On the environmental benignity and the market prospects of electric vehicles

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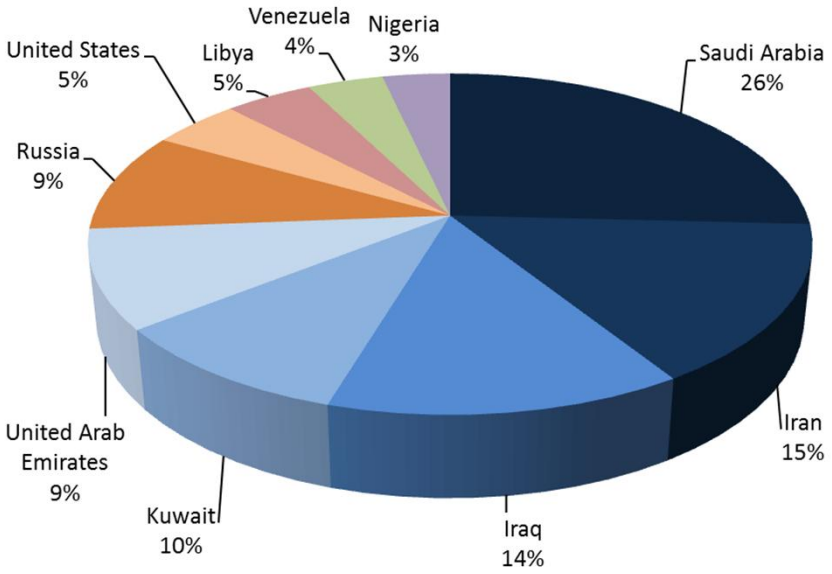
Transport sector

- **93%**

oil products' share of final energy consumption for transport, making the sector the least-diversified

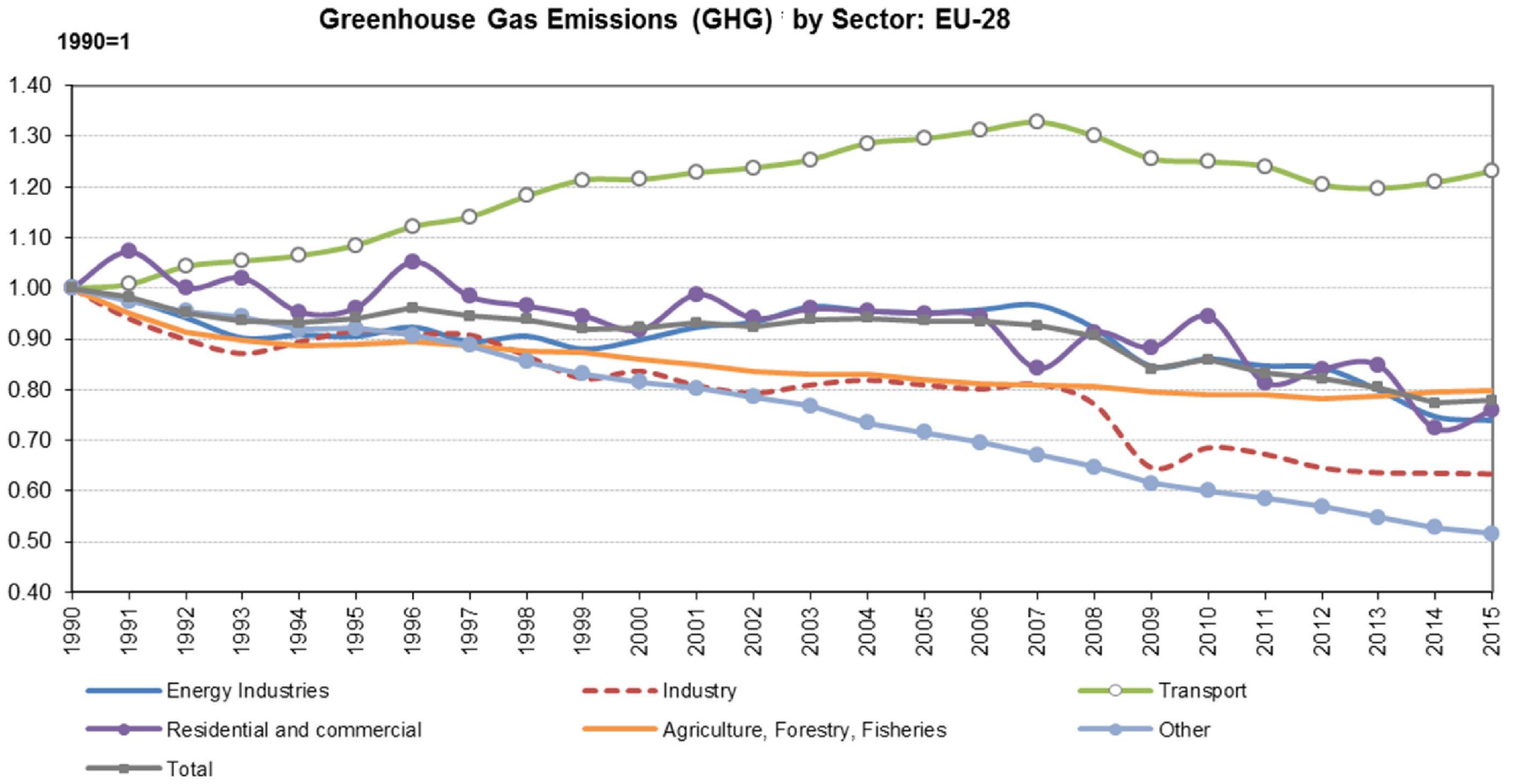


Countries with largest conventional oil reserves

- **28%**

the amount that transport energy and CO2 emissions have increased since 2000

GHG emissions by sectrors: EU-28



EU policies and targets

20-20-20

10%

40-27-27

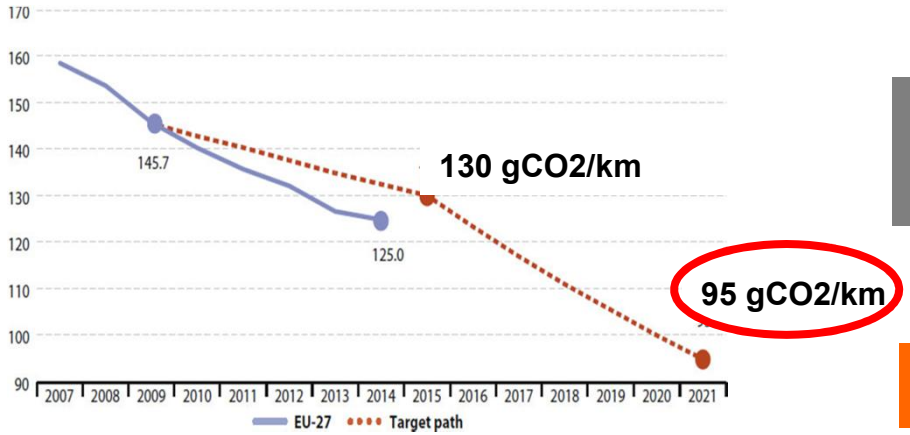
ICE -50% in city

No ICE in city

2009 2010 2015 2020 2030 2050

20% GHG (2008)

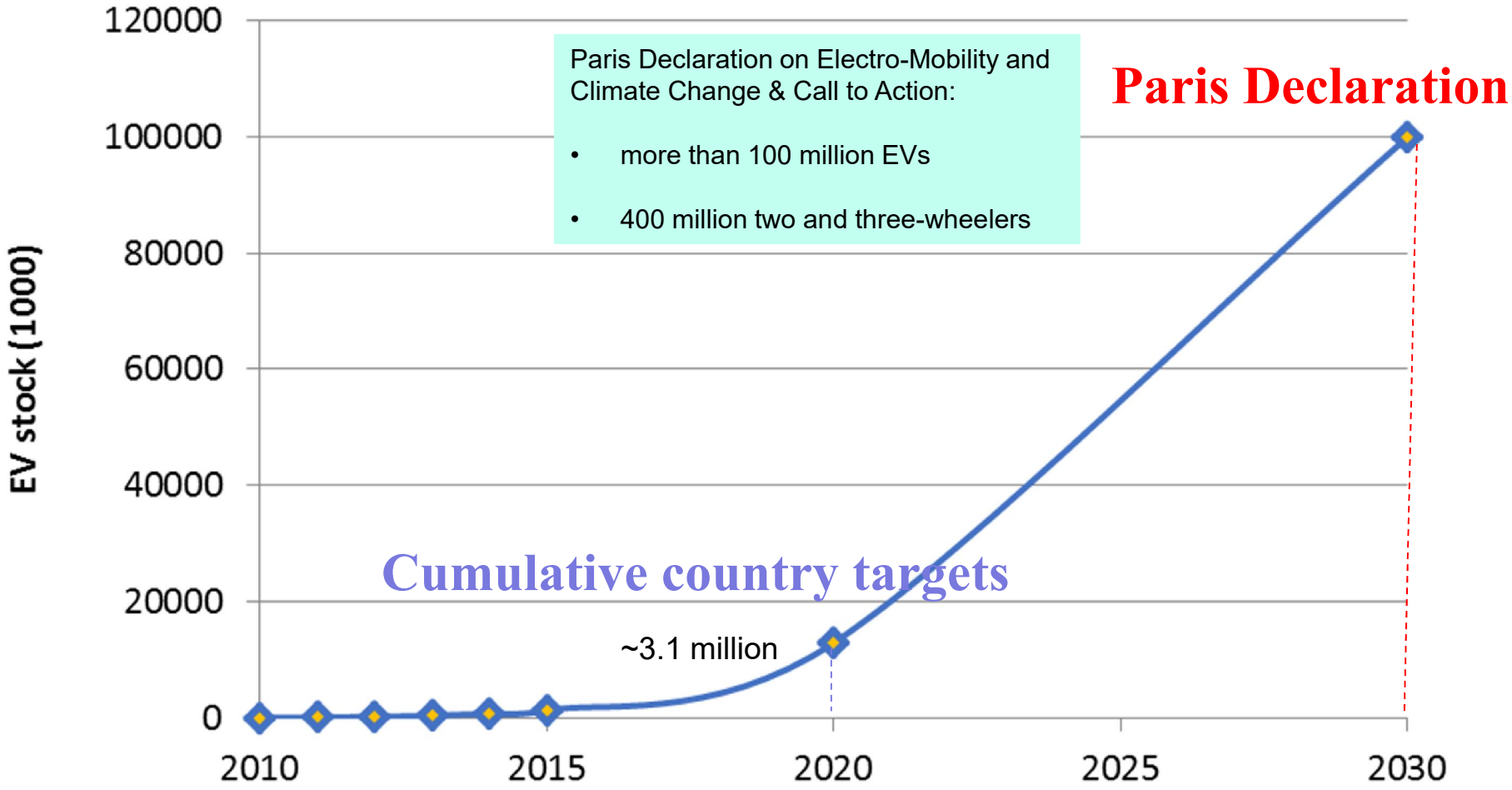
60% GHG (1990)



The White Paper on Transport Policy

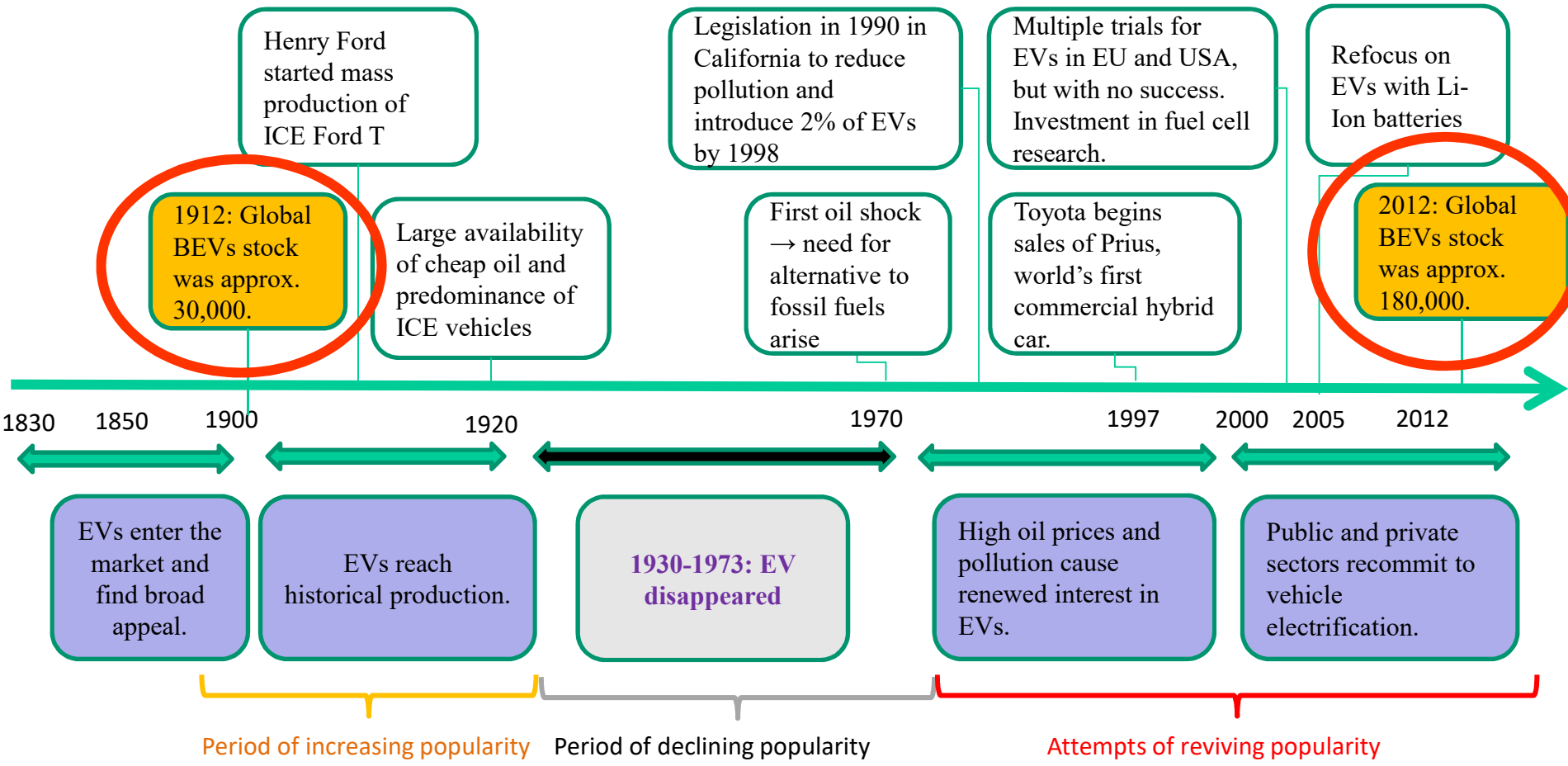
Targets and average CO_2 emissions from new passenger cars in EU countries

Electric vehicles

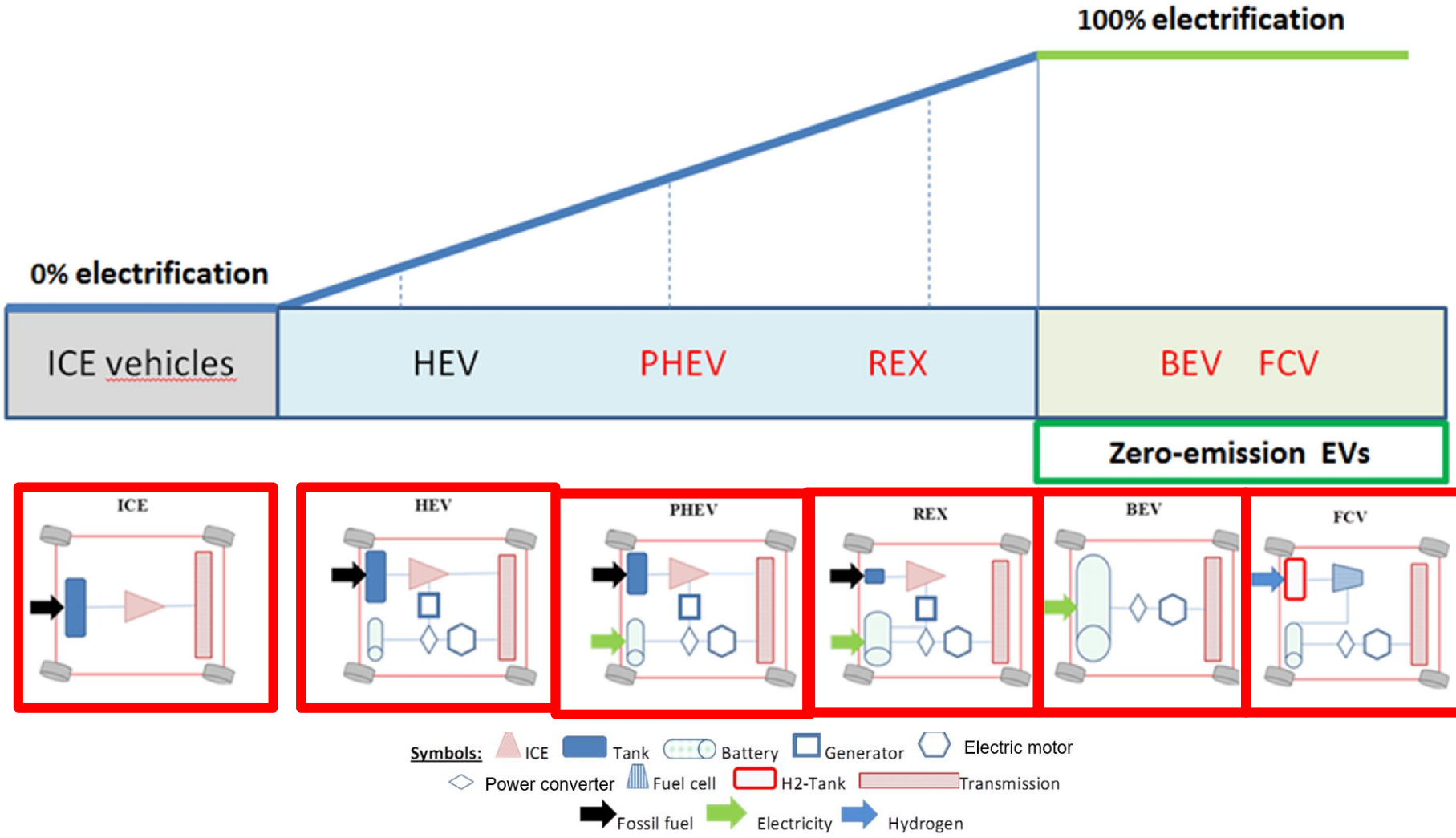


Development of the global stock of EVs

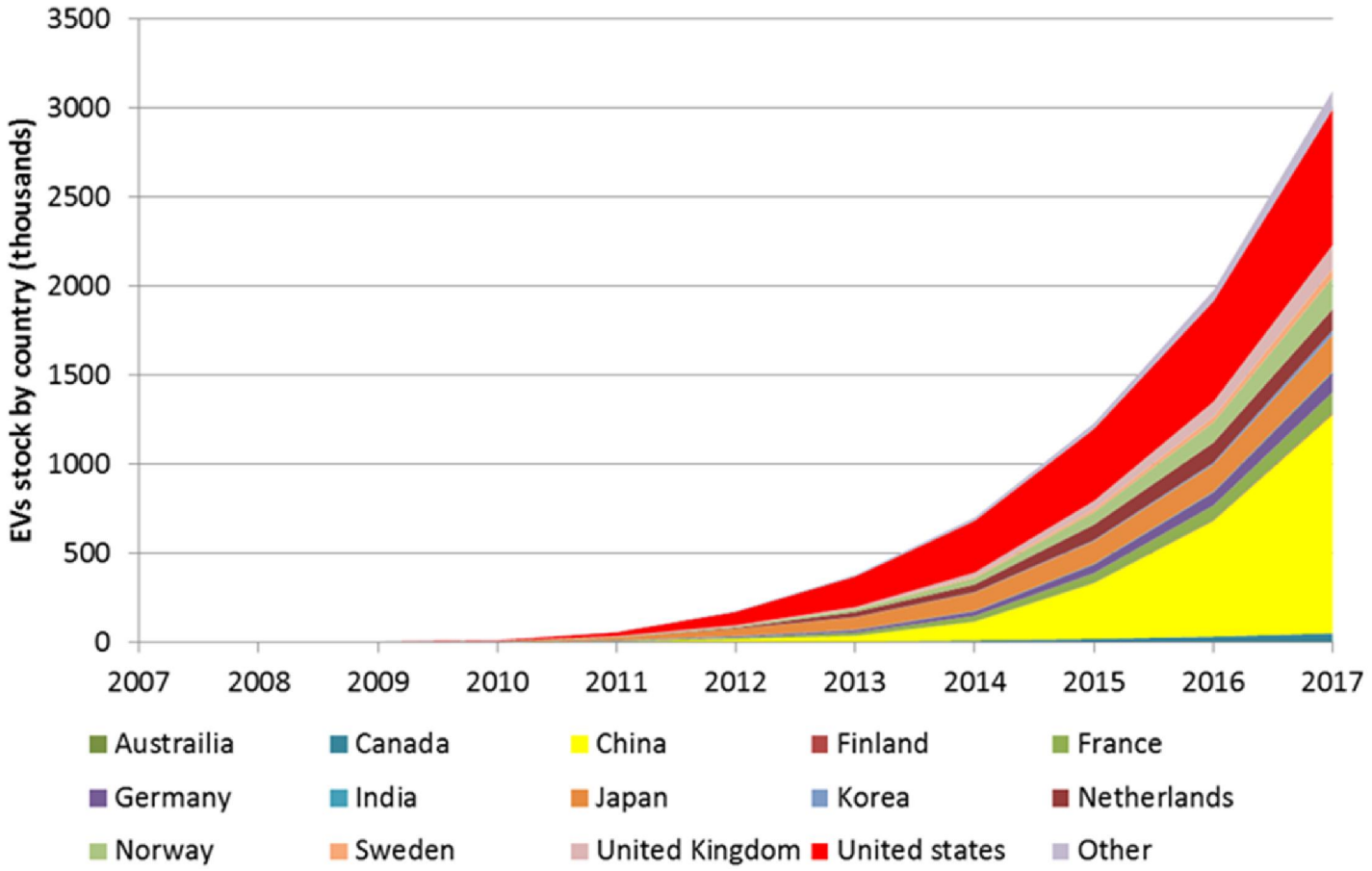
Electric vehicles



Electric vehicles



Electric vehicles



Development of the global stock of rechargeable EVs

Economic assessment

The costs per km driven C_{km} are calculated as:

$$C_{km} = \frac{IC \cdot \alpha}{skm} + P_f \cdot FI + \frac{C_{O\&M}}{skm}$$

[€/100 km driven]

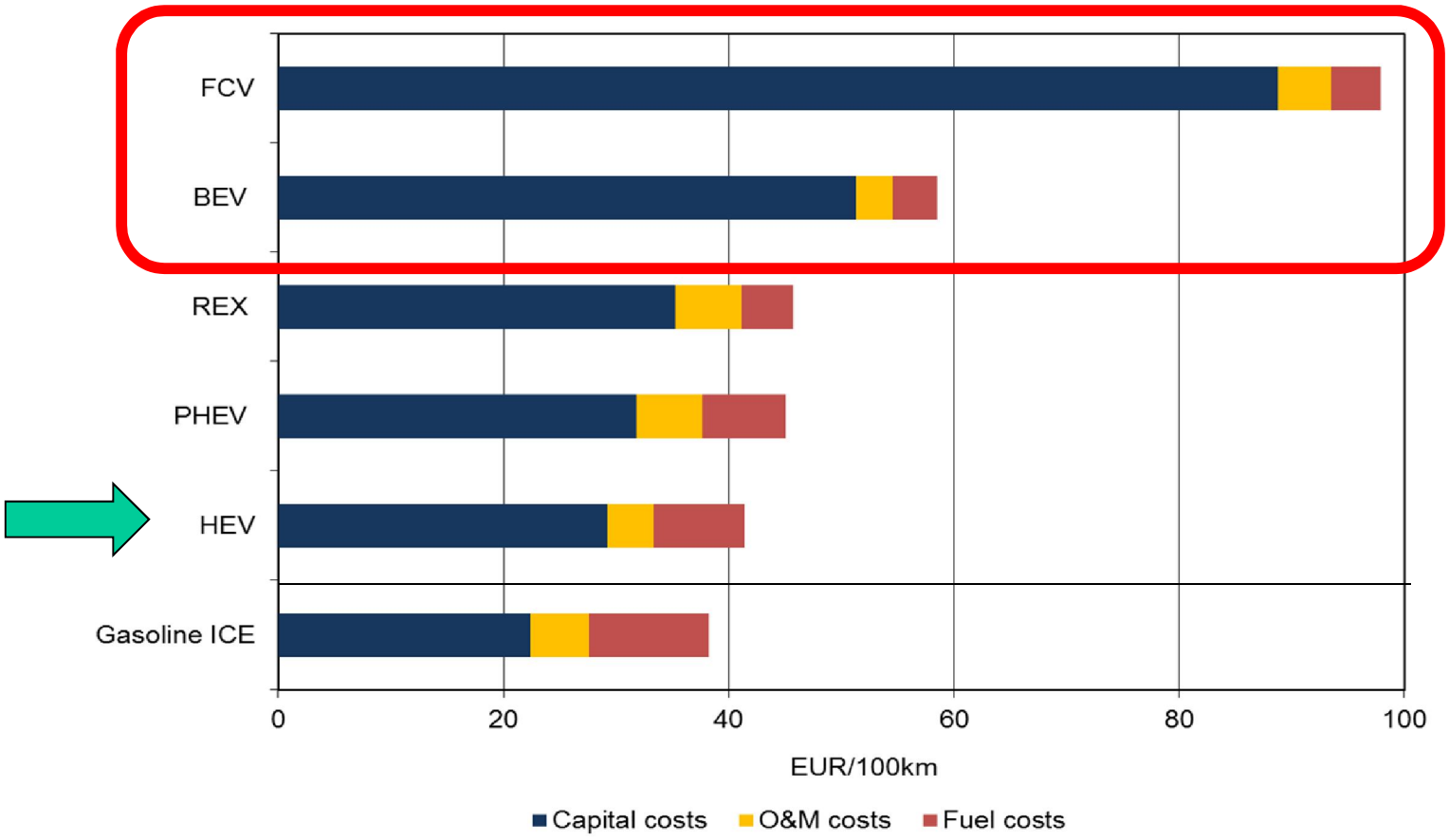
IC……investment costs [€/car]
α……..capital recovery factor
skm…..specific km driven per car per year [km/(car.yr)]
Pf……fuel price incl. taxes [€/litre]
$C_{O\&M}$…operating and maintenance costs
FI……..fuel/energy intensity [litre/100 km; kWh/100 km]

A capital recovery factor (α) is the ratio of a constant annuity to the present value of receiving that annuity for a given length of time. Using an interest rate (z), the capital recovery factor is:

$$\alpha = \frac{z(1+z)^n}{(1+z)^n - 1}$$

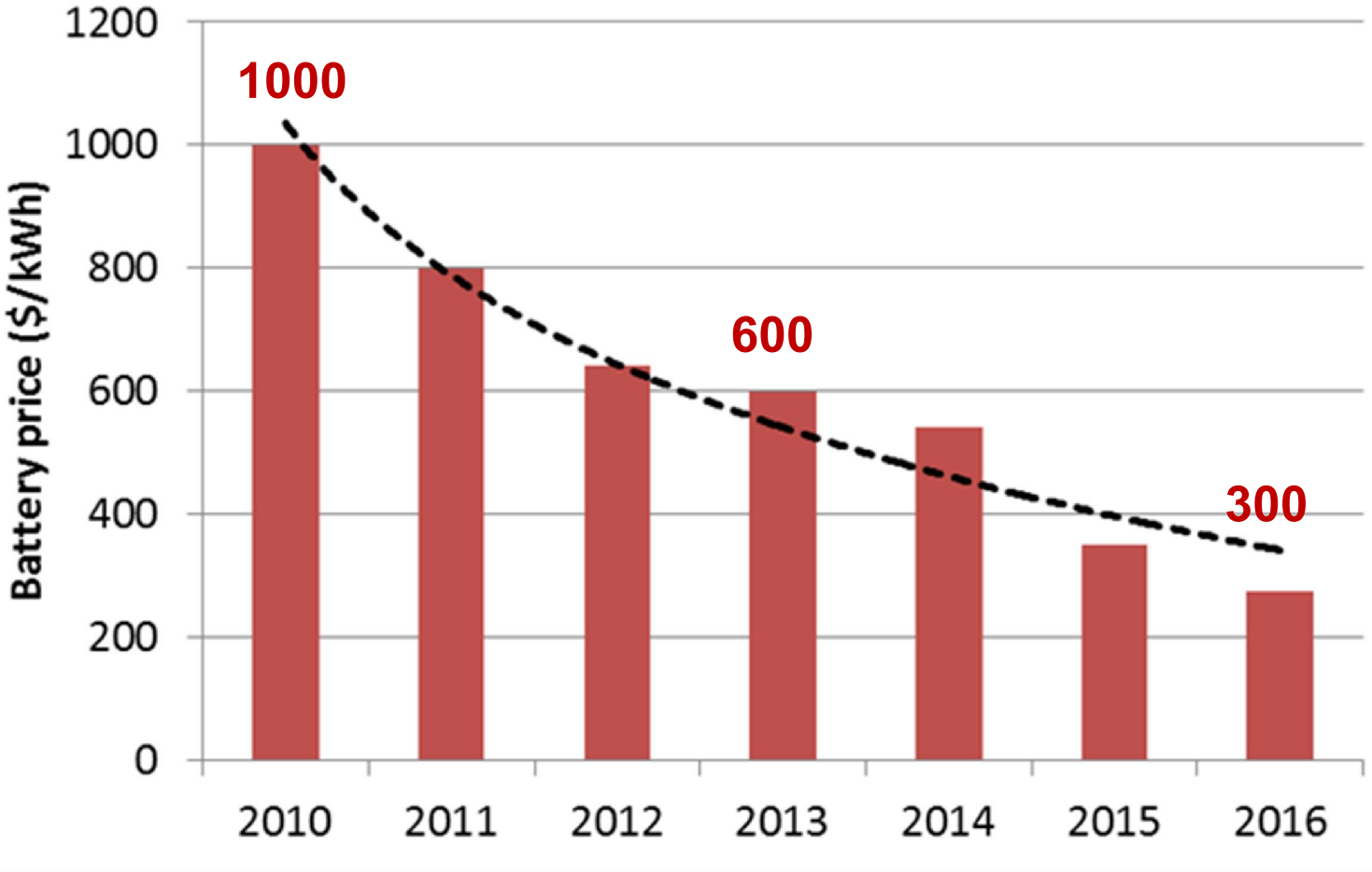
n…..the number of annuities received.

Economic aspects



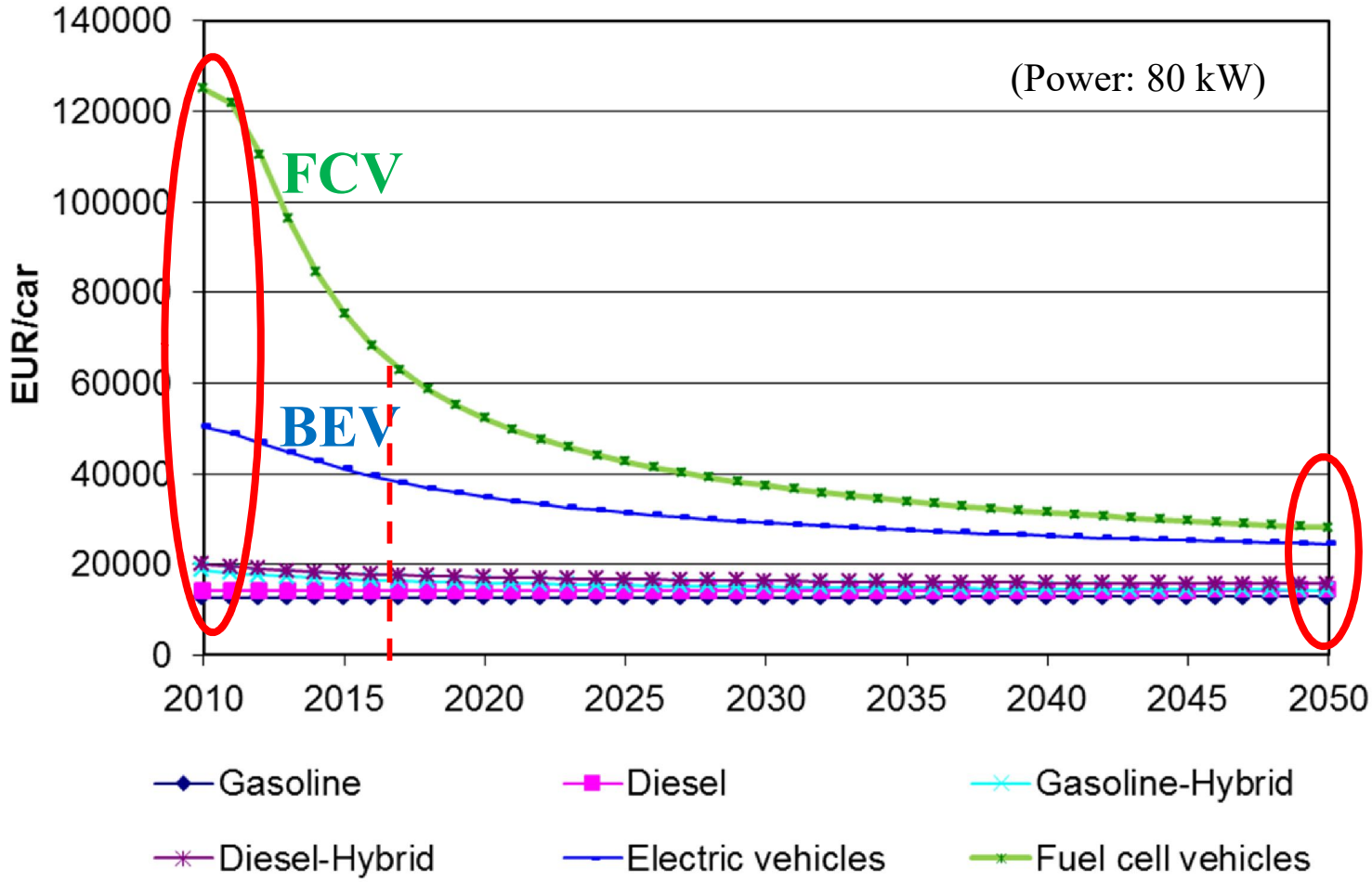
Total costs of service mobility of various types of EV in comparison to ICE cars

Technological learning – Battery



Scenario for development of investment costs

Technological learning

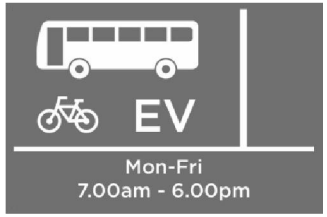


Monetary measures

The most commonly used monetary measures are subsidies and exemptions (or reductions) from:

- road taxes
- annual circulation tax
- company car tax
- registration tax
- fuel consumption tax
- congestion charges

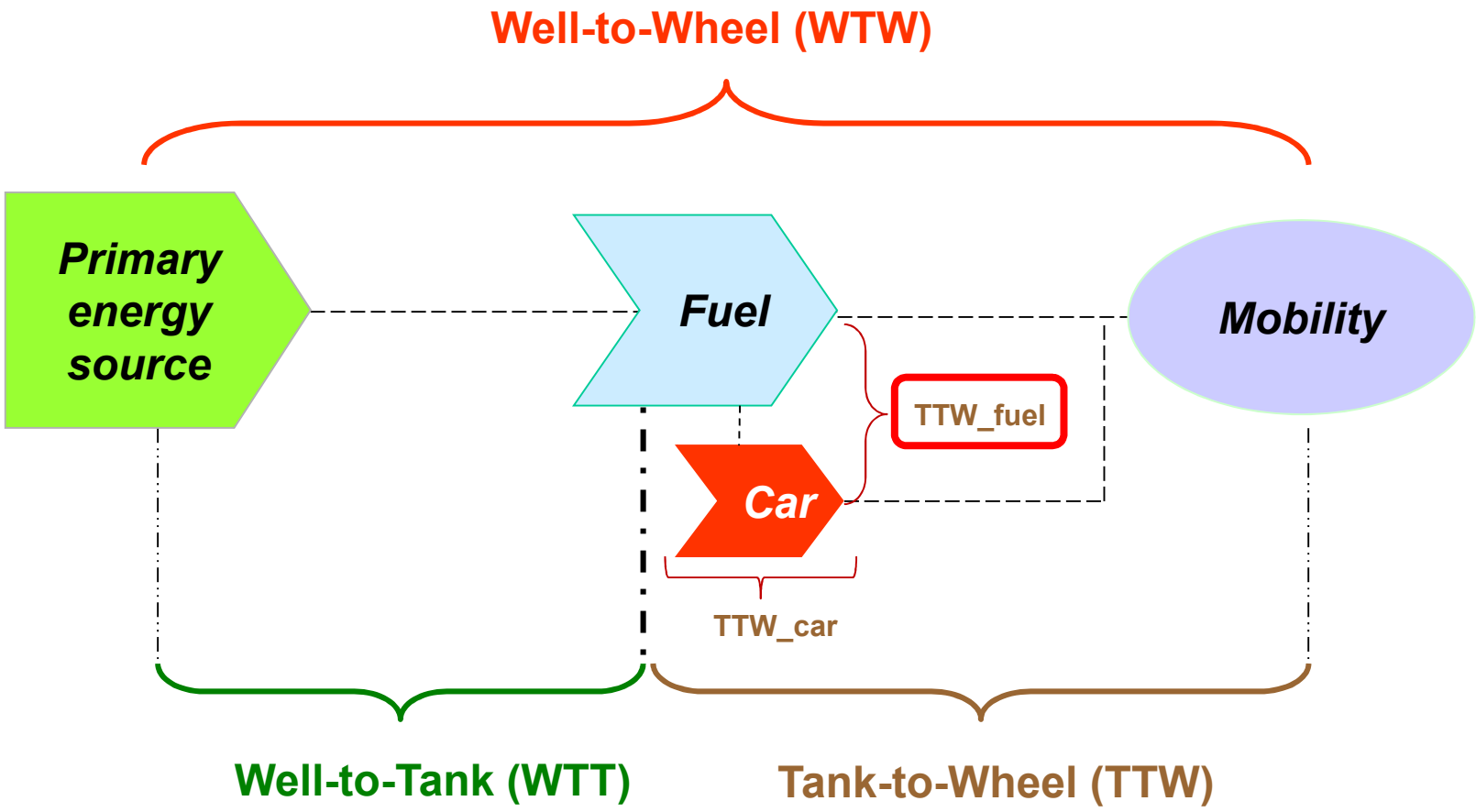
Non-monetary measures



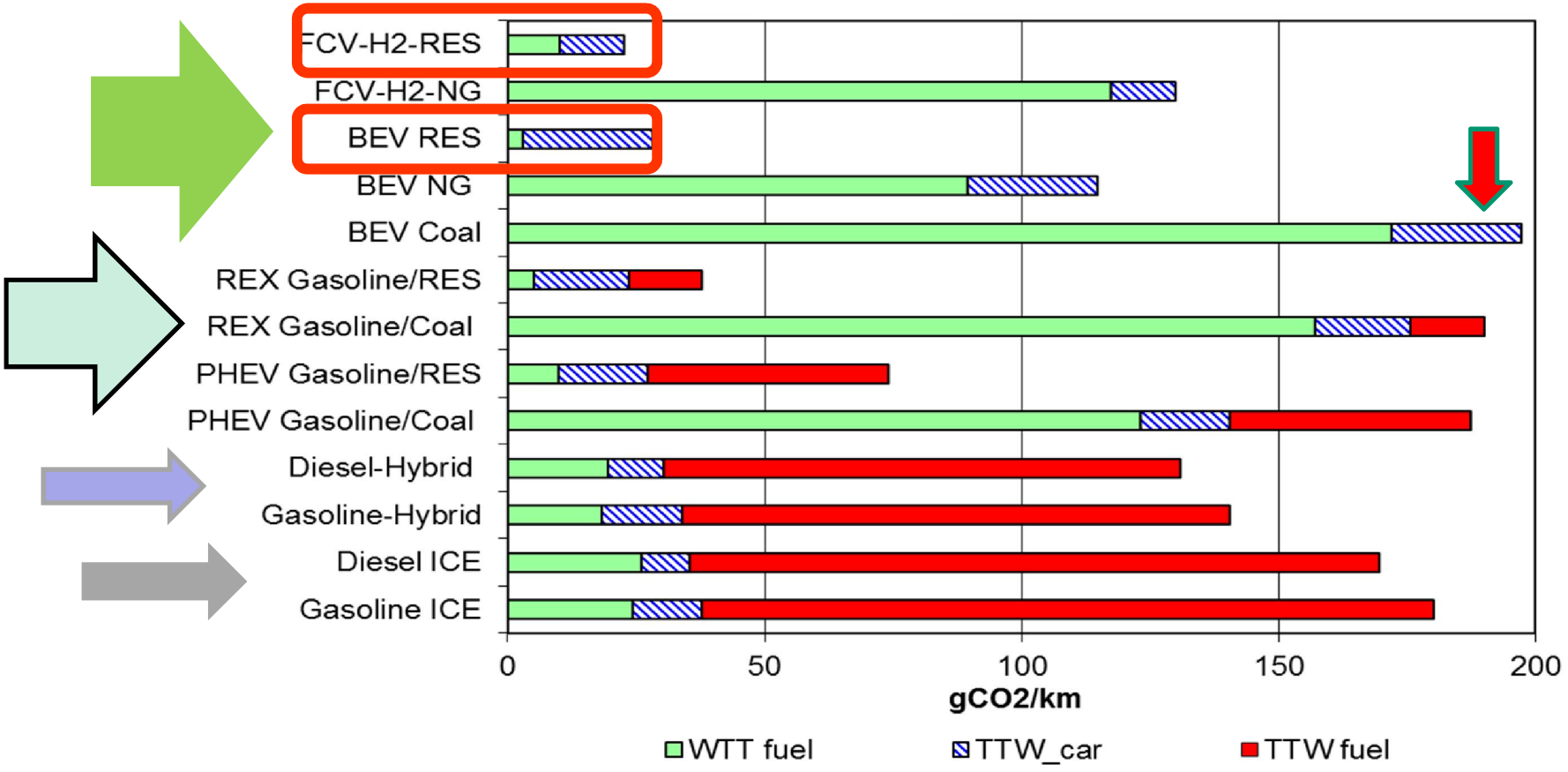
- free parking spaces,
- possibility for EVs drivers to use bus lanes,
- wide availability of charging stations,

- permission for EVs to enter city centers and zero emission zones.

Environmental assessment

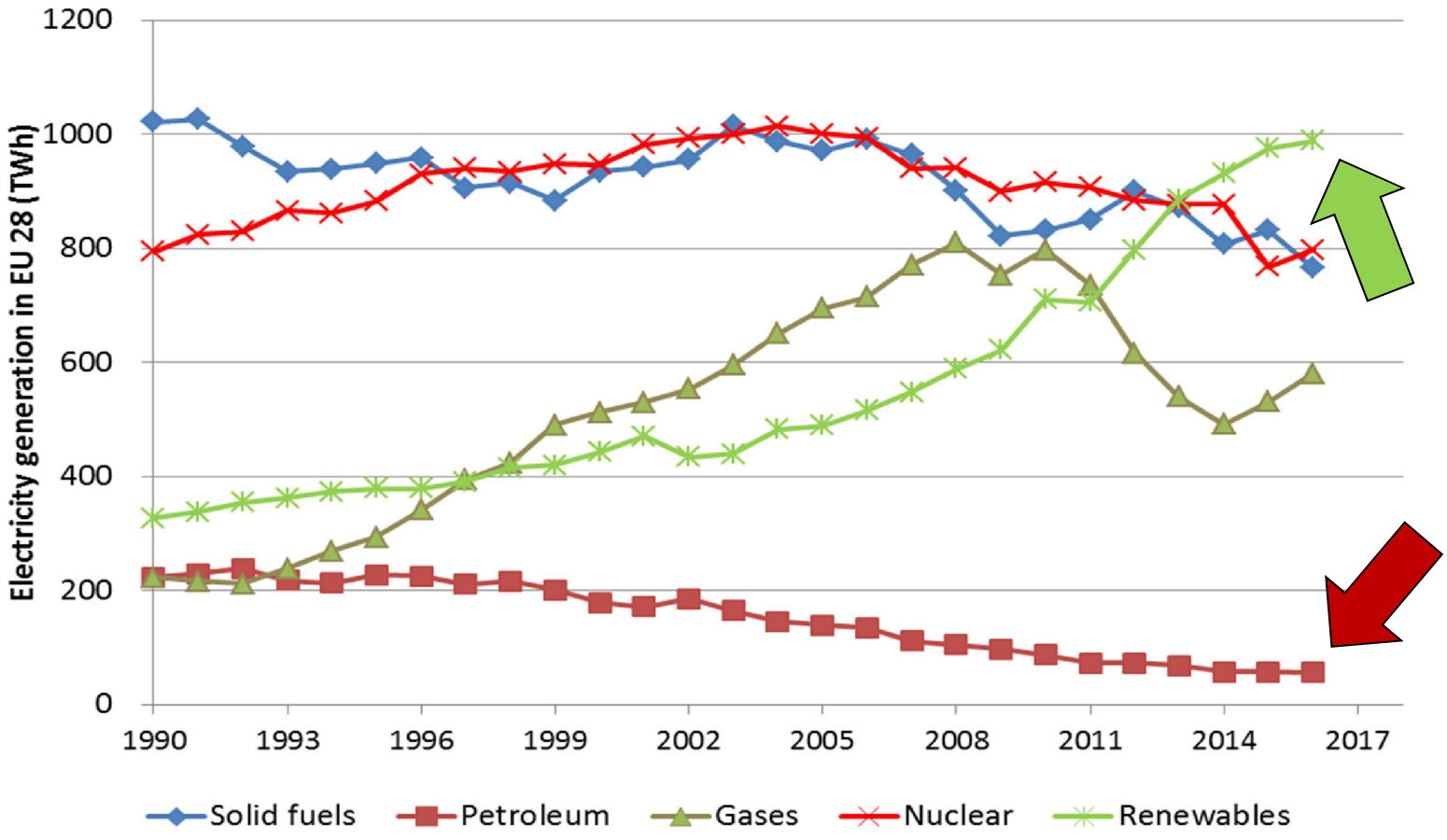


Environmental assessment

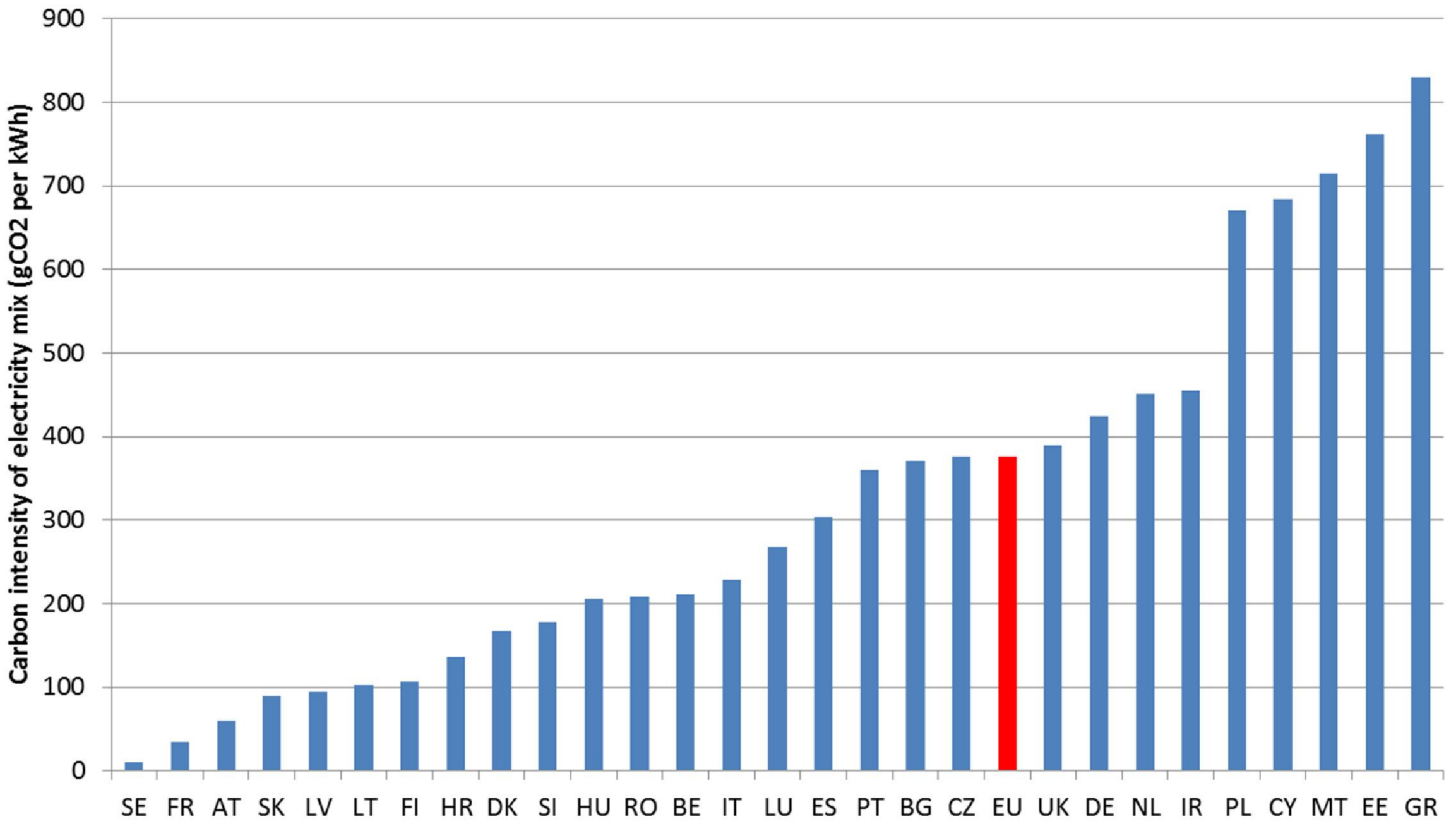


CO_2 emissions per km driven for various types of EV in comparison to conventional cars (power of car: 80kW)

Electricity generation in the EU 28

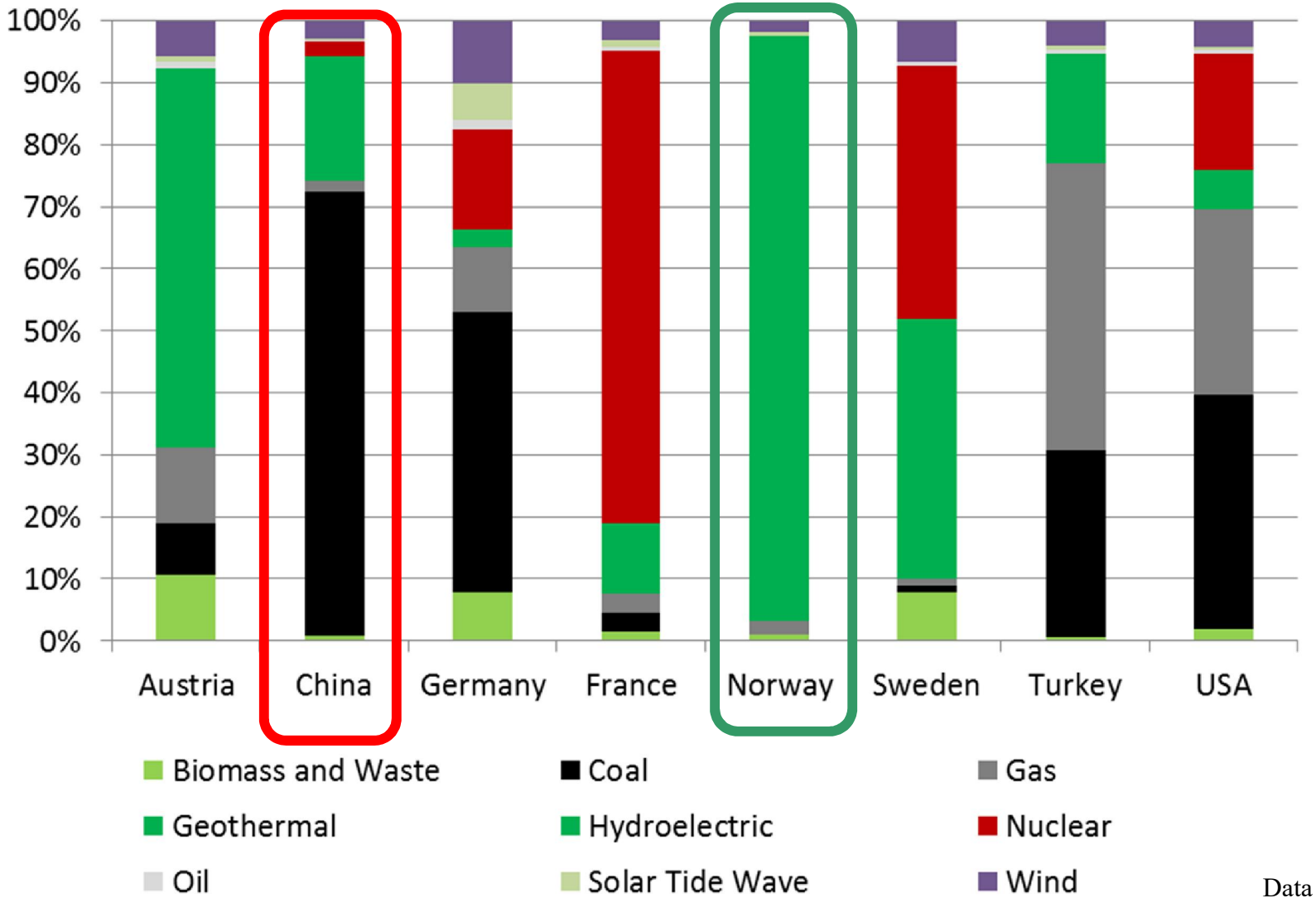


The carbon intensity of electricity mix



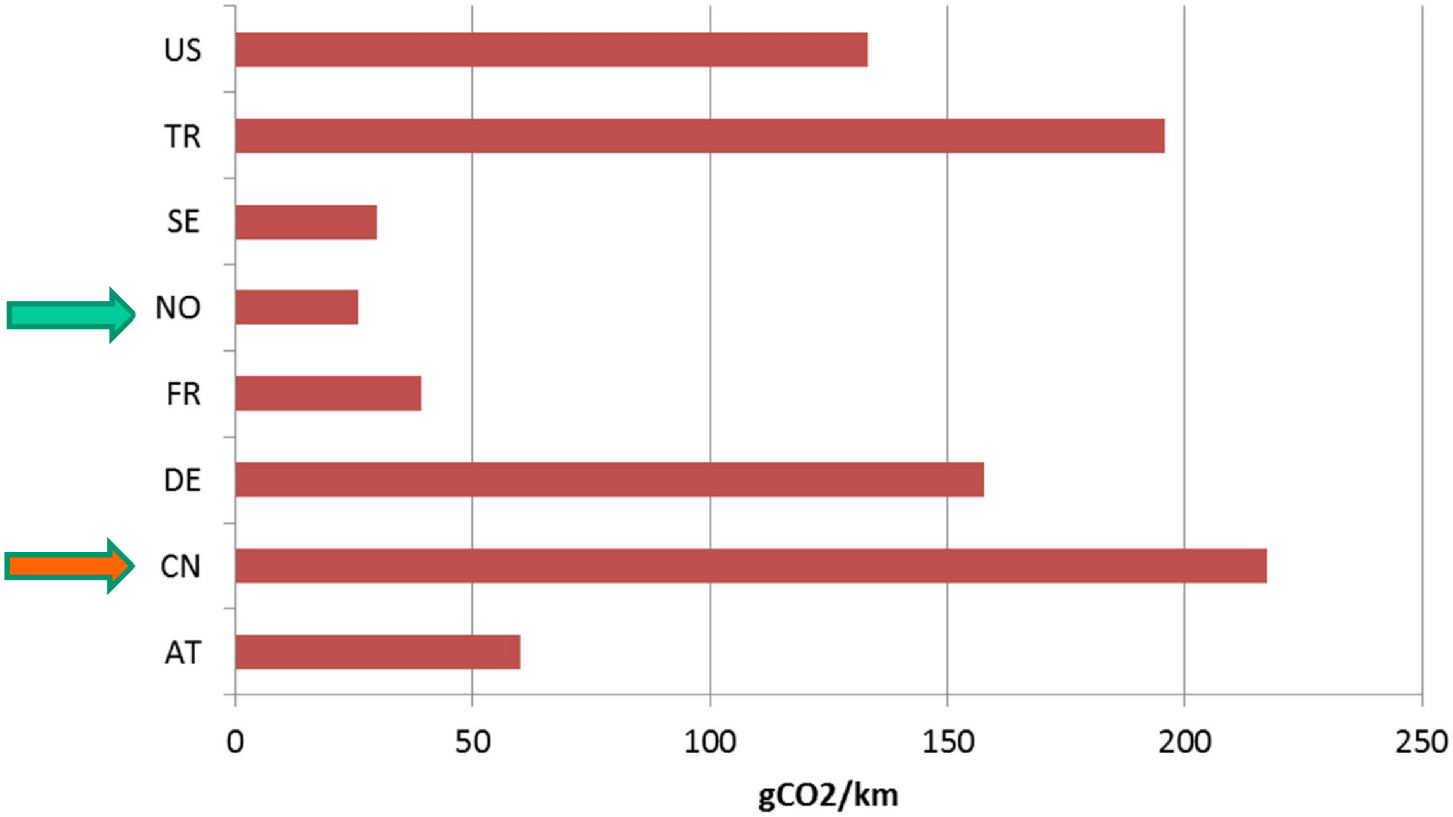
CO2 per kWh electricity generated in different European countries, 2014

Electricity mix



Data source: tsp,2014

Environmental assessment



CO_2 emissions per km driven for BEVs powered by grid electricity in different countries

Conclusions

- EVs …cost reductions, improvement of battery characteristics as well as development of infrastructure
- New policy design….most of the policies implemented will be abolished with the increasing number of EVs
- Full environmental benefit – only if EVs are powered by electricity generated from renewable energy sources
- Half-thinking….

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