

# **Assessment of the impact of a fully electrified postal fleet for urban freight transportation**

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## **Abstract-**

The progressive electrification of urban distribution fleets, motivated by the consolidation of electric vehicle technology and by the mobility advantages that cities grant to non-polluting vehicles, poses future challenges that affect electrical distribution networks. This paper simulates the main last mile distribution models that can be adopted in a mega-city such as Madrid. In particular, the impact of carrying out the full load of the last mile distribution by means of electric vehicles is analyzed. Two fundamental aspects are studied, the efficiency of the different routes developed by each transport vehicle and the impact that these routes have in the electrical distribution network. For this purpose, an intelligent route planner, capable of optimizing the distribution of the load among the number of vehicles available in each postal service hub (PSH), is combined with a Reference Network Model that designs and expands the distribution network to supply consumers and electric vehicles. Several scenarios in terms of location and segmentation of postal service hubs are analyzed. From this analysis, it is concluded that reinforcements on the distribution network are avoided if the operation is decentralized (using fourteen PSHs), since a centralized operation (a single PSH) would require longer routes with higher energy consumption. Moreover, decentralized operation would enhance de emissions reduction achieved by electrifying the fleet, since the estimated absolute emissions of the electrified fleet for a decentralized scenario are up to 50% lower compared to a centralized one. Finally, the results reveal that smart charging strategies also contribute to lessen the incremental costs in the distribution network, in addition to significantly reducing the cost of energy supply.

**Index Terms-** Electric vehicle charging, power distribution networks, vehicle routing problem, last mile distribution

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**Citation:**

*Martínez, M.; Moreno, A.; Angulo, I.; Mateo, C.; Masegosa, A.D.; Perallos, A.; Frías, P.; "Assessment of the impact of a fully electrified postal fleet for urban freight transportation", International Journal of Electrical Power & Energy Systems. December, 2021.*