

# On the state of alternative powertrains and fuels in transport

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- ✓ Introduction
- ✓ Policies and targets
- ✓ Alternative fuels
- ✓ Alternative powertrains
- ✓ Conclusions



Amount of transport services per capita

*based on non-commercial renewable energy*

Horse power



Sailing ship



Steam machine,  
steam railway



Electricity,  
combustion engine

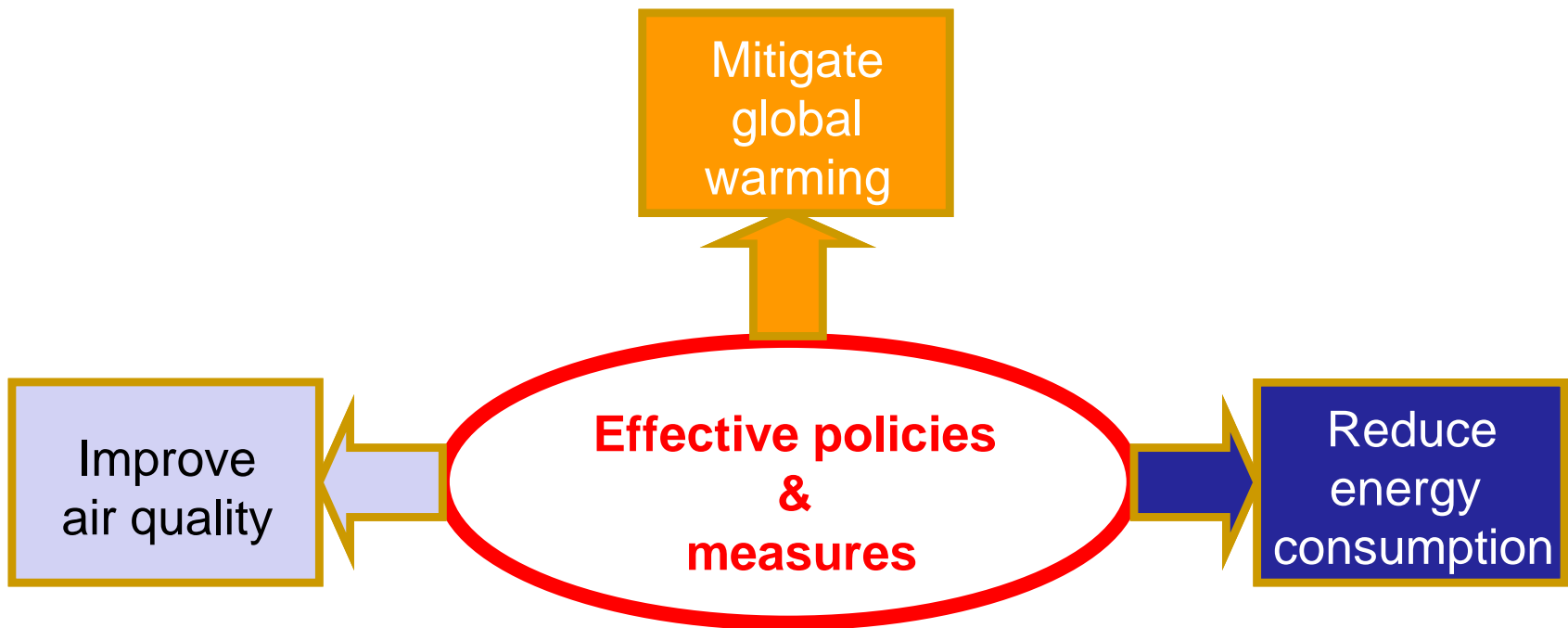


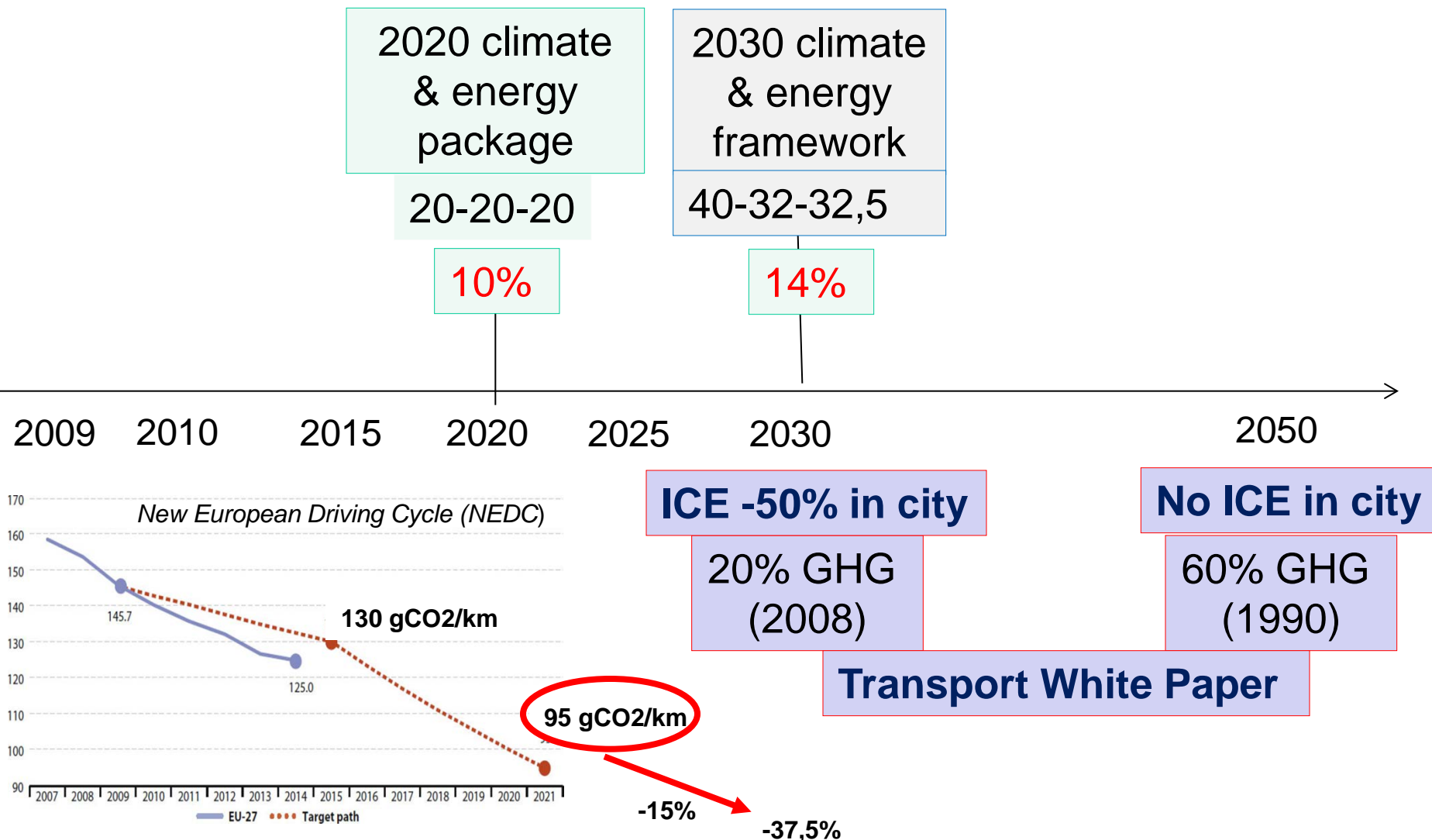
*based on  
commercial energy*

?

time

# ***The challenges for EU climate and energy policies***

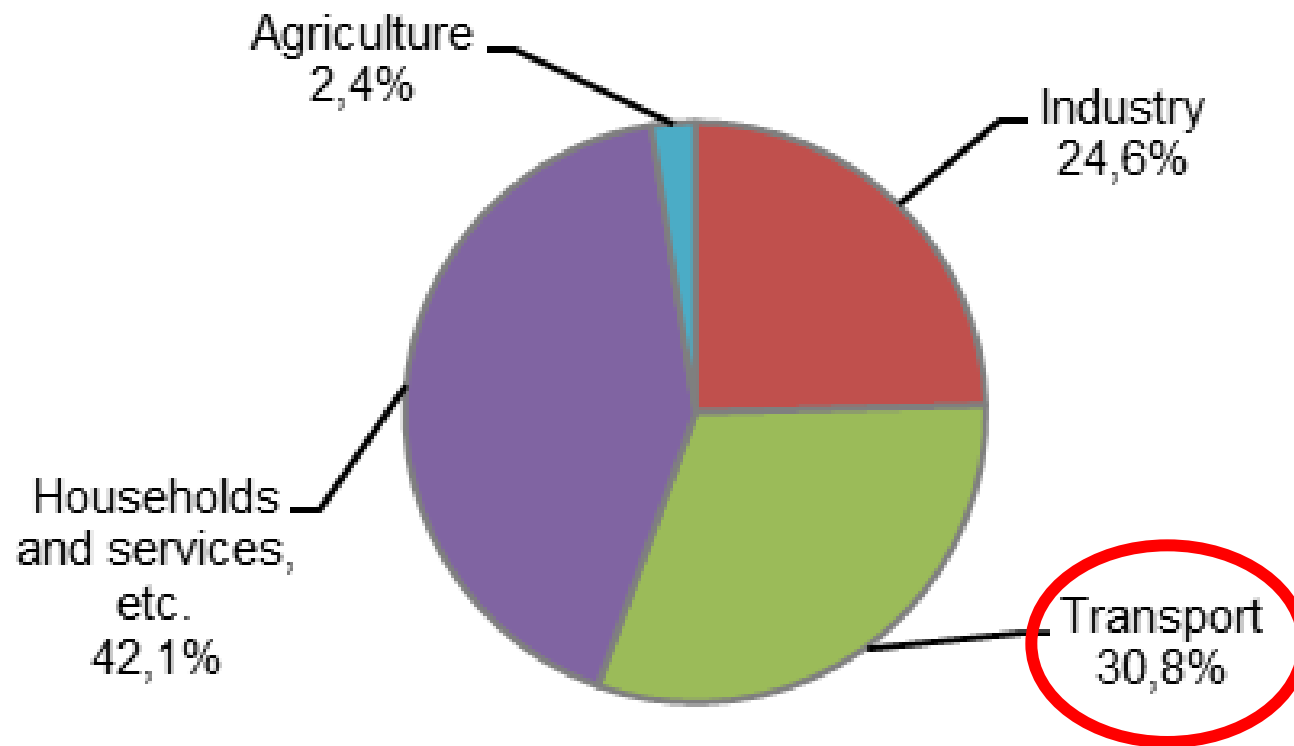




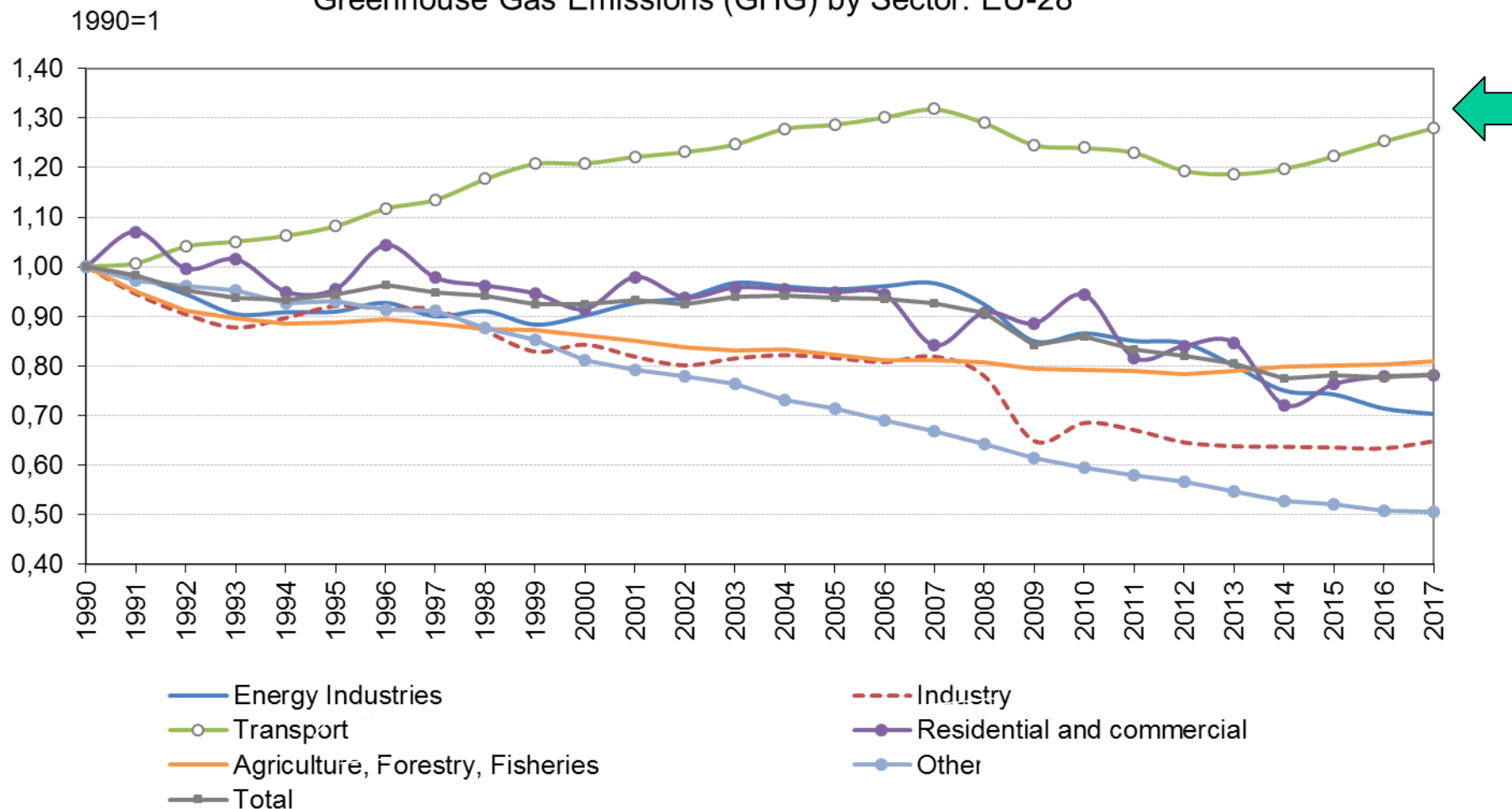
Targets and average CO<sub>2</sub> emissions from new passenger cars in EU countries

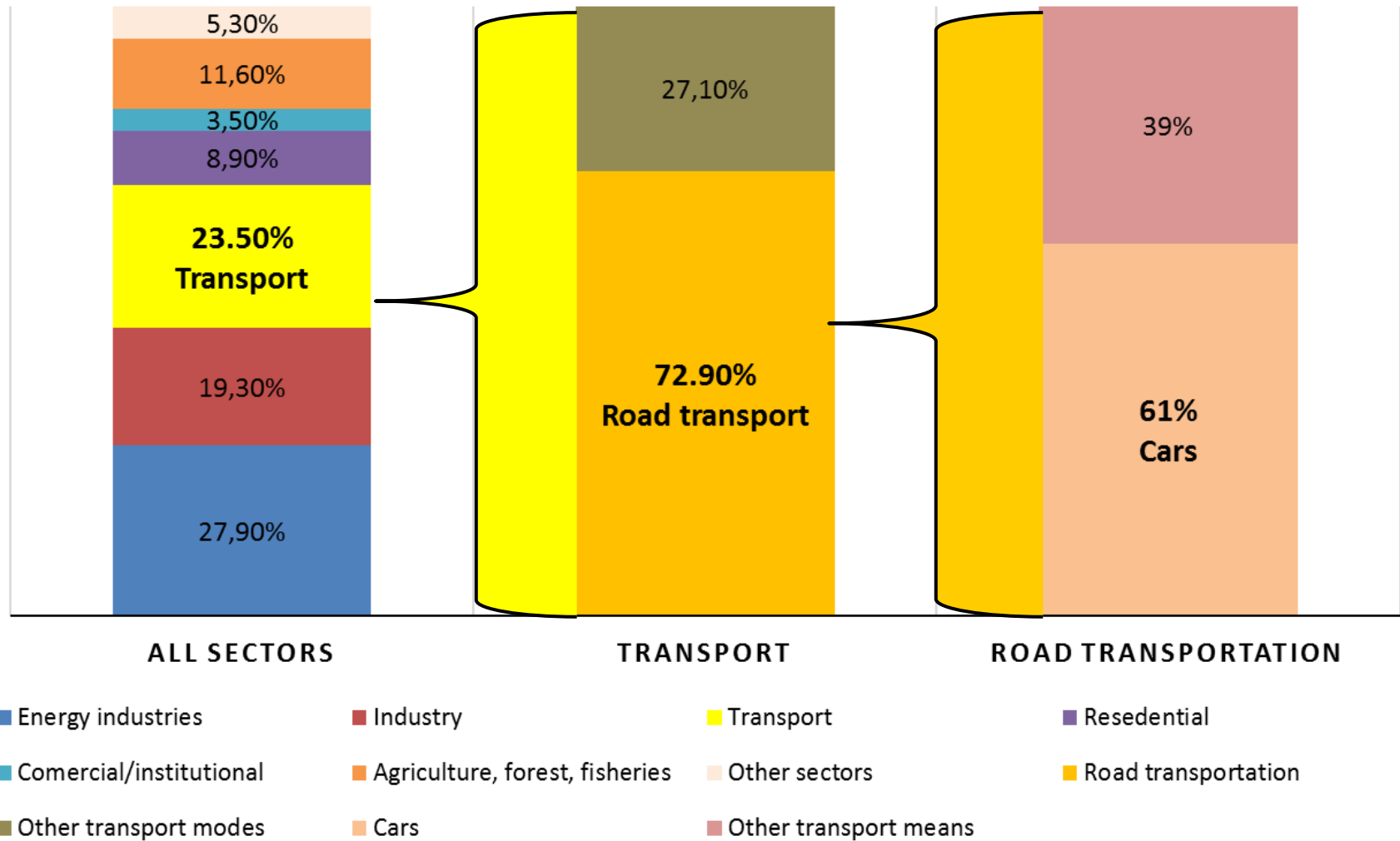
*World harmonized light-duty vehicles test procedure (WLTP)*

**Year 2017**



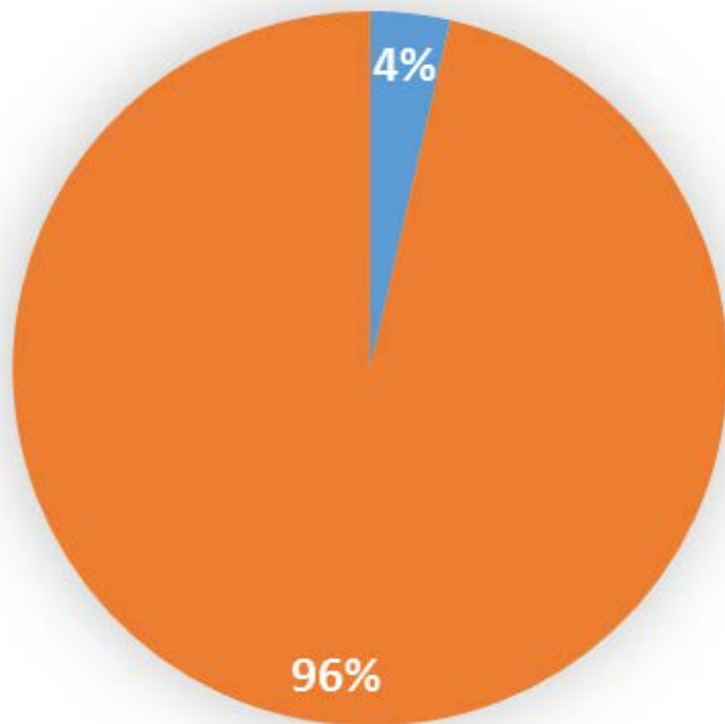
# Greenhouse Gas Emissions (GHG) by Sector: EU-28







# Share of alternatively-powered vehicles in the EU, 2017



■ Alternative fuels    ■ Fossil fuels

- ✓ Biofuels
- ✓ Electricity & electric vehicles
- ✓ Hydrogen & fuel cell vehicles

**Mature biofuels**  
*1<sup>st</sup> generation biofuels*

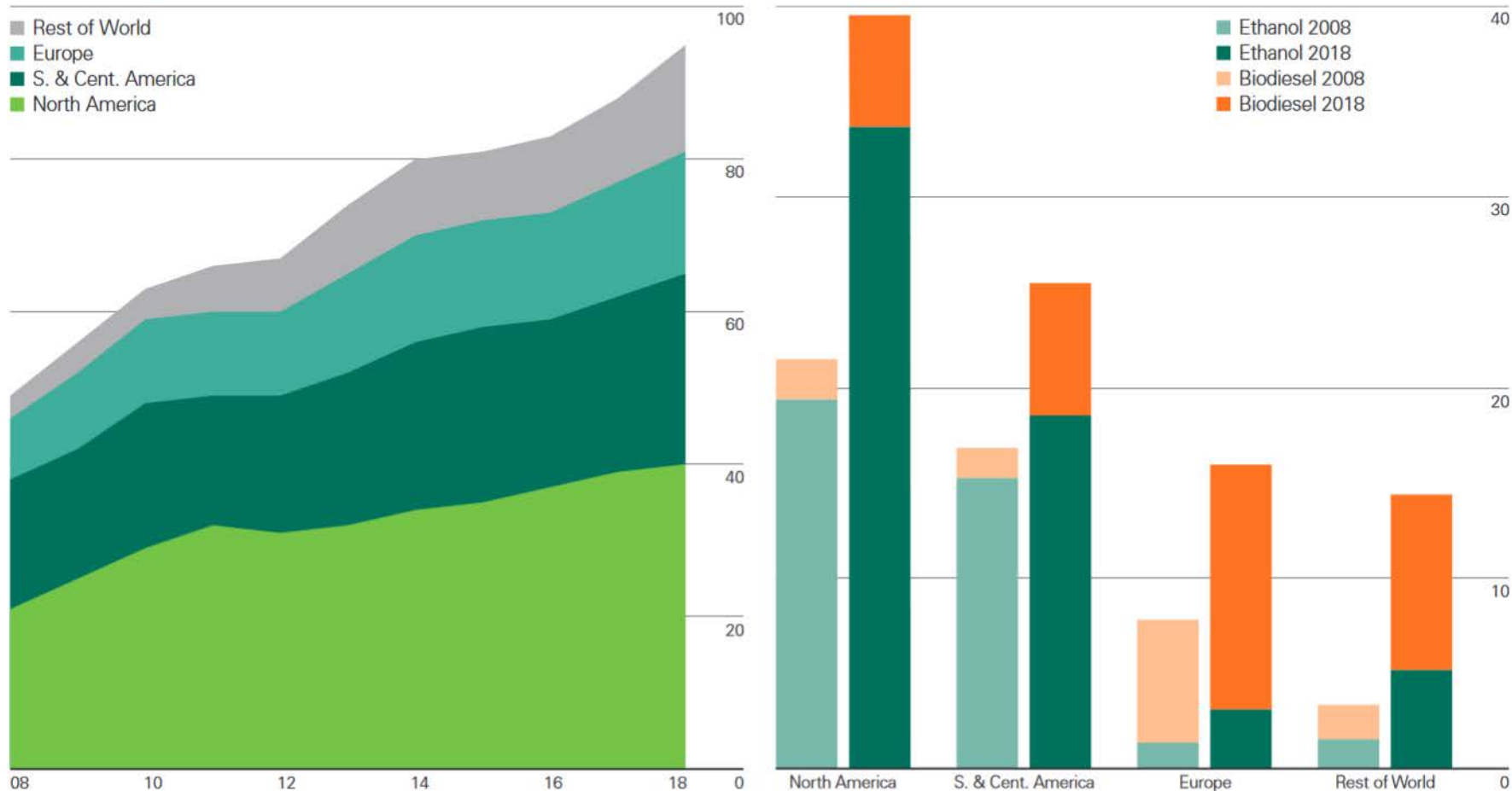
**Immature biofuels**  
*2<sup>nd</sup> generation biofuels*  
*(from lignocellulose)*

**Biofuels in labour stage**  
*3<sup>rd</sup> generation biofuels*  
*(from algae)*

**Long term possibility**  
*4<sup>th</sup> generation biofuels*  
*(from genetically manipulated  
feedstocks)*

## World biofuels production

Million tonnes oil equivalent



## Quotas for ethanol and biodiesel by country, in 2016, in per cent

Source: Global Renewable Fuels Alliance

E=ethanol, B=biodiesel

Germany: 2017: 4 % GHG avoidance;  
2020: 6 % GHG avoidance

EU-28: 10 % biofuels in transport by 2020

Norway: E= 4 %, B= 7 %

Canada: E=5 %, B=2 %

USA: E+B= 7 % by 2022

Peru: E= 7.8 %, B= 2 % (planned 5 %)

Costa Rica: E= 7 %, B= 20 %

Jamaica: E= 10 %

Panama: E= 2 % (planned 10 %)

Colombia: E= 8 % (planned 10 %)

Brazil: E= 25 %, B= 5 %

Paraguay: E= 24 %, B= 1 %

Argentina: E= 5 %, B= 10 %

Mexico: E= 2 % in Guadalajara

E=ethanol, B=biodiesel

South Africa: E= 10 %, B= 5 %

Mosambique: E= 10 %

Angola: E= 10 %

Malawi: E= 10 %

Zimbabwe: E= 10 %

India: E= 5 % (planned E+B 20 %)

Indonesia: E= 3 %, B= 10 % (planned  
E= 20 %, B= 30 % by 2025)

China: E= 10 % in 9 provinces,  
(gepl. E+B 10 %)

Philippines: E= 10 %, B= 5 %  
2020: E= 20 %, B= 10 %

Malaysia: B= 5 % (planned 15 %)

South Korea: B= 2,5 %

Thailand: B= 5 %

Australia: E= 4 %, B= 2 % in New South Wales



20-20-20

40-27-27

40-32-32.5

BF: 5.75%

10%

## Targets for 2030

- a 40% cut in greenhouse gas emissions compared to 1990 levels
- at least a 27% share of renewable energy consumption
- at least 27% energy savings compared with the BAU scenario.
- **No sub-target on renewable energy in transport (e.g. biofuels)!**

14%

the share of **advanced biofuels and biogas** must be at least **1%** in 2025 and at least **3,5%** in 2030.

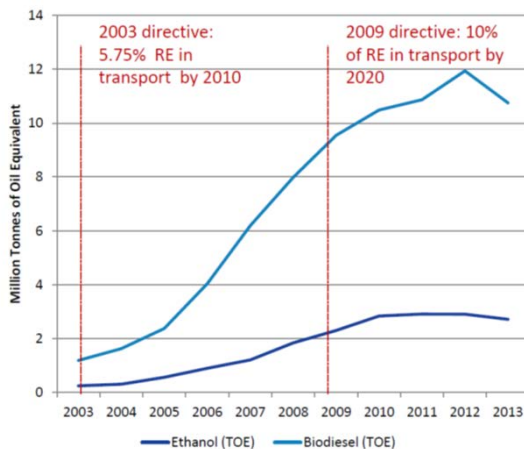
2010

2015

2020

2030

Consumption of biofuels in Europe 2003-2013

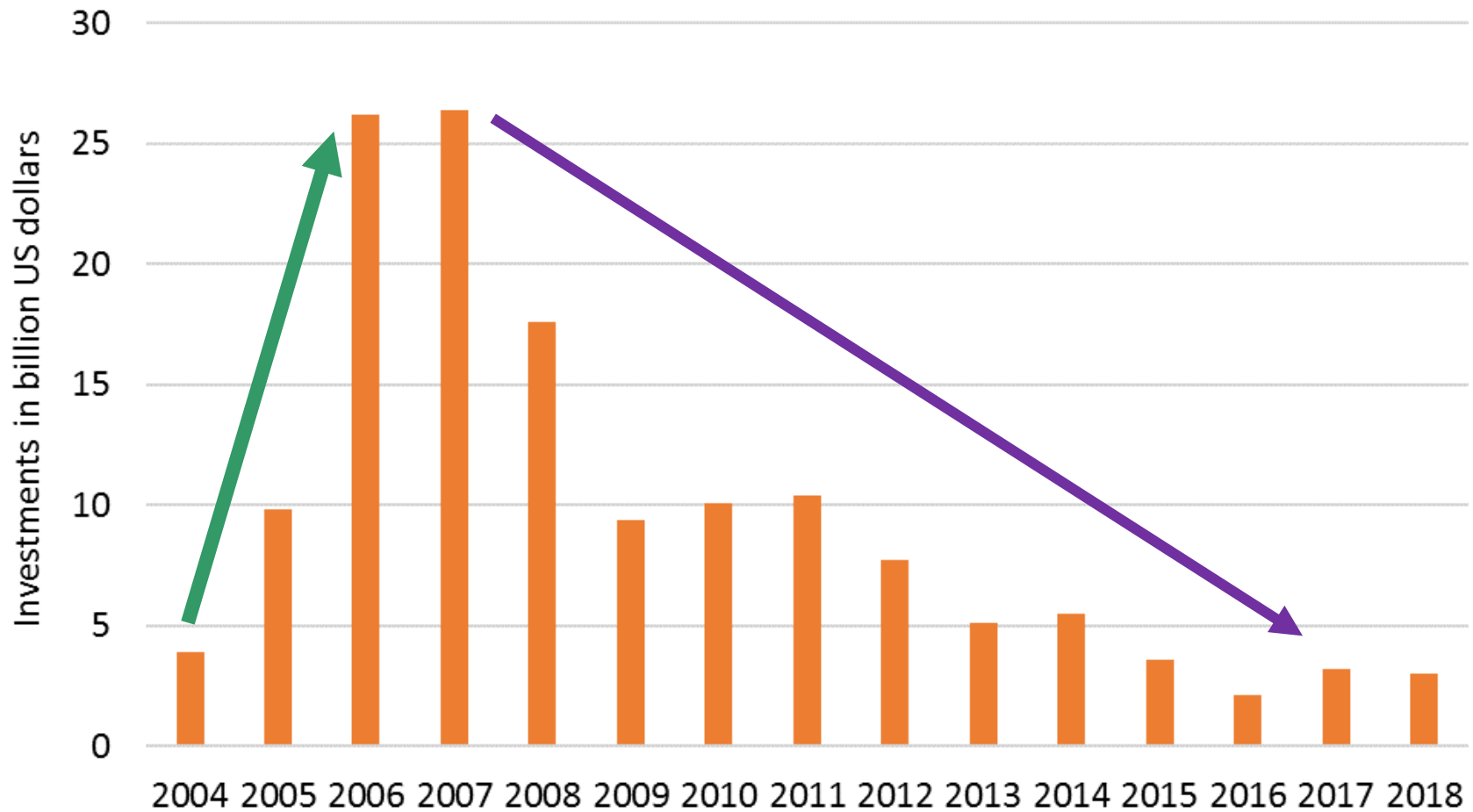


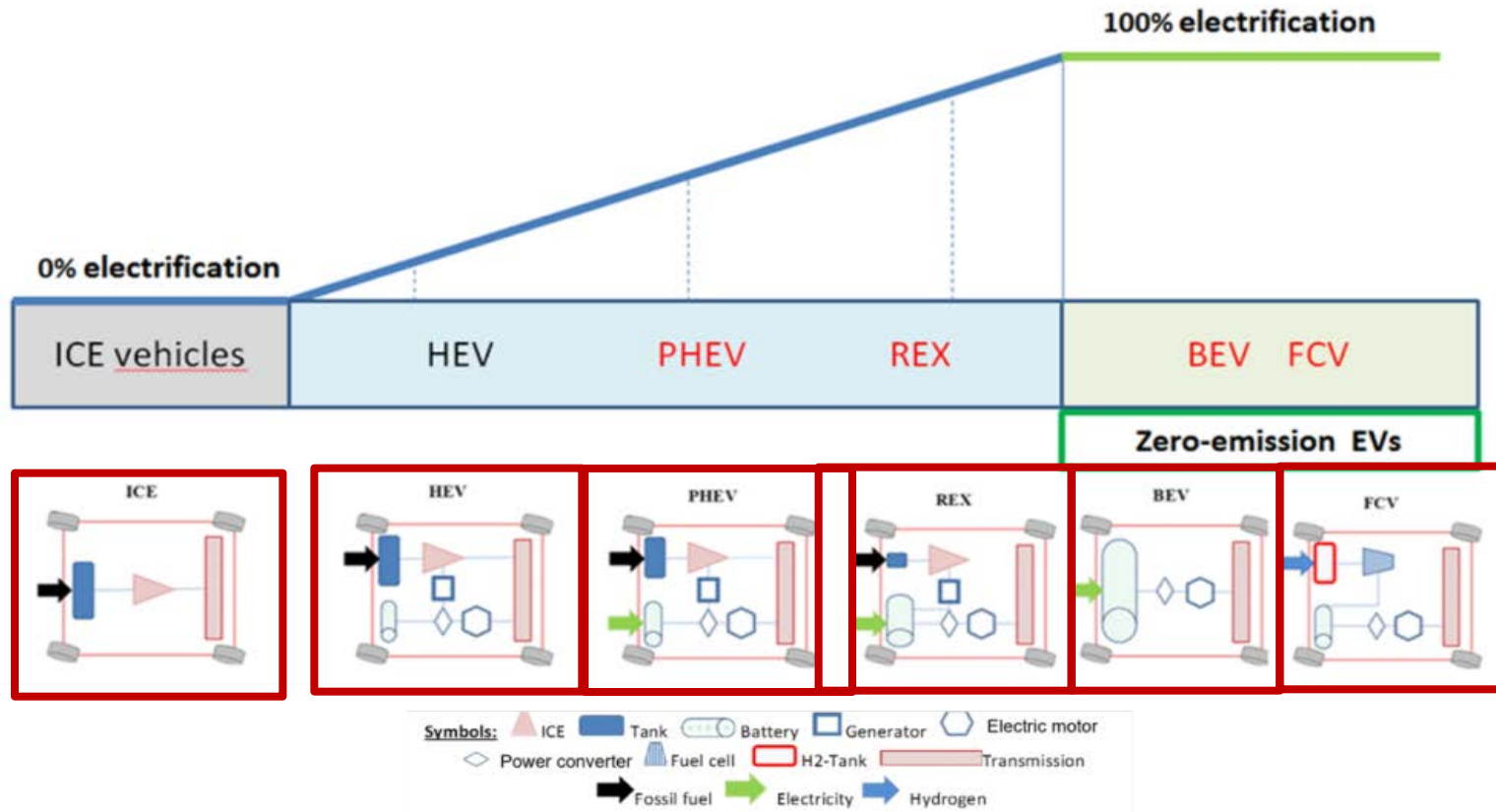
Source: Eurostat

## New legislation approved by European Parliament on 28 April 2015

- Cap of 7% on the contribution (to 2020 targets) of biofuels produced from 'food crops' to mitigate ILUC emissions
- No public support for food crop based biofuels post 2020

# Global investment in biofuels







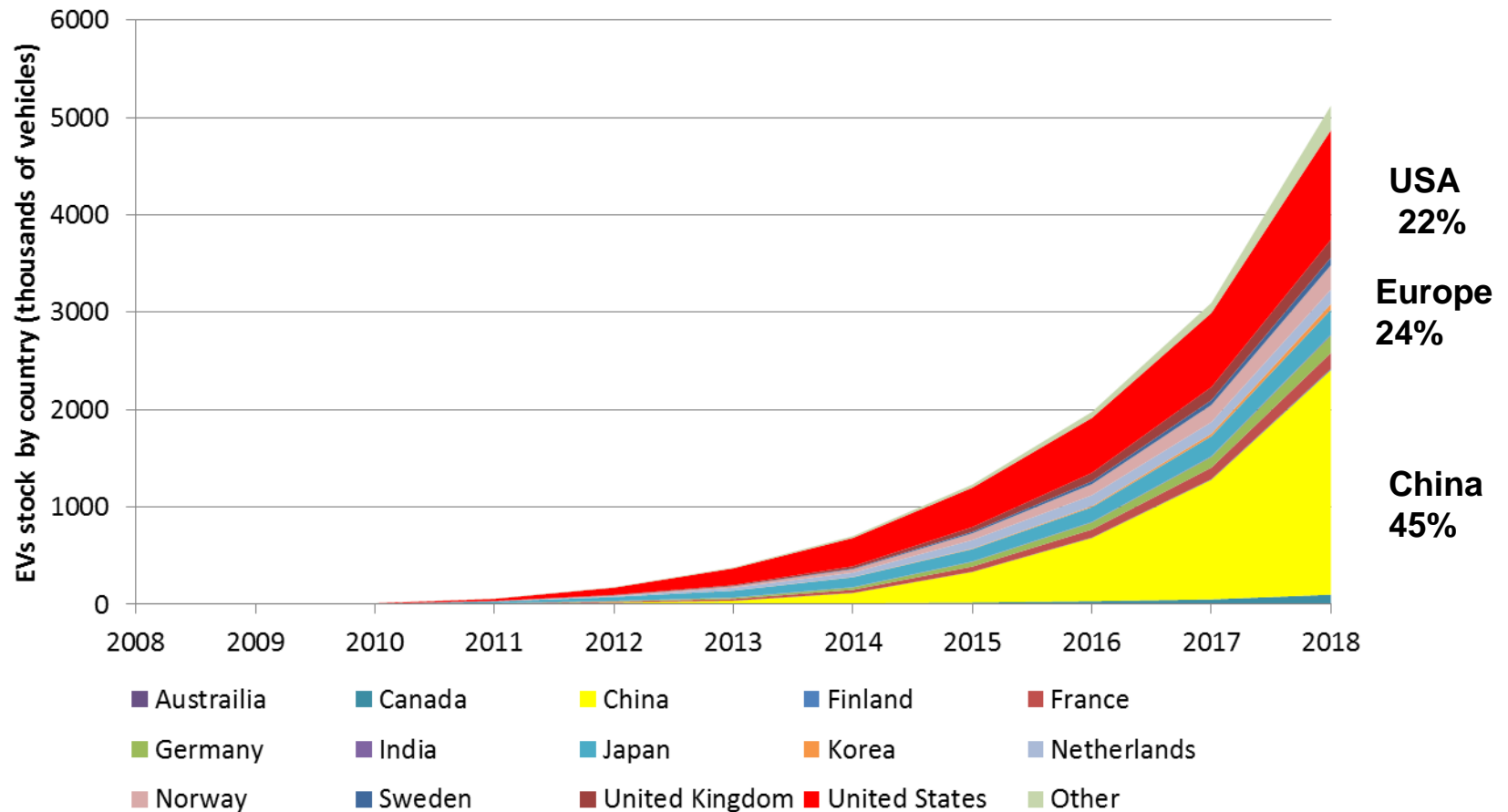


## **Advantages**

- ✓ Energy efficiency
- ✓ Energy security
- ✓ Air pollution
- ✓ Noise reduction

## **Disadvantages**

- Costs
- Driving range
- Charging time
- Charging infrastructure



Development of the global stock of rechargeable EVs

## Paris Declaration on Electro-Mobility and Climate Change & Call to Action:

- more than 100 million EVs
- 400 million two and three-wheelers

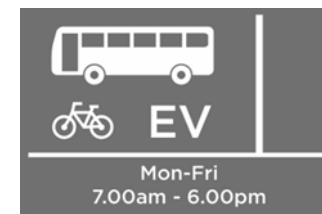
## Monetary measures

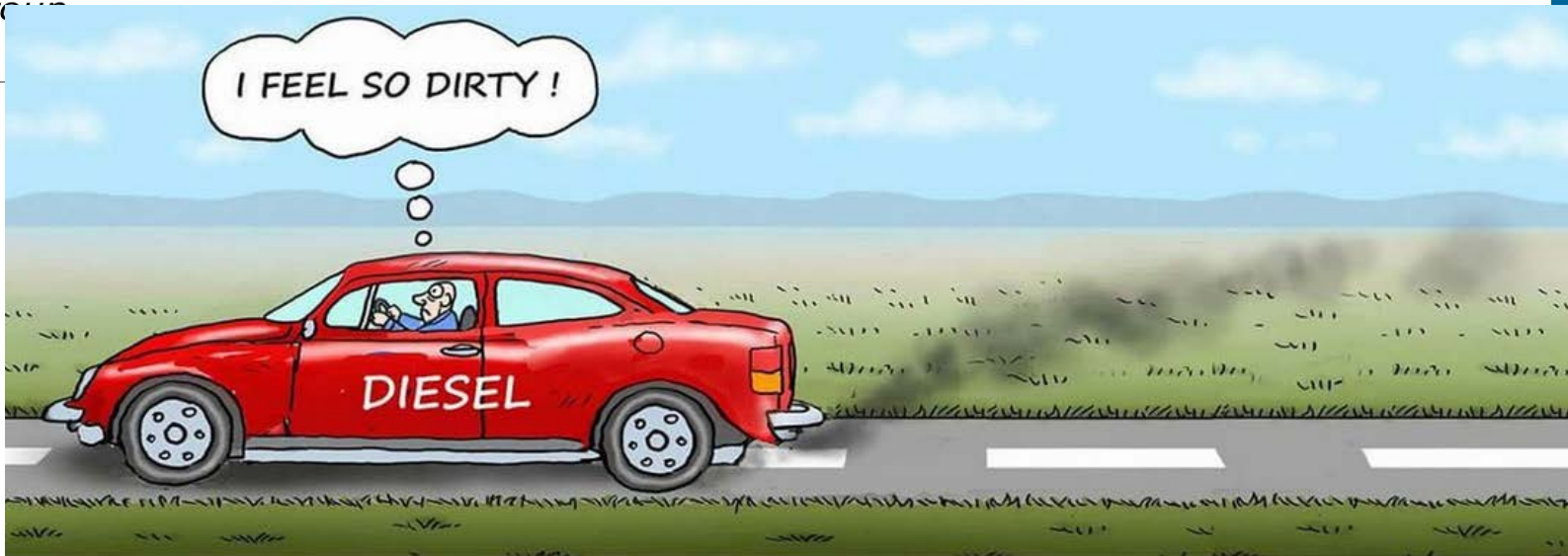
- road taxes
- annual circulation tax
- company car tax
- registration tax
- fuel consumption tax
- congestion charges



## Non-monetary measures

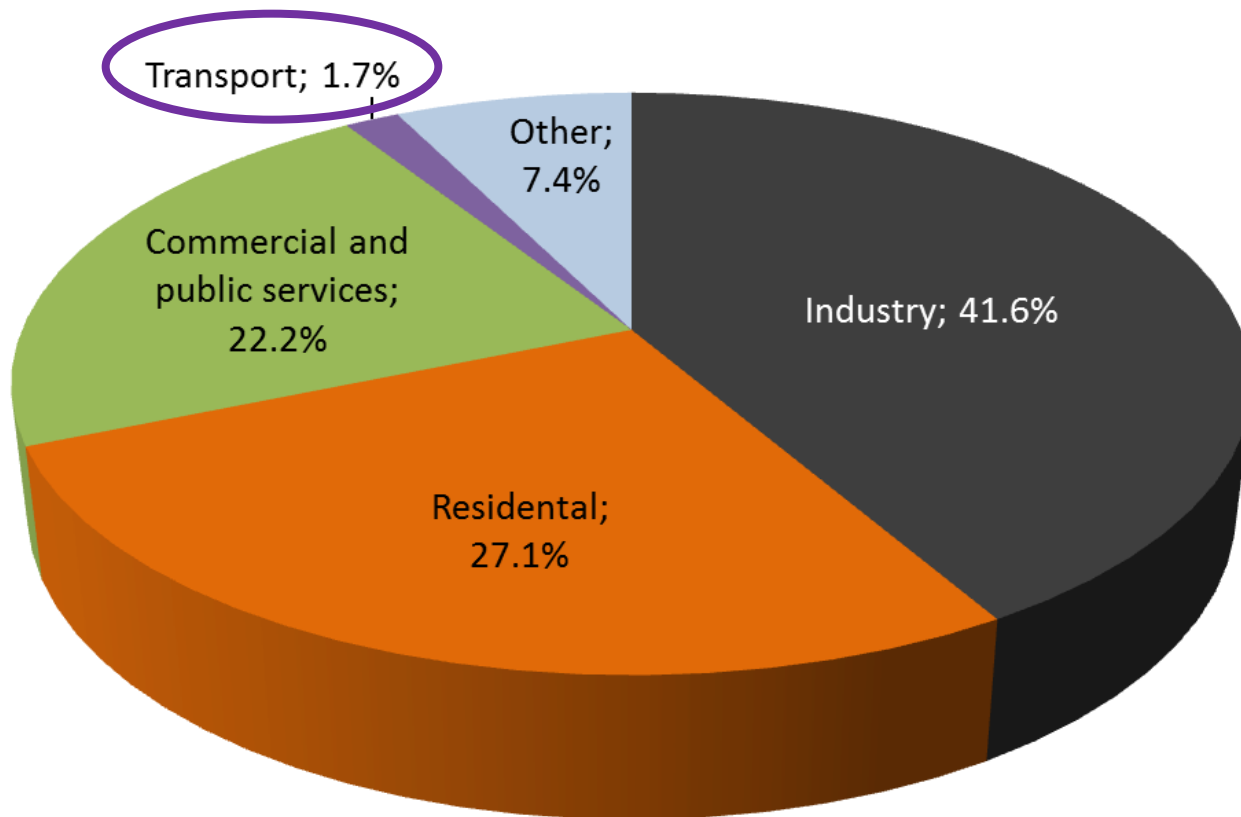
- free parking spaces
- possibility for EVs drivers to use bus lanes
- wide availability of charging stations
- permission for EVs to enter city centers and zero emission zones



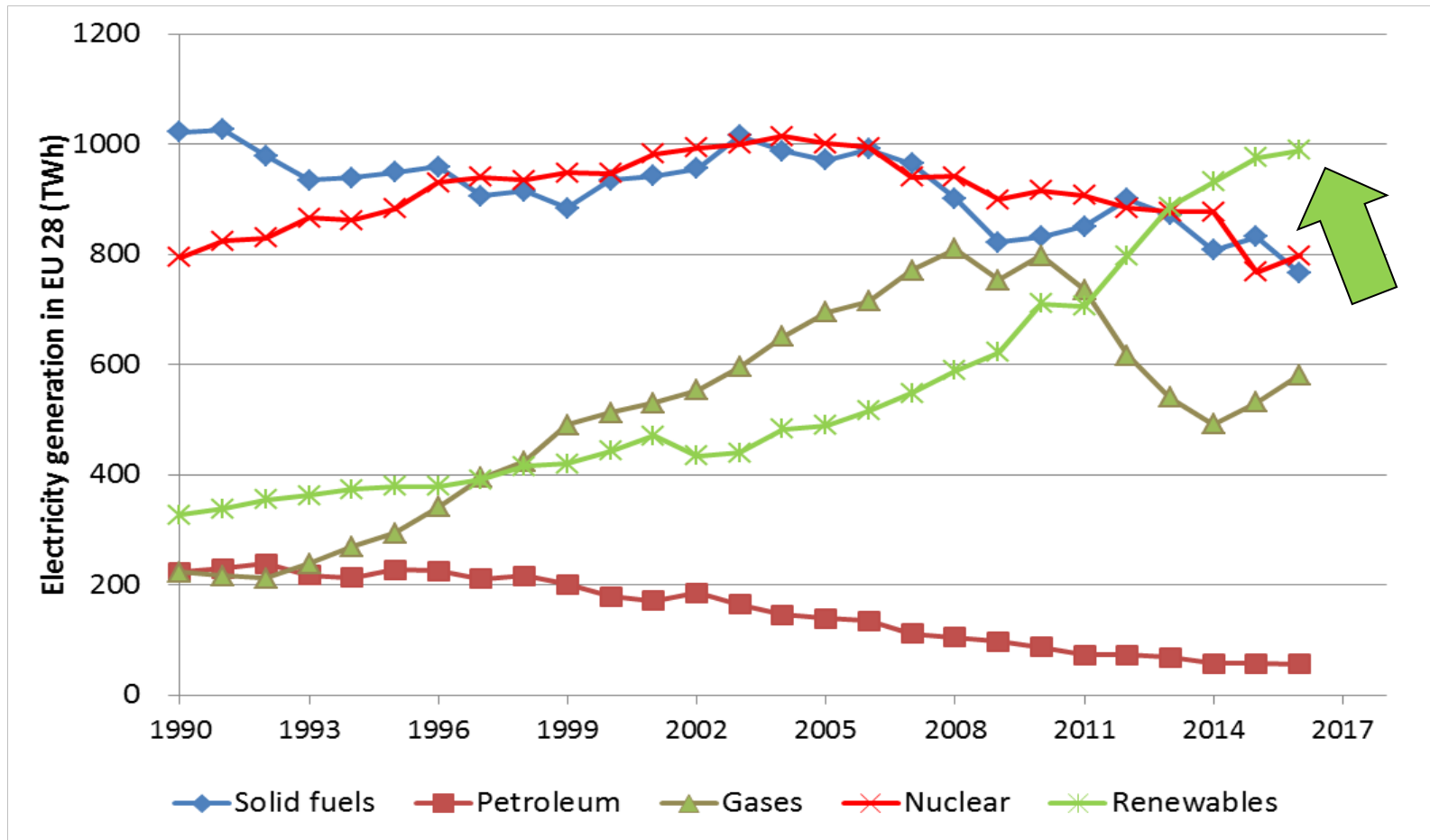


Artist: Marian Kamensky

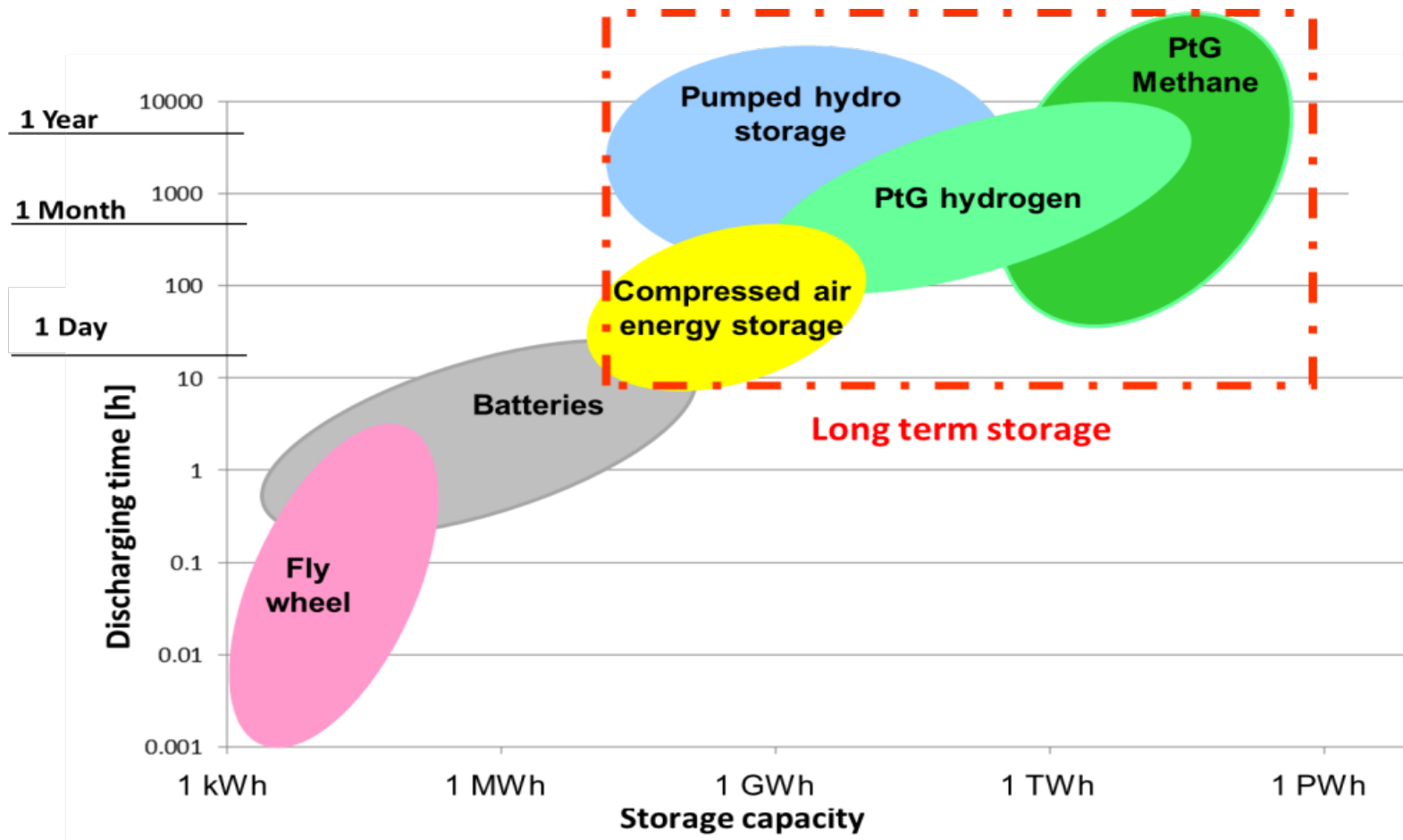
# ***World total final electricity consumption by sector***



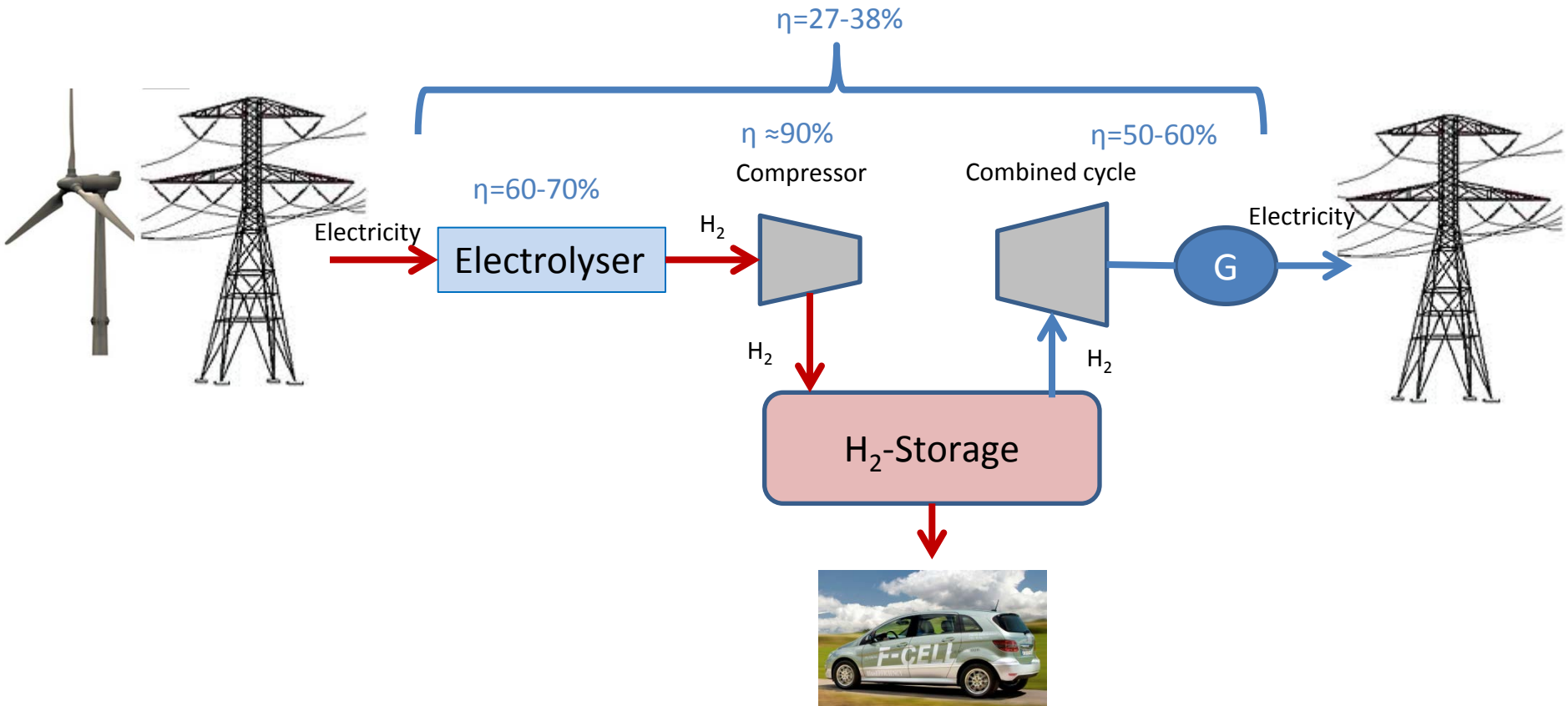
# Electricity generation in the EU 28



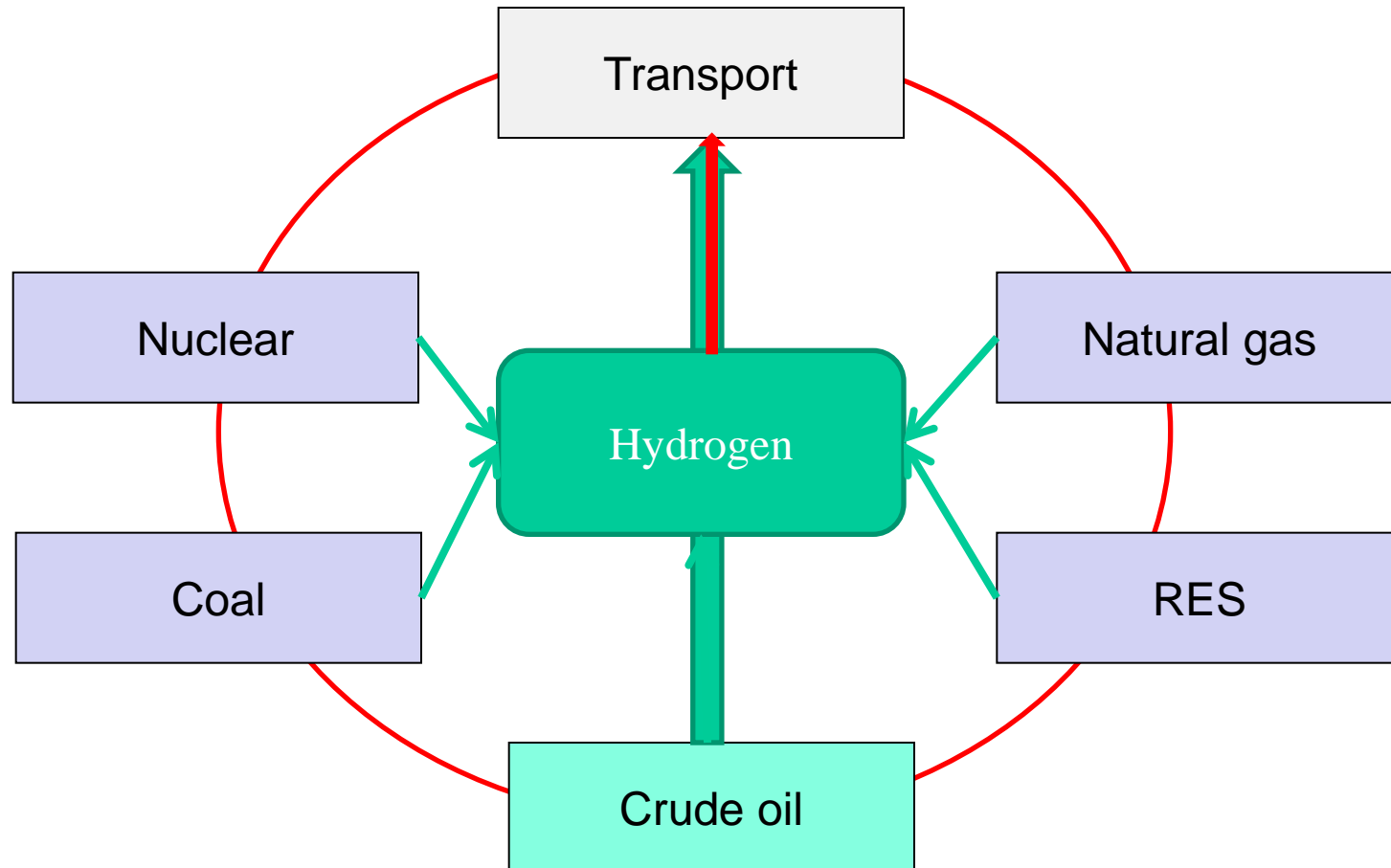
# Different storage options

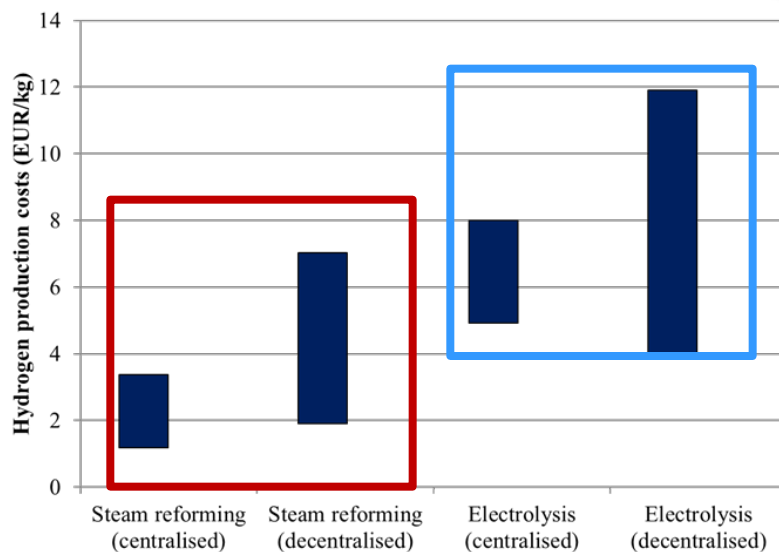
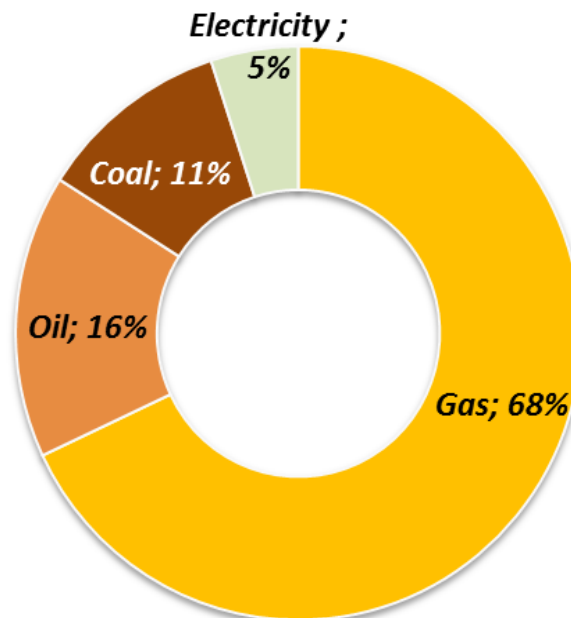
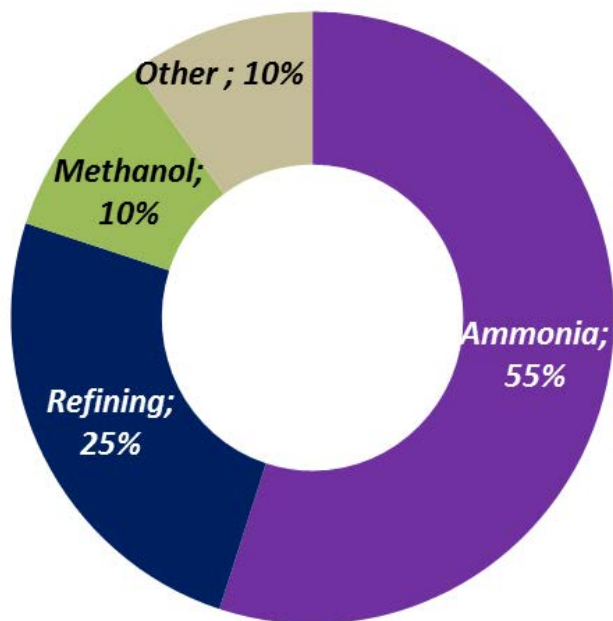


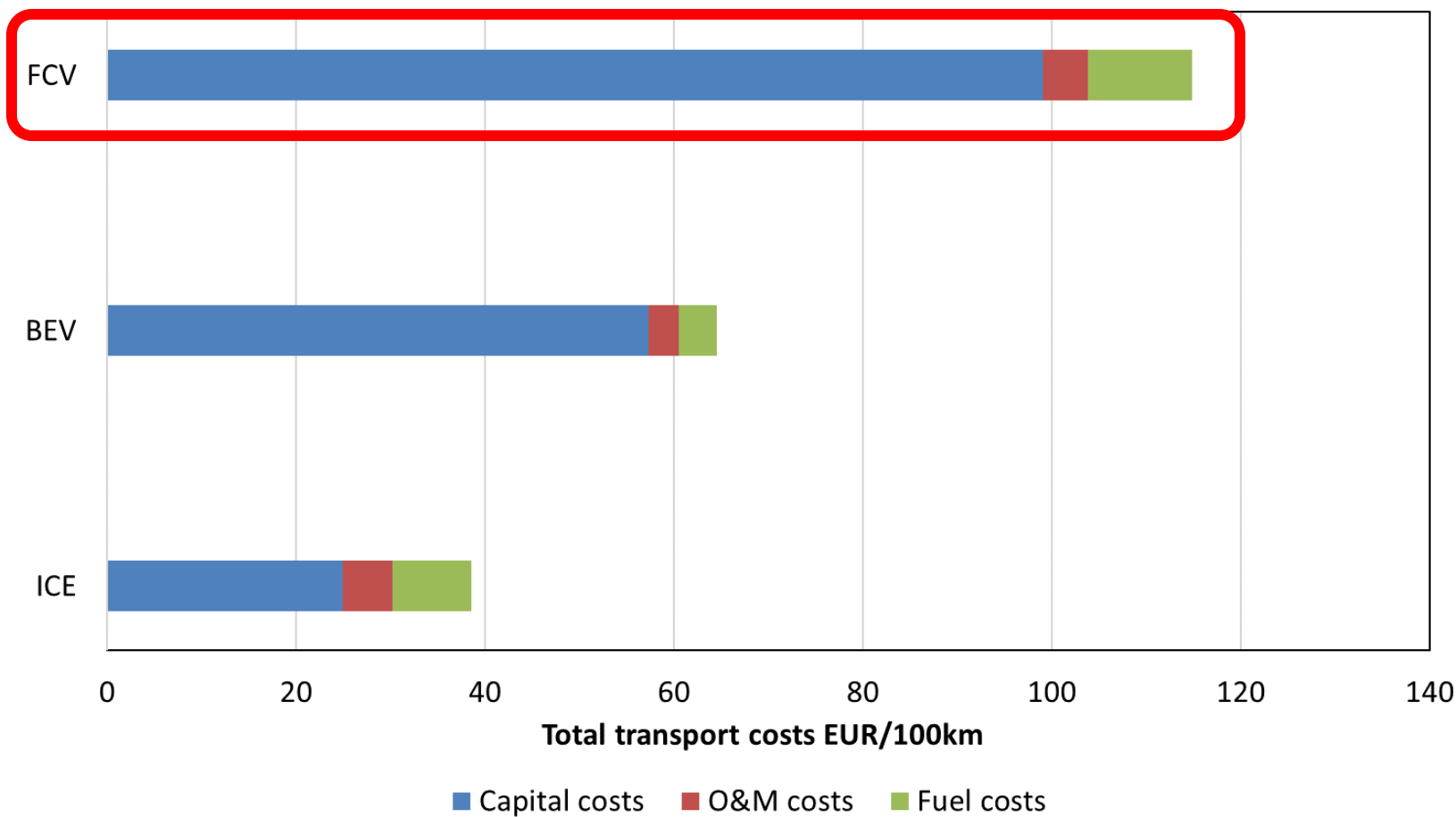




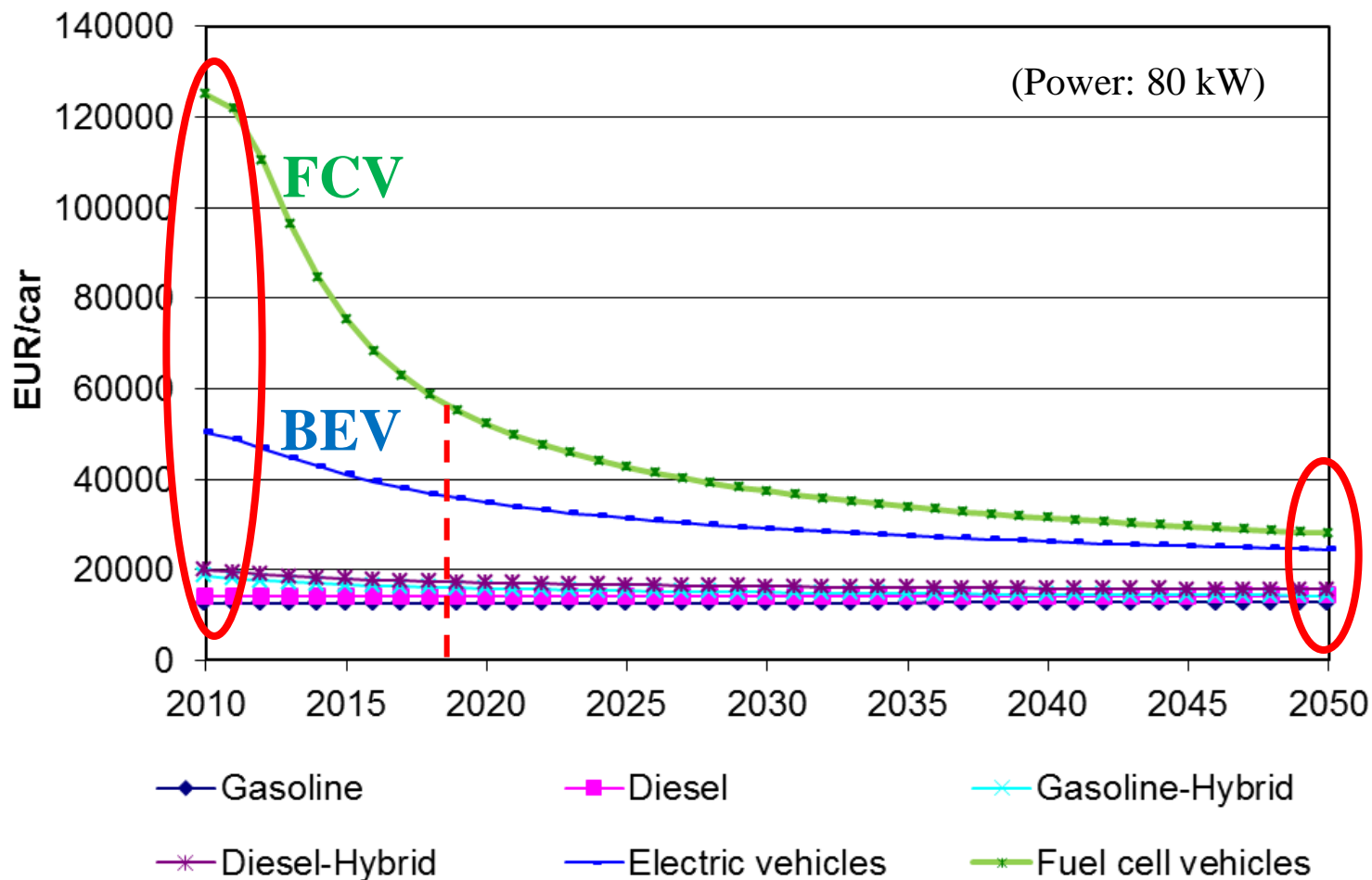
Energy supply chains: Storage and/or use of RES for mobility



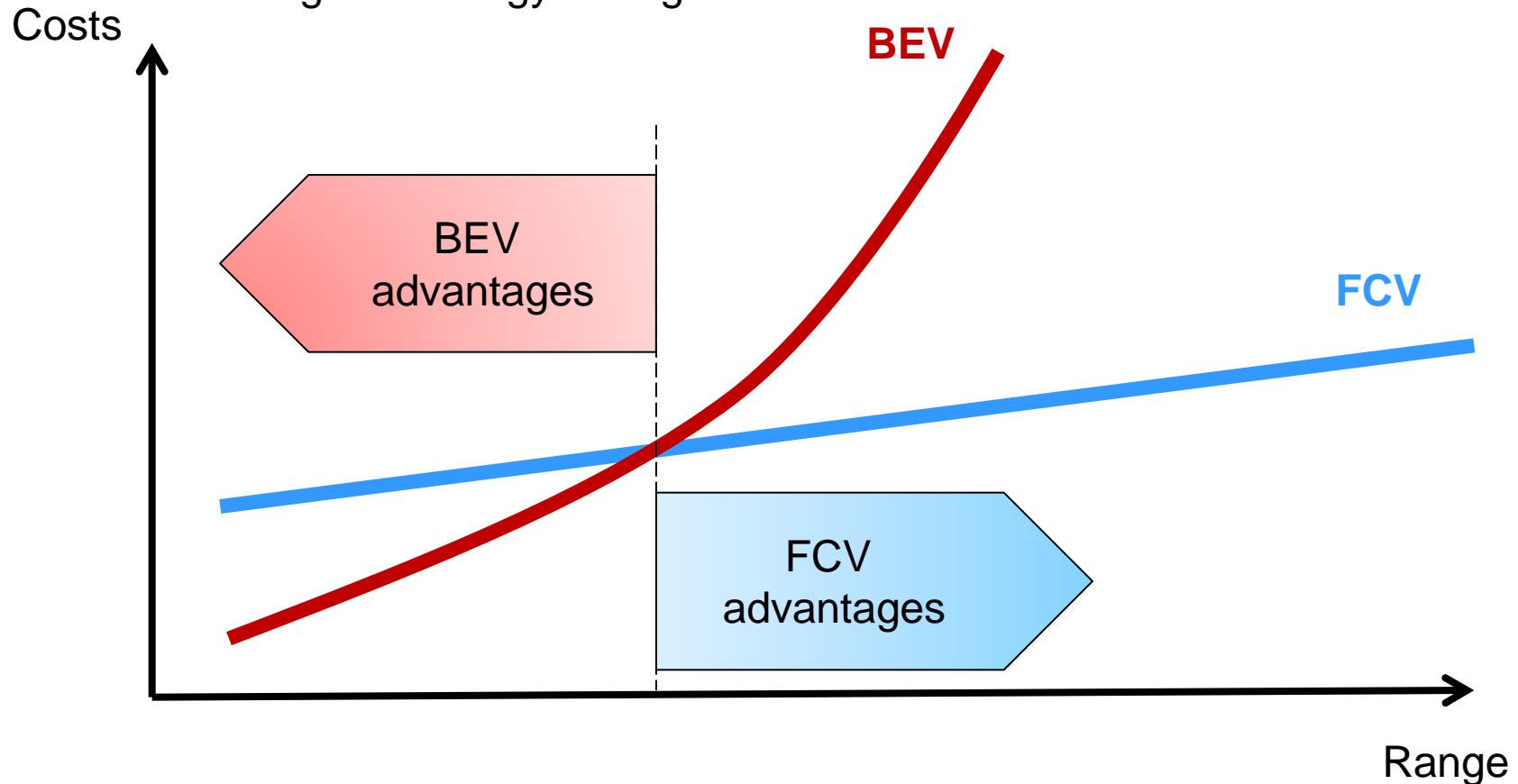




# Scenario for development of investment costs



- Fuel efficiency
- Refuelling time
- Driving range
- Weight of energy storage



- Need for environmentally friendly fuels and technologies in the transport sector
- Biofuels...next generations
- Increasing electricity generation from variable RES  
⇒ need for new long-term storage options
- Major challenge – cost reduction and infrastructure development
- Stable policy framework, coordinated action between different stakeholders, standards – to derive economics of scale and reduce risks of the investment.

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Ajanovic A., Haas R. (2019). **Economic and Environmental Prospects of Battery Electric- and Fuel Cell Vehicles: A Review.** Fuel Cells. Wiley Online Library. DOI: 10.1002/fuce.201800171

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