Why Place Matters for Electric Mobility: Socio-Spatial Inequalities and Justice in Vulnerable Urban Neighbourhoods

Electric mobility and Vehicle-to-Grid (V2G) technologies have become central pillars of European strategies for decarbonisation, energy system flexibility, and climate neutrality (European Environment Agency, 2025). Despite their growing policy prominence, however, patterns of adoption remain markedly uneven across space (Geels & Schot, 2007; Bridge et al., 2013). In socioeconomically vulnerable neighbourhoods, this unevenness does not stem from a single spatial condition but from diverse territorial configurations of disadvantage (Sovacool et al., 2021). These range from dense urban settings characterised by apartment-based housing, shared infrastructures, and collective decision-making, to peri-urban and low-density areas marked by dispersed housing, car dependence, infrastructural gaps, and limited institutional coordination. In both contexts, the conditions shaping electric mobility adoption diverge substantially from the assumptions embedded in dominant policy narratives centred on individual consumers, private ownership, and market-led diffusion (Chilvers & Longhurst, 2016). These disparities raise fundamental questions for regional science and urban studies regarding how energy transitions unfold unevenly across territories, and how institutional, infrastructural, and social conditions interact to shape opportunities for participation and inclusion (Bellamy et al., 2022).

Existing research on electric vehicles (EVs) and V2G has predominantly focused on technical performance, economic viability, or individual acceptance (Lopes et al., 2011; Wu et al., 2023; Chemudupaty et al., 2025). While these strands have generated important insights, they tend to underplay the territorial embeddedness of transitions and the collective nature of decision-making in contexts where infrastructures, spaces, and resources are shared (Chilvers & Longhurst, 2016). In multi-owner residential environments, adoption is not simply the outcome of individual preferences, but a negotiated process shaped by governance arrangements, institutional capacities, and power relations. When these dimensions are overlooked, electric mobility transitions risk reproducing or even intensifying existing socio-spatial inequalities (Mattioli et al., 2020).

This paper addresses this gap by examining how residents of three socioeconomically vulnerable neighbourhoods perceive EVs and V2G technologies, and how these perceptions are shaped by place-specific infrastructural conditions, governance arrangements, and broader socio-technical dynamics. To capture these interrelated processes, the analysis combines two complementary analytical lenses: the Multi-Level Perspective (MLP) on socio-technical transitions and an energy justice framework.

The Multi-Level Perspective is used as a heuristic device to analyse how transitions unfold across interconnected spatial and institutional scales (Geels, 2002). Rather than conceiving adoption as a linear or individual process, MLP distinguishes between niche-level dynamics, associated with everyday practices, lived experiences, and early experimentation; regime-level structures, encompassing dominant infrastructures, regulatory frameworks, market arrangements, and governance institutions; and landscape-level pressures, such as climate change discourses, energy price volatility, and broader societal transformations. This multi-scalar approach is particularly well suited to the analysis of socio-spatial inequality, as it allows neighbourhood-level constraints to be situated within wider institutional and structural contexts (Geels & Schot, 2007).

The energy justice framework complements this perspective by foregrounding normative questions of fairness and inclusion (McCauley et al., 2013). It enables a systematic examination of distributive justice (the allocation of costs and benefits), procedural justice (access to and quality of participation in decision-making), and recognitional justice (the extent to which diverse needs, capacities, and circumstances are acknowledged in policy design and implementation). By integrating these frameworks, the paper analyses how justice concerns emerge and interact across spatial scales, from everyday mobility practices to institutional arrangements and macro-level policy narratives.

Empirically, the study focuses on three contrasting European neighbourhoods: Aradas in Aveiro, Kanaleneiland in Utrecht, and Annelinn in Tartu. These neighbourhoods share several characteristics associated with socio-spatial vulnerability, including relatively low-income levels, lower educational attainment, and limited access to services. At the same time, they differ markedly in spatial form, national political contexts, welfare regimes, institutional arrangements, and stages of electric mobility market development. This combination allows the analysis to identify both shared mechanisms of exclusion and context-specific dynamics shaping EV and V2G uptake.

The research forms part of the V2G-QUESTS project under the Driving Urban Transitions partnership and adopts an exploratory qualitative design based on multiple comparative case studies. A comparative logic underpins the analytical strategy, enabling the identification of recurring patterns across different territorial contexts while also capturing divergences linked to regulatory frameworks, governance arrangements, and neighbourhood characteristics. This approach strengthens the robustness of the findings and enhances their analytical transferability beyond single-case explanations.

Across the three neighbourhoods, resident focus groups were conducted using a standardised and co-created methodology, complemented by pre-discussion questionnaires capturing everyday mobility practices, attitudes towards EVs, and basic socio-demographic characteristics. In Aveiro, three focus groups involved 34 participants; in Utrecht, two focus groups involved 12 participants; and in Tartu, three focus groups involved 15 participants. All sessions lasted approximately 90 minutes, were audio-recorded with informed consent, and fully transcribed using anonymised identifiers.

Focus group discussions followed a shared thematic structure to ensure comparability while allowing for context-sensitive elaboration. Core topics included perceptions of EV and V2G technologies; everyday mobility and energy practices; perceived barriers and enabling factors; and broader concerns related to trust, costs, fairness, and policy expectations. Participants were introduced to EV and V2G concepts through an accessible presentation and invited to ponder on alternative future scenarios contrasting fossil-based, EV-based, and V2G-enabled mobility systems.

Qualitative data were analysed using MAXQDA through a two-stage content analysis. An initial inductive phase allowed themes to emerge directly from participants' narratives, capturing lived experiences and locally grounded concerns. This was followed by a deductive phase in which themes were interpreted through the MLP framework, enabling a structured comparison of niche, regime, and landscape-level dynamics and their justice implications.

At the niche level, limited hands-on experience with EVs and widespread unfamiliarity with V2G generated uncertainty regarding everyday use, including charging routines, range reliability, battery degradation, and vehicle warranties. These uncertainties constrained trust, particularly in contexts where car use remains functionally important. Interest in V2G was consistently framed as conditional upon prior and successful EV adoption, underscoring the sequential nature of socio-technical transitions.

At the regime level, structural barriers emerged as the most decisive factors shaping perceived feasibility. High upfront costs, insufficient residential charging infrastructure, collective land ownership arrangements, grid capacity constraints, and complex decision-making processes involving housing associations and municipalities substantially reduced perceived accessibility. These barriers were compounded by opaque governance processes and uncertainty regarding costs, responsibilities, compensation mechanisms, and data governance, giving rise to significant procedural and distributive justice concerns.

At the landscape level, broader societal trends, such as heightened climate awareness and rising energy prices, fostered a general openness towards electric mobility. However, this openness was consistently mediated by justice considerations. Participants emphasised that transitions perceived as unfair, inaccessible, or imposed without meaningful participation would struggle to gain legitimacy and public support.

Synthesising across cases, the findings show that EV and V2G adoption in vulnerable neighbourhoods is shaped by the interaction of place-based infrastructures, governance arrangements, and justice concerns across scales. As a final remark, electric mobility transitions cannot be adequately understood through techno-economic or behavioural lenses alone. Instead, they require territorially sensitive policy approaches that recognise neighbourhoods as critical sites where global decarbonisation goals intersect with everyday practices, institutional capacities, and local power relations. In doing so, the study contributes to debates on socio-spatial inequality, polarisation, and just transitions, offering empirically grounded insights for designing electric mobility policies that are not only low-carbon, but also socially embedded and spatially equitable.

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