

Governing the V2G Transition: participatory insights for smart and sustainable urban mobility

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Keywords: citizens' perceptions, electric vehicle, mobility transition, participatory methods, vehicle-to-grid

Abstract Urban mobility systems are central to achieving climate neutrality and energy resilience. Electric vehicles (EVs) and Vehicle-to-Grid (V2G) technology represent key enablers of this transition, allowing cities to reduce greenhouse gas emissions while supporting flexible energy management. However, large-scale adoption depends on societal acceptance and governance frameworks that ensure inclusivity.

This study explores citizens' perceptions, needs, and expectations regarding EVs and V2G in Aradas, a peri-urban district in Aveiro, Portugal. A participatory mixed-methods approach was employed: (i) a questionnaire (n=32) assessing mobility habits and familiarity with EVs/V2G; (ii) three focus groups (n=34) to capture concerns and social acceptability; and (iii) scenario-based discussions exploring three alternative mobility futures, from continued fossil fuel dependency to full integration of smart energy systems.

Findings reveal a strong reliance on private vehicles (97%) and internal combustion engines (94%), despite short daily travel distances (<5 km). Awareness of V2G is minimal (76% had never heard of it), yet attitudes became positive after deliberation, with perceived benefits in energy efficiency and cost savings. Participants identified current conditions as a mix of "fossil fuel dependency" and "early electrification" (Scenarios 1 and 2), and anticipated a future combining transition challenges with elements of an intelligent energy system (Scenarios 2 and 3). Key concerns include battery degradation, infrastructure gaps, and regulatory uncertainty, but willingness to adopt V2G was expressed under clear technical, financial, and legal guarantees.

The results underscore the need for adaptive governance and phased planning, supported by locally tailored engagement strategies that combine technological innovation with social readiness. Inclusive adoption of V2G requires policy frameworks that build trust, anticipate socio-territorial inequalities, and align infrastructure planning with citizens' expectations, turning smart mobility into a lever for just and sustainable energy transitions.