OPTIMIZATION OF EV FLEET CHARGING STATION PLACEMENT WITH MATSIM

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Abstract: To increase the adoption of electric vehicles, an effective charging infrastructure is required, which also increases the future-peak power demands. In this paper, energy system-implications of an algorithm designed to minimize the walking distance from activity locations to charging stations are analysed, together with changes in charging accessibility parameters like walking distances and charging events, while the spatial and temporal energy demand with the accessibility driven-optimization across the Hamburg districts is investigated. So, in this study, mainly electric vehicles charging station placement is optimized by minimizing the average walking distance (in meters) between activity locations and charging stations in the Hamburg districts.

For this study, 2030 charging demand with 2024 public charging locations of Hamburg city are used, and its GTFS data have been utilized to simulate electric vehicle (EV) charging behavior across urban charging infrastructure using an agent-based transport simulation (MATSim)-based framework to model agent behavior and charging demand. Energy-related metrics, such as district peak loads, temporal demand profiles, and activity-based charging patterns in the Hamburg districts are calculated for accessibility-driven EV charging optimization. A spatial-temporal perspective on the energy impacts of accessibility-driven EV charging optimization is given by this study through the combination of district-wide energy demand, hourly peak loads, and activity-based charging behavior.

To create sustainable urban EV infrastructure, the significance of combining user-centric accessibility optimization with an integral energy system perspective is highlighted by these new findings. With analysing energy demand and peak loads with accessibility based-optimization, insights can be derived, that can support grid-charging infrastructure planning and identification of districts where and when local grid stress may occur.

Keywords: charging infrastructure, EV charging behavior, agent-based transport simulation (MATSim), user-centric accessibility optimization, grid-charging infrastructure planning.

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