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EV Charging at work: Do We Really Need All That Power?

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Introduction

The growing shift to electric vehicles (EVs) highlights the strong need for effective charging infrastructure. While public fast charging networks support longer journeys, workplace charging is a key part of this, providing easy top-up charges for daily commutes and work trips. Much infrastructure planning emphasises demand for higher-power chargers, influenced by EV users wanting fast and rapid charging speeds. However, this approach can lead to installing the facility to provide more power than needed, which can increase costs and waste energy.

This paper examines this issue by studying how the stated preferences of EV car drivers at a UK logistics company for high-power charging matches their actual daily energy needs. Using a mixed approach that includes driver surveys and detailed travel logs, the study examines real charging patterns and miles driven. The research specifically explores whether lower-power workplace chargers (e.g. 7kW) can meet the practical range requirements of employees EV travel habits. The analysis suggests that, despite driver preference for higher-power chargers (e.g. 22kW), the typical time spent charging at work could enable lower-power units to meet their daily energy needs. This study provides a data-driven overview to help create more cost-effective and efficient EV charging plans for companies.

Background

The global shift towards EVs is a key part of efforts to reduce carbon emissions and build sustainable transport systems. However, the growth in EV use relies heavily on developing effective and reliable charging infrastructure. Different EV chargers, categorised by their power output (e.g., slow; 3kW- 7kW, fast; 7kW- 25kW, rapid; 50kW- 150kW, ultra-rapid; 150kW+), are best suited for varying operational demands (Sarda et al., 2024). For instance, commercial fleets with high daily utilisation and rapid turnaround demands, such as car-sharing or taxi services, necessitate fast or rapid charging to minimise vehicle downtime and maintain service availability (Zhan et al., 2025). Conversely, lower-power charging solutions can prove equally effective and more economically viable for operational contexts where vehicles are stationary for longer durations, such as overnight charging at a depot (Speth & Plötz, 2024) or during typical working hours at a workplace (Hind et al., 2024).

Research has explored electric vehicle user preferences for charging infrastructure (Wolff & Madlener, 2019), indicating a strong inclination among EV drivers towards higher-power charging solutions (Brückmann & Bernauer, 2023). In fact, charging speed is their most important consideration when driving an EV (Fischer et al., 2024). This preference is often motivated by the desire for reduced charging times, aiming to minimise inconvenience and replicate the familiar refuelling experience of conventional internal combustion engine vehicles (Song & Potoglou, 2024). Furthermore, the perception of readily available rapid charging helps to alleviate 'range anxiety' (National Grid, 2019; Zhang et al., 2021), a common barrier to increased adoption of EVs. Consequently, significant investment and development in public and commercial charging networks prioritise the deployment of higher-power chargers (IEA, 2025; Mastoi et al., 2022).

From a technical perspective, deploying high-power chargers, particularly when not functionally necessitated by operational demand, significantly exacerbates the strain on existing electrical distribution grids (Tasnim et al., 2023). Such installations typically mandate costly upgrades to local substation capacity and wider network infrastructure, thereby contributing to the protracted grid connection processes (Ofgem, 2023) and inherent network capacity limitations prevalent in the UK (Office for Zero Emission Vehicles, 2024). Economically, for stakeholders investing in on-site charging facilities this misalignment, of what is desired against what is needed in practice, can result in considerable unnecessary capital expenditure and implementation delays.
Given the substantial technical and economic implications of establishing rapid and ultra rapid charging infrastructure, a critical question concerns whether EV users' preference for higher power aligns with their energy needs. This paper, seeks to address this question by examining a workplace scenario widely applicable across diverse organisations to inform technical decisions on EV charging infrastructure.

<u>**Methodological approach**</u>

1. **Participants and context**

The research involved employees of a UK-based logistics company. The company operates a large fleet of 74 EVs used as employee company cars. Participants for this study were recruited on a voluntary basis through internal company communications from this fleet, ensuring informed consent. A total of 22 employees completed the initial survey, and from this group, a representative subset of 4 drivers provided a detailed travel log over a one week period, which provided the empirical foundation for actual energy consumption analysis. The geographical distribution of the participating EV drivers across the UK can be seen in Figure 1 marked with green circles, in relation to the central workplace charging infrastructure (see the red marker on Figure 1).

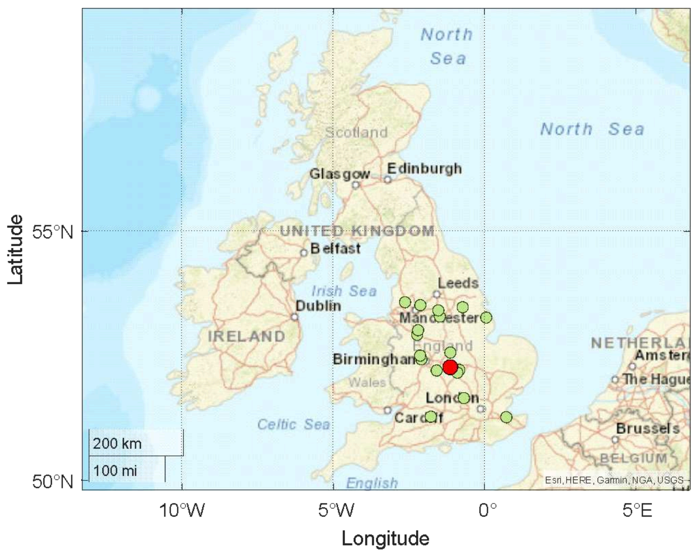


Figure 1. Parking site under study (red circle) and survey's participants geographical distribution (green circles).

The map reveals that the study participants are widely distributed across various regions of the UK. Their locations span from the North West (e.g., Rochdale, Newcastle-under-Lyme, Chorley), through the Midlands (e.g., Leicestershire, Dudley, Northampton, Warwick, Wolverhampton, Crick), to areas further south (e.g., Hemel Hempstead, Pewsey) and east (e.g., Lincolnshire, Doncaster) of the Crick site.

2. Car park and EV charging infrastructure under study

The company's operational site is in Crick, Northamptonshire (see the red marker on Figure 1) where the charging infrastructure is located. This location is strategically positioned within the UK's 'logistics golden triangle', an area renowned for its dense concentration of distribution centres and transport links. This geographical context is significant as it suggests that the operational environment and the associated travel patterns of the participating drivers may be broadly representative of other logistics companies situated in the region, enhancing the potential generalisability of the study's findings to similar scenarios across the UK.

The car park area dedicated to employee parking and EV charging spans approximately 8,000 square metres and offers around 400 parking spaces. A bird's eye view of this facility is presented in Figure 2.

Figure 2. Bird's eye view of the parking site under study.

The EV charging infrastructure at this site comprises a total of 12 installed charge points. These are strategically differentiated based on their primary user group and power output. Specifically, 10 chargers are designated exclusively for employee Battery Electric Vehicles (BEVs), while the remaining 2 chargers serve Plug-in Hybrid Electric Vehicles (PHEVs) and visitors. The EV charging infrastructure has 10 chargers providing 11kW power output and only two units providing 22kW power, dedicated for BEVs only.

3. Data collection & analysis

This study employed a pragmatic mixed-methods research design, integrating both quantitative survey data and travel log data. By combining insights into drivers' stated preferences with empirical observations of their real-world charging behaviours and energy demands, a comprehensive assessment of the alignment between perception and reality in workplace EV charging needs was undertaken.

The structured survey consisting of 25 questions was administered digitally using Qualtrics online survey platform. The survey aimed to gather insights into participants' general travel patterns, existing EV charging behaviours, and their expressed preferences for charging infrastructure. Key data points captured included their preferred charger power outputs (e.g., slow, rapid, ultra-rapid) for both workplace and on-the-road business travel scenarios.

Participants recorded a daily travel log for a continuous one-week period. For every trip undertaken, data including miles travelled, the vehicle's battery State of Charge (SoC) at the commencement and conclusion of the journey, and the duration of any associated charging sessions were logged. Furthermore, the logs documented the location of each charging event (categorised as workplace, home, or public charging) and the SoC at the start and end of all charging and parking periods.

Based on the recorded SoC changes and a nominal battery capacity of 70.2 kWh for the company's EV fleet, the actual energy consumed was calculated as follows:

Equation 1: $$Estimated\ energy\ needed\ (kWh) = Battery\ capacity\ (kWh)\frac{SoC_d - SoC_a}{100}$$

Where SoC_d and SoC_a are the SoC at departure and arrival, respectively.

To assess the alignment with workplace charging infrastructure, the estimated energy demand during typical workplace parking durations was used to determine the minimum charging power necessary for each individual driver to complete their journey. This calculation was performed using equation 2.

Equation 2: $$Required\ Power\ (kW) = \frac{Estimated\ energy\ needed\ (kWh)}{Work\ parking\ duration\ (hours)}$$

A comparative analysis was then conducted to evaluate whether drivers' stated preferences for higher-power workplace chargers (e.g., 22kW) were consistent with their empirically derived energy needs and the available charging time at work. This involved comparing the theoretical energy that a standard 7kW or 11kW, or 22kW charger could deliver within the observed parking duration against the actual energy required by the vehicle.

Results & discussion

EV charging infrastructure driver's preferences

The survey results provided clear insights into the charging power preferences of the participating EV company car drivers, differentiating between workplace and on-the-road charging scenarios.

When considering charging at their workplace (Figure 3), the majority of respondents expressed a preference for higher power outputs. Specifically, 64% of drivers indicated a preference for 22kW chargers, while 7% preferred 11kW chargers. The remaining proportion of respondents (29%) stated no specific preference, suggesting flexibility or a lack of strong opinion regarding the precise power output at this location. This strong inclination towards 22kW charging at the workplace highlights a perceived need for relatively faster top-ups even during extended static periods (such as during the 7hr working day).

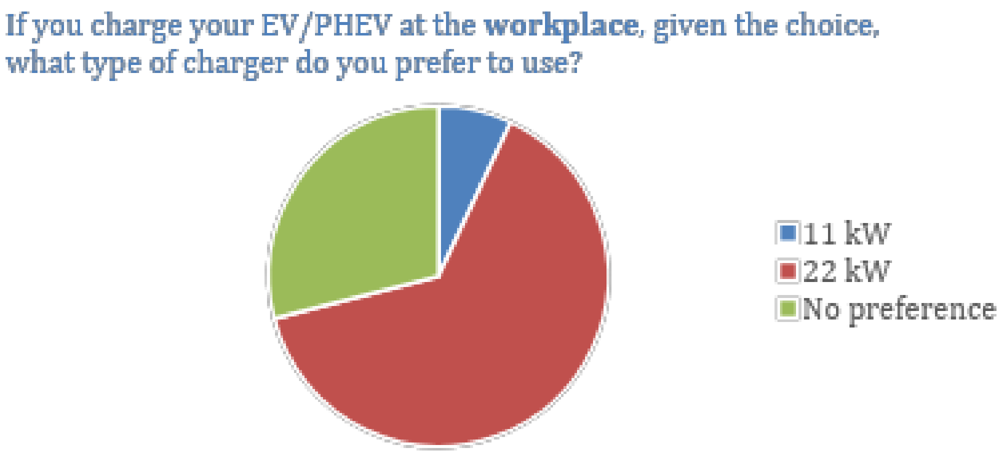


Figure 3. Charging power preferences of the participating EV drivers at the workplace site.

For charging during work-related trips (Figure 4), where time efficiency is often more critical, the preference shifted significantly towards even higher power levels. A substantial majority, 69%, expressed a preference for ultra-rapid chargers (100kW+). This was followed by 19% preferring rapid chargers (25kW-99kW), and 6% opting for fast chargers (7kW-22kW). A small remainder (6%) indicated no particular preference for on-the-road charging speeds. These results underscore a strong desire among drivers for the quickest possible charge when away from their primary charging locations, consistent with the objective of minimising downtime during essential business travel.

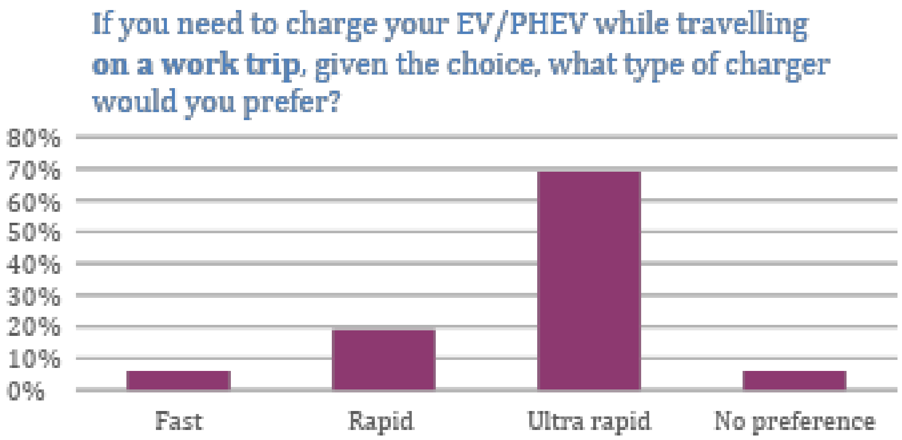
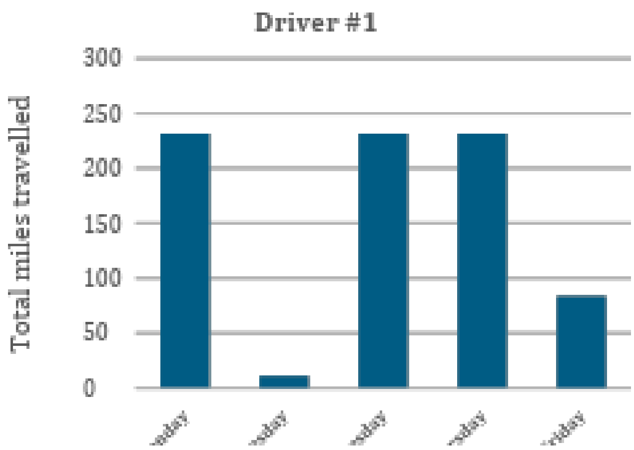
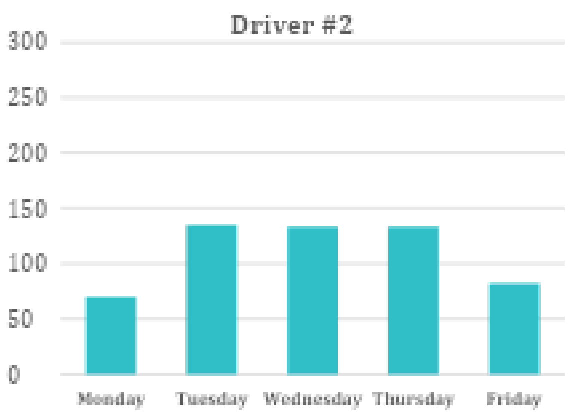


Figure 4. Charging power preferences of the participating EV drivers for en-route charging.

Travel log: energy demand

The travel log data provided empirical insights into the daily mileage and driving patterns of the participating EV drivers, which directly inform their energy demands. Figure 5a-5d illustrate the mileage profiles for four representative drivers from Monday to Friday, all of whom operate on a consistent working schedule from 09:00 until 17:00.





(a) (b)

(c) (d)

Figure 5. Travel log outcomes: daily mileage and driving patterns

Each driver, on average, travels between 60 and 160 miles per day, depending on their working schedules.

The daily mileage figures reveal variability both between drivers and within individual drivers' weekly patterns. The outcomes from Figure 5 underscore the complexity of predicting precise energy needs based only on average figures. For example, Driver #1 frequently undertakes long-distance business journeys, while Driver #2 exhibits more consistent daily usage. Understanding these driving patterns is fundamental to assessing the adequacy of workplace charging infrastructure.

Table 1 provides an overview of the energy dynamics for the four representative drivers, illustrating their average daily mileage, typical SoC upon arrival and departure from work, the duration of time parked at work, the calculated energy needed to complete their journey, the energy a 22kW charger would provide over the same duration and, the optimal standard charger power to meet the energy demand.

Table 1. Overview of the energy demands for the four representative drivers

Driver	Avg. Daily Miles	Arrive SoC (%)	Leave SoC (%)	Work Parking Duration (hours)	Est. Energy Needed (kWh)	Energy from 22kW (kWh)	Optimal Charger (kW)
#1	160	40	90	4	35.1	**88**	11
#2	110	20	100	7	56.2	**154**	11

#3	62	60	100	4	28.1	**88**	7
#4	132	40	100	8	42.1	**176**	7

The analysis presented in Table 1 reveals a significant finding: for the observed driving patterns and typical workplace parking durations, the preferred 22kW charger capacity often substantially exceeds the actual energy required by drivers. For instance, Driver #1, with an average daily mileage of 160 miles and needing approximately 35.1 kWh to reach a 90% SoC, has a required power of 8.78 kW. With a 4-hour parking duration, an 11kW charger would be optimally sufficient. For Drivers #3 and #4, with lower required power, a 7kW charger is identified as optimally sufficient for their average parking time.
These empirical results indicate that, for the typical workday charging patterns observed in this fleet of logistics company car users, the drivers' strong preference for 22kW chargers does not align with the power output needed to meet their daily energy demands. While 22kW chargers are highly capable, they appear to be over-specified for the majority of routine workplace charging events. This deviation between preference and actual requirement has important implications for infrastructure deployment. Investing predominantly in a mix of 7kW and 11kW chargers, rather than 22kW chargers, could meet the daily charging demands of the fleet. Such an approach would not only lead to significant reductions in initial capital expenditure for charging equipment and associated electrical infrastructure upgrades but could also allow for the installation of a greater number of charging points within the available grid connection capacity.

Conclusions

This study investigated the alignment between EV driver charging preferences and their actual energy demands within a logistics company's workplace setting. Our findings reveal a notable disparity: while drivers strongly prefer higher-power chargers, empirical analysis of their daily travel patterns and parking durations indicates that lower-power charging solutions, specifically 7kW and 11kW units, are often sufficient to meet their energy needs during typical work periods. This suggests that the prevailing user desire for rapid charging may lead to an over-specification of workplace infrastructure. Deploying a charging infrastructure tailored to actual energy consumption rather than solely preference offers significant benefits. It can substantially reduce initial capital investment and associated grid upgrade costs for companies installing EV charging infrastructure, while simultaneously alleviating strain on the national electricity network. The EV fleet energy demand study promotes a more efficient allocation of resources, enabling more charging points to be installed within existing grid capacity. This data-driven insight can guide logistics companies and other organisations towards more cost-effective, scalable, and sustainable EV fleet electrification strategies, ensuring operational readiness without unnecessary expenditure.

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