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Forecasting public electric vehicle charging demand

A guide for local authorities in England prepared by the Local Government Support Programme

September 2022

Purpose of this guide

Developed as part of the Local Government Support Programme (LGSP), this guide aims to provide impartial support to local authorities looking to understand different approaches to forecasting electric vehicle (EV) uptake and chargepoint (EVCP) demand.

Who should use this?

Whether you're developing an EV strategy, writing a proposal to install charging infrastructure, or just beginning to ask these types of questions, we hope to demystify the forecasting process and offer practical steps you can take to use existing forecasts or even develop your own.

This guide **will not** answer questions such as what chargepoints should you install, where to put them and how to fund them. Local authorities in England can access additional free support developing and delivering an EV strategy through LGSP – **get in touch with us here**.

What does this guide cover?

Section 1 – Introduction to EV forecasting
Why forecast EV chargepoints, what will 'ideal' public charging look like and how this will evolve?

Section 2 – National forecasts
An overview of existing national EV and chargepoint forecasts and how these can be compared.

Section 3 – Forecasting approaches
Four approaches available to local authorities looking to develop an EV chargepoint forecast, ranging from simple estimates to building detailed scenarios.

Section 4 – Appendix
A list of acronyms & useful terms and information on data sources referenced in this guide.

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Section 1

Introduction to EV forecasting

This section will cover (follow the links to jump to sections):

Introduction to EV forecasting

Do I need to develop an EV chargepoint forecast?

While forecasting is the focus of this guide, not every council will need to develop a complex EV chargepoint forecast. If you do decide to go down this route, there is a growing range of resources available to help local authorities understand future EV and charging demand, including lessons learned from councils who have already been through this process.

Some reasons forecasting may be useful:

An EV chargepoint forecast can help to:

- provide strategic direction and guide planning and policy decisions (e.g. as part of an EV Strategy).
- inform chargepoint procurement decisions
- inform funding applications (e.g. the On-street Residential Chargepoint Scheme or Local Electric Vehicle Infrastructure fund).

The primary reason for producing a forecast will define the level and scale of detail you require:

A **strategic forecast** should aim to cover as many charging types (e.g. slow, fast, rapid, ultra-rapid) and vehicle types (e.g. cars, vans, taxis, buses) as possible. Ideally, your forecast will also extend further into the future, projecting chargepoints up to 2035 (or beyond).

A **forecast to inform procurement decisions** may require a higher level of detail, but with an emphasis on the near term (e.g. 2025-2030). You may also choose to focus on specific charging and vehicle groups where there is a particular need for the council to intervene, such as:

- local slow-to-fast chargepoints for residents without access to off-street parking
- rapid chargepoints for taxi and private hire drivers
- fast or rapid chargepoints for electric car club vehicles

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Introduction to EV forecasting

What are your priorities for public charging?

If you do decide to develop a chargepoint forecast, it will help if you define from the outset what you want your public charging network to achieve. What role do you see the council playing in delivering this infrastructure? You may want to consider the relevant priorities in your area with respect to the following perspectives:

1. **Commercial focus** – designing the network to maximise revenue from charging. This is the most likely route for a network entirely led by market forces.

   The network will see:

   - priority for more profitable types of chargepoints (e.g. rapid)
   - priority for locations that are likely to have higher utilisation
   - unequal geographical chargepoint provision until widespread EV adoption is reached

2. **User focus** – designing the network to maximise consumer confidence and improve the user experience.

   The network will see:

   - priority for devices that are reliable, easy to use, and with transparent pricing
   - chargepoint wait times reduced
   - an ambition to ensure the experience of charging an EV is as easy as refuelling at a petrol station

3. **Equity focus** – designing a network that is local, accessible and affordable for all users.

   The network will see:

   - all users have fair access to charging, both in terms of availability of charging and the cost to charge. A particular focus should be given to those in rural communities or those without access to off-street parking
   - all chargepoints designed to be fully accessible and meet the needs of Disabled people

Introduction to EV forecasting

What will 'ideal' charging infrastructure look like?

A successful charging network will need to address the **quality**, not just the **quantity**, of chargepoints. Over the next two pages we compare eight metrics you may consider using to evaluate your charging network.

The 'ideal' charging network will vary from one area to the next. Deciding what your ideal will be before you begin developing an EV charging forecast will help to provide an ultimate goal to aim towards.

Metric	Examples	Assessment of metrics
Total chargepoints	300,000 public chargepoints by 2030 (UK EV Infrastructure Strategy, March 2022)	Easy to calculate, but difficult to compare between regions. Does not distinguish between chargepoint types: one ultra-rapid chargepoint can supply many more vehicles in one day than one slow chargepoint.
Chargepoints per population	39 charging devices per 100,000 population in the UK (OZEV, Electric vehicle charging device statistics, October 2021)	Allows for some regional comparison, but does not account for regional differences such as vehicle ownership, EV uptake, or access to off-street parking. Does not distinguish between chargepoint types.
Chargepoints per on-street household	~1 charging site per 1,000 'On-Street Households' in Great Britain (Field Dynamics report, 2021)	Similar benefits and drawbacks to chargepoints per population, except this accounts for off-street parking availability. Details on Field Dynamics' methodology for estimating the number of 'On-Street Households' are available in this report.

Table continued on next page >>

Introduction to EV forecasting

What will 'ideal' charging infrastructure look like? (Continued.)

Metric	Example(s)	Assessment of metrics
Chargepoints per km (or km^2)	Minimum of 1 rapid chargepoint per 25km along motorways and major A roads	Useful for assessing geographical coverage in the early stages of the EV market. Does not account for regional differences such as vehicle ownership or traffic volumes.
Proportion of residents within 'reach' of a chargepoint	100% of residents within a 5-minute walk of a public chargepoint	Gives priority to equity, but does not account for regional differences that will impact charging demand. May be better serving as a minimum standard, as opposed to an 'ideal' metric. Might not distinguish between different chargepoint types.
EVs per chargepoint	10 EVs per public chargepoint (Alternative Fuels Infrastructure Directive, 2014)	EV per chargepoint (EV:CP) ratios can indicate the potential pressure on public chargepoints at a given location. EV:CP ratios allow comparison between regions and can account for EV uptake and vehicle ownership. However, other regional differences (e.g. access to off-street parking) are still not accounted for.
BEVs per rapid chargepoint	125 BEVs per rapid chargepoint (Zero Carbon Futures, 2017)	
Chargepoint performance	Less than 5% down-time (per year) across a network of chargepoints	Indicates the quality (and user experience) of the network, but performance alone cannot tell us if there are enough chargepoints.
Combined index	Any combination of other metrics	While this is more difficult to calculate, the right combination could allow for a comparison of quality, quantity and regional differences.

Introduction to EV forecasting

Understanding EV per chargepoint (EV:CP) ratios

While EV:CP ratios can be a helpful tool to monitor and compare chargepoint provision, it is important to be aware of what they reveal and how they can be misinterpreted.

EV:CP ratios in **Table 1** indicate that fewer EVs share each public chargepoint in Brent and Barrow-in-Furness compared to the UK average. This may mean that EV drivers in Brent and Barrow (for short) are less likely to compete to access a public chargepoint than the average UK EV driver. However, the additional data in **Table 1** reveals that chargepoint coverage and EV uptake vary considerably between Brent and Barrow.

On their own, EV:CP ratios do not reveal to what extent a 'good' ratio is the result of good chargepoint provision or simply low EV uptake. Certain areas will also need a lower EV:CP ratio, such as those with a high proportion of residents without off-street parking who will rely on public chargepoints.

Authority	Total CPs	CPs per 100,000 people	CPs per km^2	EV:CP ratios		Proportion of all vehicles that are EVs
				EVs per CP	BEVs per rapid CP	
Brent	492	150	11.4	7	106	3.3%
Barrow	15	23	0.2	13	100	0.5%
UK average	30,290	45.2	0.2	27	89	2.0%

Table 1. Comparison of different EV chargepoint metrics for two local authorities (Brent and Barrow-in-Furness) and the UK average. Data sources listed in the Appendix.

Introduction to EV forecasting

How will public charging evolve over time?

It is widely accepted that as the EV market develops, the charging network will become more efficient. This means that one chargepoint in 2030 will be able to support more vehicles compared to today, largely as a result of improvements to technology and increased utilisation.

Technology improvements include an increase in the average chargepoint power and the amount of power vehicles can actually receive (known as the 'acceptance rate'). On average, chargepoints will be able to deliver power to an EV more quickly compared to today.

Utilisation of chargepoints is expected to increase as a function of the EV market. While EV uptake is low, good geographical coverage of public chargepoints is necessary to improve visibility and reduce anxiety of finding a chargepoint on demand. As EV uptake increases and sufficient coverage is achieved, fewer chargepoints will be required to support each additional vehicle. Utilisation will need to be carefully balanced to support drivers and sustain the charging market:

> **Utilisation** is the proportion of time that a chargepoint is in use. You might see this referred to in terms of hours (or a percentage) of use per day.

If **utilisation rates remain too low**, chargepoints will be readily available but are unlikely to be profitable. This may prevent the market from installing new chargers or investing in existing ones. This would likely lead to a high cost to charge and a poor service for customers.

While **higher utilisation** will mean fewer chargepoints are required, if too high, drivers may struggle to find a chargepoint when they need one, or be forced to queue. This could negatively impact the consumer experience and discourage other drivers from switching to an EV.

Section 2

National forecasts

This section will cover (follow the links to jump to sections):

National forecasts

How many chargepoints will the UK need?

As of March 2022, there were more than 750,000 plug-in vehicles in the UK[1]. By 2035, there could be as many as 28 million EVs on UK roads, according to the Climate Change Committee[2]. While it is clear that charging demands are set to increase dramatically, there is a lack of clarity on the optimal or minimum number of chargepoints that will be required to meet this growing demand.

Launched in March 2022, the UK Government EV Infrastructure Strategy projects between 300,000 and 700,000 public chargepoints may be required by 2030. This broad estimated range indicates the high level of uncertainty when forecasting future chargepoint need.

Box 1 outlines some forecasting assumptions that will have a significant impact on the number of chargepoints projected to be required.

Box 1 – Forecasting assumptions

- **EV uptake** – how quickly will this transition take place? How many EVs will there be by 2030?
- **Proportion of slow, fast and rapid charging** – will there be a high or low share of slow charging or will drivers prefer to top-up at rapid chargepoints?
- **Driver behaviours** – how far will drivers travel? Will they charge efficiently (e.g. unplugging their EV once it has finished charging)?
- **Future technology** – what will be the typical range of an EV? How will high-powered charging evolve?
- **Access to home charging** – how many EV drivers will be reliant on public charging? How many people with a home chargepoint will share this with other drivers?
- **Chargepoint utilisation** – how many hours of the day will chargepoints be in use?

1 – UK EV Infrastructure Strategy (March 2022)
2 – The Sixth Carbon Budget, Surface Transport (Dec 2020)

National forecasts

What national forecasts are already available?

The following organisations have produced national forecasts for both **EVs and chargepoints**[3]:

- **UK EV Infrastructure Strategy (EVIS)**
  Taking charge: the electric vehicle infrastructure strategy (Mar 2022)
- **EV Energy Taskforce (EVET)**
  Charging the Future (Mar 2022)
- **Climate Change Committee (CCC)**
  Sixth Carbon Budget report (Dec 2020)
- **Society of Motor Manufacturers and Traders (SMMT)**
  'New car market and parc outlook to 2035' (Jun 2021) and EV Infrastructure Position Paper (Feb 2022)
- **Transport & Environment (T&E)**
  'Recharge EU' report (Jan 2020)
  'Charging forward' report (May 2021)
- **International Council on Clean Transport (ICCT)**
  'Quantifying the electric vehicle charging infrastructure gap in the UK' report (Aug 2020)
- **Delta-EE**
  European EV Chargepoint Forecasts (Jul 2020)

The following organisations have published national forecasts for **EVs only**:

- **National Grid ESO (Energy System Operator)**
  2021 Future Energy Scenarios (FES) (Jul 2021)
- **Department for Transport (DfT)** provide projections for EV sales (not a full EV forecast) in the 2035 Delivery Plan (Jul 2021).

A comparison of many of these forecasts is presented from page 15 onwards. Please note, this list will become out of date as new forecasts are released.

3 – Links to forecasts are accurate as of August 2022.

National forecasts

Can we compare national forecasts?

Forecasts of chargepoints typically rely on a number of assumptions that will have a significant impact on the number of chargepoints projected to be required (see **Box 1** on page 11). When comparing national forecasts, it is particularly important to be aware of the following:

Basic definitions can and do vary!

Even the most fundamental definitions can vary from one forecast to another, for example:

- The term 'electric vehicle' may refer to plug-in hybrid vehicles (PHEVs) and battery electric vehicles (BEVs) combined, or just BEVs. In some cases, this may also include fuel cell electric vehicles (FCEVs). **Figure 1** shows the standard terminology for alternative fuel vehicles used by DfT in their licensing statistics[4].

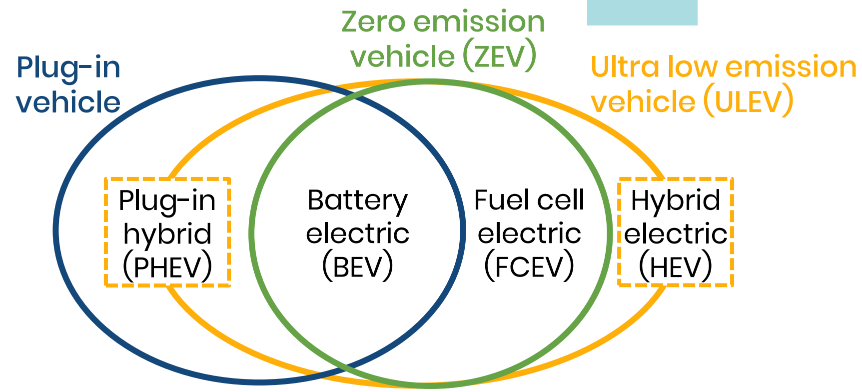


Figure 1. Summary of alternative fuel vehicle terminology. HEVs and PHEVs overlap the ULEV category, depending on how highly emitting they are.

- While forecasts may broadly use the term 'vehicle', do not assume this means all vehicle types are covered. In some cases, 'vehicle' may refer to all vehicle types (cars, vans, taxis, buses, HGVs, motorbikes), but elsewhere this may just refer to cars, or any combination of vehicle types in between.

4 – Vehicle Licensing Statistics: Annual 2020, Figure 3 (May 2021)

National forecasts

Can we compare national forecasts? (continued)

- The term 'chargepoint' may refer to the number of connectors (sockets) or the number of individual devices (which will be lower than the number of connectors as some chargepoints can recharge more than one vehicle at once).

  Note: DfT use the convention of counting individual charging devices in their national electric vehicle charging infrastructure statistics.

- The types of chargepoint classed as 'public' may vary. For example, this may or may not also include workplace or 'semi-public' chargepoints.

Semi-public chargepoints may have restrictions due to parking or opening times or a requirement to make use of facilities, e.g. chargepoints at supermarkets.

- Terms such as 'fast charger' are not always consistent. Forecasts developed outside of the UK may use the term 'fast' to describe chargepoints rated 25 kW and above (typically referred to as rapid or ultra-rapid in the UK).

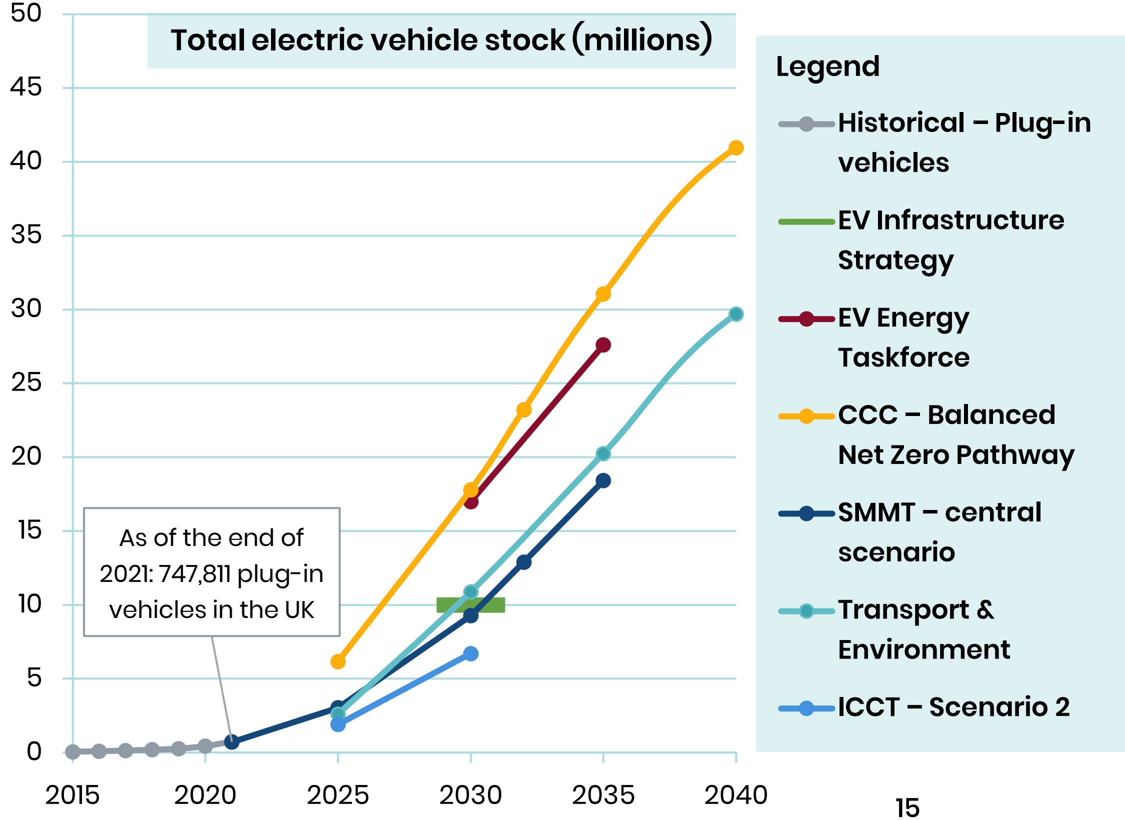
Forecasts quickly become out of date

Data or assumptions used in older forecasts may no longer be relevant. Reliable forecasts should be regularly updated to account for changes in:

- **policy** – e.g. petrol and diesel vehicle phase-out dates being brought forward
- **technology** – e.g. EV battery size and range improving more rapidly than expected
- **behaviour** – e.g. changes in travel patterns as a result of events such as the Coronavirus pandemic

National forecasts

Note – to encourage a fair comparison, information on the methods and assumptions that underpin each forecast are outlined on page 18. Links to data sources are provided on page 12.



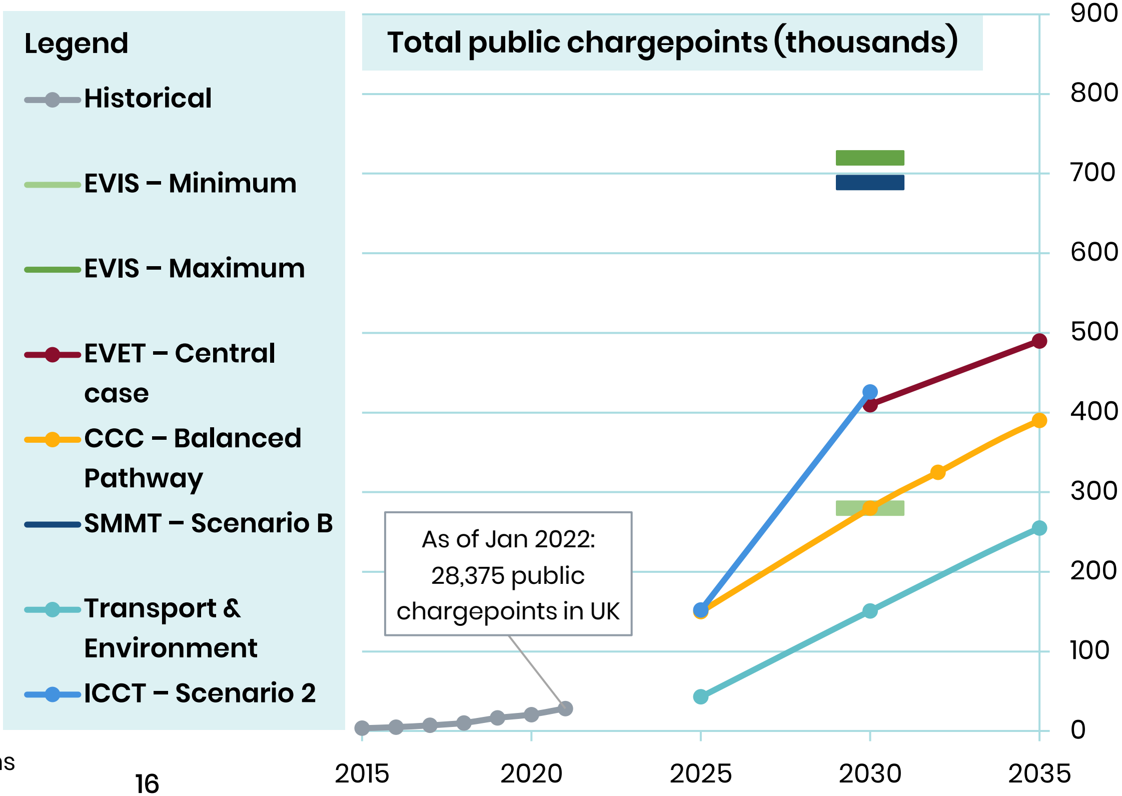
Total electric vehicle stock[5] (in millions)	2025	2030	2035	2040
Maximum & minimum values for each year are shown in **bold**				
UK EV Infrastructure Strategy (EVIS)	-	10	-	-
EV Energy Taskforce (EVET)	-	**17**	28	-
CCC – Balanced Pathway	**6**	18	**31**	**41**
SMMT – central scenario	3	9	**18**	-
T&E ('Charging forward' report)	2.5	11	21	**30**
ICCT – Scenario 2 (high EV share)	**1.9**	**7**	-	-

5 – Total EVs in use (i.e., vehicles on the road)

National forecasts

Note – to encourage a fair comparison, information on the methods and assumptions that underpin each forecast are outlined on page 18. Links to data sources are provided on page 12.

Chargepoints (thousands)	2025	2030	2035
Maximum & minimum values for each year are shown in **bold**			
UK EVIS – Minimum	-	280	-
UK EVIS – Maximum	-	**720**	-
EVET – Central case	-	410	**490**
CCC – Balanced Pathway	150	280	390
SMMT – central scenario	-	689	-
T&E ('Charging forward' report)	**43**	**151**	**255**
ICCT – Scenario 2 (high EV share)	**152**	426	-



Please note, some of these figures have been read from graphs and may therefore not be exact values.

National forecasts

Why do forecasts vary so much?

According to the forecasts shown on page 16, the UK could require between 150 and 720 thousand public chargepoints by 2030. The UK would need significantly more investment in chargepoints to reach the higher estimate: on average, 70,000 more public chargepoints would need to be installed each year to reach 720,000 chargepoints by 2030 (compared to 150,000).

When comparing forecasts, it is important to be aware of the assumptions that underpin them. Key differences between the six forecasts presented are outlined below:

- **Vehicle type:** three forecasts cover cars and vans, while the other three only cover cars. The ICCT forecast references 'passenger' cars in particular.
- **EV uptake:** four forecasts are in line with current UK policy to ban diesel and petrol cars and vans from 2030 and non-ZEVs from 2035. The two older forecasts (CCC and ICCT) have slightly different projections.
- **Workplace charging:** two forecasts (T&E and ICCT) include workplace charging, while the others do not (classifying this as private charging). ICCT predict that a lot of 'workplace' charging will take place at public chargepoints and use the terms interchangeably.
- **Access to home charging:** the forecasts estimate between 50% and 85% of drivers (or households) have access to home charging. ICCT model this proportion to vary over time, recognising that current EV drivers are more likely to have off-street parking than the national average. The SMMT and T&E models address the fact that access to off-street parking does not guarantee being able to install a home charger.

A full comparison table can be found on the next page.

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National forecasts

Table 2. Comparison of six national chargepoint forecast approaches (continued on next page)

Forecast – Scenario [Year published]	Vehicle types	EV uptake scenarios	Public chargepoint classifications	Access to home charging
UK EV Infrastructure Strategy (EVIS) [2022]	Cars and vans. ZEV only.	New internal combustion engine (ICE) vehicles (cars & vans) banned from 2030. ZEV sales reach 100% market share in 2035.	• Residential on-street • Destination • On route rapid Workplace charging classified as 'private' charging.	Around **70%** of households with a vehicle in England currently have access to private, off-street parking. Unclear if this is modelled to vary over time.

EV Energy Taskforce (EVET) – Central case [2022]	Cars and vans. BEV + PHEV.	New ICE vehicles (cars & vans) banned from 2030. ZEV sales reach 100% market share in 2035.	• Near home charging
			  • On-street (7 kW)
			  • Local rapid hubs (50+ kW)
			• En-route rapid (50+ kW)
			• Destination (22 kW)
			Workplace charging not included.
				65% of households have access to off-street parking. Not modelled to vary over time.

Climate Change Committee (CCC) – Balanced Pathway [2021 update]	Cars and vans. BEV + PHEV.	New ICE vehicles (cars & vans) phased out by 2032. BEV sales reach 97% market share in 2030.	• On-street
			  • Slow (7 kW)
			  • Fast (22 kW)
			  • Rapid (43 kW)
			• Inter-urban rapid (43+ kW)
			Workplace charging not included.
				70% of car owners have access to off-street parking. Not modelled to vary over time.

National forecasts

Table 2 (continued). Comparison of six national chargepoint forecast approaches

Forecast – Scenario [Year published]	Vehicle types	EV uptake scenarios	Public chargepoint classifications	Access to home charging
SMMT – Central scenario (EVs) / Scenario B (EVCPs) [2021 / 2022]	Cars only. BEV + PHEV.	New ICE vehicles (cars & vans) banned from 2030. ZEV sales reach 100% market share in 2035.	• On-street (7-50 kW) • Destination (7-50 kW) • Forecourt/hub/motorway (50-350 kW) Workplace charging categorised as 'private' charging.	**53%** of all households are able to install a home charger. Not modelled to vary over time.
Transport & Environment ('Charging forward' report) [2021]	Cars only. BEV + PHEV.	EV sales reach 100% market share by 2030. BEV sales reach 100% market share by 2035.	• Slow kerbside and workplace (3-5 kW) • Fast destination (7-22 kW) • Rapid (50+ kW)	**51-67%** (55% on the median scenario) of EV drivers have access to home charging. Not modelled to vary over time.

ICCT – Scenario 2 (high EV share) [2020]	Passenger cars only. BEV + PHEV.	New EV sales reach 70% market share by 2030.	• Normal (3-22 kW)
			  • Public charging
			  • Workplace charging
			• Fast (43-100+ kW)
				72% of car owners park overnight in off-street locations. Modelled to vary over time (85% in 2019, 80% in 2035, tending towards 72%).

Section 3

Forecasting approaches

This section will cover (follow the links to jump to sections):

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Routes to forecasting

Depending on the level of detail you require, as well as the resource, skill and time available, we have identified four routes to forecasting chargepoint demand (as covered in the rest of this section).

A **chargepoint** may be able to charge more than one vehicle at a time. In this section, it is assumed that each chargepoint has only one connector and can only charge one vehicle.

1

Use existing local or regional forecasts

Find existing 'ready to use' forecasts for your area.

2

Adapt national forecasts to your area

Different ways to adapt national forecasts to derive a local estimate for your area.

3

Estimate based on accepted EV per chargepoint ratios

Apply a simple metric to an existing EV forecast.

4

Develop your own scenario-based model

Either on your own or with support from an external consultancy.

Moving from left to right:

- More opportunities to tailor the forecast to your area which may improve accuracy
- Increasing resource or technical skill may be required

Use local forecasts

Where can I find local or regional forecasts?

Distribution Network Operators (DNOs) are required by the energy regulator, Ofgem, to forecast EV uptake and are encouraged to work with local stakeholders to determine potential public charging demand. Typically this work takes place alongside modelling of Distribution Future Energy Scenarios (DFES). **Unsure who your network operator is?** Find out here.

Table 3. Key resources provided by each DNO in England and whether this includes a forecast of public chargepoints.

DNO	Forecasting resources available	Public chargepoint forecast available?
Electricity North West	DFES data – in excel format	**No** – but total EV energy consumption to 2050 is available
Northern Powergrid	DFES data – via geospatial tool or in excel format	**No**
Scottish & Southern Electricity Networks	DFES data – in annual report only. No data download option. Total for Southern England licence area only	**Yes** – total connected capacity of 'non-domestic' chargepoints to 2050
SP Energy Networks	DFES data – via geospatial tool or in excel format (Manweb licence area)	**Yes** – ConnectMore tool (beta) provides charging insights for the Manweb licence area only
UK Power Networks	DFES data – via geospatial tool or in excel format (via 'Where do I access the data?')	**No**
Western Power Distribution	DFES data – via geospatial tool. Data export in excel format also available	**Yes** – number of units (devices) for eight chargepoint categories up to 2050

Links are accurate as of May 2022.

Think this information incorrect? Please get in touch.

Use local forecasts

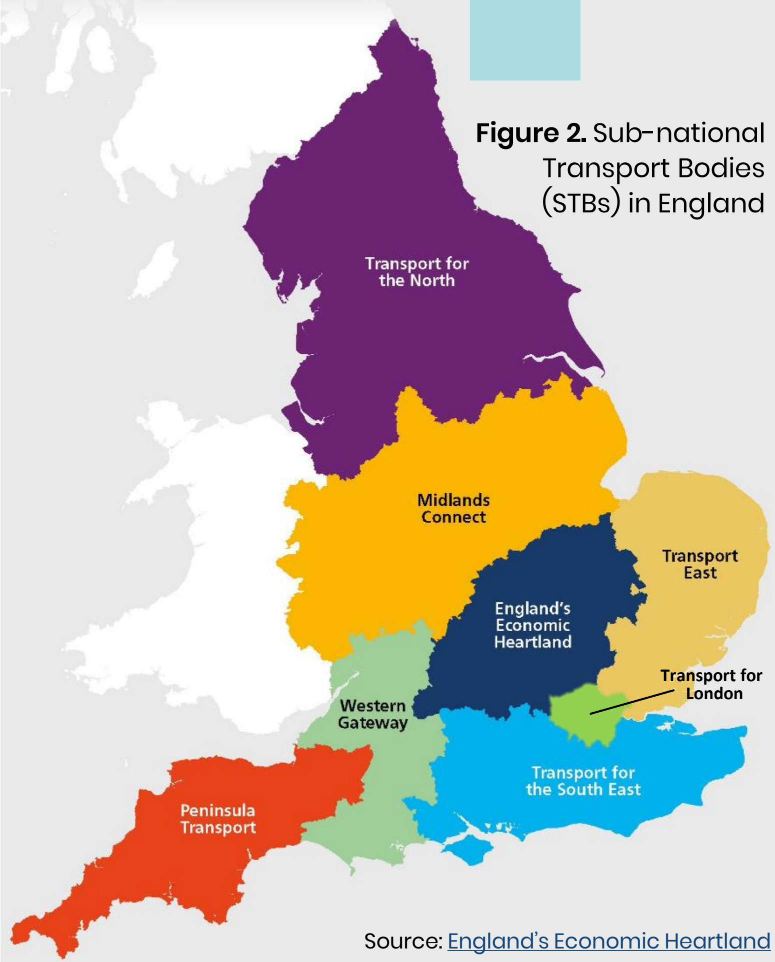
Other local forecasts:

Transport & Environment have projected public chargepoints required by 2025 for each local authority in the UK, alongside their 'Charging forward' report. This information is presented in an interactive map. It is worth being aware that this study claims to 'focus on sufficiency' and T&E's projections are lower than other forecasts (as shown on page 16).

The **International Council on Clean Transportation (ICCT)** published a working paper setting out estimates of the charging needs for each London borough to 2030 and 2035. The ICCT's national forecast (presented earlier in this report) also estimates charging needs to 2030 for all metropolitan areas in the UK. Regional totals are also provided.

Sub-national Transport Bodies (STBs, see Figure 2) are in a unique position to support cohesive delivery of charging infrastructure between local authorities. STBs have received funding from the UK Government to develop tools to assist local authorities in developing chargepoint plans. As part of this work, Transport for the North have published a Visualiser tool. Midlands Connect are due to launch an EV planning tool this year.

Figure 2. Sub-national Transport Bodies (STBs) in England



Source: England's Economic Heartland

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Adapt national forecasts

National forecasts can be used to derive a simple local estimate using the following method:

1. **Select a national forecast**, such as any of those listed on page 12 of this guide.

   For the examples presented here, we have used the EV Energy Taskforce (EVET) central case. Under this forecast, it is projected that **410,000 public chargepoints** will be required in the UK **by 2030**.

2. **Derive a proportional local estimate** by applying any of the relationships outlined on pages 25-26 to your chosen national projection. Which relationship(s) you decide to use will depend on the data you have available for your area.

   Example calculations are presented on pages 25-26. We have used data for the Borough of Luton (selected at random) to help illustrate this process for a real local authority,

What to watch out for

Chargepoint projections generated by adapting national forecasts are unlikely to account for local variations from nationwide trends, for example:

- **EV uptake** may be faster or slower in your area compared to the national average.
- The proportion of residents in your area with **access to off-street parking** may be higher or lower than the national average. This will affect the number of residents who will rely on public charging.
- DfT vehicle licensing statistics are known to be distorted by the **presence of fleet or leasing companies**. These vehicles may all be registered in one local authority but located and driven elsewhere.

You may wish to adjust the outputs generated via this method to account for any known differences between local and national averages.

Adapt national forecasts

Here we outline five examples of relationships that can be used to derive a local chargepoint estimate.

- **Current EV population**

  Calculate the current (or latest) proportion of the UK total that existing EVs in your area represent.

  Data used: DfT Vehicle Licensing Statistics (VEH0142).

EXAMPLE

747,811 plug-in vehicles in the UK (end of 2021)
809 plug-in vehicles in Luton (end of 2021)
Plug-in vehicles in Luton represent **0.11%** of UK total
0.11% of UK chargepoint projection = 0.11% x 410,000 = 444
444 public chargepoints required in Luton by 2030

- **Future EV population**

  If you already have an EV forecast (for example, from your DNO), you can calculate the proportion of the UK total that future EVs in your area are projected to represent.

  Data used: EVET central case (Charging the Future report), UKPN DFES 2022 (Consumer Transformation).

EXAMPLE

17 million electric cars & vans projected in the UK in 2030
35,833 electric cars & vans projected in Luton in 2030
In 2030, electric cars & vans will represent **0.21%** of UK total
0.21% of UK chargepoint projection = 0.21% x 410,000 = 864
864 public chargepoints required in Luton by 2030

- **Current vehicle population**

  Calculate the current (or latest) proportion of the UK total that existing vehicles (across all fuel types) in your area represent.

  Data used: DfT Vehicle Licensing Statistics (VEH0105).

EXAMPLE

40,274,788 vehicles in the UK (end of 2021)
97,901 vehicles in Luton (end of 2021)
Current vehicles in Luton represent 0.24% of UK total
0.24% of UK chargepoint projection = 0.24% x 410,000 = 997
997 public chargepoints required in Luton by 2030

Adapt national forecasts

- **Current population (or households)**

  Calculate the current proportion of the UK population that the population in your area represents. This could also be calculated for households.

  Data used: Office for National Statistics (ONS) mid-2020 population estimates.

EXAMPLE

67,081,234 people in the UK (mid-year 2020)
213,528 people in Luton (mid-year 2020)
Population of Luton represents **0.32%** of UK population
0.32% of UK chargepoint projection = 0.32% x 410,000 = 1,305
1,305 public chargepoints required in Luton by 2030

- **Households with a car**

  Calculate the current proportion of the UK total that households with at least one car or van available in your area represent.

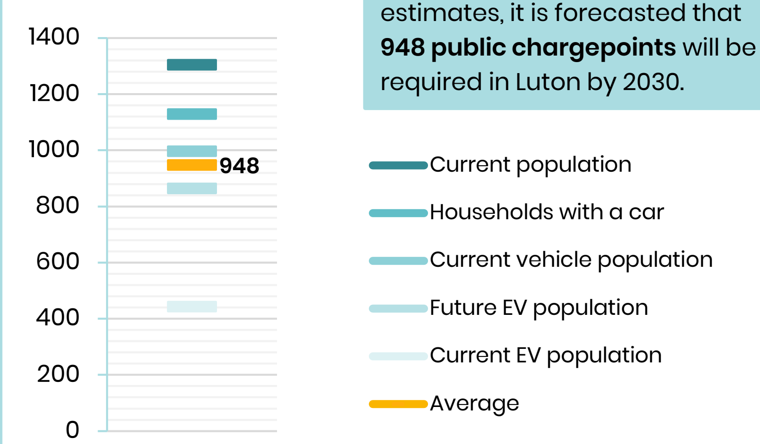
  Data used: UK Census 2011 – car or van availability. 2021 Census data is expected to be released in 2023.

EXAMPLE

19,568,523 households in the UK with a car or van
53,904 households in Luton with a car or van
Households that own a car or van in Luton represent 0.28% of the UK total
0.28% of UK chargepoint projection = 0.28% x 410,000 = 1,129
1,129 public chargepoints required in Luton by 2030

Summary of all estimates:

Taking an average of these five estimates, it is forecasted that **948 public chargepoints** will be required in Luton by 2030.



Ratio-based estimations

Earlier in this guide, we introduced EV per chargepoint (EV:CP) ratios as a way to evaluate the success of your charging network. EV:CP ratios can also be used to set chargepoint targets. This method is simple to implement—provided you have EV projections for your area—and can easily be updated if EV projections change as the EV market develops.

Which ratio is best to use?

The trickiest part of this process is deciding which EV:CP ratio to use. There is significant uncertainty about the number of EVs that each public chargepoint can and will support in the future. One prevalent ratio is:

2014 Alternative Fuels Infrastructure Directive (AFID)
At least one public chargepoint per 10 EVs
UK example: 1.7 million public chargepoints required in 2030 (based on EVET central EV forecast)

Problems with using a 'simple ratio'

The current AFID ratio is not able to account for:

- **Types of chargepoints being installed**. A 50 kW rapid chargepoint can theoretically serve 7 times as many vehicles in a day as a standard 7 kW chargepoint.
- **Availability of chargepoints**. Some chargepoints have access restrictions and cannot serve as many vehicles as those that are available 24/7 to all users.
- **BEVs and PHEVs**. BEVs typically require more energy than PHEVS as they rely solely on an electric motor.
- **Efficiency of the charging network**. This is expected to increase as the EV market develops, as a result of improvements to technology and increased utilisation.
- **The proportion of EV owners that have access to off-street parking**. This proportion is expected to decrease over time, as more people without a driveway or garage make the switch to an EV.

Ratio-based estimations

There are proposals to revise the AFID, replacing this with mandatory national charging infrastructure targets. While any targets will only apply to members of the European Union and not the UK, they may still offer a useful benchmark for authorities in the UK.

Proposed Alternative Fuels Infrastructure Regulation

At least 1 kW (0.66 kW) of publicly accessible charging power output for every light-duty BEV (PHEV).

UK example: 16.8 million kW (16.8 gigawatts, GW) of public charging output required in 2030, equivalent to:

2.4 million 7 kW chargepoints
760,000 22 kW chargepoints
110,000 ultra-rapid (150 kW) chargepoints

The term **light-duty vehicle (or LDV)** refers to cars and vans collectively.

Transport & Environment also offered an alternative metric in their Recharge EU report.

Transport & Environment (T&E) Supply Metric

$$\textbf{Supply Metric} = \frac{\textbf{(2 x No. of BEVs) + No. of PHEVs}}{\textbf{Sufficiency indicator}}$$

The **optimal sufficiency indicator** is based on regional characteristics (e.g. housing stock, vehicle sales and average distance driven). In T&E's Recharge EU report, optimal sufficiency indicators range from 10 to 30 in 2030.

UK example: using a sufficiency indicator of 15, the Supply Metric for the UK will be 2.2 million in 2030.

Chargepoints are then assigned a weighting factor according to their power output. A Supply Metric of 2.2 million is therefore equivalent to:

2.2 million slow (3-7 kW) chargepoints
220,000 ultra-rapid (150+ kW) chargepoints

Ratio-based estimations

In reality, future charging networks will require a mixture of slow, fast, rapid and ultra-rapid charging. To develop a realistic chargepoint forecast, the EV:CP ratios presented should be accompanied by assumptions about how people will interact with public charging in the future. For this you will need to allocate a proportion of public charging demand by chargepoint type. Below, we present an example for Luton:

EXAMPLE

Method used: Proposed Alternative Fuels Infrastructure Regulation

- UKPN DFES (2022) project that by 2030 there will be 29,397 BEVs and 6,436 PHEVs in Luton.
- Assuming 1 kW of public charging for every BEV and 0.66 kW for every PHEV, the total energy required to serve these vehicles would be 33,645 kW.
- If we develop a future scenario where a high proportion of charging takes place at near-home residential chargepoints, we can estimate:
  - Slow-to-fast chargepoints will supply 60% of public charging demand[6]
  - rapid and ultra-rapid chargepoints will supply the remaining 40% of public charging demand
- Breaking this down by chargepoint type, we can estimate more than 2,000 public chargepoints may be required in Luton by 2030 under this scenario[7].

Chargepoint type	Chargepoint power (kW)	% of public charging demand	Number of chargepoints
Slow-to-fast	7	20%	961
	11	20%	612
	22	20%	306
Rapid	50	10%	67
Ultra-rapid	150	30%	67
Total public chargepoints		**100%**	**2,013**

6 – This is **not** the same as 60% of public chargepoints being slow-to-fast; the proportion of devices will be higher than 60%.

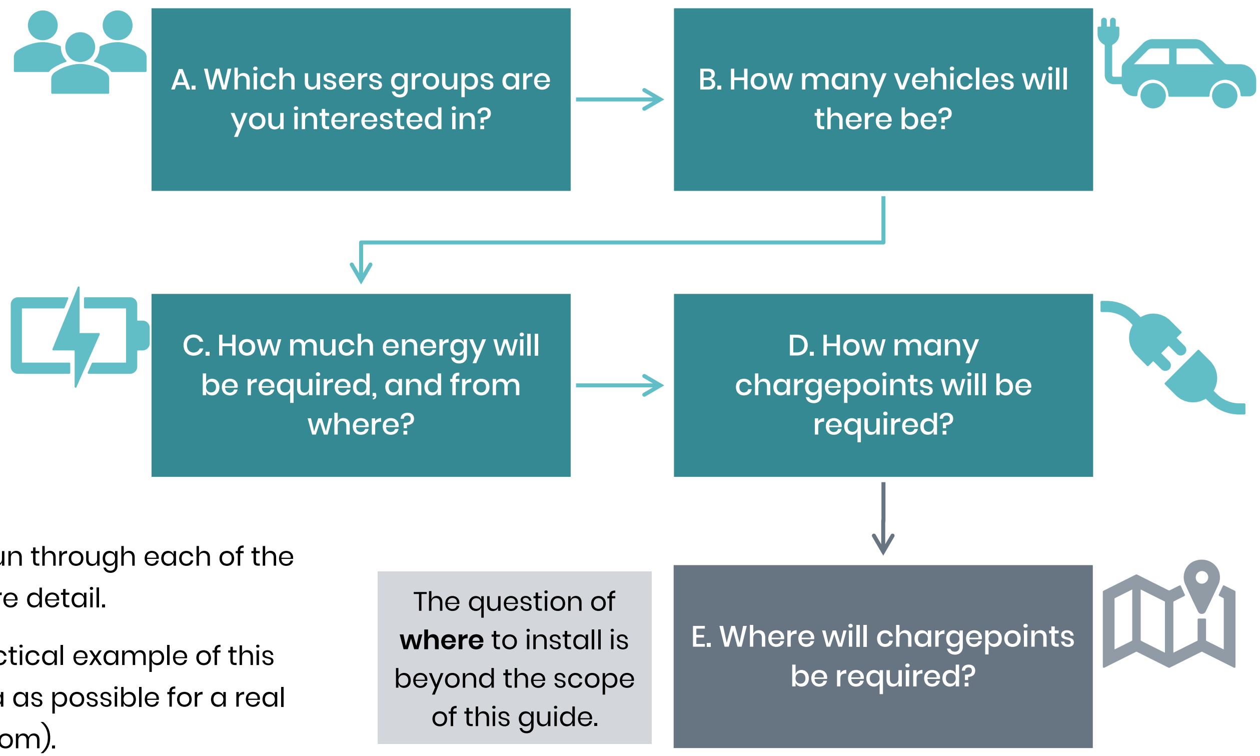
7 – Public charging demand proportions have a strong influence on the number of chargepoints required.

Build your own model

The chargepoint forecasting journey: key questions to ask along the way...

You may decide you require a greater level of accuracy and need to develop a detailed forecasting model.

There are many approaches to forecasting EV chargepoint demand, as illustrated by the national forecasts reviewed earlier in this guide. Here we will present a general process you may choose to follow.



On the following pages, we will run through each of the key questions shown here in more detail.

From page 40, we present a practical example of this process using as much real data as possible for a real local authority (selected at random).

A. Which user group(s) are you interested in?

This will depend on your reasons for forecasting.

A **strategic forecast** should aim to cover as many user groups as possible.

A **forecast to inform procurement decisions** may choose to focus on specific user groups where there is a particular need for the council to intervene, such as:

- residents without access to off-street parking
- taxi and private hire drivers
- electric car club vehicles
- council-owned fleet

You may also be limited by the data you have available.

Data you may require for each 'user group' includes:

- the current total number of vehicles
- vehicle turnover (how many vehicles are purchased or replaced each year)
- an estimation of driving and charging behaviours (typical mileage, where drivers will want to charge and what type of chargepoints they will want or need to use)

At this point you should aim to:

1. Define **which vehicles** you're interested in:
   - Body type: cars, vans (LGVs), HGVs
   - Fuel type: BEV, PHEV or both
   - Primary use: private, commercial, taxi and private hire vehicles, car club vehicles
2. Define **which chargepoint types**[8] you want to include:
   - Power: slow, fast, rapid, ultra-rapid
   - Primary use: residential, destination, en-route, dedicated taxi or private hire chargepoints
   - Are you also interested in private (e.g. workplace or home) charging?

8 – An overview of chargepoint types is provided on page 49.

B. How many vehicles will there be? (p.1 of 2)

First, gather as much vehicle data as possible. You should aim to collect vehicle data that:

- **Includes a full fuel type breakdown**

  Data for non-electric vehicles is useful to understand the total vehicle population and the 'EV share': the proportion of total vehicles that are electric.

- **Spans at least 5 years**

  This will help build a picture of vehicle trends that will ultimately underpin your vehicle forecast.

EXAMPLE

Private cars	Diesel	Petrol	Hybrid	Plug-in hybrid	Battery electric	Total
Dec 2021	2,000	1,500	500	250	300	4,600
Dec 2020	2,100	1,425	450	210	250	4,435
Dec 2017	2,150	1,350	350	90	80	4,020

Next, understand which policies are relevant. It is likely your forecast will need to consider the following **national policies** which will see a ban on the sale of new:

Petrol or diesel cars & vans in 2030

Non-zero emission cars & vans in 2035

Non-zero emission HGVs in 2040

Local or regional policies may also affect EV uptake in your area, such as:

- Taxi & private hire licensing policies (e.g. a requirement for vehicles to be zero emission by a specific date)
- Vehicle charging zones (e.g. clean air zones or ultra-low emission zones)
- Additional incentives or funding available for those who switch to an EV (e.g. vehicle scrappage schemes)

Build your own model

B. How many vehicles will there be? (p.2 of 2)

Develop future vehicle scenario(s).

If you're developing a simple forecast, you may choose to use just one EV uptake scenario. For more detailed forecasts, you're likely to require at least three vehicle uptake scenarios. If you are using more than one vehicle scenario, you will need to start by deciding which inputs will remain the same and which will vary.

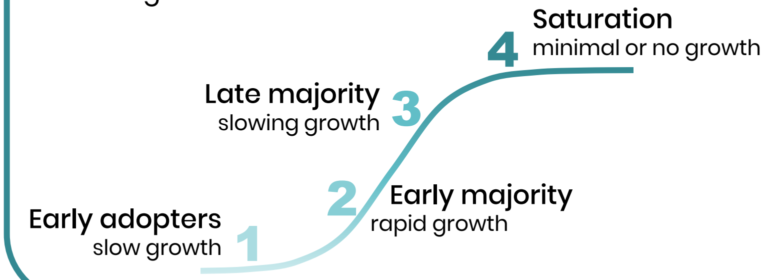
Summary of potential scenario inputs:

- Current total number of vehicles (including total EVs)
- Number of new vehicles each year
- Number (or proportion) of vehicles that are replaced each year
- Current BEV and PHEV share of **new** vehicles
- An estimation of how the BEV and PHEV share of new vehicles will change in the future

If this is unknown, you may want to consider:

- ❑ Date(s) by which all new vehicles will need to be electric (or zero emission)
- ❑ An '**S-curve**' model to simulate EV uptake

'S-curves' are a common tool used to forecast the uptake of new technologies. There are four typical stages to an S-curve, starting with slow growth, followed by a period of rapid progress, before growth slows again:



C. How much energy will be required? (p.1 of 3)

Once we have a picture of how many electric vehicles there might be in the future, the next step is to estimate how much energy these vehicles might require.

While there is more than one way to reach an estimation of energy demand, a simple approach is to use the annual mileage, as follows:

Annual mileage (miles)	X	EV energy consumption (kWh/mile)	=	Annual energy required (kWh)

Annual mileage:

Where possible, you will want to use a single average annual mileage for all vehicles. For example, the average car travelled 6,800 miles in 2020 according to the National Travel Survey (NTS) 2020 (NTS0901). However, if you are modelling very different users and require a higher level of detail, you may decide to use different average mileages for each user group. For example, the average **company car** travelled nearly twice as far as the average **private car** in 2020 – 13,200 miles compared to 6,700 respectively (taken from NTS0901).

For plug-in hybrid vehicles (or PHEVs), we are only interested in the proportion of miles carried out in a fully electric mode. While official figures estimate the electric driving share of PHEVs to be 70-85%, real-world studies have shown that on average this is less than 50%[9].

EV energy consumption:

Just as fuel consumption varies for petrol and diesel vehicles, EV models consume a different amount of energy per mile (kWh/mile). Official energy consumption values are reported by vehicle manufacturers, however these figures do not accurately reflect real world values.

9 – ICCT (2022), 'Real-world usage of plug-in hybrid vehicles in Europe: A 2022 update'

Build your own model

C. How much energy will be required? (p.2 of 3)

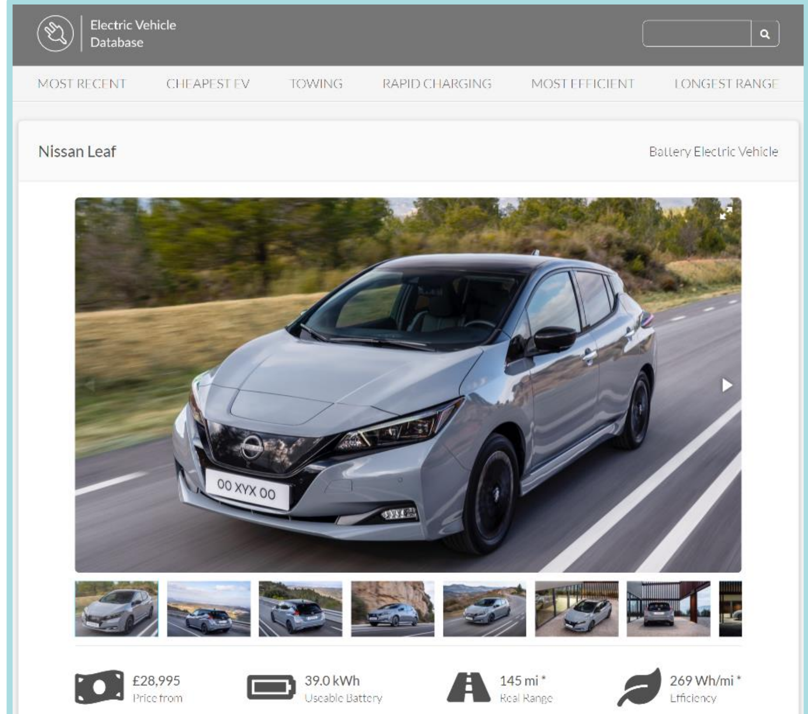
The Electric Vehicle (EV) Database was designed to enable an easy comparison between EV models on the market and presents official testing figures alongside real-world data. The average 'real-world' energy consumption for all EV models currently listed on the EV Database[10] is roughly 0.3 kWh per mile.

As with mileage figures, you may want to use a sensible average for all vehicles, or break this down by user group.

Bringing this together for a private EV (covering 6,700 miles a year) we can estimate roughly 2,000 kWh of annual energy would be required:

6,700 miles per year	X	0.3 kWh/mile	=	2,010 kWh per year

Figure 3. Example of vehicle data for the Nissan Leaf. Source: EV Database.



10 – 168 models listed on the EV Database as of 25 July 2022.

Build your own model

C. How much energy will be required? (p.3 of 3)

Before we can move onto the final step, we need to understand what proportion of charging demand will be delivered by different types of chargepoints.

Not all chargepoints are created equal

One ultra-rapid (100kW+) chargepoint could supply the same energy demand as 25 slow (4kW) chargepoints. However, ultra-rapid charging is more expensive (around 50p per kWh[11], whereas it can cost as little as 8p per kWh to charge at home overnight[12]) and places additional pressure on the electricity network.

There is still a lot of uncertainty about what the 'right' balance of chargepoints should be. Scenarios can help to illustrate the impact different approaches might have on the overall number of chargepoints required.

Three potential chargepoint scenarios are shown below:

High on-street share – high proportion of public charging taking place close to home at slow-to-fast on-street chargepoints.

E.g. energy demand is met by: slow-to-fast (60%), rapid (20%) and destination (20%) chargepoints.

High motorway or en-route share – high proportion of public charging taking place at rapid or ultra-rapid chargepoints on motorways or at urban hubs. Speed of charging is a priority.

E.g. slow-to-fast (40%), rapid (40%), destination (20%).

High workplace or destination share – high proportion of public charging taking place at fast chargepoints at retail or leisure destinations. Those that commute predominately charge at slow-to-fast chargepoints at their workplace.

11 – Taken from RAC Charge Watch (May 2022)
12 – Based on Octopus Go tariff (August 2022) – price variable.

Build your own model

D. How many chargepoints will be required? (p.1 of 4)

Once we know the energy demand per chargepoint type, we can estimate the number of chargepoints required using the following calculation:

Number of chargepoints (#) = Annual energy demand (kWh) ÷ Annual charging capacity (kWh)

In a simple sense, a 7 kW chargepoint can deliver 7 kWh of energy every hour. This means more than 160 kWh each day, and more than 60,000 kWh per year. This is what is known as the annual **charging capacity**.

> Actual **energy delivered** is affected by the vehicle's charge rate and state of charge; grid capacity; and weather conditions such as extreme heat or cold.

This is assuming chargepoints are constantly in use.

In reality, utilisation of chargepoints is often very low, particularly in the early stages of EV adoption. One way to account for this is to multiply the annual charging capacity by a **utilisation factor**.

> The **utilisation factor** is a number between 0 and 1 which represents the proportion of time that a chargepoint is in active use. See page 9 for a discussion on utilisation rates.

If every chargepoint is only in use 12 hours a day, the annual charging capacity would be halved, meaning twice as many chargepoints would be required to meet the same demand.

$$\text{Number of chargepoints (\#)} = \frac{\text{Annual energy required (kWh)}}{\text{Annual charging capacity (kWh)} \times \text{Utilisation factor (\%)}}$$

Build your own model

D. How many chargepoints will be required? (p.2 of 4)

Some chargepoint forecasts might stop at this point. However, there are some practical considerations that this approach overlooks:

- **What about vehicles that are plugged in but not actively charging?** Vehicles charging overnight or at slow chargepoints are likely to be left plugged in but not actively charging, preventing that chargepoint from providing power to another vehicle.
- **What if all drivers want to charge at the same time?** Certain times of the day will be more or less popular for drivers to charge, resulting in peaks in demand.

To demonstrate the significance of this second point, we can imagine a fleet of 100 EVs. If we assume each EV has an annual energy demand of 2,000 kWh, this fleet will have a collective annual energy demand of 200 MWh.

If this demand is to be served by a network of 7 kW fast chargepoints with an average utilisation factor of 50%, we can estimate (using the method shown on page 37) that 7 public chargepoints are required.

$$\text{Number of chargepoints (\#)} = \frac{\text{Annual energy required [200 MWh]}}{\text{Annual charging capacity [60 MWh]} \times \text{Utilisation factor [50\%]}}$$

$$= \text{7 fast (7 kW) chargepoints}$$

But, what happens if half of these EV drivers want to charge at 8 a.m. every morning? 43 drivers would be unable to find a chargepoint and may even be unable to use their vehicle until a chargepoint becomes free. While theoretically, 7 chargepoints could meet the energy demand of this fleet, in reality, this network is inadequate.

D. How many chargepoints will be required? (p.3 of 4)

The 'plug-in event' approach:

One way to account for more realistic charging patterns and behaviours is to build a profile of **plug-in events**. For this, we can follow the method outlined on previous pages up to the end of Step C ('How much energy will be required?'). Next it is necessary to calculate:

- **Amount of energy delivered per plug-in event**
  Most plug-in events are unlikely to provide a full recharge (0-100%). Guided by data on current public charging behaviours[13], it is possible to estimate the average amount of energy (as a percentage of the battery capacity) provided per plug-in event.

- **Number of plug-in events per day**
  Estimated as the daily energy demand divided by the amount of energy provided per plug-in event.

> A **plug-in event** is the entire period a chargepoint is occupied, including time spent actively charging and any remaining time the vehicle occupies the chargepoint after charging is complete.

- **Typical plug-in duration**
  In the 'Central Scenario', the UK EV Infrastructure Strategy estimates the following average plug-in durations at different chargepoint types:

10h 45m	at on-street chargepoints
2h 59m	at destination chargepoints
29m	at rapid chargepoints

- **Distribution of charging events that start per hour**
  Data on current public charging behaviours[13] can indicate what proportion of charging events begin at different times of the day. Peak times that charging events begin is likely to vary by chargepoint type.

13 – Ideally this would be based on local public chargepoints. If unavailable, other data sources are provided in the Appendix.

Build your own model

D. How many chargepoints will be required? (p.4 of 4)

- **Number of vehicles plugged-in per hour**
  Combining charging start times with the average plug-in duration, it is possible to estimate a profile of total plug-in events per hour throughout the day. The number of vehicles plugged-in during the peak hour indicates the minimum number of chargepoints required to meet peak demand.

Sense-check your results

Regardless of the approach you decide to take, the final step to building a model is to carry out a final sense-check of the results. Ratio-based estimations or projections adapted from national forecasts (as outlined earlier in this guide) can help to validate the outputs of a more detailed forecasting model.

Example: building a simple chargepoint forecast

Here we present an example of how a local authority may build a simple model to understand public charging demand from residents. We have chosen to model this for **Luton** to demonstrate this approach using real data and allow easy comparison with examples provided in earlier sections.

Step A: Define user groups

For this example, we will primarily be interested in resident-owned EVs that will rely on public chargepoints:

- Our forecast will cover BEV and PHEV private vehicles (including cars, vans, HGVs, buses, coaches and motorbikes, as this is the data available from DfT).
- These vehicles will then be categorised by whether they have access to off-street parking or not.

Continued on the next page ››

Example: building a simple chargepoint forecast

- This forecast will not cover private charging (such as home, workplace or depot-based chargepoints).

Step B: Gather vehicle data

Current vehicle parc:

At the end of 2021, in Luton there were:

- 90,339 private vehicles (DfT Vehicle Licensing Statistics, VEH0105),
- 607 private EVs (DfT VEH0142).

Vehicle turnover:

Without local data on how many vehicles join and leave the Luton vehicle parc each year, we have used regional trends for the East Midlands:

- Based on the number of vehicles registered for the first time (DfT VEH1154) and the total number of licensed vehicles (DfT VEH1104), we have estimated the proportion of vehicles that are scrapped each year in the East Midlands. Taking a 5-year average, we estimate **5% of vehicles are scrapped each year**.
- Looking at the annual change in total private vehicles in Luton (DfT VEH0105), and assuming 5% are scrapped each year, it's possible to estimate the number of new private vehicles that are registered each year. Taking a 5-year average again, we estimate **5,200 new private vehicles are registered each year** in Luton.

Current EV share of new vehicles:

In 2021, **EVs represented 10% of new vehicles** registered in the East Midlands (DfT VEH0182 & VEH1154). While we did not have a regional fuel breakdown, for the UK as a whole, **BEVs made up 65% of new EV registrations** in 2021, with PHEVs making up the remaining 35% (DfT VEH0181).

Continued on the next page >>

Build your own model

Example: building a simple chargepoint forecast

EV uptake:

We have chosen to use an S-curve to model how the EV market share will evolve between 2020 and 2035. Our S-curve model is described by the following equation:

$$EV_{\%}(Y_i) = EV_{\%}(Y_0) + \left(EV_{\%}(YF) - EV_{\%}(Y_0)\right) \times \left(\frac{1}{1 + \exp(-k(Y_i - Y_x))}\right)^a$$

Where:

$Y_{0/F}$ are the initial/final years of the model

Y_x is the mean (or average) year, i.e. $\frac{Y_0 + YF}{2}$

Y_i is the year being forecasted

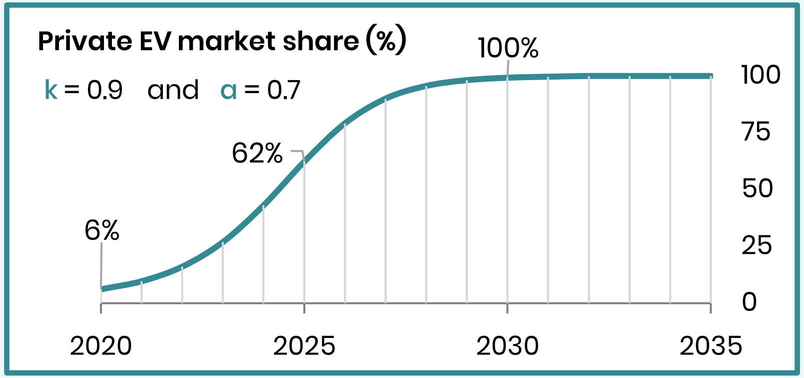
$EV_{\%}(Y_{i,0,F})$ is the EV market share (as a %) in $Y_{i,0,F}$

k and **a** are parameters (which must be greater than zero) that control the shape of the S-curve

'**exp**' is a mathematical function (in Excel) that returns 'e' raised to the power of another number

A copy of this model in Excel can be downloaded here.

The final year was set as 2031 to account for a very small number of non-EVs that may still be sold after the 2030 ban. Values of '**k**' and '**a**' were then adjusted to produce a realistic uptake curve for EV market share. By setting 2019 as the initial year of the forecast, we could use actual EV market share data for 2020 and 2021 to assess how well the S-curve model was performing. Continued on the next page ››

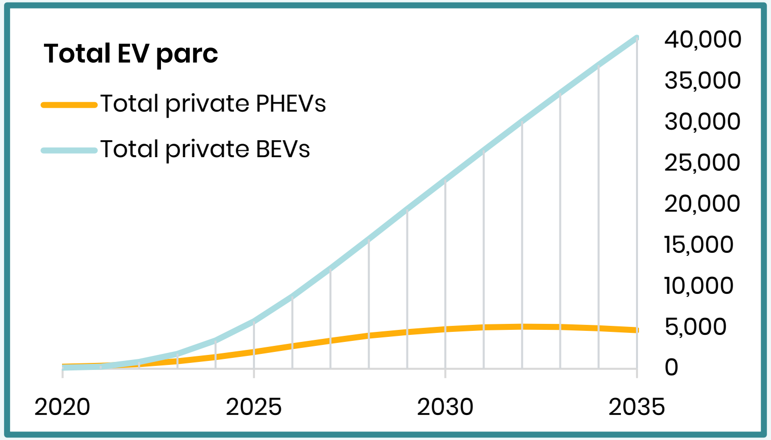


Example: building a simple chargepoint forecast

The proportion of the EV market share made up by BEVs was assumed to be 65% in 2021 (based on national trends), increasing linearly to reach 100% in 2035.

EV parc projections:

Bringing everything together, we were able to project the total private BEV and PHEV parc in Luton each year to 2035.



Step C: How much energy is required, and where?

Our model covers four user groups:

1. BEV drivers **with** off-street parking
2. BEV drivers **without** off-street parking
3. PHEV drivers **with** off-street parking
4. PHEV drivers **without** off-street parking

Off-street parking availability:

- According to analysis carried out by Field Dynamics, an estimated 35% of households in Luton don't have off-street parking (Field Dynamics, 2021). However, research suggests that as few as 16% of current EV owners don't have off-street parking (Pod Point 2021 EV Driver Survey, Zap-Map EV Charging Survey 2021).
- We estimate the off-street parking proportion will reduce from 80% in 2025, to 72.5% in 2030, reaching 65% in 2035.

Continued on the next page ››

Build your own model

Example: building a simple chargepoint forecast

Annual mileage:

The average private car travelled 6,700 miles in 2020 (National Travel Survey, NTS0901). We have assumed PHEVs carry out 50% of their annual mileage (3,350 miles) in electric mode.

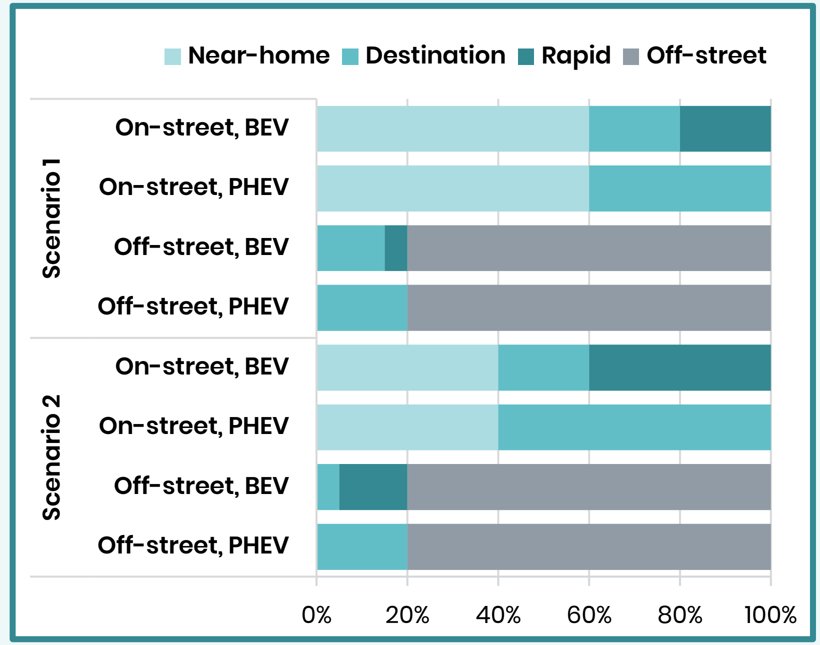
Charging scenarios:

In order to illustrate a range of possible outcomes, we have modelled two scenarios:

- **Scenario 1** – High share of charging close-to-home
- **Scenario 2** – High share of motorway charging

The proportion of energy demand we expect to be met by different chargepoint types under these scenarios is summarised for each user group in the chart opposite.

Under both scenarios, 80% of demand from drivers with off-street parking is met by off-street charging. It is also



assumed that PHEVs are unable to use rapid chargepoints.

Continued on the next page ››

Example: building a simple chargepoint forecast

Step D: Chargepoint projections

At this point, we now have a breakdown of the amount of energy (in kWh) required for each chargepoint type in 2025, 2030 and 2035. For this example, we will use the utilisation approach to convert this energy into the number of chargepoints required. We therefore need to estimate the average power (in kW) and utilisation rate (as a %) of each chargepoint type, and whether these will vary over time.

Average charging power:

We have assumed each of the chargepoint types have the following average power-rating:

- Near-home charging – 7 kW
- Destination charging – 11 kW

We anticipate that technology improvements will impact high-powered charging more than slow-to-fast charging. The average power of rapid charging is therefore expected to increase as follows:

- 50 kW in 2025, 100 kW in 2030, and 150 kW in 2035

Utilisation:

While utilisation of chargepoints is expected to increase as a function of the EV market, there is large uncertainty about exactly how this will evolve in the future. There is also a lack of data available to help us understand current utilisation rates of public chargepoints.

For the purposes of this example, we have chosen to increase utilisation rates by 5% each 5-year period:

Near-home	50% in 2025, 55% in 2030, 60% in 2035
Destination	20% in 2025, 25% in 2030, 30% in 2035
Rapid	20% in 2025, 25% in 2030, 30% in 2035

Continued on the next page ››

Example: building a simple chargepoint forecast

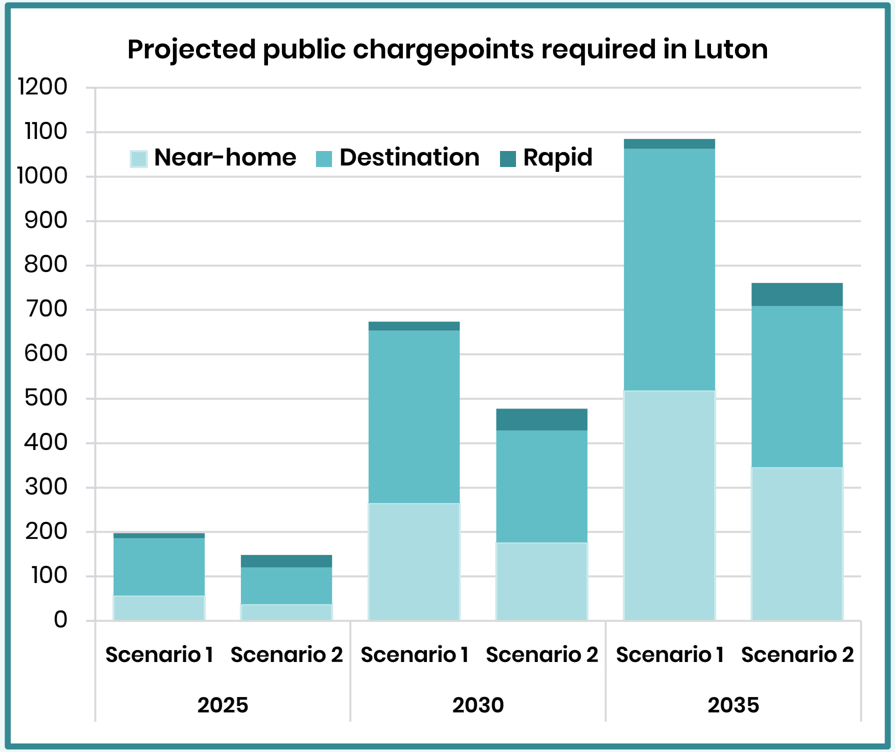
The results of this model suggest that resident-owned EVs in Luton may require:

- **150–200** public chargepoints by **2025**
- **480–670** public chargepoints by **2030**
- **760–1,090** public chargepoints by **2035**

Final step: Sense-checking the results

Our forecast is in agreement with projections adapted from the EV Energy Taskforce national forecast (444–1,305 public chargepoints required by 2030).

The ratio-based method estimated more than double the number of chargepoints by 2030 (just over 2,000 public chargepoints) as were projected here. However, the ratio-based method did not distinguish between the public charging demands of EVs with and without access to off-street parking at home.



Further support

Sounds great, but we still need help!

If you've made it this far and feel you still need support forecasting EV charging demand, that's okay. Below are various places you may want to look for further support:

National EV Insight & Strategy (NEVIS)

Delivered by Cenex, NEVIS aims to provide local authorities with reliable and independent information about EVs and charging infrastructure. The **Insights Toolkit** offers projections to 2050 of EVs, chargepoints, emissions and more for each local authority.

As of September 2022, access to this system is currently freely available to all English local authority officers via their official gov.uk email address.

Consultancy support

While we are unable to provide an exhaustive list, the organisations listed below are known to have worked with authorities to forecast EV chargepoint demand:

- Cenex
- Element Energy
- Jacobs
- WSP

This work usually takes place alongside wider EV or EVCP strategy support.

Further support from Energy Saving Trust

Local authorities in England can access additional free support developing and delivering an EV strategy through the **Local Government Support Programme (LGSP)**. Many of our resources are available online, including best practice guidance for developing charging infrastructure networks and recordings of previous webinars. Alternatively, you can **get in touch with the LGSP team here**.

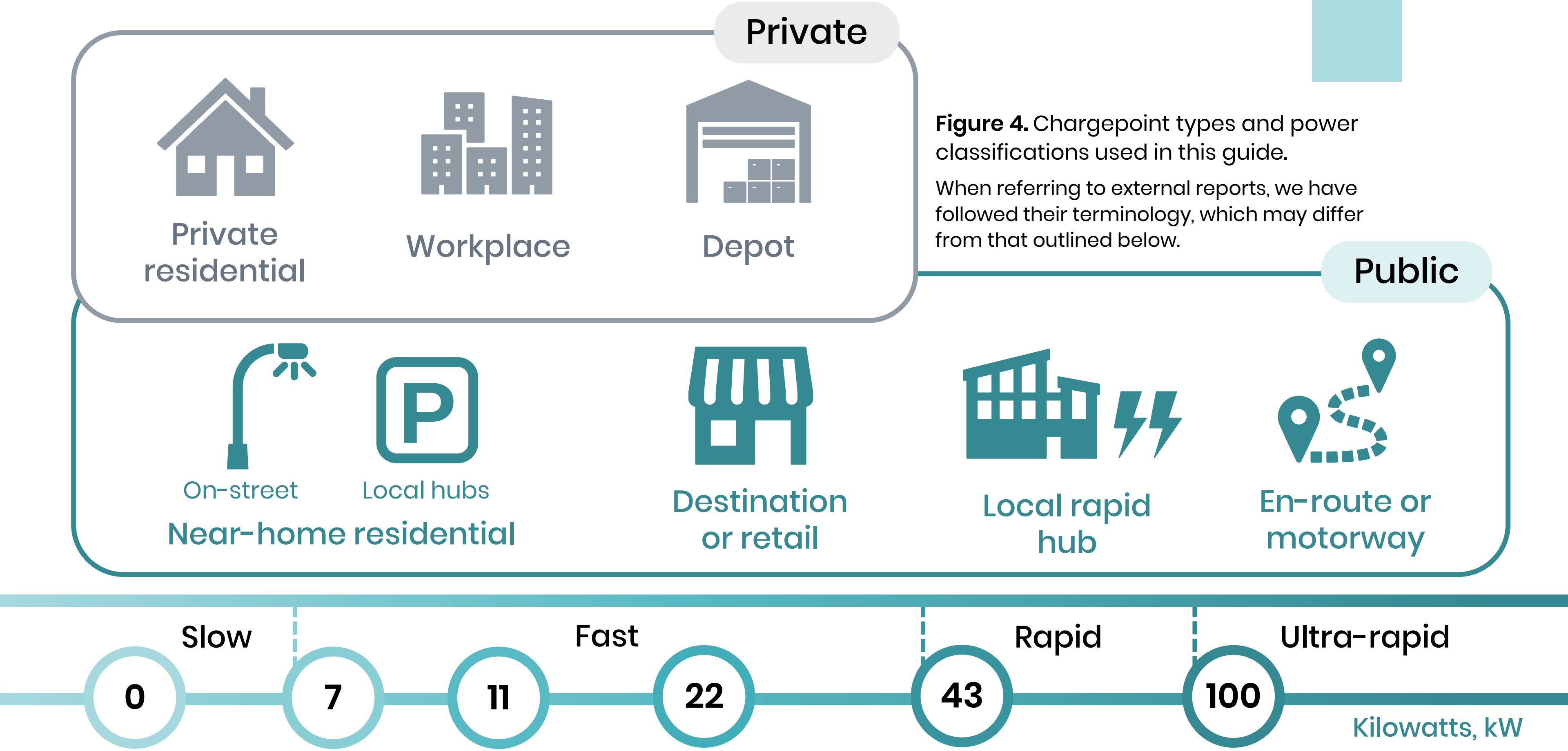
Section 4

Appendix

Chargepoint types

Figure 4. Chargepoint types and power classifications used in this guide.

When referring to external reports, we have followed their terminology, which may differ from that outlined below.



energy saving trust

Useful terms & acronyms (p.1 of 3)

Vehicles

BEV — **Battery electric vehicle** – powered only by an electric motor and battery that is recharged by connecting to an external power source.

HEV — **Hybrid electric vehicle** – combines a conventional internal combustion engine (ICE) with an electric motor.

PHEV — **Plug-in hybrid electric vehicle** – a hybrid electric vehicle with an electric battery that is recharged by connecting to an external power source.

FCEV — **Fuel cell electric vehicle** – powered by an electric motor that is recharged using an on-board hydrogen fuel cell to produce electricity.

EV — **Electric vehicle** – often an unclear term, but here it is used as a collective term for BEVs and PHEVs only.

Plug-in vehicle — Any vehicle that must be connected to an external electricity supply to be recharged, such as BEVs and PHEVs.

ICE — **Internal combustion engine** – an engine that burns fuels such as petrol or diesel to propel a vehicle.

ZEV — **Zero emission vehicle** – which emits no carbon dioxide (CO_2) or other pollutants from the tailpipe. ZEVs include BEVs and FCEVs.

ULEV — **Ultra low emission vehicle** – vehicles that are reported to emit less than 50g of carbon dioxide (CO_2) from the tailpipe for every kilometre travelled. While all BEVs (and FCEVs) are zero emission and are classed as ULEVs, only some HEVs and PHEVs will be ULEVs.

LDV — **Light-duty vehicle** – which refers to cars and vans collectively.

LGV — **Light goods vehicle** – motor vehicle (such as a van) with a gross vehicle weight of less than 3.5 tonnes.

HGV — **Heavy goods vehicle** – motor vehicle (such as a truck or lorry) with a maximum gross vehicle weight of more than 3.5 tonnes.

Passenger car — A car used for the transport of passengers, as opposed to the transport of commercial goods.

Taxi — A taxi can pick up passengers from the street (by being hailed) and can also stand on ranks. Also known as a hackney carriage.

Private hire vehicle — Private hire vehicles must be pre-booked via a licensed private hire operator.

Car club — Short-term rental service that offers the use of shared vehicles.

Vehicle (EV) parc — All registered vehicles (or EVs) within a defined geographic region. There are currently over 40 million vehicles in the UK vehicle parc.

EV uptake — A general term to describe the level of EV adoption (how widespread EVs are), often measured by the proportion of total vehicles that are EVs or the EV share of new vehicle sales.

EV share — The share of new vehicles that are EVs.

(EV) energy consumption — The rate at which an EV uses energy, often measured in kilowatt-hours per mile. Official energy consumption values are reported by vehicle manufacturers, however these figures do not accurately reflect real-world values

(EV) battery capacity — The maximum amount of energy that the battery can store, usually measured in kilowatt-hours.

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Useful terms & acronyms (p.2 of 3)

Chargepoints & charging

CP or EVCP	Electric vehicle chargepoint
Socket or connector	These terms refer to the actual points of connection between a chargepoint and a vehicle, of which there can be more than one per charging device.
Device	A charging device refers to the chargepoint unit itself which may have more than one connector or socket to allow more than one vehicle to charge at the same time.
Chargepoint types	In this guide, we typically define chargepoints by their power-rating (slow, fast, rapid or ultra-rapid) or location (private or public) – as outlined in more detail on page 49.
Slow-to-fast	A collective term for slow and fast chargepoints e.g. chargepoints with a power-rating up to 43 kW.
Semi-public	A public chargepoint that may have restrictions due to parking or opening times or a requirement to make use of facilities, e.g. chargepoints at supermarkets.
On-street, off-street	In the context of residential parking (or charging), on-street refers to parking (or charging) that takes place on the public highway. Off-street refers to parking (or charging) that takes place on residents' driveways, garages or other private land.
EV:CP	A ratio of the number of EVs per chargepoint. This can refer to 'actual' EV:CP ratios, such as current and historical values, or 'optimal' EV:CP ratios, such as a target number of EVs per chargepoint to aim for by a future date.
Utilisation (of EVCPs)	The proportion of time that a chargepoint is in use. You might see this referred to in terms of hours (or a percentage) per day, or the number of full charges provided per day.
Utilisation factor	A number between 0 and 1 which represents the proportion of time that a chargepoint is in active use.
Plug-in event	The entire period a chargepoint is occupied, including time spent actively charging and any remaining time the vehicle occupies the chargepoint after charging is complete.
Charging capacity	The amount of energy a chargepoint can deliver over a specific time period. A 7 kW chargepoint has a maximum capacity to deliver 7 kWh every hour, 160 kWh each day, and more than 60,000 kWh per year.
Acceptance rate	The amount of power a vehicle can receive from a chargepoint. A vehicle cannot receive power above the acceptance rate, regardless of the power of the chargepoint.
kW	**Kilowatt** – a measure of power typically used to describe the power or speed of chargepoints. The higher the kilowatt rating of a chargepoint, the more power it can deliver and the faster it can charge a battery.
MW	**Megawatt** – 1 MW = 1,000 kW
GW	**Gigawatt** – 1 GW = 1,000 MW = 1,000,000 kW
kWh	**Kilowatt-hour** – a measure of energy typically used to describe the capacity of an EV battery. The greater the kilowatt-hour of an EV battery, the more energy it can store, which typically means a longer range.
Wh	**Watt-hour** – 1,000 Wh = 1 kWh
MWh	**Megawatt-hour** – 1 MW = 1,000 kWh

Useful terms & acronyms (p.3 of 3)

Organisations & related terms

DfT	Department for Transport
OZEV	Office for Zero Emission Vehicles
EVIS	(UK Government's) Electric Vehicle Infrastructure Strategy
LEVI	Local Electric Vehicle Infrastructure fund – open to local authorities in England and funded by OZEV. LEVI is designed to encourage large-scale, ambitious and commercially innovative chargepoint projects.
ORCS	On-street Residential Chargepoint Scheme – funding from OZEV, available to local authorities across the UK to install residential chargepoints.
LGSP	Local Government Support Programme
ONS	Office for National Statistics
NTS	National Travel Survey
FES	Future Energy Scenarios – developed by National Grid to represent a range of different, credible ways to decarbonise our energy system.
DNO	Distribution Network Operator – the company that owns and operates the electric power infrastructure.
DFES	Distribution Future Energy Scenarios – a regional equivalent of the national future energy scenarios developed by National Grid, developed by each DNO.
UKPN	UK Power Networks – a DNO operating across London, the South East and East of England.
STB	Sub-national (or regional) Transport Body – designed to co-ordinate a strategic transport approach across entire regions.
EVET	Electric Vehicle Energy Taskforce
ICCT	International Council on Clean Transport
SMMT	Society of Motor Manufacturers and Traders
T&E	Transport & Environment
NEVIS	National Electric Vehicle Insight & Strategy – an online platform developed by Cenex to provide local authorities with reliable, independent, up-to-date information about Electric Vehicles and EV Charging Infrastructure.

Miscellaneous

AFID	Alternative Fuels Infrastructure Directive
S-curve	A curve named after its 'S'-like shape. S-curves are a common forecasting tool used to model the uptake of new technologies. There are four typical stages to an S-curve, starting with slow growth, followed by a period of rapid progress, before growth slows again.

Data sources (p.1 of 2)

Data provider	Description of data	Link to data source
Office for National Statistics (ONS)	Standard area measurements (2020) for administrative areas in the United Kingdom	https://geoportal.statistics.gov.uk/datasets/ons::standard-area-measurements-2020-for-administrative-areas-in-the-united-kingdom/about
	Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland (Mid-2020 edition)	https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland
Office for Zero Emission Vehicles (OZEV)	Electric vehicle charging device statistics: January 2022 • Total charging devices (per LA) • Rapid charging devices (per LA) • Charging devices per 100,000 people (per LA)	https://www.gov.uk/government/collections/electric-vehicle-charging-infrastructure-statistics#latest-electric-vehicle-charging-device-statistics
Department for Transport (DfT)	VEH0105: Licensed vehicles by body type and local authority: United Kingdom	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/985605/veh0105.ods
	VEH0142: Licensed plug-in vehicles (PiVs) at the end of the quarter by body type, fuel type, keepership (private and company) and upper and lower tier local authority: United Kingdom	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1046001/veh0132.ods
	VEH0181: Plug-in vehicles (PiVs) registered for the first time by body type and fuel type, including breakdown of generic models: Great Britain and United Kingdom	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1105270/veh0181.ods
	VEH0182: Plug-in vehicles (PiVs) registered for the first time by body type and region: United Kingdom	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1105271/veh0182.ods
	VEH1104: Licensed vehicles at the end of the quarter by body type and region: Great Britain and United Kingdom	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1105274/veh1104.ods
	VEH1154: Vehicles registered for the first time by body type and region: Great Britain and United Kingdom	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1077489/veh1154.ods

Data sources (p.2 of 2)

Data provider	Description of data	Link to data source
Department for Transport (DfT) – continued	National Travel Survey, NTS0901: Annual mileage of cars by ownership and trip purpose: England, since 2002	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1017059/nts0901.ods
	Electric Vehicle Charging Research – Survey with electric vehicle drivers	https://www.gov.uk/government/publications/electric-vehicle-drivers-attitudes-and-behaviours
	Electric Chargepoint Analysis 2017: Public Sector Fasts Electric Chargepoint Analysis 2017: Local Authority Rapids (revised)	https://www.gov.uk/government/statistics/electric-chargepoint-analysis-2017-public-sector-fasts https://www.gov.uk/government/statistics/electric-chargepoint-analysis-2017-local-authority-rapids
UK Census 2011	KS404UK: Car or van availability	https://www.nomisweb.co.uk/census/2011/ks404uk
EV Database	Cheatsheet: Energy consumption of electric vehicles	https://ev-database.uk/cheatsheet/energy-consumption-electric-car
RAC Charge Watch	Average public ultra-rapid charging costs	https://www.rac.co.uk/drive/electric-cars/charging/electric-car-public-charging-costs-rac-charge-watch/
Field Dynamics	National Map of EV Charge Point Coverage	https://onstreetcharging.acceleratedinsightplatform.com/
Pod Point	2021 EV Driver Survey	https://pod-point.com/electric-car-news/2021-driver-survey
Zap-Map	EV Charging Survey 2021	https://www.zap-map.com/ev-charging-survey/
UK Power Networks (UKPN)	Distribution Future Energy Scenarios 2022	https://www.ukpowernetworks.co.uk/future-energy/dfes-2022
EV Energy Taskforce (EVET)	Charging the Future: Drivers for Success 2035	https://evenergytaskforce.com/charging-the-future/
Element Energy	Electric Vehicle Charging Behaviour Study	http://www.element-energy.co.uk/wordpress/wp-content/uploads/2019/04/20190329-NG-EV-CHARGING-BEHAVIOUR-STUDY-FINAL-REPORT-V1-EXTERNAL.pdf

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