

ON THE ENVIRONMENTAL BENIGNITY OF ELECTRIC VEHICLES

Amela AJANOVIC¹, Reinhard HAAS¹

Introduction

The environmental problems related to the use of fossil fuels in the transport sector such as greenhouse gas (GHG) emissions and air pollution are becoming more and more visible. In the EU-28 transport accounts for about 25% of total GHG emissions which were continuously increasing over the last decades (EU, 2014). These developments are the major reason for the growing interest in electrification of mobility.

However, the current share of electric vehicles (EV) in total car stock is still low – about 0.09% in 2013. The most important barriers for a faster market penetration of EVs are technological characteristics (especially operating range and battery weight) and their still very high investment costs. To increase market penetration in recent years EVs have been promoted in many countries by financial and non-financial incentives. All these incentives could increase attractiveness and number of EVs. However, this will not directly lead to the significant GHG emission reduction in all countries. From a lifecycle CO₂ perspective, total emissions are highly dependent on the primary energy sources – e.g. coal, natural gas or renewable energy from wind, hydro or photovoltaics (PV) – used for electricity generation which is finally used in EVs.

Objective and method of approach

The core objective of this paper is to show whether and under which conditions various types of electric vehicles are really environmentally benign alternatives to conventional cars as well as to identify how emission savings depend on the source of electricity used. In addition, environmental effectiveness of policies in different countries is analysed. The method of approach used for the environmental assessment of GHG emissions is shown in Figure 1.

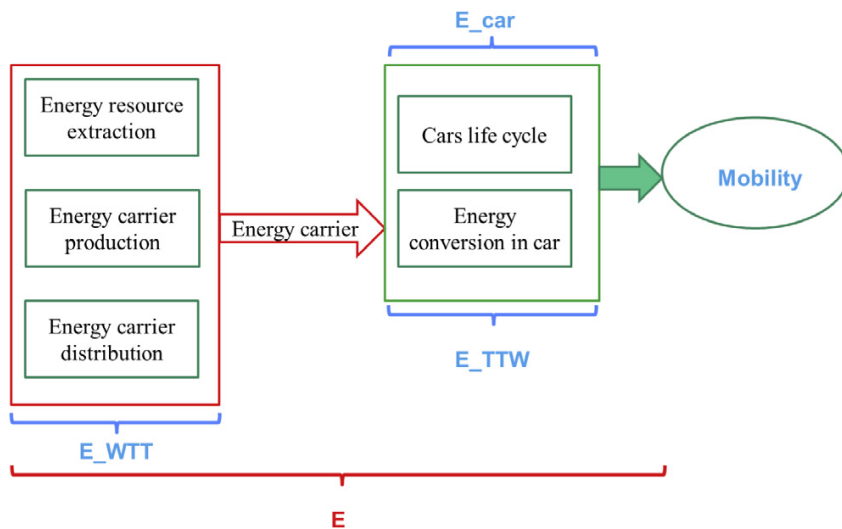


Figure 1: Method of approach for the environmental assessment of GHG emissions (adapted from Ajanovic et al. (2013)).

¹ Technische Universität Wien, Energy Economics Group, Gußhausstraße 25, 1040 Wien, www.eeg.tuwien.ac.at, {Tel.+ 43 1 58801 370364, ajanovic@eeg.tuwien.ac.at}, {Tel.+ 43 1 58801 370303, haas@eeg.tuwien.ac.at}

Results

The major results and conclusions are:

- All types of EVs can contribute to a reduction of GHG emissions compared to conventional cars with the exemption of EVs powered by electricity generated purely from old coal power plants, see Figure 2.
- The full environmental benefits of EVs could be achieved in the case of battery electric vehicles (BEV) and fuel cell vehicles (FCV) using solely electricity from renewable energy sources.
- Currently, policies implemented could increase the number of EVs but they cannot ensure significant reduction of GHG emissions. Yet, for a continuous and environmentally friendly support of EVs promotion strategies has to depend on the carbon content of the electricity used in cars.

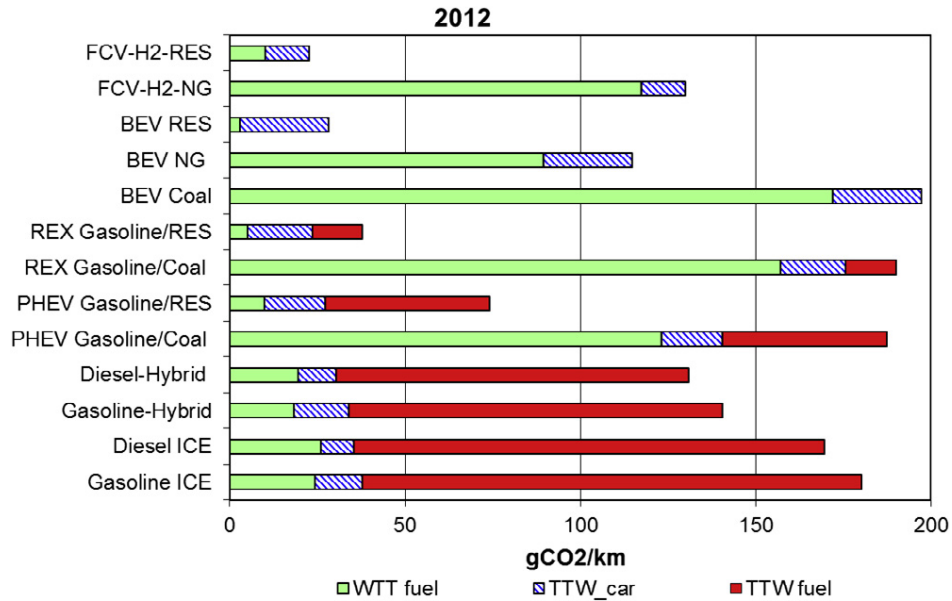


Figure 2: CO₂ emissions per km driven in 2012 for various types of EV in comparison to conventional cars (power of car: 80 kW).

References

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- [2] Ajanovic, A., Jungmeier, G., Beermann, M., Haas, R., 2013. Driving on renewables – on the prospects of alternative fuels up to 2050 from an energetic point-of-view in EU countries. J. Energy Resour. Technol. 135 (3), 031201. <http://dx.doi.org/10.1115/1.4023919>.