved self-esteem;
- e-bike providing an opportunity to ride with a fitter friend or relative; and
- e-bikes allowed users to move away from junctions more quickly and avoid wobbling up hills and inclines.

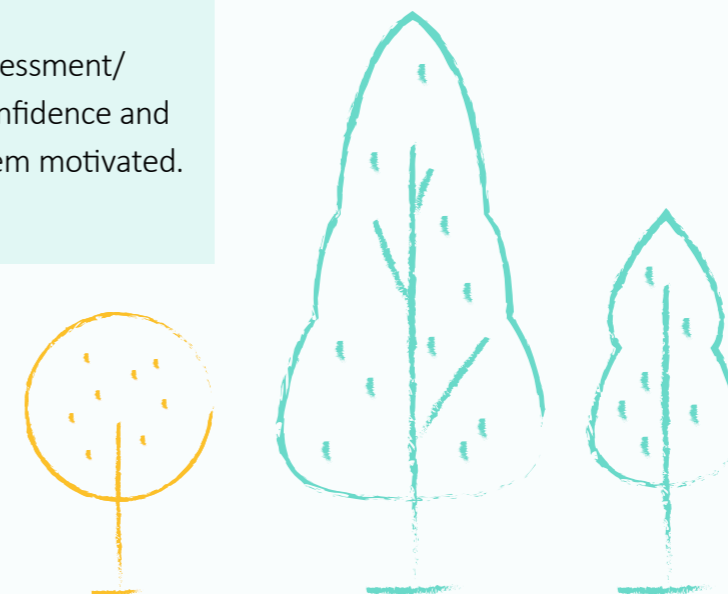
Participants also commented that the initial cycle assessment/training programme supported them with gaining confidence and the structured programme over eight weeks kept them motivated.

Reduction of carbon emissions

A study carried out by CREDS researchers at the University of Leeds⁴³ estimated that e-bikes, if used by people to replace as many of their car journeys as possible, have the capability to reduce carbon emissions in England by up to 50% and save about 30 million tonnes of CO₂ per year, equivalent to half of current CO₂ emissions from cars. A very radical change in travel behaviour would be required to achieve this. The study simulated how far people can travel and combined this with information about car use in each LSOA (Lower Layer Super Output Area, which is a neighbourhood of around 1,500 people) in England.

A recent study conducted by University of Oxford using statistical modelling across seven different European cities and data from 1,849 participants shows how cycling affected mobility-related carbon dioxide emissions. It was estimated that those who switch just one trip per day from car driving to cycling reduce their carbon footprint by about 0.5 tonnes over a year. If just 10% of the population were to change travel behaviour, the emissions savings would be around 4% of lifecycle CO₂ emissions from all car travel.⁴⁴

Research using data from a North American survey of e-bike owners (a sample of 1,796), estimated the impact of e-bikes on carbon emissions in Portland, USA.⁴⁵ It was found that an individual e-bike could provide an average reduction of 225 kg CO₂ per year and overall carbon emissions could be reduced by 12% if 15% of person miles travelled were instead made by e-bike.



The CanBikeCO Mini Pilot, USA

In 2020 the Colorado Energy Office (CEO) supported an e-bike pilot that increases access to e-bikes for low-income essential workers.⁴⁶ Thirteen low-income essential workers were given e-bikes.

The National Renewable Energy Laboratory (NREL) conducted research to assess the impacts of the scheme during the COVID-19 pandemic.⁴⁷

The evaluation of the initial pilot results indicates that e-bike was a dominant commute mode (31%), in contrast to the census bicycle commute mode share of <1%, and e-bike trips primarily replaced single-occupancy car trips (28%), followed closely by walking (24%) and regular bikes (20%). Participants used e-bikes for a variety of purposes beyond commuting, including shopping, recreation, and entertainment.

Emissions impact analysis was conducted and estimated savings of 0.62 kg of CO₂. It should be noted, that although the results are positive, the narrow demographic profile of study participants and their limited mobility alternatives indicate caution in broader interpretation.

Economic benefits

E-bikes could unlock a range of economic benefits including but not limited to the following:

- Time savings;
- Financial savings;
- Health and well-being benefits; and
- Wider economic benefits such as job creation and increased production.

E-bikes can reduce financial costs for users when replacing a car completely or using it a few days instead of driving. There can be savings on car purchase, insurance, parking, fuel and maintenance costs. In some European countries there is already a perception that e-bikes will save a rider money: a quarter of Italian, Dutch, Spanish and Norwegians believe that an e-bike can save them money.⁴⁸

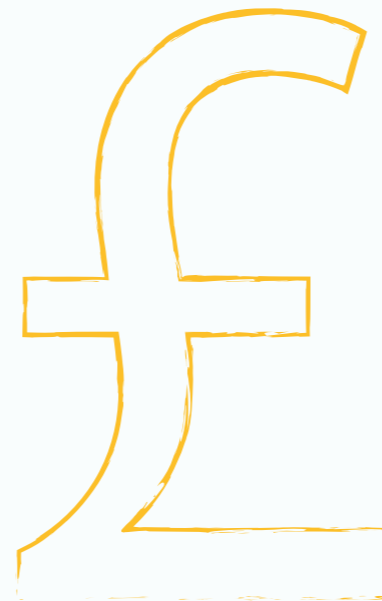
A study by CREDS revealed that e-bike schemes could help people to cut their transport costs by enabling them to reduce their car dependence.⁴⁹ Researchers took into account car use, income and quality of public transport and found that there were places with low incomes and limited access to public transport where e-bikes offered real potential to replace costly car journeys.

As well as reducing costs, benefits could include improving the mobility of low income households and enhancing access to services and employment. 22% of the participants of the DfT's Shared Electric Bike Programme stated that their reason for shifting to e-bike was financial with an e-bike journey being cheaper than other modes. The case studies also showed that shared e-bikes supported those accessing employment and social opportunities, offering a means of reaching places that are poorly served by public transport.

Travel time savings are also reported by e-bike users. The DfT's Shared Electric Bike Programme found that using an e-bike enables people to reduce their journey times: 35% of regular riders reported using e-bikes to cycle because it allowed them to reduce their journey time, cutting through congestion.

A trial on the Isle of Wight demonstrated that only a quarter of people would have visited the same attraction (by regular bike or other mode) if the e-bikes had not been available, highlighting a positive impact e-bikes can have on the local visitor economy.⁵⁰

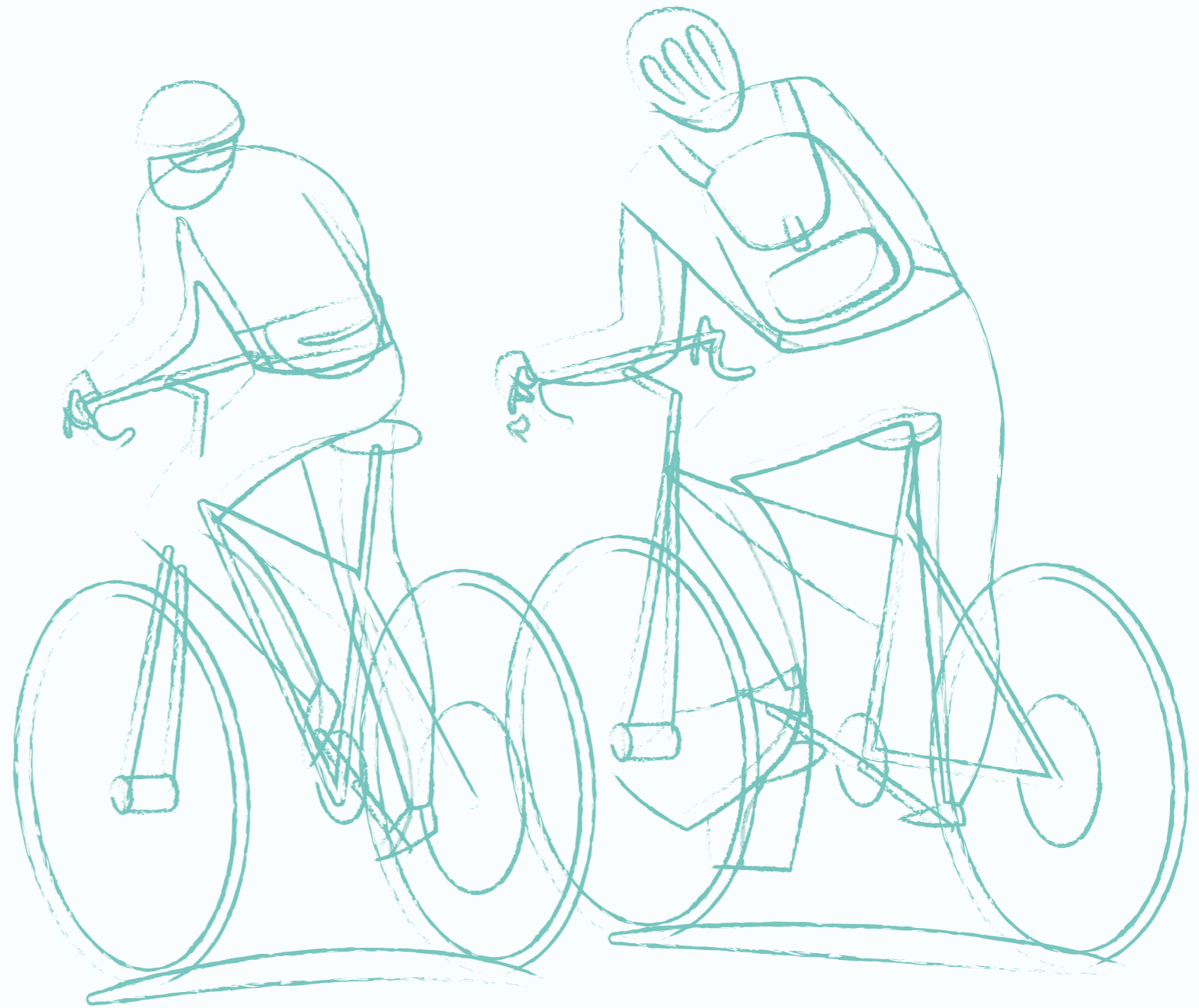
Increased uptake of e-bikes could also provide a boost for UK manufacturing. The UK e-bike market was valued at £0.16 billion in 2020, and it is expected to reach £0.29 billion by 2026.⁵¹ In recent years, the UK-based e-bike companies has evolved with players such as Hurrecane, Volt Bikes, Gocycle and Ribble Cycles entering the market. For example, Volt's new e-bike factory in Milton Keynes has the capacity to build up to 25,000 e-bikes per year and create 30 new jobs.⁵²



Focus on shared e-bikes

Specific benefits of shared e-bikes schemes in addition to the benefits identified above include the following:

- Increased sales of e-bikes: The provision of an e-bike share scheme in a city can encourage uptake of e-bikes by allowing people to try them before making a purchase. The 2020 CoMoUK Bike Share Survey found that 55% of bike share users started or restarted cycling because of bike share. Of these people, 29% hadn't ridden for five years or more and 2% were new to cycling.⁵³ It also acknowledged that bike share triggers users to purchase their own bike - 12% of respondents said they had bought a bike since joining (including people buying e-bikes).
- Wider use: The Shared Electric Bike Programme Report, 2016,⁵⁴ states that bike share has a role in facilitating access to a bike for people who are deterred from buying a bike because of problems arising from storage, maintenance and theft. Users appreciate convenience of picking up a bike to carry out a one-way trip or to complete the first or last leg of a public transport journey.
- Other benefits of shared schemes could include:
 - connecting suburbs with transport hub and town and city centres, filling the gaps in locations where public transport provision is lower;
 - increased visibility of e-bikes generated by shared schemes helps to raise awareness of e-bikes, the profile of active travel and e-bikes as viable components of integrated transport strategies;
 - providing access to the scheme for low income groups who may not be able to afford to purchase an e-bike and supporting those accessing employment and social opportunities; and
 - providing an ability for people to test new technology and try e-bikes.



Focus on e-cargo bikes

Research by the Bicycle Association⁵⁵ highlights the following benefits of e-cargo bikes compared to conventional vehicles:

- less polluting;
- more efficient use of road space;
- easier and quicker parking closer to final destinations;
- potential for shorter routes through use of cycle lanes, bus lanes and other areas where general vehicle traffic is restricted;
- less affected by congestion;
- cost less; and
- offer health advantages for their users.

E-cargo bikes have great potential to replace vans in urban or compact and congested areas. Before the COVID-19 pandemic, vans were the fastest growing vehicle group in the UK, and a considerable contributor to urban congestion and pollution. E-cargo bikes have been described as revolutionary to the last mile transport market⁵⁶ as they are ideal for transporting goods on short journeys (typically have a range of 25 to 50 miles on a full charge dependent on the weight of the load they carry), and are a much greener alternative to the petrol/diesel vans.

Outspoken Cycles in Cambridge and Norwich, found that e-cargo bike riders were 5.5% quicker compared to the same trip by car.⁵⁷

A butcher based in Greenwich participated in a demonstration project commissioned by the Royal Borough of Greenwich in partnership with Sustrans. The project compared the environmental impact of deliveries made by van to those made by an e-cargo bike. During the trial, 95% of the butcher's local deliveries under 5 km were made by e-cargo bike and, as a result, the CO₂ emitted fell by an estimated 75%.⁵⁸ The overall reported benefits of the trial included yearly fuel savings of £829, increased fitness levels of staff and led to faster deliveries.⁵⁹

The European Union's CityChangerCargoBike (CCCB)⁶⁰ project, which aims to accelerate e-cargo bike take-up, states that the e-cargo bikes have potential to replace:

- 23 - 25% of the commercial deliveries in cities;
- 50% of the commercial service and maintenance trips; and
- 77% of private logistics trips (shopping, leisure, child transport).

E-cargo bikes also bring benefits for non-business users including but not limited to the following:

- ease of parking;
- potential for shorter journeys as e-cargo bikes are less affected by congestion and riders can use cycle and bus lanes;
- ability to make journeys and carry goods for shopping and transporting children;
- health benefits through exercising riding an e-cargo bike;
- cheaper costs compared to a car.

The CycleLogistics study⁶¹ found that a high proportion of personal motorised trips could potentially switch to e-cargo bikes: of personal motorised trips, 69% had potential to shift to bike or e-bike including those both with and without goods transport.⁶²

The *State of the Nation* report by Shimano provides an example of a family in Durham, UK, who, after purchasing an e-cargo bike for personal use, sold their second car. The family estimated that the costs of an e-cargo bike can be recovered over three years of its regular use.⁶³

“ We use our e-cargo bike for all sorts, it has a space for our two children, so we regularly use it for commuting, dropping the kids at nursery on the way. ”

“ We find shopping is much more convenient by bike, as the road access to our nearest supermarket is shocking. ”



Quantifying potential benefits of e-bikes for city regions

4

Introduction

This section attempts to quantify the scale of potential e-bike benefits across the seven core UTG city regions – Greater London, Greater Manchester, Liverpool City Region, South Yorkshire, Tyne and Wear, West Midlands and West Yorkshire.

E-bike scenarios

In order to estimate the potential benefits of increasing e-bike use, a scenario-based approach was developed to assess the potential number of trips that could be made by e-bikes across the seven core UTG city regions.

Each scenario assumes a proportion of all trips that could be feasibly made using e-bikes. The scenarios assume the total number of annual trips across all modes remain constant.

Three scenarios for potential future cycling mode share across all trip types have been developed for the analysis as presented in Table 4-1.

Table 4-1. Scenarios for potential cycle mode share

Scenario	Description
Baseline Scenario	<p>Cycle mode share remains at current levels</p> <p>This scenario assumes the current cycling mode share in the UTG city regions based on the 2019 National Travel Survey (NTS).</p>
Government Target Scenario	<p>Cycle mode share increases by 100% compared to 2017 levels</p> <p>This scenario is adapted from the Government target (near market) scenario of the Propensity to Cycle (PCT) tool,⁶⁴ which assumes doubling of cycle mode share from 2017 levels across the city regions, taking into account local differences in trip distance, hilliness and various geodemographic characteristics such as age, sex, ethnicity, car ownership and income deprivation that are associated with opportunities to commute by bike. The PCT tool does not specify a particular target date by when this growth in cycle trips should be achieved.</p> <p>In addition to the Government target of doubling cycle mode share, the positive behavioural change towards cycling driven by the COVID-19 pandemic and availability and convenience of using e-bikes are also considered in this scenario. Based on this, a 2 percentage point higher mode shift to cycling than the Government target (near market) scenario of the Propensity to Cycle tool across all the city regions was assumed.</p> <p>As the PCT tool only considers commuting trips, we have also considered mode shift to cycling and e-bikes for non-commuting trips.</p>
Accelerated Growth Scenario	<p>Cycle mode share increases above the Government Target Scenario due to increased e-bike adoption</p> <p>This scenario is adapted from the e-bike scenario of the Propensity to Cycle tool. This scenario assumes the additional increase in cycling to be achieved through widespread uptake of e-bikes. This scenario considers the baseline (current mode share), applies 'Go-Dutch' scenario scaling factor (how likely a Dutch person would be to cycle that trip⁶⁵), and applies additional e-bike scaling factors considering hilliness and trip lengths in the area.</p> <p>As the PCT tool only considers commuting trips, mode shift to cycling and e-bikes for non-commuting trips was also taken into account.</p>

In the absence of evidence on the current (and future) proportion of all cycle trips made by e-bike, the following assumptions have been made:

- Baseline scenario: 5% of existing cycle trips are made by e-bike; and
- Government Target and Accelerated Growth scenarios: 50% of new cycle trips (above and beyond the Baseline scenario) are made by e-bike.

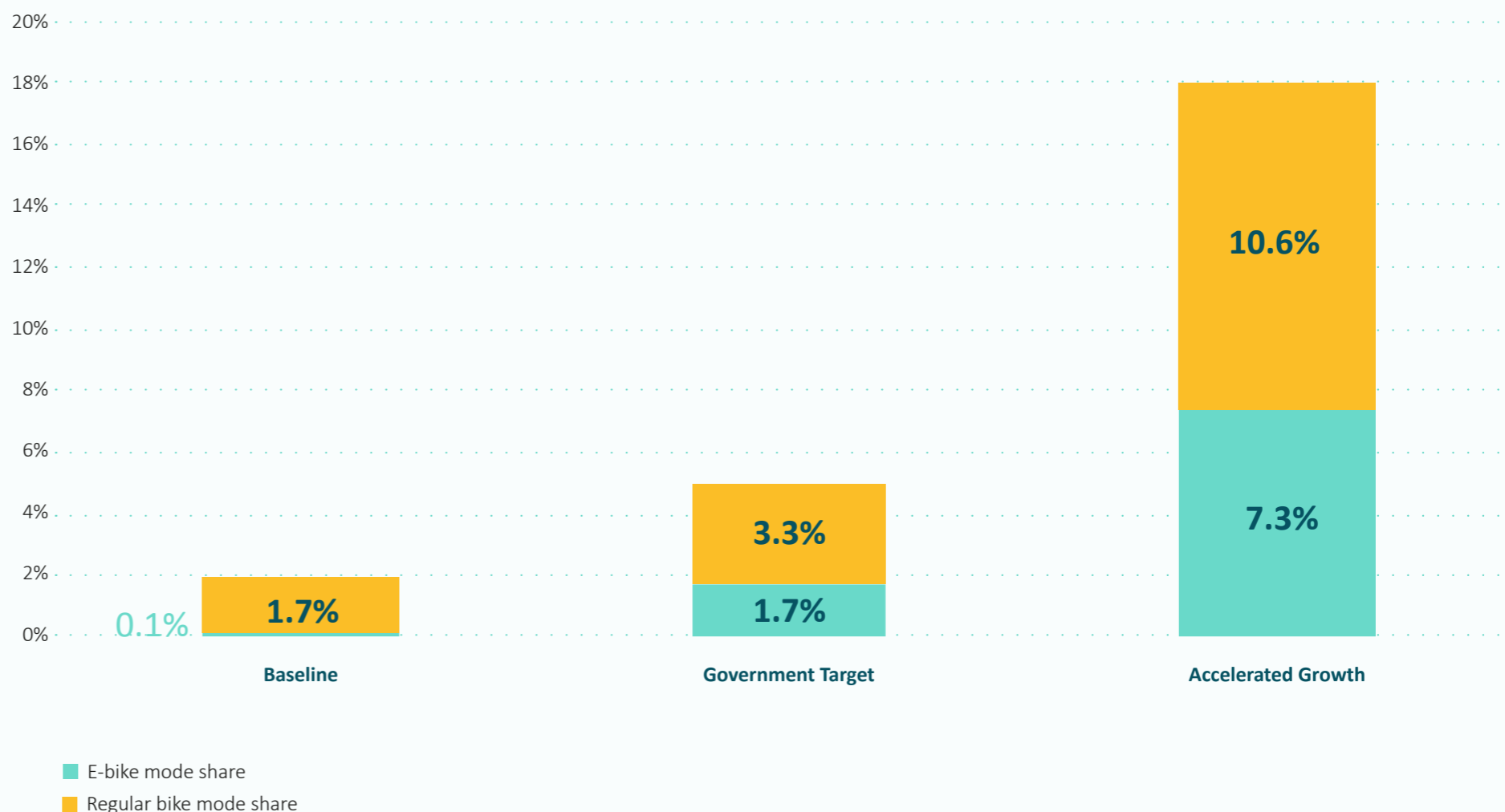
Based on these assumptions, the number of trips that can be made by bikes, and, more specifically, e-bikes, which are currently made by other modes was calculated. The shift of trips to cycling (and e-bikes) from other modes is assumed to be proportional to the current levels of trips made by other modes.

In the Government Target scenario, it is estimated that cycle mode share will average at about 5% to meet the government target of doubling cycle trips by 2025 across all the UTG city regions, and e-bikes will contribute to about 2% of all trips.

In the Accelerated Growth Scenario, it is estimated that cycle mode share will average at about 18% across all UTG city regions, and within that, e-bikes will account for about 7% of all trips.

Figure 4.1 presents our assumptions for cycle mode share (split by e-bikes and regular bikes) for the three scenarios (see Table 4.1) across the seven UTG city regions.

Figure 4-1: Cycle mode share by scenario



E-bikes benefits assessment

Potential e-bike trips

Approximately 19 million people live in the seven core UTG city regions, with an average of 2.3 trips made by each person per day. Therefore, about 44 million daily trips, and about 16 billion trips are made annually across these seven city regions for all trip purposes. On average, about 2% of those trips are currently made by bikes (including e-bikes), while about 57% are made by car, 2% by taxi, and 40% by other modes including walking and public transport.

While 16% of all trips are commuting trips, the majority (84%) of trips are non-commuting trips such as for shopping, education, personal business, escort, visiting friends and family, and others.

Cycle mode share for commuting trips is almost 30-40% higher than non-commuting trips (e.g. 4% of commuting trips in London are made by bike, compared to 2.6% of trips for non-commuting purposes). It was assumed that the ratio between cycle mode share for commuting and non-commuting trips will remain the same in each scenario.

It was assumed that trips from all modes (including public transport and walking) are in scope to be transferred to e-bikes. Our calculation of potential benefits from an increase in e-bike trips are based on those transferring from personal cars and taxis only. Therefore, the potential number of car and taxi trips that are replaced by e-bike trips was calculated for each scenario.

The outcomes of the assessment include:

- In the Baseline scenario, it is assumed that 0.1% of all trips are currently made by e-bikes, accounting for about 15 million annual trips.
- For the Government Target scenario, about 256 million trips per year can be potentially made using e-bikes, out of which 103 million trips will replace car and taxi trips.
- For the Accelerated Growth scenario, about 1.2 billion trips can be potentially made by e-bikes, which are currently made by other modes. In this scenario, 646 million fewer trips will be made by cars and taxis each year.

Figure 4.2 presents the estimated annual cycle trips (including e-bikes and non e-bikes) across the seven UTG city regions by each scenario. Figure 4.3 presents the potential number of trips transferred to e-bikes from car and taxi trips in the Government Target and Accelerated Growth scenarios.

E-bikes benefits

For benefits calculation, the DfT's Active Modes Appraisal Toolkit (AMAT) was utilised which provides a comprehensive model to calculate the monetary benefits of replacing car and taxi trips with active travel modes such as walking and cycling. The carbon savings from replacing car and taxi trips were also estimated. A detailed methodology for benefits calculation is presented in Appendix A.

Based on the assumption that an average e-bike trip is 6.4 kms long and the AMAT default assumption of car and taxi occupancy rates of 1.6 and 2.4 respectively, potentially 416 million car and taxi kms could be removed annually in the Government Target scenario and 2.6 billion annual car and taxi kms could be removed in the Accelerated Growth scenario.

Figure 4-2: Estimated annual cycle trips (e-bikes and non e-bikes) by scenario

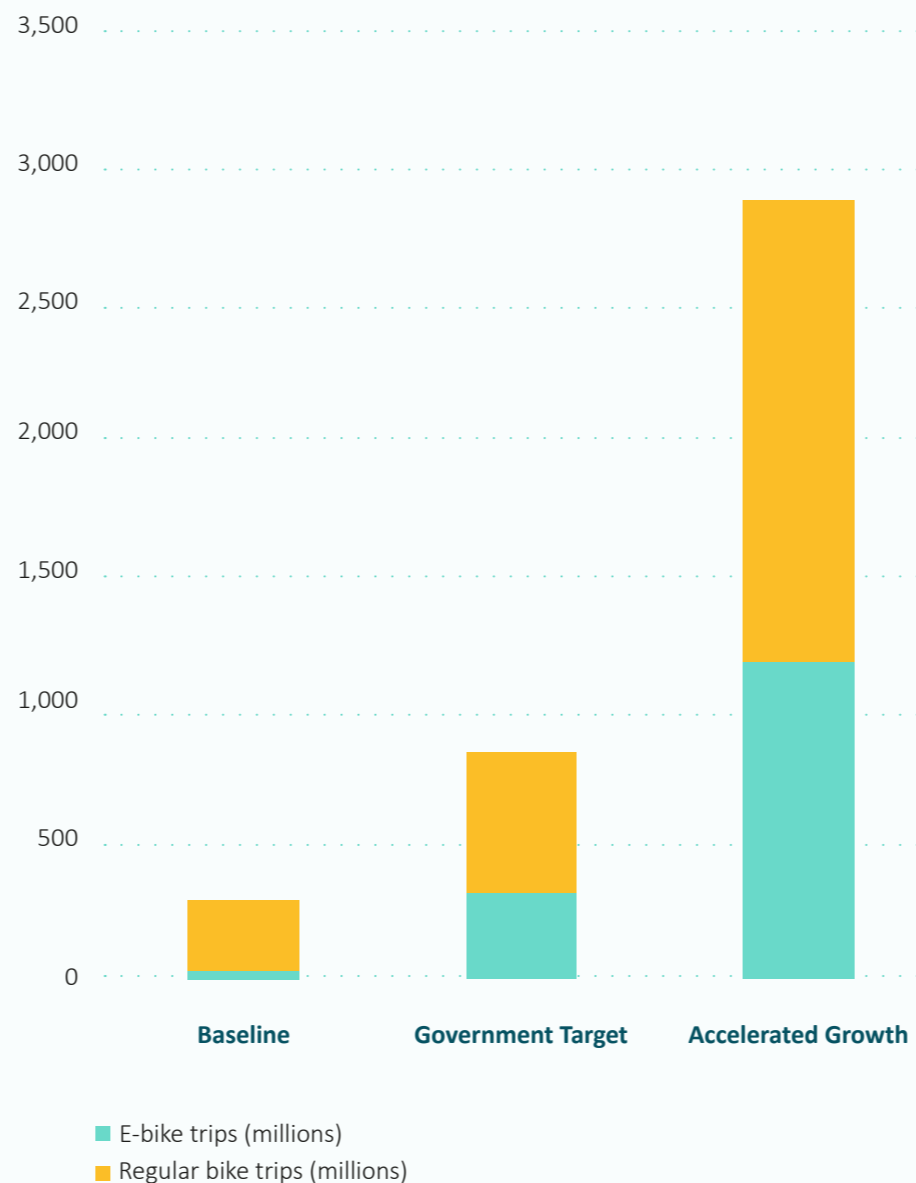
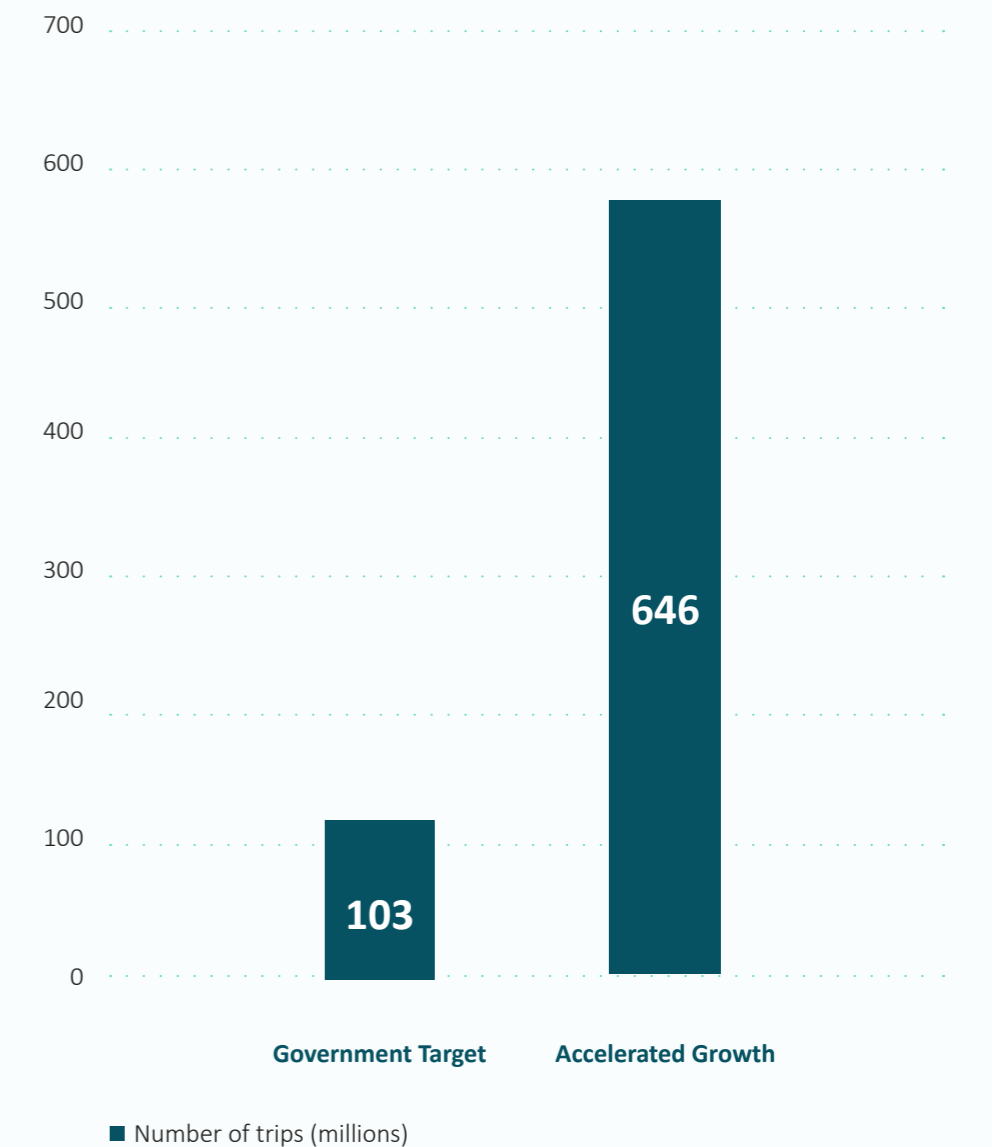


Figure 4-3: Estimated annual reduction in car and taxi trips by scenario



Monetary benefits

There are primarily two types of monetary benefits⁶⁶ that can be achieved from transferring car and taxi trips to e-bikes:

Modal shift benefits considering:

- Reduced congestion;
- Reduced accidents;
- Reduced noise pollution;
- Reduced greenhouse gases;
- Local air quality improvements; and
- Infrastructure improvements

Health benefits⁶⁷ considering:

- Reduced risk of premature death; and
- Absenteeism from work.

It is estimated that about £280 million worth of monetary benefits can be achieved from e-bikes usage annually across the seven UTG city regions in the Government Target scenario, out of which about £130 million would arise from mode shift benefits, and an additional £150 million can be achieved in health benefits.

If e-bikes become more prevalent with support from local authorities (through increase in cycle infrastructure, road safety measures, etc.), the annual monetary benefits of e-bikes would be almost £1.5 billion (Accelerated Growth scenario), of which £800 million would arise from modal shift and an additional £700 million can be achieved in health benefits.

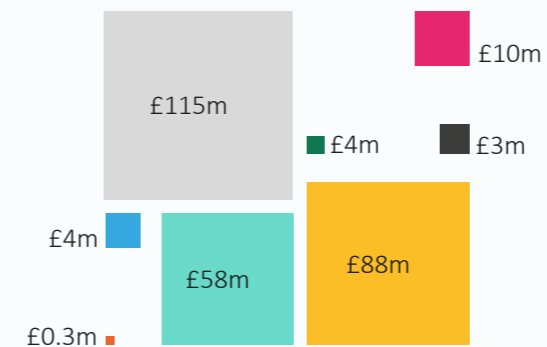
Almost 50% of monetary benefits arise from reduction in congestion, 25% from health benefits including reduced risk of premature death and 16% from a reduction in absenteeism from work.

Figure 4.4 presents the potential monetary benefits by type of benefits for each scenario.

Figure 4-4: Estimated annual monetary benefits of e-bikes by scenario

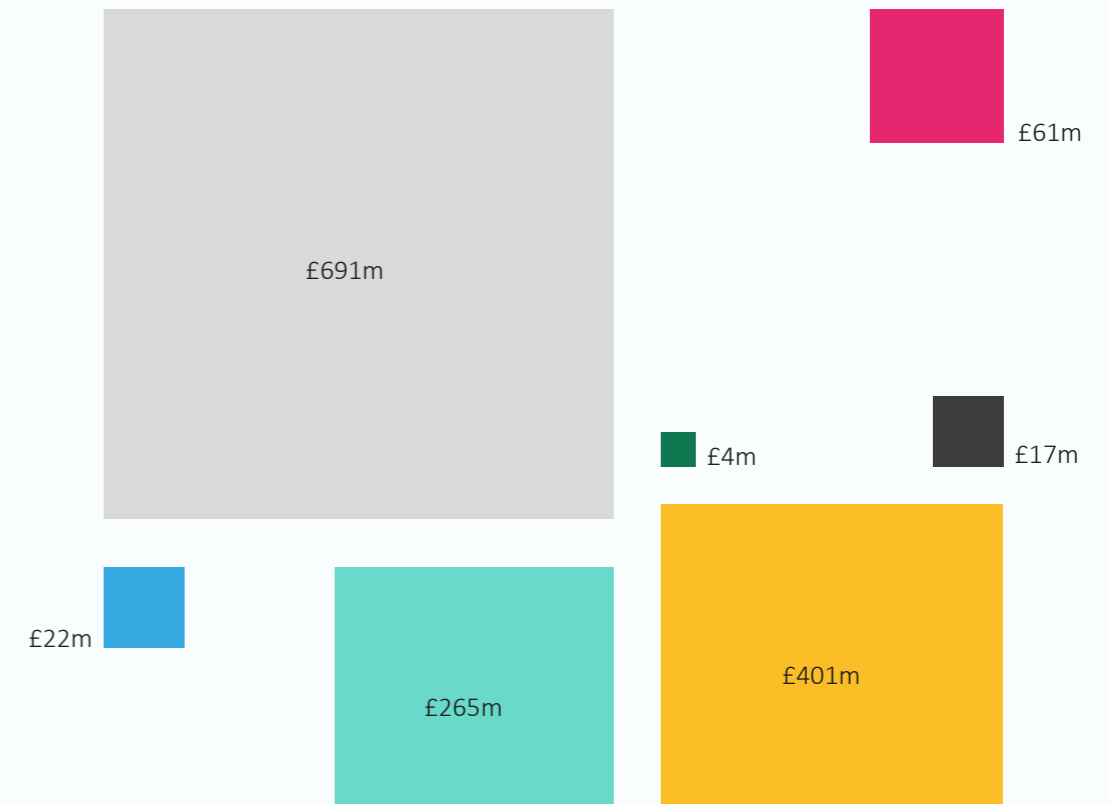
Government Target scenario

Infrastructure Maintenance	£0.3m
Noise	£1m
Greenhouse gases	£3m
Local air quality	£4m
Accidents	£10m
Absenteeism	£58m
Reduced risk of premature death	£88m
Congestion	£115m
Total	£280m



Accelerated Growth scenario

Infrastructure Maintenance	£2m
Noise	£4m
Greenhouse gases	£17m
Local air quality	£22m
Accidents	£61m
Absenteeism	£265m
Reduced risk of premature death	£401m
Congestion	£691m
Total	£1.5b



Carbon benefits

The carbon emission savings are calculated from reduction in car and taxi kms through replacing car and taxi trips with e-bike trips. Assuming an average car emits 150g of CO₂ per km,⁶⁸ approximately 62,000 tonnes of CO₂ can be saved in the Government Target scenario and about 390,000 tonnes of CO₂ emissions can be saved in the Accelerated Growth scenario. This is equivalent to planting around 3 million trees in a year in the Government Target scenario, and up to 20 million trees in the Accelerated Growth scenario.⁶⁹ For the purposes of these calculations it was assumed that e-bike batteries are charged using renewable energy.

Summary

In summary, the benefits of transferring car and taxi trips to e-bikes are comprehensive and offer a wider range of economic, environmental, health and social benefits.

If the government target of doubling the cycle mode share is achieved and e-bikes account for roughly 2% of all trips, which has significant potential given the current positive user sentiments towards cycling led by the pandemic and the ongoing investment in cycle infrastructure development, the total annual monetary benefits would amount to £300 million.

These benefits can be increased by up to five times if a systematic shift towards cycling and, particularly, e-bike use, is achieved, where an e-bike becomes a preferred mode of travel for trips less than ten kms and account for about 7.5% of all trips as seen in many European cities such as Amsterdam.

Potential carbon benefits of increased e-bike use under each scenario

Government Target scenario



62,000 tonnes saved per year...



... equivalent to three million new trees planted

Accelerated Growth scenario



390,000 tonnes saved per year...



... equivalent to twenty million new trees planted

Key factors influencing e-bike take up

5

Introduction

In order to achieve the scale of benefits outlined in the previous chapter, it is important to understand what factors influence whether or not a person or business chooses to use an e-bike. This section summarises the key factors affecting e-bike take up including:

- cost;
- public perception and awareness;
- convenience and security;
- quality of infrastructure;
- safety concerns; and
- design.

Note that many of these factors apply as much to push bikes as to e-bikes, but some are unique or particularly pronounced for e-bikes.

The following Chapter 6 explores potential initiatives to address the barriers identified and increase e-bike take up.

Cost

The purchase prices of new e-bikes are considerably higher when compared to regular bikes with a typical e-bike ranging in price from £1,000 to £3,500 while an average price paid for a new standard bike is £365 .

E-cargo bikes are even more expensive with the price ranging from £1,500 to around £6,500. At the same time, e-cargo can be cost-efficient for businesses: "The promise of low carbon freight, benefits of cargo bikes in London" study published in August 2021 by the University of Westminster shows that e-cargo bikes can deliver goods 60% faster than vans in city centres. E-cargo bikes also cut carbon emissions by 90% when compared to diesel vans, and 33% when compared to electric vans.

Shimano's *State of the Nation Report*⁷⁰ indicates that price was mentioned as the most significant barrier stopping people buying an e-bike in the UK regardless of age, gender and nationality, with two in five respondents saying that e-bikes are too expensive (see Figure 5-1).

Figure 5-1. Barriers to buying an e-bike



Too expensive

Overall	35%
Male	+3%
Female	-3%



Don't like cycling

Overall	27%
Male	-5%
Female	+4%



Lack of safe storage

Overall	17%
Male	=%
Female	-1%



Fitness wouldn't improve

Overall	16%
Male	+3%
Female	-2%



Can't store at home

Overall	13%
Male	-1%
Female	+1%



It feels like cheating

Overall	11%
Male	=%
Female	-2%



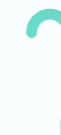
Wouldn't feel safe riding

Overall	19%
Male	-3%
Female	+3%



Don't know enough

Overall	14%
Male	-3%
Female	+2%



It's for older people

Overall	2%
Male	+1%
Female	-1%

Source: State of the Nation Report, 2020

Public perception and awareness

Public attitudes towards the potential uses and benefits of e-bikes influence the likelihood of purchase. Public awareness of the advantages of e-bikes above and beyond standard bikes is still considered to be low, although interest is growing.

Perceived benefits of e-bike:

Some people are not aware of the benefits of e-bikes, especially those who do not cycle.

Some e-bike owners feel judged by others who perceive riding an e-bike as “lazy” and “not proper cycling”. Shimano’s *State of the Nation Report* found that in the UK, 11% of those surveyed consider riding an e-bike as ‘cheating’ with 16% who believe that their fitness level will not improve.⁷¹ One in five Europeans aged between 18 to 24 agreed with the statement that “e-bikes are cheating”. These reactions are often related to a lack of knowledge about e-bikes with 14% of respondents feeling that they did not know enough about e-bikes to buy one.

Interviews with e-bike owners in the Netherlands and the UK⁷² revealed a stigma attached to e-bike use. The respondents mentioned teasing comments from colleagues and members of public leading to some of the e-bike owners trying to disguise their e-bikes by using accessories. Some participants also actively searched for e-bike models which look similar to regular bikes. The CycleBOOM⁷³ project revealed similar findings about misperceptions of the general public on e-bike benefits and use who assumed that a rider does not need to pedal and consider riding an e-bike as ‘cheating’. This perception can be challenged through awareness raising campaigns, for example, with a focus on reducing private car use for shorter trips.

Attitude towards cycling:

Dislike of cycling was the second most common barrier (27%) preventing e-bike purchase in the UK as stated in *The State of the Nation* report. A change in perception of cycling is required, especially amongst females, as those who dislike cycling or consider it is not for them, may never try an e-bike and appreciate their range of benefits.

Convenience and security

Crime and antisocial behaviour were mentioned as safety concerns around cycling by 86% of people living in the cities in the UK.⁷⁴ Although cycle theft has been on the decline, the UK Government reports 300,000 cycle thefts each year: three times more than car thefts. Cycle theft can threaten users’ confidence, with many of those who fall victim never returning to cycling.⁷⁵ With costs of e-bikes being significantly higher compared to standard bikes, risk of theft adds additional pressure on e-bike owners with concern of theft being more prevalent amongst cyclists with e-bikes.

E-bike storage:

Many users, who would use a bike to commute or for other journeys, do not have access to appropriate storage space at home or at their destination, with 13% of people surveyed in the UK seeing this as a barrier for e-bike purchase.⁷⁶ In particular, those, who live in smaller flats, may find it difficult to own an e-bike due to its size. A lack of secure bike storage at home and concerns about leaving e-bikes in public places because of fear of theft have been also stated by the participants of the CycleBOOM project.

Parking of e-bikes at major transport hubs and interchanges such as railway stations has been stated as problematic due to the availability of secure and spacious parking. There was a strong desire for more secure long-stay valet style parking in city centres and at transport hubs including provision of charging infrastructure.⁷⁷

E-bike maintenance:

Higher costs associated with e-bike maintenance are seen as a factor influencing e-bike purchase. The unexpected (‘hidden’) cost of potential battery replacement has been stated as a concern by the research in the Netherlands and the UK.⁷⁸ Additionally, availability of the bike repair services and mechanics who are experienced in fixing e-bikes is noted as a concern from potential e-bike buyers.

Maintenance was also commonly mentioned as a challenge by those participating in the North American Survey of Electric Bicycle Owners.⁷⁹ Difficulties of changing the inner tube in the rear tyre with a hub motor have been explicitly mentioned.

Quality of infrastructure

Bikes are more likely to be taken up by a wider audience if supporting infrastructure is perceived to be safe, convenient and attractive. 95% of respondents in the Sustran’s report *Bike Life: Cities for People* mention that road quality is an important improvement that needs to be addressed.⁸⁰ The CycleBOOM project found that purpose built cycle infrastructure was generally regarded as narrow, inconsistent and poorly maintained.⁸¹

Currently, the UK’s National Cycle Network contains 12,763 miles (20,540 km) of cycling routes, consisting of 59% on-road and 41% traffic free routes.⁸² There is a historical bias towards building routes for leisure, such as those running through the countryside. This highlights an issue: access to cycle routes for urban journeys is limited, and most routes run directly alongside cars. The Department for Transport plans to make the whole network either separate from the road (off road) or on roads with reduced traffic/reduced speeds by 2040.⁸³

Safety

Safety issues and concerns when cycling or considering cycling can arise from a variety of areas including availability and quality of separate cycle routes, other road users’ behaviour and crime.

The *State of the Nation* report found that people in the UK are more concerned about cycling safety than in any other European country, with 19% of British respondents feeling the “least safe to cycle”.⁸⁴ The Bikes for All social equity bike share project in Glasgow found that safety and confidence is a key concern affecting cycling uptake.⁸⁵ Some of the strongest safety concerns are due to car driver behaviour including their speed and level of traffic. Not all cyclists have the confidence to share the road with motorised vehicles. Sustrans also found that 84% of people would like to see an improvement in other cyclists’ behaviour.⁸⁶

Interviews with e-bike owners in the Netherlands and the UK revealed that other road users generally do not anticipate the speed difference of e-bikes compared to regular bikes. Almost all participants mentioned the need to ‘re-adapt’ their cycling style by learning to moderate their speed and anticipate the reactions of other road users.⁸⁷

Design

Design of e-bikes including their weight and battery range can cause concerns and prevent riders from the purchase. However, the development of new innovative materials and technologies could help to address these issues in future.

Research in the UK and Netherlands revealed that the weight of e-bikes can cause issues with participants experiencing difficulties manoeuvring their e-bike when parking, lifting it over obstacles, or for example, trying to place it on public transport or on the back of a car.⁸⁸

“ It's a big, heavy thing and it's, well you know, it's just the main weight of it. That is the one disadvantage. If you've got to lift the bike over a threshold or something, it's a bit of a hassle. ”

Calvin, 70, Oxford.

Participants also raised concerns about battery range and experienced more limited range than specified by manufacturers especially in winter. The need to charge the e-bike in advance and plan the journey ahead to ensure the battery charge is sufficient was mentioned as one of the nuances:

“ There is no information about cycling with an e-bike in the cold. But it's terrible in winter the battery is terrible. ”

Jos, 57, Amsterdam.

“ That's the only hassle, remembering to charge it because if you've got back and you've only got a range of five or ten miles then I can't get to work. ”

Sam, 57, Oxford.

“ The annoying thing about that is if you're doing a long journey you actually have to remember to take the charging cable with you if you think you might run out and the charging cable is really heavy. ”

Roberta, 50, Oxford.

Focus on bike share

Bike share fleets are increasingly incorporating e-bikes to broaden the appeal of cycling. Currently, there are a range of different models for charging e-bike share batteries which include battery swapping, charging bikes at a depot by the operator and charging at docking stations.

The inclusion of e-bikes within a bike share scheme provides an opportunity for people to discover and test this new mode. For bike share operators, e-bikes are often seen as a complement to their scheme, allowing them to attract new customers such as users who are less confident cyclists or have physical limitations preventing them from using conventional shared bikes.

When implementing e-bikes in bike share schemes it is important to plan for additional requirements of charging batteries and extra maintenance required as e-bikes tend to have higher levels of use than conventional bikes. In addition, mixed fleet schemes should be considered carefully as users may have a preference for e-bikes which result in lower demand for conventional bikes.

Focus on e-cargo bikes

In Europe, use of e-cargo bikes is growing fast with UK numbers still being small but gradually increasing. One of the key barriers for e-cargo bike purchase is high purchase costs.

The recent grants for e-cargo bikes announced by the Department for Transport could encourage take-up of e-cargo bikes for businesses; although there are no incentives available in the UK for buying an e-cargo bike for personal use. For example, the Outspoken trial of e-cargo bikes demonstrated the value of e-cargo bikes to delivery companies but struggled to create the right model to encourage shared use by the wider population.⁸⁹ Availability of secure and spacious storage for e-cargo bikes (at home and work) is another limiting factor for purchasing an e-cargo bike for personal use.



Potential initiatives to increase e-bike take up



Overview

Through a process of desktop research, literature review, a workshop with UTG members and interviews with Sustrans and Cycling UK, a set of possible initiatives to increase e-bike take up has been identified, which can be broadly classified into the categories presented below.



Financial incentives



Changing attitude and increasing awareness



Infrastructure improvements



Safety, security and convenience



Monitoring, evaluation, and further research

It should be noted that this report does not cover all possible interventions that encourage cycling in general. The initiatives proposed in this section are specifically focused on e-bikes, e-cargo bikes and shared e-bikes going above and beyond the usual measures that are needed to encourage cycling.

Whilst national initiatives are touched upon, this chapter attempts to primarily focus on options which local and transport authorities could potentially implement and that are within their remit. It is acknowledged that measures focused on general cycling infrastructure improvements, standardisation of e-bikes including standards for shared e-bikes, and policy and strategy related measures will influence e-bike take up but these are matters for the Government at national level and as such, are not within the specific scope of this work.

Financial incentives

Financial incentives encouraging purchasing of e-bikes and e-cargo bikes are widespread both in Europe and North America. These initiatives can be broadly categorised into the following groups:

- Grant schemes for purchasing e-bikes;
- Tax incentives for e-bike purchase through workplaces; and
- Scrappage scheme for cars including e-bike purchase.

Grant schemes:

The 2019 Case for a UK Incentive for E-bikes report,⁹⁰ 2019, evaluates e-bike grant schemes in various countries and highlights that European experience suggests grants of approximately £250 are effective in encouraging an e-bike purchase.

The Bicycle Association⁹¹ highlights the potential for a national purchase incentive scheme in the UK to increase the adoption of e-bikes⁹², these could also be used as a model for financial incentives locally.

National schemes have proven to be successful across Europe, for example Sweden's national scheme resulted in e-bikes sales increasing from 12% to 19% of bike sales within a year.⁹³ In 2012 in Austria, a national scheme covered on average 15% and up to 40% of the cost of the purchase of an e-bike. After accessing grants, people reduced their car use for a range of trip purposes including commuting, shopping, leisure and work trips. Transport Scotland announced £900,000 of grant funding for 2020/21 to assist local authorities, public sector agencies, higher education institutions, active travel hubs and community groups to adopt ebikes, e-cargo bikes, e-trikes, adapted bikes, cargo bikes, tandems and trailers on a large scale as an alternative to car journeys and promote sustainable travel. This commitment builds on previous rounds in 2018/19 and 2019/20.⁹⁴

National grant schemes should not be viewed as an isolated measure, but as part of a broad strategy to encourage active travel and reduce emissions. A national scheme could be supplemented by regional and local schemes. For example, in May 2020 Lisbon offered a €100 grant for bikes, €350 for e-bikes and €500 for e-cargo bikes. Within a day, the scheme was fully subscribed by users highlighting the underlying demand.⁹⁵

Offering specific targeted grants (which can be implemented by local authorities) aimed at under-represented groups could also be considered. For example, the Colorado Energy Office (CEO) in the USA and Bicycle Colorado team committed to an e-bike pilot aimed at low-income essential workers. A mini-pilot was held in 2020 to demonstrate that e-bikes are a safe, healthy, and convenient way to travel around the town. Thirteen low-income essential workers received a free e-bike and equipment including a helmet, lock and lights.⁹⁶ Bikes for All in Glasgow, Scotland, is another example of a project which is focused on increasing access to cycling by breaking down barriers related to ability, lack of confidence or low income through the provision of shared bikes, personal support and training.

Specific initiatives can include subsidising purchases of electric assist adapted bikes and inclusion of grants for specific vehicles, e.g. electric trikes for people with restricted mobility. Some schemes offer higher levels of subsidies for lower income groups.

Case study: Local financial incentives across France

A 2016 evaluation by ADEME identified around 36 e-bike purchasing schemes across France, frequently capped at €250 and providing a subsidy of around 25%. The survey shows that 31% of the participants surveyed said they would not have purchased an e-bike if not for these schemes, and 42% said they would have spent less. Grants were popular with retired people (21%) and with women (58%). Two-thirds of respondents used their bicycle for commuting travel one to two times a week or more.⁹⁷ The success of the scheme in France is largely attributed to running the grants as a campaign, offering fresh promotions every few months to renew the initiative.

In Paris, grants are now offered for up to €500 for an e-bike. The programme was launched in early February 2020 as a way to mitigate the COVID-19 pandemic's impacts and help residents use alternative modes of transport. With €12 million dedicated to the project, it is expected that it could potentially stretch to helping 24,000 new e-bikes hit the road. There is no cap placed on an applicant's maximum income.

E-cargo bikes - Financial incentives:

Over financial year 2020/2021, the DfT set up the 'E-cargo Bike Grant Fund', making £2 million available for e-cargo bikes purchases.⁹⁸ The grant funding covered up to 20% of the cost of an e-cargo bike, up to a maximum of £1,000 per bike. Other schemes and organisations, for example Outspoken Cycles based in Cambridge, are offering "try-before-you-buy" schemes to encourage the uptake of e-cargo bikes. Interest free loans for bike purchasing by business can also be introduced.

Additional grant funding could also be provided for individuals, who may wish to purchase an e-cargo bike for transport of children, shopping or other items. Transport for Quality of Life suggested that the government "could ensure that business purchase of e-cargo bikes are explicitly identified as zero emission goods vehicles that are eligible for enhanced capital allowance i.e. so that the entire cost of their purchase can be set against profits in the year of purchase".⁹⁹ Transport and local authorities can introduce grants supporting both local businesses and general public purchasing e-cargo bikes.

The French Ministry of Ecological Transition has recently announced plans to create a subsidy for parcels delivered by cargo bike. The proposals are set to provide up to two euros per parcel for the first 500,000 in the inaugural year, then up to €1.30 for 1.5 million parcels in year two, and €0.6 for three million parcels in the third year. These funds will be paid to those providing the delivery service.¹⁰⁰

Tax incentives for e-bike purchase:

Across Europe tax incentives are being used to increase e-bike uptake by commuters. In the UK, prior to 2019 employers typically applied a cap of £1,000 for bike purchases as part of the Cycle to Work scheme. In June 2019, the DfT updated the Cycle to Work scheme guidance removing the cap of £1,000.¹⁰¹ The scheme allows employees to save 25-39% on a bike and accessories and payments are taken from their salary (tax efficiently) by employers. The DfT says that the changes were made to promote use of e-bikes to help reduce congestion, reduce commuters' travel costs, and improve air quality in cities. Local and transport authorities can work with key employers to ensure they are aware of the changes and remove the cap of £1,000 to allow for e-bike purchases (employers are free to set their own limits on value).

The limitation of the Cycle to Work scheme is that it is available only to those who are employed and whose employer registers with the scheme. Furthermore, lower income earners may not be able to participate, if the amount of salary they sacrifice takes their wage below the Living Wage, which is not permitted under the guidance.

Scrappage schemes:

A way to both decrease the use of cars (particularly older more polluting cars) and increase the use of e-bikes is to offer a scrappage or trade-in scheme. This would cover most or all the e-bike's purchase costs. For example, following extensive lobbying from the French Federation of Bicycle Users, the French government passed a preliminary vote in parliament in April 2021 to include a grant of up to €2,500 e-bike incentive should people chose to scrap an old car. An incentive programme in the province of British Columbia, Canada, offers \$750 incentive for purchasing an e-bike and requires participants to scrap their old cars.¹⁰²

Transport for West Midlands has recently introduced a "mobility credits" scheme to scrap cars, offering £3,000 in the credits towards the cost of alternative transport including buses, shared bikes, trains, taxis, and car hire over two years.¹⁰³ This initiative is thought to be the first of its kind in the UK. E-bike purchase is currently not a part of the scheme but could prove a useful model to which e-bikes could be added as one of the options for spending mobility credits.

It should be noted that scrappage schemes will only help those who currently own a car and will not benefit people who do not possess a car (many of whom have lower incomes).

Changing public attitude and increasing awareness

Changing public attitude and increasing awareness is one of the key areas of focus influencing increased e-bike take up, which can be achieved through a range of initiatives.

Try-before-you-buy, bicycle libraries and loan schemes:

Try-before-you-buy, bicycle libraries and longer loans provide an opportunity for people to try an e-bike and understand better how it works. The EU project “Active Access” (EU programme STEER¹⁰⁴) recommends that try-before-you-buy schemes could be offered to users more often; and, in addition to a first short test, people should have the chance to test e-bikes in their daily life for a longer period of time. It also stated the importance of providing information on available subsidies for e-bikes. By providing low cost, convenient access to trial an e-bike, local authorities can help to overcome a barrier to purchase. The DfT’s Shared Electric Bike Programme found that desire to buy an e-bike is greatest amongst those who used the bikes regularly and reported that 13% of regular riders participated in the programme purchased an e-bike and a further 17% proceeded to purchase a standard bike.¹⁰⁵

In Graz, Austria, a scheme where e-bikes were lent out for free to people aged 40 to 70 was successful in replacing 50% of the participants’ car journeys. At a start-up meeting, participants were briefed about the scheme and about e-bikes in general. During the test period the participants had access to a hotline for solving problems with the e-bikes. The aim of the scheme was to find out how middle-aged and senior people use e-bikes for their daily trips and what kind of advantages and disadvantages appear in daily use. Another goal was to reduce scepticism towards e-mobility. One of the main findings was that people changed their opinion on e-bikes: at the beginning participants were sceptical about e-bikes and their ability to handle the technology but after the tests most of the doubts and fears were gone.

Similar numbers have been replicated in the UK. In Totnes, for example, a community scheme offered ten e-bikes for hire. Participants replaced between 40% and 70% of car journeys with

an e-bike. It appears there is a common willingness to use e-bikes for journeys when given suitable access. Allowing people to trial e-bikes in a low risk way can help them to make the switch.¹⁰⁶

In South Yorkshire there are three e-bike loan schemes with one of them being the Journey Matters Hub¹⁰⁷ in Rotherham: people can borrow a bike for free (including e-bikes); get their bikes checked over by the expert mechanics and sign up to one of the free cycle courses. The Hub is not supported by any revenue income and is reliant on grant funding, although, it is exploring partner contributions. In Leeds, 15 free to use e-bikes were implemented in a fortnight long trial in September 2020. Rather than ask a subscription fee, signing up to use these bikes required a deposit of £200. After just five days there were over 100 applications resulting in a waiting list.¹⁰⁸

Leeds City Council introduced its try-before-you-buy trial scheme offering organisations the opportunity to use e-cargo bikes. Leeds University was the first organisation to participate in the scheme getting three e-cargo bikes.¹⁰⁹ Colchester Borough Council received funding to establish an e-cargo bike library: three e-cargo bikes were given to ten local organisations including Colchester Hospital; six are available for short term loans for local organisations, and the rest used by the Council’s staff. The project was successful in raising awareness of a new transport mode and up to May 2021 5,070 miles have been travelled on e-cargo bikes, most of which would have previously been done using cars or vans, translating into an emission saving of roughly 1.2 tonnes of CO₂. The lessons learned from the initiative included the need for local and transport authorities to allocate time to acquire the required insurance to loan e-cargo bikes to businesses and the need for secure storage.¹¹⁰

Individual initiatives and projects could work in partnership with local bike shops to develop a voucher system to offer a discount on e-bike purchases to people signing up to trials and providing a system to monitor sales.¹¹¹ The 2016 Shared Electric Bike Programme Report¹¹² recommends that a national ‘test before you buy’ scheme could be introduced, which would be a partnership involving e-bike manufacturers, Government bodies and bike shop networks.

Case study: GO e-Bike - the West Lothian Bike Library (WLBL), Scotland, UK

GO e-Bike¹¹³ is a regional e-bike share and hire offer at different sites in the South East Scotland region. The West Lothian Bike Library (WLBL) is a social enterprise based in Livingston, Scotland.

Nine standard e-bikes were offered on short hire periods with a try-before-you-buy offer. One e-trike was also offered to a wider all-ability audience and was available on longer term loan.

Local residents were also offered e-bike loans. The promotion strategy involved attending local events and was channelled through the inclusive cycling project to users who have mobility issues. Promotion of the projects was crucial and the West Lothian Bike Library found the GO e-Bike banners particularly effective.

Outcomes: ten e-bikes have been purchased locally within the first six months. A local GP has also tried an e-bike and has been promoting them to patients with certain mobility issues.



Source: <https://goebike.scot/west-lothian-bike-library/>

Roadshows and e-bike/e-cargo bikes demonstrations:

Roadshows are another form of test to buy initiative which presents an opportunity for riders to try new forms and types of bikes including e-bikes and e-cargo bikes. The aim is to change awareness and attitudes towards e-bikes and e-cargo bikes. The Go Pedelec project encouraged new users of e-bikes through a series of demonstrations. Across the project (in Austria, Czech Republic, Germany, Italy, Hungary and the Netherlands) 20 roadshows were held with over 10,000 participants. The results showed that on average 18% of e-bike test riders showed a willingness to purchase an e-bike after their test ride.¹¹⁴

A series of employer roadshows were organised as part of the GO e-Bike project in Scotland. Employers were provided with the opportunity to trial an e-bike pool scheme. They were given a fleet of e-bikes, which were made available for free use by their employees for between two and six weeks. The employees were engaged through a series of launch and on-going events, and through channels established with employers. The roadshow also offers employers the opportunity to gauge interest in a pool bike scheme as a long-term solution.

Marketing and Promotion:

Promotion of e-bike initiatives and schemes plays a key role in their take up. Inclusive language and imagery could be used to break the stigma of cycling as an elite or leisure activity and improve engagement across demographics, for example through inclusion of more images of older people, female cyclists, a broad range of ethnicities and intergenerational activity.

The Shared Electric Bike Programme Report¹¹⁵ states that “new lines of communication could be developed with the Department for Transport and Department of Health to optimise the contribution of e-bikes to health through informed policy and funding prioritisation.” It is also mentioned that regional and local public health organisations could be engaged in the funding and delivery of e-bike provision locally.

The creation of a cycling map which offers a new perspective of the area for bike and e-bike riders and highlights the key safe routes and places of interest could support e-bikes uptake. Utrecht in the Netherlands introduced the regional 'electric' bike map as a way to promote purchase and use of e-bikes. The map includes information about cycle routes and lots of additional information, for example about e-bike initiatives and schemes in the region.¹¹⁶

The Zero Emissions Network (ZEN)¹¹⁷ is a business liaison initiative established in 2012 through a partnership between the London Boroughs of Hackney, Islington and Tower Hamlets and supported by the Mayor of London. The network is free to join and offers free advice and services to switch to low emission energy and travel options to businesses and residents in London's City Fringe area. The initiative has more than 1,500 business members and over 900 residential members. The scheme is raising awareness and encouraging positive behaviour change through number of initiatives and actions including provision of free Dr Bike sessions, publishing of “How to choose an e-bike” guide and establishing a directory of companies and tradespeople from across the UK who deliver by e-cargo bike.

Set up city-wide information sharing networks for e-cargo bike operators and repair services:

The European ‘Cyclelogistics Ahead’ project¹¹⁸ states that a city-wide discussion forum for addressing issues relating to cycle logistics would be beneficial. It provides an example of Cambridgeshire County Council, where a range of stakeholders meet to discuss how cycling is currently used in their business context and how use of e-cargo bikes can be encouraged. The availability of repair and maintenance services for e-cargo bikes can be resolved at the city level, since ensuring bike reliability is key to viable operations.¹¹⁹

Local and transport authorities could work with local business and residents to promote e-bikes and their benefits. They could work with existing Business Improvement Districts to incentivise local businesses to try e-cargo bikes and publicise their experience to encourage others to make a switch.

Infrastructure improvements

This report is focused specifically on measures focusing on increasing the use of e-bikes acknowledging that infrastructure improvements for general cycling will also influence e-bike take up. As such, this section includes recommendations on infrastructure improvements with a specific focus on increasing the use of e-bikes.

Improvement of cycle routes:

CREDS highlights suburbs as areas having the greatest opportunity for e-bike take-up.¹²⁰ The report notes that due to numerous public transport options already available in the densest urban areas, infrastructure improvements can make a bigger impact elsewhere. A worldwide review of 84 active travel interventions in 2019 found that the greatest impacts were seen when applying a scheme to a whole system or city.¹²¹ For a dramatic change in travel habits infrastructure solutions should extend beyond just the city centre into residential neighbourhoods. Prioritising infrastructure where transport options are poor, especially where this coincides with multiple deprivation, can encourage greater levels of cycling. Local and transport authorities could work to improve infrastructure connecting suburban areas with the city and town centres and also improve connectivity between the cities and nearby towns and villages. Local authorities could consider e-bikes as part of the development of Active Travel Strategies and Plans and Local Cycling and Walking Infrastructure Plans.

The development of bicycle-friendly infrastructure should also keep in mind the needs of cycle logistics which, for example, requires wider cycle lanes. A guide to planning cycle logistics hubs by CityChangerCargoBike¹²² in 2020 recommends that streets offer cycle lanes with a minimum width of 2.25 metres. Wider cycle lanes make cycling more comfortable for all riders.

Some cycling infrastructure in the UK that was implemented prior to the latest design guidance is not suitable for encouraging a wide range of people to cycle and for all different types of e-bikes. Local authorities could ensure existing and new cycling infrastructure is fully inclusive and consider the needs of all users and actively engage them in schemes through the design process. Among other measures, Sustrans¹²³ suggests to introduce continuing professional development (CPD) training for designers and engineers on inclusive cycling; developing guidance to audit existing streets for inclusivity including walking and cycling; and setting up an Inclusivity Advisory Group to ensure different users' needs are met throughout the planning, design and delivery of new cycling infrastructure.

Low Traffic Neighbourhoods (LTNs) can influence uptake of cycling including use of e-bikes through provision of safer environment. When surveyed by Bike Life,¹²⁴ 75% of people were in favour of increasing pedestrian and cycle space on their high streets, and 68% would sacrifice road space for cycle tracks.¹²⁵

Mobility Hubs and charging networks:

Increasing the geographic coverage of places to access shared e-bikes and trial e-bikes can be facilitated through introduction of Mobility Hubs.

The city of Utrecht, the Netherlands, introduced cycle stops (Fiet Stops, see the image below) for recreational cyclists at tourist attractions and restaurants which include parking facilities, storage, e-bike charging, information and basic tools.



Source: https://trimis.ec.europa.eu/sites/default/files/project/documents/20140318_141737_59262_BestPractices.pdf

The DfT's Shared Electric Bike Programme notes the importance of e-bike charging networks especially for tourism projects.¹²⁶ The value of local businesses such as cafes, hotels, and visitor centres offering charging facilities was linked to potential sales of goods/activities whilst riders waited to 'top-up' their batteries. The charge point network can involve a number of key attractions, which could offer discounts or incentives for visitors who arrive on an e-bike with charging points added to local cycle maps.

E-cargo bikes - Trial micro-depots for operations by cycle logistics companies:

Sites can be made available for micro-consolidation centres in small warehouses or former commercial premises, at retailers and business services with backroom space; in car parks; at railway stations; or in shipping containers or other mobile depots. Click and Collect services can also be located at the micro-consolidation centres. The Mayor of London and TfL are planning to make more land available for a network of micro-consolidation centres in key locations as part of their Freight and Servicing Action Plan announced in March 2019. Local authorities can assist by making land available and working with the industry to introduce micro-depots which can be serviced by e-cargo bikes.

Case study: KoMoDo¹²⁷, Berlin, Germany

KoMoDo project in Berlin tested collaborative micro hub for e-cargo bikes with an aim to test sustainable solutions for deliveries in urban areas.¹²⁸

Several shipping containers were provided in one central point in Berlin and supplied with parcels by larger vehicles from different parcel operators including Hermes, DHL, DPD, UPS and GLS. E-cargo bikes were then used for last mile delivery.

The project was supported by funding of around €400,000 from the Federal Environment Ministry's Climate Protection Initiative.¹²⁹

The practical test showed that micro-depots and e-cargo bikes can be used efficiently, especially in areas with a high densities of customers and a consignment structure suitable for e-cargo bikes (number of packages, volume and weight). In the area surrounding the micro-depots, around 160,000 parcels were delivered by the Germany's five largest parcel service providers using e-cargo bikes in the last twelve months of the project. Even after the end of public funding (in July 2019), the parcel service providers involved decided to continue to use the location for another six-month period.¹³⁰



Source: <https://www.komodo.berlin>

Safety, security and convenience

A range of initiatives can be implemented to improve safety, security and convenience for e-bike users.

Provision of secure storage for e-bikes:

Ensuring that e-bike storage solutions are secure, well designed and provided in locations where they will be used such as at key interchanges, housing developments and workplaces will discourage theft and encourage uptake, as e-bikes are typically significantly more expensive than a regular bike.

Cyclists should feel safe storing their high value items in public, so a dedicated hub for e-bikes could make riders feel more comfortable. Providing secure on-street storage solutions in residential areas will help encourage those who do not have space at home to consider e-bike purchase. Local authorities could also work in collaboration with key employers to introduce safe and secure e-bike storage.

Provide storage and dedicated parking for e-cargo bikes and shared e-cargo bike schemes:

A guide to planning cycle logistics hubs¹³¹ highlights the importance of providing parking areas and loading zones for e-cargo bikes. Necessary charging infrastructure could also be provided for e-cargo bikes in appropriate locations.

Maintenance of e-bikes:

Easy access to maintenance of e-bikes can provide re-assurance for future riders. For example, one of the measures proposed in the 2015-25 Austrian Cycling Masterplan was to initiate a nation-wide repair network.¹³² Schemes promoting e-bikes can also establish partnerships with local bike repair shops. The Cycle BOOM¹³³ project recommends providing cycle maintenance services specifically aimed at older people, who may not be familiar with new technology, to ensure e-bikes are kept reliable and efficient.

Training and education:

Feedback from various e-bike projects shows that people respond in different ways to initiatives encouraging cycling, and personal support is required especially for those who are less confident riding e-bikes and using new technology.

Training can alleviate safety concerns, where informed cyclists both feel safer and cycle more safely. To improve accessibility, all e-bike schemes and projects should be easy to use and have training or explanations readily available. Bikes for All's survey of their bike share users found that some participants were left confused after their introduction to the scheme or had forgotten the information when they next came to use the bikes.¹³⁴

The importance of the group setting for training and targeted training for underrepresented and vulnerable groups has been highlighted through the initiatives such as Bikes for All scheme. To further boost accessibility, free training could be offered to riders of all backgrounds. This is a vital step to improve cycling inclusivity by increasing confidence in getting on an e-bike in the first place.

Local and transport authorities could work towards integrating an e-bike module into existing cycle training schemes.

Case study: Smart e-bikes project, Brighton, UK

E-bike training was developed through the "Smart e-bikes" research project led by University of Brighton. All participants in the project received e-bike training.

The project developed an e-bike training document¹³⁵ that is intended for cycle trainers and their organisations, local councils and policy makers. The first part contains information about e-bikes and a general overview of e-bike training from the experience in Brighton, which was very well received by the participants. The training comprises a range of considerations, so that trainers can tailor their session to take into account the possible wide range of existing cycling skills among participants. The project also envisions that e-bike training could form a module on the Bikeability curriculum and could be integrated into institutions' and councils' cycle programmes across the UK.

Training and promotion of e-cargo bikes:

Some existing cycle logistics companies provide training to the riders using either Bikeability guidance or bespoke training, but there is currently no national accreditation or training specifically designed for e-cargo bikes.¹³⁶ Sharing of experience and best practice by both public and private sectors will be beneficial for increasing awareness about e-cargo bikes.

The Bicycle Association¹³⁷ highlights the importance of public procurement strategies encouraging use of cycle logistics companies for local authority services. It is recommended that there should be more pro-active strategies to encourage use of e-cargo bikes by councils and other public bodies. Local Government Shared Services arrangements could also explicitly refer to e-cargo bikes. It was also recommended that the "Government buying standards for transport" procurement guidelines could explicitly mention e-cargo bikes.

Try-before-you-buy and short-term loans could be implemented to encourage e-cargo bike uptake. Milton Keynes launched its EV Experience Centre,¹³⁸ which is the UK's first brand neutral centre for electric and plug-in vehicles. Visitors are offered free EV test rides and expert knowledge and end-to-end advice. While primarily focusing on EVs (cars and SUVs), the centre also offers an e-cargo bike for the public to test.

Additionally, it is important for businesses to recognise that it is not feasible to ask all van drivers to become delivery cyclists. For a start, not all drivers would want to or be comfortable with cycling instead of driving. There could be a resistance from staff to make a switch and it is noted that riding an e-cargo bike requires specific training.

Case study: PRO-E-BIKE project, EU

The key aim of the PRO-E-BIKE project was to increase awareness and promote e-cargo bikes for delivery of goods. The project provided several public authorities and private companies across Europe with subsidies to test e-bikes and e-cargo bikes.

On average, it resulted in four out of five vehicles tested continued to be used after the trial period with some of the participating companies purchasing more e-bikes and e-cargo bikes.¹³⁹ For example, four vehicles tested by the Croatian Post resulted in a fleet of 180 e-bikes purchased for a total of €500,000 and deployed across the country. La Poste (France) has 20,000 e-cargo bikes in their fleet and ordered 10,000 more for deployment in 2017. In the Netherlands, each DHL express courier bike saves the company €13,000 per year, applying their policy of replacing one delivery van with one e-cargo bike. In Milan (Italy), GLS, Italy's second biggest delivery company, moved their logistics centre, replaced six delivery vans with nine e-cargo bikes, hired more people and optimised their delivery system to best fit e-cargo bikes. This resulted in increased number of deliveries, their efficiency and overall productivity saving money.¹⁴⁰



Source: PRO-E-BIKE project, EU

Research and monitoring

Monitoring and evaluation of new and existing initiatives and schemes:

Existing and future projects and schemes should be backed up with monitoring and evaluation to build the evidence base highlighting potential benefits of e-bikes and any challenges associated with their adoption. A robust evidence base of outcomes and impacts is of critical value in informing policy and development prioritisation, and for directing public and private investment.¹⁴¹ CoMoUK stresses that “the imperative for impartial monitoring and evaluation to continue across the whole sector of e-bike and bike share wherever there is some form of public sector involvement”.

The CycleBOOM project mentioned the need to monitor use of e-bikes by distinguishing it from pedal cycling in the National Travel Survey and also including the proportion of older people (age 60+) and women in national and local cycling targets.¹⁴² CoMoUK undertakes a rolling annual survey of outcomes of shared e-bike projects which is linked to associated surveys (e.g. the CoMoUK car club survey, TfL's surveying of users of their Cycle Hire scheme, the National Travel Survey etc). They also state the need for the quarterly or monthly update of the scale and distribution of bike share and e-bike availability as well as associated best practice advice.

Further research:

Further research into benefits of e-bikes, e-cargo bikes and shared e-bikes is required to get more evidence and data from larger trials and schemes to increase the research sample size. It is also important to conduct the targeted research for specific user groups, e.g. older users and women.

Local and transport authorities could fund and implement pilot programmes that test approaches to incentivise the use of e-bikes to replace car travel in various settings including city, suburban and rural areas.

Focus on shared e-bike schemes

The following set of initiatives can be introduced to support development of e-bike share schemes.

Funding targeted to introducing e-bikes into bike share schemes:

For example, the eBike Grant Fund¹⁴³ by Transport Scotland provided funding to Glasgow City Council to introduce 63 e-bikes for the public bike share scheme operated by nextbike.

Long-term rentals of e-bikes and cargo e-bikes run by regional and local authorities.

The loan model packaged with cycle training and accessories has previously been proven to be a good method for converting potential cyclists, and the addition of e-bikes has widened the pool and increased success. For example, the "Véligo Location" programme, set up by Ile-de-France Mobilités in France, offers long-term (six months) rentals of e-bikes and e-cargo bikes starting at €40/month with more than 10,000 e-bikes. A long term rental scheme can be managed either by a local authority, or as a supplementary offer to an existing bike share scheme.

Provision of shared e-bikes:

As highlighted by The CoMoUK Shared Electric Bike Programme Report,¹⁴⁴ it is important to provide easy access to shared e-bikes available across a network of locations including at transport interchanges as a last mile solution in areas with significant traffic between a transport hub and a business district.

Collaboration, education and training:

Local authorities could collaborate with existing bike share schemes to increase awareness, provide discounts/free use for certain groups and establish training especially for e-bikes. For example, Bikes for All offers annual membership to the citywide bike hire scheme, nextbike Glasgow, for £3.00. Additional support is offered through one-to-one advice, group rides, route-finding tips, road skills and general advice on cycling.

Case study: Bikes for All: widening access to cycling through social inclusion, Glasgow, UK

Bikes for All in Glasgow is a project which is focused on increasing access to cycling by breaking down barriers related to ability, lack of confidence or low income through the provision of shared bikes and personal support and training to use them.¹⁴⁵ The project is delivered by Bike for Good and is managed and evaluated by a partnership of CoMoUK, Bike for Good, the Glasgow Centre for Population Health, Cycling Scotland and nextbike. Bikes for All offers reduced annual membership (£3.00) to the existing bike share scheme nextbike.

Additional support is offered through one-to-one advice, group rides, route-finding tips, road skills and general advice on cycling. In a two-year period (July 2017 – July 2019), 414 people were signed up, representing 8% of all new annual members of the nextbike scheme in Glasgow during this time.

Participants are recruited through existing links with a range of community groups across Glasgow. Targeted recruitment has focused on people who face financial barriers, are not currently cycling, do not have access to a bike or are from a population group that is less likely to cycle (e.g. ethnic minority groups and women). One of the limitations of the scheme is the current limited geographical range of the nextbike pick up locations in Glasgow and difficulties in understanding the hire process.



Source: <https://goebike.scot/west-lothian-bike-library/>

A key lesson from this project is that people who may not previously have considered cycling can build the activity into their everyday life through appropriate training and one-to-one support. Engagement with community groups has been crucial in enabling participation for many. Group training has proved itself successful as it also creates a social aspect for the scheme's participants. Users described the benefits of being in an environment where they were comfortable, often with other people from a similar background or level of cycling experience. Participants have benefited through increased physical activity, improved mental wellbeing and became more confident cyclists. 52% had never cycled before and 30% are now cycling regularly.

E-bike rental schemes for employers, universities, hospitals:

Shared bikes supporting businesses and inter-site staff travel can be strengthened with the offer of e-bikes for employers and University estates teams.

Case study: GO-eBike, University of St Andrews, Scotland

The University of St Andrew's participated in 2018 in the GO-eBike project providing e-bikes for short- or long-term hires for staff.¹⁴⁶

The aim of the project was to release congestion around the university campuses.

The e-bikes were stored in shelters accommodating five bikes each. The pin access panel with a code was given to staff once they have completed the sign-up process.

The University Health and Safety department required users to undergo training with weekly sessions training 47 members of staff. Of these 28 people have gone on to rent an e-bike with 12 regular users (more than four times).



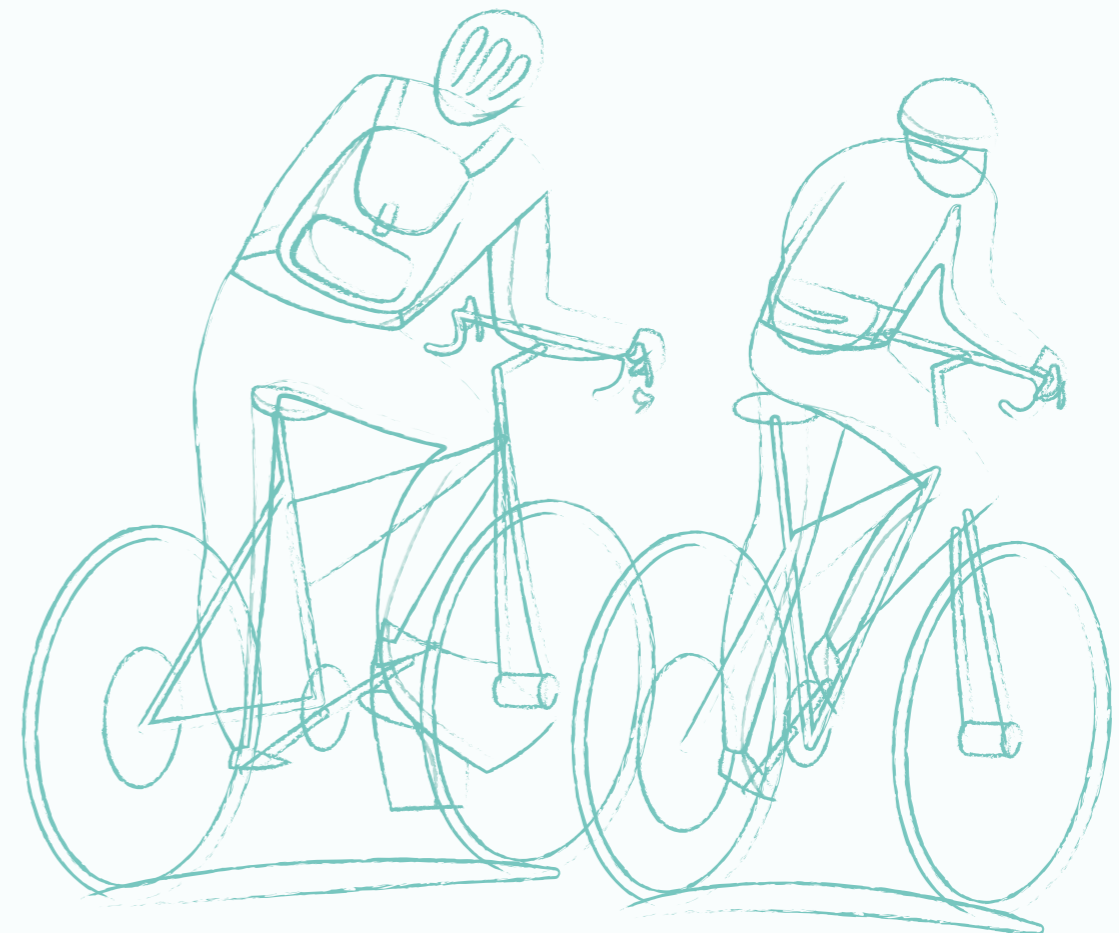
Source: <https://como.org.uk/wp-content/uploads/2019/04/St-Andrews-Case-Study.pdf>

Housing developers:

Local authorities could work with housing developers to introduce e-bike rental schemes and safe and secure e-bike storage.

CoMoUK's Shared Electric Bike Programme Report¹⁴⁷ states that new housing developments present an ideal opportunity to plan for the addition of e-bike pools or e-bike docking stations instead of extra car parking. For example, Slough Borough Council requested that developers funded Slough Cycle Hire docking stations and memberships for all new sites but the response from residents has been so positive that the developers are now voluntarily asking to add bikes to all their schemes.

Orwell Housing Association in Ipswich, Lowestoft, and Felixstowe offered their staff and residents free usage of the Compass electric bikes for journeys including care workers attending appointments. There is an opportunity to support the health and mobility needs of older generations by exploring the inclusion of e-bikes in accessible housing and retirement villages.



Conclusion

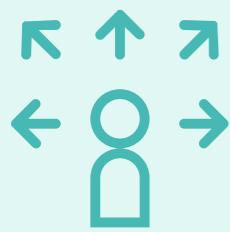
We have identified a range of potential initiatives for local and transport authorities to increase e-bike take up based on the six themes identified in this chapter. The potential initiatives presented in Table 6.1 should be considered as complementary, with initiatives designed to address different opportunities and challenges to e-bike take up.

Table 6-1. A set of potential initiatives

Potential initiatives	Potential role of local and transport authorities
 <p>Financial incentives</p> <ul style="list-style-type: none"> Grant schemes for purchasing e-bikes and e-cargo bikes 	<ul style="list-style-type: none"> National grant schemes should not be viewed as an isolated measure, but as part of a broad strategy to encourage active travel and reduce emissions. A national scheme could be supplemented by regional and local schemes funded by local and transport authorities. Grant schemes could often exclude certain groups such as low income, unemployed or disabled people. Local and transport authorities could offer financial aid with a focus on subsidies at local level targeting underrepresented groups. Specific initiatives can include subsidising purchases of electric assist adapted bikes and inclusion of grants for specific vehicles, e.g. electric trikes for people with restricted mobility.
<ul style="list-style-type: none"> Tax incentives for e-bike purchase 	<ul style="list-style-type: none"> Local and transport authorities can work with key employers to ensure they are aware of the Cycle to Work scheme and are fully utilising it. The limitation of the scheme is that it is available only to those who are employed and whose employer registers with the scheme. Furthermore, lower income earners may not be able to participate, if the amount of salary they sacrifice takes their wage below the Living Wage.
<ul style="list-style-type: none"> Scrappage schemes 	<ul style="list-style-type: none"> Local and transport authorities could introduce scrappage schemes offering financial aid to purchase e-bikes for those who have agreed to give up their private car. It should be noted that scrappage schemes will only help those who currently own a car and will not benefit people who do not possess a car (many of whom have lower incomes).

Potential initiatives

Potential role of local and transport authorities



Changing attitude and increasing awareness

- Try-before-you-buy, bicycle libraries and loan schemes
- Roadshows and e-bike/e-cargo bikes demonstrations
- Marketing and promotion

- Local and regional authorities could fund and establish try-before-you-buy schemes, e-bike libraries and loan schemes. By providing low cost convenient access to trial an e-bike, local authorities can help to overcome a barrier to purchase.
- The Shared Electric Bike Programme Report, 2016, recommends that a national ‘test before you buy’ scheme could be introduced, which would be a partnership involving e-bike manufacturers, Government bodies and bike shop networks. Local and regional authorities can support establishment of such a scheme working with the government and the industry.

- Local and regional authorities could support local organisations and also organise roadshows in partnerships with e-bike shops and bike share schemes.
- Local and transport authorities could work with local businesses and residents to promote e-bikes and their benefits. They could work with Business Improvement Districts to incentivise local businesses to try e-cargo bikes and publicise their experience to encourage others to make a switch.
- Local and transport authorities could sponsor and develop maps which include information about cycle routes and e-bike initiatives and schemes in the region.
- Local and transport authorities could facilitate stakeholder engagement and create forums and working groups working with residents and businesses to encourage use of e-bikes and e-cargo bikes.
- Inclusive language and imagery in marketing and promotion materials could be used to break the stigma of cycling as an elite or leisure activity and improve engagement across demographics, for example through inclusion of more images of older (and female) cyclists and intergenerational activity.
- Local and transport authorities could facilitate and promote use of e-bikes and e-cargo bikes by its staff setting a good example.



Infrastructure improvements

- Improvement of cycle routes

- Prioritising infrastructure improvements where transport options are poor, especially where this coincides with multiple deprivation, can encourage greater levels of cycling. Local and transport authorities could work to improve infrastructure connecting suburban areas with city and town centres and also improve connectivity between the cities and nearby towns and villages.
- Local and transport authorities could support development of bicycle-friendly infrastructure such as wide cycle lanes to accommodate e-cargo bikes.
- Local and transport authorities could ensure existing and new cycling infrastructure is fully inclusive and consider the needs of all users and actively engage them in schemes through the design process.
- Local authorities could consider e-bikes as part of the development of Active Travel Strategies and Plans and Local Cycling and Walking Infrastructure Plans.

- Mobility hubs and micro-consolidation

- Local and transport authorities could promote and develop Mobility Hubs which include secure cycle parking, e-bike share schemes and charging facilities.
- Local and transport authorities could review the potential to use council land/properties and work with the industry to introduce micro-depots which can be serviced by e-cargo bikes.

Potential initiatives

Potential role of local and transport authorities



Safety, security and convenience

- Provision of secure cycle storage

- Integration with transport eco-system

- Maintenance of e-bikes

- Training and education

- Central government could make funding available to local and transport authorities so they could work to ensure that secure e-bike storage is provided at key interchanges and housing developments.

- Local and transport authorities can work with key employers to encourage provision of secure cycle storage at workplaces.

- Local and transport authorities could support design and provision of parking areas and loading zones for e-cargo bikes and necessary charging infrastructure.

- Local and transport authorities could work with train operating companies and encourage those to provide sufficient space for e-bikes on trains.

- Local and transport authorities could support local bike repair shops and encourage those to provide e-bike and e-cargo bike maintenance.

- Local and transport authorities could work towards integrating the e-cycle module into existing cycle training schemes.

- Local and transport authorities could organise and facilitate e-bike training for the public.



Monitoring, evaluation, and further research

- Monitoring and evaluation of new and existing initiatives and schemes

- Conducting further research

- Local and transport authorities could fund and implement pilot programmes that test approaches to incentivise the use of e-bikes to replace car travel in various settings including city, suburban and rural areas.



Shared e-bikes

- Funding

- Long-term rentals

- Collaboration, education and training

- E-bike rental schemes for employers, universities, hospitals

- Working with Housing developers

- Local and transport authorities could secure funding targeted to introduce e-bikes into existing bike share schemes or plan a new bike share scheme in their area.

- Local and transport authorities could establish long-term rentals of e-bikes and e-cargo bikes.

- Local authorities could collaborate with existing bike share schemes to increase awareness, provide discounts/free use for certain groups and establish training especially for e-bikes.

- Local and transport authorities could work with local businesses, hospitals and universities to introduce pool bikes for employers and University estates teams.

- Local and transport authorities could work with housing developers to introduce e-bike rental schemes and safe and secure e-bike storage.

Appendix A. E-bike benefits: calculation methodology

Methodology

The National Travel Survey (NTS) England 2019 database has been used as the foundation for this analysis. This data forms the assumptions for the baseline scenario. The data (pre-COVID) used from the NTS database includes the following:

- Number of trips by region and mode; and
- Number of trips by region and trip purpose (commuting/non-commuting).

The mode share data for commuting trips for each city region from the Journey to Work dataset was used (also used in the baseline scenario for PCT tool). The mode share for non-commuting trips for each region was calculated based on the mode share data for all trip purposes from the NTS dataset.

Benefits calculation methodology

While trips from all modes (including public transport and walking) are transferred to e-bikes, the potential benefits from increase in e-bikes use can be achieved through reduced use of personal cars and taxis. Therefore, the potential number of car trips that are replaced by e-bike trips was calculated for each scenario.

For benefits calculation the DfT's Active Modes Appraisal Toolkit (AMAT) was utilised which provides a comprehensive model to evaluate the monetary benefits of replacing car and taxi trips with active travel modes such as walking and cycling. The carbon savings from replacing car and taxi trips were also estimated.

As an input to the AMAT model, it was assumed that an average length of an e-bike trip will be 20% higher than the current cycle trip length of 5.3 km across the UK, with an average trip length of 6.4 km.¹⁴⁸

The benefits are calculated for each city region and for both scenarios. A summary of benefits is presented in Table 6-2.

Table 6-2. Types of potential benefits

Benefits	Description
Health benefits (monetary value)	– Reduced risks of premature death due to increase in physical activity through use of active travel modes
	– Reduced absenteeism from work due to improved health through use of active travel modes
Mode shift benefits (monetary value)	– Reduction in congestion
	– Reduction in accidents
	– Improvements to local air quality
	– Reduction in noise pollution
	– Reduction in greenhouse gases
	– Reduction in maintenance costs of transport infrastructure
Carbon benefits	– Reduction in transport emissions from reduced car and taxi use. This has been calculated using the assumptions on average emissions per vehicle km

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steer

Prepared by:

Steer

28-32 Upper Ground

London SE1 9PD

+44 20 7910 5000

www.steergroup.com

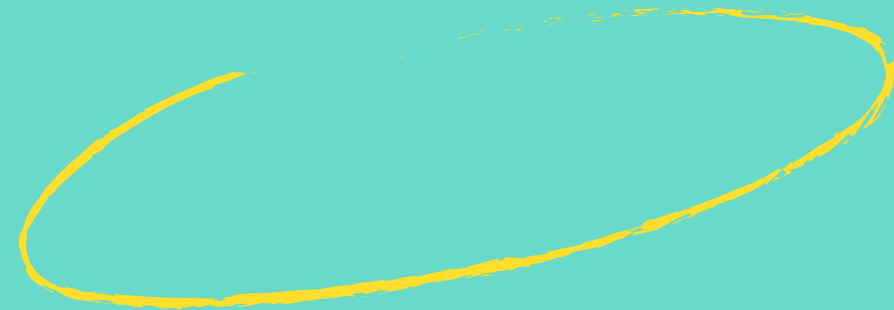
Prepared for:

Urban Transport Group

Wellington House

40-50 Wellington Street

Leeds LS1 2DE



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