

Two scenarios – one for 100% BEVs, one for some PHEVs with Alt fuels (Biofuels and eFuels).

Need for strong price (and tax) signal to consumers to ensure that PHEVs run largely on electricity.

Need for strong price (and tax) signal to fuel producers to ensure fast ramp up of Alt Fuels, especially eFuels.

Avoid hydrogen for transport. Would need new fuel cell vehicles (FCEVs) and hydrogen production and fuelling infrastructure. FCEVs would use PEM fuel cells for fast startup. These need Platinum Group Metals which are very scarce and expensive.

The UK is a small country with a high population density, so expanding the charging infrastructure should be relatively easy. However, Alt Fuels will be needed for aviation and marine, so some could be supplied for HDVs – road and off-road – during the transition (up to 2050). A diminishing amount could be supplied for existing ICE LDVs, especially low-mileage users,

The Government's primary concern should be meeting the zero by 2050 climate target, while ensuring the supply of Food and Shelter (including heating). The necessary transport associated with these is small – e.g. 10% of present. Most public transport (train, tram, bus) is already or easily electrified. Much other transport is optional, especially with (office) working from home. So some GHG reduction should be achieved by modal switching to electric modes and reduced road transport volumes.

P 18. Ethanol blend to 25% seems too high for existing engines. Also, ethanol production has low energy efficiency, with large energy requirement for distillation/de-hydration. So bio-wastes may be better used to produce drop-in gasoline - as at the Altalto plant in Immingham.

P 21. With a carbon target of zero by 2050, the three possible measures for LDVs are 1) Ramping up of batteries for BEVs, 2) Ramping up of eFuels for PHEVs and 3) Reduced transport volumes.

Complimentary to all three would be encouragement of lighter, smaller vehicles by highly progressive taxation of larger, heavier vehicles. This would help with the Net Revenue Loss.

As reduced transport volumes is one of the measures, investment in infrastructure such as roads, rail and runways should be reduced in favour of batteries and eFuels. Also, all aviation and marine transport should pay fuel tax and carbon tax. Domestic transport should pay at a uniform rate, and overseas transport at a similar rate. This too would help with the Net Revenue Loss.

P 25. For PHEVs to run largely on electricity, the charging infrastructure must be almost as extensive as for 100% BEVs. So including PHEVs from 2035 to 2050 would imply little reduction in the charging infrastructure required.

P 27. I do not agree with the claim that the PHEV scenario has a lower cumulative cost up to 2040. They say that the ZEV 2035 scenario is lower in total social costs by 2050. So this is no basis for a decision between these two scenarios. Also, persisting with PHEVs beyond 2035 blunts the message and could result in lower ambition for BEVs by vehicle makers and buyers.

P 29. 'However including the electricity consumption for efuel may result in higher overall electricity demand for the Alternative scenario'. In fact, the electricity consumption for efuel would be around eight times as high as that for charging BEVs. The Well-to-tank efficiency is only about half, and the Tank-to-Wheel efficiency is only about a quarter. So expect to phase out PHEVs after 2035 to reduce need for Alt Fuels, as this pathway is much less energy efficient than BEVs.

P 43. Improvement of the battery pack energy density from 148 Wh/kg in 2020 to ~600 Wh/kg in 2050 needs justifying. Where is the evidence – references ?

I suggest allowing PHEVs with Alt Fuels as well as BEVs to reduce risk up to 2035. The relative uptakes and usages could be adjusted via taxation over the period. This could then be reviewed for 2035 to 2050 in the light of much better information. This aligns with the position in the I.Mech.E. document.