The limited impact electro mobility will have on reaching climate change mitigation targets

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Abstract

The transport sector has been identified as a key barrier to decarbonisation based on the high costs of substituting energy-dense liquid fossil fuels. A potential solution is in the transition to electro-mobility, and more specifically to Electric Vehicles (Heidrich et al., 2017). Previous research has demonstrated that EVs offer the potential for large scale carbon reduction in the transport sector. The belief that EVs can deliver high carbon reductions requires better underpinning of detailed national or regional studies that are informed both by empirical and conceptual detail (Creutzig et al., 2015).

It is generally believed that large reductions in road transport carbon emissions are urgently needed to meet global and national targets as specified in the Paris Agreement and the UK's own carbon budget (Miotti et al., 2016). A shift in road transport from the Internal Combustion Engine (ICE) to Electric Vehicles (EVs) promises significant reductions in emitted CO2. However, the transition to a low carbon mode of transport will not be instantaneous and any policy or technological change implemented now will take years to have the desired effect. Within this paper we show how on-road emission factors of EVs and models of embedded CO2 in the vehicle production may be combined with statistics for vehicle uptake/replacement to forecast future transport emissions (Hill et al., 2019).

We demonstrate that EVs, when compared to an efficient ICE, provides few benefits in terms of CO2 mitigation until 2030. However, between 2030 and 2050, predicted carbon savings under the different EV uptake and decarbonisation scenarios begin to diverge with large carbon savings seen for the accelerated EV uptake. This work shows that simply focussing on on-road emissions is insufficient to model the future CO2 impact of transport. Instead a full life-cycle calculation must be combined with an EV uptake model. Using this extended model, our scenarios show how the lack of difference between a Business as Usual and accelerated EV uptake scenario can be explained by the time-lag in cause and effect between policy changes and the desired change in the vehicle fleet.

Our work reveals that current UK policy is unlikely to achieve the desired reduction in transport-based CO2 by 2030. If embedded CO2 is included as part of the transport emissions sector, then all possible UK EV scenarios will miss the reduction target for 2050. This result highlights that whilst EVs offer an important contribution to decarbonisation it is necessary to look at other transport mitigation strategies, such as modal shift to public transit, car sharing and demand management, to achieve both near-term and long-term mitigation targets.

We conclude that whilst EVs will not provide a solution for near-term CO2 mitigation, it will be possible to achieve the short term carbon reduction goals through demand-side solutions, rather than simply focussing on the supply side solutions implied by electric vehicles. Whilst the majority of change in on-road CO2 emissions (for light duty passenger vehicles especially) has come from technological improvements, demand side solutions to either reduce travel demand or induce a modal shift hold promise, often also for quality of life. Demand side solutions of this nature can be implemented alongside the technological solutions and will provide a multiplier effect that will not be dependent on possible future technologies.

References

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