

FUTURE TRENDS ON THE COSTS AND BENEFITS OF ELECTRIC, HYBRID AND CONVENTIONAL VEHICLES IN EUROPE

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ABSTRACT

The European Commission Transport White Paper “Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system” envisages that by 2050 only electric vehicles would circulate in cities, being the use of conventionally-fuelled vehicles halved by 2030. One of the policy objectives is to reduce Europe’s dependence on imported oil and to cut greenhouse gas emission (GHG) from transport by 20% by 2030 and by 70% until 2050 (with respect to 2008 levels).

Drawing upon future scenarios set by the European Commission and the International Energy Agency, this paper investigates the costs and benefits of electric, hybrid and conventional vehicles in Europe until 2030. A top-down approach will make it able to analyse further the Portuguese case, given trends in regional mobility patterns (including car fleet and price of energy scenarios). Other key research issue is to find out the horizon when electric vehicles can offer the highest potential to reduce carbon related emissions from transport.

The data comprises an integrated set of energy and transport data collected for Europe and Portugal, as part of the research project COST-TRENDS project funded by the Portuguese Foundation for Science and Technology.

A Life-Cycle Assessment (LCA) analysis was performed to compare the costs and benefits of Battery-powered Electric Vehicles (BEVs), Plug-in-Hybrid Electric Vehicles (PHEVs), Hybrid Electric Vehicles (HEVs) and Internal Combustion Engine Vehicles – diesel and gasoline (ICEVs), taking the perspective of the user. The analysis considered the emissions along the entire chain of production and usage of vehicles – the Well-to-Wheel (WtW) analysis, comprising the Well-to-Thank (WtT) and the Tank-to-Wheel (TtW) emissions, allowing for the energy grid trend scenarios regarding the mix of electricity production and incorporation of renewables (range of gCO₂/kWh).

The results show that users’ benefits related to BEVs are likely to be higher than those attached to ICEVs after the 2020 horizon. This is mainly due to the expected technology progress (reduction of battery costs and charging infrastructure) and to the decrease of the relative prices of electricity in comparison to prices of fossil fuels. Considering the LCA analysis conducted for the Portuguese vehicle fleet, BEVs would emit 43 gCO₂/km against 151 from ICEVs. Assuming the continuous replacement of older ICEVs by BEVs between 2010 and 2030, it will be possible to have a reduction of 11.8 GtonCO₂/year in 2010 to 9.8 GtonCO₂/year in 2030.

The integration of BEVs in the vehicle fleet is a key policy measure to comply with the European transport policy objectives to achieve a low-carbon and competitive economy. The analysis of future trends on users’ costs and benefits for all vehicle types (BEVs, PHEVs, HEVs and ICEVs) indicates that the highest potential to reduce GHG emissions from transport would occur only after 2020. Besides technology progress on cost reduction (battery and charging infrastructure), electricity prices and fuel taxation seem to be important drivers for the BEV market growth.

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