Electrification of Light-Duty Vehicle Fleet Alone will not Meet Mitigation Targets

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Summary

Mitigating greenhouse gas (GHG) emissions from passenger vehicles will be necessary to maintain global warming below 2 °C. In my PhD, I develop methods to estimate the life cycle GHG emission implications of mitigation strategies and to outline mitigation pathways under ambitious climate targets at national and urban scales.

Abstract

Climate change mitigation strategies are often technology-oriented, and electric vehicles (EVs) are a good example of a believed silver bullet. In this study, published in Nature Climate Change [1], we use the Fleet Life cycle Assessment and Material-flow Estimation (FLAME) model, develop by the authors in a previous study [2], to quantify the prospective life cycle GHG emissions and material flow of the U.S. light-duty vehicle (LDV) fleet. Then, we estimate suitable GHG emission budget for the U.S. LDV fleet to maintain global warming below 2 °C using intergated assessment models. Finally, we outline the deployment pathways for EVs in the U.S. to remain within the budgets and compare them with existing goals and targets.

We show that current U.S. policies are insufficient to remain within a sectoral GHG emission budget for LDVs, creating a mitigation gap of up to 19 gigatonnes CO_2 (28% of the projected 2015-2050 LDV fleet emissions). Closing the mitigation gap by betting solely on EVs would require more than 350 million on-road EVs (89% of the fleet) in 2050, higher than the most optimistic deployment targets. More importantly, this level of deployment could imply an additional half of national electricity demand in 2050, and excessive amounts of critical materials (e.g., cobalt, lithium, mangaense). Improving average fuel consumption of conventional vehicles, with stringent standards and weight control, would reduce the requirement for alternative technologies, but is unlikely to fully bridge the mitigation gap. There is therefore a need for a wide range of policies that include measures to reduce vehicle ownership and usage.

References

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