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Enabling the roll-out of on-street charging infrastructure

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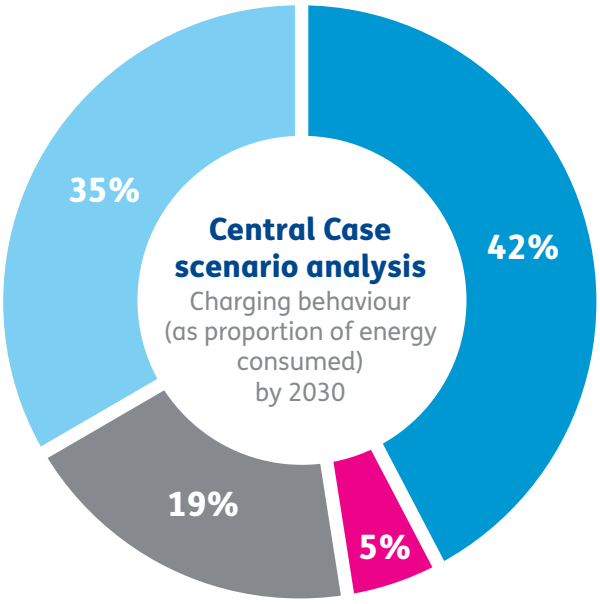
Deployment of on-street charging infrastructure must be tailored to the needs of local residents. Understanding local charging behaviours and centrally coordinated support for local governments can enable efficient and commercially viable deployment of on-street charging infrastructure.

Are there enough on-street public chargers?

Up to 30% of households in the UK do not have access to off-street parking. Further, 90% of these households DO NOT have access to public charging infrastructure within a five-minute walk of their home, based on a study conducted by analytics firm Field Dynamics and Zap-Map . There are currently just over 35,000 public charging devices installed in the UK (of which about 5k are on-street), which equates to just under 12 electric vehicles (EVs) per public charger (based on current EV penetration of 410k). The public on-street chargers that do exist are also unevenly distributed across the country with nearly 80% located within Greater London.

On-street charging is an essential component of the UK's network of charging infrastructure

Our consumer analysis suggests that EV users will charge at four location archetypes: off-street for those who have access to off-street parking; on-street for those who don't; at primary locations where the purpose is to charge e.g. transient fuel forecourts; and secondary locations where the purpose to travel is not to charge, such as workplaces and destinations. This charging behaviour is a zero-sum game in that all the energy for an average EV's annual mileage will come from a combination of the above location types. Our Central Case scenario analysis, shown below, estimates that in 2030, charging behaviour (as proportion of energy consumed) will be along the lines of the below split:



We have also developed an "on-the-go" scenario where consumers rely on forecourt-type charging akin to fuel forecourts today, and a "home & work" scenario where charging occurs predominantly on private properties. In all scenarios, the amount of charging infrastructure required varies between location, but the energy consumed remains a zero-sum game. However, these scenarios will offer different amounts of grid flexibility as this depends on the size of the connection; speed of charging and how long customers typically plug-in for. Government policy and consumer behaviour will influence the probability of these different scenarios playing out. However, in all three scenarios, a minimum dependence on public and on-street charging remains.

In the Central Case scenario, while the percentage of energy consumed on-street is lower due to a slower charging speed (5% of all energy needed by EVs in 2030), on-street charging is a key requirement for addressing range anxiety for on-street-parking households who will expect stable overnight charging as a starting point (and should be able to do so from a social equality standpoint just as people with off-street parking).

In addition, a significant proportion of return-to-home fleets are households without off-street parking. Fleets will likely find it cost-effective to electrify in the next three to four years (given the UK Government's announcement for a halt on ICE sales in 2030, and the expected range of clean air zones across the country). However, limited access to credible overnight on-street charging could be a significant constraint for businesses in supporting their drivers to electrify.

A large amount of private capital to date has been mobilised towards the deployment of rapid charging infrastructure, predominantly at primary and secondary locations, such as fuel forecourts, and 'destination charging' locations, such as retail centres and car parks. These installations provide a higher ROI, despite demand risk, due to the ability to charge higher prices for rapid charging. However, this type of charging infrastructure will only cater for specific charging-use cases, where the customer is expected to be at the location for a short time-period. A significant proportion of on-street overnight charging remains largely unaddressed.

Barriers to deploying public on-street charging infrastructure

There are a few established Charge Point Operators working in the on-street charging market, such as BP's Chargemaster and Source London (now acquired by Total), as well as some smaller innovative companies such as Connected Kerb and Trojan Energy. Additionally, there are also a range of lamppost-charging companies such as Ubitricity and Char.gy, that can service a portion of the local charging needs through a simple trickle charge speed. This landscape of providers is still fragmented and the technology is emerging.

More than 80% of all public chargers are publicly owned by Local Authorities, indicating that while the On-street Residential Chargepoint Scheme has seen limited uptake, nearly most of the on-street charging infrastructure has been deployed through public money. Our commercial modelling and interviews with key industry players indicate that there are some key factors that are making the deployment of on-street charging particularly commercially challenging: 1) utilisation and price 2) grid constraints and upgrade costs.

1. The commercial viability of on-street charging infrastructure requires greater adoption of EVs

All charging infrastructure, including on-street, needs a minimum threshold of utilisation in order to be commercially viable, and this requires more EVs to be on the roads. The current utilisation uncertainty characterising on-street charging infrastructure acts as a significant barrier to wider deployment. Further, on-street slow-charging and fast-charging prices (between 15 and 22p/kW) are also lower than rapid-charging, thus impacting the commercial viability of any deployment.

2. **Site suitability and grid constraints**

   The installation of on-street charging infrastructure may require significant upfront investment, particularly to facilitate the installation of the underground network connection infrastructure. This is particularly prevalent within inner-city areas, in which demand for electric vehicles is likely to be the highest. The cost required to upgrade the grid infrastructure to facilitate the installation of on-street charging points could render the project financially challenging.

The lead times associated with grid connections and permit lead times have also been seen to have negative implications on the speed of deployment of on-street charging infrastructure.

As a result, the installation of charging infrastructure can be capex intensive and ROIs can be spread over a long-time horizon. This has resulted in locations that facilitate 24/7 access; have amenities on site or nearby; have a direct customer demand for utilisation or a straightforward grid connection; are being prioritised as 'prime and easy sites' for the installation of charge points (e.g. taxi ranks; council-owned car parks and car clubs), even though none of these locations provide for the crucial overnight on-street charging.

Enabling optimal on-street charging deployment

So how can Local Authorities, regional transport authorities, central government and private sector CPOs deploy efficient and adequate on-street and public charging infrastructure?

It is worth noting from the charging behaviours, that charging-infrastructure provision at certain locations can reduce dependence/requirement at others. However, consumer preference and the market will essentially drive charging infrastructure to those locations that facilitate convenience at optimal cost. Therefore, while secondary charging at work and destinations is convenient and, in most cases, cost-effective (reducing dependence on overnight on-street charging), a proportion of on-street charging infrastructure will be inevitable. This "least-regrets investment" needs to be understood and tailored to every local authority/region based on the resident's requirements.

Charging behaviours and the resulting charging infrastructure requirements will be critical in order to:

i) overcome the above barriers and ensure the general public have sufficient confidence that there is enough on-street (overnight) charging infrastructure to support their transition to EVs;

ii) deploy capital efficiently (i.e. where charging infrastructure will be well-utilised);

iii) identify this location-specific 'least-regrets investment', understanding the granular local propensity to electrify.

This means understanding the anticipated EV uptake in a specific area requires insight into the living and travel behaviours of the residents in an area; their parking circumstances and propensity to electrify over time. Specifically, their jobs, commuting habits and lifestyle preferences will determine their charging behaviours and the charging infrastructure (speed and locations) required.

Baringa's customer analytics team has developed an approach to gather this level of detailed customer behavioural insight by articulating the different driver archetypes and testing the validity of this analysis through dynamic feedback within the current and future EV market, so that we can assess public charging needs, either at a national level or for a specific granular local area.

Below we have shared an overview of our customer segmentation, which categorises the UK driving population into seven customer segments using three key metrics to better understand their behaviours:

1. **Location:** rural/suburban dwellers and urban dwellers

2. **Property type:** detached/semi-detached and terraced house/flat

3. **Commuting habits:** short commute/long commute, whereby the vehicle returns to home, and long commute whereby the vehicle returns to a depot

These variables enable the UK driving population to be segmented based on their propensity to own an EV, as well as their likelihood of using different locations and speed of chargers.

	Segment A	Segment B	Segment C	Segment D	Segment E	Segment F	Segment G
	Rural home top-up	**Rural home high mileage**	**Urban on-street top-up**	**Urban on-street high mileage**	**Urban depot**	**Urban home top-up**	**Urban home high mileage**
Location	Rural / suburban	Rural / suburban	Urban	Urban	Urban	Urban	Urban
Property	Detached / semi-detached house	Detached / semi-detached house	Terraced house / flat	Terraced house / flat	Terraced house / flat	Detached / semi-detached house	Detached / semi-detached house
Length of Commute	Short	Long	Short	Long and return to home	Long and return to depot	Short	Long
Charging behaviours by location							
Home (off-street)	Customer will charge mostly at home due to access to off-street parking.	Customer will charge mostly at home due to access to off street parking.				Customer will charge mostly at home due to access to off street parking.	Customer will charge mostly at home due to access to off street parking.
On-street near home i.e. nearby			Customer will charge on-street due to no access to off-street parking.	Customer will charge on-street due to no access to off-street parking.	Customer will charge on-street due to no access to off-street parking.		
Primary (fuel forecourts & transient charging): Charging is the purpose of the destination		Due to longer commutes consumer will rely on transient / on-the-go charging	Access to rapid charging required	Access to rapid charging required	Access to rapid charging required		
Secondary (workplace & destinations): Charging located where the customer was going anyway	Infrequent charging at work due to short commute. Due to rural / suburban location we expect a dependence on the car and therefore likely use of destination charging.	Due to rural / suburban location, we expect a dependence on the car and therefore likely use of destination charging.	Infrequent charging at work due to short commute. Customer will use destination charging	Infrequent charging at work due as customer will return home. Customer will use destination charging	Frequent charging at work due as customer will return to depot. We don't expect consumers to lean on destination charging	Frequent charging at work due to short commute. Due to rural/ suburban location we expect a dependence on the car and therefore likely use of destination charging.	Due to long commute customer will charge often. Due to rural/ suburban location we expect a dependence on the car and therefore likely use of destination charging.

The analysis and segmentation above illustrates the wide range in charging infrastructure needs across the seven different customer segments, both in terms of infrastructure location and charging speed. This highlights the need for Local Authorities and CPOs to consider the customer segments that are present in a specific area, the relative size of the segments and expected EV-adoption based on propensity metrics, how that changes over time and the need to take a holistic multi-location approach to ensure that charging infrastructure meets customer needs while deploying capital efficiently. For instance, for a given area higher presence of Segment C residents (Urban on street top-up users) means that while destination and local rapid charging is important, on-street overnight charging is crucial to enable EV uptake.

Another factor to bear in mind is time horizons. Using census data, we have estimated Segment C (Urban on street top-up users) accounts for 25% of the driving population. However, we predict this segment to have a low EV adoption in the early years. Nevertheless, in an area with significant Segment C residents, presence of public charging infrastructure will be required across all location types (especially on-street overnight) in order to address any perceived range anxiety.

This analysis will be further explored in our next article, where we will use a UK city as a practical example to illustrate how charging-infrastructure demand can be modelled to tailor charging-infrastructure to local demand; allow for efficient deployment of capital to some 'least regrets' investments and overcome utilisation uncertainty.

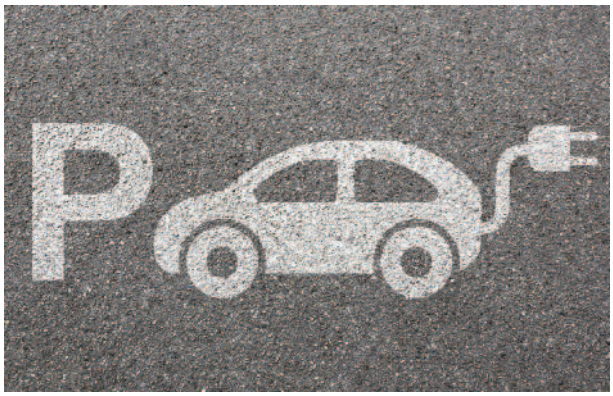
Key actions and actors to enable deployment of on-street charging infrastructure

To summarise, we believe that detailed customer segmentation to understand both the current and future needs of EV driver and the local charging behaviours, can help increase the commercial viability of on-street charging infrastructure.

As we detail above, there is a significant market opportunity for those Local Authorities and CPOs who can overcome the barriers associated with deploying on-street chargers and deliver the infrastructure required to drive mass EV uptake.

However, local authorities require support to make this happen. The challenge of developing an EV strategy that understands these behaviours; while future-proofing and developing a holistic approach, is time-, resource- and spending-intensive. Central government and regional transport authorities have an opportunity to support local governments with this challenge by:

- Supporting an efficient understanding of this EV-customer demand and segmentation at a local level, by rolling out a simple tool to help quantify the boundaries of public on-street-charging infrastructure deployment; and any least-regrets investment opportunities
- Helping deploy larger tenders and ensuring these tenders are procured for the longer term (to guide helpful economics for both public and private sector)
- Supporting the commercial structuring of these concessions with standard frameworks in regards to commercial models and key variables and arrangements, (eg price to be charged; owning the underground infrastructure and O&M contracts/service levels)



We've seen some success in this approach from London councils and TfL, who have a centralised commercial framework. However, a more coordinated approach across the UK could truly save local government procurement spend, and unlock the local public charging infrastructure and revenue streams for local governments, all the while addressing range anxiety and promoting EV uptake.

Baringa Partners

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