ELECTRIC VS. CONVENTIONAL CARS: IMPACT OF OIL PRICES

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Overview

Currently, our mobility is almost completely dependent on fossil fuels. The transport sector is second largest emitter of the greenhouse gas emissions (GHG) in the EU. The largest amount of increasing energy consumption in this sector is caused mostly by passenger car transport due to increasing car ownership level as well as car size and vehicle kilometer driven. Due to pressing environmental and other problems interest in alternative, more environmental friendly automotive technologies has been growing in the last decades. Currently, in EU-countries a wide portfolio of monetary and non-monetary measures is implemented with the goal to increase the attractiveness of electric vehicles. The most important challenge is to make EVs technically and economically competitive with conventional internal combustion engine vehicles powered by gasoline or diesel.

The core objective of this paper is to analyse the economic performance of different types of EVs (hybrid electric vehicles, plug-in hybrid electric vehicles (PHEV), range extender (REX) and pure battery electric vehicles (BEV)) depending on the level of fossil fuel prices as well as vehicle's investment cost reductions due to technological learning.

This paper builds mostly on analyses conducred by Ajanovic (2015), Ajanovic and Haas (2015), Profe et al (2013) and Weiss et al (2012).

The paper is organised as follows: After the introduction the second section gives a brief overview about the current situation in the passenger car transport. The third section focuses on development of electric vehicles as well as corresponding supporting policies and measures implemented. In section four we describe the conducted economic assessments and scenarios, and present our results. In the final section major conclusions are derived.

Methods

The future developments of the fuel prices and vehicle's costs are one of the most crucial aspects for the acceptance of EVs. Of the special interest is the development of battery technology as well as the reduction of their costs. To be able to compare EVs with conventional cars the total costs of mobility (incl. costs of vehicles, operation and maintenance costs, and energy/fuel costs) in per kilometre driven are calculated.
In addition we have derived scenarios showing the impact of different (high and low) fossil fuel prices as well as impact of technological learning.

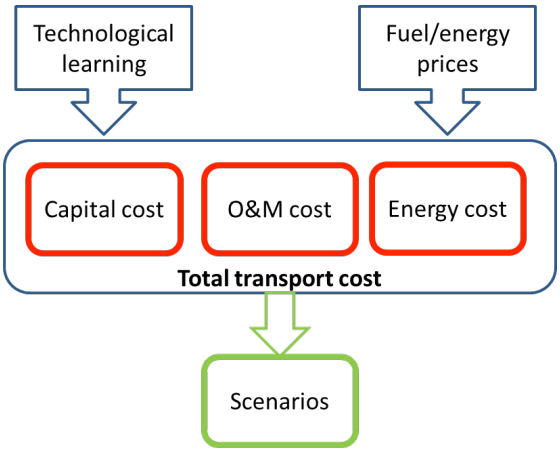

Fig.1 Method of approach

Results

Although interest in and need for more environmentally friendly automotive technologies are increasing, the market penetration of these vehicles is still very slow. The major reasons are: (i) high costs, (ii) limited driving range, and (iii) limited availability of infrastructure.

In the next years the attractiveness of EVs will remain highly dependent on the availability of supporting policy measures, and especially on the development of battery costs. Since the largest part of total transport costs are capital costs of special interest is the achievement of technological learning potentials. Changes in fuel prices (energy costs) have a relatively low impact on the total costs.
The current cost structure of different types of EVs depending on primary energy sources used for electricity generation, and conventional ICE vehicles powered by gasoline and diesel are depicted in Fig.2. It can clearly be seen that the by far largest share of the ownership costs of all vehicles are the investment costs.

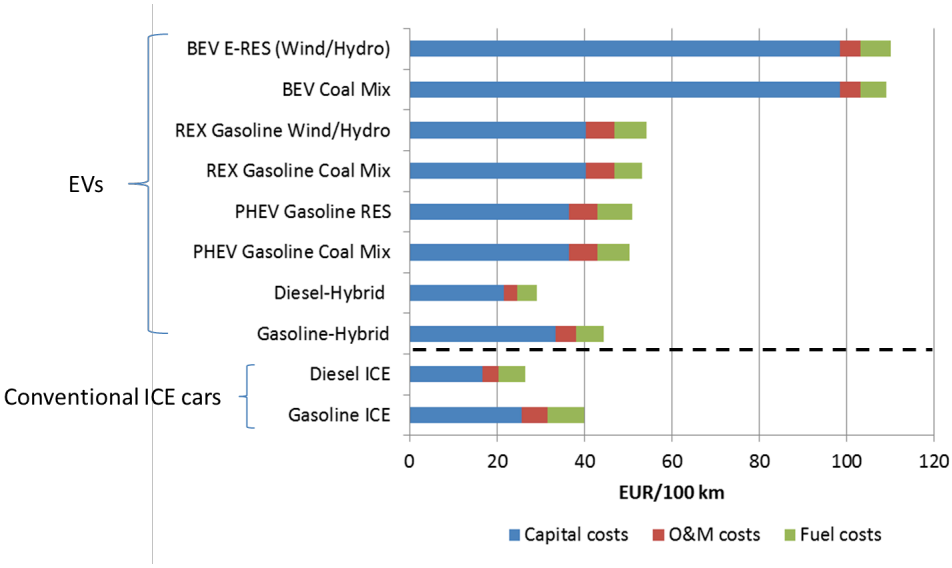

Fig. 2 Current cost structure of mobility: EVs vs. conventional cars

However, lower fossil fuel prices could lead to the increasing travel activity with conventional cars and consequently to increasing GHG emissions. As a consequence, more rigorous policies must be implemented (e.g. wide use of zero-emission zones, CO_2 based tax system, etc.) which should make environmental friendly technologies more attractive.

Conclusions

Despite significant improvements of conventional cars the decrease of their average fuel intensity is very moderate. For a more substantial reduction of GHG emissions from transport sector a broad portfolio of policies and technologies is needed. Two aspects are important:
(i) With respect to the impact of fuel prices it is important to notice that fuel prices have very small share in the overall costs. For the largest part of the total costs the investment costs are responsible. Hence, all currently available alternative automotive solutions need further research and development as well as significant reductions in investment costs due to technological learning.
(ii) Another important aspect is that the policies and measures for the promotion of EVs currently implemented focus in the first line on the dissemination of EVs and not on the real environmental benefits related to their use. It is of core relevance that promotion strategies are in the relation to the total environmental advantages of vehicles used. This issue must be included in future policy design.

References

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