Electric vehicles: An energetic, ecological and economic assessment

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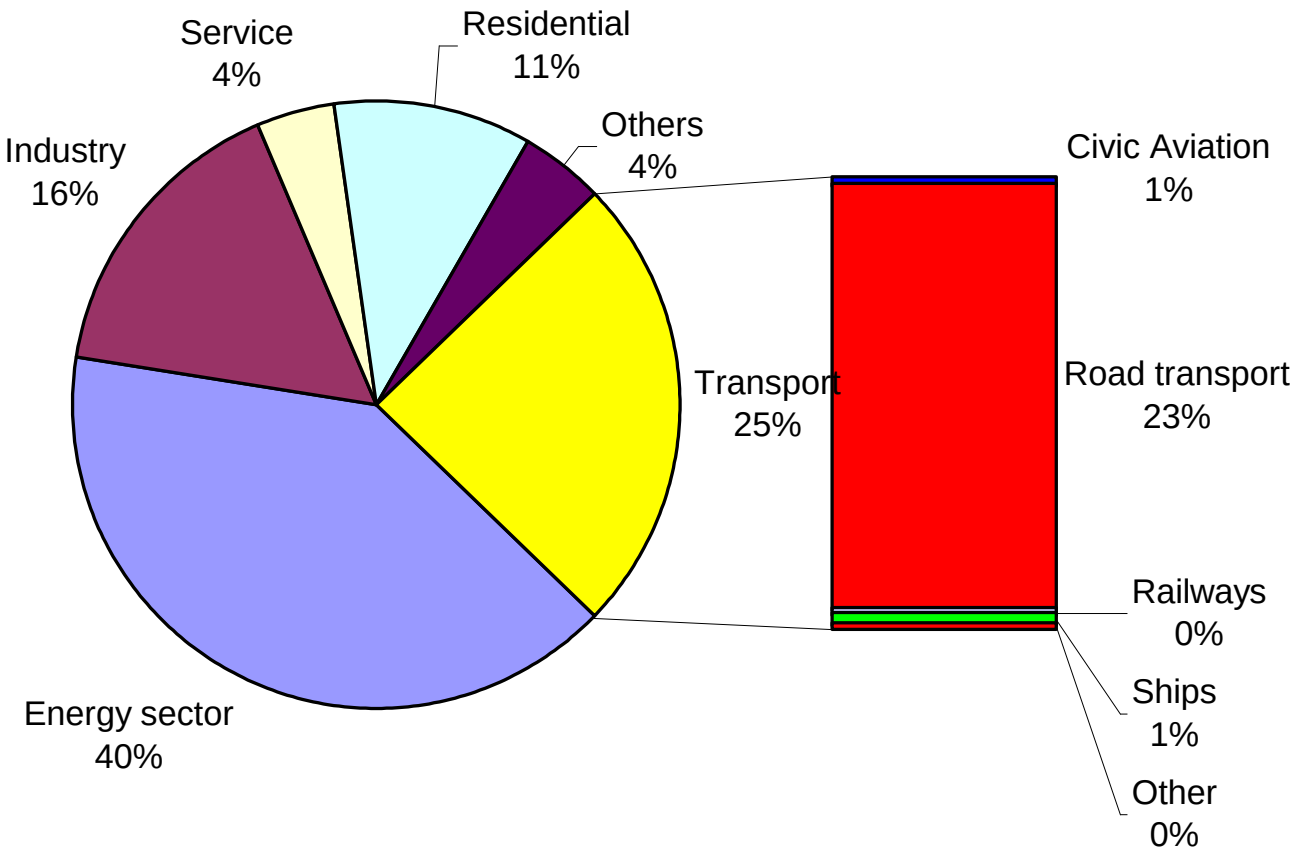
Introduction

GREENHOUSE GAS EMISSIONS EU-27

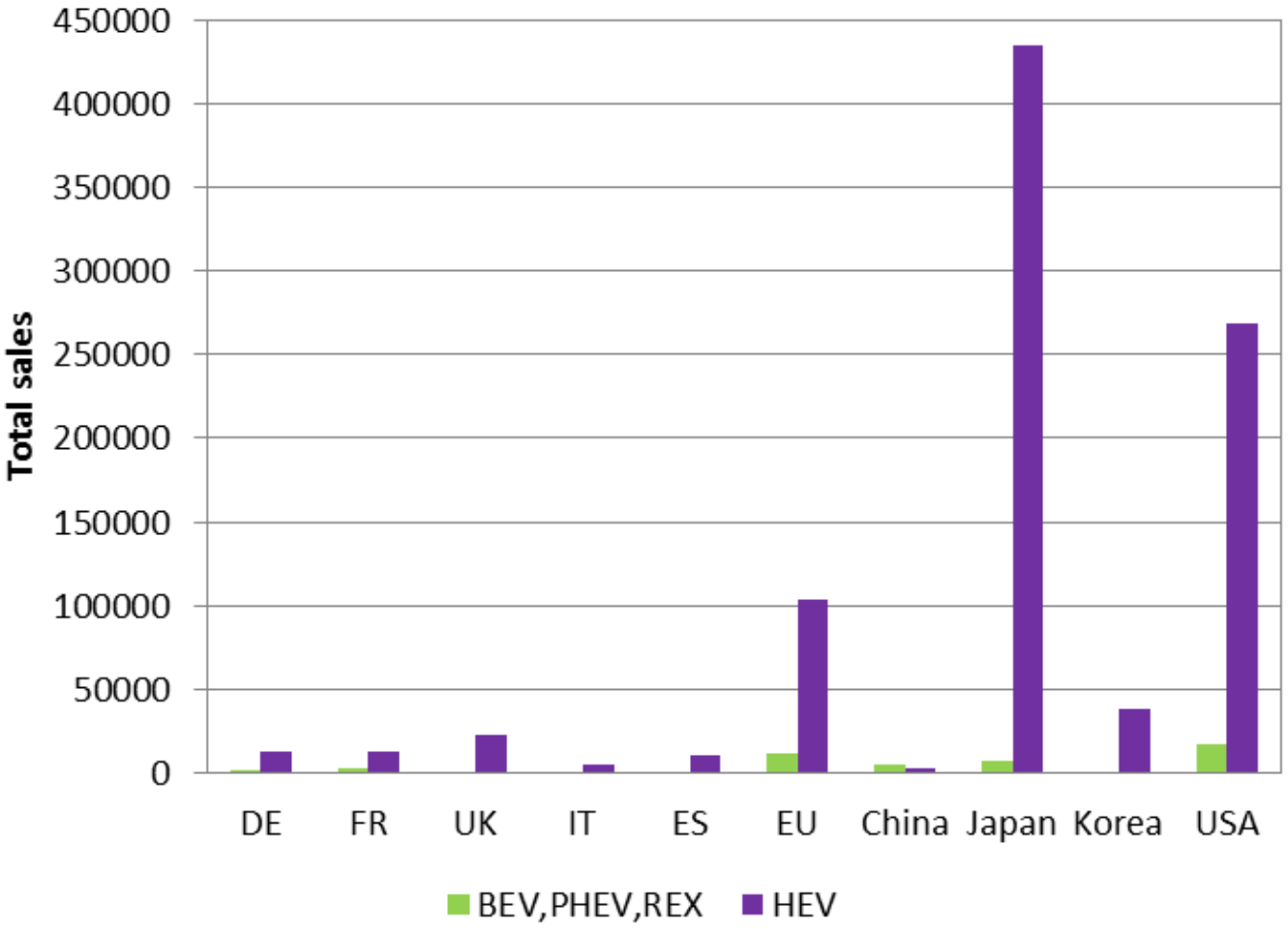


Introduction

Different types of electric vehicles:

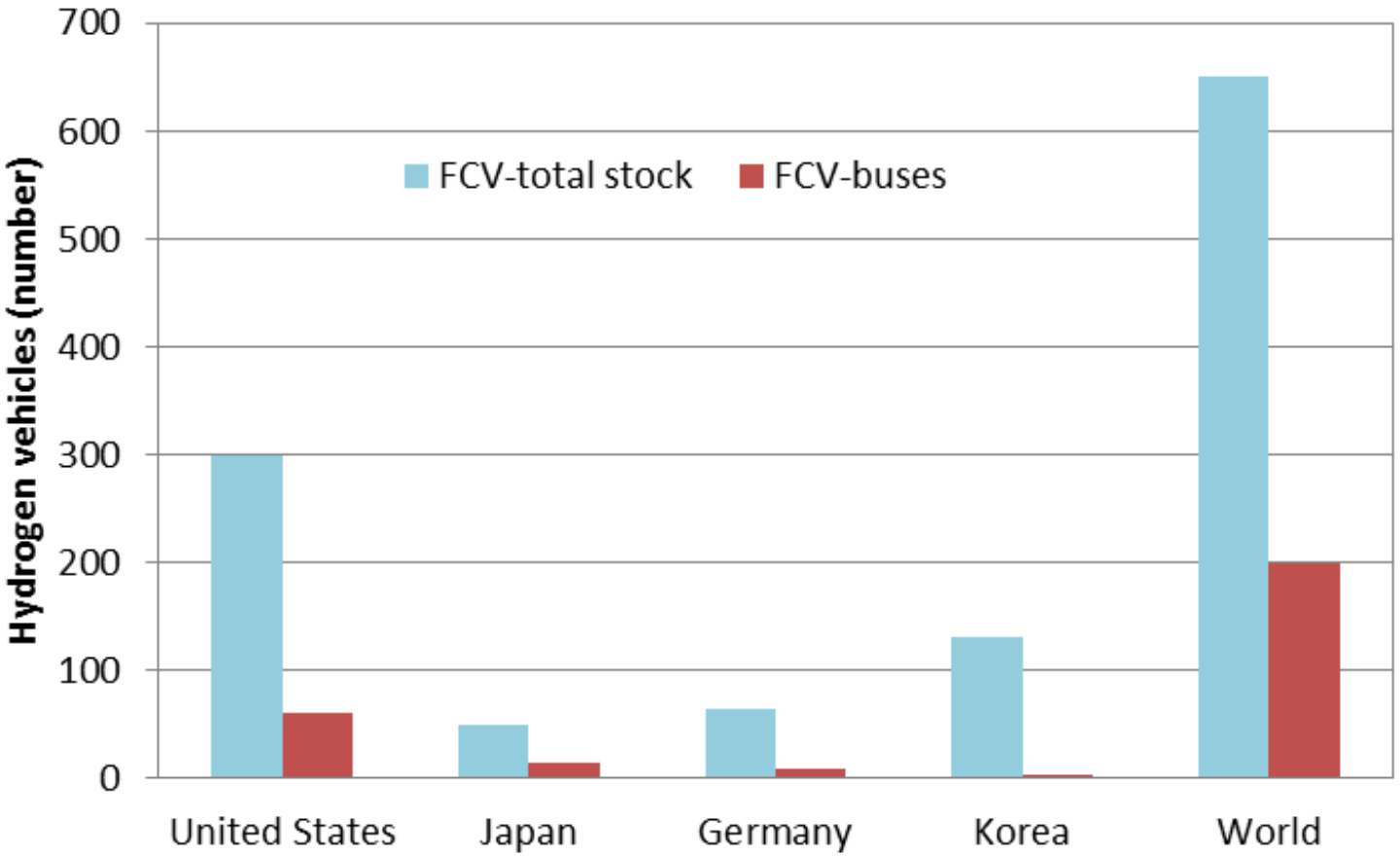
- Full battery electric vehicles (BEV): these vehicles have only an electric engine
- Hybrid electric vehicles (HEV): it is an ICE vehicles with an electric engine (battery is charged by regenerated energy during braking)
- Plug-in-hybrid electric vehicles (PHEV): these vehicles have an ICE and an electric engine (battery can be charged externally)
- Range extender vehicles (REX): these vehicles have a full size electric engine and a small ICE which can be used to charge battery. Battery can be also charged on the grid.
- Fuel cell vehicles (FCV): these vehicles have a fuel cell and an electric engine. Battery is charged by energy from hydrogen.

Introduction



Sales of electric vehicles in 2011(only Japan in 2010)

Introduction



Total stock of hydrogen FCV in today's leading countries and worldwide

Introduction

The main reasons for the slow introduction of electric vehicles:

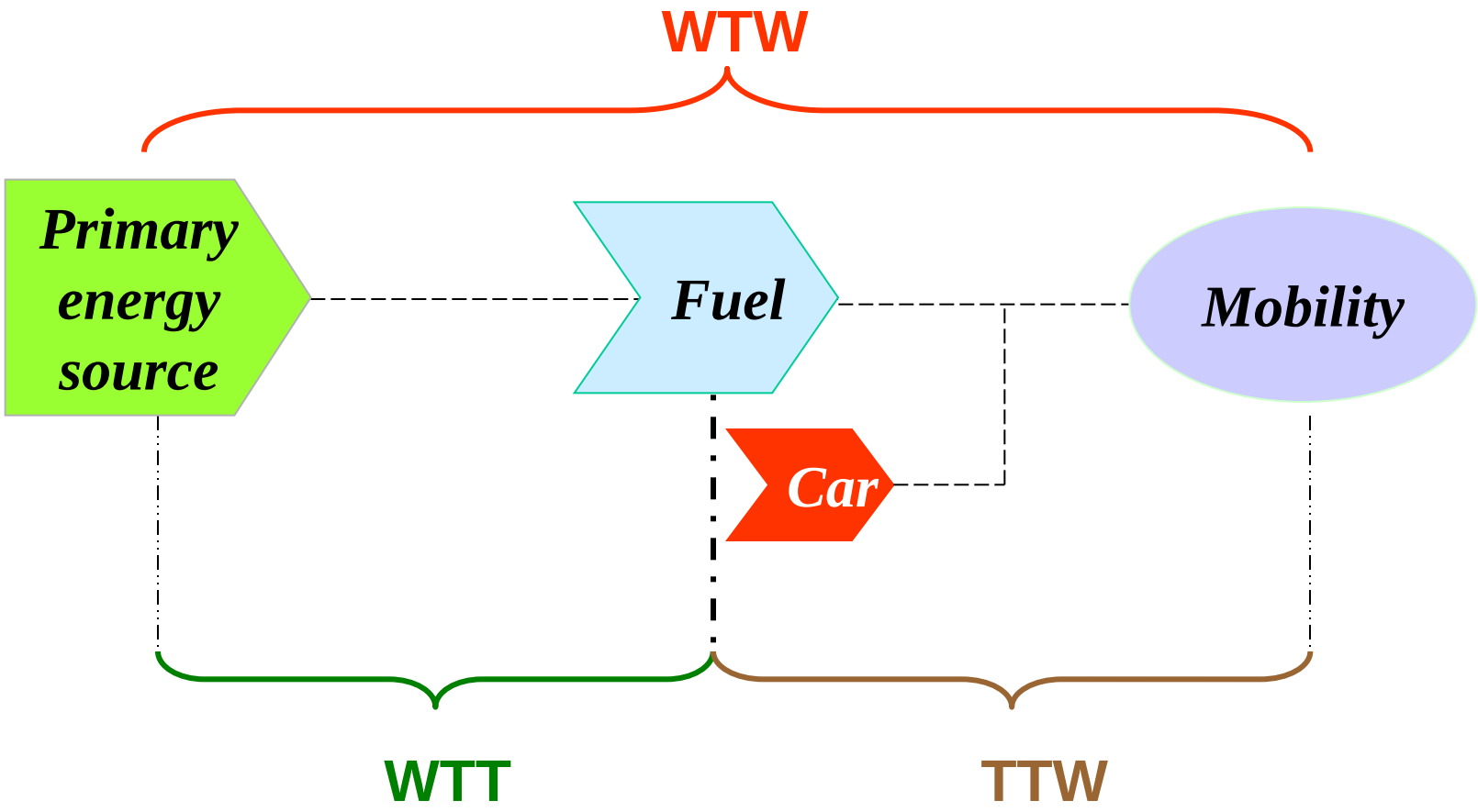
- Costs – the costs of the battery will remain one of the main obstacles to the adoption of the electric vehicles

- Charging infrastructure – existing charging network is very limited. Charging points installed in homes are relatively inexpensive (ca. 200 EUR) but slow. More rapid charging requires an investment of several thousand euros. Additional problem is missing harmonization of standards.

- Consumer acceptance

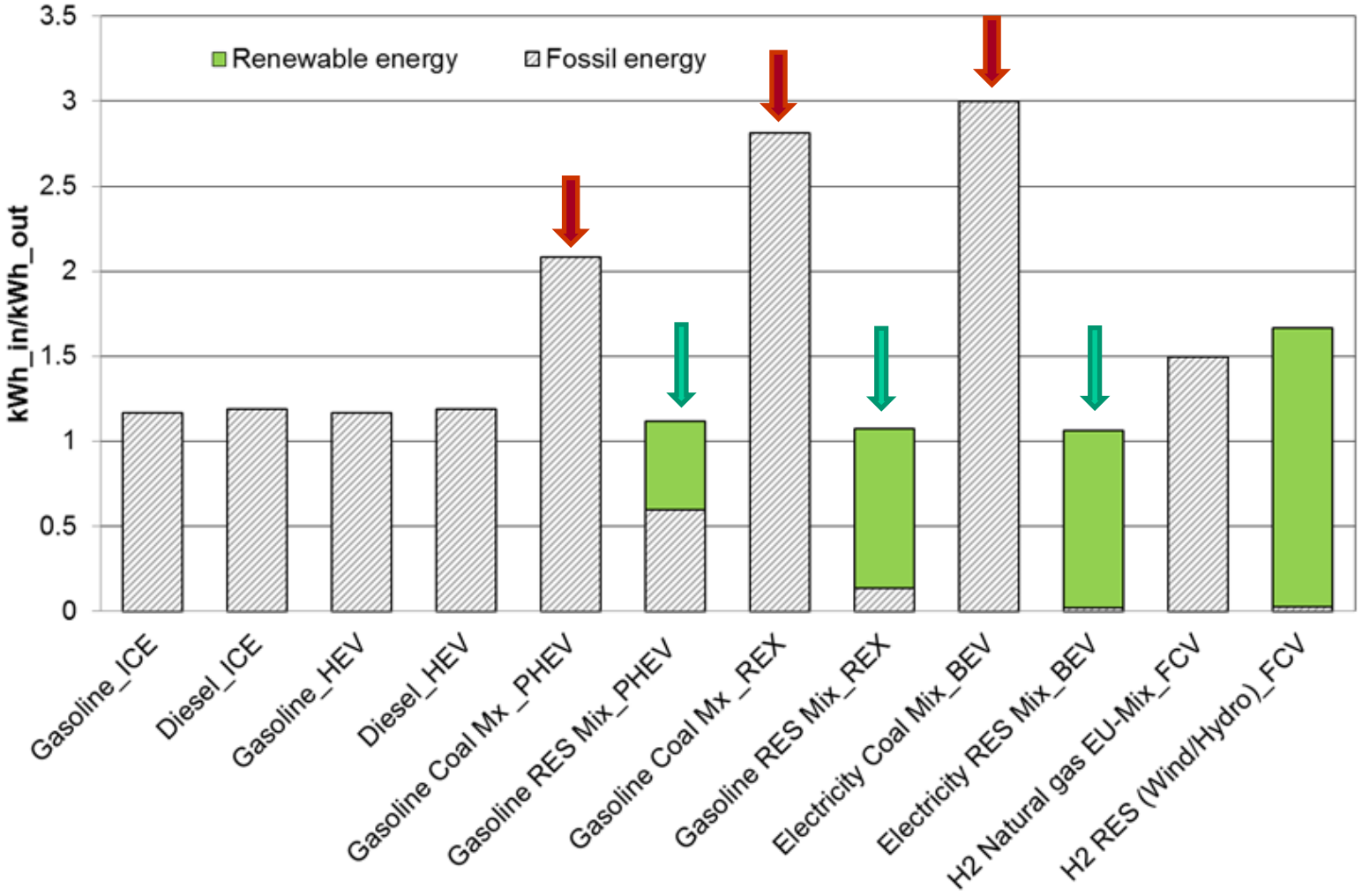
- The evolution of other technologies

Method of approach



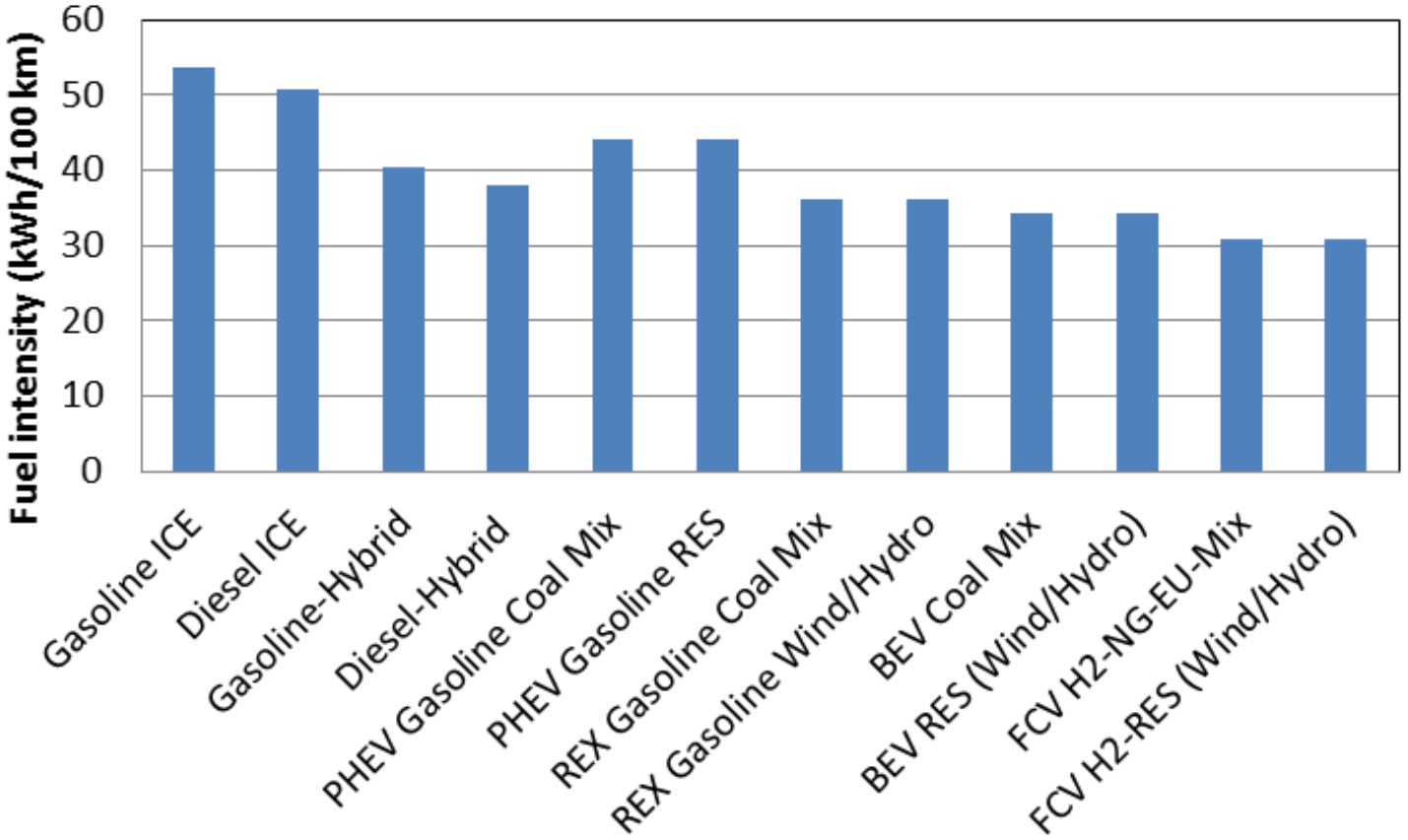
Energy service providing chain

Energetic performance



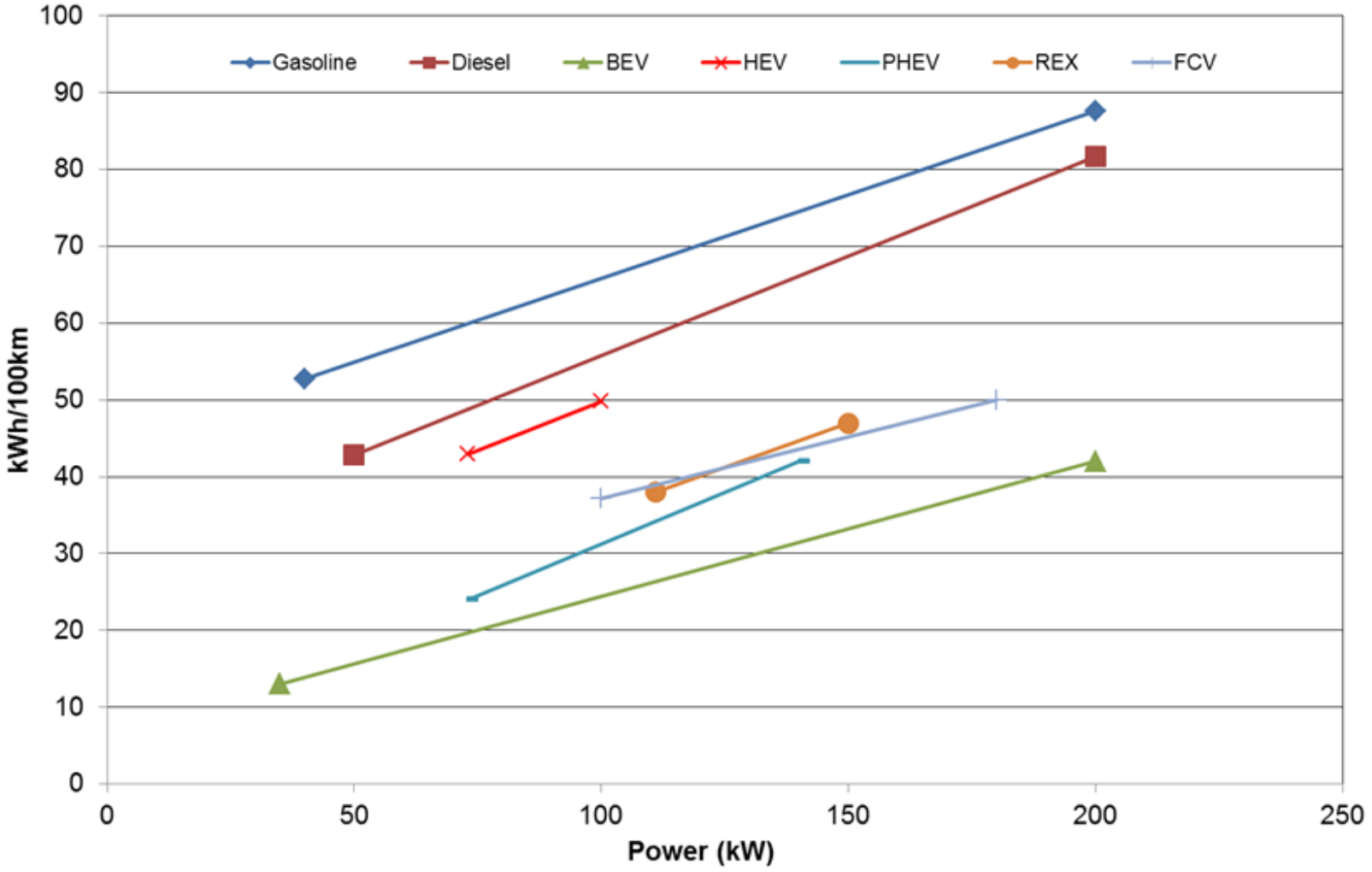
Energetic WTT-performance of various types of fuels for EVs in comparison to gasoline and diesel cars (2010)

Energetic performance



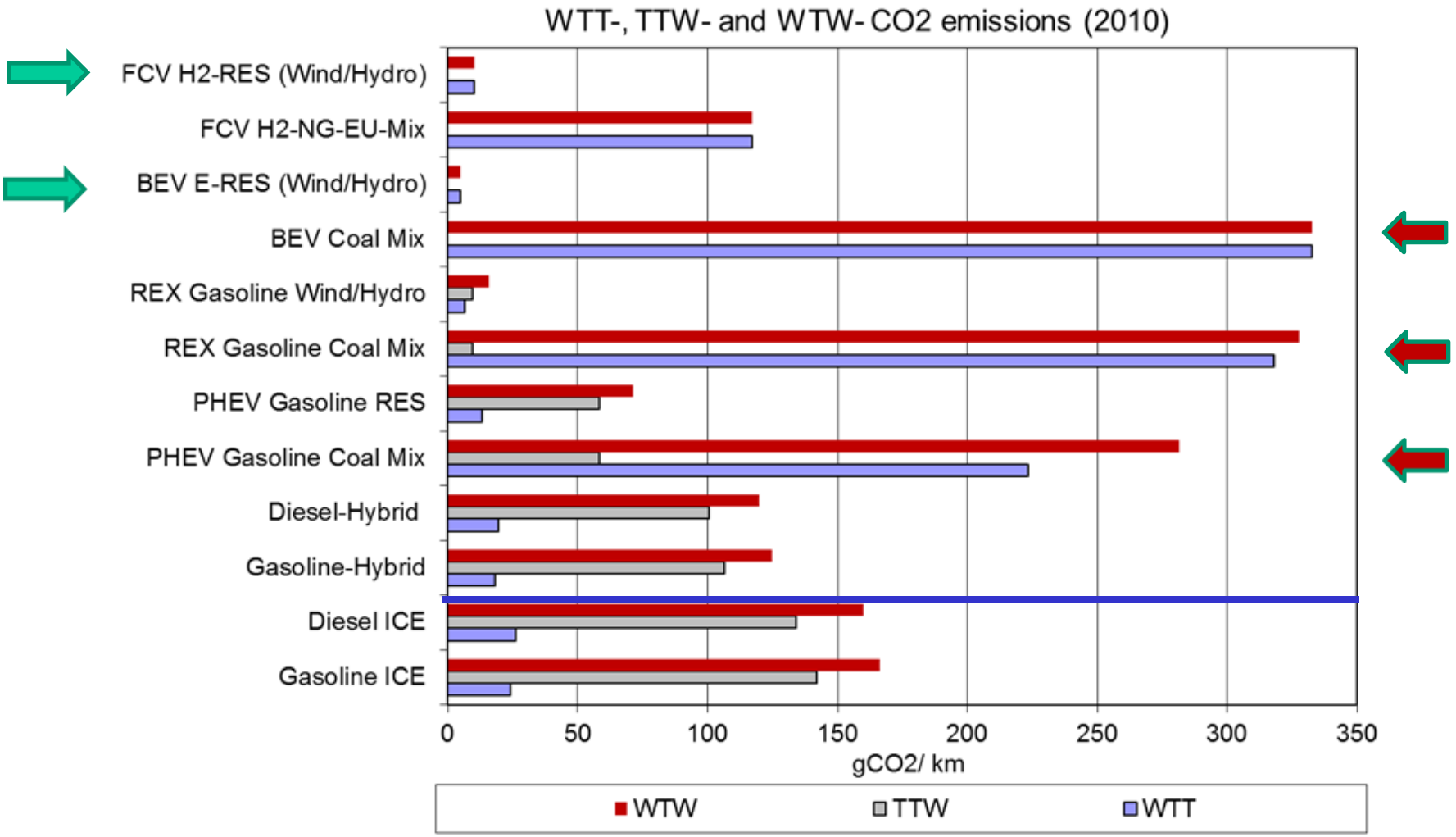
Fuel intensity per 100 km driven for various types of EV in comparison to gasoline and diesel cars (Power of car: 80 kW)

Energetic performance



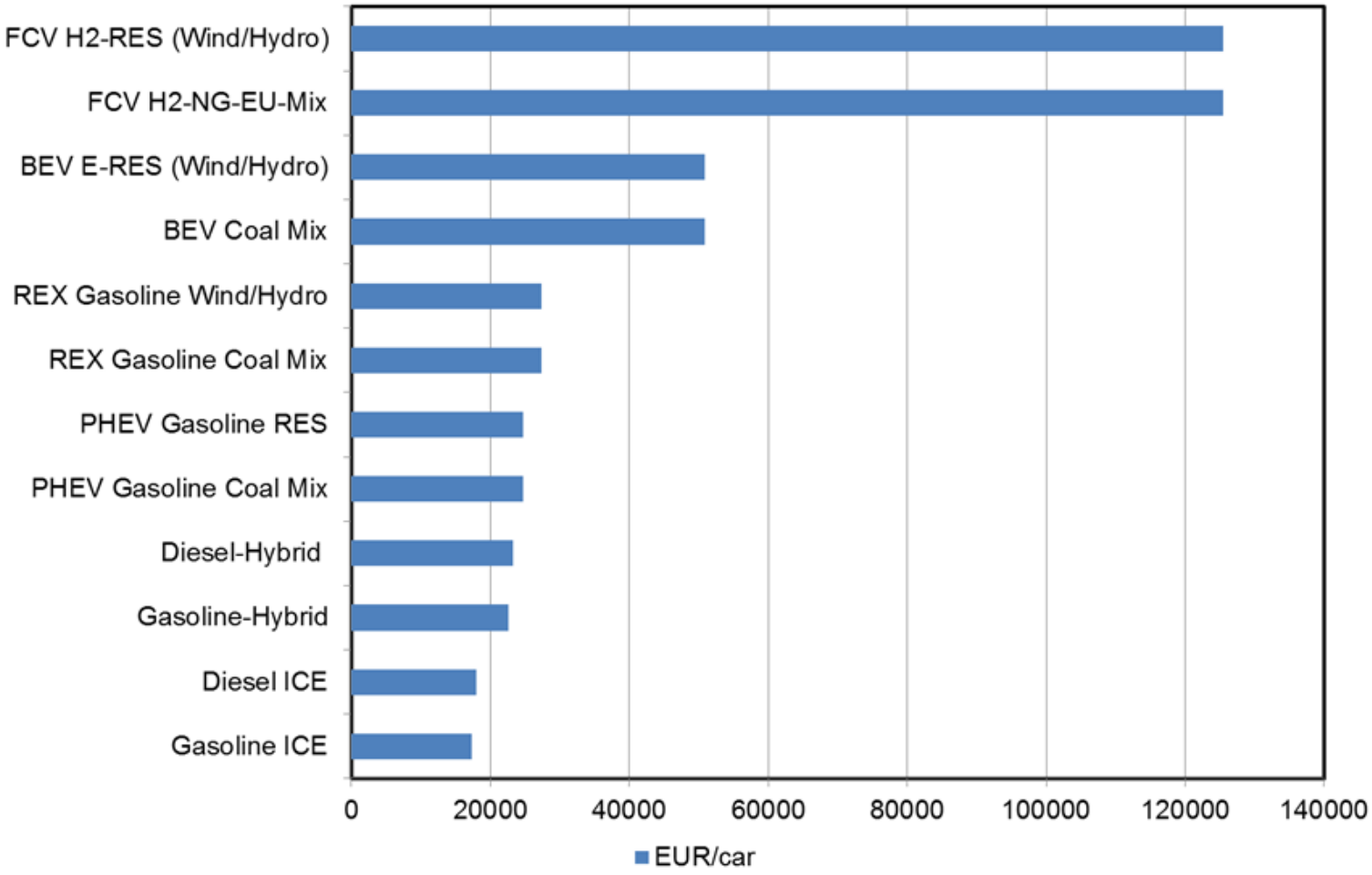
Energy use per 100 km for various types of EV in comparison to gasoline and diesel cars depending on power of car (2010 – 2012)

Ecological assessment



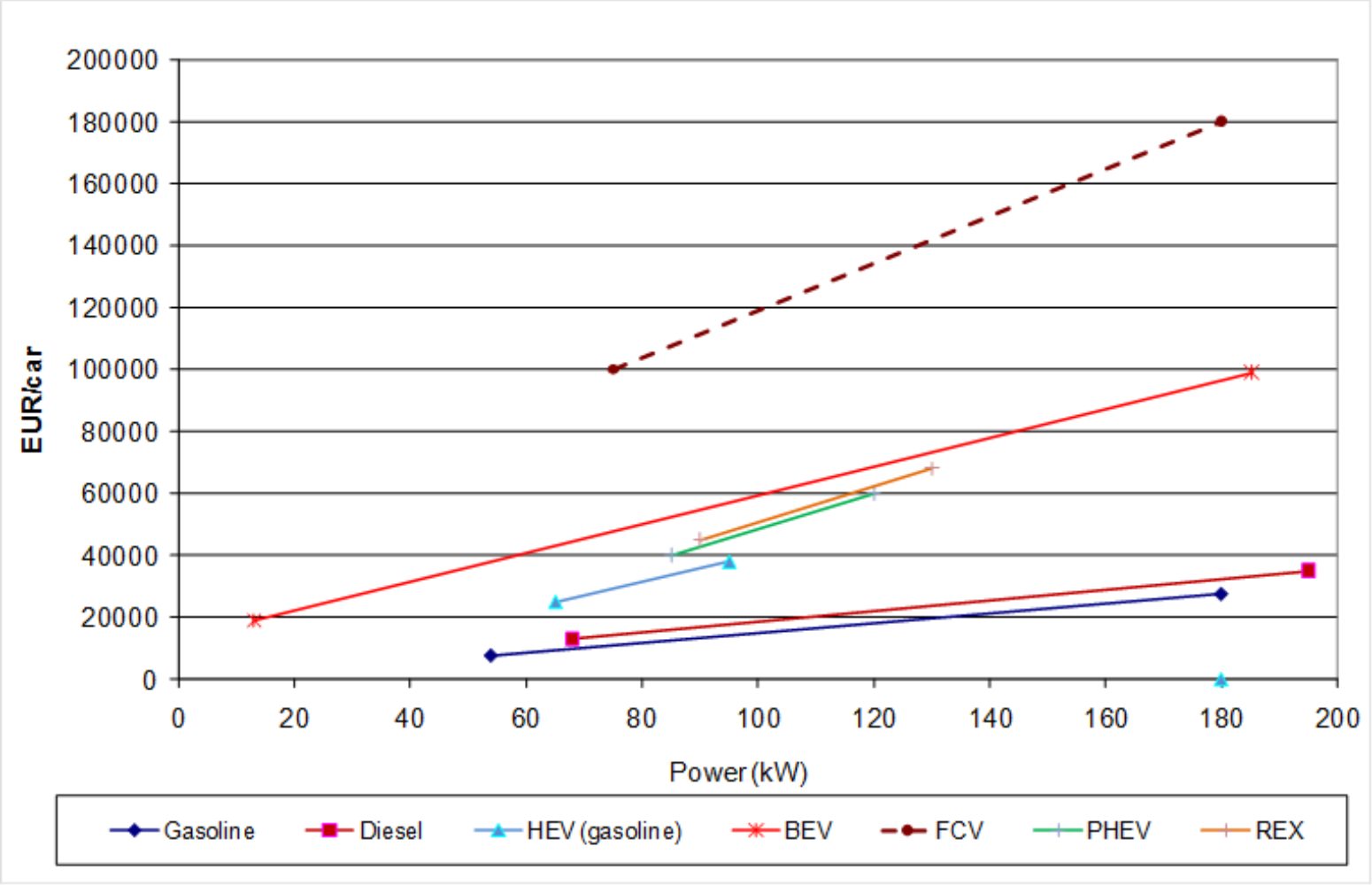
WTW-balance of CO2-emissions per 100 km driven for various types of EV in comparison to gasoline and diesel cars (Power of car: 80 kW)

Economic assessment



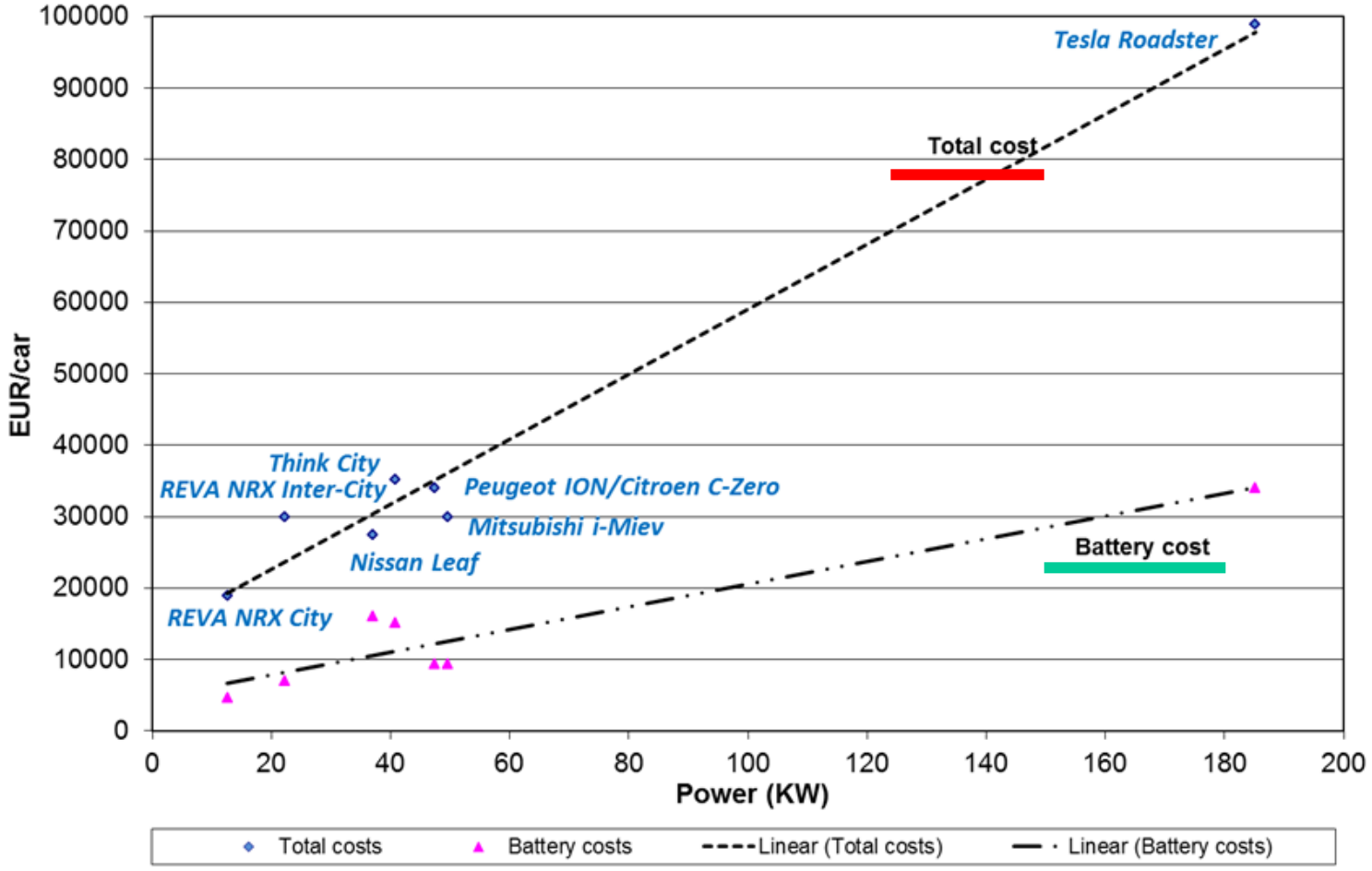
Investment costs of various types of fuels for EV in comparison to gasoline and diesel cars in 2012 (Power: 80 kW)

Economic assessment



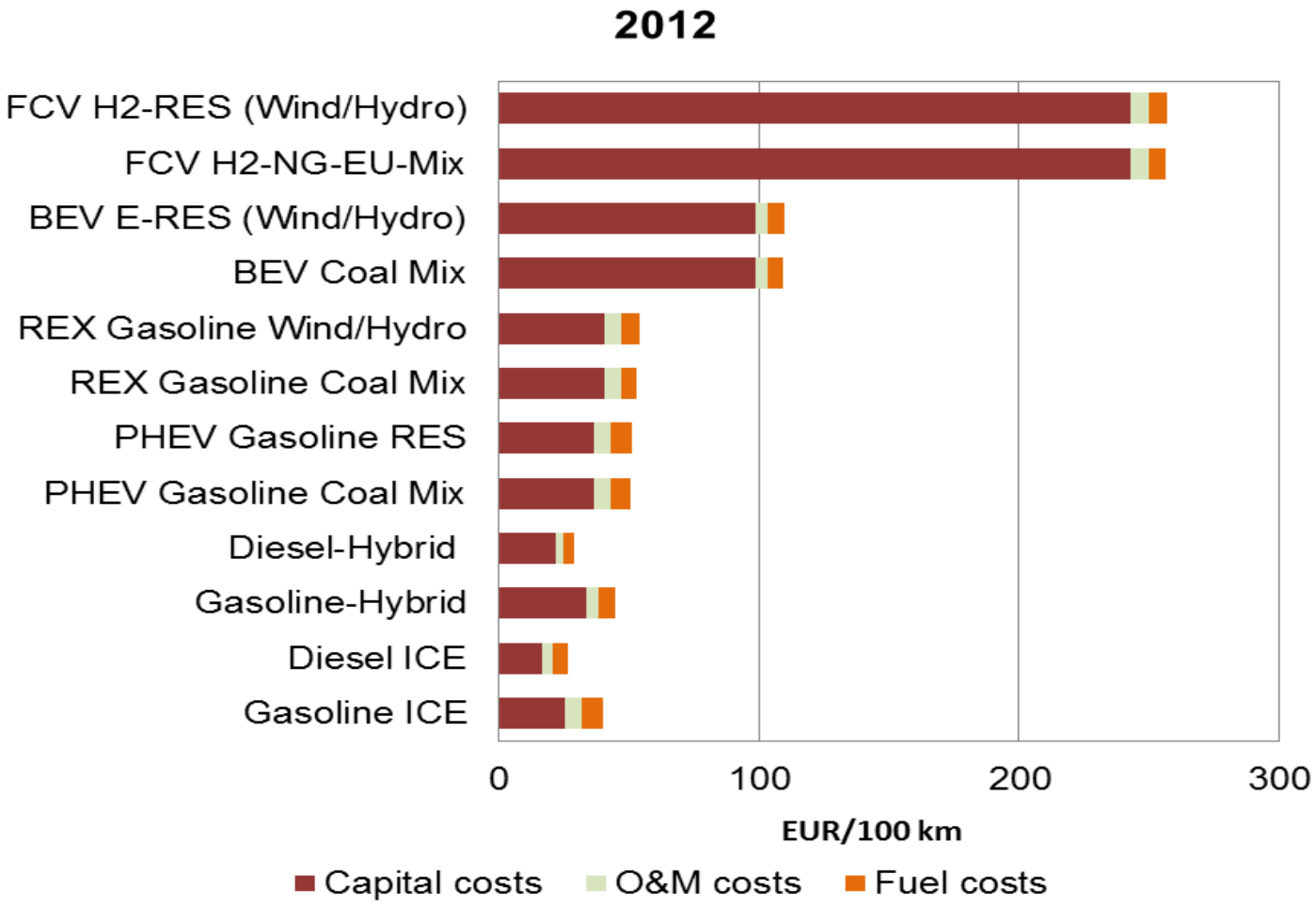
Investment costs of EV in comparison to gasoline and diesel cars depending on power of car

Economic assessment



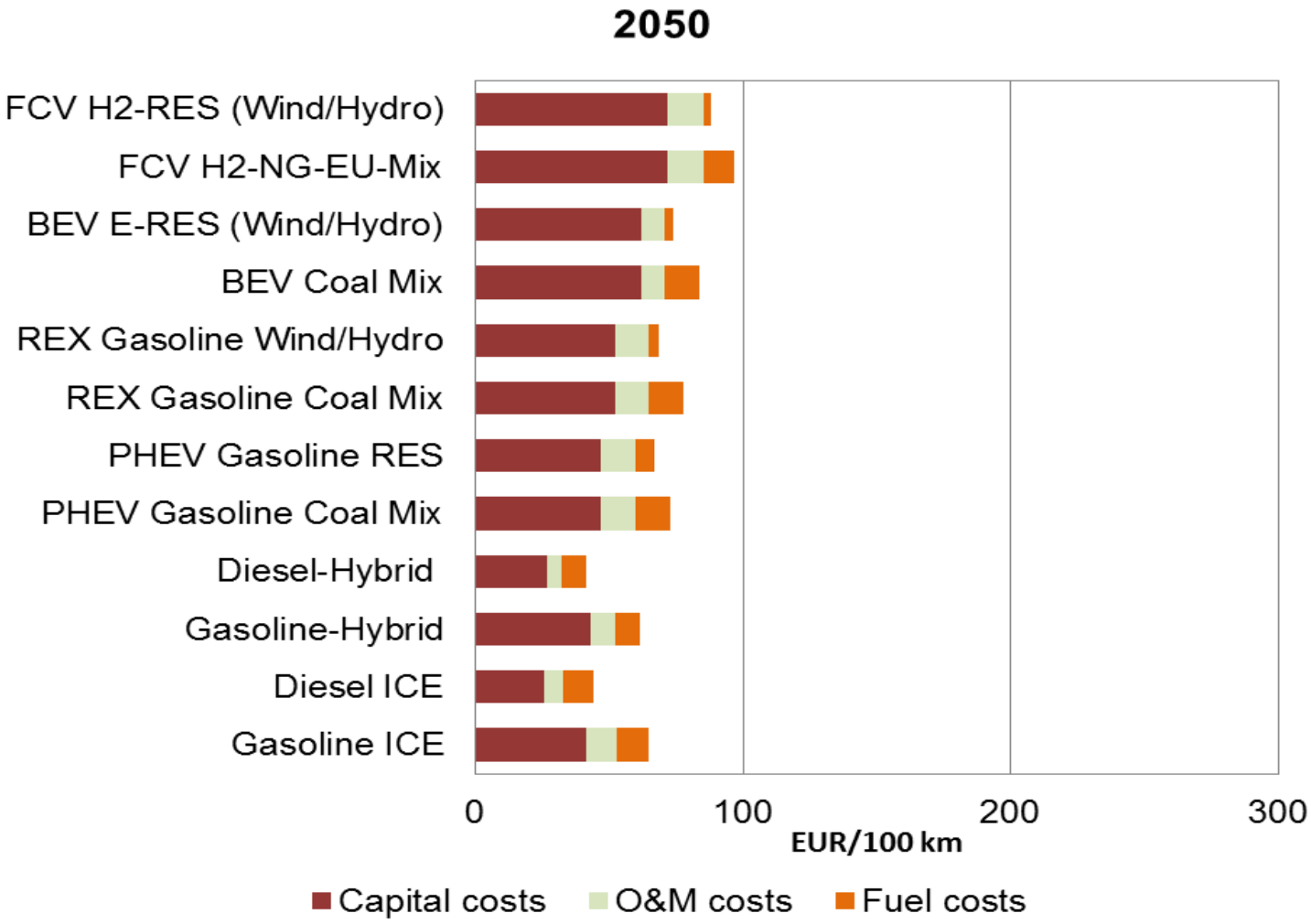
Total investment and battery costs of BEV depending on power of car in 2012

Economic assessment



Total costs of service mobility of various types of EV in comparison to gasoline and diesel cars

Economic assessment



Total future costs of mobility with electric vehicles in comparison to conventional ICE vehicles

Policies for promotion of EV

Major monetary measures:

- Financial incentives
- Tax relief
- Exemption from tolls
- Free parking
- Free recharging stations

Important non-monetary parameters:

- Use of bus lines
- Charging time/Charging options
- Entry to city center and zero emission zones
- Social/ecological benefits

Conclusions

- BEV and FCV: the major barrier → high investments cost
- BEV → limited driving range
- Hybrids → bridging technology
- BEV and FCV → electricity from RES

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