An Ultra Low Emission Vehicle Delivery Plan for London

Cleaner vehicles for a cleaner city

July 2015
About Transport for London

We are the integrated transport authority for London. Our purpose is to keep London working and growing and to make life in the Capital better. We reinvest all our income to run and improve London’s transport services.


On the roads, we regulate taxis and the private hire vehicle (PHV) trade, run the Congestion Charging scheme, manage the city’s 580km red route network, operate the Capital’s 6,200 traffic signals and work to ensure a safe environment for all road users.

We are delivering one of the world’s largest programmes of transport capital investment, which is building Crossrail, modernising Tube services and stations, improving the road network and making the roads safer, especially for more vulnerable road users, such as pedestrians and cyclists.

We are a pioneer in integrated ticketing and providing information to help people move around London. Oyster is the world’s most popular smartcard, and contactless payment is making travel ever more convenient. Real-time travel information is provided by us directly and through third parties, who use the data TfL makes openly and freely available to power apps and other services.

Improving and expanding transport in London is central to driving economic growth, jobs and housing across the country.
Foreword

Our famous red double-decker and inimitable black taxi are two of London’s most recognisable icons. Now they are set to become symbols of the Capital’s green transport revolution as our plans to introduce more hybrid, pure electric and zero emission capable models continue.

By 2020, London will have the greenest bus and taxi fleets of any world city. This document sets out how we are going to make this a reality, and what steps we will take to transform other vehicle fleets and support private owners to ensure our city leads the way in the ultra low emission vehicle era.

As the Capital continues to grow, we must ensure that its vehicles play their part in my vision for a truly sustainable transport system. Our imperative must be to reduce emissions and clean our air, improving quality of life and health for our residents. We can also celebrate the fact that cleaner vehicles will save people and businesses money and place London and the UK in pole position to benefit from the rapidly expanding green economy, creating thousands of new jobs.

The Capital is already providing global leadership by working with other cities to ‘normalise’ new technologies like hybrid-electric, pure electric and hydrogen. We already have more than 1,300 double-deck, hybrid-electric buses on our streets, with a commitment to have at least 3,000 in central London by 2020. Our trials of eight pure electric and eight hydrogen buses mean that by 2020 all 300 single-deck buses in central London will be zero emission at tailpipe. I have also announced that the Capital will trial the first purpose-built pure-electric, double-deck bus and inductive charging, preparing the ground for a further transformation of the bus fleet over the coming years. As a result of new licensing requirements, the Capital will have 9,000 zero emission capable taxis by 2020. TfL will also work with London’s car clubs to ensure that 50 per cent of their fleets are ULEVs within the next 10 years.

I am determined that we will go further, and central to that are my plans for the world’s first Ultra Low Emission Zone (ULEZ). From September 2020 all vehicles in central London will be required to comply with stringent environmental standards or pay a daily charge. This will be a game changer for air quality in the Capital: as a result of ULEZ more than 80 per cent of central London is expected to meet the nitrogen dioxide (NO₂) annual legal limits and a significant number of people across the city will no longer live in areas of poor air quality.

Underpinning this will be charging and refuelling infrastructure supporting the wide variety of needs that exist in this complex city, including at home or on the move. TfL has assessed demand across London and the plan sets out our expectations of where infrastructure will be needed.
Work is under way to realise these aspirations, with TfL recently starting a formal market engagement exercise for its new rapid charging network. This will see 300 rapid charge points in place by 2020. Thanks to my Air Quality Fund, local partners are able to put in place complementary community initiatives, with boroughs developing innovative proposals for Low Emission Neighbourhoods.

I have ensured that TfL is leading the way, but everyone – Government, local authorities, commercial partners and drivers – must work together if we are to make my vision of London as a world-leading, ultra low emission vehicle city a reality. I hope you will be inspired by this document and will play your part in putting ultra low emission vehicles on our streets.

Boris Johnson
Mayor of London
Purpose of the Delivery Plan

Since the launch of the Mayor’s Electric Vehicle Delivery Plan in 2009, we have made significant progress in making ultra low emission vehicles (ULEVs) part of London’s public transport offer. We are now ready to work with government, boroughs and industry partners to prepare London for a step change in ULEV uptake. Our vision is for London to grow as a sustainable city where ULEVs are the preferred option for all vehicle travel, not only across public transport, but also in other fleets and for private vehicle owners.

By setting out our commitment to this agenda, we send a strong message to the industry and to drivers that ULEVs will be an essential part of the Capital’s future. We want the vehicle and charging/refuelling industries to be confident in London as a market that is ready for investment. We are committed to staying at the forefront of new technology, so we will remain technology neutral and welcome new ideas. We want drivers to have the confidence in our systems so they can operate these vehicles in London.

The energy and commitment TfL and the Greater London Authority (GLA) are ready to put into increasing the uptake of ULEVs is demonstrated by the range of actions we commit to in this Delivery Plan. It sets out the steps TfL and the GLA will take and calls on our partners and stakeholders to do what they can to help realise this vision for London. Together we can ensure our city has the right infrastructure, incentives and supportive policy needed to make ULEVs the obvious vehicle choice for all.
Executive summary

The vision for London

London aims to be the ULEV capital of Europe, with ULEVs as a core part of our sustainable transport. ULEVs include battery electric vehicles (BEVs), plug-in hybrid vehicles (PHEVs), range-extended electric vehicles (RE-EVs) and hydrogen fuel cell electric vehicles (FCEVs).

The Capital’s world-class transport network means that public transport, walking and cycling are the obvious choice for most journeys in London. However, travel by car is still needed for many journeys. When the Mayor set out his ambition for London to become the electric vehicle capital of Europe, this sent a clear message that encouraging ULEVs is a critical next step towards delivering a fully sustainable transport system for London. This Delivery Plan sets out what is needed to make this ambition a reality.

Meeting London’s challenges

London has seen significant improvements in air quality in recent years. However, London still does not meet EU legal limits for nitrogen dioxide. We also have to take further action if the Capital is to meet our ambitious targets for reducing CO₂ emissions.

Moreover, our efforts to reduce emissions need to be set in the context of the wider challenges facing London, the greatest of which is population growth. With a growing population comes increasing travel demand. To continue to reduce emissions in this context we need to continue to encourage walking, cycling and public transport use, and in parallel, improve the environmental performance of private and commercial vehicles. Successful growth in a city is only possible with a sustainable transport system supporting it.

Finally, London and the UK are in a global race for jobs and growth with other world cities. Investing in supporting infrastructure and encouraging the accelerated uptake of ULEVs will place London and the UK in poll position to benefit from the rapidly expanding green economy.

Principles for delivery

Transforming London’s vehicle fleet will require time, investment and commitment from a wide range of stakeholders. To ensure that all ULEV users’ needs are met, in a cohesive and equitable way across the Capital, TfL has set out seven guiding principles for delivering ULEV uptake:

1. TfL and the GLA provide strategic direction
2. ULEVs are part of a sustainable transport system
3. An open, fair accessible market
4. The right infrastructure in the right place
5. Boroughs play a vital supporting role
6. Incentivising early ULEV uptake
7. Working together to maximise benefits

These principles form the backbone of this Delivery Plan and underpin all the actions within it.

**Understanding ULEVs in London**

TfL is undertaking comprehensive research on likely ULEV growth in London and the infrastructure needed to support that growth. Along with consultation with key stakeholders, this research has informed our understanding of ULEVs in London and the actions we will take to stimulate uptake (see Chapter 4).

There have been more than 30,000 purchases of ULEVs in the UK to date and a remarkable surge in demand for ULEVs in the past two years. According to the Society of Motor Manufacturers and Traders (SMMT) figures, registrations of BEVs more than doubled from 2013 to 2014. PHEVs/RE-EVs showed even faster growth, with registrations quadrupling from 2013 to 2014.

In 2014, the market share for all new cars for ULEVs in the UK was 0.6 per cent. ULEVs hold a higher market share in London – 0.8 per cent – than in the UK overall (2014 figures). This demonstrates the impact of the supportive policy environment in London, with strong incentives such as the 100 per cent discount for the Congestion Charge and free parking and charging in many boroughs to encourage early adoption. It is this head start that London will build on.

To understand likely growth in the longer term, TfL and the GLA commissioned a study into the spatial distribution of ULEV uptake across London. The study looked at two potential scenarios for uptake, a ‘baseline’ and ‘high BEV’ scenario (see Chapter 3 for an explanation of these scenarios). In the baseline scenario, it is projected that the number of ULEVs registered in the Capital will surpass 20,000 in 2020 and will be approaching 100,000 in 2025. This means a 25-fold increase in ULEV cars in London in 10 years in the baseline scenario. In the high BEV scenario, the number of ULEVs registered in London is projected to reach nearly 50,000 in 2020 and more than 220,000 in 2025.

**Taking action**

Chapter 4 of this Delivery Plan sets out 15 actions designed to address the specific issues and challenges currently limiting ULEV uptake in London.

The delivery of a number of actions set out in this Delivery Plan, and the forecast growth in ULEV uptake, is dependent on support and funding from the Office for Low Emission Vehicles (OLEV). TfL and the GLA are supporting London’s Go Ultra Low City Scheme bid to OLEV. London was shortlisted in April 2015 and will submit the final bid in autumn 2015. TfL calls on OLEV to back London’s bids for funding through its different programmes.
The immediate/quick wins: actions needed in the next 12 months to support those who already own ULEVs and those poised to change to such vehicles.

Medium term actions: to prepare London for the predicted uptake in next 5-10 years.

Longer term actions: that will prepare us for ULEVs becoming a mainstream vehicle option for London vehicle travel and will enable innovation and maintain flexibility as the market and technology develops.

Action plan

1. Support stakeholders’ aspirations for expanding Source London
2. Identify priority charging and refuelling infrastructure locations, based on research and stakeholder insight
3. Work with car clubs to achieve a target of 50 per cent ULEV in the London car club fleet by 2025
4. Deploy 1,000 vehicles in GLA Group fleets, including 120 ULEVs in TfL support fleet
5. Increase public awareness and acceptance of ULEVs
6. Deploy a rapid charge point network
7. Provide charging solutions for residents without off-street parking
8. Offer attractive incentives to stimulate ULEV uptake
9. Support the implementation of local air quality schemes
10. Streamline the ULEV and charging infrastructure procurement processes
11. Achieve zero emission capable taxis and PHVs on London’s streets from 2018
12. Increase the uptake of ULEVs in freight and fleet organisations
13. Demonstrate and test new technologies and approaches
14. Test and evaluate the application of geofencing for zero emission capable vehicles
15. Ensure London is ready for the commercialisation of hydrogen transport
**Next steps**

As well as the specific actions, we will continue to build our relationships with stakeholders and partners, introducing new groups to improve coordination and implementation across London. For example, we will work with London Councils to set up a new working group for us to effect the deployment of rapid charge points and other charging infrastructure.

We will meet regularly to further our understanding of all ULEV users’ needs and identify new solutions to enable mainstream uptake of ULEVs. We will also continue to look for new innovations and welcome new ideas that could be trialled in London.

In addition to individual stakeholder conversations, it is important that the industry can discuss the issues specific to London. Therefore, after the launch event for this ULEV Delivery Plan in July 2015, we will hold an annual ULEV event. These events will provide an open platform for all industry and public sector stakeholders to continue to share knowledge and ideas, helping to ensure we are on track to deliver on our actions and maximise the uptake of ULEVs in London.
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1 Vision for London

1.1 ULEVs and sustainable transport

With a world-leading public transport system, the ground-breaking Congestion Charge, the world’s largest city Low Emission Zone and the Mayor’s ambitious Cycling Vision, the Capital is at the forefront of sustainable transport. It is globally recognised as a city to look to for inspiration and expertise. When the Mayor set out his ambition for London to become the electric vehicle capital of Europe, this sent a clear message that encouraging ULEVs is a critical next step towards delivering a fully sustainable transport system for London. This Delivery Plan sets out what is needed to realise this ambition.

London’s world-class transport network means that public transport, walking and cycling are the obvious choice for most journeys in London. However, travel by car is still needed for many journeys. Public transport, walking and cycling mode shares continue to grow in London, but 33 per cent of journeys are still made by private transport1. Stimulating the uptake of ULEVs in both the private and commercial vehicle markets is the next piece of the puzzle for fully realising London’s sustainable transport vision. We want the vehicles on London’s streets to be the cleanest in the world and we will work hard, in collaboration with the industry, national and local government, to make this happen.

What are ULEVs?

Ultra low emission vehicle, or ULEV, is the collective term for:

- Battery electric vehicles (BEVs)
- Plug-in hybrid electric vehicles (PHEVs)
- Range-extended electric vehicles (RE-EVs)
- Hydrogen fuel cell electric vehicles (FCEVs)

1.2 Meeting London’s challenges

London has seen significant improvements in air quality in recent years. However, the Capital still does not meet EU legal limits for nitrogen dioxide. London’s air quality challenge makes reducing emissions from transport a top priority for TfL and the GLA and increasing ULEV uptake will be an important component of tackling this challenge.

1 Travel In London Report 7, tfl.gov.uk Publications & reports section
Reducing CO₂ emissions and our impact on global warming is also a priority for London. In the Climate Change Mitigation and Energy Strategy, the Mayor committed London to reducing CO₂ emissions across all sectors to 60 per cent below 1990 levels by 2025. For transport, we need to reduce CO₂ emissions by approximately 48 per cent from 1990 levels. The CO₂ emissions of a ULEV depend on the energy mix of the grid; a study by the Department for Business, Innovation and Skills (BIS) in 2008 estimated that electric vehicles (EVs) emit 40 per cent less CO₂ than similar petrol or diesel vehicles. As the grid decarbonises, the CO₂ benefits of ULEVs will increase.

ULEVs can help to improve air quality and reduce CO₂ emissions in London. BEVs and FCEVs emit no pollution at the point of use, and PHEVs and RE-EVs emit no pollution at point of use when in electric mode.

Our efforts to reduce emissions need to be set in the context of the wider challenges facing London. The greatest of these is population growth and the associated growing demand for transport and road space. London is experiencing a sustained period of population growth and the latest GLA projections estimate that by 2031 London’s population will rise to over 10 million. With a growing population comes growing travel demand. To continue to reduce emissions in this context we need to continue to encourage use of walking, cycling and public transport, while improving the environmental performance of private and commercial vehicles. Successful growth in a city is only possible with a sustainable transport system supporting it.

1.3 Wider benefits

ULEVs also provide an exciting opportunity for London and the rest of the UK to be at the forefront of a technological revolution in the motor industry. With our world-renowned expertise in vehicle technology and political support for the ULEV agenda, the UK is in pole position to emerge as a leader in this field.

The race is on to attract investment to design and manufacture a new generation of vehicles. This potential was demonstrated by the recent £250m investment by Geely, owners of the London Taxi Company, in manufacturing new zero emission capable taxis in Coventry², which will create up to 1,500 new jobs.

Further details on the air quality, climate change and economic benefits of increasing the uptake of ULEV in London can be found in the Transport Emissions Roadmap³.

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² See Chapter 4 for further details on proposals for and definition of zero emission capable taxis
³ tfl.gov.uk/transport-emissions
Box 1: The Transport Emissions Roadmap

The Transport Emissions Roadmap (TERM) was published in September 2014. It looks at how to reduce emissions from transport in London and reports on what we have already done and what we may do in the future. It provides a range of possible new measures that the Mayor, TfL, the London boroughs, the government, the EU and other parties should consider to help meet the challenge of reducing air pollutants and CO₂ emissions in London. These measures include: the Ultra Low Emission Zone (see Appendix 4); transforming London’s public and commercial fleets; delivering zero emission taxi and private hire fleets; transforming London’s bus fleet; and an action on ‘Driving the uptake of Low Emission Vehicles’.
2 Principles for delivery

2.1 Building on the 2009 Electric Vehicle Delivery Plan
In 2009, the Mayor’s Electric Vehicle Delivery Plan set out his vision for London to become the electric vehicle capital of Europe. Progress has been swift and significant, including:

- Over 1,400 charge points via the Source London public charging network
- A planning requirement for EV charge points in all new developments through the London Plan
- 100 per cent Congestion Charge discount for vehicles emitting less than 75g/km CO₂
- New stakeholder groups such as the Mayor’s Electric 20, to encourage knowledge sharing and collaboration
- The largest green bus fleet in the world, including 1,700 new hybrid buses (including the new Routemaster) by 2017, the early introduction of new Euro VI buses and retrofitting to reduce NOx emissions by up to 88 per cent
- Over 2,750 ULEVs registered in London up to the end of the first quarter of 2015 (London registrations account for 9.3 per cent of the UK total)²

Since 2009, the market has developed and there are a number of new and emerging alternative vehicle and charging technologies, making ULEVs an increasingly viable and affordable alternative to conventional internal combustion engine (ICE) cars and vans.

We must now encourage the transformation of ULEVs from a niche technology to an attractive and accessible option for any Londoner who needs to drive. The public and private sectors need to work together to overcome the practical, technological and perceived barriers to ULEV uptake, across a range of users and vehicle types.

2.2 Key principles
Transforming London’s vehicle fleet will require time, investment and commitment from a wide range of stakeholders. These key principles will help guide the successful development of the ULEV market and the necessary coherent and consistent supporting infrastructure across London.

TfL and GLA provide strategic direction

GLA and TfL will provide leadership for a consistent London-wide approach that provides coherence to users. This strategic direction will be crucial to ensure that London’s charging and refuelling networks meet the specific needs of the various

users and types of ULEVs. TfL has many of the policy levers needed to incentivise the uptake of ULEVs and coordinate London-wide action and we call on our industry and public sector public partners to help us. TfL can also directly increase the number of ULEVs on our streets and we will lead by example with our buses, our own support fleet and through implementing emissions regulations for the vehicles we licence, such as zero emission capable taxis and PHVs.

**ULEVs are part of a sustainable transport system**

When public transport, walking or cycling are not feasible, Londoners need to be able to use a ULEV with at least as much ease and convenience as they would a petrol or diesel vehicle. This could be an electric taxi or a shared car club or car hire vehicle, which lets them use a car for occasional journeys without having to actually own a car. Businesses also need to be able to see the economic benefits, with the right infrastructure and incentives, to encourage a switch to ultra low emission commercial vehicles.

**An open, fair and accessible market**

There is ‘no one size fits all’ solution to providing for charging and refuelling for ULEVs. Different charging/refuelling infrastructure and different types of services are needed for different users: zero emission capable taxis and private hire; residential users without off-street parking; commercial fleets; car clubs and many more. Source London was an early way for partners to stimulate the ULEV market, but we remain technology neutral and the market is open to any provider looking to serve ULEV users in London. To make this work, however, there must be interoperability between networks and open access for relevant user groups.

**The right infrastructure in the right place**

Demand for ULEVs is set to grow and we need to ensure that the right infrastructure – be it for battery electric, plug-in hybrid or hydrogen fuel cell technology – is in the right place to support this. TfL has undertaken research to understand how uptake is likely to be distributed across London. We will use this research to develop new guidance on infrastructure locations (see Action 2 in Chapter 4). We have carried out similar exercises for rapid charging. Space is at a premium on London’s roads and providing space for ULEVs is not easy. We need to be more innovative, provide the right incentives and look for more flexible options to make the best use of the space we have.

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Boroughs play a vital supporting role

Appendix 1 includes a matrix that summarises the different charging infrastructure required by different ULEV fleets and the type of locations where they are likely to be needed. As the matrix makes clear, a number of users will need on-street charging so borough support will be crucial in helping to find and manage space for charging infrastructure. This may be provided by other parties, including private enterprises. Boroughs will also be a vital partner for the growth of car clubs, which will allow Londoners to use ULEVs without having to purchase their own vehicle. Boroughs can also offer local incentives to encourage residents and businesses to choose ULEVs, for example, using preferential parking policy and charges. As local planning authorities, boroughs will also have a role to play in the future deployment of hydrogen refuelling stations.

Incentivising early ULEV uptake

The Ultra Low Emission Discount (ULED) for the Congestion Charge has proven to be a strong and successful incentive for encouraging ULEV uptake. TfL will continue to use opportunities like this to promote ULEVs. As discussed in TERM, if there are changes made to the way we pay to use the roads or build new infrastructure, discounts could be made for ultra low emission or zero emission vehicles (see Chapter 5 of TERM for more detail). We will encourage boroughs to use local opportunities for ULEV incentives, as discussed above. TfL will also work with government to look at new ways to incentivise ULEVs, for example, through road user charging and ensuring that fiscal incentives only encourage and promote the cleanest vehicles.

Working together to maximise benefits

The resources and funding that TfL is investing are significant and will take us a long way to stimulating the ULEV market in London. But we cannot do this alone. To reap the maximum benefits of our investment, we need support from national government, the boroughs and industry partners. We look to industry to invest in and trial new solutions in the London market. As London is recognised as leading the way, we expect to lever further investment from EU, public and private sources. We welcome any opportunities to work together to share our knowledge and expertise with national and international peers.
3 Understanding ULEVs in London

3.1 Introduction
TfL is undertaking a comprehensive research programme on likely ULEV growth in London and the infrastructure needed to support that growth. Along with consultation with key stakeholders, this research has informed our understanding of ULEVs in London: the current context, the potential for growth and the supporting actions and infrastructure needed to achieve this growth.

The research is still under way and the results still being analysed so the documents have not yet been published, but some interim findings are presented in this Delivery Plan. The key pieces of this draft research and authors are:

- Electric vehicle charging scheme study, WSP Parsons Brinckerhoff
- Feasibility study into a rapid charge point network for plug-in taxis, Energy Saving Trust
- Fleet mapping for rapid charge points, Energy Saving Trust
- Rapid charging network study, Element Energy
- Socio-economic benefits of ULEV policy, Ecorys
- ULEV uptake and infrastructure impacts, Element Energy & WSP Parsons Brinckerhoff
- Understanding electric vehicles, Future Thinking

In this chapter, our research complements knowledge about the market gathered from other sources, such as the Office for Low Emission Vehicles (OLEV) and the SMMT.

3.2 Current situation
London has one of the cleanest bus fleets in the world and a history of implementing world-leading, progressive environmental schemes such as the Low Emission Zone, which successfully led to London meeting its particulate matter (PM) limit values. Incentives such as theULED have been very successful in incentivising uptake of ULEVs and alongside national initiatives this has helped the UK achieve more than 30,000\(^4\) purchases of ULEVs to date.

The UK has seen a remarkable surge in demand for ULEVs in the past two years, albeit we are still behind the leading countries for ULEV uptake where ULEV owners benefit from significant national incentives, such as tax and VAT exemptions in Norway and parking permit priority in the Netherlands. According to SMMT figures, registrations of BEVs more than doubled from 2013 to 2014. PHEVs/RE-EVs showed even faster growth, with registrations quadrupling from 2013 to 2014. As the UK has the second largest new car market in Europe, there is excellent potential for the UK to be a leader in ULEV uptake.

\[^4\text{Plug-in car and van grant uptake, Q1 2015}\]
Furthermore, as shown in Figure 1 below, ULEVs hold a higher market share in London than in the UK overall; 0.8 per cent compared to 0.6 per cent (2014 figures). This demonstrates the impact of the supportive policy environment in London, with strong incentives such as the 100 per cent discount for the Congestion Charge, and free parking and charging in some boroughs. It is this head start that London will build on.

The development of ULEVs for the consumer market has to date been focused mainly on cars, partly because commercial vehicles have more demanding operational and payload requirements. Sales of plug-in vans in 2014 represented 0.2 per cent of the market share in 2014, illustrating that there is considerable work and policy support needed for commercial vehicles. Supporting uptake of ULEV in commercial fleets is a principal focus for us.

3.3 Future uptake: what can be achieved?

Uptake of the government’s plug-in car grant also demonstrates the surge in uptake of ULEVs in the UK in the past year. Figure 2 below shows the uptake to date for car and van grants since 2010.
There were 14,498 plug-in car grant eligible vehicles registered in 2014. A total of 9,046 ULEVs were registered in the first quarter of 2015 – a rise of 366 per cent from the same period in 2014. This strongly suggests that the total uptake of the grant will be much greater by the end of 2015 and that we can expect a record number of ULEVs purchased in the next year.

To understand likely growth in the longer term, TfL and the GLA have commissioned a study into the spatial distribution of ULEV uptake across London, and the likely infrastructure and energy demands associated with this. Two uptake scenarios have been used for the study, both representing an ambitious level of ULEV uptake. In both scenarios, ULEVs represent 100 per cent of sales by 2040, as per the Committee on Climate Change (CCC) projections. This would deliver a stock of which the majority is ULEV by 2050.

- The ‘high BEV’ scenario assumes that we reach the CCC recommended target of 60 per cent EV sales by 2030. In this scenario, PHEVs have a larger market share than BEVs in 2025, but in 2040 FCEVs increase significantly and between them BEVs and FCEVs capture all the sales by 2050 (FCEVs effectively fulfilling the long distance driving role of PHEVs).

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5 Study for TfL by Element Energy and WSP Parsons Brinckerhoff, to be published later this year.
The ‘baseline’ scenario assumes a slower rate of ULEV market penetration, with 30 per cent EV sales reached by 2030. It also assumes that consumers prefer PHEVs over BEVs or FCEVs through to 2050. The implication of this is that there would be a higher dependency on liquid fuels continuing to 2050.

![Baseline Scenario vs High BEV Scenario](image)

**Figure 3: Projected market share (new car sales) of ULEVs, baseline and high scenarios (Element Energy, draft report for TfL, unpublished)**

The resulting ULEV stock for cars in 2020 and 2025 in London under the baseline scenario is shown in Table 1. In this scenario, it is projected that the number of ULEVs registered in London will surpass 20,000 in 2020 and will be approaching 100,000 in 2025. This means a 25-fold increase in ULEV cars in London in 10 years in the baseline scenario.

**Table 1: Projected ULEV cars in London in 2020 and 2025, baseline scenario (based on Element Energy model for TfL, unpublished)**

<table>
<thead>
<tr>
<th>Baseline scenario (cars)</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total new sales (all cars)</td>
<td>160,000</td>
<td>161,120</td>
<td>167,565</td>
</tr>
<tr>
<td>Total plug-in sales share</td>
<td>1%</td>
<td>3%</td>
<td>13.1%</td>
</tr>
<tr>
<td>- BEV share of all sales</td>
<td>0.5%</td>
<td>1.2%</td>
<td>5.6%</td>
</tr>
<tr>
<td>- PHEV share of all sales</td>
<td>0.5%</td>
<td>1.8%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Total ULEV sales</td>
<td>1,600</td>
<td>4,785</td>
<td>21,867</td>
</tr>
<tr>
<td>Total ULEV stock</td>
<td>3,600</td>
<td>21,007</td>
<td>92,328</td>
</tr>
<tr>
<td>- BEV stock</td>
<td>1,970</td>
<td>9,142</td>
<td>38,923</td>
</tr>
<tr>
<td>- PHEV stock</td>
<td>1,630</td>
<td>11,865</td>
<td>53,405</td>
</tr>
<tr>
<td>Share of plug-in stock (BEV:PHEV)</td>
<td>55:45</td>
<td>44:56</td>
<td>42:58</td>
</tr>
</tbody>
</table>

In the high BEV scenario, as shown in Table 2, the number of ULEVs registered in London is projected to reach nearly 50,000 in 2020 and more than 220,000 in 2025.
Table 2: Projected ULEV cars in London in 2020 and 2025, high BEV scenario (based on Element Energy model for TfL, unpublished)

<table>
<thead>
<tr>
<th>High scenario (cars)</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
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<tr>
<td>Total new sales (all cars)</td>
<td>160,000</td>
<td>161,120</td>
<td>167,565</td>
</tr>
<tr>
<td><strong>Total plug-in sales share</strong></td>
<td><strong>1%</strong></td>
<td><strong>8.9%</strong></td>
<td><strong>30.1%</strong></td>
</tr>
<tr>
<td>- BEV share of all sales</td>
<td>0.5%</td>
<td>3.5%</td>
<td>12.6%</td>
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<td>- PHEV share of all sales</td>
<td>0.5%</td>
<td>5.4%</td>
<td>17.5%</td>
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<tr>
<td><strong>Total ULEV sales</strong></td>
<td><strong>1,600</strong></td>
<td><strong>14,356</strong></td>
<td><strong>50,437</strong></td>
</tr>
<tr>
<td><strong>Total ULEV stock</strong></td>
<td><strong>3,600</strong></td>
<td><strong>49,719</strong></td>
<td><strong>223,293</strong></td>
</tr>
<tr>
<td>- BEV stock</td>
<td>1,970</td>
<td>20,452</td>
<td>92,191</td>
</tr>
<tr>
<td>- PHEV stock</td>
<td>1,630</td>
<td>29,266</td>
<td>131,102</td>
</tr>
<tr>
<td>Share of plug-in stock (BEV:PHEV)</td>
<td>55:45</td>
<td>41:59</td>
<td>41:59</td>
</tr>
</tbody>
</table>

For vans, owing to the low number of models on the market, the starting point in 2015 is much lower than cars (just 347 ULEV vans in London in 2015, compared to 3,600 ULEV cars). However, with the potential fuel cost savings positively impacting the total life costs for commercial vehicles, there is excellent potential for ULEVs in this market. As more ULEV vans become available, and challenges such as the conflict between battery weight and payload are addressed, the growth in this sector could be rapid. By 2025, the baseline uptake scenario in the study estimates that, for van sales, the total ULEV share will reach 30 per cent. In the high BEV scenario, the ULEV market share for vans in 2025 is 52 per cent. This would result in over 27,000 ULEV vans in London in 2025 in the baseline scenario. If the high BEV scenario is achieved, this rises to nearly 40,000 ULEV vans in 2025.

3.4 Distribution across London

In their study for TfL (yet to be published), Element Energy and WSP Parsons Brinckerhoff (EE & WSP PB) applied the ULEV uptake scenarios described above geographically across London to understand where ULEV uptake is most likely to occur. This analysis is based on assumptions of likely patterns of uptake across London, based on demographic indicators, including employment and income, historic hybrid sales and local ULEV policy.

The figure below illustrates how ULEV stock (cars, vans, taxis and powered two-wheelers) is likely to be distributed across London in 2020 and 2025. The distribution is shown per Middle Super Output Area (MSOA).  

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6 An MSOA is a designated geographic area used for the mapping of area-based statistics by the Office of National Statistics. An MSOA has a minimum size of 5,000 residents and 2,000 households with an average population size of 7,500. They fit within local authority boundaries.
Appendix 2 presents the projections for the number of ULEVs (cars and vans) owned by residents in 2020 and 2025 in the baseline scenario and high BEV scenarios, per borough.

Chapter 4 sets out further analysis on the likely charging infrastructure needed to support this uptake, taking into account off-street parking availability.
4 Taking action

4.1 Introduction

There are three pillars that are needed to support the uptake of ULEVs. These are:

1. Infrastructure: to ensure ULEV users have the confidence to charge up or refuel when they need to
2. Vehicles on the roads: using public sector procurement and own fleets to increase visibility of ULEVs on London’s streets and demonstrate confidence in the technology
3. Marketing and incentives: using incentives and policy mechanisms to make ULEVs an attractive alternative to petrol and diesel vehicles

This Action Plan sets out 15 complementary actions designed to address these three pillars, with cross-cutting actions on innovation and new technologies which will push forward progress across all three themes.

Figure 5: Thematic approach to the actions

Grouped into distinct themes, the actions can also be categorised by time. Actions range from immediate action to development in the long term:
This chapter looks at the actions we will put in place in these time categories. This is based on research carried out to date and insight from the various stakeholders consulted in the development of this document.

4.2 Quick wins and immediate action

Introduction

These actions have already started or will begin immediately. They aim to tackle the current issues affecting ULEV users and potential ULEV users now.

The actions include supporting the expansion of ULEV infrastructure in London and improving public understanding and acceptance of ULEVs. We will use TfL’s influence as one of the largest vehicle operators in London to get more ULEVs on London’s streets, increasing visibility and sharing our learning with other fleet operators.

Source London

TfL set up and administered Source London from 2009 to 2014, using government Plugged-in Places and match-funding from partners. Together, the Source London partners have delivered 1,400 publically accessible charge points.

Source London was transitioned to BluepointLondon (BPL), a subsidiary of IER Bolloré, in September 2014. The transition will help ensure Source London can continue to expand without further reliance on public subsidy. TfL is working with BPL and other key stakeholders, such as boroughs, to improve and expand...
the network, ensuring Source London works within the wider context of all future charging provision so ULEV drivers can charge when needed.

**Action 1: Support stakeholders’ aspirations for expanding Source London**

BPL wants to increase the number of charge points to 6,000 by 2018 and our customer research has also told us that ULEV owners would like more publicly accessible charge points (see Box 2 on page 18). TfL and the GLA will continue to work closely with all stakeholders to protect the legacy of Source London and to ensure the scheme meets the needs of ULEV users.

We will:

- Provide guidance on optimum locations for publicly accessible charge points (see Action 2)
- Ensure London has open and accessible networks of charging and refuelling options that meet the needs of all Londoners
- Administer a one-year limited fund to help boroughs fix out-of-service charge points during contract negotiation. Funding has been made available through Local Implementation Plans (LIPs) and boroughs can invoice TfL for reimbursement when work is complete.

We call on:

- BPL, boroughs and charge point manufacturers to work together to deliver a reliable, open and accessible Source London network
- BPL to establish a target of 95 per cent network availability by September 2015

**The right infrastructure, in the right places**

The Source London network is a starting point to stimulating the ULEV market by allowing ULEV owners to top up when out and about. While we continue to support boroughs in their aspirations for an improved Source London, we also need to work to support competition in this market. For example, Chargemaster recently announced their plans to install over 1,000 charge points in London.

In addition, we also need to work with other partners to support uptake in the wider market. This includes taxis, private hire and commercial operators with high daily mileage and specific business requirements, plus residents and businesses without the space for their own off-street charging infrastructure. The different charging and refuelling services for different users are summarised in the matrix in Appendix 1, but we need to understand which users these new services need to serve and where they are needed. For this reason, TfL is undertaking research to understand the likely distribution of ULEV uptake and what infrastructure will be needed to support it.

Fundamental to this is providing on-street charging infrastructure for residents and businesses without off-street parking facilities. Figures 6 and 7 below are taken from
the interim findings of a study undertaken for TfL by Brinckerhoff EE & WSP PB into the potential geographical distribution of ULEV uptake. Based on the projections discussed in Chapter 3, these figures show the number of residential ULEVs that will need to be charged on street per MSOA in the baseline and high BEV uptake scenarios. This analysis takes into account the availability of off-street parking which is more limited in the high density areas.

Figure 6: On-street residential EV charging requirements per MSOA, baseline scenario (EE & WSP PB for TfL, unpublished)

Figure 7: On-street residential charging requirements per MSOA, high scenario (EE & WSP PB for TfL, unpublished)
The initial findings of the analysis indicate that the highest levels of on-street charging are likely to be needed in southwest and northwest inner London boroughs. The full report will include results and recommendations for the infrastructure needed in four distinct area typologies, characterised by population density and off-street parking.

There will be challenges for boroughs in providing these on-street spaces, not least the competition for space between ULEV owners and non-ULEV car owners. Boroughs will need to be confident that any spaces provided for ULEV charging will be used. Increasing public awareness and acceptance and incentivising ULEVs over conventionally-fuelled vehicles will be crucial in creating sufficient demand to justify converting spaces, which will further increase the appeal of ULEVs.

More research is ongoing and planned, including into the needs of the private hire and car club industries. This analysis will be brought together into new guidance for boroughs and industry partners to ensure London has comprehensive and strategic provision of infrastructure, where it is most needed. This will include a strategic approach to hydrogen refuelling stations, as covered in Action 15.

**Action 2: Publish guidance on charging infrastructure locations, based on research and stakeholder insight**

TfL’s research will be compiled into one strategic guidance document that will help public or private organisations which are installing charging/ refuelling infrastructure to ensure the right infrastructure is provided in the right locations, serving all ULEV users.

We will:

- Undertake research and stakeholder engagement throughout 2015 to help develop this guidance
- Publish new guidance to inform effective investment in new charging and refuelling infrastructure that meets the needs of all Londoners by December 2015

We call on:

- Boroughs, charge point users and key stakeholders to help us further refine our understanding of where EV uptake is likely to happen and where infrastructure will be needed.
Car clubs

Car clubs provide an alternative to private car ownership by offering members access to a car when they need one, on a pay-as-you-go basis. Car club vehicles are generally newer and therefore have lower emissions than private cars and the car club industry is committed to remaining at the forefront of clean vehicle technology.

In London, car club operators have joined together with TfL, the GLA, boroughs and car club industry bodies to set out the ambitious Car Club Strategy for London. The strategy sets out the aim to achieve one million members by 2025. It also includes a

Box 2: What do ULEV customers want?

TfL recently commissioned Future Thinking to undertake a survey of ULEV owners to understand their motivations for choosing ULEVs, their current usage and charging behaviour and what they want to see from future charging infrastructure (Understanding Electric Vehicles, unpublished). The survey found that proximity of charge points to the final destination was very important to existing ULEV users and they were unlikely to walk more than 15 minutes to/from a charge point: 56 per cent of respondents choose to plug in when their state of charge is <50 per cent, while 25 per cent charge whenever they can.

The main concerns of ULEV users are still limited mileage range, poor provision of public charge points and the number of charge points out of service. When asked what one thing they would campaign for, 33 per cent of respondents referred to ‘more charge points’. This supports the need for more public charge points in London and underlines our aim to develop strategic charge point location guidance, to make sure these charge points are in the right place.

The most popular locations for more charge points would be at supermarkets (noted by 60 per cent of respondents), shopping centres (57 per cent), public car parks (57 per cent) and residential streets (52 per cent). Digital sources are key to helping users find available public charge points – four in five use websites or apps to do so.
commitment to increase the uptake of ULEVs in the fleet. This will reduce emissions from the industry and provide many more Londoners with the opportunity to drive ULEVs. The full Car Club Strategy for London can be accessed at tfl.gov.uk/car-clubs.

Action 3: Work with car clubs to achieve a target of 50 per cent ULEVs in the London car club fleet by 2025

Through the Car Club Coalition, a working group has been set up to overcome the barriers to introducing ULEVs into car club fleets and share best practice and solutions. We will continue to help the car club industry to access the charging infrastructure that meets their operating requirements and ensures customers have confidence to drive and charge ULEVs. This could include retrofitting existing car club bays and ensuring London’s public charging networks are open and accessible to car clubs.

We will:

- Support and encourage the car club industry to achieve 50 per cent ULEVs in their fleets by 2025
- Undertake research on the complex operational needs of all models of car clubs for charging infrastructure and the needs of their customers, to be completed by December 2015
- Dependent on OLEV support, put in place the right supporting charging infrastructure from April 2016 and support open access to this infrastructure

We call on:

- London Councils and boroughs to work with the Car Club Coalition to provide ULEV charging and parking where appropriate and practical, including converting existing bays where appropriate

ULEVs in our support fleet

The GLA Group has a target to deploy 1,000 ULEVs in its combined fleet. Of this, TfL’s target for our own support fleet is 120 vehicles. New charge points have been installed across the TfL estate in preparation and we are working with the Energy Saving Trust to better understand how these 120 ULEVs will fit best within the fleet. Early deployment of (mostly first generation) ULEVs has highlighted operational challenges in terms of range and load/capacity, but this has enabled us to learn lessons for future deployment. We currently have 15 ULEVs in the fleet.
Public acceptance
To expand ULEV use beyond early adopters, we must engage with potential users and help more people see ULEVs as an attractive option that works for them. Giving individuals and businesses the chance to test these exciting new technologies will help normalise ULEVs.

We can also use insight from current ULEV owners to better understand the motivations behind purchasing ULEVs and what might be preventing others from doing so.

TfL recently undertook a survey of ULEV owners, carried out by Future Thinking. This delivered a number of insights into the motivations for purchasing a ULEV.

Action 4: Deploy 1,000 ULEVs in the GLA Group fleet, including 120 ULEVs in TfL support fleet

We will introduce new ULEVs into our support fleet and share our experiences with others.

We will:
- Develop an implementation plan to outline how we will achieve the target of 120 ULEVs in the TfL fleet
- Support the GLA Group, emergency services and boroughs by sharing our technical expertise on ULEV deployment

We call on:
- Vehicle manufacturers to develop light duty vehicles which suit a wider range of commercial applications
- Government to review vehicle weight restrictions to take account of the added weight of the battery in light duty vehicles (see also Action 12)
As shown in Figure 8, 64 per cent of respondents said they purchased their vehicle to reduce their environmental impact. The second most popular reason was to save on fuel costs (62 per cent), followed by embracing new technology (53 per cent). This helps us identify what is important to those considering buying a ULEV and appeal to a new audience through our promotional work.

**Action 5: Increase public awareness and acceptance of ULEVs**

TfL is participating in several high profile motoring events to give the public a hands-on experience of ULEVs. We are also working with boroughs and businesses to encourage expansion of ULEVs in our corporate fleets.

We will:

- Promote the benefits of ULEVs and provide the public with a hands-on experience of the vehicles, including at the Regent Street Motor Show (autumn 2015) and London Motor Show (spring 2016).
- Pilot a fleet audit programme in London boroughs, providing participating boroughs with a comprehensive report of the benefits of different fleet management options (such as leasing, rental and car clubs) which will include benefits of ULEVs, from winter 2015/spring 2016.
- In the medium term and subject to the success of upgrading fleets to include ULEVs, roll out the fleet audit programme to businesses in the private sector from early 2017.

We call on:

- OLEV and vehicle manufacturers to collaborate with TfL to develop London-based proposals to increase public awareness and acceptance of ULEVs.
- Boroughs (and later, businesses) to take part in TfL’s fleet audit programme.

### 4.3 Medium term actions

**Introduction**

To date, TfL has been a leader on the ULEV agenda, delivering one of the world’s cleanest bus fleets, preparing for the introduction of the Ultra Low Emission Zone, and demonstrating the benefits of using ULEVs in our own support fleet. However, the significant uptake in ULEVs in London so far is just the tip of the iceberg in terms of London’s potential. We must continue to work with industry to stimulate faster, wider uptake in the next 10 years and take the ULEV market beyond the innovators and early adopters.

We need to capitalise on new opportunities to support ULEVs by offering new types of charging options, such as rapid charging, as well as new incentives and packages of measures that work together in a geographical area. We can imbed ULEVs more
into wider business activities, such as in procurement processes. We also need to help promote the benefits of ULEVs for commercial fleets, where the reduced fuel costs can significantly reduce total costs of ownership, but recognise and help overcome the challenges for commercial vehicles, such as the compromises between battery size, electric range and payload.

**Rapid charge point network**

Rapid charging is defined as having a power rating of greater than 40kW, usually 43kW AC, 50kW DC or greater. Rapid charge points can charge a vehicle battery considerably faster than standard charging, delivering an 80 per cent charge in 20-30 minutes. They are ideally suited to high mileage urban fleet duty cycles. To develop the most effective rapid charge point network for London, we are currently undertaking an early market engagement exercise through a Prior Information Notice (PIN). We have also undertaken distinct pieces of research looking at different aspects of rapid charging.

Element Energy has conducted a study for TfL that investigated how networks in other cities and regions have been funded, installed and managed (this study will be published in summer 2015). While London has its own specific challenges, in particular with regards to the limited space availability and capacity of the electricity distribution network, there are still many valuable lessons to be learnt from others. The research found that there are a number of commercial and operational models being employed in the UK and Europe, but that there is a core set of challenges and barriers likely to be experienced, including siting and practical considerations, making a business case and the end-user experience.

![Figure 9: Key themes raised in the Rapid Charge Point Network Study (Element Energy, 2015)](image)
To understand where rapid charge points would be best located, TfL has commissioned Energy Saving Trust to carry out two studies to understand movements of likely users, notably zero emission capable (ZEC) taxis and commercial fleets\(^7\).

The first of these, a Feasibility Study for Rapid Charging for Taxis (to be published summer 2015), identified the need for 90 rapid charge points in central London to meet the needs of the ZEC taxis (see Action 11). Based on current taxi driver working patterns and the likely capabilities of ZEC taxis currently being designed, the study recommended types of locations that would fit best with taxis drivers’ needs. For example, these could be where taxis already congregate, such as stations, hotels, airports, or cabmen’s shelters.

Owing to space and electricity network constraints, it is likely that in very central locations one or two should be installed in each location. In areas further from central London, where there might be more space, ‘hubs’ of three or more charge points are recommended. The map in Appendix 3 shows potential locations based on this analysis alone (ie not taking into account site-specific planning requirements or potential electricity constraints).

This research and our own analysis have identified that:

- In total, 150 rapid charge points are likely to be needed in 2018 for ZEC taxis, ZEC PHVs, other commercial vehicles and car clubs
- Of these, 90 charge points will be needed for ZEC taxis in 2018 (see Action 11)
- The network will need to expand further by 2020. The extent and locations of this wider network will be determined as a result of how the initial round of rapid charge points are used (it is currently estimated that 300 rapid charge points will be needed by 2020)

Through this study and our wider stakeholder engagement, TfL and the GLA are also aware of the potential challenges in terms of the high power requirements of rapid charging. We are working closely with UK Power Networks (UKPN) and the Department of Energy & Climate Change (DECC) to understand how best to approach this issue in delivering a network of rapid charge points, particularly in terms of identifying suitable locations with minimal cost implications.

The second Energy Saving Trust study is a new fleet mapping exercise, building on our previous work together on the Plugged-In Fleets Initiative to map the potential ULEV requirements of commercial fleets operating in London. Telematics data from more than 2,000 vehicles operated by 26 fleets was analysed to identify those routes which could be completed using a suitable ULEV and where rapid charge points

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\(^7\) Further studies on private hire vehicles and car clubs will be carried out later in 2015
should be located to support the use of these vehicles. The interim findings have identified 85 sites for rapid charge points.

A sample of the mapping outputs from the two Energy Saving Trust studies for TfL can be found in Appendix 3. This research, alongside the results of the PIN and stakeholder meetings, will be used to inform our deployment strategy for rapid charge points in London.

**Action 6: Deploy a rapid charge point network by 2018**

We have undertaken research to identify where a strategic network of rapid charge points would be needed. We are now undertaking early market engagement through a PIN and through stakeholder engagement to identify the best way of deploying rapid charge points in London. We intend to issue an Official Journal of the European Union (OJEU) invitation to deliver a network later this year.

We will:

- Work with private hire and other commercial operators such as car clubs to understand their needs for rapid and other charging infrastructure (autumn 2015)
- Undertake early market engagement through the PIN to understand the best deployment mechanism for London’s rapid charge point network and issue an OJEU invitation in autumn 2015
- Work with suppliers to deliver a network of 150 rapid charge points by 2018

We call on:

- Boroughs to help TfL secure the right locations for rapid charging, especially in central London
- Industry and stakeholders to engage with us via the PIN on how to deliver rapid charging in London
- OLEV to support the delivery of rapid charging in London through its infrastructure funding
- UKPN, DECC and key stakeholders in the London energy market to help us develop a deployment strategy for rapid charging, taking into account grid capacity in identifying potential locations

**Providing for ULEV owners without off-street parking**

In London, many residents and workplaces do not have access to dedicated off-street parking facilities so cannot install their own charge points. This leads to potential ULEV owners not having the confidence to purchase a ULEV or sometimes trailing leads from household sockets across pavements, which can be hazardous to pedestrians. While OLEV offers grants for residential on-street charge points, few boroughs are yet to take this up. One reason for this is the high demand for parking...
space, which makes it difficult for boroughs to reallocate on-street parking spaces to ULEVs. Enforcement of ULEV-dedicated bays is also a significant challenge. We need to find new, more flexible solutions to provide on-street parking infrastructure in the context of parking space scarcity.

Led by Hackney Council, TfL and a number of boroughs have commissioned WSP Parsons Brinckerhoff to undertake research into alternative options for these users. The study, to be published this summer, found there are a variety of different options for different contexts, so there is unlikely to be a ‘one size fits all’ solution. Flexibility and interoperability is therefore necessary to improve the customer experience and a range of options should be considered. These could include alternative technologies for charging on-street, eg taking power from street furniture, innovative technologies such as inductive and portable chargers, or using solutions to improve the safety of cable charging from home electricity supplies. A comprehensive investigation of all of these options will be provided in the final study.

**Action 7: Provide charging solutions for residents without off-street parking**

TfL wants to hear about new, innovative solutions and will continue to meet with new providers interested in bringing their products to London.

We will:

- Encourage and support boroughs to sign up to the OLEV funding programme to provide on-street residential charging for ULEV owners
- Provide guidance and technical support on the charging options for on-street charge points (research report to be published by autumn 2015)
- Review the role of the Mayor’s Transport Strategy and boroughs’ annual Local Implementation Plan funding in driving delivery of residential charging infrastructure where needed

We call on:

- OLEV to help us develop technical solutions for residents without access to off-street charging
- Businesses and public sector organisations to install workplace charge points

**Incentivising uptake**

Incentives can be an effective way of encouraging ULEV uptake and we need to do more to incentivise ULEVs over conventional vehicles.

The ULED for the Congestion Charge has been very successful in encouraging uptake of ULEVs, providing a 100 per cent discount for fully electric vehicles and/or those emitting less than 75g/km CO₂ and meeting Euro 5 standards. Only BEVs and PHEVs currently meet this standard. In a recent survey, 48 per cent of respondents
said that avoiding paying the Congestion Charge was a motivating factor when choosing to purchase a ULEV. As of March 2015, nearly 4,000 vehicles had registered for the ULED.

Free parking for ULEVs has also been a successful incentive to date. However, as the ULEV market grows and becomes a more mainstream option, this will not be sustainable in the long-term and incentives will have to be reviewed.

**Action 8: Offer attractive incentives to stimulate ULEV uptake**

We can review the requirements for the ULED as vehicle emission standards improve and incentivise ULEVs over conventional petrol and diesel cars through priority access or preferential rates. Boroughs can also implement preferential parking permit charges for vehicles based on emissions. These could be delivered in new area-based schemes, such as Low Emission Neighbourhoods (LENs) (see Action 9).

We will:

- Review the ULED requirements as emission standards improve so only the cleanest vehicles are incentivised
- Ensure the revised London Plan includes sufficient minimum requirements for charging infrastructure at new developments
- Place ULEVs at the centre of future Mayoral transport strategies for delivering a sustainable transport future for London
- Work with boroughs to explore preferential access, parking or charging in new area-based schemes such as LENs, as part of future revisions of policy

We call on:

- OLEV to continue the plug-in car grant and plug-in van grant
- The government to ensure fiscal incentives only encourage and promote the cleanest vehicles, and consider both carbon and air pollutant emissions in any eligibility requirements

**Local air quality schemes**

The concept of Low Emission Neighbourhoods (LENs) was introduced in TERM. They are area-based schemes that include measures focused on reducing emissions and promoting sustainable living. A LEN will be delivered by a borough with support from TfL, the GLA and the local community. LENs require targeted local action to increase the uptake of ULEVs, encourage a reduction in overall vehicle mileage and make improvements to the urban realm. Measures could include traffic management, parking management, providing ULEV charging infrastructure, including for taxis and freight vehicles, geofencing, plus freight and servicing plans. There is also an opportunity to encourage commercial uptake of ULEVs through restricted loading bays or prioritised delivery booking slots.
Funding is available via the Mayor’s Air Quality Fund (MAQF) for boroughs to develop LEN proposals. TfL has produced guidance to boroughs on measures that could be included within a LEN\textsuperscript{8}. The measures introduced are expected to be visibly transformative and could include significant redesign of roads and urban features. City Hall will be looking for ambitious and holistic approaches to tackling the issue of air quality.

**Action 9: Support the implementation of local air quality schemes**

We will work with boroughs to access funding and support the implementation of Low Emissions Neighbourhoods and Neighbourhoods of the Future, through the Mayor’s Air Quality Fund.

We will:

- Provide funding, data and guidance for boroughs to develop LENs. Boroughs are invited to apply for the Low Emission Neighbourhoods scheme by the end of July this year, with implementation of the first two schemes expected to start by June 2016.

We call on:

- Boroughs to draw up innovative proposals for LENs which incentivise ULEV, particularly commercial vehicles, for example through priority loading and servicing access.

\textsuperscript{8} [www.tfl.gov.uk/transport-emissions](http://www.tfl.gov.uk/transport-emissions)
Procurement

As a major vehicle operator in London, TfL can stimulate the uptake of ULEVs through our own procurement processes and set an example to and share knowledge with other organisations. We are already working with our vehicle suppliers to improve the terms on which ULEVs are leased to provide best value and ensure ULEVs are a cost-effective option for procurers across TfL.

We are also looking into establishing a new procurement framework for electric vehicle charge points. This would be open to a wide range of suppliers, enabling a simplified purchasing process and realising the financial benefits delivered by bulk procurement.

Action 10: Streamline the ULEV and charging infrastructure procurement processes

TfL is looking into implementing a new procurement framework for EV charge points to support the electrification of TfL support fleet. TfL’s distribution services will also work with its suppliers to improve the terms on which ULEVs are acquired to help meet the target of 120 ULEVs in the TfL fleet by end 2016.

We will:

- Develop a new infrastructure procurement framework that is open to established and new entrants to the charge point market and provides best value for procurers in the GLA Group. The new framework will be in place by the second quarter of 2016
- Develop a strategy for rolling out a cohesive charge point network across the TfL estate for the benefit of the whole organisation, by the end of 2015
- Identify the most suitable internal combustion engine (ICE) vehicles on the TfL fleet to be substituted for ULEVs, depending on vehicle class, location and operational duty, by the end of 2015
- Provide guidance and support to boroughs and other public sector organisations that are planning the procurement and distribution of ULEVs and supporting infrastructure. This assistance will be provided through workshops and stakeholder engagement during the second half of 2016

We call on:

- Boroughs and public sector organisations to engage with us in developing best practice guidance and a procurement framework for ULEVs and supporting infrastructure
- Boroughs and public sector to set targets for the inclusion of ULEVs in their fleet, where these do not already exist
- OLEV to allocate additional funding for the provision of infrastructure in public sector buildings
Ultra Low Emission Zone (ULEZ)

The ULEZ will come into operation in central London on 7 September 2020. It will require motorcycles, cars, vans, minibuses, coaches, non-TfL buses and heavy goods vehicles travelling in the Congestion Charge zone to meet new emission standards or pay a daily charge, significantly improving air quality and helping to protect the health of Londoners. It will operate 24 hours a day, seven days a week, 365 days a year. More information on ULEZ and how it works can be found in Appendix 4.

The ultra low emission aspects of ULEZ focus on commitments for ground-breaking improvements to the TfL bus fleet and to TfL-licensed taxi and PHVs, as discussed below.

Delivering the world’s cleanest bus fleet

ULEZ will require single deck buses operating within the ULEZ to be zero-emission at tail pipe. This will affect 15 current routes with a combined Peak Vehicle Requirement (PVR) of 256 vehicles. Field trials of eight electric buses (on routes 507, 521, H98 and 312) are already under way and will inform the ULEZ single-deck bus deployment strategy and timing of the migration from diesel to electric by 2020. Following the initial deployment of two deploying electric buses on route 312, we will be fully converting this route to electric by autumn 2015.

Additional electric buses may be required to replace the number of diesel buses currently in operation, to account for the need to recharge during the day. The final number is subject to further monitoring data and evaluation, developments in technology and the bus companies’ proposed charging strategies for each route.

All double-deck buses operating within the ULEZ from 2020 will be hybrid diesel-electric and will meet the Euro VI standard for NOx emissions, or be New Routemasters. Buses with Euro VI engines first entered service in the TfL fleet in April 2014 and from 2015 all new buses entering service have been Euro VI (typically 700 per year). Buses with a Euro VI Engine have been tested by TfL for emissions in real-world driving conditions. The tests have found the Euro VI buses to have 95 per cent lower NOx emissions than a conventional bus with a Euro V engine (down from 10g/km to 0.5g/km). This correlates with testing conducted by manufacturers.

The Euro VI programme complements the work the Mayor and TfL are doing to reduce emissions from the bus fleet, including the roll out of hybrid buses, with nearly 1,300 currently in service on London’s roads, 1,700 due to be in operation by 2016 (equivalent to around 20 per cent of the total bus fleet) and 3,400 in operation by 2020.
Zero emission capable taxis

TfL licenses all taxis and PHVs operating in London. We can therefore use licensing conditions to reduce emissions from these fleets across London and encourage the uptake of ULEVs. From 1 January 2018, subject to public consultation, all new taxis and PHVs presented for licensing in London for the first time will need to be zero emission capable (ZEC)\(^9\).

For taxis, a ZEC vehicle is defined as ≤50g/km CO\(_2\) with a minimum zero emission range of 30 miles. The zero emission requirements for PHVs will be aligned with the government’s criteria for the plug-in car grant. This means that ZEC taxis and PHVs could be battery electric vehicles (BEVs), plug-in hybrids (PHEVs) or range-extended electric vehicles (RE-EVs).

Both taxis and private hire owners will benefit from OLEV’s plug-in-car grant (currently £5,000). To reduce the purchase costs of the new ZEC London taxis, TfL has also secured £25m from DfT to provide additional taxi top-up grants for ZEC London taxis. This will provide a £3,000 grant for early adopters, on top of the plug-in car grant.

TfL is also proposing to introduce a taxi decommissioning scheme, subject to public consultation, which would incentivise the drivers of the oldest taxis not to relicense the vehicles in London, thereby removing the most polluting taxis from London’s roads.

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Action 11: Achieve ZEC taxis and PHVs on London’s streets from 2018

A six-week public consultation on the ZEC requirements for taxis and private hire licensing proposals from 2018 was launched on 30 June 2015. TfL will carry on working with the taxi and private hire trades to introduce the necessary infrastructure and incentives to stimulate the early uptake of ZEC taxis and private hire vehicles.

We will:

- Continue to work closely with stakeholders to understand the needs of the trade and the plans of manufacturers to ensure suitable charging infrastructure is available, including rapid charging (Action 6) and residential charging options (Action 7)
- Administer ZEC London taxi top-up grants, as well as decommissioning grants for taxis older than 10 years to encourage accelerated uptake of ZEC taxis

We call on:

- Taxi and PHV owners and operators to help London’s transport go ultra low emission by purchasing or leasing ZEC vehicles

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\(^9\) For seven-seater PHVs we will be consulting on a two-year sunset period after 2018.
Commercial vehicles

Commercial vehicles offer both an excellent opportunity and a significant challenge for the uptake of ULEVs. There is enormous variation in the types of businesses in this market, ranging from those with large depot-based fleets, through to sole traders with vehicles also used as private vehicles. There are also issues with the vehicles themselves, with the additional weight from batteries impacting on the available payload\(^\text{10}\) and the higher upfront costs for van operators. However, as commercial vehicle investment decisions are made on whole life costs, ULEVs could be attractive to fleet managers and business owners responsible for reducing fuel costs.

TfL’s Freight and Fleet team has a proven track record of working with the industry to implement transformative schemes such as the Construction Logistics and Cyclist Safety programme (CLOCS) and Fleet Operator Recognition Scheme (FORS). We have also worked with the receivers of goods, who can implement policies and processes to reduce the impact of their deliveries. TfL will now build on the relationships and expertise developed with the industry to implement a new Low Emission Commercial Vehicle (LECV) Programme. The LECV will launch this year and aims to accelerate the development, supply and widen uptake of low emission commercial vehicles and refuelling infrastructure.

\(^{10}\) While there is some leeway in the legislation for BEV vans, this may force some operators to move to heavier vehicles and vehicles over 3.5 gross weight are subject to more onerous regulations
**Action 12: Increase the uptake of ULEVs in freight and fleet organisations**

Building on our experience and relationships with the freight and fleet industry, TfL will continue to provide advice and support to commercial vehicle operators to help accelerate the uptake of ULEVs in commercial fleets. This will include the implementation of the Low Emission Commercial Vehicle Programme.

We will:

- Implement the Low Emission Commercial Vehicle Programme, starting with a scoping and feasibility exercise from summer 2015
- Use our experience of setting FORS standards as a foundation for new voluntary environmental standards for commercial fleets and lead by example through our own procurement requirements
- Inform and support fleet operators, boroughs, vehicle manufacturers and cleaner fuel suppliers to increase the availability and uptake of LECVs and their fuel needs
- Prepare the freight industry for the introduction of the ULEZ in 2020

We call on:

- Boroughs to use local policy measures such as priority loading and micro-consolidation (using ULEVs for last mile deliveries) to incentivise ULEV uptake among businesses and freight operators
- Boroughs to lead by example and require suppliers’ vehicles to meet environmental standards, implementing ULEVs where feasible
- Industry to invest in the development of cost-competitive commercial ULEVs
- Government to review the regulations on payload to implement a concession for instances where battery load contributes to taking payload over 3.5 tonnes

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4.4 Long term actions

**Introduction**

The world of ULEVs is rapidly evolving. New vehicles and smart technologies are constantly being developed and brought to market, aiming to reduce emissions, maximise efficient use of infrastructure and improve the service for customers. TfL has led the way in trialling this new technology, most notably with our bus fleet and with the GLA on trialling hydrogen fuel cell vehicles. We are also involved with a number of exciting EU projects seeking solutions to the emissions and logistical problems faced by busy, densely populated cities such as London.

**Innovation**

We will continue to play a lead role in trialling new ultra low emission transport technologies in London and work with companies to trial their near-market products. We will support the demonstration of new solutions and enablers, such as inductive
charging and geofencing, to test how they meet the real-world demands of London’s transport system. As the electricity distribution network is already near capacity in many parts of London, we also need to investigate energy storage and dynamic demand management to accommodate the high energy demands of rapid charge points and the cumulative effect of standard charging.

**Box 3: ZeEUS: trialling inductive charging trials with our buses**

Three plug-in hybrid double-deck buses are to be trialled as part of the ZeEUS demonstration project, which will evaluate high-power wireless (inductive) charging. It will also assess the benefit of an extended-range series diesel-electric hybrid configuration which can be externally recharged. The charging can be facilitated through wireless power transfer during normal service operation (‘opportunity charging’) or by conductive (‘plug-in’) charging, typically at night at the bus garage.

**Action 13: Demonstrate and test new technologies and approaches**

TfL and the GLA will provide support and funding for new companies looking to demonstrate near-market innovations in a real-world CITYLAB situation (see Box 4 below). TfL will work closely with providers to share our knowledge of London’s needs so that any trials in London result in solutions for our specific problems. In return, we will gather vital data to help us make decisions about future investment.

We will:

- Trial innovative ULEV solutions, with a particular focus on solving the challenges of the demands on the electricity distribution network and reducing the space needed for infrastructure, from 2016
- Continue to take part in new EU projects, such as ZeEUS and ELIPTIC (see Boxes 3 and 4), that focus on ULEV uptake and charging solutions, including inductive charging, smart demand management and energy storage
- Trial inductive wireless charging in the bus fleet
- Conduct research, as part of the London Energy Plan (due to be published December 2015) into how to manage grid capacity more effectively. This could include demand side response technologies and services and generation of decentralised energy to balance supply with demand and ultimately reduce demand.

We call on:

- OLEV to continue supporting research and development into new vehicle technologies and innovative charging solutions
- UKPN, DECC, OLEV, Ofgem, and the energy industry to continue innovating with new energy system approaches that assist us in overcoming London’s energy challenges
**Box 4: EU projects: innovation through collaboration**

TfL is involved in a number of European projects involving ULEVs for freight and logistics. Current and recently awarded projects include:

- **FREVUE**: through which electric freight vehicles will be exposed to daily rigours of urban logistics to prove they can offer a viable alternative to diesel vehicles
- **CITYLAB**: which aims to improve city logistics by establishing seven living laboratories to test different solutions including using ULEVs
- **ELIPTIC**: which will assess the feasibility of accessing and sharing the Underground electricity distribution network to charge electric buses at transport hubs and bus garages, reducing reliance on the public electricity distribution network

We will continue to look for new opportunities to use EU funding to undertake ground-breaking trials and share knowledge and learning with other cities.

**Geofencing**

Geofencing uses GPS systems to create a virtual zone around a particular location. This could be used to set up a zero emission zone. PHEVs or RE-EVs could be programmed so that their vehicle is switched into electric mode when they enter the zone. Geofencing could be configured to allow ‘hard zones’, where certain vehicles must always run in electric mode and ‘soft zones’ where they switch to electric mode if there is enough battery charge remaining. The triggers could also be set to only operate in a certain time period, such as peak congestion times.
**Action 14: Test and evaluate the application of geofencing for zero emission capable vehicles**

Geofencing technology is already being trialled for buses (see Box 5). Depending on the results of these trials, the technology could also be used in Low Emission Neighbourhoods and other roads with high concentrations of emissions and high levels of pedestrian activity, such as Oxford Street. Subject to feasibility, testing and working with the manufacturers, it could also be used to require all ZEC taxis to operate in electric mode in central London or certain air quality focus areas.

We will:

- Continue to evaluate geofencing for buses through the ZeEUS and Route 159 projects
- Engage with ZEC taxi manufacturers to understand the technological feasibility and cost/benefits of geofencing for taxis
- Depending on the results of the above, undertake a new trial with taxi manufacturers to understand the feasibility of this technology and the potential air quality benefits

We call on:

- Taxi manufacturers to collaborate with us to understand the feasibility and potential for a trial of geofencing

**Box 5: Geofencing trials**

Trials are already under way in London and learning from these initiatives will inform further research into the potential of Geofencing technology for the wider bus fleet and taxi applications.

- **ZeEUS**: In London, the EU-funded ZeEUS project is investigating the effectiveness of geofencing on three inductively-charged diesel electric hybrid buses on Route 69 from Walthamstow to Canning Town. The geofencing element of this project is planned for 2016

- **Route 159 geofencing evaluation**: We will use bus route 159 (which includes Oxford Street) as a test route for geofencing, with the aim of producing a geofencing prioritisation toolkit for buses in air quality hotspots in 2016. Route 159 includes a number of air quality hotspots that can be overlaid on the Millbrook bus drive cycle testing facility, to determine the optimum locations for operating in electric mode. If the Route 159 trial is successful, TfL will have a logical and hierarchical approach to the rollout of geofencing ready for when suitably-equipped RE-EV or PHEV vehicles are available
Hydrogen transport

TfL and the GLA are supportive of hydrogen transport and the development and commercialisation of Fuel Cell Electric vehicles (FCEVs). FCEVs run on compressed hydrogen fed into a fuel cell stack that produces electricity to power the vehicle. Some of the benefits of hydrogen include:

- A low to zero-emission source of energy (depending upon the source of the hydrogen used), offering long term emission savings
- Decarbonisation of energy: hydrogen can be produced from various energy sources, including renewables
- Reduced noise: there is no combustion process in a fuel cell
- Diversity of energy supply: reducing reliance on imported fossil fuels
- Increased resilience to power outages
- Economic opportunities: due to local production/supply of the fuel and technology development and application. Also, hydrogen can attract new investment into London as well as developing skills and creating opportunities for new jobs

The Mayor’s Hydrogen Programme is working with industry, public bodies and academia to address the final issues prior to commercialisation. To date, the programme has secured significant initial investment from industry and Europe to enable vehicle deployment and refuelling infrastructure. The GLA is active in the UK H2Mobility programme (see Box 6) and the EU-funded Hydrogen for Innovative Vehicles (HyFIVE) project, http://www.hyfive.eu.

There are three operational hydrogen refuelling stations in London; two publicly accessible stations based in west London (Hatton Cross) and northwest London (Hendon) and a third in east London (Leyton) used by the hydrogen buses (see Box
There are three more stations, deployed through the HyFIVE EU project, which will become operational by end of 2015.

Government funding of £9m will enable us to build further two new stations, planned to be operational by end of 2016.

**Action 15: Ensure London is ready for the commercialisation of hydrogen transport**

Hydrogen vehicles are nearing commercialisation and we want to ensure London is a leading European city for hydrogen transport when this happens.

**We will:**

- Use future funding opportunities to increase the deployment of hydrogen vehicles in the TfL fleet and encourage other public bodies to do the same
- Continue to lobby UK government for sector support and include hydrogen as a viable option for a zero emissions future for London in our own policy
- Support creation of policy and standards for forecourt integrated hydrogen refuelling stations

**We call on:**

- Industry and London boroughs to work with us to provide wider coverage of hydrogen refuelling stations, using available funding from UK government and EU for the installation of new stations to provide strategic coverage across London
- UK government for continued funding and support for this exciting new sector

**Box 6: UK H2Mobility**

H2Mobility is a collaborative project between government and industry partners (including the GLA), brought together to evaluate the environmental and economic benefits of hydrogen fuel cell transport technology and determine the potential uptake of FCEVs in the UK. The project has evaluated the potential market for FCEVs, including customer perceptions and appetite for FCEVs, and developed a roadmap which sets out a likely timeline for FCEV uptake.

The UK H2Mobility Phase 1 results predict that as the price of vehicles becomes more competitive (when fully commercialised production brings costs down) and the refuelling network develops, by 2030 FCEV uptake could increase to 1.6 million FCEVs, with annual sales exceeding 300,000. It recommends that an initial national network of 65 hydrogen refuelling stations is required to kick-start the market in the UK and that this would rise to 1,150 stations by 2030. More information can be found at: [www.ukh2mobility.co.uk](http://www.ukh2mobility.co.uk)
Box 7: Hydrogen FCEVs in the TfL support fleet

In October 2014, TfL acquired two Hyundai ix35 hydrogen FCEVs for our support fleet on a four-year lease. This is part of the HyTEC project, which aims to create three new European hydrogen passenger vehicle deployment centres in London, Copenhagen and Oslo. The goal of the HyTEC project is to demonstrate the day-to-day use of hydrogen vehicles and encourage their mainstream use by the public, at the same time encouraging manufacturers to bring competitively priced vehicles to market. The FCEVs are used by TfL’s Bus Operations management team to undertake a number of tasks, including checking bus route diversions and carrying out site meetings.

Hydrogen buses in London

TfL currently runs eight zero-emission hydrogen fuel cell buses on route RV1. Two additional fuel cell buses will join this route in 2015/16. These buses are refuelled in the Leyton hydrogen refuelling station.
5 Conclusions and next steps

5.1 Conclusions

London has come a long way in making ULEVs part of our sustainable transport system. We have implemented the Source London network of more than 1,400 charge points, we have a clean bus fleet which includes fully electric and hydrogen fuel cell vehicles and we will implement new zero emission capable licence requirements for taxis and PHVs from 2018.

However, there are still many benefits yet to be realised through a wider uptake of ULEVs: for improving air quality and reducing carbon emissions, achieving the associated health benefits of improved air quality, as well as economic benefits for London and the rest of the UK.

TfL and GLA will provide the strategic leadership needed to ensure that London has a cohesive network of charging and refuelling infrastructure that meets the needs of all users and ULEV types. We also need to raise public awareness and acceptance of the opportunities ULEVs offer. But we cannot do this alone. To achieve significant uptake and realise the potential benefits, we need to work together with government, boroughs and industry partners to overcome the challenges outlined in this Delivery Plan.

Together we can ensure that London has the right infrastructure, incentives and supportive policy to make ULEVs the obvious choice of vehicle for residents and commercial operators in London and achieve the uptake needed to fulfil the Mayor’s vision to make London the electric vehicle capital of Europe.

5.2 Next steps

With the cooperation of other key partners in the ULEV industry, in both the public and private sector, we will deliver the 15 key short, medium and long term actions set out in this document.

As well as these actions, we will continue to build our relationships with stakeholders and partners. We will continue to meet regularly to further our understanding of all ULEV users’ needs and identify new solutions to enable mainstream uptake of ULEVs. We will also continue to look for new innovations and solutions and welcome new ideas that could be trialled in London.

In addition to individual stakeholder conversations, it is important that the industry gets together to discuss the issues specific to London. Therefore, after the launch event for this ULEV Delivery Plan in July 2015, we will hold an annual ULEV event. These events will provide an open platform for all industry and public sector stakeholders to continue to share knowledge and ideas, helping to ensure we are on track to deliver on our actions and maximise the uptake of ULEVs in London.
Appendix 1: Charging matrix

This matrix sets out the variety of possible electric vehicle charging location types the different charging needs of the various ULEV user groups.

<table>
<thead>
<tr>
<th>Domestic</th>
<th>Residential</th>
<th>Depot</th>
<th>Workplace</th>
<th>Public On-Street</th>
<th>Public Off-Street</th>
<th>Restricted Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard domestic socket or dedicated wall-box in garage or driveway</td>
<td>On-street charge point provided for residents where no off-street parking is available</td>
<td>Standard domestic socket or dedicated charge point in vehicle depot</td>
<td>Charge point provided in workplace car parking</td>
<td>Charge point provided on-street, either open access or requiring payment</td>
<td>Charge point located in car parks, either open access or requiring payment</td>
<td>Charge point off-street or on-street restricted for use by certain types of vehicle, eg, taxi, car club</td>
</tr>
</tbody>
</table>

| Private cars | Slow, Fast | Fast | Slow, Fast | Slow, Fast, Rapid | Slow, Fast, Rapid |
| Private motorcycles | Slow, Fast | Fast | Slow, Fast | Slow, Fast | Slow, Fast |
| Car clubs | Slow, Fast | Fast | Slow, Fast | Fast, Rapid | Slow, Fast |
| Private sector fleets | Slow, Fast, Rapid | Fast, Rapid | Fast, Rapid |
| Public sector fleets | Slow, Fast, Rapid | Fast, Rapid | Fast, Rapid |
| Taxi | Slow, Fast | Fast | Fast, Rapid | Fast, Rapid |
| Private hire vehicles | Slow, Fast, Rapid | Fast, Rapid | Fast, Rapid |
| Buses | Fast, Rapid | Fast, Rapid | Fast, Rapid |
| Commercial fleet vans | Slow, Fast, Rapid | Fast, Rapid | Fast, Rapid |
| Heavy goods vehicles | Slow, Fast, Rapid | Fast, Rapid | Fast, Rapid |

Definitions: Slow = 3kW, Fast = 7kW-22kW, Rapid = 43kW AC or 50kW DC (or higher)
Appendix 2: projected ULEVs by borough in 2020 and 2025

These are estimates based on a number of assumptions (including the current number of cars and vans in that borough, which varies significantly). They give an indication of the variation of ULEV uptake that could be expected across the boroughs in the next 10 years.

The borough with the highest number of ULEVs (cars and vans) predicted in this study in the baseline scenario in 2025 is Barnet, with more than 9,000, rising to over 16,000 if the high BEV scenario uptake is achieved. In the high BEV scenario in 2025, Hillingdon has the highest projected numbers of ULEVs (over 17,000).

Table 3: Projected ULEVs (cars and vans) in London boroughs in the baseline and high BEV scenarios (based on EE & WSP PB model, 2015)

<table>
<thead>
<tr>
<th>Borough name</th>
<th>Baseline scenario</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<td></td>
<td>2015</td>
<td>2020</td>
<td>2025</td>
<td>2015</td>
<td>2020</td>
<td>2025</td>
</tr>
<tr>
<td>Barking and Dagenham</td>
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<td>21</td>
<td>399</td>
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<td>332</td>
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<td>142</td>
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<td>4,034</td>
<td>119</td>
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<td>12,677</td>
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<td>4,169</td>
<td>131</td>
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<td>16</td>
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</table>
Appendix 3: Sample rapid charge mapping study outputs

Feasibility study for rapid charge points for plug-in taxis (Energy Saving Trust, 2015)

The map below shows recommended possible locations for rapid charge points and charging hubs (three or more charge points) to serve zero emission capable taxis in and around central London.

![Map showing recommended locations for rapid charge points for taxis](Image)

**Figure 10: Recommended locations for rapid charge points for taxis (Energy Saving Trust for TfL, 2015)**

Draft output from fleet mapping for rapid charge points (Energy Saving Trust, unpublished)

A total of 26 commercial fleets took part in this study to identify routes that could be suitable for ULEV's and where rapid charge points could be located to support those vehicles. The following map shows the 85 identified potential locations.
Figure 11: Possible locations for rapid charge points for commercial fleets (draft output, Energy Saving Trust for TfL, unpublished)
Appendix 4: Guide to the ULEZ

From 7 September 2020, all vehicles must meet ULEZ emissions standards to travel in the zone without charge.

### Tfl Buses
- By 2020, all double deck TfL buses operating in the zone will be hybrid and all single deck buses will be zero emission
- A substantial number of double deck buses operating in inner London will also be hybrid, as will many in outer London

### Taxis (*subject to consultation*)
- Taxis are exempt from the ULEZ scheme
- From 1 January 2018, all newly licensed taxis must be zero emission capable (≤50 g/km CO2 and 30 miles minimum zero emission range)*
- The taxi age limit will remain at 15 years. To remove the oldest, most polluting vehicles from London’s streets, TfL will run a voluntary decommissioning scheme. This will compensate drivers of 10-15 year old taxis to not re-license the vehicle in London*
- ZEC taxis eligible for purchase grant of £3,000 from TfL on top of OLEV plug-in car grant
- TfL will ensure a rapid charging network is in place by 2018 to support the introduction of ZEC taxis

### Private hire vehicles (*subject to consultation*)
- Must meet ULEZ standards to drive in zone without charge
- Age limit for PHVs remains 10 years
- From 1 January 2018, all newly licensed PHVs (up to 18 months old) must be zero emission capable (≤50 g/km CO2 and 10 miles minimum zero emission range, or 50-75 g/km CO2 and 20 miles minimum zero emission range)*
- 7-passenger PHVs would not need to meet ZEC requirements until September 2020 because of a lack of suitable vehicles*
- PHVs can benefit from OLEV’s plug-in car grant. OLEV has £200m available until 2020

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*Euro standards for heavy-duty diesel engines use Roman numerals and light-duty vehicle standards use Arabic numerals.
**Vehicles this age or younger in 2020 will comply with the ULEZ standards and not incur a charge.
***This is payable in addition to any applicable LEZ or CO charges.
How will ULEZ work?

- The ULEZ will operate 24 hours a day, 7 days a week in the same area as the current Congestion Charging zone (CCZ)
- All cars, motorcycles, vans, minibuses and HGVs will need to meet exhaust emission standards (ULEZ standards) or pay an additional daily charge to travel within the zone
- There will be no barriers and tollbooths. Cameras will read your number plate as you enter, leave or drive within the zone and check it against the database of those who meet the ULEZ standards or need to pay the daily charge
- The ULEZ standards are in addition to the Congestion Charge and the Low Emission Zone requirements
- TfL is working with manufacturers to develop a retrofit solution for buses – this could potentially be expanded to HGVs and coaches

Residents’ discount

- Residents who live in the ULEZ will be granted a three year sunset period with a 100% discount to give them more time to change their vehicle to meet the ULEZ standards
- The discount will be available to those who live in the ULEZ from 2020 to 2023 and will only apply while they live within the zone
- After 6 September 2023 residents must pay the daily ULEZ charge to drive a vehicle in the zone if it does not meet the ULEZ standards

Vehicles for disabled people

- Vehicles that have a 'disabled' or 'disabled passenger vehicle' tax class (disabled exemption) will be granted a three year sunset period with a 100% discount, up until 6 September 2023
- After this date the daily charge will apply

Historic vehicles

- All vehicles that have a 'historic vehicle' tax class and vehicles built before 1 January 1973 will be exempt from the ULEZ

Specialist Vehicles

- A small number of vehicle types which are currently exempt from the LEZ would also be exempt from the ULEZ charge. These include:
  - Agricultural vehicles
  - Military vehicles
  - Non-road going vehicles which are allowed to drive on the highway (for example excavators)
  - Certain types of mobile cranes

- These vehicles typically use engines certified to different standards than road-going engines and are exempt due to their unsuitability for conversion to an alternate fuel or engine replacement