Prospects for new alternative technologies and alternative fuels in individual passenger car transport in the EU up to 2050

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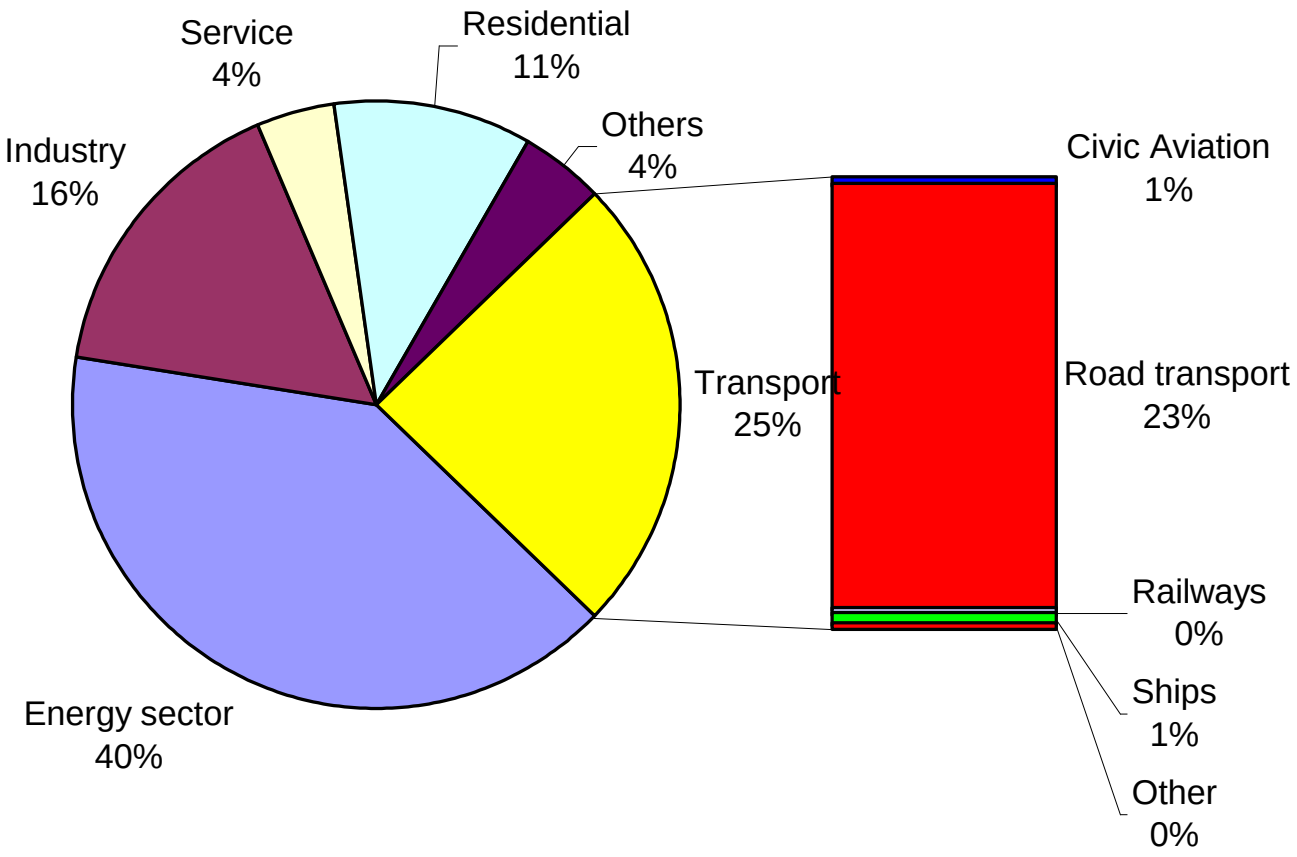
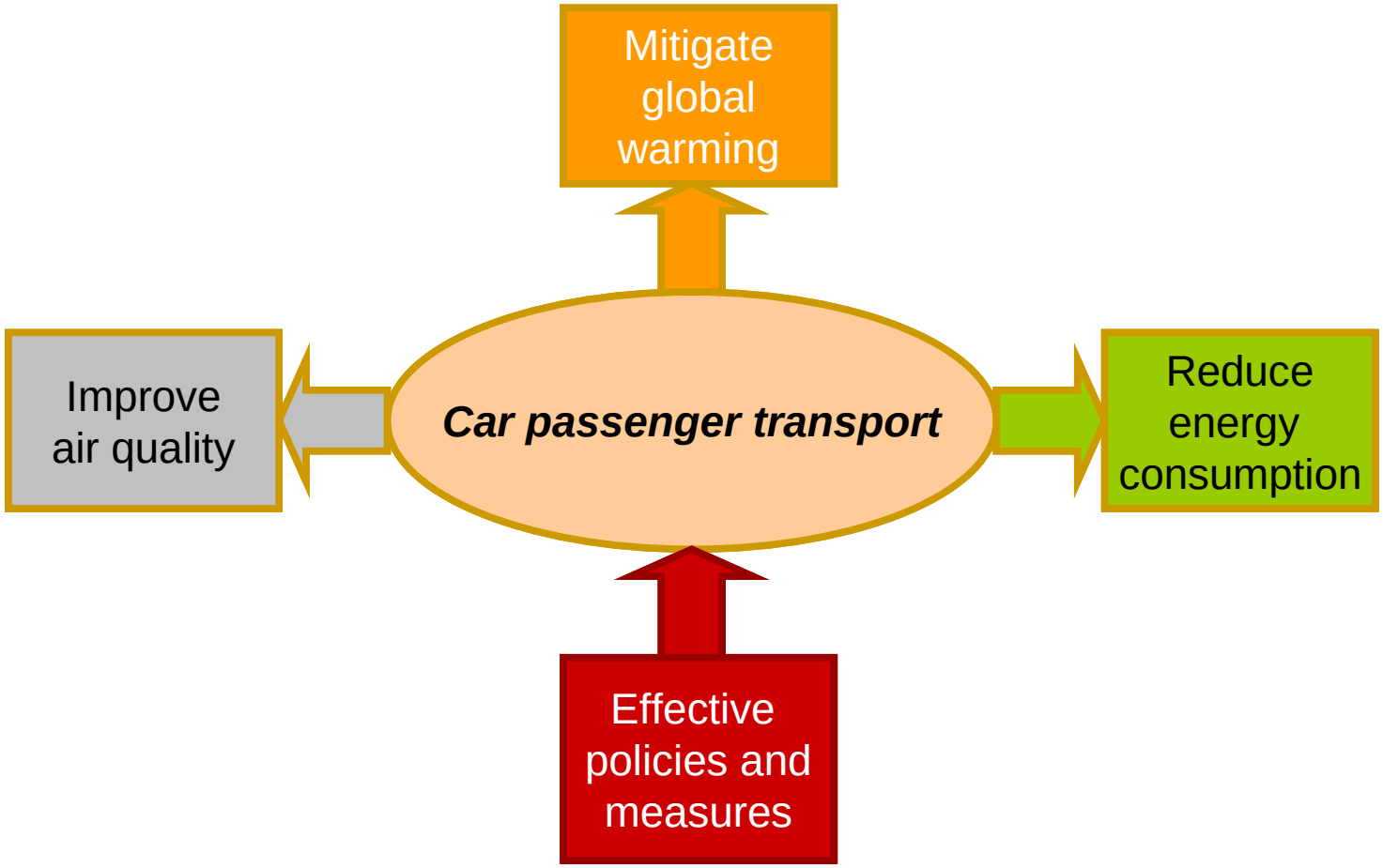
Introduction

GREENHOUSE GAS EMISSIONS EU-27

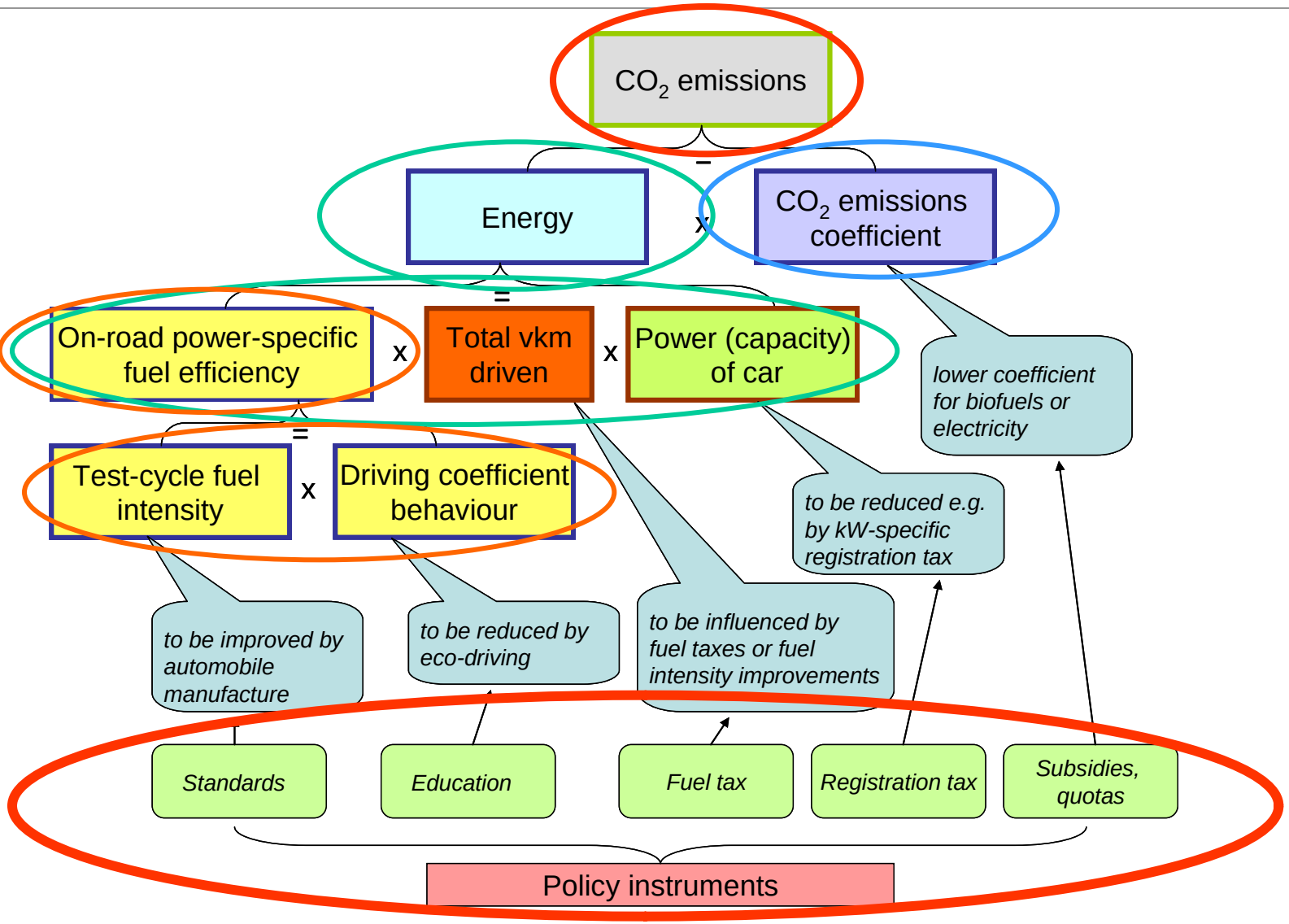


Introduction



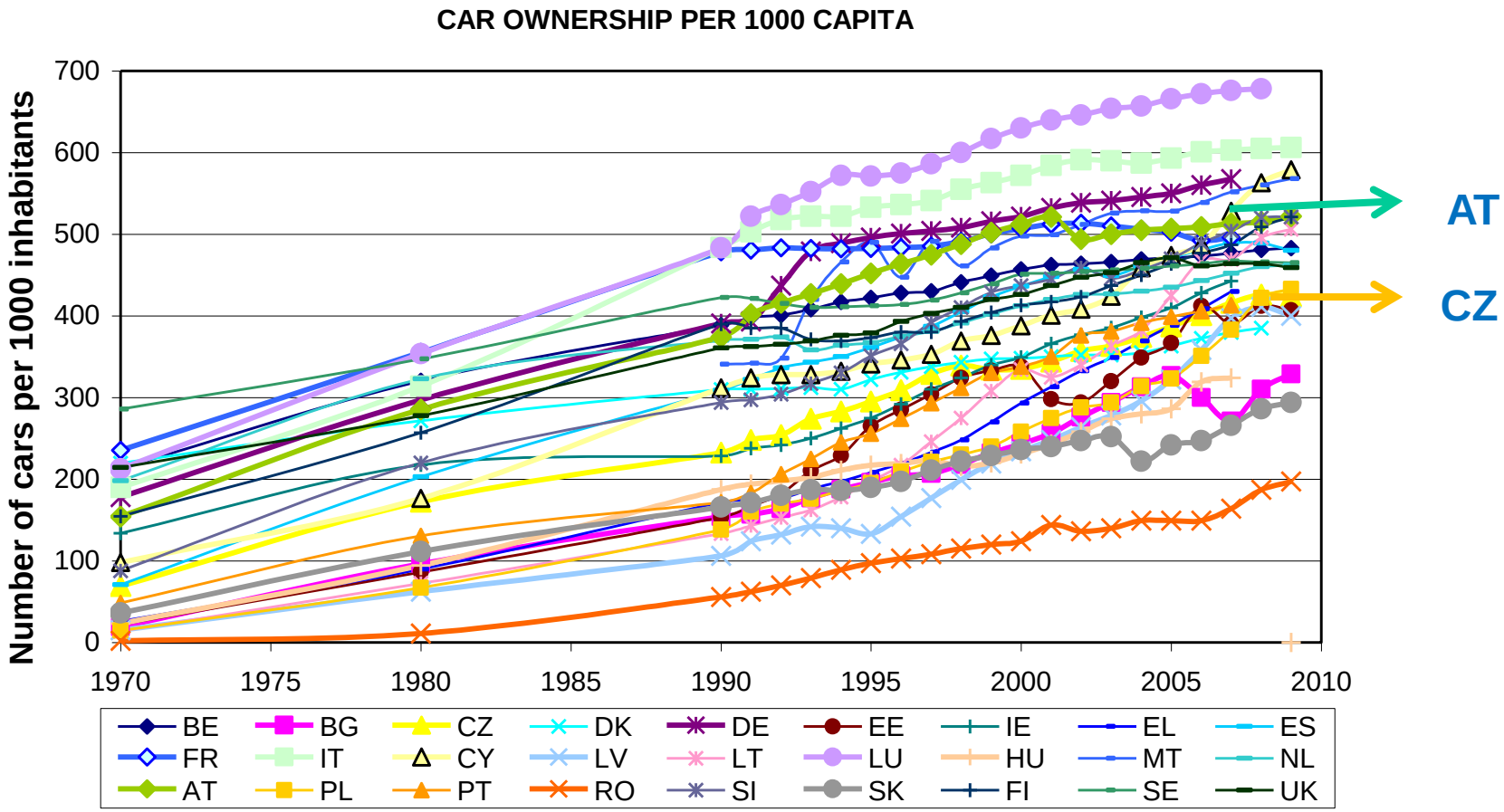
The challenges for EU climate and energy policies

CO_2 emissions in passenger car transport



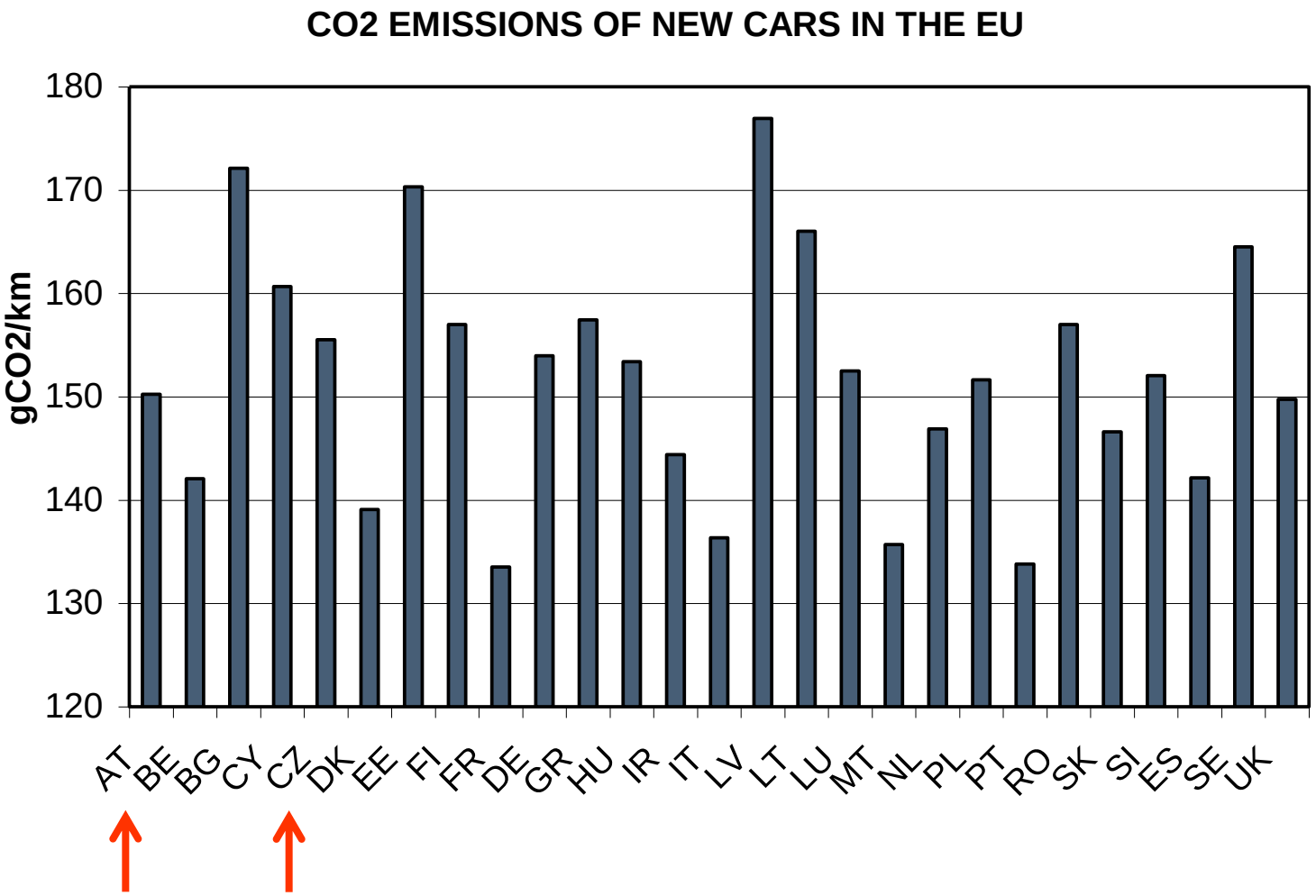
Impact factors on CO2 emissions in the car passenger transport sector

Development of car stock



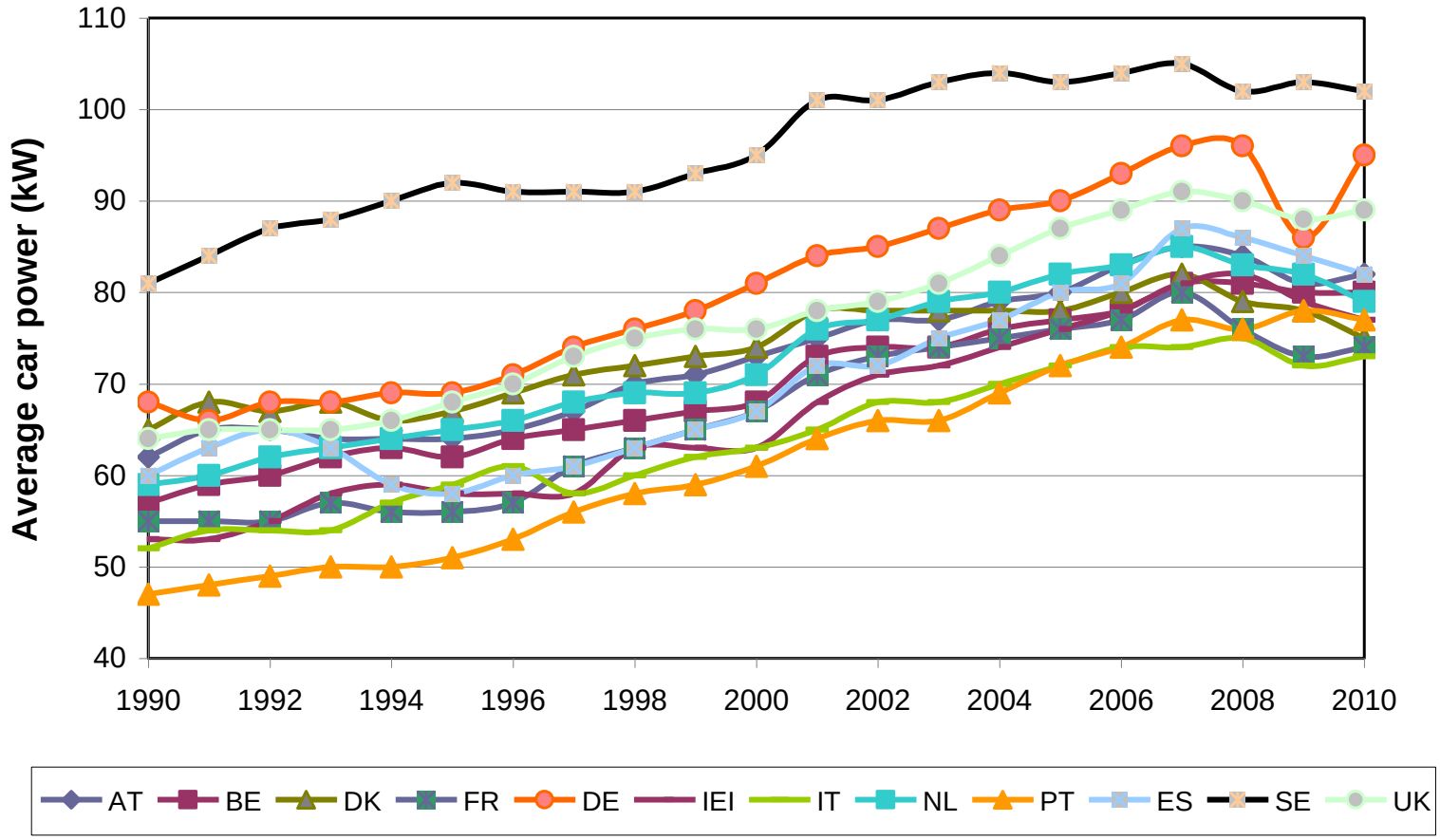
Car ownership per 1000 capita in EU-27 countries 1970 – 2009
(Source: EUROSTAT; ALTER-MOTIVE database)

Performance of new registered cars



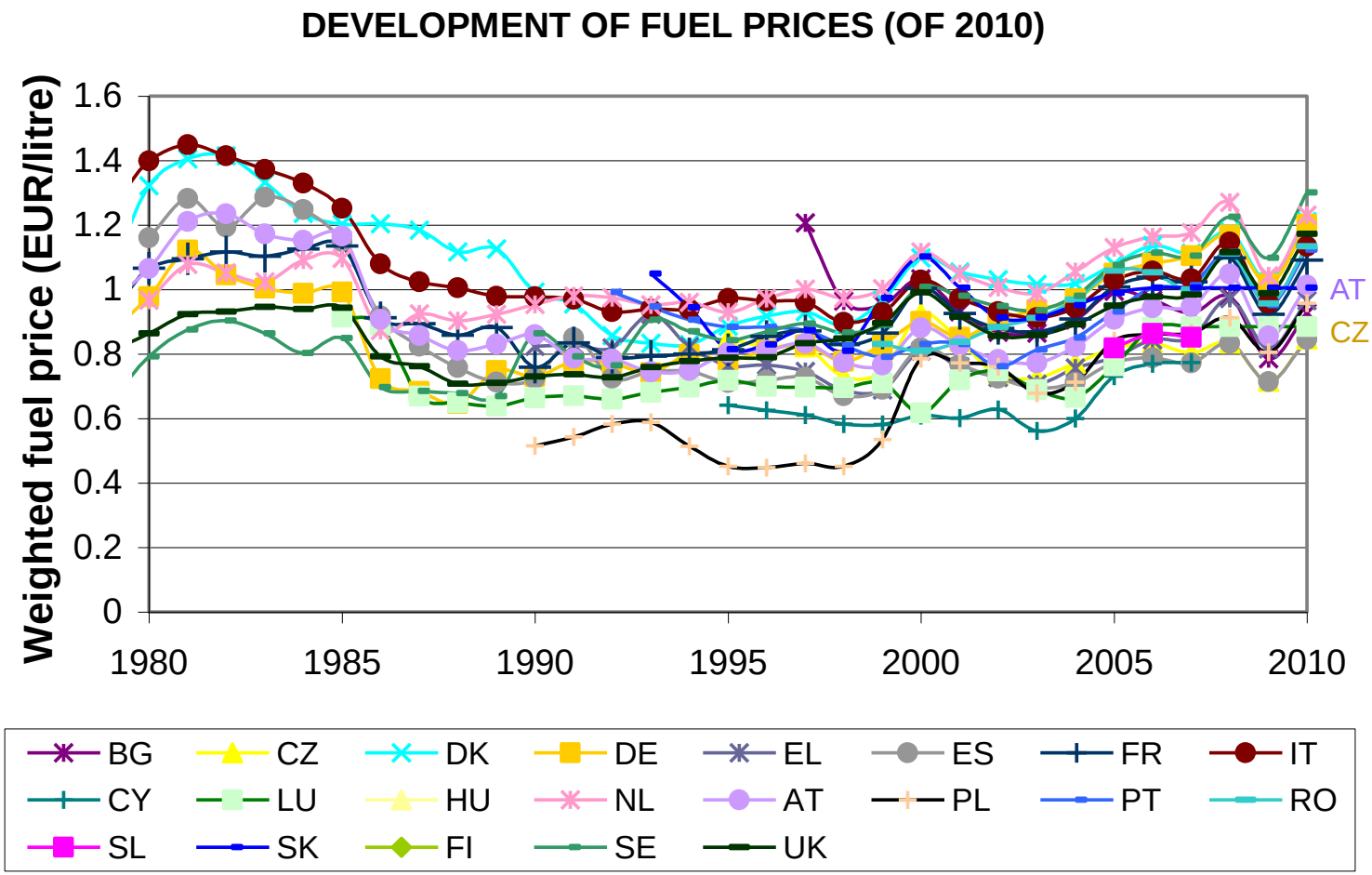
CO2 emissions of new cars in EU-countries in 2009 (data source: DB, 2009)

Increases in power of cars



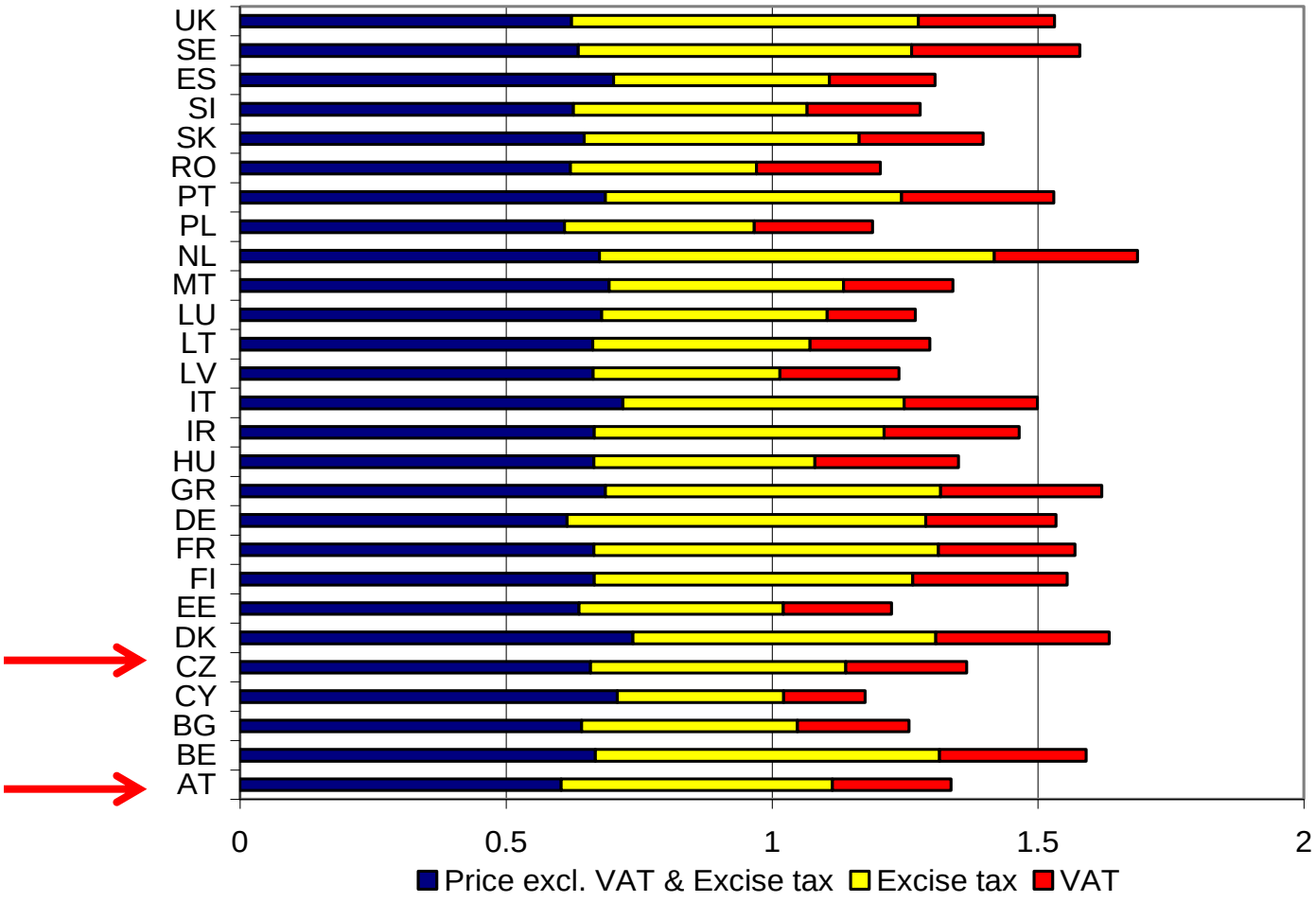
Average developments of car power (kW) of new cars in various EU-15 countries from 1990 to 2010 (Source: (EU-DB, 2009), (EC, 2007)).

Development of fuel prices



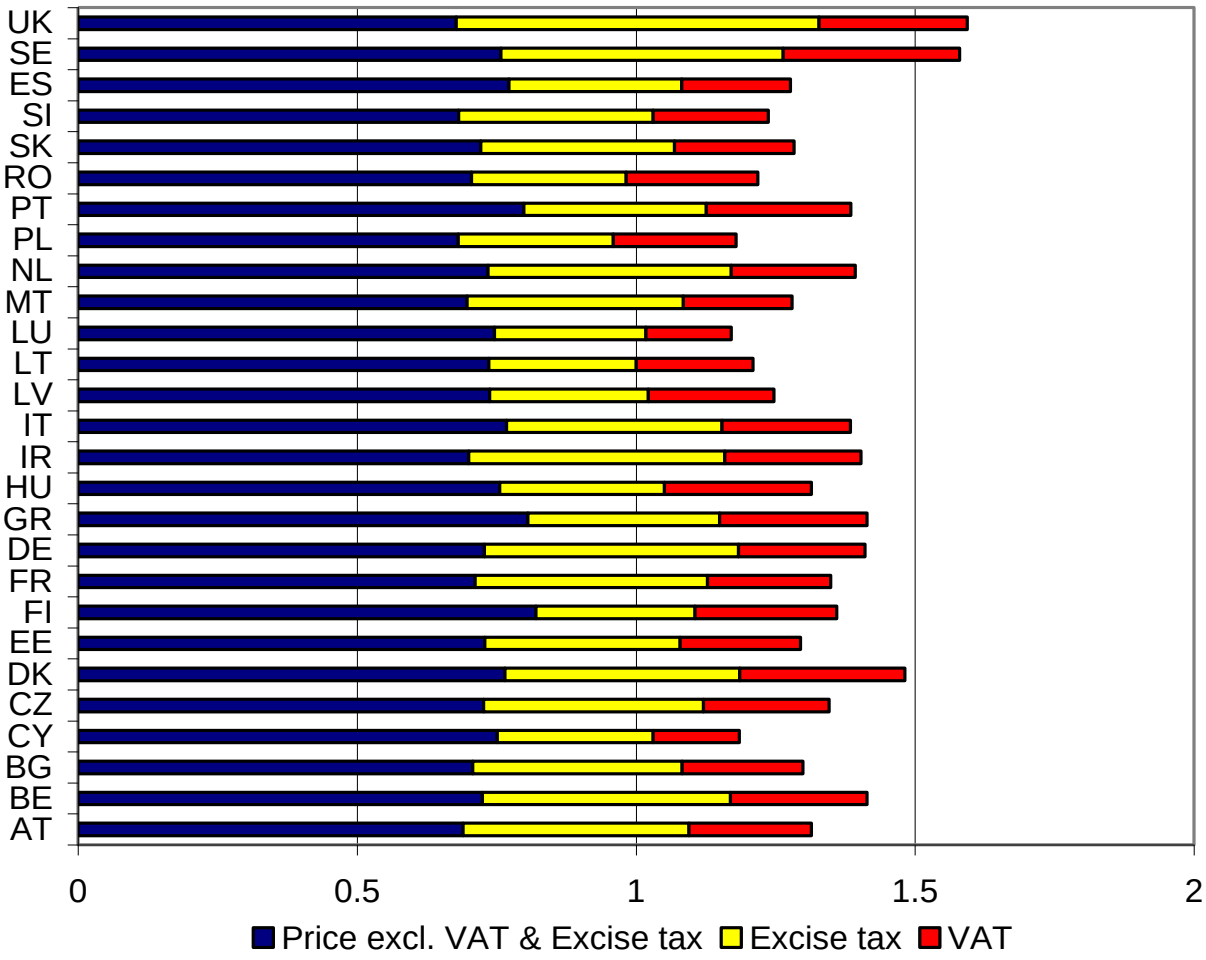
Weighted fuel prices (including all taxes) for EU countries 1980 – 2010 (in prices of 2010, numbers for 2010 preliminary) (Source: EEP; IEA, 2010)

Development of fuel prices



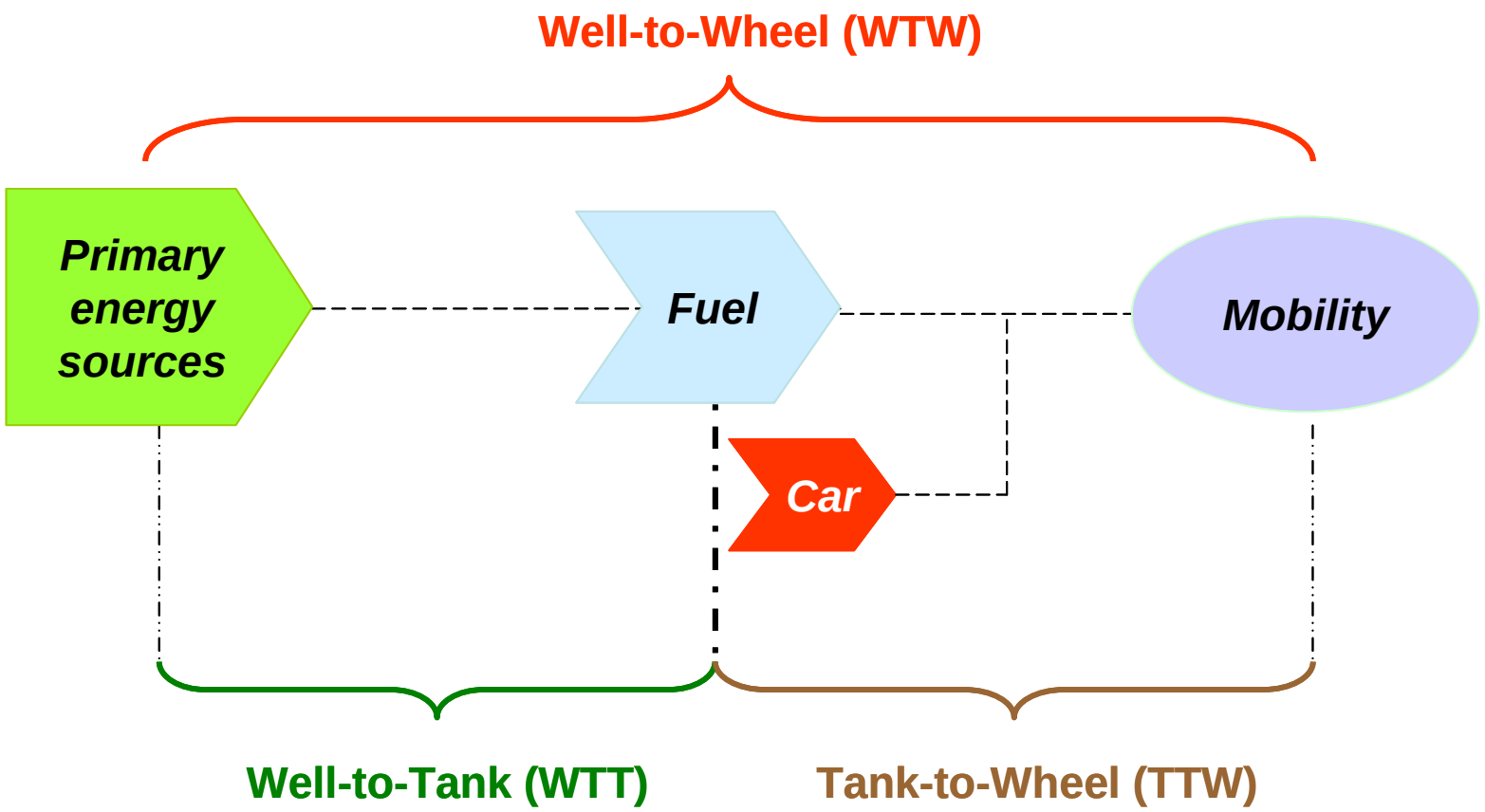
Price structure of gasoline in EU-27 (data source: EEP, 2011 - effective March 2, 2011)

Development of fuel prices



Diesel prices in 2011 for EU-27 (data source: EEP, 2011 - effective March 2, 2011)

Method of approach



The energy chain for providing the service mobility

Method of approach

The overall energy used to provide mobility is dependent from total energy in the WTT- and the TTW-part of the chain:

$$E_{WTW} = E_{WTT} + E_{TTW}$$

In the both parts of the energy supply chain we can use fossil and/or renewable energy. The total energy used in WTT part could be split in a fossil part (FF) and a renewable part (RE):

$$E_{WTT} = E_{RE-WTT\ fuel} + E_{FF-WTT\ fuel}$$

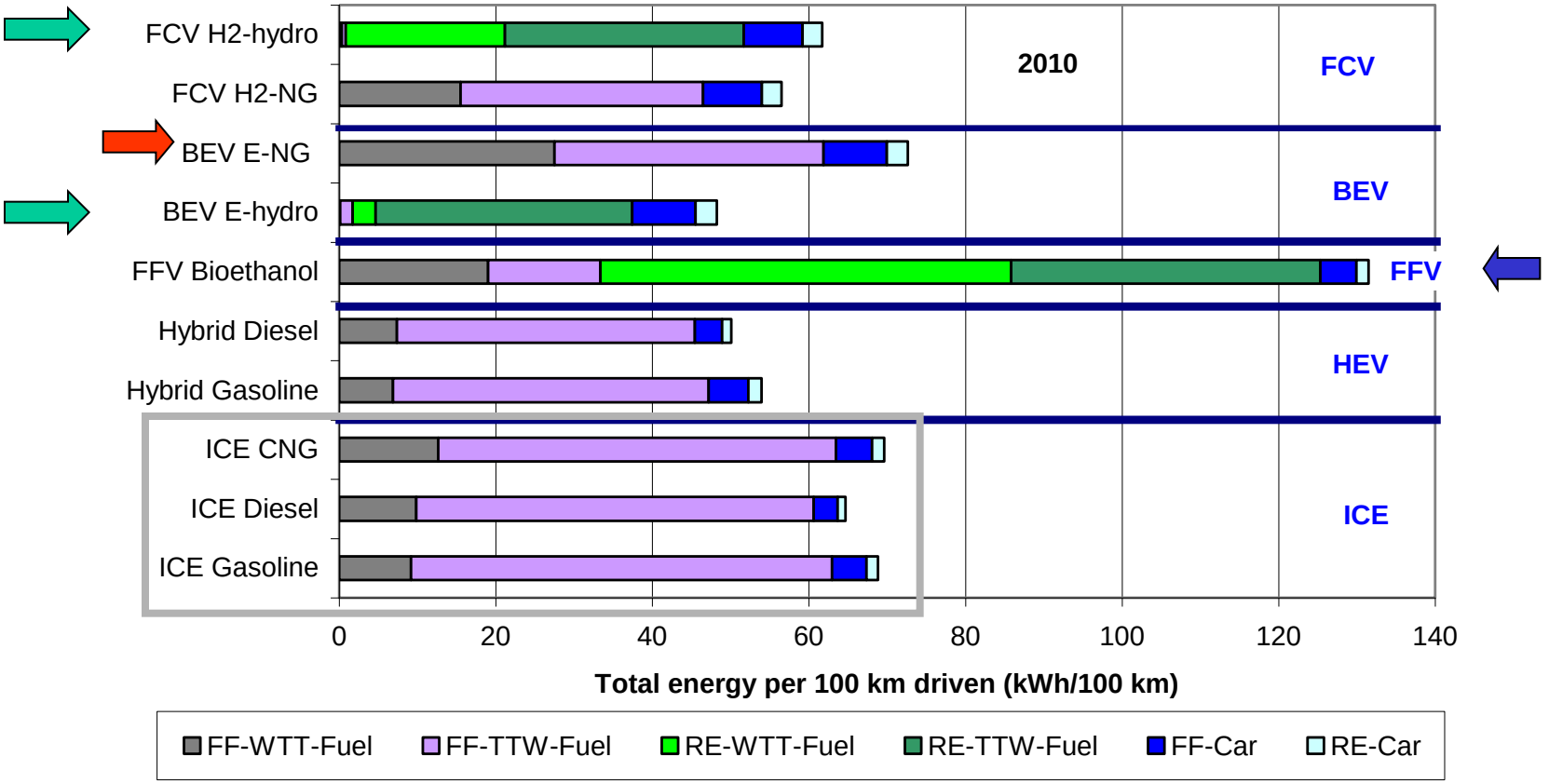
E**RE-***WTT-fuel*…..total renewable energy used for production of fuel
E**FF-***WTT-fuel*……total fossil energy used for production of fuel

In TTW part total energy can be divided in four parts:

$$E_{TTW} = E_{RE-TTW\ fuel} + E_{FF-TTW\ fuel} + E_{RE\ car} + E_{FF\ car}$$

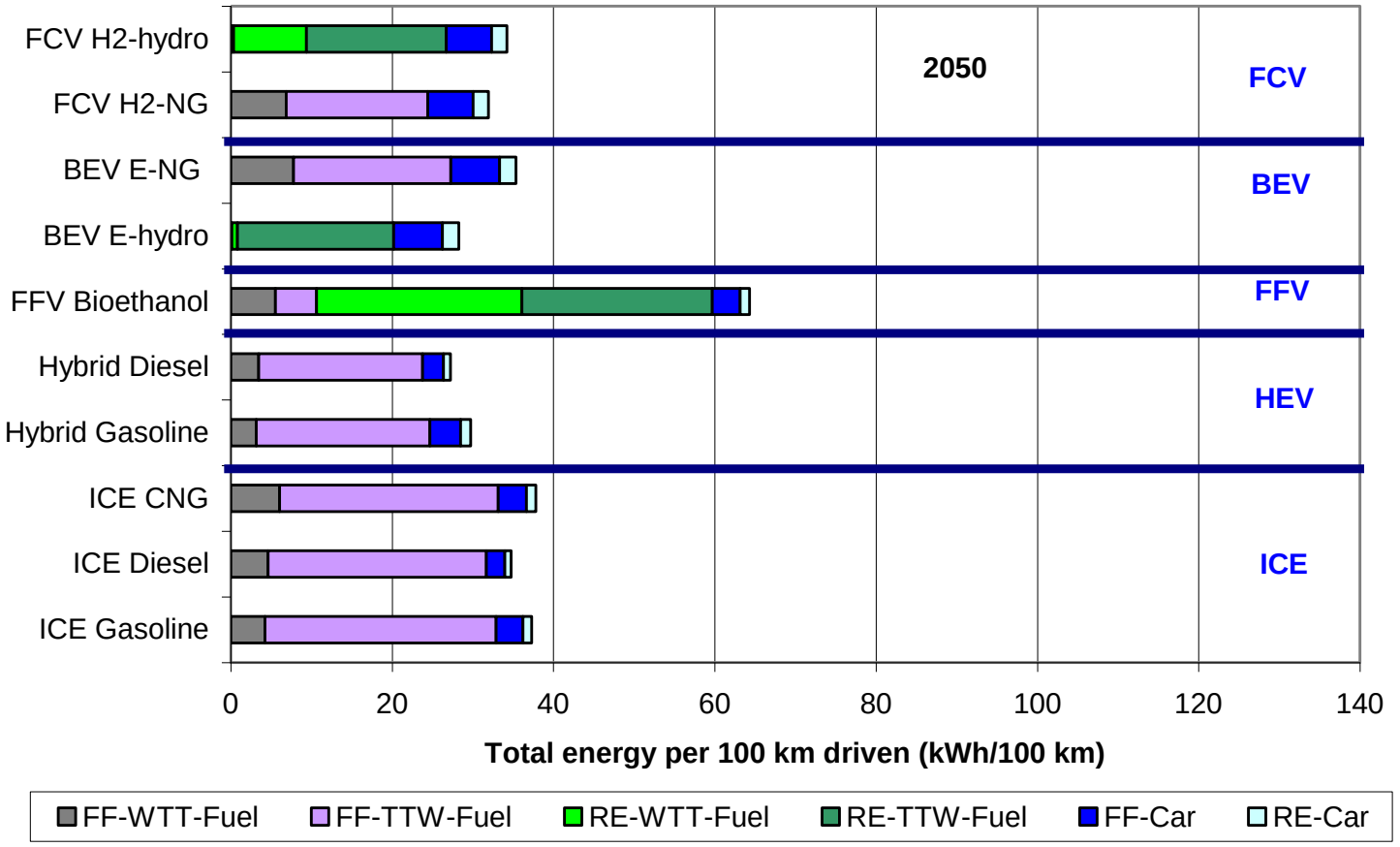
$E_{\text{RE-}TTW\text{-}fuel}$……total renewable energy used in cars
$E_{\text{FF-}TTW\text{-}fuel}$……total fossil energy used in cars
$E_{\text{RE-}car}$……..renewable energy used for production and scrappage of car
$E_{\text{FF-}car}$…….fossil energy used for production and scrappage of car

Energetic performance



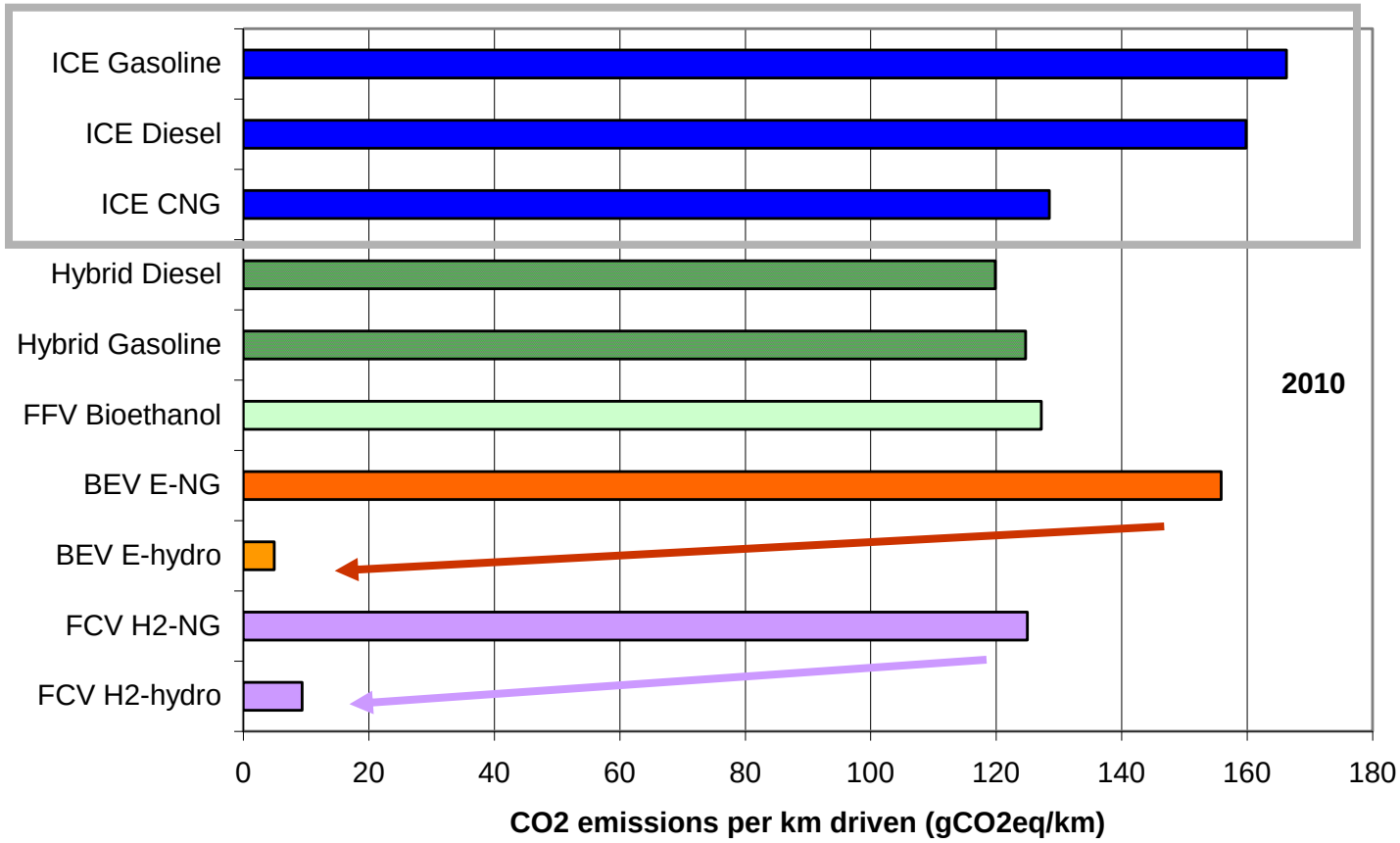
Renewable and fossil energy shares in the whole WTW energy service provision chain in 2010 for AAMT and alternative fuels in comparison with conventional ICE vehicles powered by fossil fuels

Energetic performance



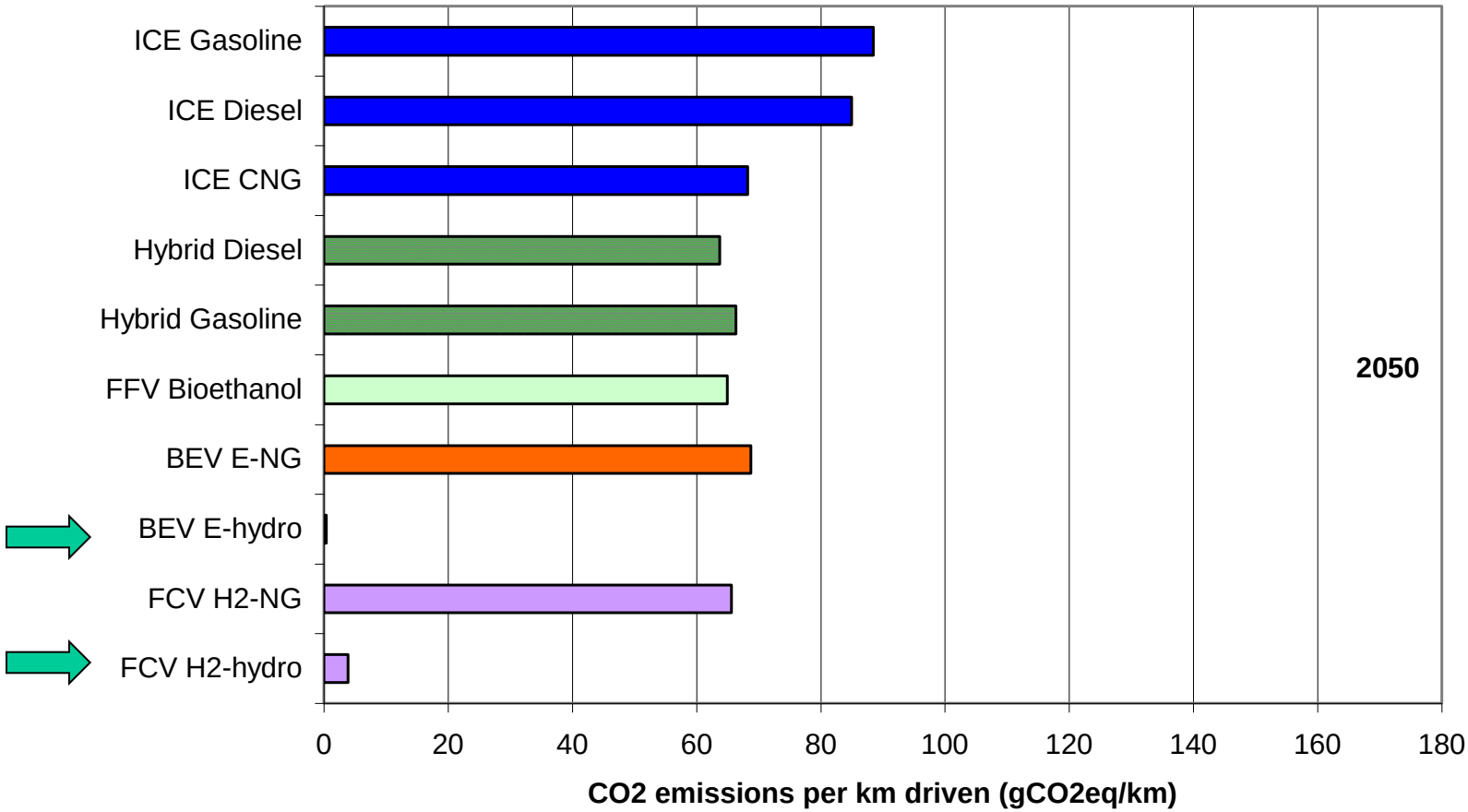
Renewable and fossil energy shares in the whole WTW energy service provision chain in 2050 for AAMT and alternative fuels in comparison with conventional ICE vehicles powered by fossil fuels

Ecological assessment



Comparison of specific CO2 emissions of conventional vehicles with AAMT in 2010

Ecological assessment



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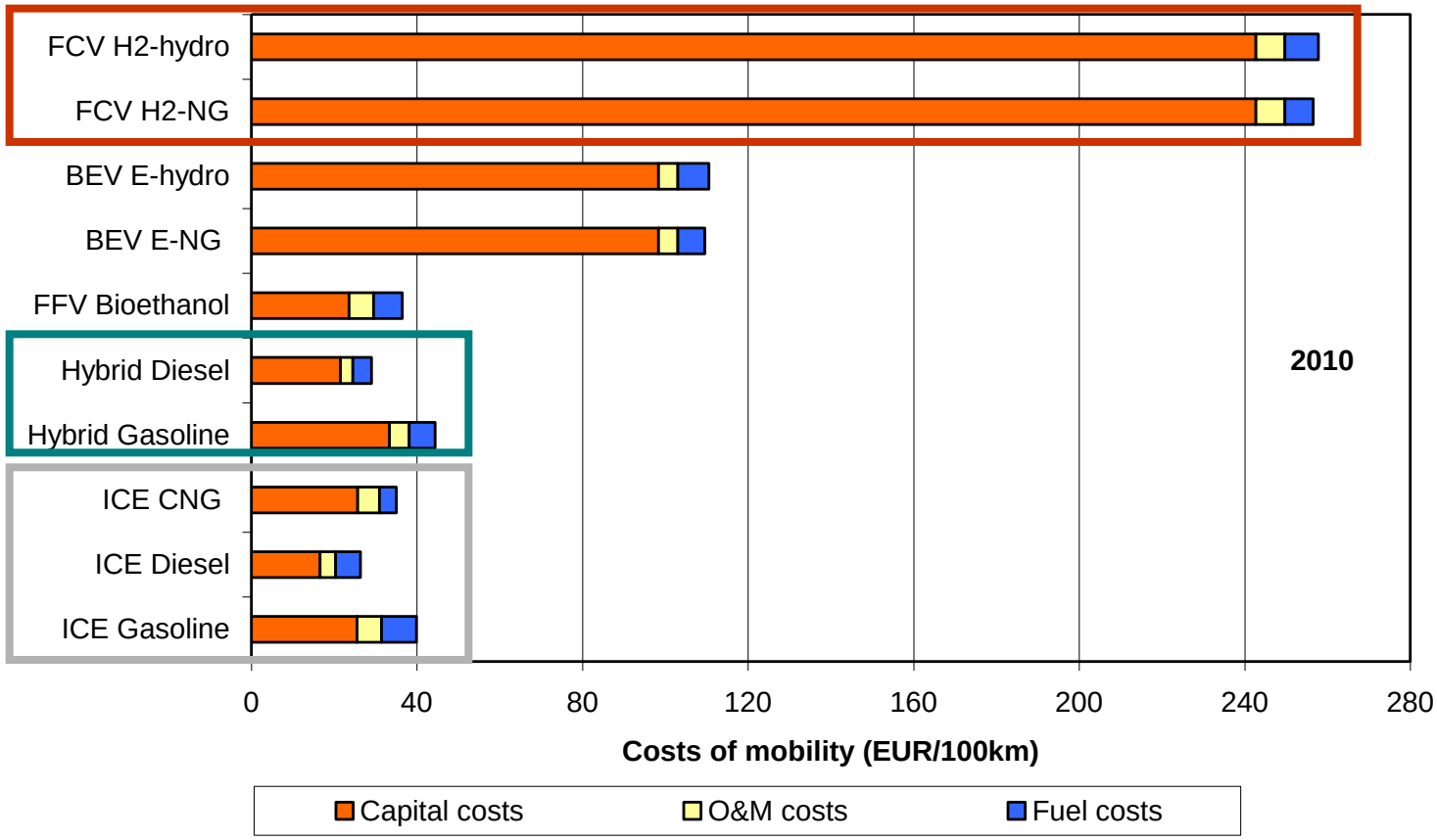
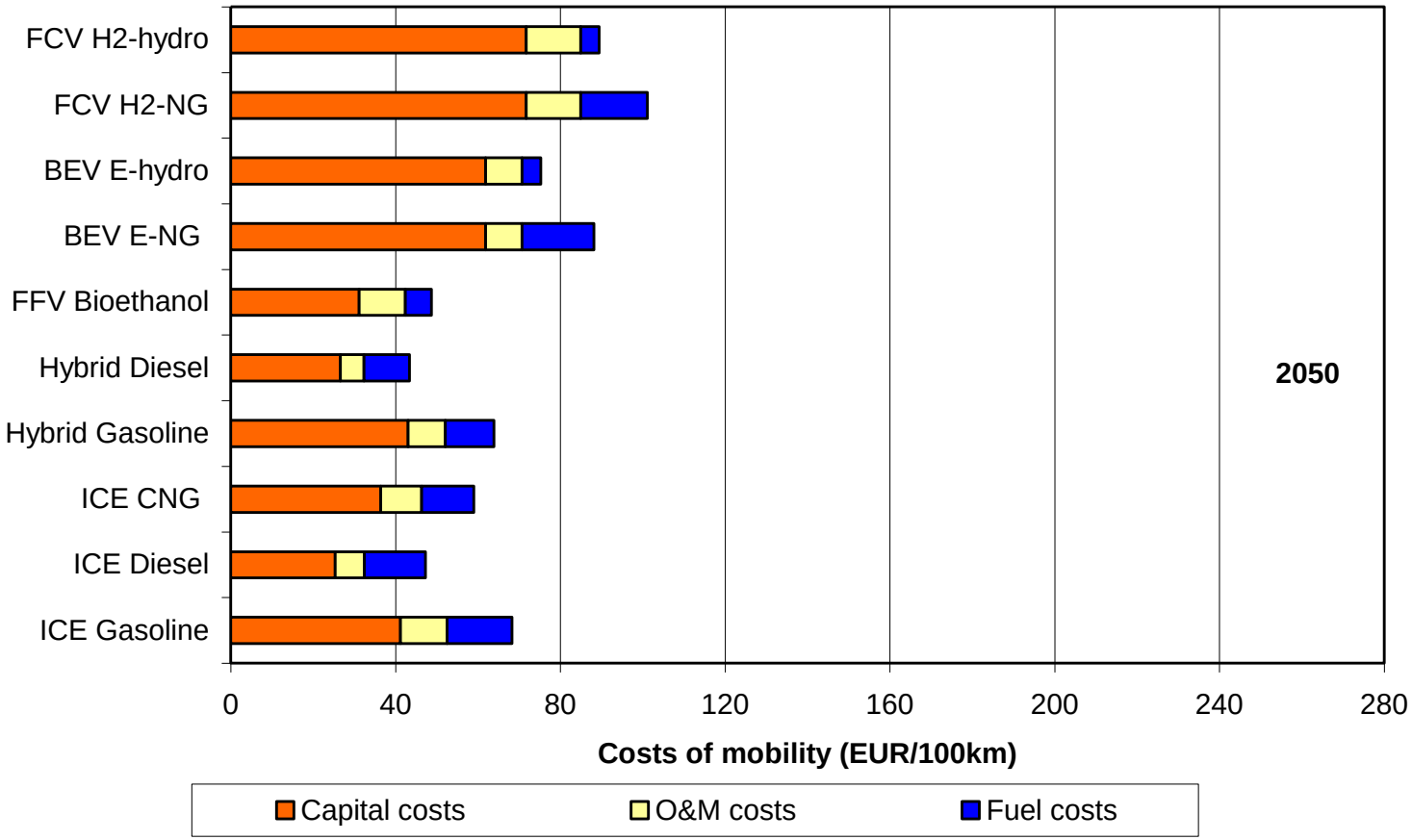
Economic assessment



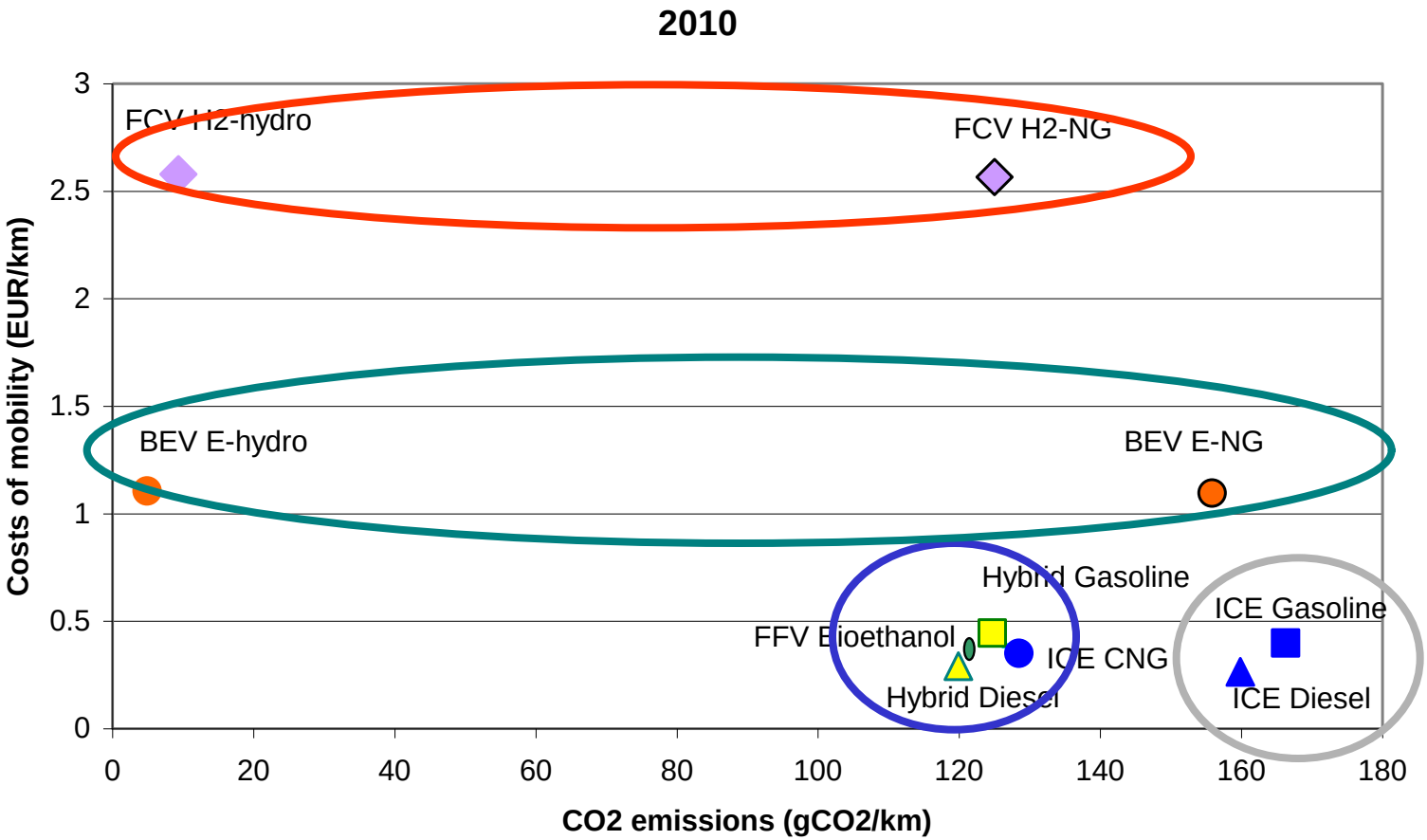
Total costs of mobility in passenger cars in 2010

Economic assessment



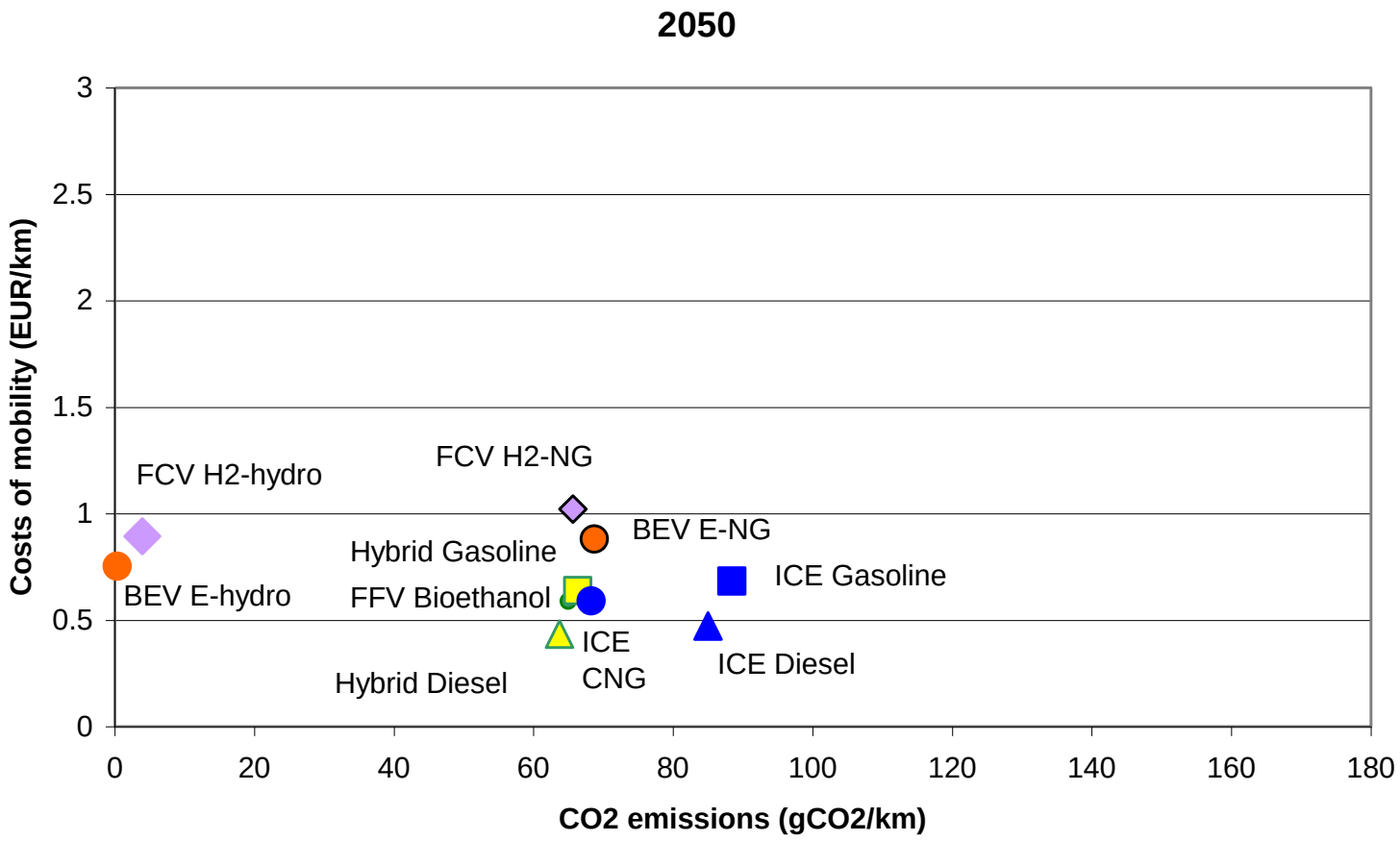
Total costs of mobility in passenger cars in 2050

Economic assessment



Comparison of specific CO2 emissions and driving costs of conventional vehicles with alternative automotive vehicles in 2010

Economic assessment

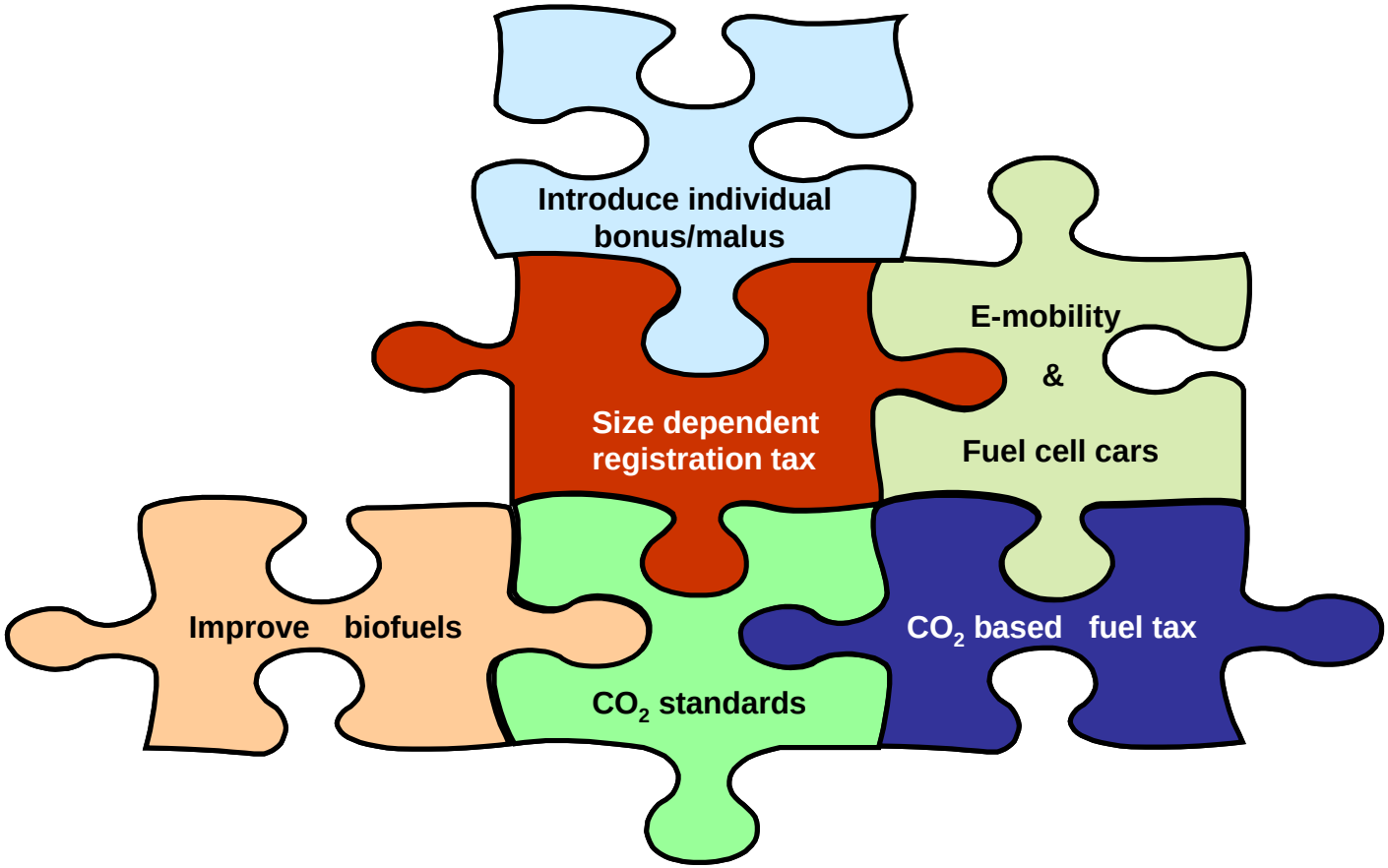


Comparison of specific CO2 emissions and driving costs of conventional vehicles with alternative automotive vehicles in 2050

Conclusions

- By 2050 there will be no big difference in total costs of the different technologies. It seems likely that much broader portfolio of car types will be used in the future;
- Significant technical efficiency improvements are possible and looming but their implementation has been procured by R&D from car companies as well as governments;
- The introduction of fuel taxes is an important policy measure to efficiency improvements (for curtailing the rebound) and a signal to consumers to switch to more environmentally friendly fuels and technologies;
- The highest uncertainty lies in the speed of the market introduction of BEV and FCV. It depends mainly on the technological learning effects that can be achieved with respect to batteries and fuel cells;
- Hybrid as well as CNG vehicles may serve as a bridging technology. They are economically almost competitive, use less fuel than conventional gasoline and diesel vehicles and can compete environmentally with BEV except those based on pure RES.

Conclusions



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