Are UK public chargers keeping up with EV demand in the UK?

Capstone Project Technical Report

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Executive Summary

As battery-electric vehicle (BEV) ownership grows, access to reliable public charging across Great Britain is becoming increasingly important. However, it remains unclear whether public charging points are being installed in line with local BEV demand. This project builds a reproducible, open-data pipeline to compare public charging supply with BEV demand across Great Britain. Using:

- OpenChargeMap (OCM) for public charging sites and plugs
- DfT VEH9901 for BEV registrations
- ONS Postcode Directory (ONSPD) for postcode to local authority mapping

Key findings

- Great Britain has around 587k privately owned BEVs and 62k public charge points and an average of around 115 plugs per 1,000 private BEVs**.**
- Coverage is highly uneven**:** London, Northen Ireland, Scotland and Wales are above the national benchmark, while most other regions sit well below it.
- A group of high-demand but under-served authorities combine large BEV fleets with below-average public charging.
- Many councils start from a very low base (often <25 plugs per 1,000 BEVs), meaning they will quickly run into issues as BEV uptake grows.
- The network is still dominated by small, slow sites**;** rapid and ultra-rapid plugs are a minority, and a handful of operators control much of the open public network.

Recommendations

- Prioritise investment in local authorities with large privately owned BEV fleets but below-average plugs per BEV, and in regions that consistently underperform on coverage.
- Improve not just the quantity but the quality of infrastructure in under-served areas by increasing the share of rapid and ultra-rapid chargers and developing larger multi-plug hubs, making the network more reliable for everyday use.

Problem, Goals and Audience

Problem statement

BEV adoption is rising, but public charging provision at local authority level is uneven, creating a risk of underserved areas where BEV ownership is relatively high but public charging is sparse. This project asks: where is public EV charging supply well aligned with BEV demand, and where are there gaps at local authority level?

Project goals

- Measure how well public charging supply matches BEV demand
- Identify under- and over-served authorities
- Assess quality of coverage
- Look ahead using simple forecasting

Success criteria

- A clear, well-documented data pipeline in SQL
- A set of local-authority KPIs that can be easily explored in Tableau dashboards
- Visualisations that highlight regional differences in coverage
- A simple model to look ahead at BEV growth
- Audience-appropriate recommendations

Intended audiences

Potential audiences include national and regional transport planners, who could use local authority–level benchmarks to monitor public charging. Also, local authority officers might use the KPIs and dashboards to support EV strategies and funding bids. Charge-point operators and investors could use coverage and BEV counts to spot opportunities and gaps in the network. Members of the public and advocacy groups can use the map and simple metrics to understand regional differences.

Data Sources

OpenChargeMap (OCM)

OpenChargeMap (OCM) is an open, crowd-sourced database of public EV charge points. For this project it was used to measure public charging supply by local authority in Great Britain. The raw OCM extract was transformed into a sites table, with one row per physical site and a plugs table, with one row per plug. Key limitations include the crowd-sourced nature of OCM, missing or incorrect postcodes for some sites, and incomplete power ratings for some plugs.

DfT VEH9901 – BEV Demand

The Department for Transport's VEH9901 dataset provides annual counts of licensed vehicles by body type and fuel for each local authority in Great Britain. It is used here to represent BEV demand at local authority level. The raw table was filtered to create a BEV-only table (veh9901_bev) containing counts of privately kept battery-electric cars per local authority. Demand is defined using only privately kept BEVs, with company-registered vehicles excluded because fleet registrations are often tied to head-office addresses and can create artificial hotspots that do not reflect where vehicles are actually used. Key limitations are that the keeper postcode may not match the main usage location and excluding company vehicles means some real local demand is not captured.

ONS Postcode Directory (ONSPD) – Geography

The ONS Postcode Directory (ONSPD) provides a lookup between full postcodes and administrative geographies and is used in this project to assign OCM charging sites to local authorities. It was used to build a postcode_la table linking cleaned postcodes to local authority district (LAD) codes, and an la_names table holding LAD names and region labels. These tables enable sites and plugs to be aggregated consistently to local authority and regional level. A small number of OCM records remain unmatched because of missing, invalid or non-standard postcodes.

Data Cleaning and Preparation

Cleaning OCM plugs

The plugs table was cleaned using Python and Excel to represent realistic, usable public plugs. Only rows with status recorded as operational were kept so that metrics reflect infrastructure drivers can actually use. Quantities were normalised by setting them to 1 whenever they were missing, non-numeric or non-positive. Abnormally high power ratings were manually reviewed using Google Maps and charge-point operator information to check whether they were genuine chargers. Confirmed values were retained, while clear data-entry errors were capped or excluded. A power band field was then assigned using the UK government's latest charge point speed categories, based on each plug's power rating.

Cleaning OCM sites

The sites table was cleaned to give a consistent set of public charging locations in Great Britain. Records with missing or clearly invalid coordinates were removed. Postcodes were standardised into a pcds_clean field, which acts as the join key to the ONS Postcode Directory and underpins all local-authority aggregations.

Assigning local authorities to sites

Local authorities were assigned to sites by first building a postcode_la table linking cleaned postcodes (pcds_clean) to local authority district codes (lad25cd), along with an la_names table holding LAD names and regions. The sites table was then left-joined to postcode_la on pcds_clean so that each site inherited a local authority where possible. Sites with no postcode match were moved into an unmapped set and reverse-geocoded in Python using the Google Maps API. When this returned a reliable postcode, pcds_clean was updated and the site was re-matched; any remaining unresolved sites were excluded from local-authority KPIs.

Preparing BEV counts

BEV counts were prepared from the DfT VEH9901 dataset by pivoting in Excel to battery-electric fuel types and filtering to the relevant vehicle categories (cars that are privately kept). The filtered subset was imported into PostgreSQL, then aggregated and tidied into a veh9901_bev table with one row per local authority, containing the LAD code (lad25cd) and the total number of privately kept BEVs. Completeness checks were run against la_names, and LAD codes were adjusted where necessary to reflect boundary changes so that demand figures align with the geography used elsewhere in the project.

Building la_supply_kpis

The la_supply_kpis view brings together supply and demand by local authority. It joins la_names, veh9901_bev, postcode_la, sites and plugs, counts distinct sites and sums plug quantities for each LAD, and then calculates key metrics such as plugs per 1,000 privately kept BEVs.

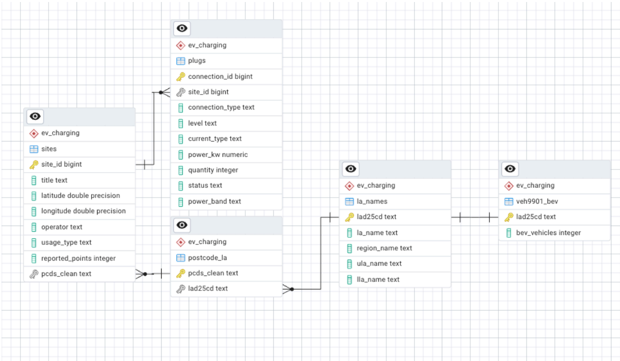
Methodology and Analytical Approach

Technical stack

All data for this project is stored in a PostgreSQL database hosted on AWS RDS, which acts as the main data platform. Using a managed cloud database allows the pipeline to be re-run from scratch, keeps a single source of truth for all tables, and mirrors how production analytics systems are typically deployed. Python (in Jupyter notebooks) is used for API calls, data checks, reverse-geocoding and predictive modelling, while Excel is used to reshape the VEH9901 file into a BEV-only subset and for light cleaning. Tableau sits on top of the PostgreSQL database for exploratory analysis and final dashboards. The Google Maps Geocoding API is used to fix unmapped sites with missing or invalid postcodes.

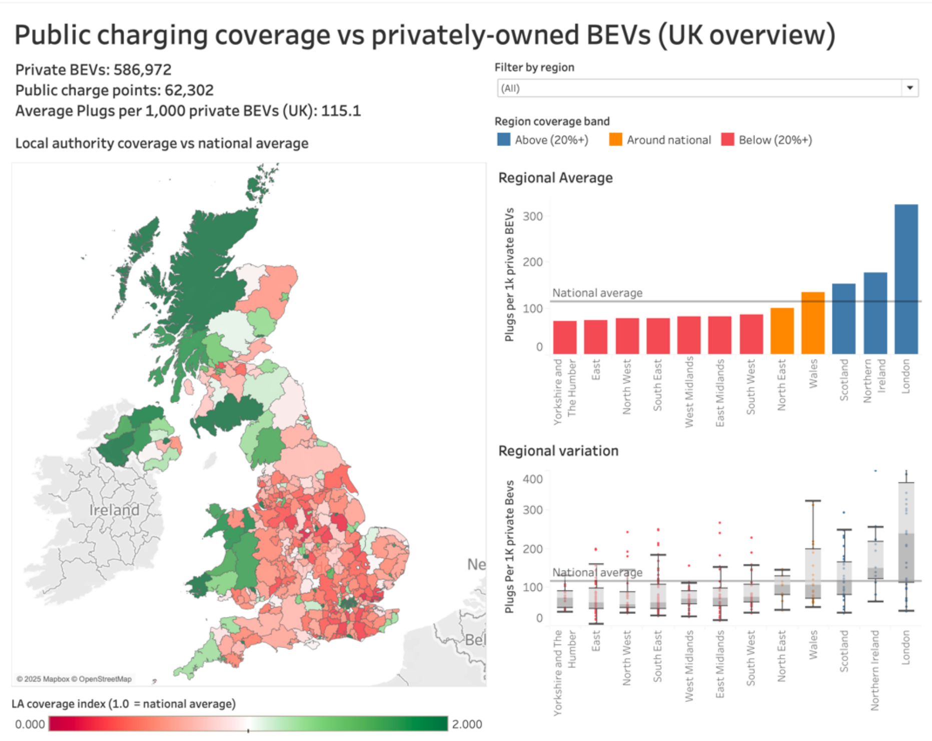
Schema design

Sites and plugs form a one-to-many relationship, with each plug linked to a single site. Sites are connected to postcode_la via the cleaned postcode, which in turn links to la_names through the LAD code, so every site can be rolled up to a named local authority and region. VEH9901_bev also joins to la_names on the LAD code, bringing in BEV demand for the same geography. The la_supply_kpis view then sits on top of these relationships, joining supply and demand so that each local authority has a single record with all key KPIs ready for analysis and visualisation.



Results and Insights

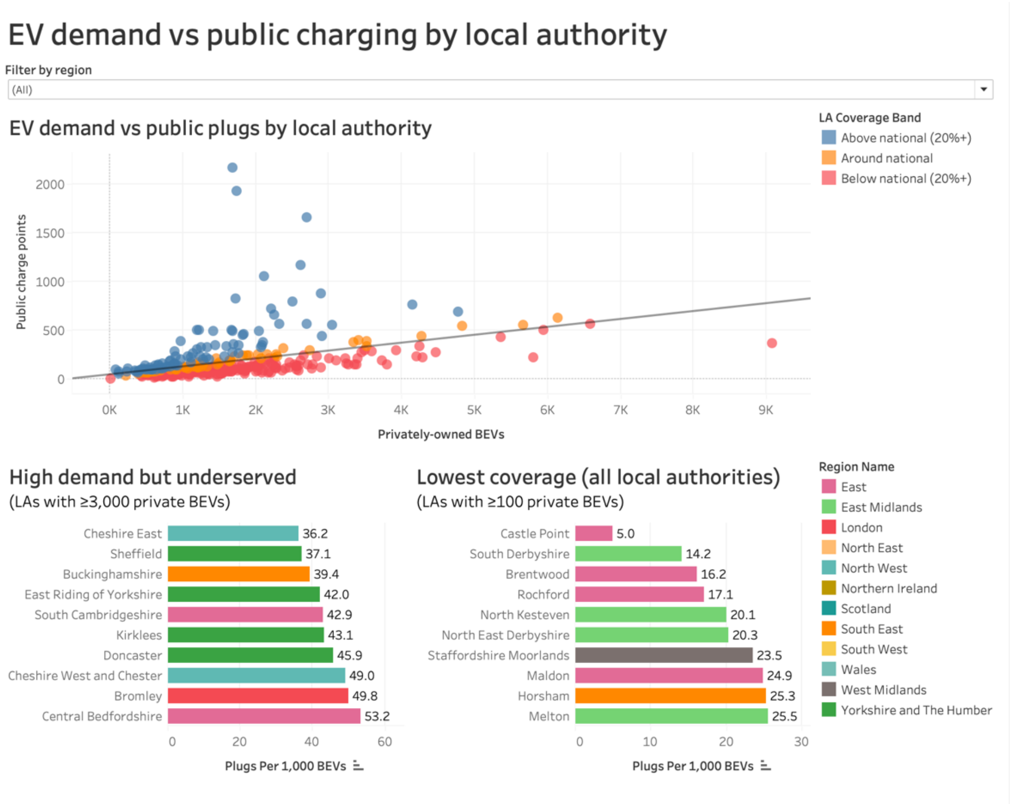
National coverage and regional differences



Public charging coverage is clearly uneven across Great Britain. Using plugs per 1,000 privately owned BEVs as a benchmark, London, Scotland, Wales and Northern Ireland emerge as comparatively well served, all sitting at or above the national average of around 115 plugs per 1,000 BEVs. In contrast, several English regions, particularly Yorkshire and the Humber, the East and North West, lag behind. This suggests that national growth in charge points has not been distributed in line with where BEV ownership is highest, and that some regions face a higher risk of constrained public charging as BEV uptake continues.

Looking within regions, the picture becomes even more uneven. Some regions show relatively tight clustering, with most local authorities offering a similar level of coverage (even if that level is below average). Others exhibit a very wide spread, with a handful of highly provisioned authorities sitting alongside neighbours that have far fewer plugs relative to their BEV fleets. This intra-regional variation means that a region which appears "acceptable" on average can still contain pockets of clear under-provision, and that drivers' day-to-day experience of public charging depends heavily on the specific local authority in which they live.

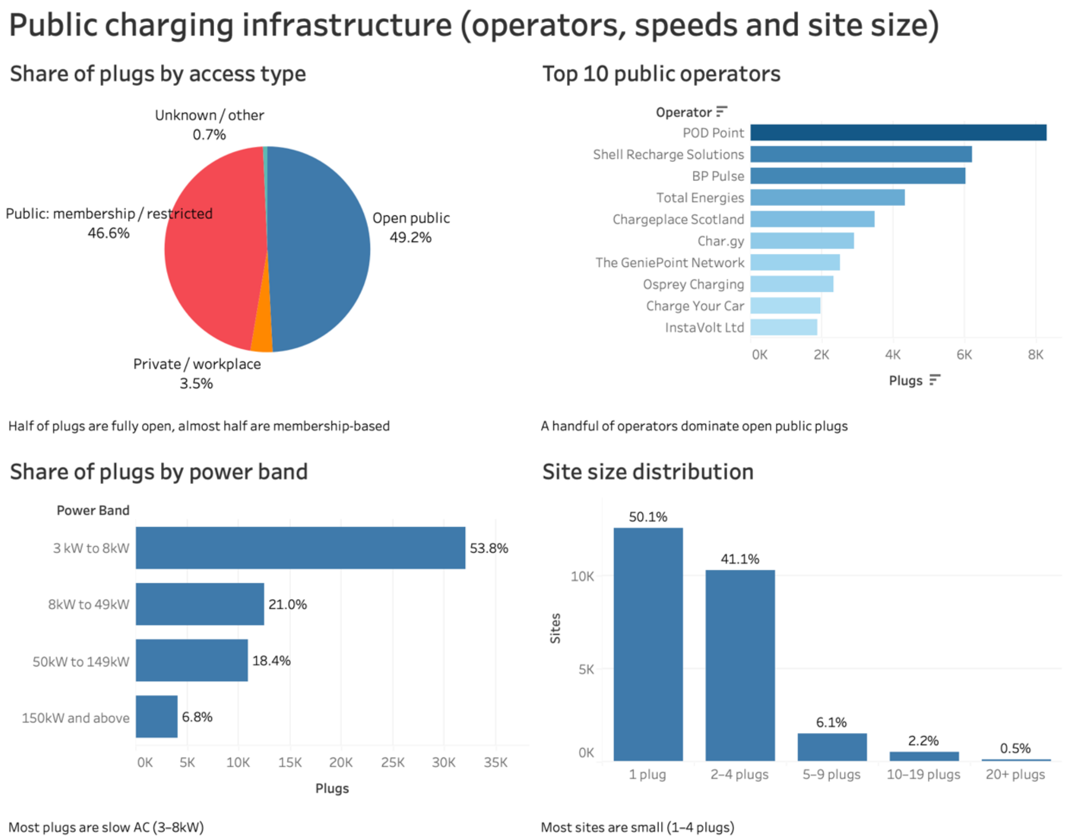
Local authority–level



The demand–supply scatterplot shows that public charging generally increases with BEV demand, but not in a consistent or proportional way. A large cluster of below-average authorities sits under the trend line, meaning they have fewer public plugs than would be expected for the size of their BEV fleet, while a smaller group of above-average authorities sits well above it, with networks that appear to be ahead of current demand. This confirms that misalignment is not just about low absolute coverage, but about councils falling behind peers with similar levels of BEV adoption.

To turn this into priorities, I identified two distinct sets of local authorities. The first contains high demand but under-served councils such as Cheshire East, Sheffield and Buckinghamshire: each with more than 3,000 privately owned BEVs but coverage well below the UK average. These places are likely to feel pressure today and are strong candidates for near-term investment. The second captures authorities with the very lowest coverage overall, including smaller or more rural areas such as Castle Point and South Derbyshire, where BEV fleets are still modest but public charging starts from an extremely weak base. Together, these groups distinguish where public charging shortfalls are already being felt from where early investment could prevent future problems as BEV uptake accelerates.

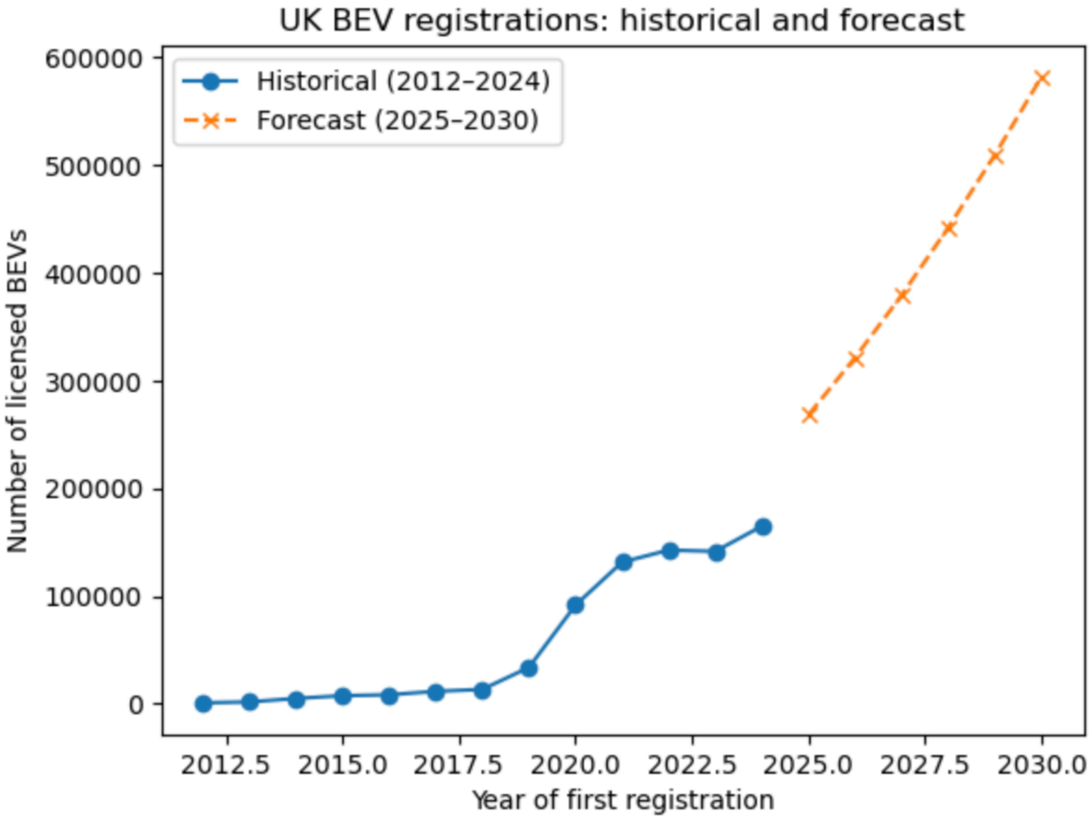
Network accessibility, operators and quality



Public charging in Great Britain is not just uneven in where it is located, but also in how accessible it is and who runs it. Only about half of plugs are straightforwardly open public, with a similar share classed as public but membership-based or otherwise restricted, meaning drivers often need specific apps or access to particular car parks to use them. The market is also quite concentrated: a small group of large operators, including POD Point, Shell Recharge and BP Pulse, account for a significant share of open public plugs, with a long tail of much smaller networks. This combination of operator concentration and fragmented access models means that decisions by a handful of providers can strongly shape drivers' real-world experience.

In terms of quality and capacity, the network is still dominated by small, slow sites. Around half of plugs are in the slowest power band, roughly a fifth are 8–49 kW, and only about a quarter are rapid or ultra-rapid. Most locations have very few connectors: around half of sites have a single plug and most of the rest only two to four, with very few sites offering 10 or more plugs in one place. This means that even in areas that look well covered on a plugs-per-BEV basis, much of the infrastructure is geared towards long-stay or overnight charging rather than fast hubs, with implications for queuing, reliability and the ease of living with a BEV without home charging.

Forward look



The simple predictive model suggests continued strong growth in BEVs.

Recommendations

The analysis highlights two main priority groups: local authorities that already have large privately owned BEV fleets but fall well below the national plugs-per-BEV benchmark, and wider regions that consistently underperform on coverage. These areas are likely to feel pressure first and are strong candidates for targeted public funding, planning support or incentives for charge-point operators.

It is also important to improve the quality of coverage, not just the number of connectors. Under-served authorities would benefit from a higher share of rapid and ultra-rapid chargers, and from larger multi-plug hubs rather than scattered single-plug sites. Coordinated investment along these lines would help bring lagging areas closer to the national average and make the public network more reliable and convenient for day-to-day BEV use, especially for drivers without access to home charging.

In summary, public charging coverage in Great Britain is uneven within and between regions; many high-demand local authorities are under-served; and the network is dominated by small, slow sites run by a handful of operators. Targeted investment in high-priority councils would help public charging keep pace with BEV adoption.