HM Government

Taking charge: the electric vehicle infrastructure strategy

Contents

Foreword from the Secretary of State for Transport

In November 2020, the Prime Minister put the UK on course to be the fastest nation in the G7 to decarbonise road transport, announcing that sales of all new petrol and diesel cars and vans would end in 2030. Alongside Government plans to introduce targets for sales of clean vehicles from 2024, the public discourse on zero emission motoring has now firmly shifted from if it will happen, to when.

The industry has also comprehensively embraced the transition to green road transport. By March 2022, Mini, Vauxhall, Ford, Bentley, Rolls Royce and others have committed to a zero emission future from 2030, and more than £3 billion of investment has flowed into the UK zero emission vehicle sector. In 2021, 190,000 battery-powered electric vehicles (EVs) were sold in the UK. This was more than the five previous years combined, and nearly 1 in 8 of all new cars sold. This year it will be even more.

Thanks to the huge investment now pouring into battery technology, EVs are getting cheaper to buy and more efficient to run, with many travelling over 200 miles on a single charge, which compares favourably with average daily car use. In 2019, the average car journey in England was 7-8 miles in urban areas, and about 10 miles in rural areas. Owning and running an EV has never been easier. We are now focused on developing a robust, fair and scalable charging network covering the entire country.

Our plans will get more chargepoints in the ground, quicker. They will strengthen the business case for chargepoint operators to invest now at this early stage of the transition, and the speed at which they are connected to the electricity system will accelerate.

Charging often starts at home, with most UK motorists having access to off-street parking. As an EV driver myself, I know that home-charging not only provides access to the cheaper electricity prices, but also means my car is charged each morning ready for the day ahead.

But not everyone has access to off-street parking, so we will focus efforts on installing more on-street chargepoints, providing convenient and affordable charging, ideally on the street where you live. You'll see chargers integrated into lamp posts and next to parking bays, for example. Innovative solutions are being piloted up and down the country as I write.

We expect around 300,000 public chargers as a minimum by 2030. Our goal is to ensure these chargepoints are installed ahead of demand, inspiring confidence in drivers who have not yet made the switch.

They must also be rolled out where they are needed the most nationwide. Government's role is to set the right foundations for an equitable nationwide charging roll-out, removing barriers along the way. That means tackling some of the key bugbears of current EV drivers, such as providing bankcard access or equivalent at chargers alongside phone payments, and setting standards on price transparency, reliability and open data.

We will step up the delivery of high powered chargers on the strategic road network for people making longer journeys. We already have one of the largest rapid charging networks in Europe – a 2020 study found we had more rapid chargers for every 100 miles of key strategic road than any country in Europe. Our £950 million rapid charging fund will support the rollout of at least 6,000 high powered chargepoints across England's motorways and major A-roads by 2035.

We'll also support local authorities with over £500 million of funding, helping them find innovative ways to increase local chargepoint coverage.

But Government is only part of the solution. The private sector has a critical role to play in providing convenient, affordable and reliable charging for all. We are already seeing a proliferation of public chargepoints at supermarkets, gyms and tourist attractions, installed without Government support.

Looking to the future, our goal is to completely integrate charging with our smart energy system, delivering benefits to the grid, and the potential for lower cost, or even negative, electricity tariffs for those willing to charge flexibly.

Ultimately, charging your EV should be easier, cheaper and more convenient than refuelling a petrol or diesel car, wherever you live. At the same time, we must make sure that this revolution happens alongside growth in all other zero emission and low emission forms of travel, such as walking – so we are setting out clear principles to minimise pavement clutter, prevent trip hazards for pedestrians and stop new EV charging bays precluding bus and cycle lanes.

Building a world-leading charging network will enable EV drivers to plug in and charge anywhere, be it on the street where they live, where they shop, or on route to their destination. This won't happen overnight, nor without challenges along the way. But the benefits of the zero emission motoring will be felt everywhere, with improved air quality in our towns and cities, economic growth through our automotive industry, and ultimately cheaper and cleaner driving for all.

Executive Summary

Introduction

In December 2021, over a quarter of all new cars sold in the UK were battery electric vehicles.[1] The equivalent figure for 2019 was less than 2%.[2] The decarbonisation of UK road transport is now accelerating at an astonishing pace and the UK is in the vanguard of this change. As the first G7 nation to announce phase out dates for new petrol and diesel cars, vans and trucks, we are determined to stay at the forefront of this transition. The UK recognises that a focus on vehicles is only half of the challenge. A world-class charging infrastructure is absolutely fundamental to delivering net zero road transport. This document sets out our strategic approach in delivering this charging infrastructure out to 2030.

The vast majority of drivers will do most of their charging at home, overnight. We need public chargepoints for two main purposes: to enable long distance journeys, and to support those without off-street parking.

Our vision for 2030

We will remove charging infrastructure as both a perceived, and a real, barrier to the adoption of electric vehicles (EVs). EV charging should be cheaper and more convenient than refuelling at a petrol station. Specific predictions of the future mix and number of chargepoints are inherently uncertain in 2022 due to rapid developments in battery and charging technology, and because consumer preferences about where and when they would like to charge are still being revealed. The commercial landscape for charging infrastructure is also developing quickly but the balance between fewer, higher-powered chargers and more numerous, lower-powered ones is not yet clear. By 2030, we expect there to be **around 300,000 public chargepoints** as a minimum in the UK, but there could potentially be more than double that number.

1 SMMT (2022). Available at: https://www.smmt.co.uk/vehicle-data/car-registrations/
2 DfT (2022). Cars registered for the first time by propulsion and fuel type: Great Britain and United Kingdom (VEH0253). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1046011/veh0253.ods

In any scenario, rollout must progress at pace to provide sufficient chargepoints ahead of demand and to ensure that the UK is a place where:

Everyone can find and access reliable public chargepoints wherever they live – be that city centre or rural village, urban flat or suburban house, in the north, south, east or west of the country. Charging opportunities will not be limited by income or location.

Effortless on and off-street charging for private and commercial drivers is the norm – easy overnight charging is, and will remain, the default for those with driveways. But charging should be just as convenient and stress-free for those who currently park on street. This must extend beyond privately owned cars; those who drive vans and commercial vehicles must also have access to chargepoints that meet their needs.

Fairly priced and inclusively designed public charging is open to all – there will be vibrant competition across the charging sector with choice in provider and type of charging, and open data on pricing and availability. Streets will not be cluttered by trailing charging cables.

Market-led rollout for the majority of chargepoints delivers a thriving charging sector – the sector is booming now with smart UK SMEs driving the pace of change and forcing big corporates to adapt. By 2030, this will represent a huge global opportunity for UK Plc. A thriving competitive market will help to drive down costs for consumers.

Infrastructure is seamlessly integrated into a smart energy system – to minimise the impact of the EV transition on the grid (both distribution and generation), but also to offer the lowest cost tariffs to consumers and to capitalise on the exciting opportunities of 'Vehicle-to-Grid'.

Continued innovation to meet drivers' needs lowers cost and increases convenience – because although the fundamentals of delivering electricity to charge batteries will not change, the charging landscape of 2030 will be very different. We are already seeing startling innovation in both technology (speed, smartness and delivery method) and business models (from peer to peer charging to portable tariffs).

The current state of play

The UK market: In 2022, the UK is a leader in the EV transition and in many aspects of charging infrastructure provision. There are around 29,600 public chargepoints in the UK of which over 5,400 are 'rapid' – able to charge an EV in around 30 minutes.[3] This infrastructure is serving around 750,000 plug-in vehicles (of which over half are pure battery electric).[4] These numbers compare well to the 8,000 or so UK petrol stations (with around 66,000 spaces at pumps) currently serving around 37 million petrol and diesel vehicles.[5,6]

The pace of deployment is also accelerating, with the certainty over phase-out dates driving private sector investments of hundreds of millions of pounds during 2021. There have been new commitments for thousands of chargers at workplaces, supermarkets, hotels, petrol stations, on local streets and in rapid charging hubs. On average, 100 new rapid chargers were added to the UK network every month during 2021.[7] Ten years of consistent Government support and private sector investment means that the UK charging market is unrecognisable from where it was a few years ago in breadth, depth and speed of deployment.

Key Challenges: Although recent progress has been strong, there are significant challenges, clearly identifiable in 2022, to delivering our vision for 2030:

- **The pace of rollout is too slow** – even the recent surge in chargepoint deployment is not at a pace consistent with what is needed for a wholly zero emission new car fleet in 2035. This is particularly true for local, low power, on-street charging which is so crucial for drivers without driveways. Many fleet drivers also rely on this type of charging. Planning arrangements can be complex to manage. Chargepoint installers can sometimes need multiple permissions, consents and licences, which adds time and cost to deployment.
- **Too often, public charging lets people down** – although many EV drivers with driveways discover that they can meet almost all of their charging needs at home, every EV driver wants access to a plentiful, reliable and fairly priced public charging network. But too often they experience poor customer service, opaque or excessive charging costs, poor reliability and complex access regimes involving numerous apps and smartcards.

3 DfT (2022). Charging Device Statistics. Available at: https://www.gov.uk/government/statistics/developing-faster-indicators-of-transport-activity

4 DfT (2022). Table VEH0133. Licensed ultra low emission vehicles by body type and propulsion or fuel type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01 and SMMT (2022). Available at: https://www.smmt.co.uk/vehicle-data/car-registrations/

5 Experian Catalist (2020). As of May 2020, there were 33,948 fuel pumps in the UK, offering approximately 66,000 fuelling spaces.

6 DfT (2022). The total number of battery electric cars and vans were subtracted from the total number of cars and vans to give the total number of cars and vans using petrol or diesel. Table VEH0133. Licensed ultra low emission vehicles by body type and propulsion or fuel type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01; Table VEH0101. Licenced vehicles at the end of the quarter by body type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

7 DfT (2022). Charging Device Statistics. Available at: https://www.gov.uk/government/statistics/developing-faster-indicators-of-transport-activity and https://www.gov.uk/government/collections/electric-vehicle-charging-infrastructure-statistics

- **The business case for commercial deployment can be challenging** – this can be particularly true in areas of potentially low utilisation or high connection costs. In 2022, there are significant regional disparities in deployment. This creates a chicken and egg problem with potential EV purchasers, at both individual and company fleet level, being reluctant to buy until there is more visible infrastructure.
- **Connecting new chargepoints to the electricity system can be slow and expensive** – this is a particular issue in remote areas, where new high power connections might be required, or locations where there is insufficient capacity in the existing distribution network, such as for charging of vehicle fleets in depots. Numerous chargepoint operators have brand new chargepoints installed, but are waiting for a grid connection so that they can be turned on.
- **We need more local engagement, leadership and planning** – local authorities are fundamental to successful chargepoint rollout, particularly for the deployment of widespread on-street charging. They are ideally placed to identify the local charging needs of residents, fleets and visitors. But the current picture is mixed. Some are driving the agenda forward at pace, others are short of dedicated resource and expertise. Planning permission delays are often cited as a major brake on the speed of deployment, and the interaction between local parking and charging policies is not fully resolved.

Delivering the vision

Our approach to addressing these challenges, and to delivering our vision of a world-leading public charging offer where 'range anxiety' is a thing of the past, will be based on the following strategic framework:

We will focus our intervention on two crucial sectors where we most need an accelerated pace of rollout, and where the business cases can be particularly challenging: high powered chargers on the strategic road network and local on-street charging. We will target our intervention at these two areas, addressing the key challenges:

a. We will accelerate the rollout of **high powered chargers on the strategic road network** through the £950m Rapid Charging Fund. This will unlock current barriers to deployment at some of these locations, enabling provision where the commercial case will not add up. Confidence in the ability to undertake longer journeys is fundamental to EV adoption. We will ensure that every motorway service area has at least six rapid chargers by the end of 2023, with some having more than 12. There will be over 6,000 high powered chargers along our strategic roads by 2035. Electricity network capacity at motorway service areas will be ready to meet demand to 2035 and beyond. We will consult on mandating that service area operators and large fuel retailers must meet minimum chargepoint numbers at specific sites, and at increasing levels over a period of time, to address both actual and perceived demand.

b. We will transform **local on-street charging** by putting an obligation on local authorities (subject to consultation) to develop and implement local charging strategies to plan for the transition to a zero emission vehicle fleet. These strategies should identify how to provide affordable, convenient charging for residents, businesses including fleets, and visitors without causing pavement disruptions that could discourage walking and cycling. They will also need to consider charging opportunities for other vehicles, including e-bikes and motorbikes. We will use our £500m local infrastructure support programme to drive innovative new approaches to deploying local chargepoints at scale, including through a new £10m pilot. This will help develop new commercial models and provide greater clarity on the best balance, for the consumer and the energy system, between low power and high power charging. Different funding streams for EV infrastructure will be consolidated as much as possible to ensure clarity, simplicity and efficiency for local authorities. We will provide a dedicated local authority support programme to ensure they have the resource and expertise they need to work out their specific local challenges and plan accordingly. The £500m will be spent to ensure provision right across England, with full consideration given to the spatial disparities set out in the Levelling Up White Paper.[8]

We will allow thriving sectors to thrive and address barriers to private sector rollout. Certain areas of the charging infrastructure market are already growing at pace. Here, the role of Government is simply to remove any existing barriers and step out of the way, so:

a. Government will not be intervening in the destination charging sector, and will look to end direct subsidy support for home charging and workplace charging at the earliest appropriate time.

b. We will help to reduce the costs to businesses by tackling barriers to investment and delivery of public chargepoints. Where barriers are slowing down private sector deployment, we will address them: for example, we will consult on measures to make Traffic Regulation Orders (part of the process to install on-street chargepoints) more straightforward.

We will give people confidence in the public network. We will regulate to ensure chargepoints are reliable and easy to use. This will include specific requirements on open data, price transparency, payment methods and reliability. We will also develop chargepoint design standards to improve accessibility and improve signage to chargepoint locations.

8 DLUHC (2022). Levelling Up the United Kingdom. Available at: https://www.gov.uk/government/publications/levelling-up-the-united-kingdom

We will work with Ofgem to ensure chargepoints can seamlessly integrate with the energy system. The EV transition is both an opportunity and a risk to the UK energy system and is part of wider changes needed to deliver net zero across the whole economy. We will ensure that the opportunities are grasped and the challenges mitigated. This will include making sure that the bulk of charging is 'smart' and ideally off-peak, that connection costs do not avoidably deter chargepoint deployment (including through the use of Ofgem's £300m Green Recovery Scheme), and that EV charging infrastructure makes the most efficient use of the electricity system. This will help ensure that charging costs are fair for both consumers and businesses.

We will support innovation in business models and technology. As the automotive sector increasingly shifts its focus to electrified cars, the pace of technology development has become ever quicker. Battery packs are becoming more energy dense, enabling longer ranges. Previously unimagined rates of charging are now possible and wireless charging is nearing commercial deployment. At the same time, the economic potential from the integration of the energy and transport systems has barely begun to be tapped. There is huge scope for chargepoint operators to gain by selling services to the grid, for the grid to gain by increasing flexibility, and for consumers to ultimately benefit through cheaper, and potentially even negative, tariffs if they agree to cede some control over charging or even share some of their vehicle's battery capacity. We will continue to facilitate this innovation and encourage new business models to deliver the charging we need. This could be through local community charging companies, longer-term on-street concessions, remote charging, cable guttering, lamppost chargers or peer-to-peer charging services.

Conclusion

Transport is the UK's largest emitting domestic sector and 91% of UK transport emissions come from road transport. If the UK economy is to achieve net zero emissions by 2050, it has to decarbonise road transport. The recent rapid increase in both the supply of, and the demand for, EVs means that charging infrastructure now stands as the single biggest challenge to that decarbonisation.

We will continue to support the excellent cross-sector engagement happening through partnerships such as Electric Vehicle Energy Taskforce (EVET), the Automotive Council, and the EV Fleet Accelerator to ensure we meet this challenge together. We will use their insights and our metrics to monitor progress, taking into account the uncertainty around future need, so that we can pre-emptively respond to changes in consumer and market needs.

Delivering the world class charging infrastructure the UK needs will not be easy and cannot be delivered by Government alone. It will require commitment and investment across the energy, chargepoint, automotive and public sectors.

But it must, and will, be done.

Our commitments

Support the accelerated rollout of a comprehensive and competitive rapid charging network on major roads	
Work with the private sector to ensure there are at least six high powered chargepoints at each motorway service area by the end of 2023.	**End 2023**
Consult on the design of the £950m Rapid Charging Fund. This fund will support the rollout of at least 6,000 high powered chargepoints across England's motorways and major A-roads by 2035, by enabling electricity network infrastructure to be installed ahead of chargepoint demand.	**Winter 2022 / Spring 2023**
Launch pathfinder projects for the Rapid Charging Fund, ahead of the fund opening in 2023.	**Winter 2022**
Support local government to develop chargepoint strategies and scale up the rollout of public chargepoints on local streets	
Provide local authorities with grant funding through the On-Street Residential Chargepoint Scheme. The scheme has supported 2,038 chargepoints to date, with a further 4,539 planned for 2021-22.	**Ongoing**
Provide expert support, through the Local Government Support Programme, to local authorities seeking to develop chargepoint strategies, procure chargepoints and apply for funding.	**Ongoing**
Launch the £10m Local EV Infrastructure (LEVI) pilot project.	**Spring 2022**
Invest at least a further £500m to support local authorities to plan and deliver local public charging infrastructure. This will include the £450m Local EV Infrastructure (LEVI) Fund, and the On-street Residential Chargepoint Scheme. The LEVI Fund includes up to £50m to fund the staff needed to do this work, and the supporting knowledge and tools to help them to work out their specific local challenges and plan accordingly.	**2022-2025**

Allow thriving sectors to thrive and address barriers to private sector rollout	
Building regulations requiring new homes and non-residential buildings to include chargepoints come into force.	**Summer 2022**
Refocus the Electric Vehicle Home Charging Scheme (EVHS) and the Workplace Charging Scheme (WCS) to ensure they are targeted at those areas still needing support, such as flats and rented accommodation, or small accommodation businesses and charities.	**Ongoing**
Consider amendments to the Transport Planning Practice Guidance (PPG) relating to chargepoints, to make local approaches to chargepoint planning and delivery more consistent and streamlined.	**Summer 2022**
Consult on measures to make Traffic Regulation Orders (part of the process to install on-street chargepoints) more straightforward.	**Spring 2022**
Regulate to make sure public chargepoints are reliable and easy to use	
Introduce new legislation to improve people's experience when using public chargepoints. Legislation will be introduced in spring 2022 and come into effect in summer 2022. We will work with industry to open up data so that drivers can access real time information about chargepoints across the public network, rely on the public chargepoint network with improved reliability, compare prices, and pay for their charging easily, whoever the chargepoint provider. We will also be supporting fleet electrification by introducing payment roaming across the public chargepoint network.	**Summer 2022**
Improve accessibility at public chargepoints for disabled users. We will work in partnership with Motability and have commissioned the British Standards Institute (BSI) to develop accessible charging standards. These standards will provide guidance to industry and allow drivers to easily identify which chargepoints are suitable for their needs.	**Summer 2022**
Publish the Government response to the Future of Transport Regulatory Review proposals that were consulted on in 2021.	**Summer 2022**

Work with Ofgem to make sure that chargepoints are easy to connect and integrate with the electricity system	
Accelerate the widespread deployment of vehicle-to-everything (V2X) technologies, working in close collaboration with Ofgem and industry. We will publish a summary of our recent Call for Evidence and outline next steps.	**Summer 2022**
Mandate that, from June 2022, private chargepoints sold in GB must be smart and meet minimum device-level requirements.	**Summer 2022**
Identify the role of smart charging in the public infrastructure network and consider mechanisms to deliver this.	**Summer 2022**
Maximise the opportunities for flexibility from EVs while protecting the electricity grid and consumers, publishing a joint Government-Ofgem Electric Vehicle Smart Charging Action Plan.	**Summer 2022**

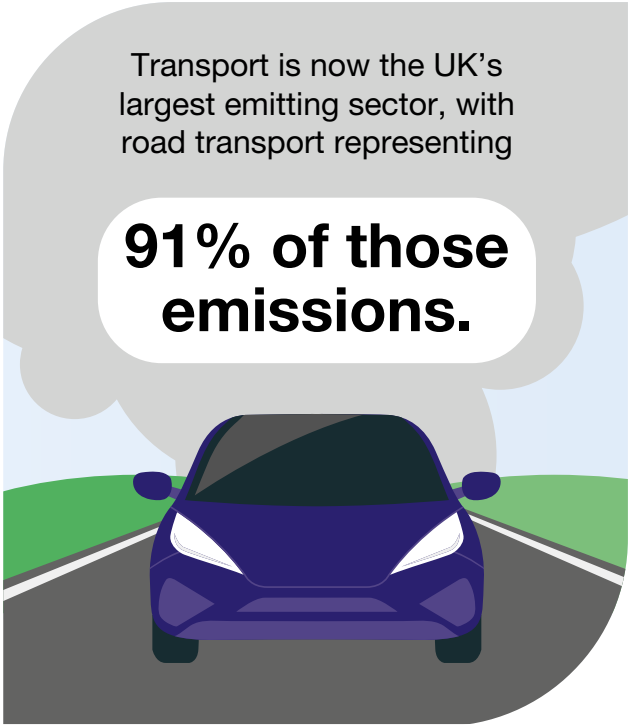
Source: DfT

1. Introduction

The switch to electric cars and vans has reached a tipping point

The UK Government has committed to net zero emissions by 2050.[9] Transport is now the UK's largest emitting sector, and 91% of those emissions come from road transport.[10,11] It is essential for the vehicles on the UK's roads to be emission-free at the tailpipe.

With the UK's clean electricity mix today, a typical battery electric car is estimated to produce only a third of the greenhouse gas emissions of an equivalent petrol car on a lifecycle basis. Emissions savings compared to petrol could rise even further, to ~76% by 2030 and ~81% by 2050, through improvements in grid decarbonisation, battery technology, manufacturing, and end-of-life processing.[12]



9 Climate Change Act 2008 (2050 Target Amendment) Order 2019 (online). Available at: https://www.legislation.gov.uk/ukdsi/2019/9780111187654

10 BEIS (2021). 2020 UK Greenhouse Gas Emissions (online). Available at: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2020

11 BEIS (2022). Final UK greenhouse gas emissions national statistics: 1990 to 2020. Available at: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2020

12 Ricardo-AEA for DfT (2021). Lifecycle Analysis of UK Road Vehicles.

In November 2020, the Prime Minister put the UK on course to be the fastest nation in the G7 to decarbonise cars and vans, announcing that all new petrol and diesel cars and vans will be phased out by 2030. Government is supporting this with a zero emission vehicle mandate which will provide certainty over the scale and pace of the transition to consumers, energy providers, the chargepoint industry and investors, vehicle manufactures and supply chains. EVs will improve air quality in our towns and cities, reduce harmful emissions, and offer cleaner and convenient driving for all.

This change has already begun. As of March 2022, there are around 450,000 battery electric vehicles in the UK and around 750,000 vehicles with a plug registered in the UK, up from 8,000 in 2010.[13] This compares with a total of 37.6 million cars and vans currently registered in the UK.[14]

In December 2021, industry statistics showed that over a quarter of all new cars sold were battery electric vehicles.[15] By 2030, we estimate that up to 10 million vehicles, up to a quarter of all cars and vans, will need to be zero emission at the tailpipe.[16] Some scenarios predict even higher levels of adoption to meet carbon targets. For example, the Committee on Climate Change (CCC) estimates that battery electric vehicles will comprise 27-37% of the car and van fleet by 2030.[17]

Cars and taxis alone represent 52% of domestic transport emissions, with an additional 16% from vans and other light goods vehicles.[18] The focus of this document is on cars and vans up to 3.5 tonnes (including some zero emissions vans up to 4.25t), both private and fleet vehicles. However, many of the principles in this document also apply to electric buses and trucks, particularly when charging at a depot or equivalent. They are also relevant to electric mopeds and motorbikes, which can use the same chargepoints as electric cars and vans.[19,20]

13 DfT (2022). Table VEH0133. Licensed ultra low emission vehicles by body type and propulsion or fuel type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01 and SMMT (2022). Available at: https://www.smmt.co.uk/vehicle-data/car-registrations/

14 DfT (2022). Statistical data set – All vehicles (VEH01). Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

15 SMMT (2022). Available at: https://www.smmt.co.uk/vehicle-data/car-registrations/

16 Estimates from internal DfT modelling (2021). RoCaFF. Consistent with electric vehicle adoption rates published in the 2035 Delivery Plan.

17 Committee on Climate Change (2020). The Sixth Carbon Budget, Surface Transport. Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Surface-transport.pdf

18 DfT (2021). Table ENV0201. Greenhouse gas emissions by transport mode: United Kingdom. Available at: https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env#greenhouse-gas-emissions-env02

19 SMMT (September 2021). SMMT vehicle data: car registrations. Available at: https://www.smmt.co.uk/vehicle-data/car-registrations/

20 British Gas (2021). 3 policy essentials to accelerate the mass roll-out of electric vehicles. Available at: https://www.britishgas.co.uk/business/blog/3-policy-essentials-to-accelerate-the-mass-roll-out-of-electric-vehicles/

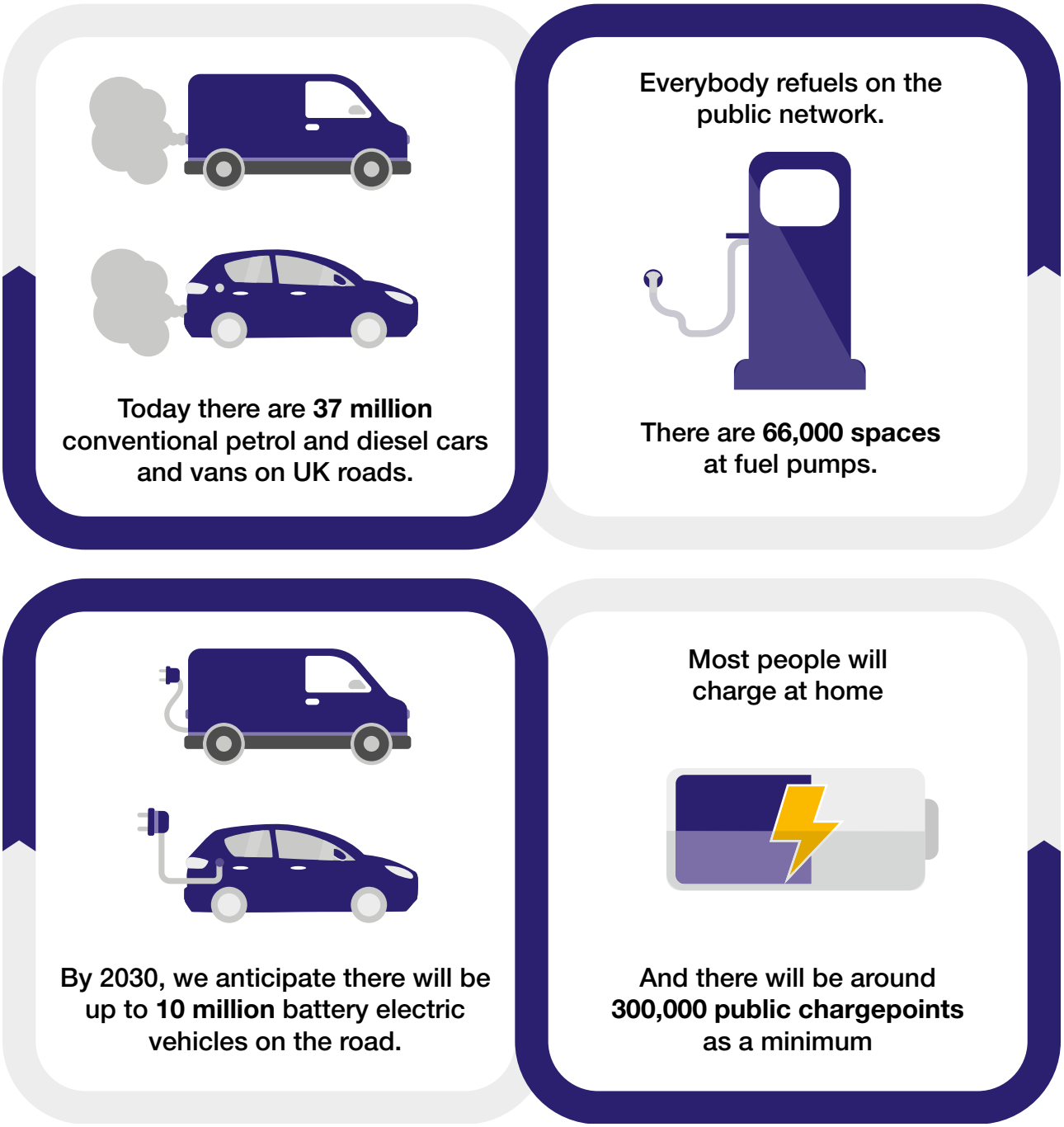
The fleet market makes up approximately half of all new car sales in the UK. In 2021, fleets had a market share of 56.5% of new car sales.[21] Fleet turnover is crucial to growing the second-hand market, which will help make electric vehicles affordable more quickly for everyone.We welcome the commitments made recently by some of the UK's biggest fleets to go electric and recognise the pressing need to improve public infrastructure provision to enable this transition. Many fleet drivers are likely to rely heavily on public charging.

Their needs can differ from those of private drivers due to several factors, including shift work, a need for flexibility and a high reliance on parking on residential streets. For example, around 70% of British Gas's electric vehicle fleet drivers rely on a combination of public charging and workplace charging.[22] We will continue to work closely with fleet operators to ensure the charging framework meets their needs.

Vauxhall Vivaro-e. Source: Vauxhall

21 SMMT (December 2021). SMMT vehicle data: car registrations. Available at: https://www.smmt.co.uk/vehicle-data/car-registrations/

22 British Gas (2021). 3 policy essentials to accelerate the mass roll-out of electric vehicles. Available at: https://www.britishgas.co.uk/business/blog/3-policy-essentials-to-accelerate-the-mass-roll-out-of-electric-vehicles/



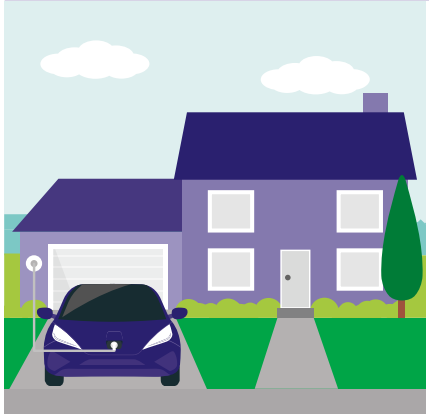
Figures from: DfT vehicle statistics,[23] and Experian.[24]

23 DfT (2022). The total number of battery electric cars and vans were subtracted from the total number of cars and vans to give the total number of cars and vans using petrol or diesel. Table VEH0133. Licensed ultra low emission vehicles by body type and propulsion or fuel type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01; Table VEH0101. Licenced vehicles at the end of the quarter by body type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

24 Experian Catalist (2020). As of May 2020, there were 33,948 fuel pumps in the UK, offering approximately 66,000 fuelling spaces.

Chargepoints are found in a variety of public and private settings around the country

Private charging options



Residential off-street – home charging

Private off-street charging on driveways and in garages.

Workplace

Charging provided in private workplace car parks.

Depot

Charging at private business locations for EVs used commercially (including buses, HGVs and public sector fleets).

Public and private charging occurs in a wide range of locations and settings, providing flexible solutions to meet people's differing needs.

Most EV drivers charge overnight at home.[25] This will remain the case as EV uptake increases. Around 70% of households with a vehicle in England currently have access to private, off-street parking.[26] However, for the sizeable minority without home charging, the public charging network is critical. 90% of all current EV drivers rely on it from time to time.[27]

25 Element Energy (2019): Electric Vehicle Charging Behaviour Study. Available at: http://www.element-energy.co.uk/wordpress/wp-content/uploads/2019/04/20190329-NG-EV-CHARGING-BEHAVIOUR-STUDY-FINAL-REPORT-V1-EXTERNAL.pdf

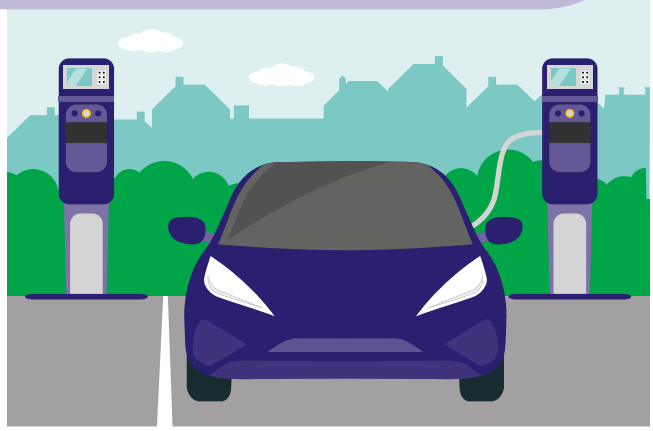
26 Department for Transport (2021). National Travel Survey Table NTS0908: Where vehicle parked overnight by Rural-Urban Classification of residence. Available at: https://www.gov.uk/government/statistics/national-travel-survey-2020

27 EVA England (2021). Improving Driver's Confidence in Public EV Charging. Available at: https://www.evaengland.org.uk/wp-content/uploads/2021/04/EVA-England-Consumer-Charging-Survey-Report.pdf

Public charging options

Residential on-street

Chargepoints installed to serve vehicles parked on-street. Can be standalone chargepoints or integrated into existing street furniture (e.g. lampposts).



Residential charging hubs

A communal parking area with chargepoints for residents.

On-route

Rapid and ultra-rapid charging to enable long-distance journeys. Depending on the vehicle, these can charge a car from 0-80% charge in just half an hour.

Destination

Charging installed at destinations with longer duration visits (e.g. gyms, supermarkets, shopping centres and transport hubs such as airports and train stations).

Public charging devices by location type, March 2022 (includes chargepoints only available for use by vehicles from certain manufacturers).[28]

16,864

at destinations such as retail car parks, hotels and workplaces.

9,382

at on-street locations.

2,011

rapid or high powered devices along the strategic road network.

Over 1,000

at other locations, including train stations and airports.

ZAP MAP

How and when people charge matters for both individual drivers and management of the wider electricity system. This will become increasingly the case as the number of EVs goes up. Increased numbers of EVs will increase the total charging demand on the electricity system. This in turn will have cost implications to ensure the electricity network is equipped to manage the demand. Emerging technologies such as smart charging and vehicle-to-grid and vehicle-to-everything (V2X) offer consumers flexibility and the ability to charge at time of lowest cost, or even sell back energy to the grid. We discuss this further in the 'Electric vehicle charging and the electricity system' annex, on page 119.

28 Analysis from Zap Map (2022).

Smart charging allows EVs to be charged when it is most efficient for the balance of supply and demand across the electricity system. This means shifting charging to periods of lower overall demand for electricity (for example, overnight) or high renewable generation (for example, particularly windy or sunny weather).

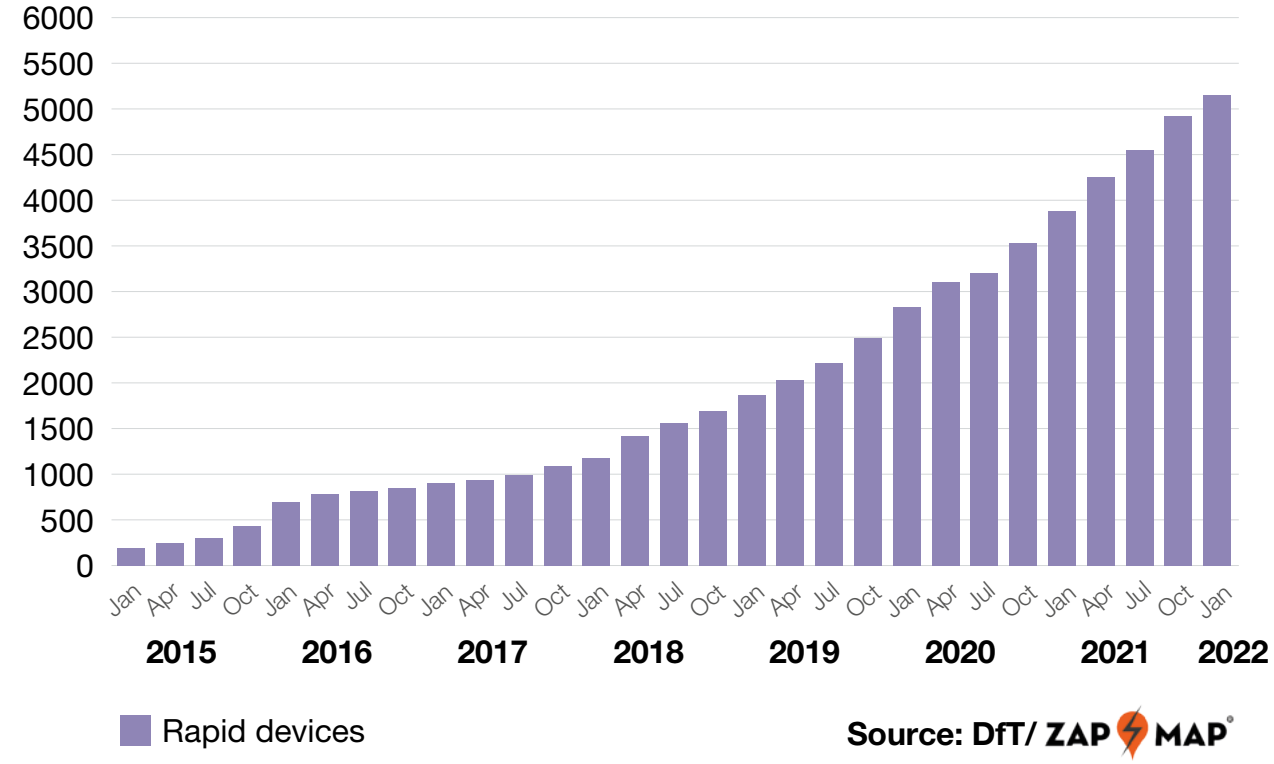
The number of public chargepoints is growing dramatically across most of the country, particularly on the rapid network

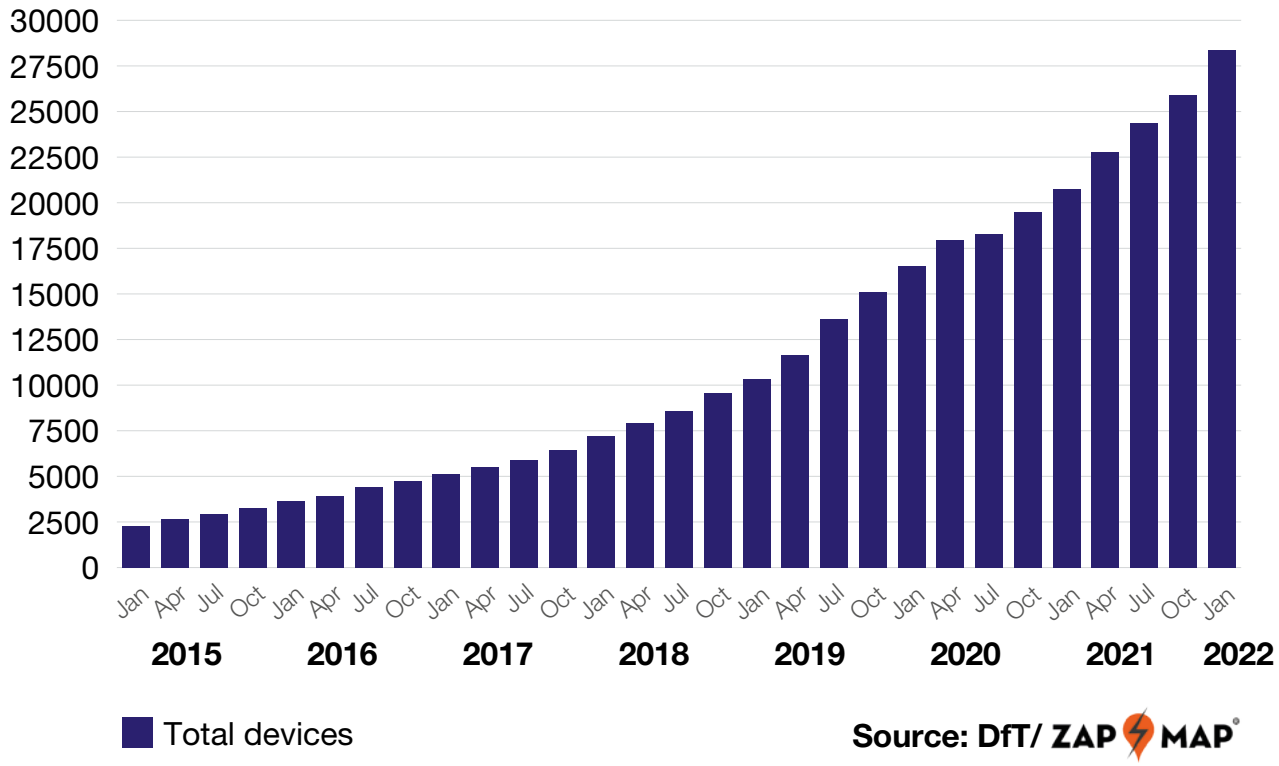
The number of public chargepoints has grown four-fold over the last five years. On average, over 600 new chargers are being added to the UK's roads each month, of which over 100 are rapid.[29] Between 1 October 2021 and 1 January 2022, 2,448 charging devices were added to the public network.[30] It is not a consistent picture across the country, however. In general, the early uptake of EVs has not been evenly spread, and, as a result, nor has public chargepoint deployment, particularly for local on-street charging.

29 DfT (2022). Charging Device Statistics. Available at: https://www.gov.uk/government/statistics/developing-faster-indicators-of-transport-activity

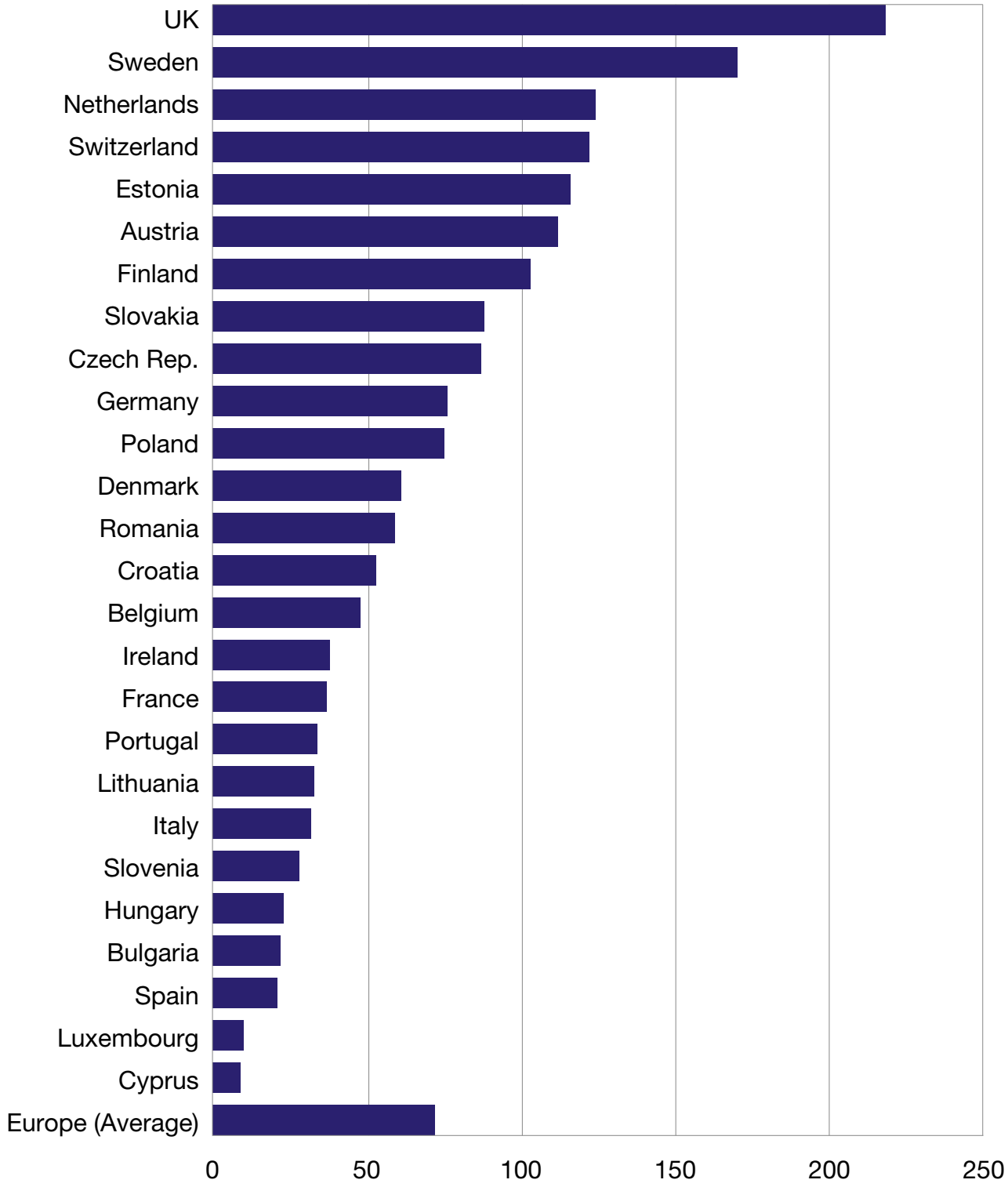
30 DfT (2022). Charging Device Statistics. Available at: https://www.gov.uk/government/statistics/developing-faster-indicators-of-transport-activity and https://www.gov.uk/government/collections/electric-vehicle-charging-infrastructure-statistics

Number of public devices



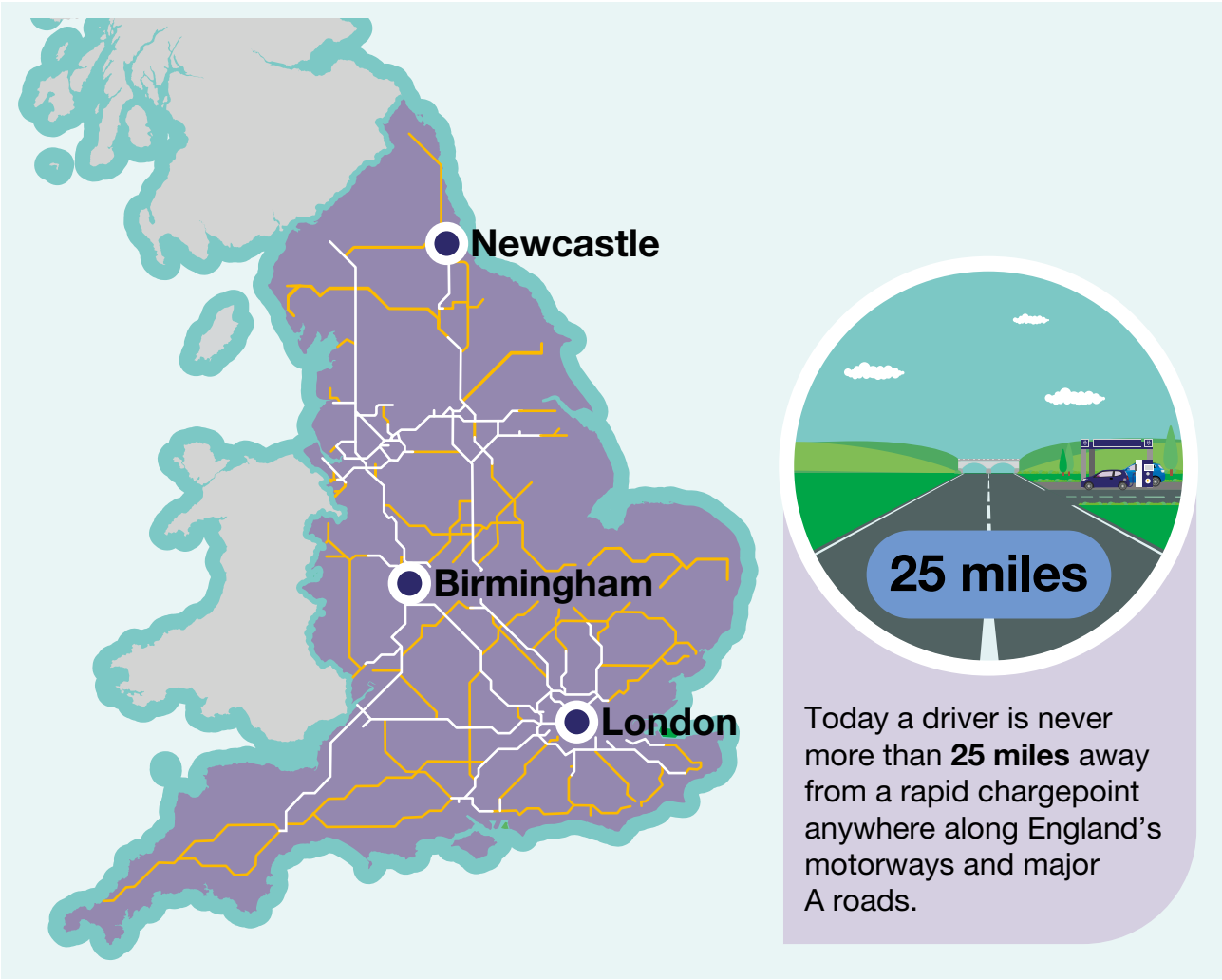


Number of fast chargers (>22kW) per 100km (62 miles) of motorway[31]



31 Transport & Environment (2020). Recharge EU: How many chargepoints will Europe and its Member States need in the 2020s. Updated based on data from EAFO and Eurostat (2021). Available at: http://www.indiaenvironmentportal.org.in/files/file/Recharge-EU-charge-points-Europe-2020s.pdf

Together, Government and industry have supported the installation of around 29,600 publicly available charging devices. This includes more than 5,400 rapid chargers at around 3,300 locations servicing over 0.4 million battery electric vehicles.[32,33,34] In comparison, the UK has around 8,000 petrol station locations[35] supplying 37 million petrol and diesel cars and vans.[36] A recent study found that the UK now has more fast chargers (>22kW) for every 100km (62 miles) of key strategic road than any country in Europe.[37]



32 DfT (2022). Charging Device Statistics. Available at: https://www.gov.uk/government/statistics/developing-faster-indicators-of-transport-activity
33 Rapid chargepoint locations based on analysis procured from Zap Map (2022).
34 DfT (2022). Table VEH0133. Licensed ultra low emission vehicles by body type and propulsion or fuel type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01 and SMMT (2022). Available at: https://www.smmt.co.uk/vehicle-data/car-registrations/
35 Experian Catalist (2020). As of May 2020, there were 8,385 fuel stations in the UK.
36 DfT (2022). The total number of battery electric cars and vans were subtracted from the total number of cars and vans to give the total number of cars and vans using petrol or diesel. Table VEH0133. Licensed ultra low emission vehicles by body type and propulsion or fuel type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01; Table VEH0101. Licenced vehicles at the end of the quarter by body type. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01
37 Transport & Environment (2020). Recharge EU: How many chargepoints will Europe and its Member States need in the 2020s. Updated based on data from EAFO and Eurostat (2021). Available at: http://www.indiaenvironmentportal.org.in/files/file/Recharge-EU-charge-points-Europe-2020s.pdf

The chargepoint sector is unrecognisable from 10 years ago, with increasing private investment

Since Government first started investing in the UK chargepoint sector in 2010, there have been huge advances in the scale of infrastructure that is being rolled out. Most EVs can now be charged at all devices on the UK public network due to increased standardisation of connectors (plugs). The supply chain is growing rapidly, and new business models continue to emerge, such as peer to peer solutions and "roving charging services", which keep track of your charging needs and come to recharge your vehicle when you need it.

Our phase out dates for new petrol and diesel cars and vans sent a clear signal of the UK's intent. This certainty has unlocked new private sector funding. In seven months, over half a billion pounds of private investment has been publicly committed to chargepoint rollout. This will expand chargepoint provision and create jobs and investment across the country.

Many charging options are now becoming widely available across a range of locations. This diversity creates flexibility for businesses and individual drivers. We cannot confidently predict at this stage of the market transition what the optimum proportions of different charging speeds or locations will be.

Indeed, people will need a place-based approach to charging mixes. Parking constraints and travel needs vary between local areas, and different people will favour different approaches to charging. These options are not independent from each other: a high proportion of workplace or destination charging, for example, may reduce the level of on-street charging needed in an area. We expect people will continue to want and use a variety of charging solutions to suit their individual needs. The home charging market is thriving and there is a growing UK ecosystem around charging with small and medium-sized enterprises (SMEs) supplying cables, chargers, and adapters. Destination charging, where drivers can charge at supermarkets, gyms, and attractions, is also being rolled out at pace by the private sector without Government subsidy. Many leading supermarkets now offer chargepoints for customers, including Tesco,[38] Waitrose,[39] Morrisons[40] and Asda.[41] New acquisitions and partnerships are springing up, such as between Shell and Ubitricity,[42] or Engie and Premier Inn.[43]

38 Pod Point (2021). Tesco Volkswagen EV Charging – UK National Rollout. Available at: https://pod-point.com/rollout/tesco-ev-charging

39 Shell (2021). Shell to install hundreds of electrical vehicle charging points at Waitrose stores by 2025 as part of expanded partnership. Available at: https://www.shell.co.uk/media/2021-media-releases/shell-to-install-hundreds-of-electrical-vehicle-charging-points-at-waitrose-stores.html

40 Energise Energy Solutions (2021). Morrisons unveils 'nation's largest network' of EV charging points. Available at: https://www.energise.energy/news/morrisons-unveils-nation-s-largest-network/

41 Asda (2021). Asda and Engie rollout EV charging points at stores in West Yorkshire. Available at: https://corporate.asda.com/newsroom/2021/05/21/asda-and-engie-rollout-ev-charging-points-at-stores-in-west-yorkshire

42 Ubitricity (2021). Shell aims to install 50,000 ubitricity on-street EV charge posts across the UK by 2025. Available at: https://www.ubitricity.com/shell-aims-to-install-50000-ubitricity-on-street-ev-charge-posts-across-the-uk-by-2025/

43 Engie (2021). ENGIE partners with Premier Inn for nationwide rollout of high power EV charging points. Available at: https://www.engie.co.uk/about-engie/news/engie-partners-with-premier-inn-for-nationwide-rollout-of-high-power-ev-charging-points/

Charging at workplaces is also growing: Government has supported the installation of over 22,000 workplace charging sockets as of January 2022.[44] Rapid charging hubs and electric forecourts are emerging as a further option for EV drivers to recharge. Other parts of the market, such as on-street charging, are less advanced and are still largely dependent on grant funding.

Recent investment commitments in chargepoint deployment

Rapid Charging	
BP Pulse	Aiming to double the size of its network in the UK to 16,000 chargepoints by 2030 and install a number of rapid charging hubs.
Shell	Plans to install 5,000 rapid and ultra-rapid EV chargers on forecourts by 2025.
Motor Fuel Group	Investing £400m to install 2,800 high powered chargers (150 kW and 350 kW) at 500 UK locations by 2030.
InstaVolt	Aims to deliver 5,000 chargers by 2024/25 and 10,000 by 2030.
GRIDSERVE	Has acquired the Electric Highway from its original developer, Ecotricity. GRIDSERVE is planning to deliver over 5,000 high powered chargers by 2025. The total investment GRIDSERVE plans to deploy across its Electric Hub and Electric Forecourt® sites is in excess of £1bn.
Osprey	Will invest £75m to install over 150 high powered EV charging hubs across the UK by 2025, with up to 12 rapid chargers per site.
Pivot Power	Plans to build a national network of Energy Superhubs delivering up to 2GW of battery storage, to create the power infrastructure for mass-scale rapid EV charging. The first project, Energy Superhub Oxford, will provide up to 50 chargepoints.

44 DfT (2021). Electric vehicle charging device grant scheme statistics: October 2021. Available at: https://www.gov.uk/government/statistics/electric-vehicle-charging-device-grant-scheme-statistics-january-2022

Destination & On-street Charging	
EVBox	Announced that 500 chargepoints will be installed across UK car parks in a boost for destination charging.
Podpoint	Partnered with VW and Tesco to deliver chargepoints at Tesco locations throughout the UK.
GeniePoint	Partnered with Morrisons to deliver chargepoints at Morrisons locations throughout the UK.
Ubitricity	Has announced an ambition to install 50,000 on-street chargepoints by 2025.
Connected Kerb	Will install 190,000 publicly accessible AC chargers in the UK by 2030. The company specialises in standard chargers with 7 to 22 kW for on-street charging.
Allstar / Gronn Kontakt	Forming a partnership to launch the first EV charge payment card for fleets which can be used across 3,700 chargepoints in Britain.

Private investment is being supported by targeted Government funding

Funding Scheme	Description
Electric Vehicle Home-charging Scheme (EVHS)	Provides a 75% contribution to the cost of one chargepoint and its installation. A grant cap is set at £350 (including VAT) per installation. From this year, this will focus on support for home charging at flats and rented accommodation. The Government has delivered over 277,000 chargepoints through the EVHS and its predecessor, the Domestic Recharge Scheme (DRS), as of January 2022.
Workplace Charging Scheme (WCS)	A voucher-based scheme to provide eligible applicants with support towards the upfront costs of the purchase and installation of EV chargepoints. The contribution is limited to 75% of purchase and installation costs, up to a maximum of £350 for each socket, up to a maximum of 40 across all sites for each applicant. Since 2016, the scheme has supported over 22,000 chargepoint installations.
On-street Residential Chargepoint Scheme (ORCS)	Provides local authorities with grant funding that can be used to part-fund the procurement and installation of on-street EV chargepoint infrastructure to meet residents' needs. The funding available contributes to the capital costs of procuring and installing the chargepoint and an associated dedicated parking bay (where applicable). The scheme has supported 2,038 chargepoints to date, with a further 4,539 planned for 2021-22.
Local EV Infrastructure Fund (LEVI Fund)	A new £450m fund to facilitate the rollout of larger-scale chargepoint infrastructure projects, including local rapid hubs and larger on-street schemes not captured by ORCS. £10m pilot to be launched.
Rapid Charging Fund (RCF)	£950m fund to future-proof electrical capacity at motorway and major A-road service areas for the installation of EV infrastructure. Under development.

Funding Scheme	Description
Charging Infrastructure Investment Fund (CIIF)	A £422m investment (with £200m being a cornerstone investment by Government) which is managed and invested on a commercial basis by a private sector fund manager. The fund is dedicated to catalysing the rollout of a robust and diversified public EV charging infrastructure. Four investments have been made from the CIIF so far: InstaVolt, Liberty Charge, char.gy, and Zest.

Delivering a reliable, comprehensive public charging network requires a UK-wide approach

The UK Government has a clear commitment to achieving net zero emissions across the whole country. To achieve this, we need a reliable, comprehensive public charging network across the UK. The vision and principles of this strategy apply throughout the UK, including the importance of increased local leadership. The specific approaches taken may vary, however. Elements of transport policy are devolved, including roads and local transport, strategic planning, land use and public transport subsidies. Energy policy is also devolved in Northern Ireland.

The Devolved Administrations have a critical role in leading the strategic approach within their devolved responsibilities. We will continue to work closely with the Scottish and Welsh Governments as they take forward their strategies (Switched On Scotland Phase Two: An Action Plan For Growth; A Network Fit For The Future: Draft Vision for Scotland's Public Electric Vehicle Charging Network and Electric Vehicle Charging Strategy for Wales respectively) and with the Northern Ireland Executive as it considers its own approach in the development of their EV Charging Infrastructure Plan in 2022.[45]

The transition to EVs will require support from Government, regulators and the transport and energy sectors. In July 2021, the Competition and Markets Authority (CMA) published its Electric Vehicle Charging Market Study: final report, which set out recommendations for Government and other bodies.[46]

We welcome this report and the recommendations in it have informed our strategy. We are publishing the Government's response to the CMA study alongside this strategy.

Ofgem, the GB regulator for gas and electricity networks, recently set out its own priorities relating to EVs in "Enabling the transition to electric vehicles: The regulator's priorities for a green fair future". These cover electricity network capacity, efficient energy system integration through smart charging, and consumer participation and protection.[47] They are all fundamental to ensuring the energy system is ready and able to meet the demands of mass EV uptake.

Government is working with Ofgem to ensure electricity network arrangements enable faster deployment of charging infrastructure across the whole country. Ofgem's £300m Green Recovery Scheme is an important part of this transition. It will fund improvements to electricity infrastructure to support low-carbon projects including the rollout of EV infrastructure. Longer term, the upcoming price control for electricity distribution (RIIO-ED2) will enable distribution network companies to ready the low voltage network for significant increase in chargepoint deployment. In addition, changes to the network charging regime will help reduce upfront connection costs for new EV infrastructure.

45 Northern Ireland Executive (2021). The path to net zero energy. Secure. Affordable. Clean. Available at: https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Energy-Strategy-for-Northern-Ireland-path-to-net-zero.pdf

46 CMA (2021). Electric vehicle charging market study. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012617/EVC_MS_final_report_--.pdf

47 Ofgem (2021). Enabling the transition to electric vehicles: The regulator's priorities for a green fair future. Available at: https://www.ofgem.gov.uk/publications/electric-vehicles-ofgems-priorities-green-fair-future

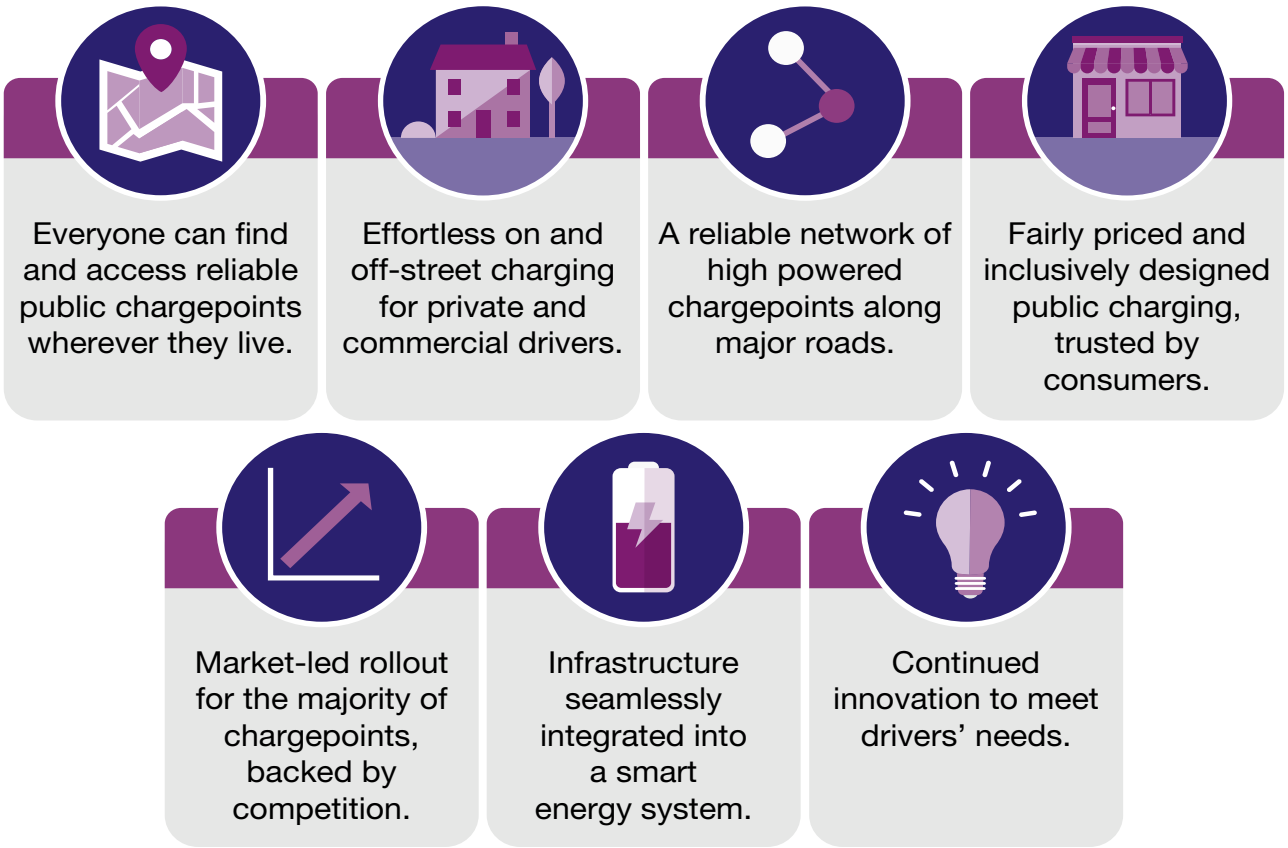
2. Vision

The switch to EVs will bring significant benefits to the country. It will be a major contributor to our net zero goal; improve the country's air quality and people's health; and support new jobs and growth opportunities. It will also be better for individual drivers, their families, and businesses. We know this change is possible. Less than 1% of people who have already switched to an EV want to go back to a petrol or diesel vehicle.[48]

As we transition into mass market adoption of EVs, the charging market will evolve to meet increasingly diverse charging needs. Rapid progress across this diverse market will be essential to stay ahead of demand and deliver our vision: charging infrastructure that works for everyone, wherever they live, work and travel.

48 Zap Map (2021). New survey reveals EV switchers don't look back. Available at: https://www.zap-map.com/new-survey-reveals-ev-switchers-dont-look-back/

We have a clear vision for the country's future charging infrastructure.



Everyone can find and access reliable public chargepoints wherever they live

People making the switch to an EV must have the confidence that the public charging network they need is available, whether they live in a densely populated city or in a remote village in the countryside. There are currently around 66,000 spaces at fuel pumps serving the entire UK diesel and petrol fleet.[49] By 2030, there will need to be at least four times that number of public EV chargepoints, based on our current estimates. Predictions of the future mix and number of chargepoints are inherently uncertain. The number of chargepoints needed will depend on consumer travel and charging behaviour; different approaches will be suitable for different local environments, particularly for those without off-street parking. But rollout will progress rapidly, ensuring sufficient chargepoints are provided ahead of demand. This is needed both nationally and within local areas, so that no region or demographic is left behind.

People will be able to find the location of nearby chargepoints easily through a choice of cross-network apps and open information. They will have confidence that the chargepoint will be operating reliably and that support is available if anything does go wrong.

49 Experian Catalist (2020). As of May 2020, there were 33,948 fuel pumps in the UK, offering approximately 66,000 fuelling spaces.

Effortless on and off-street charging for private drivers and businesses

Only an EV can charge quietly and effortlessly by your home while you are asleep, removing the need for specific journeys to a forecourt to refuel. The majority of drivers will take advantage of overnight charging at home, as most EV drivers do now.[50,51] For many people, charging will not be needed more than once a week: in 2019, the average car journey length in England was 7-8 miles for drivers in urban areas, and about 10 miles for drivers in rural areas.[52]

Where home charging is not possible, people will have easy access to public chargepoints near their home, in addition to chargepoints at destinations and workplaces. These chargepoints will be integrated seamlessly into local streets, without disrupting pavement access. Local authorities will engage with residents and businesses to ensure that chargepoint provision stays ahead of need, without exacerbating parking constraints. Local charging hubs and electric forecourts (equivalent to current petrol or diesel refuelling) will provide further options for recharging. This will give people who use their vehicle extensively (van drivers, for example) the confidence that they can charge at or near home at the end of their shift, and during the day if they need to.

Innovative solutions could also give many more people the ability to charge their vehicle using their home electricity supply while parked on-street. Pavement adaptations, for example, could enable people parked on-street to run a cable from their house to their car, without causing a trip hazard.

Peer-to-peer charging (also called community charging) will see many people making their private chargepoints available to rent. This is being pioneered by companies such as Co-Charger and JustPark.

Ensuring local chargepoints are integrated into their surrounding environment:

- Chargepoints should not obstruct pavements or highways, or present a safety risk to pedestrians.
- Cables will not be allowed to trail across the pavement unless adaptive infrastructure is provided to accommodate them safely (e.g. gullies). Anything that creates a trip hazard does not constitute adaptive infrastructure.
- Chargepoints must be incorporated into existing street furniture or parking bays wherever possible. In circumstances where it is not possible, priority must be given to ensuring that access to, and use of, pavements is not impeded and safety of pedestrians is not jeopardised.
- Parking spaces for EV charging will not be added in places where parking spaces are currently not allowed, nor where they could disrupt traffic flow, cyclists or pedestrians.
- Chargepoint design and placement should meet accessibility standards and guidance.

50 Several studies show that the vast majority of current EV owners charge their car at home. These findings are summarised in Hardman, S, et al (2018) 'A review of consumer preferences of and interactions with electric vehicle charging infrastructure', Transportation Research Part D: Transport and Environment (Volume 62).

51 Element Energy for National Grid (2019). Electric Vehicle Charging Behaviour Study. Available at http://www.element-energy.co.uk/wordpress/wp-content/uploads/2019/04/20190329-NG-EV-Charging-Behaviour-Study-Final-Report-V1-External.pdf

52 DfT (2021) National Travel Survey 2019, NTS9910. Available at: https://www.gov.uk/government/statistical-data-sets/nts99-travel-by-region-and-area-type-of-residence

A reliable network of high powered chargepoints along major roads

Drivers will be able to top up their vehicle quickly and easily while travelling. Travelling a long distance for work or leisure will be as straightforward in an EV as it is now in a petrol or diesel vehicle. All motorway service areas will have at least six high powered, open access chargepoints by the end of 2023, allowing people to top up in the time it takes them to have a cup of coffee.

By 2035, there will be at least 6,000 high powered chargers across the main roads and motorways in England. Competition between chargepoint operators at each motorway service station will give EV drivers at least as much choice as there is for on route refuelling of petrol and diesel vehicles today. Charging apps will display real time charging prices, making it easy to compare different options.

Fairly priced, inclusively designed public charging, trusted by consumers

People will have access to affordable and fairly priced public charging, so that those without off-street parking at home can switch to an EV without facing disproportionate charging costs. Competition between chargepoint operators will keep prices down and quality of service high. Drivers will be protected by rigorous reliability and transparency standards set out in law to ensure the public network is reliable and that they are able to access help using a chargepoint if they need it.

Chargepoints will work for everyone. They will be inclusively designed for all drivers, meeting standards developed with disability access as a priority. They will not inconvenience other users of roads and pavements. Instead, they will be incorporated sympathetically and safely into their environment. The transition to EVs must work with Government's wider commitments to decarbonise travel. Chargepoint locations will be aligned with local approaches to decarbonise transport such as greater active travel or use of public transport.

Market-led rollout for the majority of chargepoints, driven by competition

The private sector will lead on chargepoint rollout, stimulating UK investment and business, and creating jobs across the country. Institutional investors, among others, will take advantage of the market's huge growth potential and future demand certainty.

Infrastructure providers will have access to the data they need to identify potential business opportunities and areas of need. They will work with local authorities, transport, and energy bodies to install new chargepoints as efficiently as possible, minimising costs and disruption to the public. Competition on both the rapid and local networks will drive new delivery models for consumers.

Government will ensure that no part of the country is left behind. We will enable more local authorities to support private sector provision: they will identify specific local needs and run competitive tenders to meet the needs of their residents, businesses, and visitors. Public funds will target the least commercially viable segments of the market.

Infrastructure seamlessly integrated into a smart energy system

EV drivers will benefit from an increasingly smart energy system, helping to manage demand and in turn reducing costs for energy consumers more widely.

Individual households and companies will save money by using smart charging. People charging at home or work will have a wide choice of smart charging tariffs. They will be able to charge their vehicle when energy prices are lower without inconvenience. They will be able to take advantage of vehicle-to-grid technology, selling back energy from their vehicle battery when it is needed.

People reliant on lower power, on-street public charging could have the option to book slots to take advantage of smart charging. Companies with vehicle fleets that charge at a depot or local base will use intelligent, smart charging and vehicle-to-grid systems that are programmable and allow for scheduling. At rapid hubs, battery storage capabilities will help to manage energy demands and reduce costs at busy times. For chargepoint operators and installers, the process of connecting new chargepoints to the grid will be efficient and straightforward, with fair costs.

Continued innovation to meet drivers' needs

Innovative technologies will continue to emerge and be developed both in charging infrastructure and electric vehicles themselves. The regulatory framework will support the deployment of innovative solutions to benefit EV drivers, and wider society. New start-ups and technology innovations will create greater choice for consumers and investment opportunities. Vehicle manufacturers, energy and charging companies will work together to offer competitive packages to consumers.

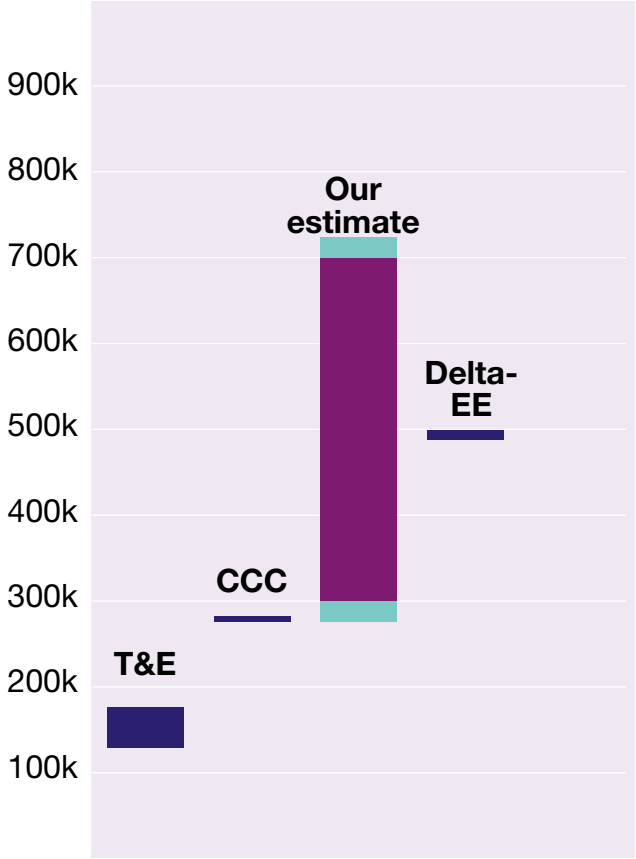
How many public chargepoints will the UK need in 2030?

We estimate that around 300,000 public chargepoints will be needed as a minimum to support our commitment to phase out sales of new diesel and petrol cars and vans by 2030. However, this figure is highly uncertain. Consumer charging behaviour and preferences, mileage and future chargepoint technologies will all influence the number of public chargepoints needed.

A fundamental aspect of this uncertainty is the question of which charging approaches will prove to be practical for people without off-street parking, and how these solutions will be used in practice. Parking constraints and travel needs vary between local areas, and different people will favour different approaches to charging. However, if we assume that on a national basis there is a high proportion of charging at workplaces and that consumers adopt efficient charging behaviour, as well as lower mileage, around 300,000 public chargepoints would be required. This number would increase up to around 700,000 if there is a higher proportion of on-street chargers across the country, and consumers drive more and adopt relatively inefficient charging behaviours, staying longer parked at chargepoints while not actually charging. Our estimates are in line with the latest industry findings.

This figure illustrates the level of uncertainty associated with forecasting future chargepoint need. Industry estimates vary significantly, with different analytical approaches taken and assumptions made around future driving behaviours, charging preferences and the development of vehicle and chargepoint technology. Our approach varies key assumptions, providing us with a range of results capturing the main uncertainties.

There is no standard categorisation of chargepoints across the industry estimates. Chargepoints at workplaces are generally not categorised as public chargepoints, and are not included in our estimates. A high proportion of workplace charging therefore assumes that more people are charging at locations not included in our estimate.



Chargepoint estimates for 2030 from Transport & Environment (T&E),[53] the Climate Change Committee (CCC),[54] the International Council on Clean Transportation (ICCT),[55] and Delta-EE.[56]

53 Transport & Environment (2021). Charging forward: creating a world-class UK charging network. Available at: https://www.transportenvironment.org/discover/charging-forward-creating-a-world-class-uk-charging-network/

54 Committee on Climate Change (2020). The Sixth Carbon Budget, Surface Transport. Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Surface-transport.pdf

55 ICCT (2020). Quantifying the electric vehicle charging infrastructure gap in the United Kingdom. Available at: https://theicct.org/sites/default/files/publications/UK-charging-gap-082020.pdf

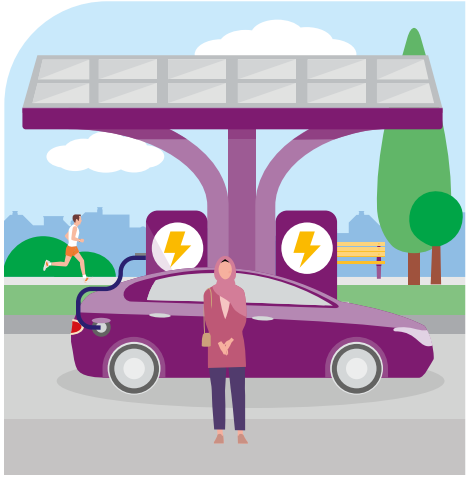
56 Delta-EE (2020). Whitepaper: European EV Chargepoint Forecasts. Available at: https://www.delta-ee.com/downloads/1-research-downloads/63-electric-vehicles-electricity/2591-forecasting-whitepaper.html#form-content

Electric vehicle charging will fit around people's individual needs.

As the network of charging infrastructure continues to expand over the coming years, drivers will have greater choice and flexibility in how they charge their vehicle. The following sets out just a few of the many possible ways that charging our vehicles will fit into our lives. Many drivers will use a combination of different charging approaches.

Amir is self-employed and uses a van for work. His work involves a lot of journeys locally, totalling around 250-300 miles per week. He usually plugs in to charge three or four evenings a week, with his vehicle fully charged by the morning.

He had a chargepoint installed on his driveway so he can charge on his domestic energy tariff. The chargepoint is smart, which means it shifts charging to off-peak times, which saves Amir money. He has also signed up to a vehicle-to-grid scheme with his electricity supplier. By keeping his van plugged in during the week when he doesn't need to use it, he's able to sell energy back to the grid when demand is high.



Jackie lives in an area where parking availability is limited at certain times, so she prefers to charge at her local community charging hub. The hub can accommodate six electric vehicles at once, with about 50 households using it regularly.

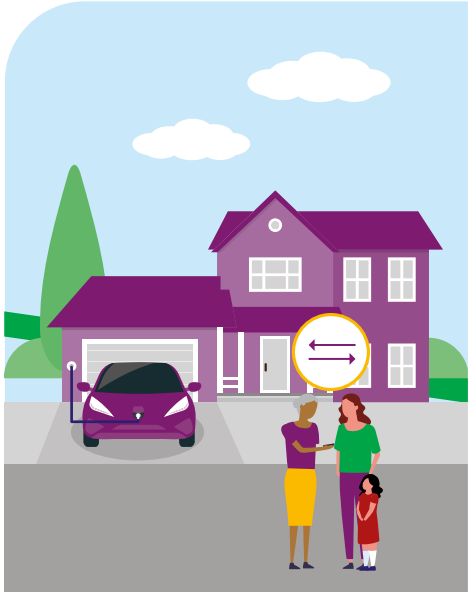
She travels around 100 miles each week for work, shopping and leisure trips. She charges at the hub overnight roughly once every week. It's about a ten-minute walk or two-minute cycle from home.

Alice is a delivery driver and travels long distances, roughly 200 miles a day. She refuels at rapid service stations when she takes her lunch break, which takes around 20 minutes. Rather than have to use different apps, she uses a fuel-card provided by her employer, much like she used for her old diesel vehicle. There are normally at least six chargepoints at the service area, with some having many more.

At the end of her shift she returns to the depot where there are chargepoints. This means she can start the next day on a full charge.

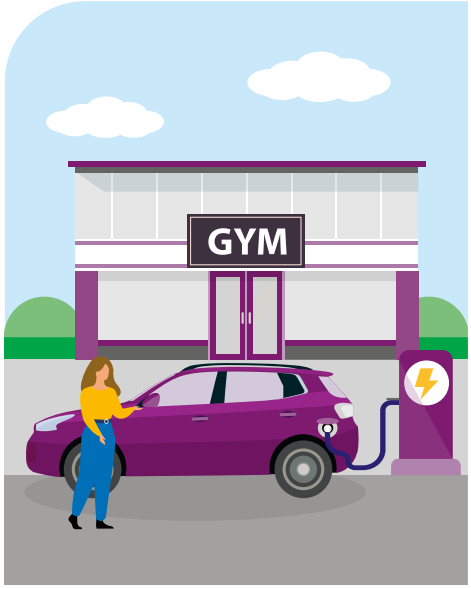
Harry usually charges his electric vehicle on his street, after his local authority had six lamp-post chargers installed by a chargepoint operator. He's able to book this on the chargepoint operator's app. One of the spaces is reserved for a car club, which his partner uses occasionally.

There are about 20 electric vehicles on his road using the chargepoints. These chargepoints are smart-enabled, so he pays less by opting to charge when there is lower demand for electricity. If he ever needs to top up unexpectedly, he can use a nearby rapid hub to quickly recharge.



Wendy has young children. She parks and charges her electric car on her driveway**.** As she doesn't travel every day, she finds she only has to charge every week or so. While she's not using her chargepoint, Wendy is able to rent it out to other people using a mobile app on her phone.

Sofia charges on Wendy's driveway. Using the mobile app she's able to arrange the charging and payment. Sofia likes this way of charging because its affordable, convenient and she always knows where she's going to charge. When she's travelling, she often uses the same app to book a place at another private chargepoint to charge ahead of time, as well as using public chargepoints at destinations and on major roads.



Elena finds it convenient to charge at work or on-the-go. She charges easily at destinations such as her workplace, the gym and the supermarket. Many supermarkets also make these chargepoints available overnight.

She travels around 50 miles a week, and it has become a habit to plug-in at her destination, so she doesn’t need to make extra trips to the forecourt. Her place of work has a chargepoint for almost every parking space. At destinations there are usually between two and four charging bays, but new chargepoints are popping up regularly.

Case study

Innovation: Trojan Energy – DoorSTEP Project:

This is an innovative project funded by the Office for Zero Emission Vehicles (OZEV) in partnership with Innovate UK (IUK). In a trial running from February to July 2022, Trojan Energy's Aon Charger, a 'flat and flush' charging technology, will be installed at 25 properties on selected streets in the London Borough of Brent and in three districts of Oxfordshire.

These chargers will be linked via an underground cable to the household's energy supply. This will allow households without off-street parking to access the same low-cost charging rates available to EV drivers with chargers installed on private driveways or in garages. Trojan's chargers sit below the pavement surface and users access them by inserting a Trojan 'lance' to connect the chargepoint to their vehicle. This will avoid the trailing of cables across the pavement and remove the need for additional permanent street clutter. The host can also choose to make this available to other EV drivers, helping to share the cost and increasing access to charging in the area.

Source: Dundee City Council

3. Key challenges

The UK's charging infrastructure is in a strong starting position. However, our ambition for EV uptake by 2030 is high. Meeting it will involve addressing some critical challenges.

The pace of rollout across the country is too slow for some chargepoint types, particularly public on-street charging.

The current pace of rollout is too slow to match our projected 2030 needs. In 2021, around 600 chargepoints were added to the public charging network every month.[57] If this rate continued, only 58,000 more public chargepoints would be available by 2030, to add to the 29,600 available today.

The pace of public chargepoint rollout will accelerate over time as EV adoption rates and demand for public charging increase. However, we want to speed up the transition across the country, by ensuring that enough chargepoints are available ahead of demand to encourage more people to make the switch. There is significant variation of chargepoint deployment across the country. This is to be expected given differing levels of early EV uptake but if left unaddressed, it risks leaving places behind.

57 DfT (2021). Charging Device Statistics. Available at: https://www.gov.uk/government/statistics/developing-faster-indicators-of-transport-activity and https://www.gov.uk/government/statistics/electric-vehicle-charging-device-statistics-october-2021

Tackling this situation is particularly important for the rollout of local on-street chargepoints, which the CMA found to be "significantly lagging behind" other parts of the market.[58] In England, an estimated 24% of households with a vehicle park on the street overnight.[59] Industry analysis suggests that this percentage can be much higher for fleet drivers, making on-street charging provision particularly important to enable businesses to transition to EVs.[60,61] And consumer research suggests that a perceived lack of on-street charging is a critical barrier to switching for people without off-street parking.[62] We will therefore increase our focus on levelling up and accelerating the deployment of local on-street charging.

The business case for commercial deployment can be challenging in some areas.

Stakeholder feedback and emerging analysis of chargepoint business cases indicate that, in some areas, the commercial model for on-street residential chargers is challenging. This can be exacerbated by low utilisation rates, as EV adoption is still in its early stages in some areas. Higher numbers of EV drivers in an area should create higher demand for public charging, making installation a more attractive investment proposition. Over time, the highest utilisation rates are likely to be found in areas where car ownership and vehicle mileage is highest. With multiple factors at play it is too early to generalise, but we expect that chargepoints will ultimately be commercially attractive in a mix of rural and urban areas.

Low utilisation can also hold back rollout of high powered chargepoints in remote areas and destination charging in seasonal tourist spots. In these instances, the gap may have wider consequences. People will have less confidence that they can travel long distances if they perceive there to be "off limit" areas for onroute top ups. Chargepoints in seasonal tourist areas will be critical to support local tourism during peak periods, despite low usage off season.[63,64]

Local on-street charging can be particularly commercially challenging for developers and investors. Charging volumes are generally lower due to the slower speed of charge and the lower margins on the sale of each kWh (though charging events are much longer). There is also limited space and electricity grid capacity along busy residential streets for chargepoints, which restricts the number of chargepoints a developer can install.

58 CMA (2021). Electric vehicle charging market study. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012617/EVC_MS_final_report_--.pdf

59 Department for Transport (2021). National Travel Survey Table NTS0908: Where vehicle parked overnight by Rural-Urban Classification of residence. Available at: https://www.gov.uk/government/statistics/national-travel-survey-2020

60 Mitie (2021). Response to CMA electric vehicle charging market study. Available at: https://assets.publishing.service.gov.uk/media/6038f51bd3bf7f038f0f5d22/Mitie.pdf

61 British Gas (2021). 3 policy essentials to accelerate the mass roll-out of electric vehicles. Available at: https://www.britishgas.co.uk/business/blog/3-policy-essentials-to-accelerate-the-mass-roll-out-of-electric-vehicles/

62 Britain Thinks (2022). Public Electric Vehicle Charging Infrastructure: Deliberative and quantitative research with drivers without access to off-street parking

63 SSEN (2020). E-tourism: charging demand by electric vehicles in Scottish tourist hotspots. Available at: https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=19789

64 CMA (2021). Electric vehicle charging market study (pg.7 – risk of charging deserts). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012617/EVC_MS_final_report_--.pdf

In addition, on-street projects have fewer opportunities for the developer to access ancillary revenues, unlike rapid charging stations connected to, for example, cafés or shops.

Generally, developers target a certain number of EV drivers in the surrounding area per chargepoint to provide certainty over demand. The viability of chargepoints therefore depends significantly on the EV uptake rates in the local area. At the same time, people are less likely to switch if they do not see chargepoints locally. Government support through the new Local EV Infrastructure (LEVI) Fund is crucial at this stage of the transition to ensure deployment remains ahead of need, giving people the confidence to switch. Rapid chargepoints (which can add around 100 miles of range in 35 minutes)[65] are already widely available along motorways and major A roads, and provision of ultra-rapid chargepoints is also growing. There are already 218 open access rapid and 76 open access ultra-rapid chargers at motorway service areas, and a further 234 ultra-rapid chargers which can be used by specific EV models.[66] But there is limited scope for the private sector to expand the number of chargepoints at many motorway service areas. Costly electricity network upgrades will be required to cater to the demand from a growing electric car and van fleet, and potentially heavy goods vehicles too.

Connecting new chargepoints to the electricity system can be slow and expensive.

Connecting new chargepoints to the electricity system can be an expensive and often slow process. Chargepoint operators have reported poor grid capacity in some areas being a barrier to projects, especially in more remote rural areas.[67] In a recent internal survey of local authorities by the Office of Zero Emission Vehicles, connection costs were the second most quoted barrier to the deployment of public chargepoints.

The costs and timescales involved can vary significantly between sites, depending on the location and available capacity at the specific site. Costly upgrades to the electricity grid may be needed to accommodate additional demand. Connecting several fast chargers could cost tens of thousands of pounds. For larger projects, such as charging at depots for fleets, or those at strategic, inflexible locations such as along motorways, the process could cost hundreds of thousands of pounds and take around two years.[68]

65 Pod Point (2021). How long does it take to charge an electric car? Available at: https://pod-point.com/guides/driver/how-long-to-charge-an-electric-car
66 Analysis procured from Zap Map (2022)
67 CMA (2021). Electric vehicle charging market study (pg.58). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012617/EVC_MS_final_report_--.pdf
68 CMA (2021). Electric vehicle charging market study. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012617/EVC_MS_final_report_--.pdf

In some areas, there is not enough local engagement and leadership for chargepoint rollout.

Installing and operating chargepoints requires several parties across the energy sector, local government and the transport sector to work together effectively. The complexity of the delivery environment can create confusion over roles and responsibilities, and can increase costs and project delays.[69]

Local highway authorities are ideally placed to help the market achieve ambitious, scaled rollout in their area as they are responsible for local highways, understand their populations' needs and have a central role in local transport planning. They can work with electricity network operators to strategically plan for future infrastructure provision. This is particularly important in areas struggling to attract market interest. Local highway authorities in GB consist of unitary authorities and county councils. Combined authorities also share some highways duties with their local highway authorities. In Northern Ireland, we propose that local councils may be best suited to this role.

There is a wide variation in local authority capacity, expertise and engagement in EV charging.[70] Although differences in provision reflect variation in population density, levels of off-street parking, and specific local commitments to transport decarbonisation, the regional disparities for on-street provision are stark. Local authorities have reported a range of challenges they can face. These include a lack of clarity over their role, perceived insufficient funding, and constrained resource. Other concerns raised include the complexity of engaging with the energy connections process, data gaps, and specialist skills/knowledge gaps in local authorities. In addition, local authorities must balance the parking needs of petrol and diesel vehicle drivers with increasing demand for parking with charging from EV drivers.

Local leadership is essential to creating new investment opportunities and inspiring local confidence in EVs. An actual or a perceived lack of sufficient supply can reduce people's willingness to switch. Without consistent prioritisation of charging infrastructure deployment across the country, some areas are at risk of being left behind.

69 Transport & Environment (2021). Charging Forward Report (2021). Available at: https://www.transportenvironment.org/publications/charging-forward-creating-world-class-uk-charging-network

70 Transport & Environment (2021). Charging Forward Report). Available at: https://www.transportenvironment.org/publications/charging-forward-creating-world-class-uk-charging-network

Too often, the public charging network lets people down.

Some people are already having a positive experience using the public chargepoint network. However, chargepoints can be difficult to find, difficult to use and may turn out to be in use or broken when a driver reaches them. For disabled drivers, the situation can be particularly challenging. In many places, insufficient thought has been given to inclusive access.

Even paying for charging can be unnecessarily complicated. It can require multiple apps or smartcards across different chargepoint operators.[71] The Competition and Markets Authority found that only 9% of all public chargepoints offer contactless payment.[72] At rapid and high powered chargers (50kW+), only 41% of chargepoints have a contactless debit or credit card payment option.[73] Limited competition on some parts of the network leaves drivers reliant on potentially expensive, unreliable, and poor-quality facilities. We considered these issues further in "The consumer experience at public EV chargepoints" consultation in 2021.[74] We will be publishing the Government's response later this year.

Public charging is also generally more expensive than private home charging.[75] The National Audit Office reported that the cost of public charging could be between 59% and 78% higher than charging at home.[76]

These issues matter, not just because current EV drivers can experience unacceptably poor service, but because they deter others from switching to an EV.

71 Policy Exchange (2021). Charging Up – Policies to deliver a comprehensive network of public EV chargepoints. Available at: https://policyexchange.org.uk/wp-content/uploads/Charging-Up.pdf
72 CMA (2021). Electric vehicle charging market study. Available at: https://www.gov.uk/government/publications/electric-vehicle-charging-market-study-final-report/final-report
73 DfT (2021). The consumer experience at public chargepoints. Available at: https://www.gov.uk/government/consultations/the-consumer-experience-at-public-electric-vehicle-chargepoints/the-consumer-experience-at-public-chargepoints
74 HM Government (2021). The consumer experience at public electric vehicle chargepoints consultation. Available at: https://www.gov.uk/government/consultations/the-consumer-experience-at-public-electric-vehicle-chargepoints
75 National Audit Office (2021). Reducing carbon emissions from cars (pg.38). Available at: https://www.nao.org.uk/wp-content/uploads/2021/02/Reducing-Carbon-Emissions-from-cars.pdf
76 National Audit Office (2021). Reducing carbon emissions from cars. Available at: https://www.nao.org.uk/wp-content/uploads/2021/02/Reducing-Carbon-Emissions-from-cars.pdf

What is the long-term charging solution for those without off-street parking?

There could be around 10 million electric cars and vans that are regularly parked overnight on-street in the UK by 2050. They will all need to access charging solutions that are as convenient and affordable as possible, and that minimise the impact on the UK's electricity system. This will almost certainly be provided by a mix of charging solutions including some local on-street charging, some destination charging, some workplace charging and some rapid charging. Although there is insufficient evidence in 2022 to suggest a definitive optimum mix, even in 2050 there will be a clear need to (a) shift as much charging activity as possible into the off-peak to minimise the burden on the electricity system, and (b) to offer access to the lowest cost charging tariffs to consumers.

Both of these imperatives would suggest that ubiquitous, low cost, overnight on-street charging should be part of the solution. But it is not yet clear if there is a sustainable commercial model to deliver this, and there are potentially tricky interactions with local parking policies and street clutter. Other key factors such as grid reinforcements will also affect the commercial model for different charging solutions.

We will use the £450m Local Electric Vehicle Infrastructure (LEVI) Fund to explore deployment of local charging at scale, to better understand some of these challenges and how they can be overcome. We are committed to ensuring that there is no unnecessary penalty in terms of cost or convenience for electric vehicle drivers without driveways.

Source: Urban Foresight

4. Taking charge: our strategic pillars

Our actions to address the challenges are already underway.

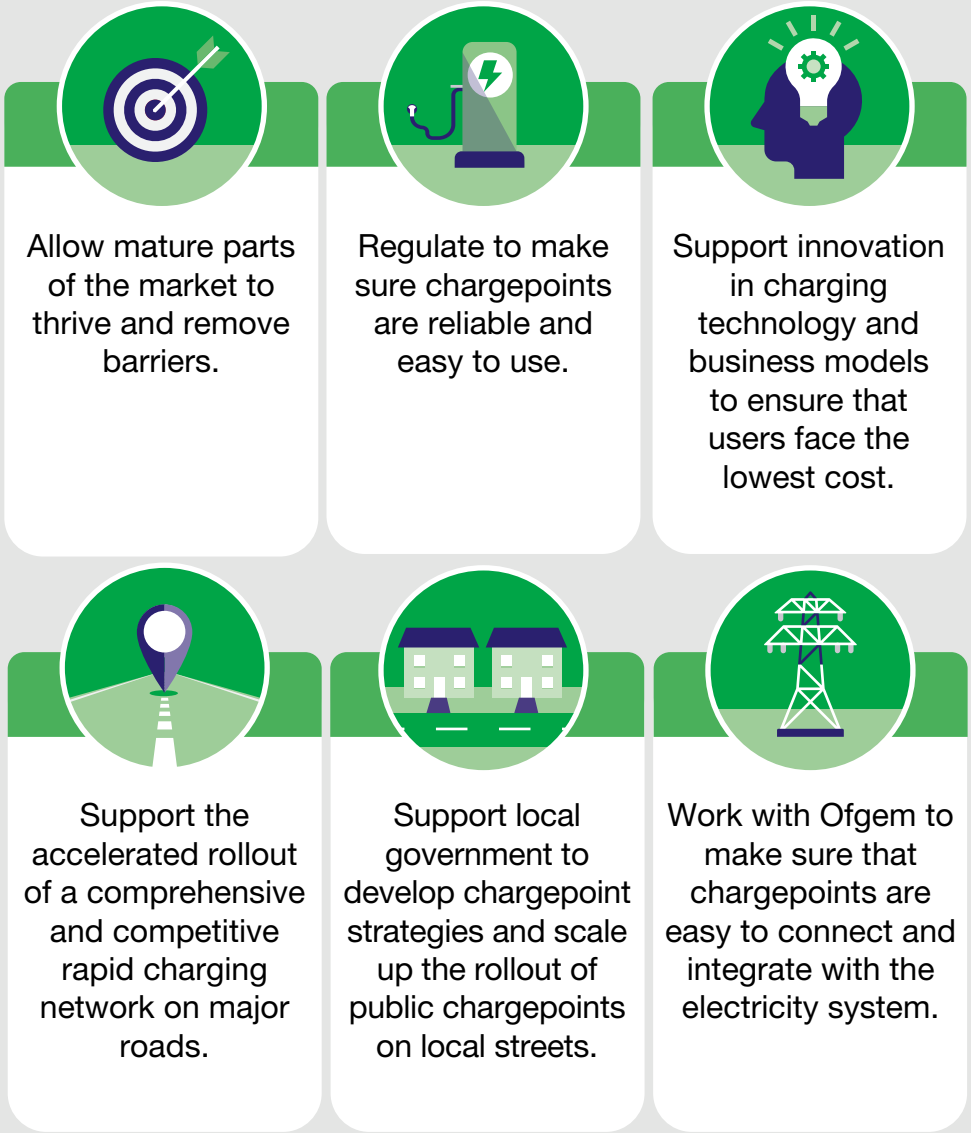
The UK Government has been investing in the country's EV charging infrastructure for over a decade, and work to support its development has ramped up steadily in recent years.

Since 2020, this government has committed over £2.5 billion to the EV transition, of which over £1.6 billion is to support charging infrastructure.

In July 2021, we set out the milestones towards achieving our phase out dates of sales of new petrol and diesel cars and vans in Transitioning to zero emission cars and vans: 2035 delivery plan.[77]

Our strategic pillars summarise what Government will do to accelerate chargepoint deployment across the whole country and deliver our vision. We set out where and how we will intervene to address the challenges currently slowing down the rollout in parts of the country. Government cannot do this alone, however. As part of our approach, we will work with organisations from across sectors to make our vision a reality. We set out in the Role and Responsibilities Annex (page 83) what we expect from the different organisations responsible for chargepoint rollout.

77 HM Government (2021). Transitioning to zero emission cars and vans: 2035 delivery plan. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005301/transitioning-to-zero-emission-cars-vans-2035-delivery-plan.pdf


Allow mature parts of the market to thrive and remove barriers.
Regulate to make sure chargepoints are reliable and easy to use.
Support innovation in charging technology and business models to ensure that users face the lowest cost.
Support the accelerated rollout of a comprehensive and competitive rapid charging network on major roads.
Support local government to develop chargepoint strategies and scale up the rollout of public chargepoints on local streets.
Work with Ofgem to make sure that chargepoints are easy to connect and integrate with the electricity system.

To maximise competition and innovation, we will allow mature parts of the market to thrive and remove barriers.

Our Vision

Market-led rollout for the majority of chargepoints, backed by competition.

Continued innovation to meet drivers' needs.

We want to maximise the opportunity for chargepoints to be delivered by the market. Market-led rollout will foster competition, encouraging chargepoint suppliers to provide innovative solutions that meet drivers' needs, at the lowest possible cost. The more mature parts of the market are already thriving, such as home charging and destination charging. We are taking regulatory action to make home charging a default option; from June 2022, all new homes, or those undergoing major renovation, with associated parking will have to have chargepoints installed.

We will remove remaining barriers to these markets as we transition our focus to less developed parts of chargepoint rollout. This year, we will reform the Electric Vehicle Homecharge Scheme (EVHS) away from the established market for people with their own driveways and garages. Instead, we will focus on supporting people living in flats and rented accommodation to access the benefits of home charging. We will also extend the use of workplace charging. We will support the charity sector and smaller accommodation businesses such as B&Bs to install workplace charging, through changes to the Workplace Chargepoint Scheme (WCS).

The delivery environment for chargepoint installation is complex, involving multiple organisations and cutting across transport, energy, and planning policies. In some cases, securing the relevant permissions, consents, and licenses to install a public chargepoint can take several months. We know that this can create additional costs and delays to projects. It can slow down deployment and may deter some investors from participating. We will make clear guidance available to make these processes as smooth as possible.

In 2020, the Government introduced a unified consent for 'pavement licences' outside cafes and restaurants. These have been successful in reducing bureaucracy, whilst ensuring local residents are consulted. We would like to explore options for introducing a unified consent process for installing EV chargepoints, including consideration of a streamlined process for obtaining both the planning permission consent and the highways consent for the traffic management works at the same time.

We will also review the regulatory framework relating to EV chargepoints. The regulatory environment needed to encourage early EV uptake, and accompanying public charging network is unlikely to be the same as that needed for a future mass market scenario. The consumer base will change from early adopters to a much wider base, creating different consumer expectations and needs from the public chargepoint network. The scale of potential investments will increase to allow for large-scale project deployment. As we move at pace from an early to a more mature market, we need to ensure the regulatory arrangements continue to support the transition, rather than hold it back.

We will regulate to make sure chargepoints are reliable and easy to use.

Our Vision

Effortless on and off-street charging for private and commercial drivers.

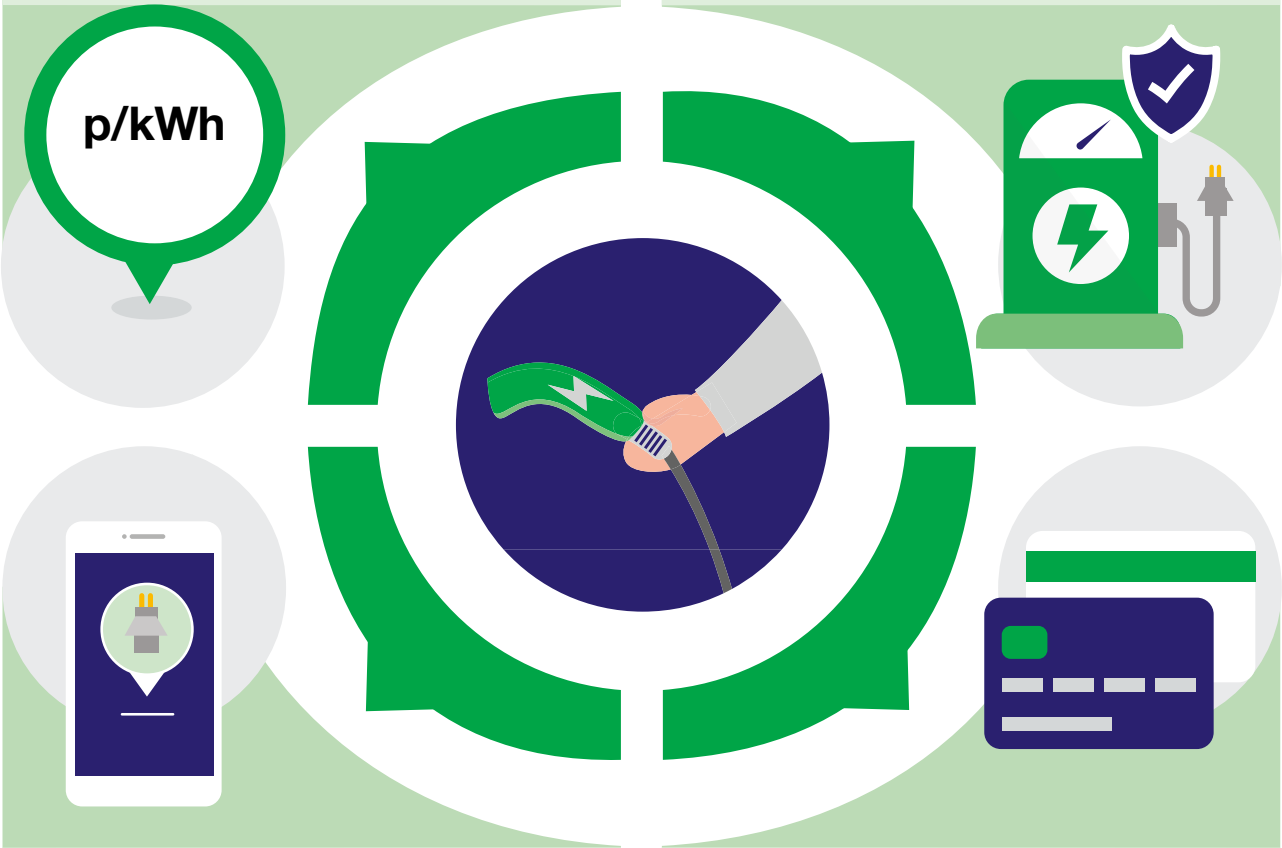
Fairly priced and inclusively designed public charging, trusted by consumers.

Too often, the charging network lets people down. To accelerate the transition to EVs, we must ensure that drivers across the country can have confidence and trust that public chargepoints will be easy to find, easy to use and fairly priced. One of our key priorities is to address issues with reliability, ease of payment and locating the right chargepoint for consumers' needs.

We expect to bring in new legislation this year which will improve drivers' experiences using the public charging network. People will be able to compare the price of charging across networks quickly; they will be able to pay for their charge easily, without relying on multiple apps. They will also be able to rely on chargepoints being operational because of rigorous new legal obligations on chargepoint operators. All publicly available rapid chargepoints of 50kW and over will have to meet 99% minimum reliability standards by the end of 2023. If people do have difficulties at a chargepoint, they will be able to get help and support. These changes will significantly improve current EV drivers' experience of using the public charging network. In doing so, they will increase wider public confidence in the network, encouraging more people to switch to an EV.

Mandating a single payment metric so consumers can compare the price across different charging networks.

Improving the **reliability of the charging network** so that consumers can feel confident that the chargepoint is working as expected.



Enabling consumers to **easily locate the right chargepoints** for their needs through opening public EV chargepoint data.

Standardising the payment methods to make it easier to pay for charging.

Accessibility will also be a cross-cutting focus for public chargepoints. We want everyone, including disabled drivers, to be able to use the public network with ease. We launched a project to develop a ground-breaking British chargepoint design, with sustainability and inclusive design at its core. The final design was unveiled at COP26 in Glasgow. We will publish the design considerations developed as part of the chargepoint design project, which will help guide local authorities and the chargepoint industry to fully consider good design, prioritising ease-of-use, inclusivity, and accessibility. We have already published guidance, through the Inclusive Mobility document,[78] on best practice for designing transport infrastructure for a barrier-free pedestrian environment.

78 HM Government (2022). Inclusive mobility: making transport accessible for passengers and pedestrians https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians

In partnership with Motability, we have commissioned the British Standards Institute (BSI) to develop charging standards to improve disabled people's experience when using public EV chargepoints across the UK. They will provide guidance to industry and drivers and allow drivers to easily identify which chargepoints are suitable for their needs.

Source: ChargePlace Scotland

We will support the accelerated rollout of a comprehensive and competitive ultra rapid charging network on major roads.

Our Vision

A reliable network of high powered chargepoints along major roads.

We know that prospective drivers of EVs often cite the risk of running out of charge on a long-distance journey as a key barrier to making the switch away from a petrol or diesel vehicle.[79] A comprehensive charging network along motorways and major A roads is key to tackling this concern. This ability to stop and recharge in 15 minutes or less will also mean that drivers will not need to invest in the most expensive EVs, which tend to come with larger batteries and extended ranges.

We want commercial and private drivers across the country to find it just as convenient to make a long journey in an EV as in a petrol or diesel vehicle. To support this aim, in May 2020 the Government published its vision for the rapid chargepoint network in England.[80]

The vision sets out the following ambitions:

- By 2023, we aim to have at least 6 high powered, open access chargepoints (150-350 kilowatt capable) at motorway service areas in England, with some larger sites having as many as 10-12.
- By 2030, we expect the network to be extensive and ready for more people to benefit from the switch to electric cars. We are planning for there to be around 2,500 high powered chargepoints across England's motorways and major A roads.
- By 2035, we expect around 6,000 high powered chargepoints across England's motorways and major A roads.

Many operators of motorway service areas have embraced the ambition to install six high powered chargers by the end of 2023. Over 70% of England's motorway service areas now have a plan to deliver this, and we will continue to work with site operators to ensure that every site is reached.

79 Bright Blue (2021). Driving uptake: Maturing the market for battery electric vehicles. Available at: http://www.brightblue.org.uk/wp-content/uploads/2021/02/maturing-the-market-for-battery-electric-vehicles.pdf

80 HM Government (2020). Government vision for the rapid chargepoint network in England. Available at: https://www.gov.uk/government/publications/government-vision-for-the-rapid-chargepoint-network-in-england/government-vision-for-the-rapid-chargepoint-network-in-england

Currently, however, the commercial case can be difficult for high powered chargepoints, particularly where connecting to the electricity system is expensive and time-consuming. Working across government, we have taken significant steps to address this. Over 40 sites will benefit from short-term grid upgrades through Ofgem's Green Recovery Scheme, which is accelerating £300m in investment in upgrades to the electricity network to support economic recovery and low-carbon development. We are working with National Highways to fund on-site electricity storage solutions, to enable additional sites to meet the 2023 goal.

We will consult on mandating that service area operators and large fuel retailers must meet minimum chargepoint numbers at specific sites, and at increasing levels over a period of time, to address both actual and perceived demand. To ensure the private sector can continue to expand the charging network at pace in the 2020s, the Government will invest up to £950m through the Rapid Charging Fund. This will fund all or a portion of the cost of upgrading the electricity grid at strategic locations along major roads to meet future demand for high powered chargepoints, where it is currently prohibitive, expensive and uncommercial to do so.

The Rapid Charging Fund provides a pivotal opportunity to open up the market at motorway service areas as well as increase charging infrastructure available to drivers. The upgraded connections will only be open to chargepoint operators with open networks that are interoperable with all EVs. We are actively considering the principles on which we will issue this funding. These could include a requirement for applicants to ensure there is fair competition between chargepoint operators at each motorway service area site and that there is an open tender process for chargepoint service contracts to make use of the funding. We will continue to work with the Competition and Markets Authority to inform the development of the Rapid Charging Fund.

The Rapid Charging Fund will be rolled out as quickly as possible. Detailed design work on the fund is currently being finalised, ahead of a public consultation later in the year. We expect to launch some pathfinder projects at selected sites in 2022, followed by the full launch of the fund in 2023.

We will ask local government to develop chargepoint strategies and we will scale up the rollout of public chargepoints on local streets.

Our Vision

Everyone can find and access reliable public chargepoints wherever they live.

We are committed to a comprehensive rollout of charging infrastructure which leaves no area of the country behind. There is huge capacity for the market to meet this challenge and, in areas with higher EV ownership and well-developed local government strategies, local infrastructure delivery is expanding rapidly and the commercial case for private investment is strengthening. However, the pace of rollout across the country is too slow and there is insufficient local leadership and engagement in some places. We are providing local government with the support they need to meet the challenge.

Many areas do not currently have sufficient charging demand to support investment, and local authorities can lack the experience and capacity to develop strategies and apply for funding. The resulting lack of infrastructure can dissuade prospective EV owners, which in turn risks slowing the transition to EVs and leaving some people behind. To ensure all areas have access to high quality, competitively priced infrastructure delivered ahead of need we are therefore significantly increasing funding with a comprehensive £500m local infrastructure support programme. This includes launching the £450m Local EV Infrastructure (LEVI) Fund to help local authorities to dramatically scale up infrastructure provision to level up provision across the country, and to negotiate good commercial terms. This fund will be flexible in its approach, to match the level of public subsidy to the specific need in different local areas.

We recognise the current spatial disparities in the provision of EV infrastructure across the UK. When allocating funding, consideration will be given to places that have not previously received funding for EV infrastructure, and those where chargepoint provision is currently low.

We are launching a £10m pilot of the LEVI Fund to provide an early opportunity for local authorities to scale up their local charging provision and maximise the potential for private sector finance. The pilot will test how we can most effectively support local authorities procuring chargepoint deployment by trialling different delivery mechanisms, business models and technologies.

We will be monitoring the level of engagement and planning taking place at the local government level. We will publish information on which local highway authorities have produced strategies for chargepoint provision. We will look to take pre-emptive powers to ensure there is a clear statutory obligation to develop local charging infrastructure strategies and oversee their delivery, subject to consultation.

We know many local authorities face challenges in developing local charging infrastructure approaches. We are taking actions through a range of routes to ensure they have the tools and resources required to identify and address their specific local challenges (ranging from how to meet seasonal charging demand from tourism, to working with housing associations and car park operators). The LEVI Fund includes up to £50m to fund local delivery support across the country, and provide training, tools and knowledge sharing. We will focus on upskilling areas which are currently behind in planning and delivering chargepoints.

In spring 2022, we will launch a local government knowledge hub on gov.uk with consolidated guidance for local authorities on EVs and charging infrastructure, and we will publish a Local Authority Toolkit to help local areas to reduce emissions from transport. This Toolkit will provide local authorities with guidance and information on a range of topics including those relevant to chargepoint provision such as electric car clubs and fleet electrification. We will also publish an EV infrastructure guide for local authorities in partnership with the Institution of Engineering and Technology (IET) to assist with the transition to zero emission vehicles.

We are addressing barriers to data sharing which can impede decision making. The Geospatial Commission is undertaking a discovery research project in 2022 to explore how location data can be better utilised to support planning and delivery of chargepoints by local authorities.

We are providing regional support for local authorities to plan chargepoints. Sub-national Transport Bodies in England have been funded to assess charging demand at a regional level and develop tools to assist local authorities in developing their own chargepoint plans. A transport working group is also being developed through the Local Net Zero Hubs, to enable regional EV infrastructure initiatives to be coordinated at a national level. (The five Local Net Zero Hubs – Greater South East, South West, Midlands, North West and North East of England – promote best practice and support local authorities to develop net zero projects that can attract commercial investment.)

We will work with industry to provide consolidated evidence on fleet charging demand to inform local planning. New research will capture fleet attitudes and preferences towards charging, and we will work with industry to improve information on depot locations and other large fleet sites. We will disseminate future outputs from fleet EV groups, such as the forthcoming research on fleet charging use cases for different user groups being developed by the British Vehicle Rental and Leasing Association (BVRLA), and specifications to standardise fleet data for sharing with local authorities and other stakeholders.

We will work with Ofgem to make sure that chargepoints are easy to connect and integrate with the electricity system.

Our Vision

Infrastructure seamlessly integrated into a smart energy system.

EVs will have a significant impact on the electricity system but the process of connecting chargepoints to the system can be a significant, and costly, challenge for developers and fleet operators. We are focused on ensuring the connection process does not slow down the transition.

Ofgem, the energy regulator, is preparing for the transition to EVs and will support strategic investment in the electricity network to deliver the capacity needed for the net zero transition. Ofgem is placing a clear expectation on network companies to anticipate and accommodate increasing demand. Stakeholders across the electricity system are already starting to adapt and put in place solutions to connect and manage the additional electricity demand from vehicle charging. There are significant opportunities from the increased use of smart, flexible charging. We will work with Ofgem, energy companies and the charging industry to improve current processes and to maximise the benefits of emerging technologies for EV drivers and energy consumers. We will set out our overall approach to transforming the electricity network to achieve our net zero goal in our electricity networks strategic framework in spring 2022.

In July 2021, we published the Smart Systems and Flexibility Plan with Ofgem. This placed commitments on distribution network operators to make more effective use of local network solutions and smart technologies in ensuring the distribution network is ready for EV charging demand. These solutions can alleviate network constraints, providing cost-effective, net-zero compliant alternatives to expensive network upgrades or renewables curtailment. We will identify the role of smart charging in the public infrastructure network and consider mechanisms to deliver this. We will consider the potential sharing of private chargepoint location and energy data with specified parties to support network planning.[81] We will aim to consult in 2022 on additional measures to ensure we are taking a systems-wide approach for a safe and secure transition to smart charging.

81 HM Government (2021). Consultation outcome – Electric vehicle smart charging. Available at: https://www.gov.uk/government/consultations/electric-vehicle-smart-charging

The cost, timeframes and complexity of connecting chargepoints to the electricity system can be a barrier to deployment. We are committed to addressing these to ensure charging infrastructure can be rolled out at the pace required, working with Ofgem. The Government's electricity networks strategic framework will set out the numerous actions being taken to improve the affordability of connections, reduce connection timescales and improve customer experience. Ofgem is proposing to reduce the cost of new grid connections where upgrades to the existing network are required, from April 2023. Increasing competition in connections will also reduce both costs and timescales and Ofgem has challenged distribution network operators to include actions to facilitate competition in their business plans for the upcoming price control for electricity distribution (RIIO-ED2).

We published guidance in June 2021 on Connecting electric vehicle chargepoints to the electricity network.[82] We will continue to review evidence on connection costs and timings and work closely with Ofgem to ensure that these do not significantly delay EV uptake, particularly at inflexible locations with high demand such as depots. We are also working with Ofgem to deliver their £300m Green Recovery Scheme.

Accommodating fleet demand at depots

- Fleets are particularly likely to need network upgrades to install multiple chargepoints (e.g. at depots). Ofgem's Green Recovery Scheme has allowed the distribution network companies to fund several projects to provide new connections at fleet depots (such as Caledonian bus depot and Wardle depot).[83]
- **We expect local government to work closely with fleets and businesses** to ensure that their needs are considered as they plan and deliver local public charging infrastructure (with our support).
- We have made funding available for Sub-national Transport Bodies to assess regional EV infrastructure demand. Clusters of demand (including sites such as depots) should be identified as part of this. This will help electricity network operators to plan their networks to accommodate this demand.
- We will work with industry to provide **consolidated evidence on fleet charging demand** to inform local planning. This will include improved information on depots and other fleet sites.

82 HM Government (2021). Connecting electric vehicle chargepoints to the electricity network. Available at: https://www.gov.uk/government/publications/connecting-electric-vehicle-chargepoints-to-the-electricity-network

83 Ofgem (2021). Decision on the RIIO-ED1 Green Recovery Scheme. Available at: https://www.ofgem.gov.uk/publications/decision-riio-ed1-green-recovery-scheme

We will intervene further if progress is not fast enough.

Infrastructure rollout must ramp up significantly, and soon. There is already excellent cross-sector engagement and commitment across government, the chargepoint industry, energy and auto sectors to making this happen. Over the next two years, we will continue to work collaboratively with bodies such as Electric Vehicle Energy Taskforce (EVET), the Automotive Council, and the EV Fleet Accelerator to monitor progress closely. Where we identify outstanding issues, we will prepare to take further actions.

In 2030, there will still be some variation in EV uptake between different regions and demographics. Local factors will impact the types of charging that people find most convenient, and significant changes in charging technology – and travel behaviour – are likely over the rest of this decade.

However, we cannot wait until 2030 to see if our approach is right. To keep track of progress, we will use metrics that enable us to identify if and where the market fails to deliver, taking into account the uncertainty around future need. This will enable us to take action. We will continue to report publicly on chargepoint provision and regional rollout, providing updates on the chargepoints per capita across the country, and the number of different types of public chargepoints by region. We will develop improved metrics to monitor provision and disparities between local areas while accounting for local needs, such as:

- The percentage of households with vehicles parked on-street compared to the number of public chargepoints in an area;
- Typical average walking time to a public chargepoint for households in areas with many vehicles parked on the street;
- Utilisation of public chargepoints (this will be over a longer time frame and will build on work to open up chargepoint data).
- We will also monitor consumer behaviour and experiences at chargepoints, as these are both fundamental to maximising the benefits of EVs. We will assess progress on consumer confidence and specific consumer experience issues at public chargepoints, and evaluate the uptake of smart charging. We will continue to review emerging evidence on how and when consumers use public chargepoints, and the associated costs and benefits to consumers and the energy system.

We expect to review our approach by 2023 and decide at this point whether we need to change the regulatory framework further. In advance of this, Government consulted in the Future of Transport Regulatory Review in 2021 on potential measures that would enable us to intervene quickly. We will publish our response to this in summer 2022.

5. Our action plan

Allow mature parts of the market to thrive and remove barriers.

We will reform the Electric Vehicle Homecharge Scheme (EVHS) to focus on support for home charging at flats and rented accommodation, rather than the more established market for people with their own driveways and garages.	**Spring 2022**
We will amend the Workplace Chargepoint Scheme (WCS) to support small accommodation businesses (such as B&Bs) and the charity sector (such as heritage sites and other charitable destinations) to install workplace charging for guests and visitors. We will transition away from supporting businesses to provide chargepoints for their staff and fleets, which is a more developed market.	**Spring 2022 for expanded remit**
From June 2022, we are requiring all new homes with associated parking, including those undergoing major renovation, to have chargepoints installed at the point of construction. Charging infrastructure will also be required in new non-residential properties. We have published guidance on meeting the new regulations in Approved Document S.	**Summer 2022**
We will consider what further role Planning Practice Guidance (PPG) can have in ensuring the delivery of EV infrastructure is appropriately supported by the planning system.	**Summer 2022**

We will work with the EV Fleet Accelerator and other fleet stakeholders to accelerate fleet transition to electrification, setting out our shared findings.	**Ongoing**
We will make charging data available to all parties that need it to plan and deliver chargepoint infrastructure, building on our commitments in our consumer experience consultation and the Modernising Energy Data programme.	**2023 industry developed data solution**
We will explore options to streamline and reduce barriers in the planning system and take any necessary actions. As part of this, we will explore whether Permitted Development Rights could be used to accelerate the process of public chargepoint installation.	**Summer 2022**
We will develop best practice guidance on Section 50 licenses for the installation of chargepoints. This will be published on the local government knowledge hub on gov.uk.	**Autumn 2022**
We will consult on measures to make Traffic Regulation Orders (part of the process to install on-street chargepoints) more straightforward.	**Spring 2022**

Regulate and provide guidance to make sure chargepoints are reliable and easy to use.

We will bring in new legislation in summer 2022 to improve people's experience when using public chargepoints. The regulations will be overseen and monitored by a public body. We will work with industry to open data so that drivers can access real time information about chargepoints across the public network, rely on the public charging network, compare prices and can pay for their charging easily, whoever the chargepoint provider. We will mandate reliability standards to ensure consumers have confidence wherever they travel in the UK. We will also support fleets by introducing payment roaming across the public chargepoint network. Legislation will come into effect in summer 2022.	**Summer 2022**
We will publish the design considerations developed as part of the chargepoint design project, which will help guide local authorities and the chargepoint industry to fully consider good design, prioritising ease-of-use, inclusivity, accessibility and aesthetics.	**Summer 2022**

In partnership with Motability, we have commissioned the British Standards Institute (BSI) to develop charging standards to improve disabled people's experience when using public EV chargepoints across the UK. These standards will provide guidance to industry and drivers and allow drivers to easily identify which chargepoints are suitable for their needs.	**Summer 2022**
We will publish the Government response to the Future of Transport Regulatory Review proposals that were consulted on in 2021.	**Summer 2022**
We will improve signing for charging facilities on the trunk road network.	**Autumn 2022**

Support the accelerated rollout of a comprehensive and competitive ultra rapid charging network on major roads.

We will consult on the design of the £950m Rapid Charging Fund. This fund will support the rollout of at least 6,000 high powered chargepoints across England's motorways and major A-roads by 2035, by enabling electricity network infrastructure to be installed ahead of chargepoint demand.	**Winter 2022 / Spring 2023**
We will launch pathfinder projects for the Rapid Charging Fund, ahead of the fund opening in 2023.	**Winter 2022**
We will work with the private sector to ensure there are at least six high powered chargepoints at each motorway service area by the end of 2023.	**End 2023**

Ask local government to develop chargepoint strategies and scale up the rollout of public chargepoints on local streets.

Lack of coherent strategic direction at a national level, including no articulation of the vision for the future and lack of clarity over the role authorities were expected to play in delivering EV charging infrastructure.	
We are setting out our strategic direction through this strategy, including roles and responsibilities for the core participants in EV infrastructure deployment.	**Immediate**
We will look to take pre-emptive powers, subject to consultation, to ensure there is a clear statutory obligation to develop local charging infrastructure strategies and oversee their delivery.	**2023**
Funding and resource constraints: current funding structures are too short term to allow strategic planning and are based on competitive allocation. This hinders the identification and delivery of infrastructure where it is most needed.	
We are funding the rollout of public chargepoints for people without off-street parking through the expanded On-street Residential Chargepoint Scheme (ORCS).	**Ongoing**
We are increasing the Local EV Infrastructure (LEVI) Fund to £450m. We will help local authorities to negotiate good commercial terms which reflect local market conditions, ensuring that our funding schemes provide good value for money in levelling up chargepoint provision.	**2022-2025**
We are launching a £10m pilot of the LEVI Fund to provide an early opportunity for local authorities to scale up their local charging provision and maximise the potential for private sector finance. This pilot will test how we can most effectively support local authorities procuring chargepoint deployment by trialling different delivery mechanisms, business models and technologies.	**Spring 2022**
The LEVI Fund includes up to £50m to fund local delivery support across the country, and provide training, tools and knowledge sharing. We will focus on upskilling areas which are currently behind in planning and delivering chargepoints, to help them identify and address their specific local challenges.	**2022-2025**

We are providing expert support, through the Local Government Support Programme (LGSP), to local authorities seeking to develop chargepoint strategies, procure chargepoints, and apply for funding. The Local Government Support Programme helps local authorities decarbonise transport, improve air quality and increase EV adoption. The programme is currently administered by the Energy Savings Trust, fully funded by the Department for Transport and available to all local authorities across England. Since the launch of the scheme in October 2018 and November 2021, LGSP has delivered support to 121 councils, helping them progress their EV and sustainable travel projects.	**Ongoing**
Lack of data to support decision making, including not having modelling of future demand.	
Following the recent consultation to improve the consumer experience at public chargepoints, the Office for Zero Emission Vehicles (OZEV) has commenced a workstream to open public EV chargepoint data. The Geospatial Commission is undertaking a discovery research project in 2022 to explore how location data can be better utilised to support planning and delivery of chargepoints by local authorities.	**Spring 2022**
We are providing regional support for local authorities to plan chargepoints. Sub-national Transport Bodies in England have been funded to assess charging demand at a regional level and develop tools to assist local authorities in developing their own chargepoint plans. A transport working group is also being developed through the Local Net Zero Hubs, to enable regional EV infrastructure initiatives to be coordinated at a national level. The five Local Net Zero Hubs (Greater South East, South West, Midlands, North West and North East of England) promote best practice and support local authorities to develop net zero projects that can attract commercial investment.	**Ongoing**

We will work with industry to provide consolidated evidence on fleet charging demand to inform local planning. New research will capture fleet attitudes and preferences towards charging, and we will work with industry to improve information on depot locations and other large fleet sites. We will disseminate future outputs from fleet EV groups, such as the forthcoming research on fleet charging use cases for different user groups being developed by the British Vehicle Rental and Leasing Association (BVRLA), and specifications to standardise fleet data for sharing with local authorities and other stakeholders.	**Autumn 2022**
Practical challenges for local delivery such as procurement approaches and local authorities' access to the right commercial skills; responding to market constraints and technology uncertainty; insufficient sharing of best practice and documentation; and competing demand for charging infrastructure against footway and road space constraints and space for bike and bus lanes.	
We will launch a local government knowledge hub on gov.uk with consolidated guidance for local authorities on EVs and infrastructure. This will include examples of local strategies for different area types, best practice to address specific challenges, examples of regional collaboration, and procurement tools. The hub will also include a comprehensive guidance document to support local government authorities in planning and provision of chargepoints to meet their specific local needs.	**Spring 2022**
The Government has made available a Crown Commercial Services framework for local authorities to use to procure a commercial partner.	**Ongoing**
We will publish a Local Authority Toolkit to help local areas to reduce emissions from transport. It will provide local authorities with guidance and information on a range of topics including those relevant to chargepoint provision such as electric car clubs and fleet electrification. This will help them build business cases, develop innovative policies, secure funding, and deliver measures on the ground.	**Spring 2022**
We will publish an EV infrastructure guide for local authorities in partnership with the Institution of Engineering and Technology (IET) to assist with the transition to zero emission vehicles.	**Spring 2022**

We will work with Ofgem to make sure that chargepoints are easy to connect and integrate with the electricity system.

We laid regulations in October 2021 to mandate that private chargepoints sold in GB must be smart and meet minimum device-level requirements from June 2022. We have made advice on smart charging available via the Energy Savings Trust.	**In force from June 2022**
We will identify the role of smart charging in the public infrastructure network and consider mechanisms to deliver this. We will consider the potential sharing of private chargepoint location and energy data with specified parties to support network planning.[84] We will aim to consult on additional measures to ensure we are taking a systems-wide approach for a safe and secure transition to smart charging.	**Summer 2022**
We will set out our overall approach to transforming the electricity network to achieve our net zero goal and continuing energy security in our electricity networks strategic framework: Electricity Networks: Enabling the Transition to Net Zero. This will include our approach to enabling cost effective and timely connections.	**Spring 2022**
We will maximise the opportunities for flexibility from EVs while protecting the electricity grid and consumers, publishing a joint Government-Ofgem Electric Vehicle Smart Charging Action Plan.	**Summer 2022**
With Ofgem, we have placed commitments on distribution network operators to make more effective use of local network solutions and smart technologies in ensuring the distribution network is ready for EV charging demand. These solutions can alleviate network constraints, providing cost-effective, net zero compliant alternatives to expensive network upgrades or renewables curtailment. Commitments published in the Smart Systems and Flexibility Plan, published jointly with Ofgem in July 2021.	**Ongoing**
Accelerate the widespread deployment of vehicle-to-everything (V2X) technologies, working in close collaboration with Ofgem and industry. We will publish a summary of our recent Call for Evidence and outline next steps.	**2022-2023**
Ofgem is proposing changes to reduce the cost of new grid connections where upgrades to the existing network are required.	**Changes to take effect in April 2023**

84 HM Government (2021). Consultation outcome – Electric vehicle smart charging. Available at: https://www.gov.uk/government/consultations/electric-vehicle-smart-charging

6. Glossary

A smart and flexible system	A system that uses smart technologies to provide flexibility to the system, to balance supply and demand and manage constraints on the network.
A-roads	Major roads between regional towns and cities.
Bundling	Selling different items i.e., products and services, together as a package.
Chargepoint	The hardware used to charge electric vehicles.
Chargepoint Operators (CPOs)	Entities that manage, maintain, and operate chargepoints and the wider charging stations (both technical and administrative).
Charging Infrastructure	All physical and non-physical facilities that aid in the charging of electric vehicles. This includes the chargepoint, the car park, the electrical grid, and other components.

Charging Station Owner (CSO)	The owner of both the charging stations and the location that they are installed at. Often, though not exclusively, this is a business that has decided to provide electric vehicle charging at their private location.
Demand-Side Response (DSR)	Responses by consumers to change consumption patterns in real-time at times of stress on the main electricity system, or in response to changes in prices.
Depot	A building or site where fleet vehicles are stored.
Distribution Network Operator (DNO)	Companies licensed to distribute electricity in Great Britain by the Office of Gas and Electricity Markets (Ofgem). Distribution network operators own and operate the local 'distribution' network. They bring energy to homes and businesses at lower pressure and voltages from the transmission network. There are 14 licensed geographically defined areas.
Electricity Network Operator	Collective term for both Distribution and Transmission Network Operators.
Electricity Suppliers	The companies that supply electricity (and gas) to your home. They do not own any of the network of cables and pipes that delivery the electricity (and gas) to your home.
Fast charging	Chargepoints with power output of 7 to 22 kilowatts (kW).
Fleet	Groups of vehicles owned by a single organisation.
Fleet Operators	Organisations who own fleets – groups of vehicles owned by a single organisation.
Flexible	The ability to shift in time or location the consumption or generation of energy.
Greenhouse gas (GHG)	Any gas that absorbs heat energy emitted from Earth's surface and reradiating it back to Earth's surface. This causes global warming. Carbon dioxide which is emitted by diesel vehicles is a greenhouse gas.

Home-charger	Electric vehicle chargers installed in homes. A slow or fast chargepoint is installed and connected to the home electricity supply.
ICE Vehicles	Internal Combustion Engine Vehicles. These are vehicles that use internal combustion engines and therefore emit carbon dioxide as pollution when using fossil fuels such as petrol or diesel.
Inclusively Designed	Whereby the chargepoint and surrounding area are designed with inclusivity and accessibility in mind; that all consumers, including those with visible and non-visible disabilities, can easily charge their vehicle. This could consider aspects such as height of chargepoint, kerb height, appropriate signage cable weight and space between bollards. We recognise that there may not be a universal solution to or definition of 'accessible', given consumers' access needs can vary on their disability. This will be worked through as part of the BSI Standards development process.
Kilowatt hour (kWh)	Measure of electric vehicle battery charging capacity using kilowatts (kW) (measure of electric power – 1kW = 1000 Watts).
Local / Residential Charging Hubs	Public stations for charging electric vehicles. They possess multiple electric vehicle chargepoints for the public to use.
Local Area Energy Mapping and Planning (LAEMP)	A means, led by local governments, of exploring a range of different future local energy scenarios to achieve decarbonisation.
Local Authority	An organization that is officially responsible for all the public services and facilities in a particular area.
Market-wide Half-Hourly Settlement	The Market Half-Hourly Settlement (MHHS) will place the right incentives on retailers to develop and offer new tariffs and innovations that encourage and enable more flexible use of energy, for example, time of use tariffs, automation, vehicle-to-grid solutions and battery storage.

Market-led Approach	Allowing private investment and business in a competitive market framework to lead the building and facilitation of electric vehicle charging infrastructure. The Government will take an active role in guiding the market.
Mobility Service Provider (MSP)	Entities that the electric vehicle driver has a subscription with for all services related to the electric vehicle operations. MSPs provide electric vehicle drivers with access to charging stations.
Motorway Service Areas (MSAs)	Site near motorways where drivers can refuel their vehicles and can take part in other activities such as eating or shopping.
Net zero	A target of reaching a balance in emissions, with the amount of greenhouse gas produced and the amount removed from the atmosphere equally zero. This can apply across an economy or for a company. The UK Government has committed to net zero emissions across the UK by 2050.
Net zero emissions	Achieving a balance between greenhouse gas emissions produced and the amount removed from the atmosphere, through a combination of emission reduction and removal.
Off-Street Charging	Charging electric vehicles anywhere that is not on or next to the streets. This could involve charging hubs (stations).
On-Street Charging	Charging electric vehicles on the street, anywhere on or along the pavement of the streets.
On-Street Residential Chargepoint Scheme (ORCS)	A UK-wide Government funded grant scheme available to Local Authorities that can be used to fund the cost of installing electric vehicle chargepoints.
On-route Charging	Electric vehicle charging by consumers on longer journeys (e.g. along motorways at MSAs or major A-roads).
Open access	We have defined ‘open access’ as not-for-proprietary-use for specific makes of vehicles.

Original Equipment Manufacturers (OEMs)	Manufacturers who make components that are used in another company's end product.
Pay-as-you-go (PAYG)	An ad-hoc method for accessing and paying for a charge at a public chargepoint without entering into a pre-existing contract with the chargepoint operator. This may include contactless, apps, QR codes or paying online.
Peer-to-peer charging	Private owners making their chargers available for the public.
Public Charging	Electric vehicle chargepoints that are in publicly accessible locations and are not exclusive for specific members such as residents or workers. Broadly includes on-route, on-street and destination charging.
Return-to-base fleets	Whereby vehicles within a fleet return to a shared location (usually a depot) when no longer in use.
Smart charging	Smart charging is a convenient way of charging an electric vehicle at times when demand for electricity is lower, for example at night, or when there is lots of renewable energy on the grid. This can help reduce the need for electricity network reinforcement to meet increased demand from EVs, and offers benefits to consumers too, including savings on their energy bills.
Sub-national transport body	A transport governance organisation intended to provide strategic transport governance at a much larger scale than existing local transport authorities, by grouping councils together.
The Energy Networks Association	An association representing the interests of the electricity transmission and distribution licence holders in the UK.
Transmission Network Operators	Transmission network operators own and operate the high pressure and voltage network transporting energy across the country from where it is made.

Ultra-low emission vehicles	Any vehicle that emits less than 75g of CO2 per kilometre.
Ultra-rapid charging	Chargepoints with power output of over 50 kilowatts, usually 100 kilowatts or more.
Utilisation rates	The rate which the public are owning and using electric vehicles (can be measured in percentages).
Vehicle-to-Everything (V2X)	V2X, where “X” stands for everything, is the umbrella for all forms of technology whereby the electric vehicle battery can export electricity back to a system, be that a home (V2H), a building (V2B) such as a business or back to the electricity grid (V2G).
Vehicle-to-grid (V2G)	A leading example of V2X – it allows electric batteries to store energy and discharge it back to the electricity network when it is most needed.

Annex 1. Roles and responsibilities

Delivering the vision set out in this strategy requires a shift in how government at all levels plans, delivers, and works with the private sector, researchers, and civil society to deliver EV charging infrastructure. The Government's policy is for a market-led rollout. Government will provide an enabling national legislative and regulatory framework and targeted funding to address market failures to ensure no areas or demographics get left behind.

The key roles and responsibilities are summarised below:

Table 1: Key roles and responsibilities in delivering EV charging infrastructure

Organisation	Summary of role and responsibilities
Central government	• Set the overall vision for the UK's electric vehicle charging infrastructure network. • Define outcomes and measure and monitor progress. • Provide the legislative, regulatory, funding and support frameworks to deliver a well-functioning, competitive market with targeted interventions where required.
Devolved Administrations	• Set out the strategy and policy for the charging infrastructure network in their devolved area. • Define outcomes and monitor progress. • Engage with UK Government to promote collaboration and best practice sharing to create a cohesive UK network.

Organisation	Summary of role and responsibilities
Local and Mayoral authorities	• Develop and deliver ambitious tailored local EV charging infrastructure strategies that provide scaled, commercially sustainable public charging provision. They should align with wider local transport and energy decarbonisation policies. • Ensure clear ownership and resourcing of the planning and delivery of EV charging infrastructure rollout. • Ensure local chargepoints are inclusively designed and accessible for residents, businesses, and visitors, and in line with local authorities' legal obligations. • Ensure internal processes for the installation of chargepoints (for example grant permissions) are efficient, fast and easy to navigate for those working with local authorities.
Sub-national Transport Bodies	• Lead assessments of demand across their regions to assist local authorities and electricity network operators in the planning of chargepoint rollout.
Ofgem	• Ensure the electricity network is ready for the transition to EVs. • More widely, regulate the energy industry to support delivery of decarbonisation of the energy system.
Electricity network operators	• Facilitate fast and efficient connections of EV charging infrastructure to the grid. • Support local authorities in planning chargepoint delivery and chargepoint operators in delivering projects.
Chargepoint operators	• Provide convenient, reliable and affordable charging infrastructure that meets all legal and regulatory requirements. • Collaborate with local governments to help develop appropriate local charging strategies and solutions, and bid into tenders. • Develop and innovate, supporting long term growth of the sector and creating jobs across the UK.

Organisation	Summary of role and responsibilities
Operators of Motorway Service Areas	• Plan and deliver the ambitious rollout of charging infrastructure at motorway service areas. • Work closely with chargepoint operators to ensure that there are enough chargepoints at services across the UK.
Fleet operators and businesses	• Develop and deliver plans to transition fleets to electric vehicles, including putting in place the appropriate supporting infrastructure. • Share plans and data with local authorities to enable local authorities to understand wider charging provision within their areas.
Investors	• Work with the stakeholders set out in this chapter to increasingly understand and invest in this growing sector.

The table above is not exhaustive. As part of their work developing and delivering charging infrastructure strategies, local authorities will be engaging with residents and businesses to understand their needs. Moreover, charities, universities, and independent representation groups provide valuable evidence, data, and insight to help with the planning and delivery of charging infrastructure. We strongly encourage this collaboration.

Given the breadth of roles and responsibilities represented by the organisations above, it is critical that there are structured ways for those organisations to collaborate, develop and deliver solutions together. In the accompanying engagement summary, we have provided an overview of some of the relevant key strategic stakeholder partnerships funded and managed by central government. These are not exhaustive and are supplemented by ongoing dialogue between the organisations above.

Local government has a critical role in planning and delivering electric vehicle charging infrastructure.

As we set out in our Net Zero Strategy, a place-based approach will be essential to achieve our cross-cutting net zero ambitions, and the strategic role of local authorities will be fundamental.[85] As the Transport Decarbonisation Plan sets out, Local Transport Plans will set the vision for individual areas to hit net zero in transport. Charging strategies should align to this higher strategic document, reflecting the complementary but sometimes competing demands of walking, cycling and public transport.

We expect the market to lead the majority of public chargepoint deployment. However, local government has a crucial role in ensuring that deployment reaches all areas, using sustainable commercial approaches (for example, procuring for expected high and low utilisation areas at the same time). Further, local authorities are able to bring wider considerations into the planning and delivery of on-street chargepoints, including granting permissions for the works to take place, approving on-street parking bays associated with chargepoints and balancing demands against other uses of the roads and pavements. This will be increasingly important as we transition to mass market adoption of EVs, and the number of drivers relying on public chargepoints increases.

Below, we set out the roles and responsibilities of local and mayoral authorities in the two key aspects of delivering charging infrastructure.

Developing local electric vehicle infrastructure strategies

We want to work collaboratively with local and mayoral authorities in England as they take responsibility to develop local EV chargepoint strategies as an immediate priority. These bodies have both the knowledge of the local areas and the policy responsibilities across core components, such as street-works, to be expertly placed to facilitate the rollout. We would also encourage local highway authorities in Scotland and Wales to develop local strategies, which reflect the priorities set out in the devolved administrations' own charging infrastructure strategies. In Northern Ireland, we envisage local councils being best placed to take on this role.

The strategies should set out how local charging needs will be met at scale and over time (for example, five years) and, where possible, ahead of need. Working with each other and central government, they should consider where and to what extent provision is likely to be met by the market, without additional intervention. As an example, an area with high destination charging or local forecourt availability will require a different approach to a highly residential area with no equivalent options. We will provide further detail on what local strategies should consider, and examples of strategies for different types of areas, on our new local government hub.

85 HM Government (2021). Net Zero Strategy: Build Back Greener. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1026655/net-zero-strategy.pdf

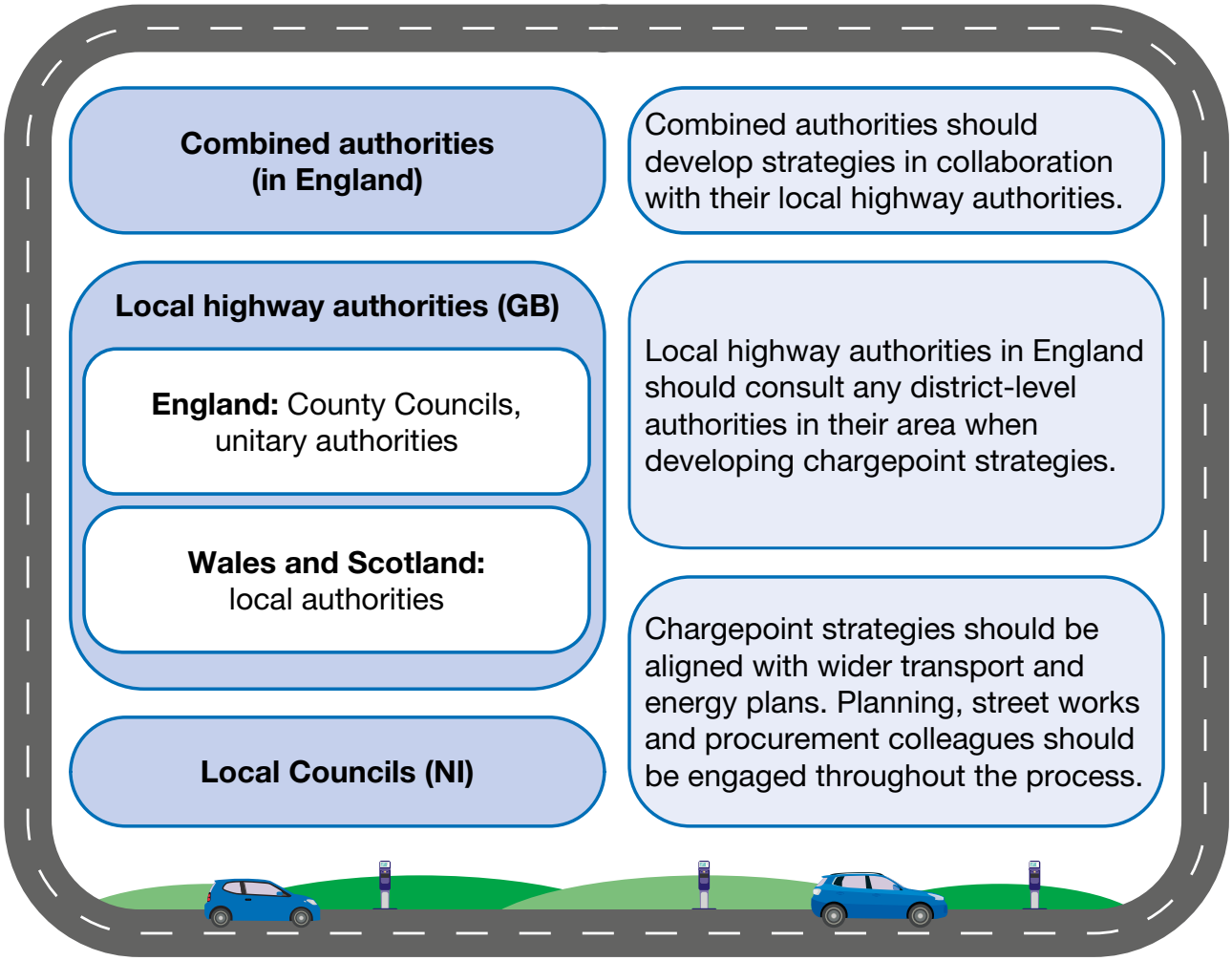
In England, there are multiple tiers of local government, and responsibilities for highways may be shared across tiers. Combined authorities share some highways duties with the county or unitary councils that work together under it. In these cases, we expect the EV chargepoint strategy for an area to be produced by the highest tier authority responsible with transport planning – i.e. the combined authority – in collaboration with their local highway authorities and other councils within the combined authority.

Combined authorities should also ensure that strategic travel needs within major cities are fully considered and that chargepoint plans are aligned with wider transport and energy plans for the area. Lower tier councils within a combined authority area should be actively involved in the development of these strategies, to ensure that the specific charging needs of their area are incorporated. Outside of combined authority areas, where there are two tiers of local government, we expect county councils to produce EV chargepoint strategies. They should do so in close collaboration with district level councils.

Each chargepoint strategy should conform to wider plans for transport and energy for the local area. In England, chargepoint strategies should be aligned with the principles in existing Local Transport Plans, which local authorities have a statutory obligation to develop. Updated guidance on producing Local Transport Plans will be published in 2022. Subsequent updates to Local Transport Plans should include the area's EV charging strategy. When assessing different chargepoint options, local authorities should avoid street clutter and prevent trailing cables, and maximise pavement space for those with disabilities. Chargepoint strategies must be aligned with plans to support walking and cycling and should consider charging opportunities for electric bikes and motorbikes, as well as cars and vans.

The strategies should also be aligned with any local area energy planning underway. This will require collaboration with energy stakeholders such as network operators. The Department for Business, Energy and Industrial Strategy (BEIS) and Ofgem are working together to assess the case for further action to address barriers and unlock opportunities presented by local energy system mapping and cross-sector planning across England. Local Area Energy Mapping and Planning (LAEMP) could help bring together key stakeholders to explore routes to decarbonisation in their local area, identify priority areas for action, and consider potential local barriers such as network constraints.

We expect these local government bodies to develop chargepoint strategies



Sub-national Transport Bodies can support in providing valuable data and insight into expected demand across regions. Early engagement with electricity network operators will help ensure plans consider grid capacity and any associated costs.

Local highway authorities should also work closely with businesses and residents. Businesses may have plans for installing charging infrastructure at their premises that could meet the needs of some residents and customers travelling in the area. Residents will provide valuable feedback on the types of charging solutions they would support in the area and how any plans interact with wider transport considerations.

To level up the benefits of EVs and to support local government in developing strategies and charging deployment, we are announcing combined capital and resource funding of £500m for local authorities to plan and deliver scaled, sustainable EV charging infrastructure over time.

What does good look like for local authorities?

- Agreed ownership and resourcing of the planning and delivery of EV charging infrastructure rollout.
- A published local strategy for the planning and delivery of charging infrastructure to ensure all areas and communities have access to it. We encourage local authorities to include commitments in their strategies on the scale and type of chargepoint deployment they will prioritise to meet local needs.
- A commercial approach which reflects local priorities, maximises opportunities to draw in private investment, and provides long term certainty on availability, reliability and ongoing maintenance costs and revenue generation.
- A clear approach to promoting competition and fair pricing for drivers in local areas, which considers the need for ongoing flexibility as technology and consumer needs evolve, and the principles for managing risk of a single provider operating in one area. For some local authorities, an option may be the use of franchising. In some areas, there may be benefits to separating ownership of the different components of the charging infrastructure, if carefully considered.
- Integration of the local strategy into broader local transport plans (including statutory Local Transport Plans in England), and in conjunction with Local Area Energy Mapping and Planning (LAEMP) as this evolves.
- A cross-sector approach, such as through a working group, which draws in expertise from transport, planning, parking, commercial, property and energy at a scale appropriate for the region. This should include the local electricity network operator to understand electricity network considerations. This may also involve working across local authority boundaries.
- An approach to street works licensing consistent with that of neighbouring local authorities.
- Early engagement with local businesses about the needs of their fleets, and consideration of how these can be addressed.

Delivery

As part of developing local EV infrastructure strategies, local highway authorities and relevant government bodies should agree who is responsible for the procurement and ongoing maintenance of any contracts to meet the identified charging infrastructure gaps. It is very likely that putting in place chargepoint provision in a local area will involve more than one team within that local authority and involve strong collaboration between the different layers of local government in that area. In addition, there will be occurrences where combining delivery approaches across different local government bodies would increase the commercial attractiveness of a proposition, drawing in a wider range of market participants and private investment, for example, bundling up multiple smaller patches with low charging utilisation across different local authorities.

To help, the Government will make £50m available to support the delivery of EV chargepoint infrastructure. Government also funds the Local Government Support Programme, which provides a free advice service to local authorities developing the strategies, plans and delivery approaches to EV charging infrastructure. Government will also work with local authorities and the Local Government Association to ensure value for money, and commercially and technological astute contracts are agreed.

Delivering chargepoint plans

Local EV charging infrastructure strategies should define the local authority (or authorities) responsible for procuring and managing contracts for delivering chargepoint infrastructure. In general:

- Local authorities should seek to deliver scaled, sustainable plans for their areas and communities with the chargepoint market and relevant stakeholders.
- When tendering out local provision, local authorities should ensure contract terms with chargepoint operators promote competition and fair pricing for drivers. Where possible, this includes ensuring there is more than one chargepoint operator within a local area.
- Local authorities should ensure any contract terms with chargepoint operators allow for flexibility in delivery approaches as technology and/or consumer needs evolve.

Sub-national Transport Bodies

We also have made funding available for Sub-national Transport Bodies in 2021-22 to produce regional assessments to support energy system stakeholders and local authorities in planning charging infrastructure provision. We expect these assessments to be in place by the end of 2022. They should:

- Produce scenarios for potential demand for EV infrastructure in the region. These may either build on demand assessments from individual local authorities or provide the basis for more tailored demand scenarios for specific local authorities, depending on the status of existing plans across the region.
- Identify clusters of demand in the region, including bringing together data on current demand and potential future demand from fleets operating in the region (where possible, this should include demand from buses and other heavy vehicles, as well as cars and vans). This should identify charging demand in areas without off-street parking, and at sites such as depots where many vehicles may be charging overnight. This will help electricity network operators to plan their networks to meet this expected demand.
- Identify different levels of engagement and progress within local authorities in the region and locations where additional support is needed to enable planning of local chargepoints.
- Highlight examples of best practices between local authorities and foster partnerships between authorities to ensure charging infrastructure is delivered in an efficient and cohesive manner. Successful charging infrastructure deployment will need committed engagement from across sectors.

Local authorities have a critical strategic role in planning and ensuring delivery of local chargepoint provision. However, rollout across the country is the responsibility of a range of other organisations as well. Chargepoint operators, fleet operators and energy network operators are all integral to a smooth transition.

We expect chargepoint operators to lead the majority of rollout across the country, working with businesses, residents, local and mayoral combined authorities, and others to deliver charging solutions which are inclusively designed. They are responsible for delivering, operating, and maintaining chargepoints, although under some business models they may wish to sub-contract some aspects.

Priorities for chargepoint operators should include:

- Accessing and attracting investment to deliver, operate and maintain chargepoints.
- Ensuring their chargepoint network meets all regulatory requirements and provides a high-quality service to drivers.
- Encouraging energy companies to offer and implement smart and flexible technologies and tariffs of benefit to consumers and the energy system.
- Working with local authorities on local chargepoint strategies and participating in local tenders.
- Identifying and developing chargepoint sites, sharing data with local authorities and electricity network companies to enable planning and quicker delivery.

Fleets are a significant part of our transition to EVs. These are groups of vehicles that are owned or leased by a business or organisation (including the public sector). They include (but are not limited to); delivery and freight vehicles, buses, emergency service vehicles, service sector vehicles, car-clubs, and business pool cars. Some businesses have a couple of vehicles, while others have many thousands. With this wide range in fleets comes a wide variety in the charging solutions that will be most appropriate for each fleet, based on their usage patterns, mileage and how long they are parked in a typical day. Fleet operators should work with local highway authorities. They will need to share information on their prospective fleet needs to inform local planning. Similarly, local electricity network operators will need to consider future fleet charging requirements as part of their network planning.

Priorities for larger fleet operators should include:

- Regularly assessing current and future charging needs, identifying potential clusters of needs (whether depot or home based).
- Sharing information on key charging locations and requirements when requested by local authorities and electricity network operators as part of strategy development.
- Liaising with electricity network operators and chargepoint operators on innovative, smart systems for scheduled charging that can reduce costs at depots (or other sites with multiple vehicles).
- Collaborating locally and nationally to improve chargepoint utilisation rates and efficiency, and create “win-wins”, for example, by providing access to other fleets with different usage patterns or to local residents.

Fleet leadership

Trade bodies and representative groups can provide a collective voice for fleets, ensuring that their needs are communicated clearly.

The EV Fleet Accelerator formed by the CEOs of bp, BT, Direct Line Group, Royal Mail, Scottish Power, Severn Trent, and Tesco, aims to use electric fleets as a catalyst to accelerate the widespread conversion to EVs across Britain.[86] This group constitutes the owners and operators of some of the biggest van fleets in the country, complemented by infrastructure, energy, retail and insurance and repair capability.

Similarly, members of the British Vehicle Rental and Leasing Association (BVRLA) have established the 'Plug-in Pledge' which will see the sector registering 400,000 battery electric vehicles per year by 2025, which could represent approximately 80% of new battery electric car and van sales.[87]

Lastly, the EV100 is a global initiative bringing together companies committed to switching their fleets to EVs and installing charging infrastructure for employees and customers by 2030.[88]

The energy sector is fundamental to fast, efficient and cost-effective installation of chargepoint installation across the country. Ofgem is the independent regulator for the gas and electricity markets in Great Britain. They are critical to ensuring that energy regulation supports EV uptake and the interests of energy consumers.

Ofgem set out their role in enabling the transition at least cost to consumers earlier this year: Enabling the transition to electric vehicles – the regulator's priorities for a green, fair future. This includes their high-level priorities across networks, system integration, and consumer participation & protection. We welcome and support the actions Ofgem have already taken in this area.

86 EV Fleet Accelerator (2021). Findings & Recommendations. Available at: https://www.openreach.com/content/dam/openreach/openreach-dam-files/images/about-us/sustainability/EVFA_Report_July_2021.pdf

87 BVRLA (2020). 2020 Plug-in Pledge. Available at: https://www.bvrla.co.uk/resource/2020-plug-in-pledge.html

88 Climate Group (2020). About EV100. Available at: https://www.theclimategroup.org/about-ev100

Areas of focus for Ofgem

- Ensuring that the process of connecting to the network is straightforward and connections can be delivered at a fair price.
- Through the 2023-2028 electricity distribution price control development, Ofgem are supporting strategic investment on local distribution networks to support the increase of electric vehicles.
- Considering reforms to promote flexibility and smart charging, and ensuring the regulatory framework supports the uptake of smart charging and V2X technology.
- Supporting innovation: A £450m fund (managed in partnership with Innovate UK) will be available over the next five years to support strategic and innovative networks projects across four key challenges, including transport.[89]
- Supporting infrastructure projects, including rapid charging rollout, across the country. In May 2021, Ofgem announced a £300m Green Recovery Scheme investment for network projects with distribution network operators (DNOs) and the Energy Networks Association (ENA) to enable the installation of charging infrastructure, such as rapid charging, and wider low carbon projects.[90]

Electricity network operators are responsible for planning and managing their networks, and delivering an efficient, easy process for new EV chargepoints to be connected to these networks. Ofgem use the price control framework to ensure that the network operators provide the required infrastructure to deliver the capacity to meet both current and future demand on the network. Electricity network operators forecast demand, including EV uptake, to shape investment plans for reinforcing the network or procuring flexible solutions.

Most new local connections will be at the lower voltage distribution level. However, some major EV hubs or depot connections may require a higher voltage transmission network connection.

89 Ofgem (2021). New £450m fund to unlock cutting-edge innovation across gas and electricity networks. https://www.ofgem.gov.uk/publications/new-ps450m-fund-unlock-cutting-edge-innovation-across-gas-and-electricity-networks

90 Ofgem (2021). Ofgem delivers £300m down payment to rewire Britain Available at: https://www.ofgem.gov.uk/publications/ofgem-delivers-ps300-million-down-payment-rewire-britain

Areas of focus for electricity network companies

- Providing a smooth, clear and timely process for new connections, including: being transparent on the process for assessing viability of connections at potential sites; making information on available capacity easily available; installing connections as quickly as is feasible; and proactively developing flexibility options to reduce costs and timescales.
- Purchasing flexibility services as an alternative to building more network, where it is economic and efficient to do so.
- Providing and disseminating information on smart and flexible new connections.
- Engaging proactively with local authorities on short and long-term local areas energy plans, including chargepoint strategies.
- Continuing to engage with Government on delivery of the Rapid Charging Fund.
- Keeping their own business plans and related publications easily available and updated regularly in response to developments in EV charging requirements.

Source: SMMT

Annex 2. Case studies

Chargepoint rollout is progressing fast. The following examples highlight how the roles set out in this strategy are already being put into practice, with many projects demonstrating innovative and collaborative approaches. To deliver our vision, these approaches – as well as lessons learnt – be shared and implemented across the UK.

Local authorities

Case study

Regional collaboration for chargepoint rollout: West Midlands Combined Authority

- West Midlands Combined Authority (WMCA) is taking a pivotal role in the regional planning and coordination of EV infrastructure. Their report: Electric Vehicle Charging and Enabling Energy Infrastructure: A West Midlands Approach, sets out the role for the Combined Authority in coordinating resources and promoting joint delivery between key stakeholders.[91]
- As a first step, they have initiated a Steering Group formed of key stakeholders to ensure that a coordinated approach to EV strategy and infrastructure provision is taken across the region to support the accelerated uptake of EVs. This has supported the development of a rapidly expanding on street public charging network.
- Their role also includes coordinating with the Distribution Network Operator (DNO) to create datasets of existing and planned energy infrastructure including known grid constraints.
- Following a successful bid as part of the City Region Sustainable Transport Settlements, over the next 5 years they plan to install 1,000 EV chargepoints, as well as the creation of a network of 10 EV Charging Area Transit Stations strategically located to provide ultra-fast charging facilities for a range of vehicles across the region.[92]
- More broadly, WMCA have also launched a new training centre in Wolverhampton to provide EV mechanic training. The first of its kind in the UK, the Electric Vehicle and Green Technologies Training Centre has been backed with £250,000 in funding and aims to train 720 local people over the next 18 months. This will enable people to start a new career or upskill, providing crucial skills for the transition to EVs.[93]

91 WMCA (2020). Electric Vehicle Charging and Enabling Energy Infrastructure: A West Midlands Approach. Available at: https://governance.wmca.org.uk/documents/s3953/Report.pdf

92 WMCA (2021). West Midlands secures over £1bn funding to drive a green transport revolution. Available at: https://www.wmca.org.uk/news/west-midlands-secures-over-1bn-funding-to-drive-a-green-transport-revolution/

93 WMCA (2021). New centre to train local people to work on electric vehicles opens in Wolverhampton Available at: https://www.wmca.org.uk/news/new-centre-to-train-local-people-to-work-on-electric-vehicles-opens-in-wolverhampton/

Case study

Partnership for on-street chargepoint planning and procurement: London

- London Councils, the Greater London Authority, Transport for London and the 33 London boroughs formed a partnership in 2016 to support the delivery of on-street chargepoints and secure funding from the Office for Zero Emission Vehicles.
- A bespoke procurement framework for chargepoints was created to support boroughs. It ensures pan-London standards, with flexibility for boroughs to deliver chargepoints that suit their requirements. Over 4,000 on-street public chargepoints have been procured through the framework since 2018.
- Officers from all boroughs receive project delivery support from London Councils. They regularly share knowledge and have access to a chargepoint data dashboard offering valuable insight into utilisation rates and trends across London. Residents can suggest locations for chargepoints to London Councils via their website.

Case study

Community engagement for rural chargepoint planning: Durham County Council

- Durham County Council's vision is to ensure all residents without off-street parking can access convenient, accessible, and safe EV charging, ideally within a 5-minute walk of their home. The Scaling On Street Charging Infrastructure (SOSCI) project creates a framework for communities to identify, finance and install chargepoints with a focus on rural areas. Durham County Council has 40% terraced housing within its community, leaving residents without a driveway or garage to charge.
- An EV working group (internally) and an EV resident group has been established to support the project. These groups meet on monthly basis to provide feedback on potential chargepoint sites. Diverse stakeholders have been involved, including village halls groups, housing associations, parish churches and libraries. All the chargepoints will be near residential areas and allow overnight charging.
- The SOSCI project is funded by Innovate UK and was awarded approximately £263,000 in 2019 for 100 chargepoints at locations. These were due to be installed by the end of 2021.

Case study

Ambitious scale deployment: Plymouth City Council

- Plymouth are taking a multi-faceted approach to decarbonising transport in a manner that is equitable, affordable, accessible, collaborative and efficient in order to best serve the local citizens. The council is developing several approaches to ensure a variety of options that will be most appropriate for different users of the infrastructure network.
- Through the Transforming Cities Fund, they are developing an innovative network of 50 mobility hubs including EV chargepoints, e-bikes and car club vehicles.
- They are delivering a network of 15 innovative vehicle-to-grid (V2G) chargepoints at their council depot. Their fleet vehicles are generally operational from 7am-4pm so lend themselves well to V2G as peak times often occur from 5-7pm.
- Through the Innovate UK Clean Streets project, they are delivering 52 on-street pop-up chargepoints to provide access to on-street infrastructure without contributing to street clutter.
- The council is working with Connected Kerb to deploy a further 50 on-street chargepoints using funding from the On-street Residential Chargepoint Fund.

Sub-national Transport Bodies

Case study

Midlands Connect

Midlands Connect have assessed the EV infrastructure needs of their region, including consideration of demand scenarios and a comparison of the extent of rollout, planning and engagement with EV infrastructure across the local authorities in their region. This identified a need for accelerated progress on chargepoint planning and rollout in the Midlands, particularly amongst rural Local Authorities and areas with high concentrations of housing with no off-street parking in the region. They are also developing an "Electric Vehicle Infrastructure Planning tool" to help local authorities to identify the best locations for new charging infrastructure.[94]

Transport East and England's Economic Heartland

Transport East and England's Economic Heartland have committed to undertake an 'electric vehicle sprint', working with local authorities and organisations from the private sector, National Grid and the broader energy sector, to better understand and coordinate the delivery of EV charging infrastructure across these regions. England's Economic Heartland are also planning to develop bespoke recommendations for each transport authority in the region to achieve their net zero pathway, based on the typology of each area.[95]

94 Midlands Connect (2021). Supercharging the Midlands. Available at: https://www.midlandsconnect.uk/publications/supercharging-the-midlands/

95 England's Economic Heartland (2021). Decarbonising Transport. Available at: https://www.englandseconomicheartland.com/our-work/decarbonising-transport/

Chargepoint operators

Case study

Agile Streets

This project will allow drivers using on-street charging infrastructure to access off-peak rates, including those offered for domestic energy tariffs. Connected Kerb will install 100 electric car chargepoints on streets and car parks in Glasgow, Hackney (London), Shropshire, and East Lothian. The trial began in autumn 2021.

The trial will collect data on participants' charging behaviour and identify how smart charging can reduce the cost of charging EVs. Once completed, the charging infrastructure will be handed over to the councils for continued operation.

Local drivers who have not yet gone electric but wish to participate in the scheme can take part by subscribing to an electric car from EV subscription service, ONTO, at a discounted rate of up to 50% for the first two months.

The BEIS funded project has been pioneered by a consortium comprised of Samsung Research, Connected Kerb, Octopus Energy for Business, SMETS Design Limited, Energy Saving Trust and the Power Networks Distribaution Centre. It has received £1.5m as part of the Beyond Off-Street Smart Meter Electric Vehicle Charging programme.

Case study

Oxford Gul-e Project

Government has funded (via Innovate UK) Oxfordshire County Council and ODS to deliver OxGul-e, a prototype design for a purpose-built cable gully. Approximately a third of households in Oxfordshire live in terraced properties in urban centres and historic market towns. The cable gully solution will allow residents without off-street parking to charge an EV outside their home by running a charging cable through this gully in the pavement. The project builds on the concept piloted in Oxford through the Go Ultra Low Oxford Project funded by the Office for Zero Emission Vehicles and aims to identify how this solution could be applied safely at scale. Where residents usually park outside their home, this could provide a safe and cost-effective alternative to stand-alone bollards and prevents trailing cables across pavements.

Government will continue to engage with this and other trials to understand how this approach can ensure the safety of all users of the pavement, including disabled users.

Fleet operators

Case study

Zenobe, Surrey[96]

Zenobe is a business leading in the deployment of grid-scale battery storage. In 2019, they partnered with Stagecoach and Surrey County Council to enable the uptake of 9 electric buses. During the scoping phase, it was found an upgrade to the on-site electricity supply would cost circa £2-3m, which threatened the viability of the project. Zenobe were able to avoid this upgrade by supplying a stationary battery as part of a package, alongside chargepoints and a bespoke software system.

This enabled the project to go ahead at ~20% the cost of the grid upgrade, paid over a seven-year contract and was operating within six weeks. The stationary battery also generates additional income through utilising the battery to provide services to the grid when not charging the electric buses.

96 Zenobe (2021). Stagecoach park & ride. Available at: https://www.zenobe.com/case-studies/stagecoach-park-and-ride

Case study

UPS and UKPN Services London[97]

UK Power Networks Services implemented new smart EV charging systems for UPS's central London delivery fleet, as part of the Smart Electric Urban Logistics project (funded by Government and Innovate UK). This solution allowed UPS to increase the number of 7.5-tonne electric trucks operating from its London site from the previous limit of 65 to 170, without the need for an upgrade to the local electricity network. It includes smart charging points, a smart grid application, and an energy storage system at the depot.

This innovative approach will be crucial in supporting UPS as they transition to electric vehicles, having recently committed to buying 10,000 electric delivery vans from Arrival.

97 UKPN (2021). UPS – Facilitating large fleet operators to go electric. Available at: https://www.ukpowernetworksservices.co.uk/case-studies/ups-facilitating-large-fleet-operators-to-go-electric/

Case study

Uber, London[98]

Last year, Uber announced its plans to invest £5m in public EV infrastructure in boroughs across London where drivers needed it the most. Their investment will focus on boroughs that have lower concentrations of chargers than others. The chargepoints will be accessible to both Uber drivers and the public.

A key component of Uber's plans is to ensure a fair transition. The funding will focus on delivering 7-22kW chargers that allow drivers to charge their vehicles overnight; but also, to identify charger locations near to drivers' homes, as most do not have access to off-street parking.

Uber have been working closely with London Councils to understand how the £5m can best be used to increase the scale and pace of the rollout of charging infrastructure. The collaboration has focussed on identifying locations using Uber driver requests as well as using a procurement framework that will enable them to work with boroughs, chargepoint operators and other third parties in a transparent and effective way. They hope that their investment will become a model which other public and private sector EVI partnerships can emulate.

98 The Guardian (2020). Uber pledges £5m toward electric vehicle charging points in London. Available at: https://www.theguardian.com/technology/2020/oct/19/uber-pledges-5m-toward-electric-vehicle-charging-points-in-london

Case study

SSE Energy Solutions

SSE Energy Solutions is investing in a scalable, strategic network of EV ultra-rapid charging 'Community Hubs' across the UK, providing a wide range of chargepoints, designed to support business fleet vehicles, including those who bring their vehicle home, and residents without off-street parking. Located predominantly in urban areas, the Community Hubs will be in clusters of between 10 and 20 bays, serving fleets who need reliable infrastructure close to their business routes. Hubs will be supplied with renewably sourced electricity, refreshment, and toilet facilities, along with WIFI connectivity, and 24/7 customer service to ensure maximum comfort while charging.

Electricity Network companies

Case study

Charge Collective Project, UKPN[99]

Running from 2020-2022, this is a collaborative project intended to demonstrate how UKPN can work together with local authorities to plan local, public charging networks in areas at risk of getting left behind in the transition to electric vehicles.

UKPN are engaging with and coordinating local authorities and EV stakeholders to plan the rollout of community EV chargepoints, with the intention of delivering community charging at the lowest possible network cost. They aim to optimise the location of the chargepoints, considering their benefits (such as facilitating EV uptake and improving air quality), and the associated network costs. The project will develop practical tools to help DNOs facilitate chargepoint deployment. These will include:

- A process for engaging and coordinating with local authorities, chargepoint investors and other EV stakeholders to plan the roll out of EV chargepoints;
- A framework to decide where chargepoints should be installed, and the level of support payments required (both of which will be locally determined);
- A method for taking the output of this framework and tendering support payments to chargepoint investors, aimed at reducing their upfront costs;
- An assessment of the net benefits of this approach; and
- An assessment of opportunities for flexibility services from public charging infrastructure, by commissioning a research study to explore this potential through e.g. analysis of charging patterns and engaging with customers.

99 UKPN (2021). Electric Vehicles – Charge Collective. Available at: https://innovation.ukpowernetworks.co.uk/projects/charge-collective/

Annex 3. Engagement summary

This strategy draws on the work of industry and Government stakeholders, many of whom have identified existing barriers and recommendations to speed up infrastructure rollout. These include:

a. Ofgem and their report – Enabling the transition to Electric Vehicles.[100] This includes how energy sector regulation supports the rapid transition to EVs and does so at least cost to consumers.

b. The Electric Vehicle Energy Taskforce (EVET) who bring together stakeholders across the automotive and energy sector to work on ensuring that the GB energy system is ready for and able to exploit the mass take up of electric vehicles. The taskforce's work is funded by Government and run by the Zemo partnership. It is chaired by Philip New, chief executive of Energy Systems Catapult. Over 350 organisations have contributed to EVET's work so far. EVET made 21 proposals to industry and Government in their 2020 report.[101]

c. EVET also coordinated and contributed to several further workstreams in 2020 and 2021, including many of the outputs mentioned below.

d. *The Competition and Markets Authority's Electric Vehicle Charging Market Study*, which sets out their recommendations for Government to enable the delivery of a comprehensive and competitive charging sector that works for everyone.

e. The Local Government Association's report on the role of local authorities in the provision of EV chargepoints, including a summary of the barriers faced by local authorities and recommendations on their role.

f. The Green Finance Institute's report on unlocking public and private capital to decarbonise road transport.

100 Ofgem (2021) Enabling the transition to electric vehicles: The regulator's priorities for a green fair future. Available at: https://www.ofgem.gov.uk/publications/electric-vehicles-ofgems-priorities-green-fair-future

101 Energy Systems Catapult (2020). EV Energy Taskforce: Moving from Proposals to Actions. Available at: https://es.catapult.org.uk/reports/ev-energy-taskforce-moving-from-proposals-to-actions/

g. The Energy Systems Catapult (ESC) and their research on consumer attitudes and system impacts of different charging approaches. ESC was set up and is part funded by Innovate UK to help the UK navigate the transformation of our whole energy system and capture the new commercial opportunities created. The Catapult's mission is to bring together industry, academia and Government to build consensus and accelerate the development of new technology-based products and services in the energy sector.

h. Energy Saving Trust and their resources providing guidance to local authorities on chargepoint planning and provision, and the processes involved. The Energy Saving Trust is an independent organisation whose role includes providing advice and outreach support to public and private sector fleets, SMEs, local authorities and the industry supply chain on road transport decarbonisation, particularly in support of EV uptake and charging infrastructure.

i. The Electric Vehicle Fleet Accelerator, (which includes the owners and operators of some of the biggest van fleets in the country, complemented by infrastructure, energy, retail and insurance and repair capability), the International Council on Clean Transportation (ICCT), Policy Exchange, Bright Blue, the Society of Motor Manufacturers and Traders (SMMT), the Automotive Council and other industry groups have also published recommendations on the approach needed to ensure that infrastructure provision enables the transition to EVs.

Throughout the first half of 2021, officials at the Office for Zero Emission Vehicles (OZEV) held a series of workshops, inviting attendees across the charging infrastructure industry, trade associations, local authorities, and distribution network operators (DNOs). We selected a broad range of stakeholders that would bring different perspectives to the discussion and ultimately inform the approach taken in the strategy. The workshops involved discussions of the key barriers, emerging best practice and support attendees wanted to see from central Government.

Officials also issued a survey to local authorities, which was shared by the Energy Savings Trust to provide a further opportunity for detailed information gathering. This survey has helped to inform our assessment of the main barriers and the scale of the impact that they have on infrastructure rollout.

Stakeholder	Subject
Devolved Administrations	Engaged with officials in Scotland, Wales, and Northern Ireland during the development of the strategy to test and discuss potential options.
Local Authorities & Associated Organisations	A series of workshops with local authorities and associated organisations (including Local Partnerships and the Local Government Association) with support from the Energy Saving Trust. Initial workshops focussed on the barriers to rollout of EV infrastructure, with later workshops used as an opportunity to test potential solutions and interventions from Government. Key topics included: • Resource and expertise • Planning system • Government funding and support We have also engaged with Sub-national Transport Bodies on their role in regional infrastructure planning and provision.
Chargepoint Operators	Hosted a discussion on barriers to chargepoint rollout with a range of chargepoint providers, operators and eMSPs.
Distribution Network Operators	Discussion of the connections process and how it can be improved to be easier, faster, and cheaper for parties installing charging infrastructure.
Fleet operators & Trade Bodies	Met with a range of fleet operators at different scales to understand the needs of fleets and the barriers they face in electrifying their vehicles. This included meetings with Zemo Partnership, BVRLA, Logistics UK, NHS Fleet, CoMoUK and individual fleet operators.
Automotive sector	Meetings with SMMT, Automotive Council and the Road Transport Transition Committee to discuss the content of the Infrastructure Strategy.

Internal / Cross-government	Subject
Ofgem	Regulatory environment and its influence on the roll-out of EV infrastructure.
BEIS	Net Zero Strategy, local area energy mapping and planning, vehicle manufacturing.
CMA	Provided considerable input to their market study and ongoing discussions over Government's response to their recommendations.
DCMS	Lessons learnt from the roll-out of broadband and how this can be applied to charging infrastructure, particularly focussing on rural provision.
DEFRA	Discussed charging infrastructure considerations for rural communities, including opportunities to maximise benefits of funding schemes.
DLUHC	Discussions with the Local Government Climate Change team to ensure join up of net zero Policy Planning reforms and how the planning system impacts the pace of infrastructure roll-out.
DfT	Discussion of the Transport Decarbonisation Plan, Bus Back Better Strategy and Local Transport Plans to ensure alignment on policy and broader decarbonisation objectives. Regions, Cities and Devolution directorate to discuss local authorities and other regional players on local leadership.
HMT	Engagement on key barriers and policy including support for local authorities.

In the development of the strategy, we have also drawn on existing evidence and reports. In particular but not exclusively:

Organisation	Report
Transport Scotland	Switched On Scotland Phase Two: An Action Plan For Growth (June 2017)
Field Dynamics	On-street Households: the next EV challenge and opportunity (October 2020)
BVRLA	Road to Zero (October 2020)
Policy Exchange	Charging Up (February 2021)
Bright Blue	Driving Uptake: maturing the market for battery electric vehicles (February 2021)
Welsh Government	Electric Vehicle Charging Strategy for Wales (March 2021)
Transport & Environment	Charging Forward (May 2021)
Local Partnerships	Scoping the role of local authorities in the provision of electric vehicle charging infrastructure (July 2021)
Scottish Futures Trust	Electric Vehicle Charging Infrastructure Report (July 2021)
Green Finance Institute	Road to Zero: Unlocking public and private capital to decarbonise road transport (November 2021)
EV Fleet Accelerator	EV Fleet Accelerator Findings & Recommendations (July 2021)

Annex 4. Electric vehicle charging and the electricity system

How and when people charge will be crucial for the impacts on the electricity system.

When people charge their EVs is relevant not just to individual drivers, but to wider management of the electricity system. This will become increasingly the case as the number of electric vehicles goes up, increasing total charging demand.

The graph on the following page shows the estimated total daily energy demand for Great Britain, illustrating current times in the day when demand is highest. If a significant proportion of increased EV charging coincides with those peaks, this will increase the costs of upgrading the electricity network to cope with the electricity demand.

Estimated total daily energy demand for Great Britain

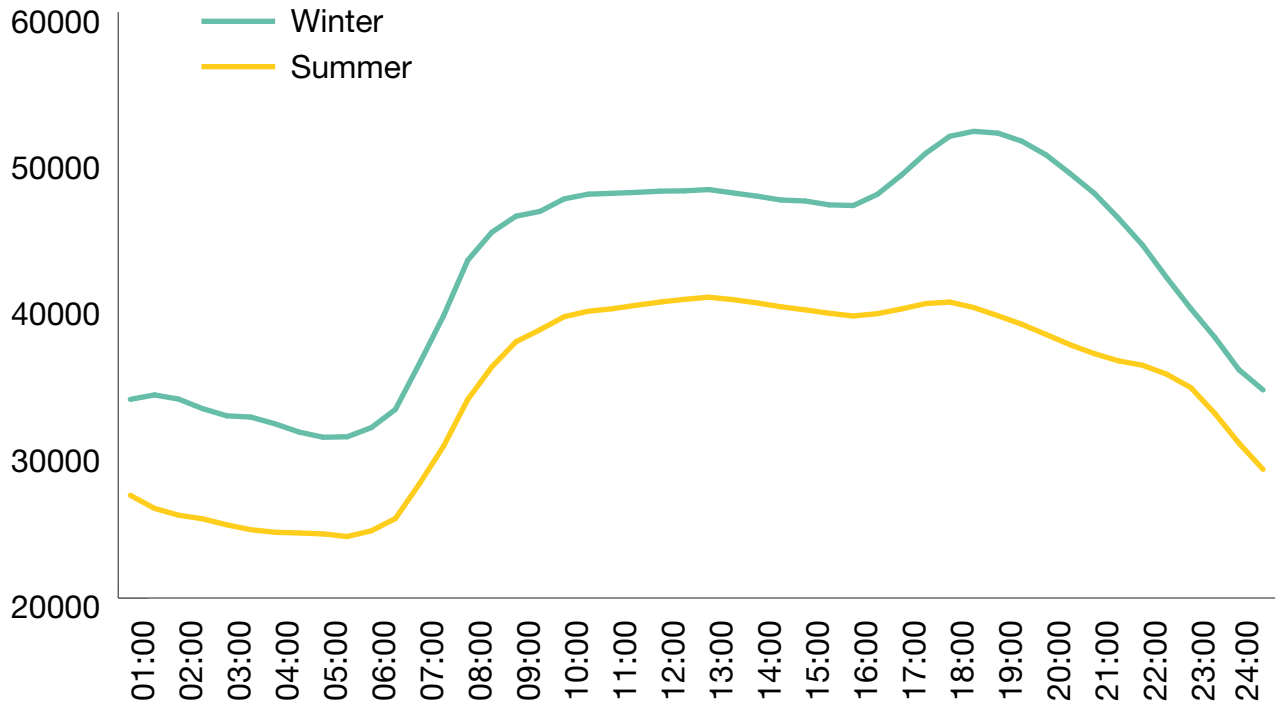


Chart shows total estimated demand on the electricity system across an average business day for summer and winter in 2019, from BEIS scenarios used in the Net Zero Strategy.[102]

However, when people choose to charge varies between different charging settings.[103] Charging at work accounts for about 15% of current EV charging demand. In this setting, drivers tend to plug in when they arrive in the morning (08:00-10:00). The use of public charging infrastructure (10% of current EV charging demand) is currently spread fairly evenly across the day.

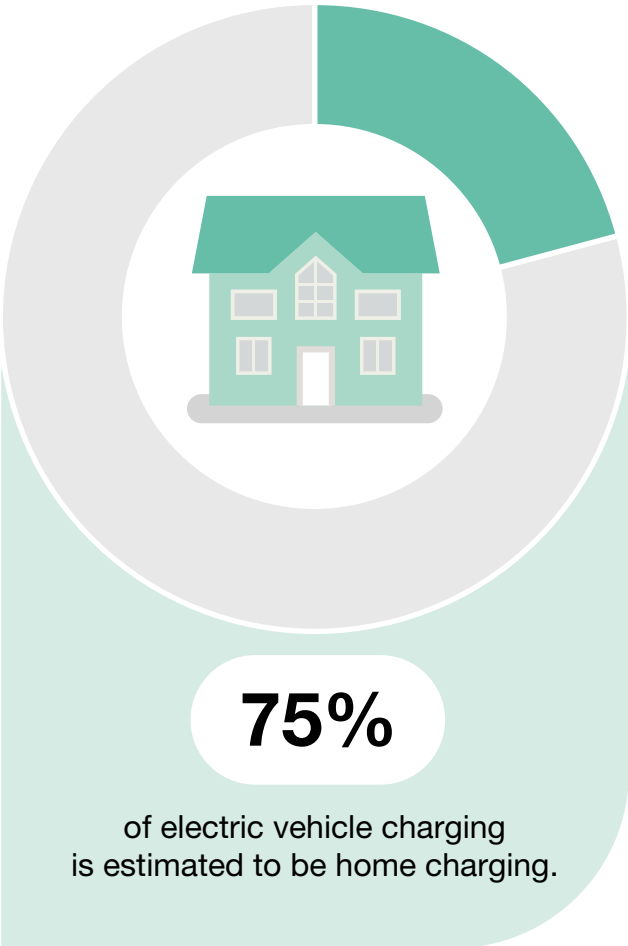
75% of EV charging is estimated to be residential charging.[104] An associated risk with this is that drivers complete their last trip of the day and plug in, which could exacerbate the existing sharp peak in electricity system demand in the early evening (17:00-20:00).[105]

102 BEIS (2021). Extracted from BEIS' Dynamic Dispatch Model scenarios used in the Net Zero Strategy (2021).

103 UK Power Networks (2018). Charger Use Study – Recharge the Future. Available at: https://innovation.ukpowernetworks.co.uk/projects/recharge-the-future/#:~:text=The%20Charger%20Use%20Study%20activity,compute%20the%20load%20from%20EVs.&text=It%20creates%20the%20industry%20leading,advancements%20in%20accuracy%20and%20granularity

104 Element Energy (2019): Electric Vehicle Charging Behaviour Study. Available at: http://www.element-energy.co.uk/wordpress/wp-content/uploads/2019/04/20190329-NG-EV-CHARGING-BEHAVIOUR-STUDY-FINAL-REPORT-V1-EXTERNAL.pdf

105 There is currently limited evidence on the patterns of use at residential on-street chargepoints. However, there is evidence from other European countries that suggest that the shape of the demand curve could be very similar to the home charging profile.



We estimate that road transport could represent approximately 15% of total electricity demand in 2050 compared to less than 1% of demand today.[106] The UK electricity market is already set up to bring forward the investment in generation that will be required to meet this. The Contracts for Difference scheme supports significant investment in low carbon generation, and is backed by the Capacity Market, our principal tool for ensuring the security of electricity supply.

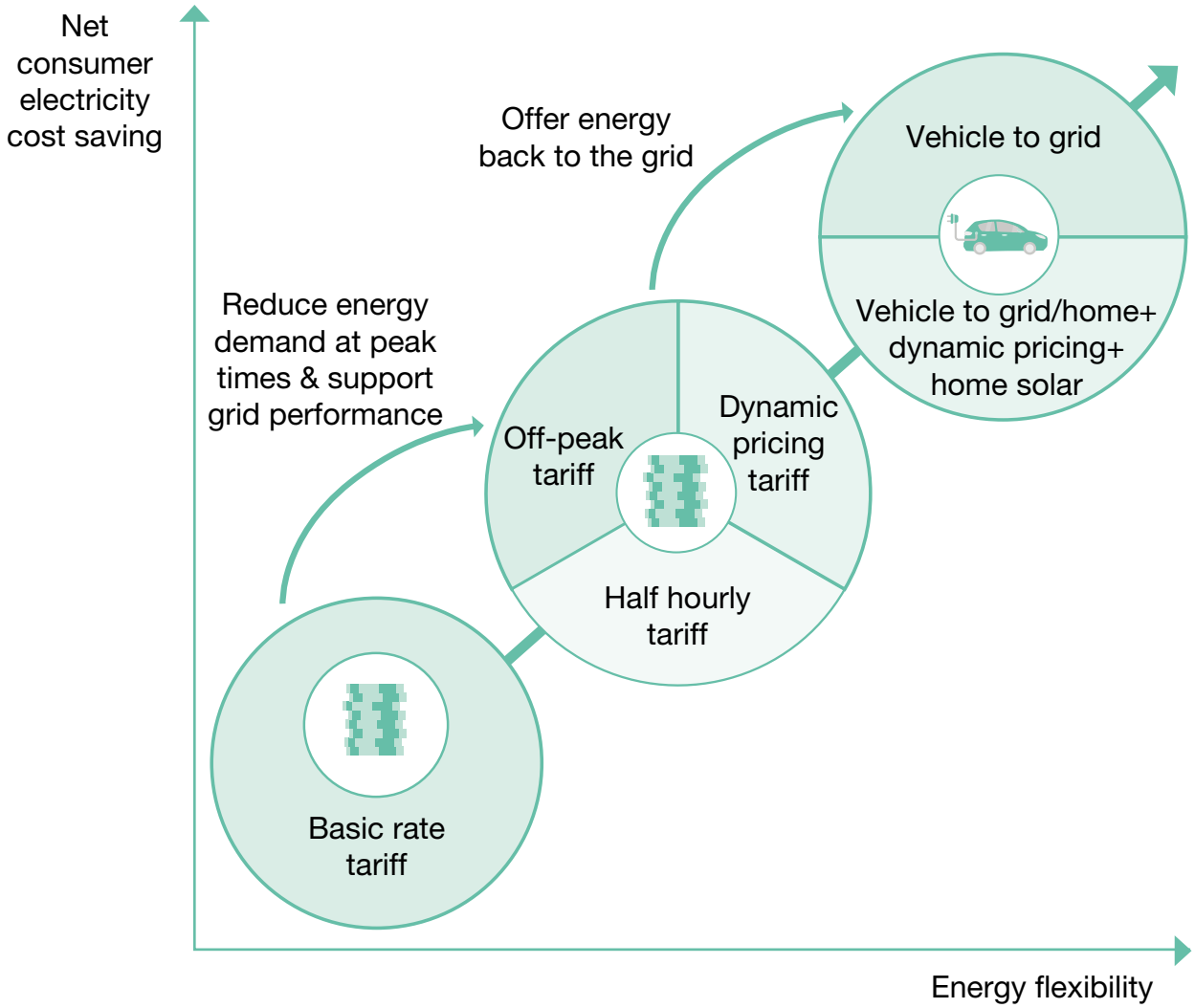
In the Net Zero Strategy, Government set out that, subject to security of supply, all our electricity will come from low carbon sources by 2035. This brought forward the Government's commitment to a fully decarbonised power system by 15 years.[107]

Smart charging will allow more efficient use of our flexible, renewable generation. It allows people to charge their vehicles when it is most efficient for the electricity system. This can save people money, allowing them to take advantage of lower energy prices without inconvenience. EV owners with off-street parking can access electricity prices below the average domestic rates via time of use tariffs and smart charging, meaning that the cost of charging can be significantly lower. In addition, consumers can be rewarded for allowing a third-party to control when their vehicle is charged (known as demand side response) – meaning they simply have to set how much charge they want their car to have by morning and then let a company optimise when their car charges in order to maximise the benefits to the energy system. In future we also expect more consumers to be able to power their homes or sell energy to the grid at times of high demand through Vehicle-to-grid and Vehicle-to-X technologies. Many people are already using smart charging at home and work, and we are requiring all new private chargepoints to be smart from June 2022. We expect to see increasing opportunities for people to have similar options on the public network as the network grows and technologies advance.

106 HM Government (2021). 5.1 Digest of UK Energy Statistics (DUKES): electricity. Available at: https://www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes

107 HM Government (2021). Net Zero Strategy: Build Back Greener. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

Consumers can benefit from cheaper EV charging, with the incorporation of energy flexibility technologies and services



(V2G) Vehicle to grid technology (where electricity is exported from the vehicle battery to the grid) can also help smooth electricity demand and reduce the associated impacts on electricity system costs. These technologies are already in use at many charging locations. We are working with Ofgem to maximise the opportunity for flexibility from EVs, while protecting the electricity grid and consumers.

Where people charge also impacts the costs of installing chargepoints and of reinforcing the electricity network to manage the increased demand, at either a national or a local level. For example, several rapid charging points in a single "hub" location may require one large upgrade to the high voltage network. Servicing a similar number of on-street chargers might require a larger number of smaller connections to the low voltage network.

These types of costs will be an important factor in determining chargepoint location. Electricity network operators are already forecasting EV demand and planning how their networks will support chargepoints. However, more analysis is required to identify the most commercially viable approaches to chargepoint deployment in different areas.

Annex 5. Future chargepoint requirements and the chargepoint demand model

Overview

The public chargepoint estimates presented in the EV Infrastructure Strategy have been constructed using the Chargepoint Demand Model (CDM). This annex outlines the underpinning modelling approach.

The CDM estimates annual electric vehicle (EV) chargepoint requirements out to 2030 across three key public charging categories[108].

10. Residential on-street (e.g. lamppost)
11. Destination (e.g. supermarkets, leisure centres, hotels)
12. On route (rapid) (e.g. motorway service areas and refuelling stations)

108 Workplace and private home charging have also been considered within the modelling framework but aren't included in the definition of public chargepoints.

It is estimated that between 280,000 and 720,000 public chargepoints[109] could be required in 2030 to support the transition to EVs. This represents direct charging demand from estimated EV mileage and not the level of infrastructure needed to encourage EV uptake through improved driver perceptions of charging.

The estimates are based on a wide range of scenario analysis which captures key uncertainties of future charging behaviour, preferences and vehicle mileage.
The scenarios are based on the best current available evidence and will evolve over time as the market matures and more evidence around consumer behaviour, preferences and technology emerge.

Modelling approach

The modelling utilises a top-down approach, based on a calculation of the future energy requirements of electric car and van owners across the United Kingdom.

The projection of EV sales assumed in the model is in line with the Office for Zero Emission Vehicles (OZEV) 2035 delivery plan range and the Net Zero Strategy[110] transport scenario. This uptake projection represents one potential trajectory to achieving road transport decarbonisation ambitions.
This corresponds to BEVs comprising 24% of total cars on the road and 14% of total vans on the road.

109 In our analysis a chargepoint is defined as the equipment required to supply energy to an EV. It is assumed that each chargepoint has only one connector meaning that it is only capable of charging one electric vehicle at a time.

110 Transitioning to zero emission cars and vans: 2035 delivery plan – OZEV (2021): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005301/transitioning-to-zero-emission-cars-vans-2035-delivery-plan.pdf
Net Zero Strategy: Build Back Greener – BEIS (2021), Technical Annex, Table 10: https://www.gov.uk/government/publications/net-zero-strategy

A detailed model map is presented below, outlining key inputs and calculation steps that underpin the chargepoint projections:

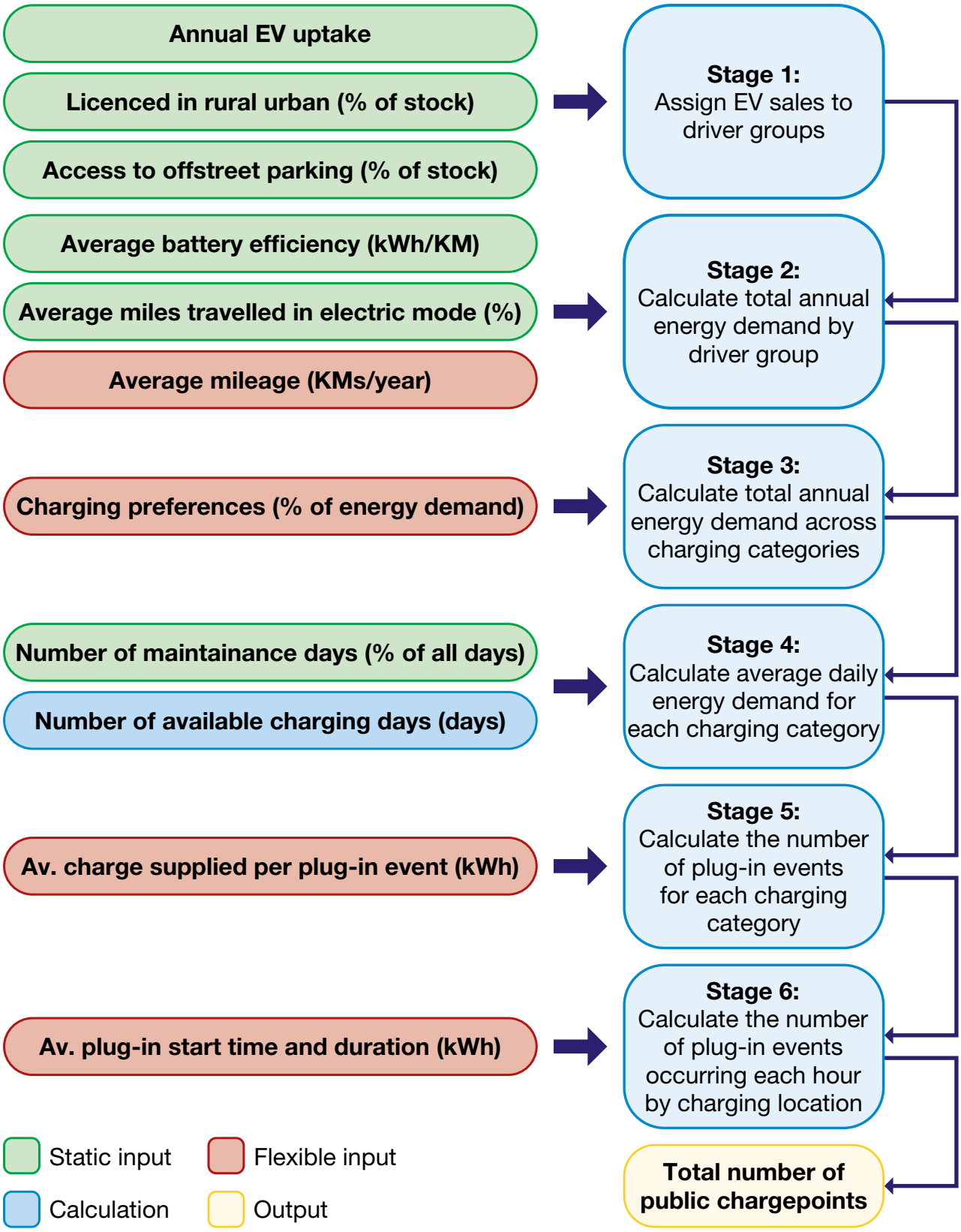


Figure 1 – Chargepoint Demand Model Map

Scenarios

A set of scenarios have been produced to underpin the estimates illustrating the scale of infrastructure rollout needed under credible 2030 outcomes. As illustrated above in Figure 1, four key assumptions have been adjusted to reflect the areas of major uncertainty:

1. Vehicle mileage
2. Where drivers prefer to charge
3. How frequently drivers charge
4. How long drivers occupy a chargepoint.

These assumptions have been selected due to significant uncertainty around how they may change over time as the market develops from its current early stage, as well as the potential scale of impact on modelling outputs. All other assumptions have been kept constant across the scenarios. More detail on these four areas can be found in the sections below and a full list of assumptions and sources can be found in Table 5 at the end of this annex.

1. Mileage

Annual mileage is a key factor in determining the energy requirements of EV owners. At Stage 2 of the model map above, three mileage levels have been tested and are displayed in Table 1 below. An additional assumption is then applied to plug-in hybrids (PHEVs) to account for the fact that only a proportion of their annual miles will be driven in electric mode.

	Cars	Vans
Low	7,700	11,500
Central	8,500	12,700
High	9,400	14,000

Table 1 – Annual mileage in 2030 (miles per year)

2. Charging preferences of drivers without off-street parking

As set out in the EV Infrastructure Strategy there will be a variety of suitable locations for an EV owner to charge in the future – at home, at work, on a residential street, at a destination or on-route to a destination. Anticipating where drivers without off-street parking will charge is very difficult as it will depend on several variables such as the price or convenience of charging at each location. These factors will become more certain once more EVs are adopted by drivers without off-street parking. To account for this uncertainty the impact of three illustrative sets of charging preferences have been tested[111] at Stage 3 of the modelling.

a. **Existing behaviour / High workplace** – EV owners without off-street parking charge at a broad mix of public chargepoints.[112] It is assumed these drivers' source approximately 60% of their energy from a combination of residential on-street, destination and rapid chargepoints with the remainder at workplaces.[113]

b. **High on-street** – Over time, on-street charging becomes more prevalent. By 2035 it is assumed EV owners without off-street parking source 80% of their charging demand from on-street chargepoints.

c. **High destination / on-route** – Over time, destination and on-route charging becomes more prevalent. By 2035 EV owners without off-street parking source 80% of their charging demand from a combination of these two locations.

3. Amount of electricity supplied per plug-in event

Stage 5 of the modelling factors in the number of plug-in events required over the course of an average day to satisfy energy demand. A 'plug-in event' is defined as the entire period a chargepoint is occupied and includes the time the EV is charging and any remaining time the driver spends occupying the chargepoint after the charging is complete.

111 Charging preferences of EV owners with access to off-street parking are assumed constant across all scenarios. Charging preferences of EV owners are the same across the three preference sets in 2021. Preferences gradually diverge over time to 2035.

112 The illustrative preference set aligns closely with assumptions used by the ICCT (2020): Quantifying the electric vehicle charging infrastructure gap in the United Kingdom. This is based upon a study of existing charging behaviour from Element Energy (2019): Electric Vehicle Charging Behaviour Study.

113 It is assumed that PHEVs without access to off-street parking source 60% of their charging demand from workplace chargepoints and 40% from a combination of residential on-street and destination chargepoints.

As it is unrealistic to assume that all drivers fully charge their battery from 0% to 100% every time they plug-in, an assumption is required to define the amount of electricity that is supplied to the battery on average every time an EV plugs-in. Assumptions have been expressed below as the amount of charge that is added to the battery (as % of total capacity) per plug-in event. As illustrated in Table 2 below, it is assumed that on average each EV adds 55% to their battery every time they charge at an on-street chargepoint.

Given the significant uncertainty around future charging behaviour, the impact of reducing the amount of charge supplied (reflecting more frequent charging) and increasing the amount of charge supplied (reflecting less frequent charging) has been tested.

	On-street	Destination	Rapids
Low	40%	20%	45%
Central	55%	30%	55%
High	70%	40%	65%

Table 2 – Average additional charge supplied per plug-in event (% of battery capacity)

4. Plug-in duration

Stage 6 of the modelling involves distributing plug-in events throughout the hours of the day. This stage of calculation is important as it accounts for public chargepoints being shared amongst EV drivers and potentially used more than once per day.

Plug-in events are distributed in line with the charging patterns observed by existing EV owners[114] and differ across charging categories. For example, it is assumed that the greatest proportion of plug-in events at destination chargepoints begin at 08:00 (13%), whilst the greatest proportion of plug-in events at on-street chargepoints begin at 17:00 (11%). Distributing plug-in events across the day enables us to calculate the number of plug-in events occurring each hour. By observing the hour with the greatest number of plug-in events taking place, it is possible to estimate how many chargepoints are occupied during the peak hour and therefore the number of chargepoints required.

A key assumption influencing the number of plug-in events taking place in any hour is how long drivers occupy a chargepoint, including time plugged-in and not actively drawing charge. Table 3 below shows the assumptions that have been used for each chargepoint location. The 'Low' captures a scenario where drivers plug-in for a shorter period relative to the 'Central' whilst the 'High' captures a scenario where drivers plug-in for longer.

It is important to note that this assumption alone does not alter the active charging time which is determined in Stage 5. Figure 2 on the following page illustrates this impact for the on-street category, where all scenarios see over four hours of active charging, with an additional 8 hours of additional plug-in time after the battery is fully charged in the high scenario.

	On-street	Destination	Rapids
Low	08:45	01:59	00:24
Central	10:45	02:59	00:29
High	12:45	03:59	00:34

Table 3 – Average plug-in duration (hh:mm)

114 HMG (2018): Electric Chargepoint Analysis – https://www.gov.uk/government/statistics/electric-chargepoint-analysis-2017-public-sector-fasts

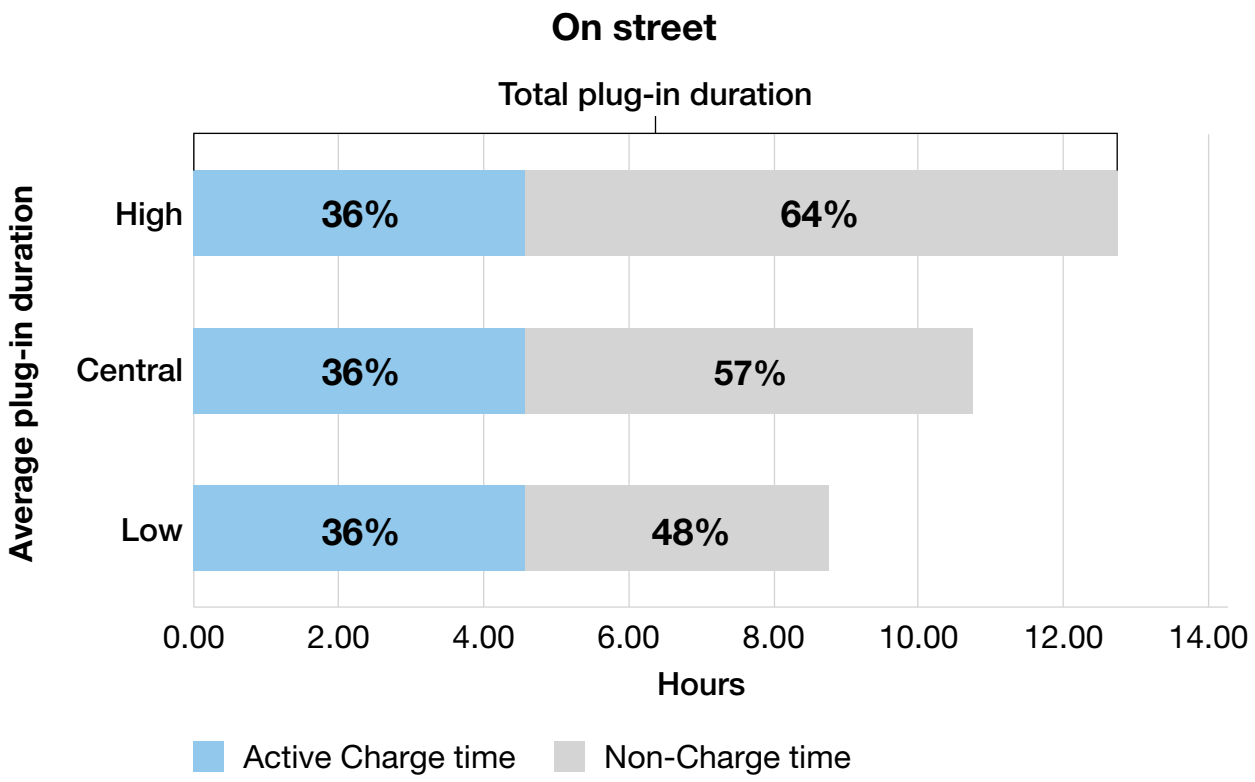


Figure 2 – Proportion of time plugged in vs actively charging

The four assumptions described above have been combined to create the set of results presented in Table 4. In the 'Low' scenario mileage, charge supplied, and plug-in duration values are lower than the Central, capturing a scenario reflecting low chargepoint need. Conversely, the 'High' scenario captures high chargepoint need. These scenarios have been repeated across different chargepoint preference sets, outlined in the sections above, to provide estimates of low and high chargepoint need.

The scenarios presented capture a broad range of behaviour to account for known future uncertainty surrounding how frequently drivers charge, how long they occupy a chargepoint, how far they drive and where they prefer to charge. The results from the modelling do not represent absolute minimum and maximum chargepoint requirements. We have used the best available evidence to provide a credible range of results and to illustrate the potential scale of roll-out needed in 2030.

Results

The results from our scenarios indicate that between 280,000 and 720,000 public chargepoints could be needed to support ambitious EV sales trajectories by 2030. Table 4 provides a breakdown by chargepoint category.

The tables illustrate the level of chargepoint demand that could be required for public chargepoints on residential streets, at destinations such as supermarkets and on-route at rapid charging stations. It also highlights the highest and lowest bounds of the estimated range across all scenarios in red.

Preference set A: Existing behaviour / High workplace

	Low	Central	High
Residential on street	125,000	155,000	225,000
Destination	140,000	175,000	220,000
Transit	14,000	15,000	16,000
Total public	**280,000**	350,000	460,000

Preference set B: High On-street

	Low	Central	High
Residential on street	270,000	340,000	490,000
Destination	140,000	170,000	215,000
Transit	9,000	10,000	11,000
Total public	420,000	520,000	**720,000**

Preference set C: High destination & on-route

	Low	Central	High
Residential on-street	70,000	90,000	130,000
Destination	300,000	370,000	475,000
Transit	15,000	16,000	18,000
Total public	390,000	480,000	620,000

Table 4 – Results[115]

115 On-street and destination chargepoints rounded to nearest 5,000. On-route chargepoints rounded to nearest 1,000.

The lower requirement of 280,000 public chargepoints represents the scale expected in a scenario where consumers without off-street parking continue to charge at the types of locations currently observed, including a significant amount of workplace charging (which are not classed as public chargepoints). This level of provision translates to approximately nine BEV drivers without access to off-street parking for every one public chargepoint.[116,117]

The high end of the range reflects a scenario where most of the charging by drivers without off-street parking is done at on-street residential chargepoints with 490,000 chargepoints needed to meet demand. This level of provision translates to approximately four BEV drivers without access to off-street parking for every one public chargepoint.

Modelling Constraints

The CDM is an economic model which by nature is unable to capture all behaviours across the chargepoint market. There is inherent uncertainty regarding the modelling results as the electric vehicle and chargepoint market is still at an early stage of development. There is uncertainty about future consumer preferences and behaviour, and how the market will respond to these.

Below is a list of technical modelling constraints that should be considered alongside these estimates:

- There is no spatial component to the model. As such, it assumes perfect geographical distribution of chargepoints, where drivers can always access chargepoints at the locations they want, when they need to. Accounting for this element would likely increase the number of chargepoints required.
- No investment or planning foresight has been assumed. Chargepoints are required to meet the direct charging needs of EV drivers rather than to incentivise uptake or minimise installation or energy system costs. Accounting for this element would likely increase our projections in the short term (e.g. 2021-2035) and reduce our projections in the long term (e.g. 2035+).
- Modelling has been based on current known and widely used chargepoint technologies, future technology solutions are likely to enter the chargepoint/ EV market that may transform current assessments of consumer chargepoint demand.
- Estimates have been provided at a national level. Further analysis utilising area-specific inputs would be required to forecast requirements at a more granular (i.e. local) level.

116 In addition to public chargepoints, some EV drivers without access to off-street parking will have access to workplace chargepoints, which represents a significant charging category.

117 However, it is assumed that a small portion of demand from drivers with access to off street parking is also met by public charging.

- Energy demand is averaged equally across all days of the year. As such, the projections reflect the number of chargepoints required to meet peak demand on an average day; they do not reflect the number of chargepoints to meet peak demand on the busiest day of the year. Accounting for this element would likely increase the number of chargepoints required.
- Vehicle licencing data has been used to create rural and urban-based EV driver groups. It is known that some vehicles are licenced to the business address rather than an individual driver's address which could lead to an under or over-estimation of chargepoint requirements. For example, an increase in the number of rural-based EVs would increase public chargepoint requirements as these drivers are assumed to have higher mileage. However, this would be offset to some extent by the assumption that rural drivers have greater access to off-street parking, relative to urban-based drivers.

Detailed Assumptions

Assumption	Description
Electric Vehicle Uptake	Number of EVs (by year, vehicle type, powertrain)
Vehicle licence information	Proportion of EVs owners licenced to rural and urban areas (by year, vehicle type)
Access to Off-street Parking	Proportion of EV owners with access to off-street parking (by year, classification)
Chargepoint availability	Time chargepoints are unavailable due to maintenance
EV mileage	Average annual mileage (by year, vehicle type, powertrain)
Battery efficiency	Average battery efficiency (by year, vehicle type, powertrain)
Electric mode	Proportion of total miles in electric mode (by year, vehicle type) – applicable to PHEVs only.
Plug-in start time	Proportion of total charging events starting (by hour, location)
Plug-in duration	Median plug-in duration per charging event (by year, vehicle type, powertrain, location)
Charge supplied	Median charge supplied per charging event (by year, vehicle type, powertrain, location)

Table 5 – Assumptions log

Low	Central	High
Source		
HMG (2021): Transitioning to zero emission cars and vans: 2035 delivery plan[118]		
HMG (2020) National Travel Survey & HMG (2020) Vehicle Licence Statistics[119]		
HMG (2020) National Travel Survey[120]		
RAC Foundation (2018) – Development of the UK Public Chargepoint Network[121]		
Data in Table 1	HMG (2020) Road Traffic Forecasts[122]	Data in Table 1
Analysis of type approval (electricity consumption) data with a 'real world' uplift applied.		
Technical Report on the development of a World-wide Worldwide harmonised Light duty driving Test Procedure (WLTP)		
HMG (2018): Electric Chargepoint Analysis – Domestics, Public Sector Fasts and Local Authority Rapids[123]		
Data in Table 3	HMG (2018): Electric Chargepoint Analysis – Domestics, Public Sector Fasts and Local Authority Rapids	Data in Table 3
Data in Table 3	Data in Table 3	Data in Table 3

(Table 5 – Assumptions log continued)

118 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005301/transitioning-to-zero-emission-cars-vans-2035-delivery-plan.pdf
119 https://www.gov.uk/government/collections/vehicles-statistics
120 https://www.gov.uk/government/statistical-data-sets/nts09-vehicle-mileage-and-occupancy#history
121 https://www.racfoundation.org/wp-content/uploads/Development_of_the_UK_CPN_Harold_Dermott_December_2018.pdf
122 https://www.gov.uk/government/collections/road-traffic-statistics
123 https://www.gov.uk/government/statistics/electric-chargepoint-analysis-2017-local-authority-rapids