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Environmental impacts of electric vehicle deployment in Copenhagen for 2016-2030

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The current transport sector is an important contributor to multiple environmental impacts, such as climate change and resource depletion. Recent technological advancements seek to provide more environmentally sustainable urban mobility. Life cycle assessment (LCA) is a widely used tool that quantifies the potential environmental impacts of systems in a life cycle perspective, and it can be applied to transport systems to ensure that these developments reduce the impact on the environment. In that dynamic, we conducted an LCA of the passenger fleet of Copenhagen between 2016 and 2030, and tested different scenarios of electric vehicles (EVs) deployment at urban scale over that time scope. Five different types of powertrains with characteristics corresponding to the actual vehicles in Copenhagen were modelled and compared, before being integrated in four fleet-based scenarios describing the evolution of the entire passenger fleet during 15 years. The major components of the transport system, i.e. the vehicles, the charging infrastructures and the electricity and fuel support systems, were differentiated in time. At the vehicle-level, fuel-cell EVs appear to have the lowest environmental impacts in ten categories, and the highest only in ozone depletion. Range-extended EVs emerge as a promising transition technology on the way to full electrification. At fleet-level, the charging infrastructures have a limited contribution to the total impacts compared to the vehicles and the energy systems. The four scenarios assessed present different ranking in the 15 impacts categories that were considered, but one of the scenarios promoting disruptive technological advances related to fuel cells EV, stand out as the most environmental-friendly option. Even though these results are only applicable to Copenhagen, they support the recommendation that technology developers and decision-makers should push the development and deployment of fuel-cell and range-extended EVs. Overall, this case study has illustrated which useful insights can be gained from applying LCA in the field of transportation, and we recommend its use in the assessment of new transport policies at urban and regional scales to ensure the actual reduction of environmental impacts and avoid burden-shifting from one environmental impact to another.