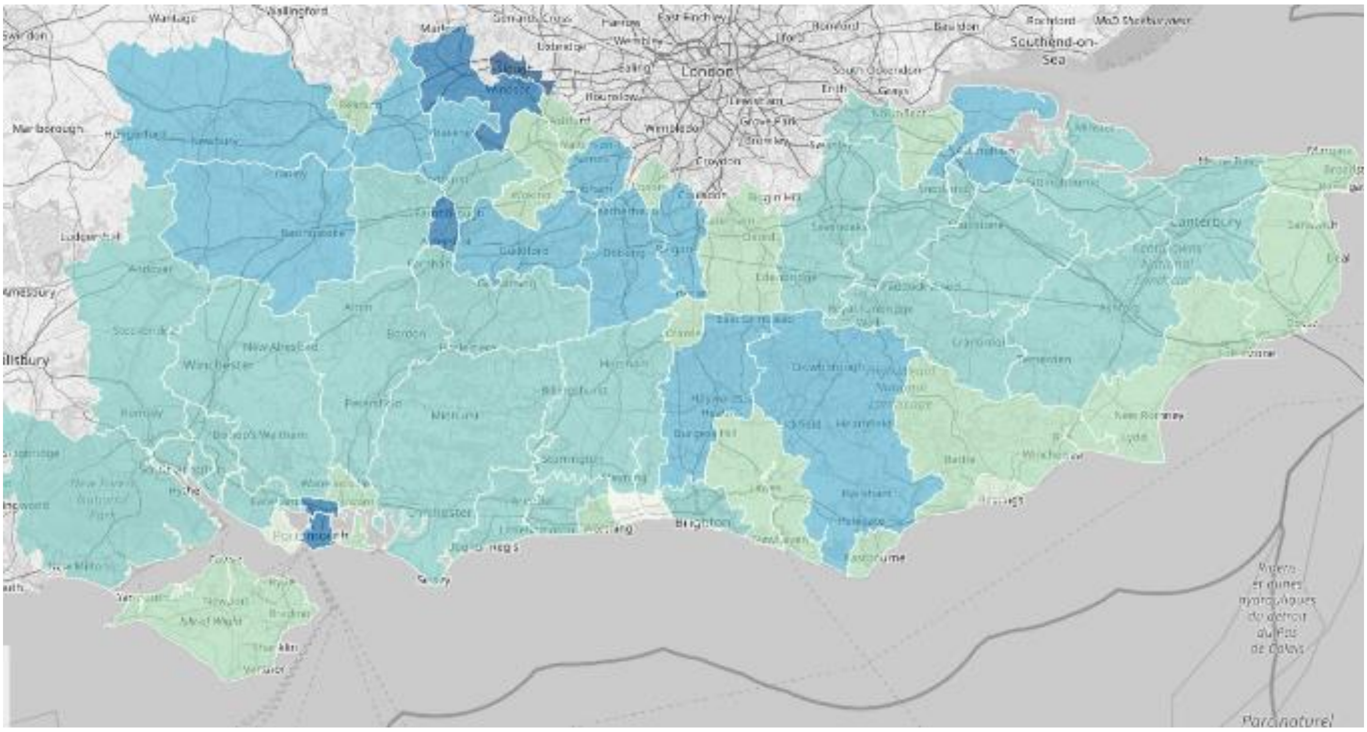
Report
November 2024

# TfSE EVCI Fleet Forecast Methodology




Transport for the South East
Our ref: 24559702

Report
November 2024

# TfSE EVCI Fleet Forecast Methodology

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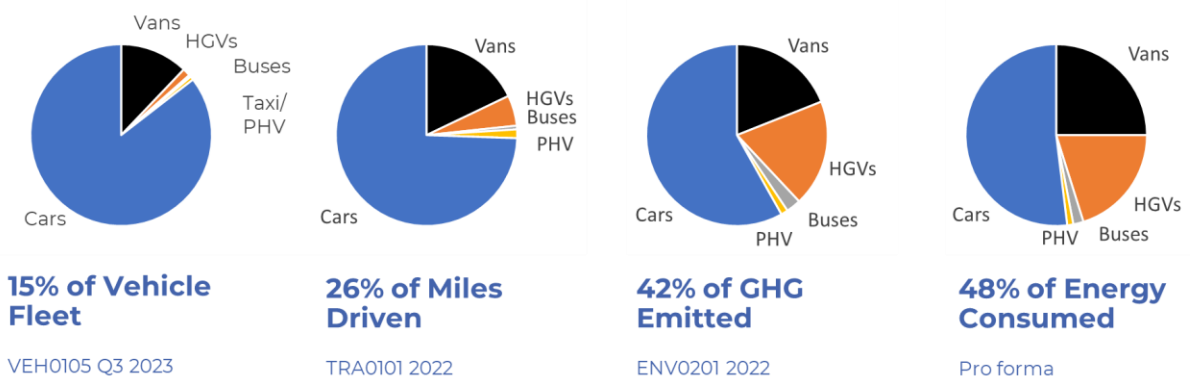
# Executive Summary

**Background**

To achieve its commitment of reaching net zero by 2050, the UK must address the decarbonisation of its transport sector. According to the UK's Transport and Environment Statistics report, transport accounts for around 26% of the UK's total greenhouse gas emissions (GHG) and road vehicles account for 91% of emissions from transport.[1]

While passenger cars have made some progress in their transition to the electric vehicles (EV) paradigm, the decarbonisation of commercial vehicles is lagging behind. As reflected in Figure 1, commercial vehicles comprise only around 15% of the total fleet, however they reflect 26% of the miles driven and 42% of the GHG emissions. When the total fleet is fully electrified, commercial vehicles are anticipated to consume half of the electricity demanded from EVs.

**Figure 1: Comparison of cars (mostly private) to commercial vehicle segments.**




The penetration of EVs within commercial vehicles is far less than that of private cars. Fleet operators and the industry's representative bodies indicate that a large proportion of commercial vehicles are not ready to embrace EVs. This is because the use cases by which they satisfy their customers do not always allow for private depot or home charging. An electric commercial fleet will depend on access to a public charging network that can accommodate their larger size and more stringent charging requirements.

In contrast, investors cannot consider investment in required charging resources without a robust understanding of where the demand will come from that will drive return on investment.

The UK Government's Electric Vehicle Infrastructure Strategy provided reference to the role which sub-national transport bodies (STBs) should play in supporting local authorities and energy system stakeholders in planning charging infrastructure provision. The Strategy explicitly indicates a requirement for STBs to forecast charging infrastructure demand from vehicle fleets across their respective regions.

In satisfying its obligation under the Government's EVI Strategy, Transport for the South East, the STB representing 16 Local Transport Authorities across the South East, has identified a critical role for the public sector in breaking this impasse between demand and supply by addressing anticipated

[1] Transport and environment statistics: 2023 - GOV.UK (www.gov.uk)

demand for energy and charging infrastructure arising from the adoption of EVs by commercial fleet operators.

Throughout the development of this methodology the project team has held workshops with a TfSE Fleet Electrification Working Group that was convened to help steer the study. The project team conducted further, targeted one-to-one engagement with a selection of industry/trade bodies, local and national government and other key stakeholders such as electricity network operators and vehicle and charging solution providers (some members of the Working Group and others not).

The aims of the commission were to:

- Develop a methodology for forecasting the emerging demand for both energy and electric vehicle charging infrastructure (EVCI) arising from the electrification of commercial vehicles,
- Focus analysis and methodology development on the vehicle segments that are likely to electrify and need charging infrastructure soonest,
- Base such forecasting methodology wherever possible on publicly available data so as to facilitate rollout of the method to all STBs, and
- Apply the methodology to forecast demand across the TfSE region at a Local Authority (LA) and MSOA level and present results within the EVCI framework tool developed by Transport for the North (TfN).

The results of the commission are intended to provide data inputs facilitating the development of EVCI projects that both serve the demand of commercial fleet drivers and yield to attract investment. In summary, this process demonstrates the role of public entities like TfSE in breaking the impasse that inhibits EV uptake by commercial vehicle operators and prevents private investors from identifying commercially viable levels of demand.

The body of this report details the methodology behind the forecasts for commercial fleet electrification and the related energy and charging infrastructure demand.

**Overview of Forecast Methodology**

There are three broad steps in the forecasting process as follows:

1. *Baseline:* review historical data to define the current state of EV penetration within commercial vehicles as well as the trends leading to the present:
   - Vehicles entering the fleet: new vehicle registrations are assessed by fuel type.
   - Vehicles leaving the fleet: vehicle turnover is calculated based on the change in the number of vehicles from the previous year, less any new additions, this also gives the estimated, indicative useful life of vehicles for the forecast.
   - Actual operating locations of vehicles: census data on population car and van availability by MSOA is used to reproportion the fleet based on where it is used rather than where it is registered (a large number of cars and vans are registered to leasing companies' headquarters).

   With the analysis of these datasets the size of fleet is forecasted to 2050 at the LA and MSOA levels.

2. *Forecast EV adoption:* the EV penetration is forecast to grow as a function of the ZEV mandate for new vehicle sales (or other public commitments and regulations) and based on the vehicle turnover rates identified.

   With this analysis the number of EVs is forecasted to 2050 at the LA and MSOA levels.

3. *Conversion of EV adoption into Energy and Infrastructure Demand Forecast:* the EV numbers together with average mileages by fleet segment and typical vehicle efficiency create the annual energy demand forecasts by LA and MSOA. Charging demand forecasts are then derived by estimating where charging will occur (across up to five charging categories) and matching these locations with utilisation metrics for different charging power levels.

A closer look at the methodology by vehicle class is outlined next.

**Forecast by Vehicle Class Overview**

*Taxis and PHVs*

In the absence of any LA specific licensing rules for zero emission taxis/PHVs, this vehicle class is forecasted to electrify along with the ZEV mandate indicated trajectory for cars. The EV and charging energy demand forecasts for this commercial vehicle segment are included and masked among passenger cars in other national forecasts (including the STB EVCI Framework tool), however taxis and PHVs need to recharge more regularly and potentially using a broader mix of charging types. TfSE have published the taxi/PHV taxi numbers and energy demand forecasts separate to the STB EVCI Framework visualiser to avoid confusion and to support any stakeholders looking to understand the potential uptake of electric taxis/PHVs and the associated energy demand.

*Vans*

Vans are the vehicle class likely to electrify next after cars. Where, when and how electrification happens (the charging paradigms) depend on the vehicle use case. Tying the use case to the industry sector and business size within which the vans operate is beneficial as there is a national ONS dataset with business data by local authority. This business data is also a much better representation of where vans are kept and operate than DfT vehicle registration data which is skewed by leasing company registrations. Using the business dataset with assumptions on the number of vans per head/per company the van fleet is split into 119 van segments for each Local Authority. Each segment represents the vans operating in one of 17 industry groups in a business that has one of 7 employee size bands. Each segment is characterised by its:

- Relative propensity to transition to EVs (relative to ZEV mandate),
- Relative average annual mileage,
- Charging category access/preference and demand.

The assumptions used to characterise the segments are based on van research undertaken in small and medium enterprises (SMEs), and analysis of van telematics data from larger companies, this segmentation approach allows for more accurate forecasting. Total van registrations are used to validate the assumptions and regional van numbers.

*HGVs*

The methodology for HGVs remains unchanged from that developed by TfN, full details can be found in their method statement. In summary HGV energy and chargepoint demand is split between HGV depots (80% of demand) and rapid en-route charging (20% of demand).

- HGV depots - are based on Element Energy's GB database of depot locations and fleet sizes,
- Rapid en-route charging – is summed for the whole major road network (MRN) and distributed to specific sites along the MRN considering various factors including the trip purpose, distance and origin and destination.

*Buses*

While the UK Government is considering a ban on the sale of non-zero emission buses by 2032, no decision has yet been made. In the meantime, penetration of e-buses in the public service fleet is being driven by commitments of the nation's five largest operators to operate fully zero emission bus fleets by 2035. These five operators manage the majority of public service buses in the UK and 55% of the buses in the TfSE area. Therefore:

- Distribution of buses across the region reflects operator licensing data showing the location of the depots (operating centres) and the number of buses stationed at each,
- Uptake of electric bus technology reflects the operators' 2035 commitment, and,
- Energy demand reflects average vehicle fuel efficiency and operational patterns (typical daily mileages).

Demand for chargers reflects only private bus depots where almost all charging is expected to occur.

**Summary**

Through the development of commercial fleet charging demand forecasts, this work supports STBs in satisfying the requirements of the UK Government's Electric Vehicle Infrastructure Strategy. This enables the public sector to provide information crucial to investors in identifying locations where charging demand will allow for return on investment, in turn facilitating the provision of infrastructure which will meet the charging requirements of the commercial users, promoting transition to an EV fleet.

**Future Work**

Due to the pioneering nature of this work and the early stage of EV uptake by commercial fleets, feedback from the TfSE Fleet Electrification Working Group (discussed below), indicates that sector stakeholders including local government authorities, commercial fleet operators and others would benefit from an annual update of the methodology and incorporated assumptions. Reviewing the latest government statistics will enable validation or recalibration of the forecasts. Advancements in both vehicle and charging technology as well as markets and the policy and regulation landscape could significantly impact the trajectory of the transition to EVs and the associated (regional) charging demand.

For example, our stakeholder engagement, including with the Confederation of Passenger Transport (CPT) early in 2024 determined that the majority of Coach operators are not seeing any viable eCoach models on the market (from a cost and/or mileage versus duty cycle perspective). As such there are virtually no eCoaches in operation. When the technology and costs make transition possible, forecasts can be developed and included, perhaps alongside HGVs as their duty cycles, routes and potential stop locations were deemed to be most similar according to the Fleet Electrification Working Group.

Other triggers for significant forecast updates could include:

- Enaction of the UK's consideration of a ban on the sale of non zero emission buses,
- Regulation on the part of Local Authorities to accelerate adoption of zero-emission taxi/PHV (like those enforced by TfL),
- Significant impacts to EV availability including those from escalating import tariff (e.g., European and Chinese originations, etc.) and others.

# Glossary

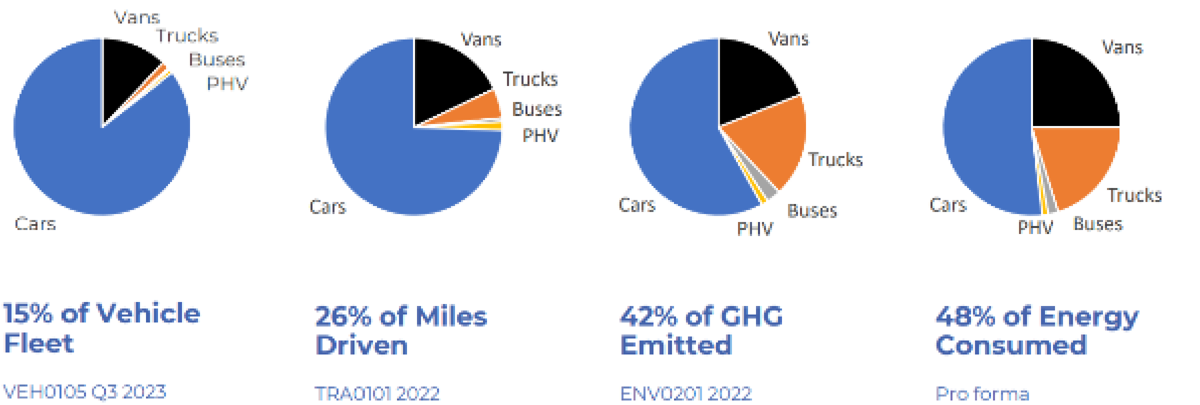
| | |
|---|---|
| Business | Used interchangeably with 'enterprise' in this work. |
| Charging Category | Charging categories are defined by location type and include a definition on typical charging power e.g. home charging 7 kW, van depot charging average 25 kW. |
| CPT | Confederation of Passenger Transport |
| DfT | Department for Transport |
| EV | Electric Vehicle |
| EVCI | Electric Vehicle Charging Infrastructure |
| EVCP | Electric Vehicle Charge Point |
| ICE | Internal Combustion Engine |
| LA | Local Authority |
| LCV | Light Commercial Vehicle (van) |
| MRN | Major road network |
| MSOA | Middle layer Super Output Area |
| ONS | Office of National Statistics |
| PHV | Private Hire Vehicle |
| PiV | Plug-in Vehicle |
| Segment | In this work we refer to a segment as a group of vans characterised by the industry sector and size of business (based on employee numbers) that they operate in. |
| SERTM | South East Regional Transport Model |
| STB | Sub-national Transport Body |
| TfN | Transport for the North |
| TfSE | Transport for the South East |
| YoY | Year on Year |
| ZEV | Zero Emission Vehicle |

# 1 Overview

## Background

1.1 Decarbonisation of transport is a crucial component of the UK's commitment to reaching net zero by 2050. Transport is the largest emitting sector of greenhouse gas emissions in the UK producing around 26% of UK's total emissions and the majority, 91%, comes from road transport split approximately half from private vehicle and half from commercial vehicles.[2] While passenger cars have been making good progress in the transition to electric vehicles (EVs), light and heavy duty commercial vehicles and fleets need further support to decarbonise. While commercial vehicles are around 15% of the total fleet, they cover 26% of the miles driven and 42% of the GHG emissions (Figure 1-1). When the total fleet is fully electrified, commercial vehicles are anticipated to consume half of the electricity demanded from EVs.

**Figure 1-1: Comparison of cars (mostly private) to commercial vehicle segments.**




1.2 Commercial fleets cannot electrify without a mix of suitable charging infrastructure, and charging infrastructure cannot be invested in without a business case. Once the commercial vehicle fleet is electrified its energy demand is projected to represent half of all road transport energy demand.

1.3 This report details the methodology behind the forecasts for commercial fleet electrification and the charging infrastructure demand. The purpose of the commercial fleet forecasts is to provide the data inputs required (number of EVs, charging and energy demand over time and by location) for business cases developed to attract public and private investment. It is imperative for fleet operators and commercial vehicle drivers to see the development of commercially accessible public charging networks in their areas in order to have the confidence to switch to EVs.

## Project Introduction

1.4 The UK Government's Electric Vehicle Infrastructure Strategy includes the funding of sub-national transport bodies (STBs) to support energy system stakeholders and local authorities in planning

[2] Transport and environment statistics: 2023 - GOV.UK (www.gov.uk)

charging infrastructure provision. The Strategy explicitly indicates a requirement for STBs to forecast charging infrastructure demand from vehicle fleets.

1.5 Transport for the South East (TfSE), the sub-national transport body (STB) representing 16 Local Transport Authorities (LTAs) across the South East commissioned this work to understand the trajectory of fleet electrification and the requisite charging demand across the region over time.

1.6 Throughout the development of the methodology the project team has held workshops and one-to-one engagement with TfSE Fleet Electrification Working Group, made up of:

**Industry Bodies**

- Association of Fleet Professionals
- British Vehicle Renting and Leasing Association
- Logistics UK
- Road Haulage Association
- Society of Motor Manufacturers & Traders
- Confederation of Passenger Transport

**(Local/National) Government**

- Department for Transport
- The constituent Local Authorities

**Other Key Stakeholders**

- Electricity Network Operators
- Transport for the North
- Van OEMs and charging solution providers

The broad scope of the commission was to:

- Develop a methodology for forecasting the emerging demand for both energy and electric vehicle charging infrastructure (EVCI) arising from the electrification of commercial vehicles,
- Focus analysis and methodology development on the vehicle segments that are likely to electrify and need charging infrastructure soonest,
- Base such forecasting methodology wherever possible on publicly available data so as to facilitate rollout of the method to all STBs and
- Apply the methodology in forecasting demand across the TfSE region at a Local Authority (LA) and MSOA level and present results within the EVCI framework tool developed by Transport for the North (TfN).

1.7 Results of the commission are intended to provide data inputs facilitating the development of EVCI projects that both serve the demand of commercial fleet drivers and yield to attract investment. In summary, this process demonstrates the roll of public entities like TfSE in breaking the impasse that inhibits EV uptake by commercial vehicle operators and obstructs private investors from identifying commercially viable levels of demand.

## Structure of the Report

1.8 This report provides an overview of the process and data sources used to generate the fleet forecasts for TfSE. Section 2 describes the overall methodology applied across all the vehicle classes considered and talks about the interface to the STB EVCI Framework tool. Section 3 details the specific datasets and calculations made for each vehicle class. Finally, Section 4 describes the future work that will support the maintenance and development of the forecasts and its application for the development and rollout of EVI.

# 2 Fleet Forecast Introduction

## Forecast overview

2.1 The below diagram gives an overview, by vehicle type, of the analysis undertaken and outputs developed at each stage of the methodology.

**Figure 2-1: Overview of forecast by commercial vehicle type.**

| | Taxi & PHV | Van | Bus |
|---|---|---|---|
| **Parc Baseline** | •LA licensing Data<br>•Census MSOA car and van availability<br>**Output: Taxis by LA/MSOA** | •Vans mapped to census of enterprises by employee numbers, location & industry sector<br>•Census MSOA car and van availability<br>**Output: Vans by LA/MSOA, industry and enterprise size** | •Bus depot locations of key operators, with number of vehicles operating from each<br>**Output: Buses by LA/MSOA** |
| **Parc Projection** | •ZEV Mandate indicated penetration of car parc<br>**Output: Annual forecast of eTaxi/ePHV by LA/MSOA** | •ZEV Mandate indicated penetration<br>•Uptake adjusted by segment (industry size/type)<br>**Output: Annual forecast of eVans by segment aggregated to LA/MSOA** | •Based around ZEB fleet commitments of the largest operators which operate a majority of the buses<br>**Output: Annual forecast of eBuses and energy demand** |
| **Annual Energy Demand** | •Assumptions of off-street charging access (LA ratios) and split of charging from other categories<br>**Output: Annual forecast of energy demand by charging category** | •Mapping of segment use case with charging category<br>**Output: Annual forecast energy demand by charging category by segment aggregated to LA/MSOA** | •Assume 100% depot-based charging (60 kW)<br>**Output: Annual forecast energy demand by LA/MSOA** |
| **Charger Need** | • Utilisation metric by charging category<br>**Output: Chargers required by charging category** | • Utilisation metric by charging category<br>**Output: Chargers required by charging category** | •Typical ratio of parking bays that can accommodate a charger<br>**Output: Bus depot chargers required** |

**Source: Steer and Mitie Plan Zero**

## General Forecast Methodology

2.2 In general, to forecast the potential uptake of EVs into the UK vehicle fleet the following datasets are required:

- The number of new vehicles entering the fleet (Additions)
- The number of vehicles leaving the fleet (Deletions)
- The number of vehicles in the fleet

2.3 Additions (Total and Plug-in Vehicle (PiV)):

- DfT VEH1153a gives the number of vehicle additions at the UK level, split by fuel type.
- The ZEV mandate (for cars and vans) is used to calculate the % of future additions to the vehicle fleet that are PiVs[3].
- The ZEV mandate is then weighted based on the EV penetration rate in sales for the UK and the Local Authority. If the EV penetration in the Local Authority is below the UK average, then it is assumed that the % of future PiV additions will also be below the ZEV mandate.

2.4 Deletions (Total and PiV):

- Deletions are calculated based on the number of additions and the number of vehicles in the fleet in the UK:

$$Deletions_{2022} = Parc_{2022} - Parc_{2021} - Additions_{2022}$$

- From this, the average useful life of the fleet for each year is calculated:

$$Average\ Useful\ Life_{2022} = \frac{-Parc_{2021}}{Deletions_{2022}}$$

- It is assumed that the average useful life of a vehicle is the same as the UK average, in lieu of more granular data. Therefore, the number of deletions in each LA can be calculated.

2.5 The forecast number of vehicles in the fleet is therefore:

$$Parc_{2023} = Parc_{2022} + Additions_{2023} - Deletions_{2023}$$

2.6 Energy Demand is calculated based on the number of vehicles, average vehicle mileage and the average vehicle efficiency

$$Energy\ Demand_{Year} = EVs_{Year} \times Avg\ Vehicle\ Mileage \times Avg\ Vehicle\ Efficiency$$

2.7 Charging demand is calculated by splitting the energy demand based on the likely proportion of charging that will be done across each of the identified charging categories. The charging categories are characterised by typical charging powers, locations and target utilisation, e.g. ‘public residential’ charging is near home charging at 8 kW and with a utilisation of 6% in 2023 rising to 25% by 2035 (the full list of charging category power and utilisation assumptions are shown in Appendix B).

[3] Zero emission vehicle (ZEV) mandate consultation: summary of responses and joint government response - GOV.UK (www.gov.uk)

$$eLCV\ Public\ Residential\ Charger\ Demand_{Year} = elCV\ Energy\ Demand_{Year} \times Proportion\ of\ charging\ at\ Public\ Residential\ Chargers \div Annual\ Charger\ Energy\ Output$$

$$Annual\ Charger\ Energy\ Output = Average\ Power\ Rating\ of\ Charger \times 365.25\ days \times 24\ hours \times Target\ Utilisation\ \%$$

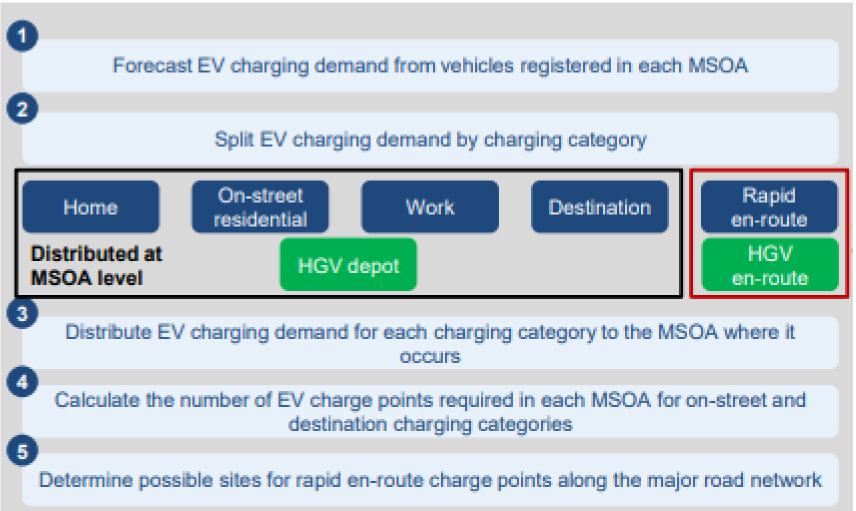
2.8 For at home charging, utilisation is not used to calculate charger numbers, instead for each vehicle that will use home charging one home charger is allocated.

2.9 A detailed methodology by vehicle type is described in the following chapter.

## Interface with STB EVCI Framework Forecast Methodology

2.10 The Electric Vehicle Charging Infrastructure (EVCI) Framework developed by Transport for the North (TfN) uses inputs from a range of existing regional models to forecast EV charging infrastructure demand by LA and MSOA. It was initially developed to cover the TfN region, and the methodology has since been rolled out to cover the TfSE and other STB regions. An overview of the methodology is shown by the diagram below.

**Figure 2-2: STB EVCI Framework: Methodology overview**




**Source: TfN**

2.11 A key benefit of the STB EVCI Framework model methodology is the use of data from regional models to geographically locate charging demand. Origin-Destination (OD) trip matrices sourced from the regional transport models are used to distribute destination-based charging demand to the location of charging, based on trip patterns in the model. The STB EVCI Framework model further includes a tool to identify locations on the major road network suitable for en-route rapid chargers, based on the modelled trip routes and trip distances.

2.12 To benefit from the body of work developed by TfN, including the publicly accessible visual user interface, the fleet forecasts developed have been integrated with the EVCI framework tool.

2.13 We have used detailed data at a disaggregate level to further develop the van fleet forecast and expand the tool to include bus charging infrastructure requirements. There have been no changes made to HGV or car forecasts.

2.14 A full statement of methodology for the STB EVCI Framework model can be found online[4].

[4] https://www.transportforthenorth.com/reports/electric-vehicle-charging-infrastructure-evci-model-statement-of-methodology/

# 3 Forecast Methodology by Vehicle Type

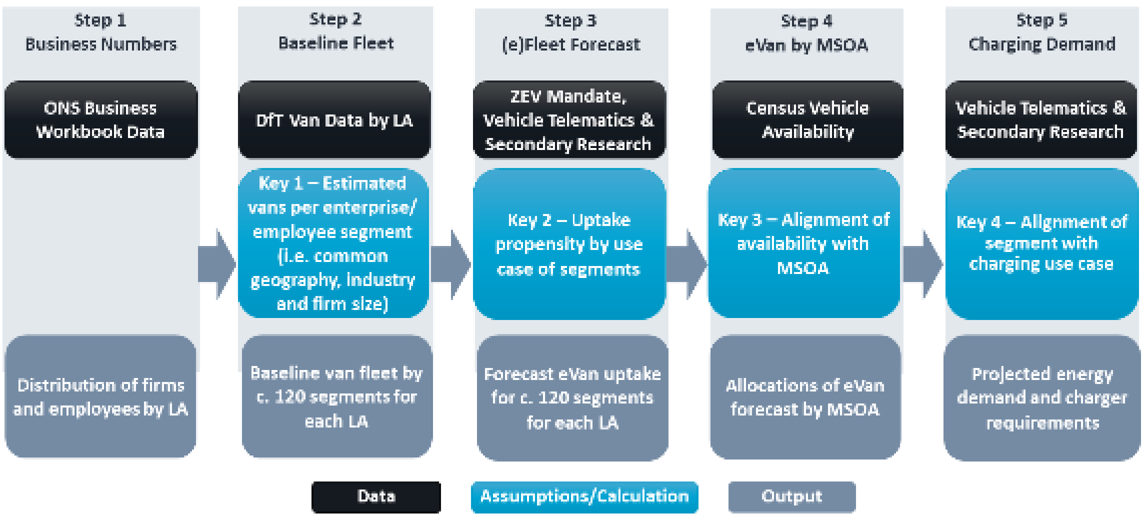
## Vans

3.1 After cars, vans represent the vehicle class that will electrify soonest and demand the most energy for charging. (As shown in the pie charts in Figure 1-1, vans are the vehicle class which represent the second largest energy demand when fully electrified). To support the planning of charging infrastructure for this vehicle class use case segmentation is used to derive more accurate forecasts.

3.2 The chosen method of segmentation is based on publicly available datasets about the businesses in each area (numbers, sizes (number of employees), types of industry). This data is used to estimate the number of vehicles per business/employee in each LA.

3.3 Assumptions on EV uptake, mileage, charging behaviour and vehicle efficiency are then applied to calculate the associated energy demand and charger requirements for each segment. An overview of the van forecast methodology is shown in the figure below and these steps are described in more detail in the following text.

**Figure 3-1: Van forecast methodology overview**



**Source: Steer & Mitie Plan Zero**

### Pre-step: Calculating the number of businesses across the TfSE region

3.4 Data from the ONS UK Business Workbook 2023 (uploaded on 27 September 2023) provides independent census information on UK businesses broken down by legal status, industry, region, employment size, and turnover size bands[5].

3.5 This business information is deemed to be a more accurate reflection of business activity, and therefore vehicle usage across the UK than DfT vehicle registration data. This is because of the high number of vans that are registered in one location to a leasing company, but used in a different location by the business who is leasing and operating the vehicle.

3.6 The following data tables, from this data set, are used to calculate the number of businesses (enterprises) within specific Industry Groups (SIC Division) and employment size bands across the South East:

- Table 1: Number of VAT and/or PAYE based enterprises in districts, counties and unitary authorities within regions and country by broad industry group
- Table 3: Number of VAT and/or PAYE based enterprises within regions by Standard Industrial Classification (SIC) division, employment size bands and region

3.7 Data on Enterprises was used rather than Local Units as this provided a truer reflection of business locations across the UK. An Enterprise is an organisational unit producing goods or services while a Local Unit is an individual site (for example a factory or shop) within an Enterprise.

3.8 The analysis results are then used to further segment Enterprise numbers across the total Transport for the South East (TfSE) region, as a proportion of Enterprises and Employment Size bands across TfSE local authorities.

3.9 The following Standard Industry Classification (SIC) Divisions are used to group businesses into distinct Industry Groupings as in Table 3-1.

**Table 3-1: Industry Groupings used for van segmentation.**

| Industry Groupings | | |
|---|---|---|
| Agriculture, forestry & fishing | Production | Construction |
| Motor trades | Wholesale | Retail |
| Transport & storage (inc postal) | Accommodation & food services | Information & communication |
| Finance & insurance | Property | Professional, scientific & technical |
| Business administration and support services | Public administration & defence | Education |
| Health | Arts, entertainment, recreation | |

[5]https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/datasets/ukbusinessactivitysizeandlocation

### Baseline and Forecast of Vans

3.10 Using assumptions on the number of vans used within different Industry Groups and employment size bands, the number of vans in use across the South East is calculated. The assumptions used were generated based on:

- industry knowledge and understanding of van operations within different industry group,
- information gathered via the Fleet Electrification Working Group discussions,
- information gathered through Mitie Plan Zero fleet consultancy projects,
- gathered research materials (e.g. UKPN White Van Plan, DfT Van Statistics).

3.11 The generated van numbers are calculated at a UK level first, adjusted to reflect the total number of licenced vans in the UK, as recorded in VEH0105 (updated 12 December 2023)[6]; The van distribution calculations are undertaken at the UK level to mitigate the impact of leasing company licensing/ registrations processes.

3.12 The results generated from the above analysis are then used to calculate the potential number of vans in use across the TfSE local authorities.

3.13 As the generated van numbers have been calculated to match the UK level, the forecasted YoY growth rate of vans at UK level has been used.

- From 2021 to 2022, the YoY growth rate for vans in the UK was 1.9%, although this is likely to have been negatively impacted by vehicle supply shortages in the COVID-19 pandemic, with longer term growth rates higher.
- The forecast growth rate decreases yearly at a linear rate to 0% by 2050, as presented in Table 3-2.
- We forecast that all vans, regardless of industry type, business size or geography, will follow this this trend.

**Table 3-2: Forecasted UK YoY growth rate of vans**

| 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|
| 2.8% | 2.2% | 1.7% | 1.1% | 0.6% | 0% |

### Baseline and Forecast of eVans

3.14 In 2022, eVans made up around 1% of the UK's total van fleet.  From this baseline figure, the penetration of eVans reflects the ZEV mandate shown in Table 3-3.

**Table 3-3: ZEV Mandate, % of newly manufactured vans that are required to be ZEVs.**

| 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10% | 19% | 22% | 35% | 46% | 58% | 70% | 76% | 82% | 88% | 94% | 100% |

3.15 Using assumptions on the relative potential uptake of eVans within different Industry Groups and employment size bands, and the useful lifespan of company vehicles, the adjusted

6 https://www.gov.uk/government/statistical-data-sets/vehicle-licensing-statistics-data-tables.

estimated uptake of eVans was calculated. For each Industry Group (and employment size band) assumptions are applied as to whether EV uptake would be:

- 20% slower than ZEV mandate (0.80)
- As per ZEV mandate (1.0)
- 10% quicker than ZEV mandate (1.10)

3.16 The uptake assumptions (shown in full in Appendix A) used are generated based on:

- Industry knowledge and understanding of van operations within different industry groups,
- Information gathered via the Fleet Electrification Working group workshop discussions,
- Information gathered through Mitie Plan Zero fleet consultancy projects and
- Notable research (e.g. UKPN White Van Plan, DfT Van Statistics)

3.17 Useful life reflects the average age at which vehicles are "scrapped" out of the national fleet. As a proxy, we estimate useful life as the proportion of scrapped vehicles to the total number of vehicles (i.e., if 7% of the fleet is scrapped in any one year, that fleet comprises 15 years worth of life).

3.18 The result of this is multiple forecasts for the growth in eVans, segmented by LA, business type and business size.

3.19 All forecasts are then split by MSOA. We have used the census dataset 'car or van availability' to apportion the number of vans and eVans from LA to each MSOA.

**Forecast potential energy demand: eVans**

3.20 To calculate the potential annual energy demand from eVans the following methodology was used.

$$Average\ Daily\ Mileage_{vans} \times \text{Mileage Factor}_{segment} \times Vehicle\ Efficiency \times Average\ Working\ Days_{year} = Annual\ Energy\ Demand\ (kWh)$$

3.21 The assumptions used in the above calculation are shown in Table 3-4.

**Table 3-4: Van assumptions used to calculate energy demand.**

| Parameter | Assumptions | Source |
|---|---|---|
| Daily average mileage | 72 miles | Van telematics |
| Working days per annum | 251 days | 265 days less 105 weekend days and 9 public holidays |
| Average vehicle efficiency | 2 miles/kWh | Real-world data |

3.22 Using the same sources as described earlier mileage factors are assigned to each industry segment as shown in Table 3-5.

**Table 3-5: Van mileage factor by industry segment.**

| Segment | Mileage Factor |
|---|---|
| Agriculture, forestry & fishing | 0.8 |
| Production | 1.0 |
| Construction | 1.0 |
| Motor trades | 0.8 |
| Wholesale | 1.0 |
| Retail | 1.1 |

| Segment | Mileage Factor |
|---|---|
| Transport & storage (inc postal) | 1.2 |
| Accommodation & food services | 0.8 |
| Information & communication | 1.0 |
| Property | 0.8 |
| Professional, scientific & technical | 1.0 |
| Business administration & support services | 1.0 |
| Public administration & defence | 1.0 |
| Education | 0.8 |
| Health | 1.0 |
| Arts, entertainment, recreation & other services | 0.8 |

3.23 Average eVan efficiency data was gathered through industry research and using results of fleet electrification analyses delivered by Mitie Plan Zero Transport Consulting.

3.24 The average daily mileage and typical eVan efficiency data was then used to calculate the average kWh charging needs per day (capped against typical eVan battery size – 68 kWh). Annual charging demand is based on an average 251 working days (365 less 105 weekends and 9 public holidays).

**Forecast potential EV charger demand: eVans**

3.25 Using anonymised vehicle telematics data from 10 businesses of varying fleet sizes and Industry Groups (gathered via Mitie Plan Zero Transport Consulting services), an analysis was conducted to identify vehicle primary and secondary stop locations based on time of day. Primary locations were classified as those locations where a vehicle spent most of the time stopped over a 24-hour period, while secondary locations were identified as those locations where a vehicle was stopped for the next longest time

3.26 The identified stop locations were categorised based on whether it was:

- Home/ Near home – where a vehicle was taken home overnight,
  - The UKPN White Van Plan research found that for business with less than 250 employees around 21% of van drivers park at home, so 79% might rely on on-street public residential charging near home.
  - Mitie analysis from larger fleet driver surveys suggest 44% have access to off-street parking/charging, meaning 56% might rely on on-street public residential charging near home.
- Workplace – where a vehicle stopped at a company office location,
- Depot – where a vehicle stopped at a company industrial location,
- Destination/ Enroute – where a vehicle stopped somewhere else, during its daily operation.

3.27 The forecasting assumption is that vehicles will prefer to charge where they already make stops of sufficient duration. In reality, charging behaviour will evolve as charging infrastructure and other factors, such as company policies, develop over time.

3.28 A range of assumptions were applied, based on above location type and vehicle charging needs, to estimate the forecast charging demand from eVans at each location type (shown in Appendix A). Based on the results of fleet electrification analyses delivered by Mitie Plan Zero

Transport Consulting, charger powers have been assigned to each stop location type. These charger powers (which reflect the average charging power expected to be available/drawn at the location types, e.g. at van depots there may be a selection of 7, 11 and 50 kW chargers), directly reflect vehicle dwell times and business usage patterns:

- Home – 7kW
- Public Residential (Near Home) – 8kW
- Workplace – 11kW
- Van depot[7] – 25kW
- Destination – 11kW
- Enroute – 50kW growing to 150 kW in 2050

3.29 Further assumptions were applied to estimate the proportion of vehicle charging that would take place at each identified stop location, based on Industry Groups and employment size band. The assumptions aimed to account for increased complexity of fleet operations as employment size bands and associated van numbers increase. The assumptions used were generated based on:

- Industry knowledge and understanding of van operations within different industry groups,
- Information gathered via project Workshop discussions,
- Information gathered through Mitie Plan Zero fleet consultancy projects and
- Gathered research materials (e.g. UKPN White Van Plan, DfT Van Statistics).

3.30 Charging demand for destination and en-route charging is distributed to the MSOA of charging using Origin-Destination matrices from SERTM (South East Regional Transport Model), which are used to identify the likely destinations of trips originating from each MSOA, splitting and allocating demand accordingly.

3.31 An additional output is generated which identifies potential en-route charger sites. This methodology was developed by TfN and is based on several factors:

- Site characteristics including classification of greenfield/brownfield land, and flood risk
- Trip characteristics from the regional model outputs, including trip length and the routing of the trip through the major road network
- Charging probability assumptions, with charging propensity assumed with a normal distribution around a 100km point into the trip.

3.32 This output is designed to identify broad areas in which charging infrastructure development may be suitable, and is produced for cars and vans combined, and separately for HGVs.

## HGVs

3.33 The methodology for HGVs remains unchanged from that developed by TfN. Full details can be found in their methodology document, and a summary is provided below.

**Baseline and forecast of fleet and eHGV fleet**

3.34 The TfN developed EVCI tool incorporates HGV fleet numbers from CAFCarb, a model in the wider analytical framework. In CAFCarb, the baseline fleet is calculated using DVLA fleet

[7] The term 'van depot' is used in the modelling methodology to differentiate between bus depots and HGV depots.

registration data by Local Authority District, which includes information on fuel type and vehicle age.

3.35 To forecast the future fleet, deletions are first modelled by removing vehicles based on a scrappage curve as a function of vehicle age.

3.36 To calculate additions to the fleet, the model compares the expected growth in the fleet for a given year with the number of vehicles remaining after scrappage has occurred, adding the vehicles required to meet this growth on a zonal basis. A lookup table of expected vehicle sales by fuel type is used to determine the proportion of vehicles added which are EVs.

**Forecast potential energy demand: eHGVs**

3.37 HGV vehicle kilometre data by MSOA is taken from outputs from the South East Regional Transport Model (SERTM). This is distributed across the HGV fleet by fuel type based on the fleet composition, to give eHGV vehicle kilometres by MSOA.

3.38 Annual charging demand is calculated by applying electricity consumption assumptions based on research by Element Energy to these vehicle kilometres.

**Forecast potential EV charger demand: eHGVs**

3.39 Assumptions on charging behaviour are used to split the demand by charging category, with 80% of demand allocated to HGV depots and 20% to rapid en-route charging.

3.40 Demand is geographically distributed to the MSOA of charging based on the following:

- HGV depots - are based on Element Energy's GB database of depot locations and fleet sizes,
- Rapid en-route charging – is summed for the whole major road network (MRN) and distributed to specific sites along the MRN considering various factors including the trip purpose, distance and origin and destination.

3.41 Power and utilisation assumptions are applied to the charging demand to calculate the charger requirement by MSOA.

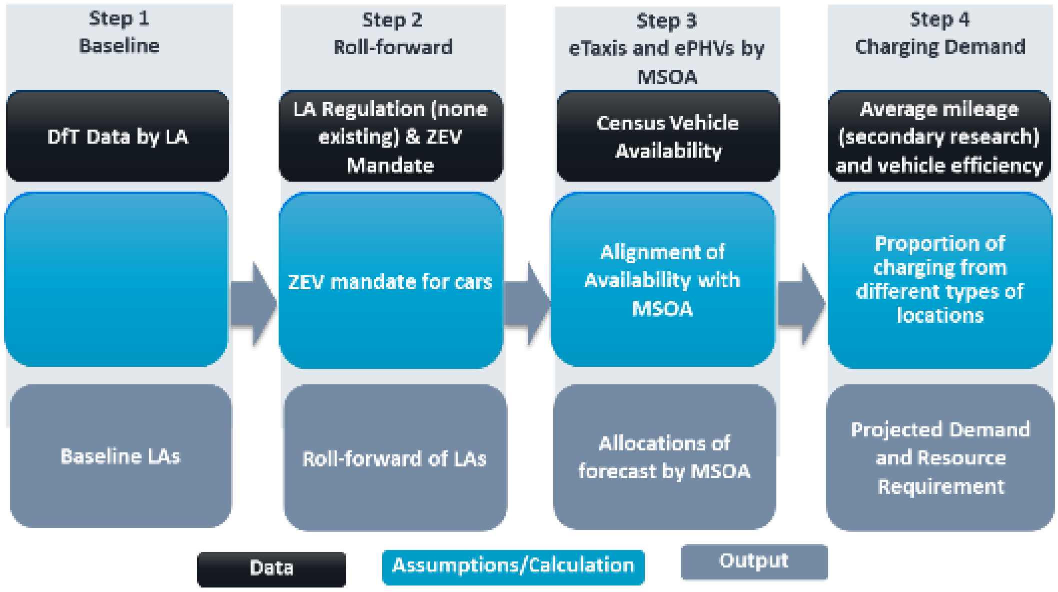
**Table 3-6: HGV charger power assumptions by charging category (kWh)**

| | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|
| HGV depot | 20 | 24 | 28 | 32 | 36 | 40 |
| HGV en-route | 450 | 550 | 650 | 750 | 850 | 950 |

## Taxis and PHVs

3.42 Forecasts have been developed for the penetration of EV within projected fleets of taxis and private hire vehicles (PHVs) and the associated demand for energy and charging resources. For the most part, taxis and PHVs will use the same charging infrastructure as private cars, and accordingly charger requirements have not been calculated for these vehicles explicitly to avoid double counting. To avoid confusion these eTaxi and ePHV forecasts are also not shown in the STB EVCI Framework visualiser.

**Figure 3-2: Taxi and PHV methodology overview**




**Source: Steer**

3.43 Cars are forecasted for the sole purpose of providing an EV penetration rate in the fleet by local authority, which is used to forecast the growth in EVs for Taxis and Private Hire Vehicles (PHVs). Taxis are vehicles licensed to pick customers up from the roadside, whilst Private Hire Vehicles are only permitted to pick up pre-arranged bookings.

**Baseline and forecast of total car fleet**

3.44 Data from DfT Statistics VEH0105, which has registration data split by ownership type (private and company), has been used to identify the number of cars in each LA.

3.45 VEH0105 is impacted by where vehicle leasing companies register vehicles. Leasing companies register vehicles at specific offices, but the vehicles themselves could be driven elsewhere. As a result, the number of company cars in a local authority can be skewed, especially if a large leasing company is located there.

3.46 To account for this problem, company cars are calculated as a function of private cars:

$$\frac{Private\ Cars\ in\ each\ LA}{Private\ Cars\ in\ the\ UK} \times Company\ Cars\ in\ the\ UK = Company\ Cars\ in\ each\ LA$$

3.47 This allocation is considered suitable for company cars which constitute around 10% of the total car fleet, whilst company registered vans comprise around 50% of the total Van fleet (DfT VEH0105).

3.48 In 2023, we use the average Year on Year (YoY) growth rate from 2015 to 2019, to exclude pandemic years, as the YoY growth rate for each local authority. This growth rate decreases linearly to 0% by 2050.

**Baseline and forecast of eCar fleet**

3.49 Data from DfT Statistics VEH0142, which has registration data split by ownership type (private and company), has been used to identify the number of eCars in each LA.

3.50 VEH0142 is also impacted by where leasing companies register vehicles. As a result, company cars have been recalculated based on census car and van availability of the population.

3.51 The addition of new eCars into the fleet has been forecasted as a function of the ZEV mandate. This is show in Table 3-7:

**Table 3-7: ZEV mandate, % of newly manufactured cars that are required to be ZEVs.**

| 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22% | 26% | 33% | 38% | 52% | 66% | 80% | 84% | 88% | 92% | 96% | 100% |

3.52 The average useful life of eCars in 2030 is adjusted to get the number of deletions required to reach an EV penetration rate of the fleet of 99% by 2050. This is because it is assumed that there will still be a very small proportion of ICE that have not been aged out of the fleet.

3.53 Taxis and PHVs use very similar data sources and have been forecasted with the same methodology. Consequently, the following section outlines the methodology for both the vehicle types.

3.54 In the absence of any known changes in licencing regulations impacting the transition to an electric fleet, the EV penetration rate of cars from the ZEV mandate have been used, as calculated above.

**Baseline and forecast of Taxi and PHV fleet**

3.55 DfT TAXI_0104 and PHV_0104 are government datasets that provide the number of registered Taxis and PHVs by local authority.

3.56 DfT TAXI_0101a is a government dataset that provides historical data on the number of Taxis and PHVs licensed by area (less granular than by local authority). This dataset has historical data every two years starting from 2005, and yearly historical data starting from 2017 onwards. The area “England Outside London” from 2017 onwards (excluding 2021) has been used to calculate the historical YoY growth rate as London has taxi and PHV licencing laws that impact the rate of electric vehicle uptake in this population.

3.57 It is assumed that this historical rate is the same for all local authorities, as there is historical taxi data by LA for 2022 and 2023 only.

3.58 In 2023, the average of the YoY growth rate of the historical years is used. This excludes the COVID lockdown year (2021):

- For Taxis, the average historical growth rate was -3.1%
- For PHVs, the average historical growth rate was 4.3%
- This growth rate is adjusted yearly until it reaches to 0% by 2050.

3.59 The growth in booking platform and apps such as Uber have contributed to the growth in PHVs and decline in Taxis.

**Baseline and forecast of electric Taxi and PHV fleet**

3.60 DfT TAXI_0117 and PHV_0117 are government datasets that give the fuel type of taxis and PHVs by **region**. We believe that this data is not granular enough, so this dataset has **not** been used. Instead, the eCar penetration rate in 2022 is used to calculate the number of eTaxis and ePHVs, as presented in Table 3-8.

**Table 3-8: EV Penetration in Cars in 2022 by Local Authority (based on reallocation of vehicles to where they operate using census data).**

| Local Authority | EV Penetration (Fleet) |
|---|---|
| Bracknell Forest | 3.4% |
| Brighton and Hove | 3.2% |
| East Sussex | 3.0% |
| Hampshire | 3.3% |
| Isle of Wight | 2.5% |
| Kent | 3.0% |
| Medway | 2.1% |
| Portsmouth | 1.7% |
| Reading | 2.7% |
| Slough | 2.5% |
| Southampton | 1.8% |
| Surrey | 4.5% |
| West Berkshire | 3.7% |
| West Sussex | 3.1% |
| Windsor and Maidenhead | 4.8% |
| Wokingham | 4.7% |

### Forecast of eTaxi/ePHV fleet

3.61 The growth of eTaxis and ePHVs used the penetration of eCars in the total car fleet. For each LA, the number of eTaxis and ePHVs was calculated by:

$$Total\ Number\ of\ Taxis\ or\ PHVs\ \times EV\ Penetration\ Rate\ in\ Total\ Car\ fleet = Number\ of\ eTaxis\ or\ ePHVs$$

### Forecast potential energy demand: eTaxi/ePHV

3.62 Potential energy demand has been calculated using the following methodology.

$$Annual\ Average\ Mileage_{taxi/PHV}\ \times Vehicle\ Efficiency\ \times = Annual\ Energy\ Demand\ (kWh)$$

3.63 The table shows the average mileages used and the sources. 3.3 miles/kWh was used as the vehicle efficiency, slightly below that of cars to reflect the higher amounts of idling time waiting for passengers with ancillary energy use from heating/cooling.

**Table 3-9: Taxi and PHV average annual mileage assumptions and sources.**

| Average Mileage Assumptions | | |
|---|---|---|
| Taxi | 27,962 | Based on taxi survey data that drivers travel an average of 70 miles per day (~110km) for an estimated 300 days per year (TfL data). |
| PHV | 37,282 | Provided by large PHV operator, includes personal distance travelled for an average full-time driver. |

3.64 For both eTaxis and ePHVs, as their daily mileage in most cases can be done on a single charge, it is assumed that overnight charging at/near home will be preferred for this reason the home/public residential charging demand reflect the off-street parking availability[8], the remainder of the charging (around 20%) will be en-route or at destinations where drivers may take a break throughout the day.

3.65 Charger demand from cars is calculated in the EVCI Model methodology developed by TfN. Charger demand has therefore not been explicitly calculated for Taxis and PHVs to avoid confusion or double counting, as in the most part chargers will be shared with private cars.

## Buses

3.66 The forecast developed covers public service buses only, mini-buses and coaches (which make up 16% of all registered 'Buses'[9]) and non public service vehicles are excluded as their use cases and electrification rates are deemed be different and slower.

3.67 Following stakeholder consultation, it is assumed the vast majority of public service bus charging will take place at the depot. Therefore, to forecast Public Service Bus charging requirements, the location of bus depots and number of vehicles operating from them were identified using two publicly available datasets: buslists.org and DfT's Vehicle Operator Licensing database.

3.68 Operationally as charging will be done overnight while the buses are stationary in the depot, the demand for chargers is equal to the maximum number of chargers the depot will accommodate.

3.69 Energy demand is based on average mileage and vehicle efficiency.

$$Annual\ Average\ Mileage_{Bus} \times Vehicle\ Efficiency_{eBus} = Annual\ Energy\ Demand\ (kWh)$$

3.70 The following text describes these steps in more detail.

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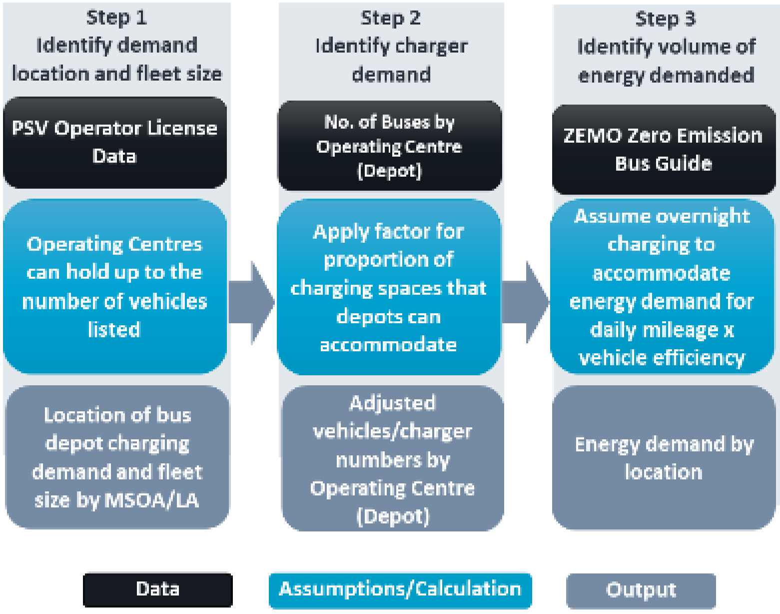
[8] Based on the RAC foundation report - **https://www.racfoundation.org/wp-content/uploads/standing_still_off_street_parking_by_LA_high_to_low.pdf** (Last accessed 20th August 2024)

[9] DfT, Bus06

**Figure 3-3: Bus forecast methodology overview**




**Source: Steer**

### Baseline and forecast of Bus fleet inc. PiV penetration

3.71 The baseline number of public service buses by LA and MSOA are determined by summing the number of buses in each of the operating centres within the LA/MSOA.

3.72 Key regional operators were identified in each local authority, and the location of depots and number of vehicles operating from each depot taken from the DfT vehicle operator licensing data.

3.73 The fleet forecast for the region is based on public service bus statistics for 'England outside London'. The average year on year change in the fleet from 2018 to 2022 has been -2.0% The forecasted change in fleet moves to 0% by 2050, as presented in Table 3-10.

**Table 3-10: Forecasted UK YoY growth rate of public service buses in a given year.**

| 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|
| -2.0% | -1.5% | -1.1% | -0.7% | -0.4% | 0% |

**Forecast of eBus fleet**

3.74 To forecast the future eBus fleet, projections have been informed by major national bus operators, and include the following assumptions:

- ZEBs represented over 50% of new UK bus registrations in 2021[10].
- Of the 2,907 zero emission buses in operation the UK (November 2023) 95% are Battery Electric, 5% are Hydrogen Fuel Cell[11].

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[10] ZEMO_ZERO_EMISSION_BUS_GUIDE_2022_ONLINE_VERSION.pdf

[11] https://www.zemo.org.uk/work-with-us/buses-coaches/low-emission-buses/areas-of-operation.htm

- Following the government consultation on ending the sale of non zero emission buses no later than 2032, CPT[12] and ZEMO[10] reports state that National Express have voluntarily committed to operating a fully zero emission bus fleet by 2030 and Go-Ahead Group, First Bus and Stagecoach have committed to the same by 2035. These are part of the five of the nation's largest operators which operate approximately 55% of the public service bus fleet in the TfSE region.

**Table 3-11: Forecast eBus penetration in Bus fleet.**

| 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.5% | 3.9% | 6.0% | 8.4% | 10.7% | 13.7% | 17.4% | 21.9% | 27.3% | 33.5% | 40.4% | 47.6% | 55% |

**Forecast potential energy demand: eBuses**

3.75 To calculate the potential daily energy demand from eBuses the following methodology was used.

$$Average\ Daily\ Mileage_{public\ service\ buses} \times Vehicle\ Efficiency \times Average\ Working\ Days_{year} = Annual\ Energy\ Demand\ (kWh)$$

3.76 From stakeholder engagement, average daily mileage is understood to be 250 km with the average bus operating the equivalent of 6 days a week over 51 weeks a year, travelling 76,000 km a year. Average vehicle efficiency 1 kWh/km based on Zemo report[10] and verified by stakeholder engagement.

**Forecast potential charging demand: eBuses**

3.77 Due to the high proportion of charging taking place at depots, and the highly situational nature of any en-route rollout, all bus charging demand is assigned to the location of the depot.

3.78 From stakeholder engagement with the CPT and eBus fleet solution providers, we determined that the average bus depot will likely be able to accommodate chargers for 90% of the buses it stations. To minimise grid connection size each vehicle will draw on average 60 kW to get the charge it needs overnight. These assumptions were used to calculate the charger requirement at each depot.

[12] https://www.cpt-uk.org/media/g31m2eor/ending-the-sale-of-new-non-zero-emission-buses.pdf

# 4 Future Work

## Future Updates (Maintenance)

4.1 At the time of developing this model, 2022 was the last full year with published data so the forecast begins in 2023. Annual updates should include an update to the baseline. Comparing the forecast with actuals will also guide whether other updates are needed through the model assumptions and methodology.

## Future Developments

4.2 Due to the pioneering nature of this work and the early stage of EV uptake in fleets it is advised that the methodology and assumptions should be reviewed and updated annually. Advancements in both vehicle and charging technology as well as markets and the policy and regulation landscape could significantly impact the trajectory of the transition to EVs and the charging demand.

4.3 For example, our stakeholder engagement (including with the CPT) determined that the majority of Coach operators are not seeing any viable eCoach models on the market (from a cost and/or mileage versus duty cycle perspective). As such there are virtually no eCoaches in operation. When the technology and costs make transition possible, forecasts can be developed and included, perhaps alongside HGVs as their duty cycles, routes and potential stop locations were deemed to be most similar according to the Fleet Electrification Working Group.

4.4 In the Taxis and PHV sector changes to policies and regulations (local or national) may influence significant changes in uptake trajectories, as did the licencing rules brought in in London several years ago.

## Future Applications

4.5 TfSE are working on exploring how they can further support LAs make use of the data from the tool to develop business cases for EV Infrastructure for fleets in their areas.

# A Appendix: Van Assumptions by Segment

**Table A-1: eVan uptake rate (in sales) relative to ZEV mandate by segment.**

| Industry Sector | Business Size (Enterprise Employment Band) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0-4 | 5-9 | 10-19 | 20-49 | 50-99 | 100-249 | 250+ |
| Agriculture, forestry & fishing | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.00 | 1.00 |
| Production | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.00 | 1.10 |
| Construction | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Motor trades | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Wholesale | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Retail | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Transport & storage (inc postal) | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Accommodation & food services | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.00 | 1.00 |
| Information & communication | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.00 | 1.10 |
| Property | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Professional, scientific & technical | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Business administration and support services | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.10 | 1.10 |
| Public administration & defence | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.00 | 1.00 |
| Education | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Health | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.00 | 1.00 |
| Arts, entertainment, recreation | 0.80 | 0.80 | 0.80 | 0.80 | 1.00 | 1.00 | 1.00 |

**Table A-2: Van segment charger split by category/type (charger_distribution_assumptions).**

**Table A-2: Van segment charger split by category/type (charger_distribution_assumptions).**

Each segment's charging across the five categories sums to 1, blank cells indicate that no charging is carried out at that type of location for that segment.

| | Employee Band | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0-4 and 5-9 | | | | | 10-19 | | | | | 20-49 | | | | |
| | Home | Public residential | Work | Depot | Destination /En-route | Home | Public residential | Work | Depot | Destination /En-route | Home | Public residential | Work | Depot | Destination /En-route |
| **Agriculture, forestry & fishing** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.2 | | 0.3 | 0.105 | 0.395 | 0.2 | 0.1 | 0.2 |
| **Production** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.2 | | 0.3 | 0.105 | 0.395 | 0.2 | 0.1 | 0.2 |
| **Construction** | 0.126 | 0.474 | | | 0.4 | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | | 0.2 | 0.3 |
| **Motor trades** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.4 | | 0.1 | 0.084 | 0.316 | 0.5 | | 0.1 |
| **Wholesale** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | | | 0.1 | 0.084 | 0.316 | | 0.5 | 0.1 |
| **Retail** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.4 | | 0.1 | 0.084 | 0.316 | 0.5 | | 0.1 |
| **Transport & storage (inc postal)** | 0.126 | 0.474 | | | 0.4 | 0.126 | 0.474 | | | 0.1 | 0.105 | 0.395 | | 0.4 | 0.1 |
| **Accommodation & food services** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.2 | | 0.3 | 0.084 | 0.316 | 0.2 | 0.2 | 0.1 |
| **Information & communication** | 0.126 | 0.474 | | | 0.4 | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.1 | | 0.3 |
| **Property** | 0.126 | 0.474 | | | 0.4 | 0.126 | 0.474 | | | | 0.126 | 0.474 | | | 0.4 |
| **Professional, scientific & technical** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | | | 0.4 | 0.105 | 0.395 | 0.3 | | 0.2 |
| **Business administration and support services** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.3 | | 0.2 | 0.105 | 0.395 | 0.3 | | 0.2 |
| **Public administration & defence** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.3 | | 0.2 | 0.084 | 0.316 | 0.4 | | 0.2 |
| **Education** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.3 | | 0.2 | 0.084 | 0.316 | 0.6 | | |
| **Health** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.5 | | 0 | 0.084 | 0.316 | 0.6 | | |
| **Arts, entertainment, recreation** | 0.126 | 0.474 | | | 0.4 | 0.105 | 0.395 | 0.5 | | 0 | 0.105 | 0.395 | 0.4 | | 0.1 |

| | Employee Band | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50-99 | | | | | 100-249 | | | | | 250+ | | | | |
| | Home | Public residential | Work | Depot | Destination /En-route | Home | Public residential | Work | Depot | Destination /En-route | Home | Public residential | Work | Depot | Destination /En-route |
| **Agriculture, forestry & fishing** | 0.5 | 0.2 | 0.1 | 0.105 | 0.395 | 0.105 | 0.395 | 0.2 | 0.1 | 0.2 | 0.22 | 0.28 | 0.2 | 0.1 | 0.2 |
| **Production** | 0.5 | 0.2 | 0.2 | 0.105 | 0.395 | 0.105 | 0.395 | 0.2 | 0.2 | 0.1 | 0.22 | 0.28 | 0.2 | 0.2 | 0.1 |

| | Employee Band | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50-99 | | | | | 100-249 | | | | | 250+ | | | | |
| | Home | Public residential | Work | Depot | Destination /En-route | Home | Public residential | Work | Depot | Destination /En-route | Home | Public residential | Work | Depot | Destination /En-route |
| **Construction** | 0.5 | 0.2 | 0.2 | 0.105 | 0.395 | 0.105 | 0.395 | 0.2 | 0.2 | 0.1 | 0.22 | 0.28 | 0.2 | 0.2 | 0.1 |
| **Motor trades** | 0.4 | 0.5 | 0 | 0.084 | 0.316 | 0.084 | 0.316 | 0.5 | 0 | 0.1 | 0.176 | 0.224 | 0.5 | | 0.1 |
| **Wholesale** | 0.4 | | 0.5 | 0.084 | 0.316 | 0.084 | 0.316 | 0 | 0.5 | 0.1 | 0.176 | 0.224 | | 0.5 | 0.1 |
| **Retail** | 0.3 | 0.4 | 0.2 | 0.063 | 0.237 | 0.063 | 0.237 | 0.4 | 0.2 | 0.1 | 0.132 | 0.168 | 0.4 | 0.2 | 0.1 |
| **Transport & storage (inc postal)** | 0.4 | | 0.5 | 0.084 | 0.316 | 0.084 | 0.316 | | 0.5 | 0.1 | 0.176 | 0.224 | | 0.5 | 0.1 |
| **Accommodation & food services** | 0.3 | 0.2 | 0.3 | 0.063 | 0.237 | 0.063 | 0.237 | 0.2 | 0.3 | 0.1 | 0.132 | 0.168 | 0.2 | 0.3 | 0.1 |
| **Information & communication** | 0.5 | 0.2 | 0.1 | 0.105 | 0.395 | 0.105 | 0.395 | 0.2 | 0.1 | 0.2 | 0.22 | 0.28 | 0.2 | 0.1 | 0.2 |
| **Property** | 0.126 | 0.474 | 0.1 | | 0.3 | 0.126 | 0.474 | 0.1 | 0 | 0.3 | 0.264 | 0.336 | 0.1 | | 0.3 |
| **Professional, scientific & technical** | 0.105 | 0.395 | 0.3 | | 0.2 | 0.105 | 0.395 | 0.3 | 0 | 0.2 | 0.22 | 0.28 | 0.3 | | 0.2 |
| **Business administration and support services** | 0.105 | 0.395 | 0.3 | | 0.2 | 0.105 | 0.395 | 0.3 | 0 | 0.2 | 0.22 | 0.28 | 0.3 | | 0.2 |
| **Public administration & defence** | 0.084 | 0.316 | 0.2 | 0.2 | 0.2 | 0.084 | 0.316 | 0.2 | 0.2 | 0.2 | 0.176 | 0.224 | 0.2 | 0.2 | 0.2 |
| **Education** | 0.084 | 0.316 | 0.6 | | | 0.084 | 0.316 | 0.6 | | | 0.176 | 0.224 | 0.6 | | |
| **Health** | 0.084 | 0.316 | 0.6 | | | 0.084 | 0.316 | 0.6 | | | 0.176 | 0.224 | 0.6 | | |
| **Arts, entertainment, recreation** | 0.084 | 0.316 | 0.4 | 0.1 | 0.1 | 0.084 | 0.316 | 0.4 | 0.1 | 0.1 | 0.176 | 0.224 | 0.4 | 0.1 | 0.1 |

# B Appendix: Charging category assumptions (power and utilisation)

These assumptions are lifted from the STB EVCI Framework model, to limit the impacts of changes to other parts of the EVCI tool changes and updates have been restricted to those that are necessary. Values in bold in the tables are the ones that have been updated via this workstream.

**Table B-1: Charging category power assumptions by year.**

| Charging Category | Year | Apparent Power (kW) |
|---|---|---|
| home | 2023-2050 | 8 |
| workplace | 2023-2050 | 8 |
| public residential | 2023-2050 | 8 |
| **van depot** | **2023-2050** | **25** |
| **bus depot** | **2023-2050** | **60** |
| destination | 2023-2050 | 8 |
| en-route | 2023 | 44 |
| en-route | 2025 | **50** |
| en-route | 2030 | **65** |
| en-route | 2035 | **75** |
| en-route | 2040 | **100** |
| en-route | 2045 | **125** |
| en-route | 2050 | **150** |
| hgv_en-route | 2023 | 410 |
| hgv_en-route | 2025 | 450 |
| hgv_en-route | 2030 | 550 |
| hgv_en-route | 2035 | 650 |
| hgv_en-route | 2040 | 750 |
| hgv_en-route | 2045 | 850 |
| hgv_en-route | 2050 | 950 |
| hgv_depot | 2023 | 20 |
| hgv_depot | 2025 | 20 |
| hgv_depot | 2030 | 24 |
| hgv_depot | 2035 | 28 |
| hgv_depot | 2040 | 32 |
| hgv_depot | 2045 | 36 |

| | | |
|---|---|---|
| hgv_depot | 2050 | 40 |

**Table B-2: Utilisation assumptions by charging category.**

| Charging Category | Year | Utilisation (hours per day) | Utilisation (%) |
|---|---|---|---|
| home | 2023-2050 | 8 | 33.3 |
| workplace | 2023-2050 | 4.3 | 17.9% |
| public residential | 2023 | 1.3 | 5.4% |
| public residential | 2025 | 1.5 | 6.3% |
| public residential | 2030 | 4 | 16.7% |
| public residential | 2035 | 6 | 25.0% |
| public residential | 2040 | 6 | 25.0% |
| public residential | 2045 | 6 | 25.0% |
| public residential | 2050 | 6 | 25.0% |
| **van depot** | **2023** | **6** | **25.0%** |
| **van depot** | **2025** | **8** | **33.3%** |
| **van depot** | **2030** | **10** | **41.7%** |
| **van depot** | **2035** | **12** | **50.0%** |
| **van depot** | **2040** | **14** | **58.3%** |
| **van depot** | **2045** | **14** | **58.3%** |
| **van depot** | **2050** | **14** | **58.3%** |
| destination | 2023 | 1.3 | 5.4% |
| destination | 2025 | 1.5 | 6.3% |
| destination | 2030 | 3 | 12.5% |
| destination | 2035 | 4 | 16.7% |
| destination | 2040 | 5 | 20.8% |
| destination | 2045 | 6 | 25.0% |
| destination | 2050 | 6 | 25.0% |
| en-route | 2023 | 1.3 | 5.4% |
| en-route | 2025 | 1.5 | 6.3% |
| en-route | 2030 | 2 | 8.3% |
| en-route | 2035 | 2.5 | 10.4% |
| en-route | 2040 | 3 | 12.5% |
| en-route | 2045 | 3 | 12.5% |
| en-route | 2050 | 3 | 12.5% |
| hgv_en-route | 2023 | 1 | 4.2% |
| hgv_en-route | 2025 | 1 | 4.2% |
| hgv_en-route | 2030 | 1.5 | 6.3% |
| hgv_en-route | 2035 | 2 | 8.3% |
| hgv_en-route | 2040 | 2.5 | 10.4% |
| hgv_en-route | 2045 | 3 | 12.5% |
| hgv_en-route | 2050 | 3 | 12.5% |

| Charging Category | Year | Utilisation (hours per day) | Utilisation (%) |
|---|---|---|---|
| hgv_depot | 2023 | 8 | 33.3% |
| hgv_depot | 2025 | 8 | 33.3% |
| hgv_depot | 2030 | 8 | 33.3% |
| hgv_depot | 2035 | 8 | 33.3% |
| hgv_depot | 2040 | 8 | 33.3% |
| hgv_depot | 2045 | 8 | 33.3% |
| hgv_depot | 2050 | 8 | 33.3% |

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