

Comparison of the Charging Profile of Two Cities of the United Kingdom

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Abstract

The increased usage of electric vehicles (EVs) has intensified the importance of understanding charging behaviour to optimise infrastructure and address evolving user needs. This study examines the charging profiles on campuses chargers of Newcastle University and the University of Edinburgh. This investigation identifies trends in EV charging patterns and the socio-technical factors influencing public charging station usage. The study evaluates seasonal, hourly, and weekly variations in charging behaviour, and comparative analysis highlights variations between urban and regional environments. Preliminary findings reveal differences in energy consumption and peak usage hours between the two sites, shaped by local habits, academic schedules, and policy mandates. The results will contribute to formulating evidence-based recommendations to improve charging solutions and promote sustainable mobility across various contexts.

Introduction and Motivation

Advancements in battery technology and government policies promoting sustainable transportation have accelerated EV adoption worldwide. The increase of EVs on the road has intensified the demand for accessible, reliable, and efficient charging solutions. Public charging stations must accommodate diverse user needs, including varying charging habits, vehicle types, and trip purposes. However, disparities in infrastructure availability, particularly across urban and regional areas, highlight the uneven distribution of resources [1]. Also, socio-technical factors such as charge anxiety, peak demand periods, and location-specific usage trends further complicate the planning and management of charging networks [2,3]. To address these challenges, it is essential to analyse EV charging patterns comprehensively, identify key factors influencing user behaviour, and explore the regional differences that shape infrastructure utilisation.

Applied Method

This study uses the CRISP-DM (Cross-Industry Standard Process for Data Mining) life cycle to guide the analytical workflow. As part of this approach, Exploratory Data Analysis (EDA) was conducted to identify patterns and trends in EV charging behavior, focusing on seasonal, monthly, and weekly variations, as well as usage differences across various connector types. Technical data (i.e., energy consumption, load profiles, and time-series patterns) is processed to identify seasonal, hourly, and weekly trends. A comparative analysis between on campus chargers of Newcastle University and the University of Edinburgh is conducted using statistical methods to identify key drivers of variability, such as peak usage times and energy demand.

Results

Preliminary results reveal important differences in EV charging patterns between the two university sites, with further analysis underway to investigate these trends. Figure 1.A shows the total energy consumptions by hour and figure 1.B represents the total energy consumptions by month. The University of Edinburgh shows higher energy consumption and concentrated peak usage during specific hours, reflecting its urban setting and academic schedules. In contrast, Newcastle University exhibits more distributed charging demand, influenced by regional factors and diverse user routines. Seasonal and weekly variations underline the interplay of infrastructure capacity, user behaviour, and charge anxiety. Ongoing work aims to deepen understanding of these findings, explore additional socio-technical factors, and provide comprehensive insights into the role of local habits and site-specific conditions in shaping EV charging demand and infrastructure utilisation.

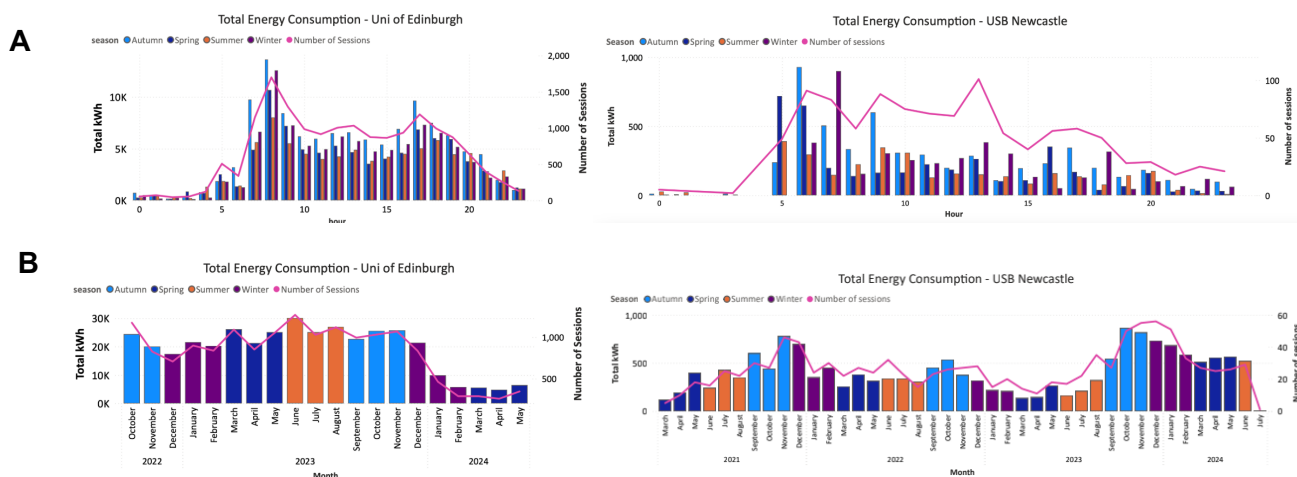


Figure 1: Total energy consumption across the two university sites by by hour (A) and month (B).

Conclusions

The rising adoption of EVs has made it essential to understand charging behaviour to optimise infrastructure and meet evolving user needs. This study compared the charging patterns of two university sites in the UK and the preliminary findings reveal significant differences in energy consumption and peak usage hours, driven by factors such as location, academic schedules, and user habits. The seasonal and weekly variations observed so far illustrate the role of local habits and infrastructure capabilities in shaping demand. Continuing efforts aim to refine these findings and provide evidence-based recommendations for improving EV charging infrastructure and supporting the growth of sustainable mobility across different contexts.

References

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