

*PLENARY SESSION*

***Sustainable mobility challenges for the  
transition targets:  
The role of the electric vehicles***

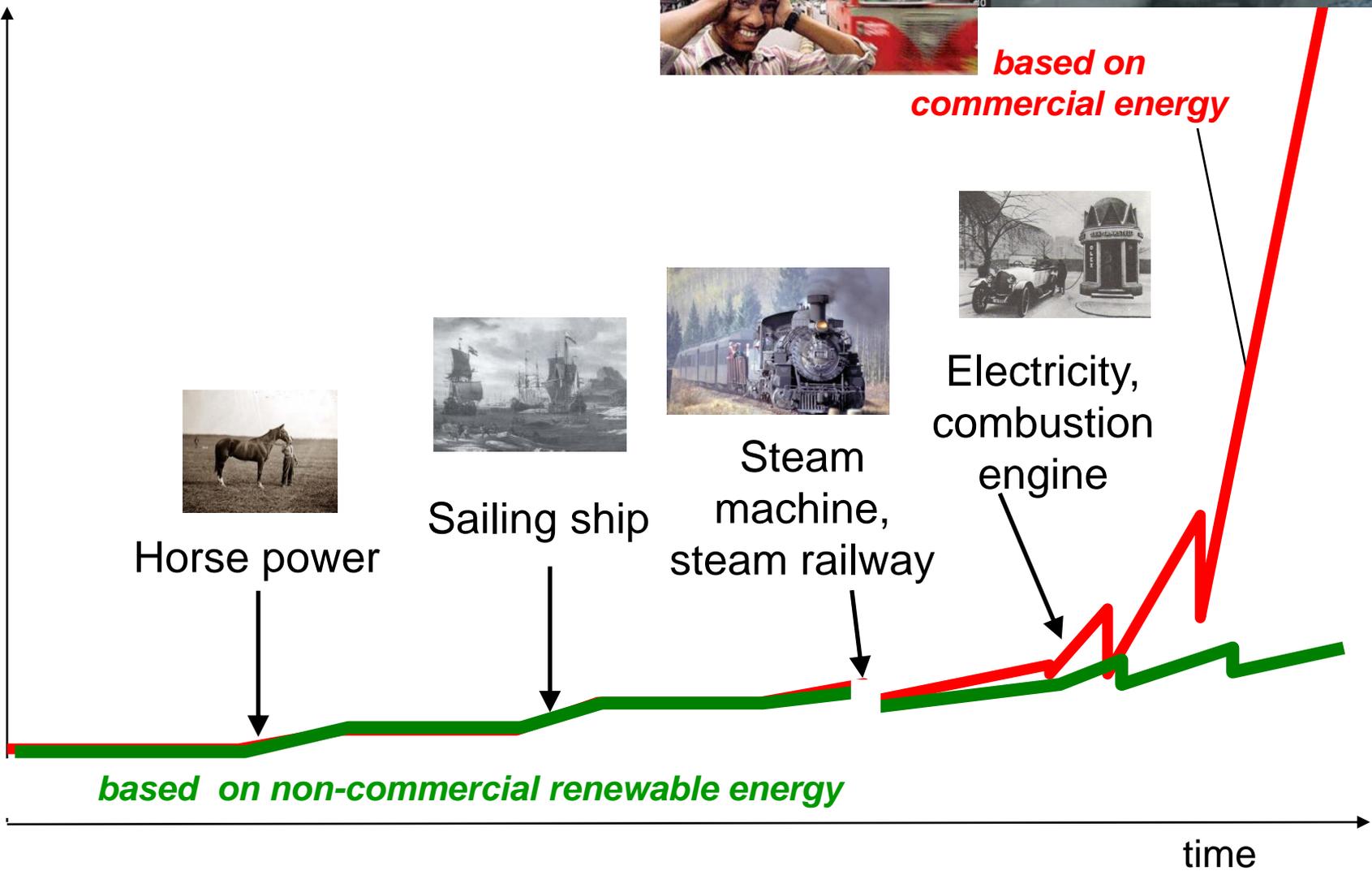
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Energy Economics Group  
Vienna University of Technology (TU WIEN)

**5TH AIEE ENERGY SYMPOSIUM  
VIRTUAL CONFERENCE 15-17 December, 2020**

- ✓ Introduction
- ✓ Policy framework in the EU
- ✓ Recent developments and challenges
- ✓ Impact of coronavirus on mobility
- ✓ Conclusions



Amount of transport services per capita



Horse power



Sailing ship



Steam machine, steam railway



Electricity, combustion engine

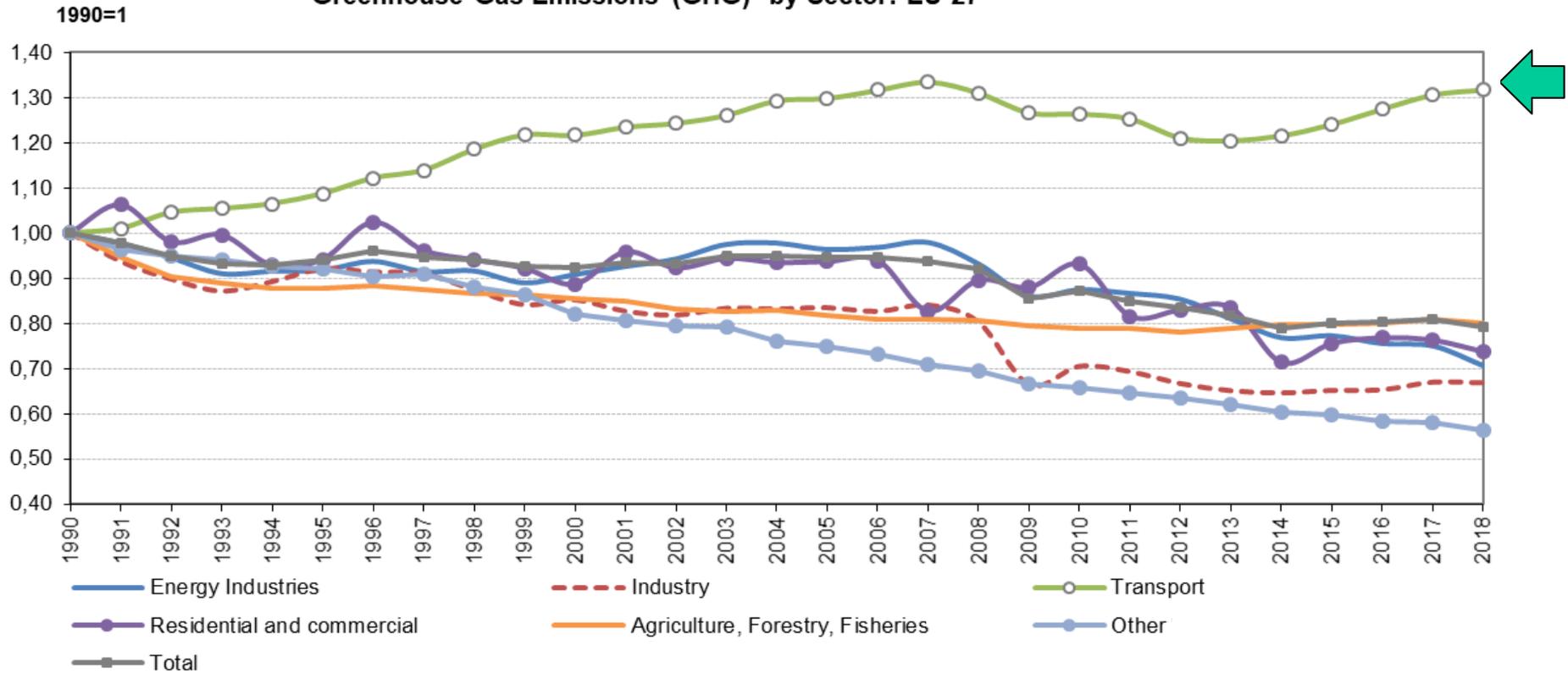


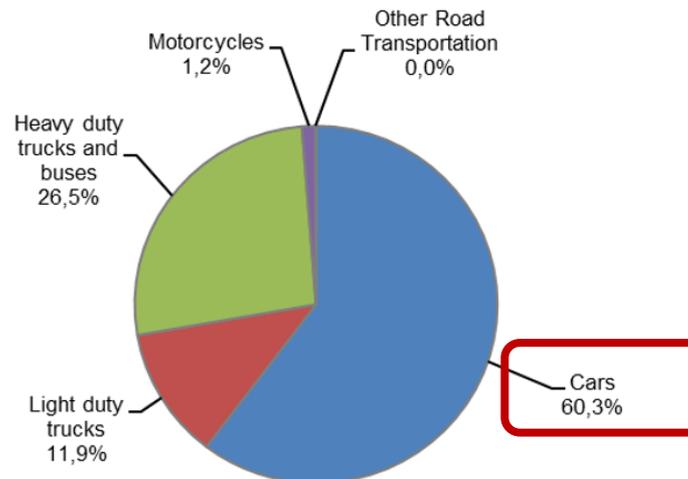
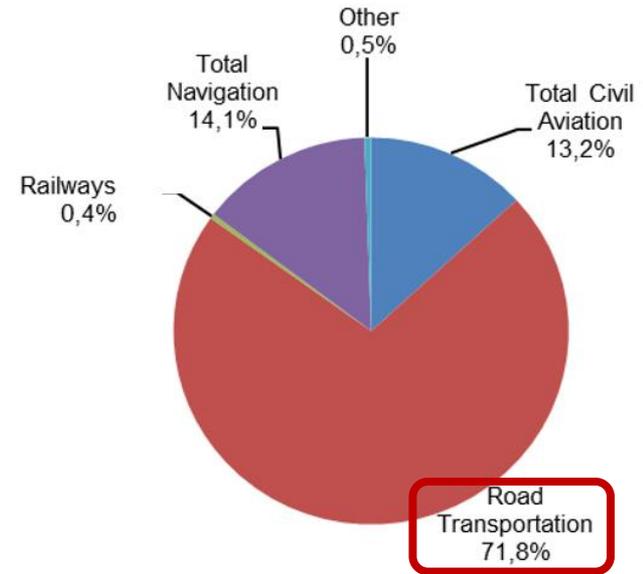
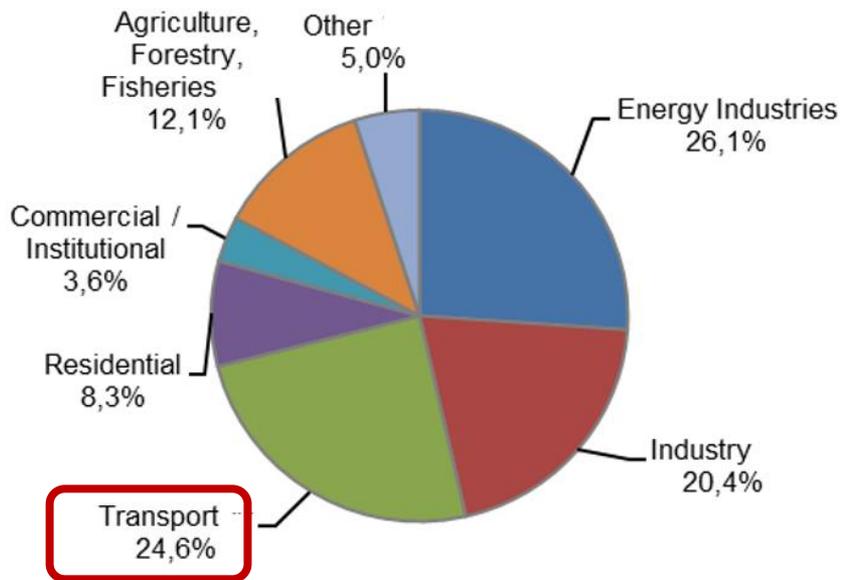
based on commercial energy

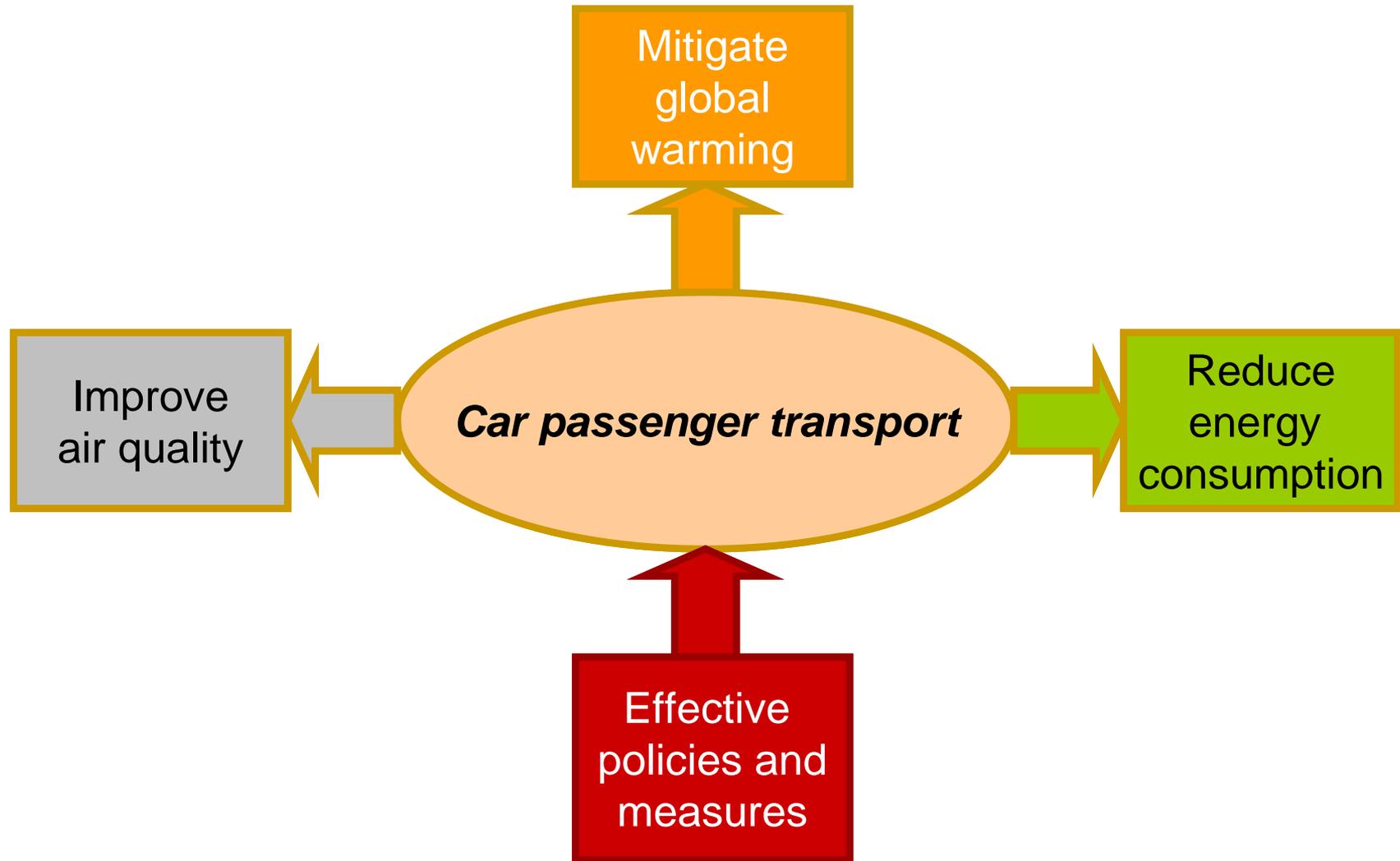
based on non-commercial renewable energy

time

**Greenhouse Gas Emissions (GHG)\* by Sector: EU-27**







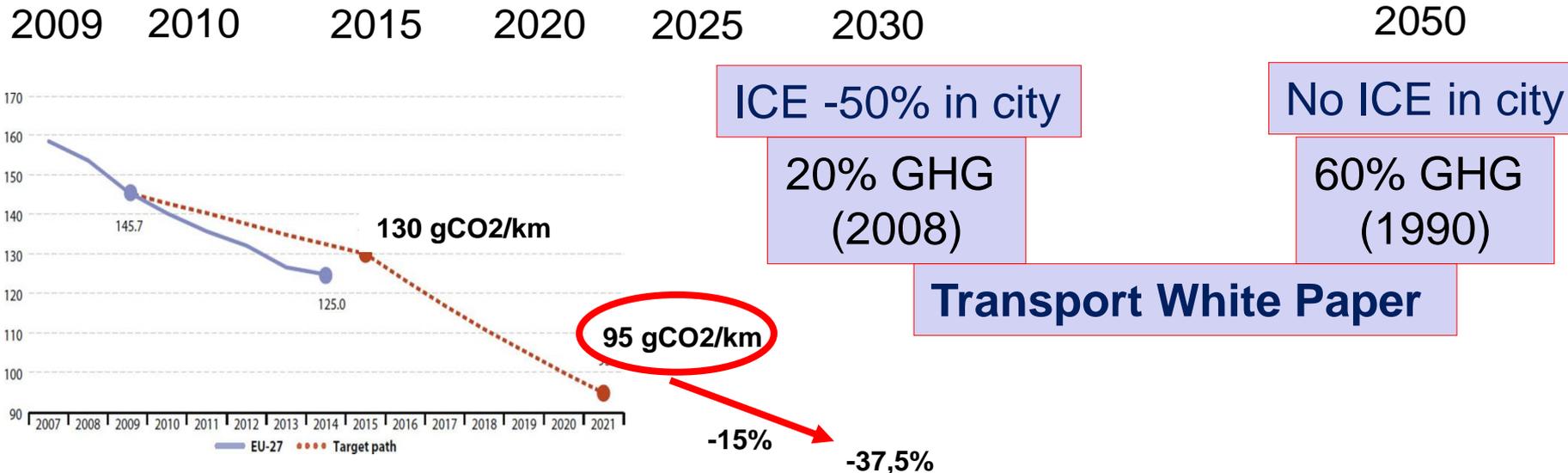
## Climate & energy package

GHG: **20** - RES: **20** - EE: **20**

GHG: **40** - RES: **32** - EE: **32.5**

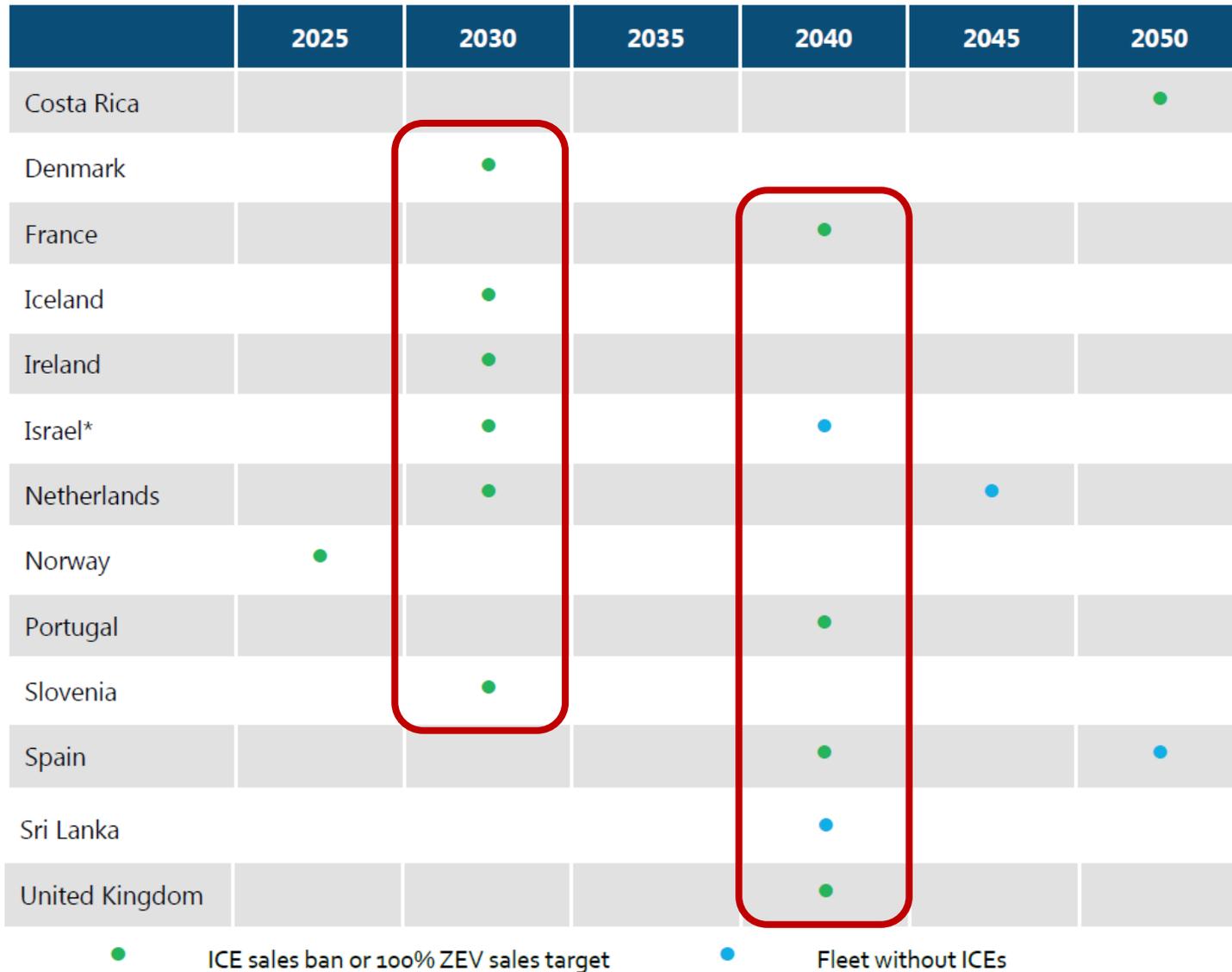
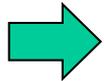
TRA: **10%**

TRA: **14%**



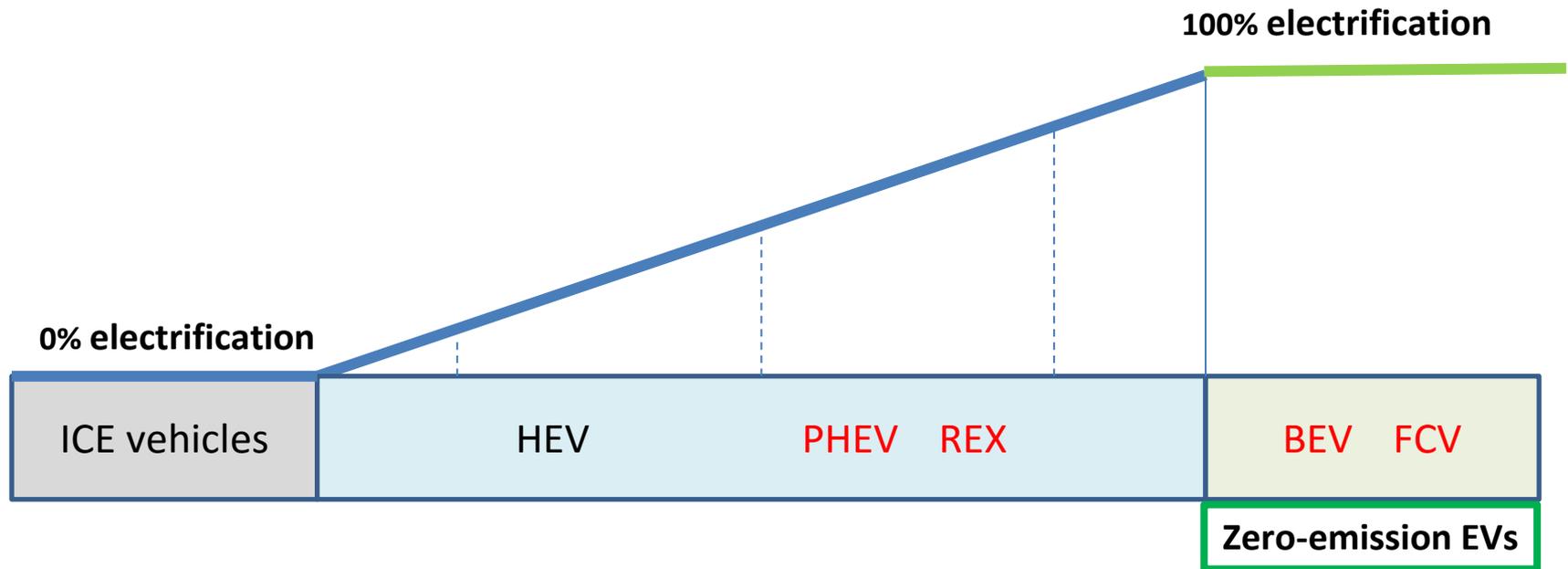
Targets and average CO<sub>2</sub> emissions from new passenger cars in EU countries

# Announced 100% ZEV sales targets and bans on ICE vehicle sales



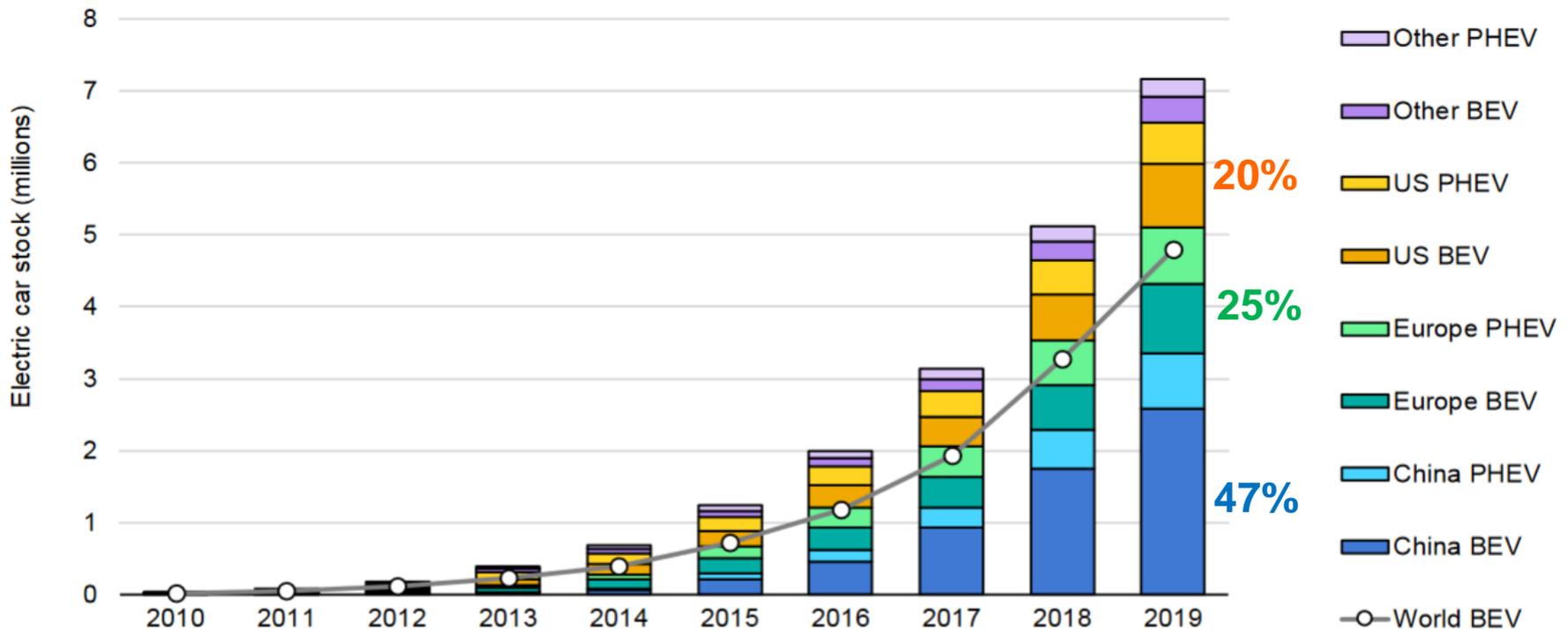
## Paris Declaration on Electro-Mobility and Climate Change & Call to Action:

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



Level of electrification of electric vehicles

Development of the global stock of rechargeable EVs



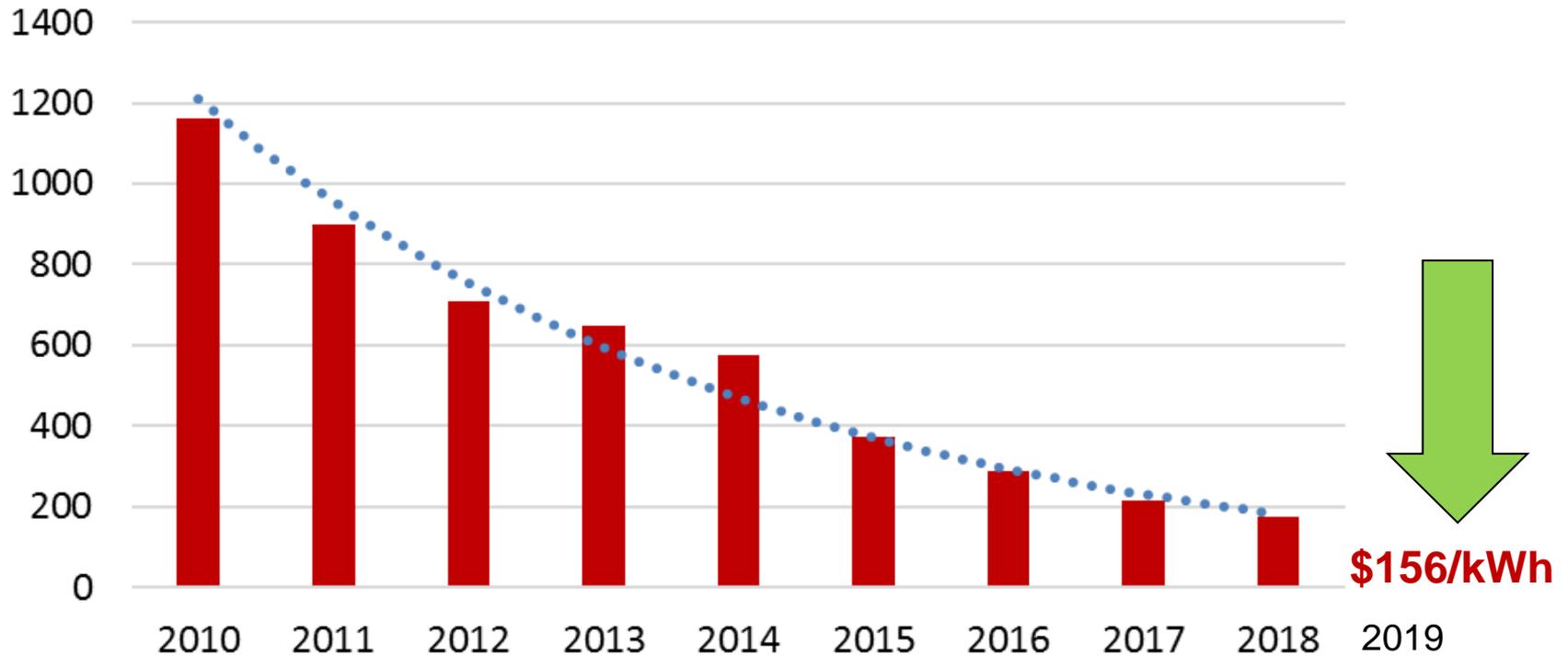
## Advantages

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

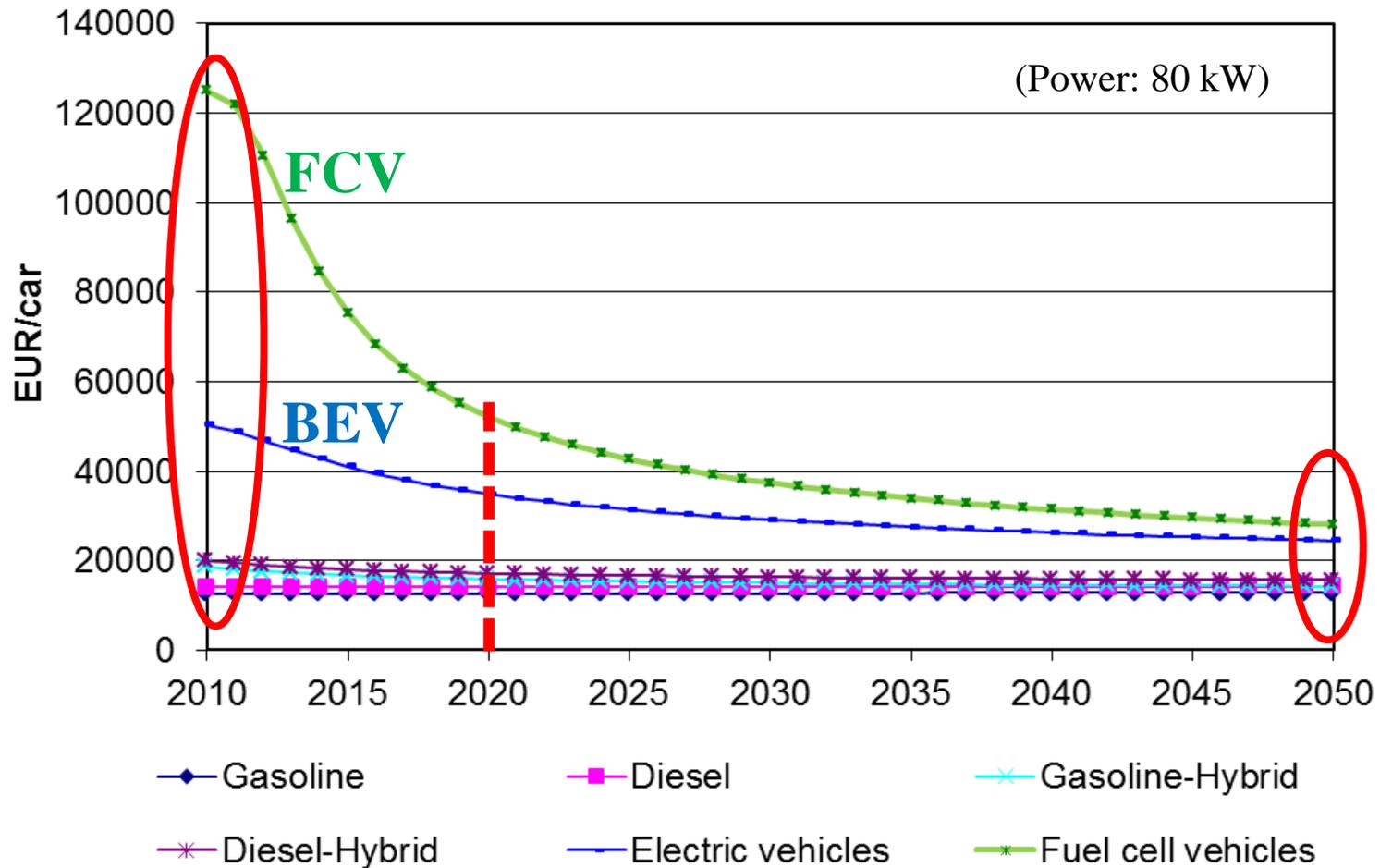
## Disadvantages

- Costs
- Driving range
- Charging time
- Charging infrastructure

Battery pack price (\$/kWh)



# Scenario for development of investment costs



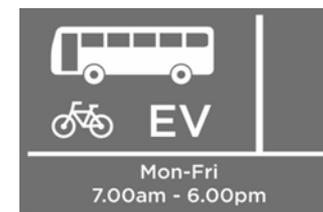
## Monetary measures

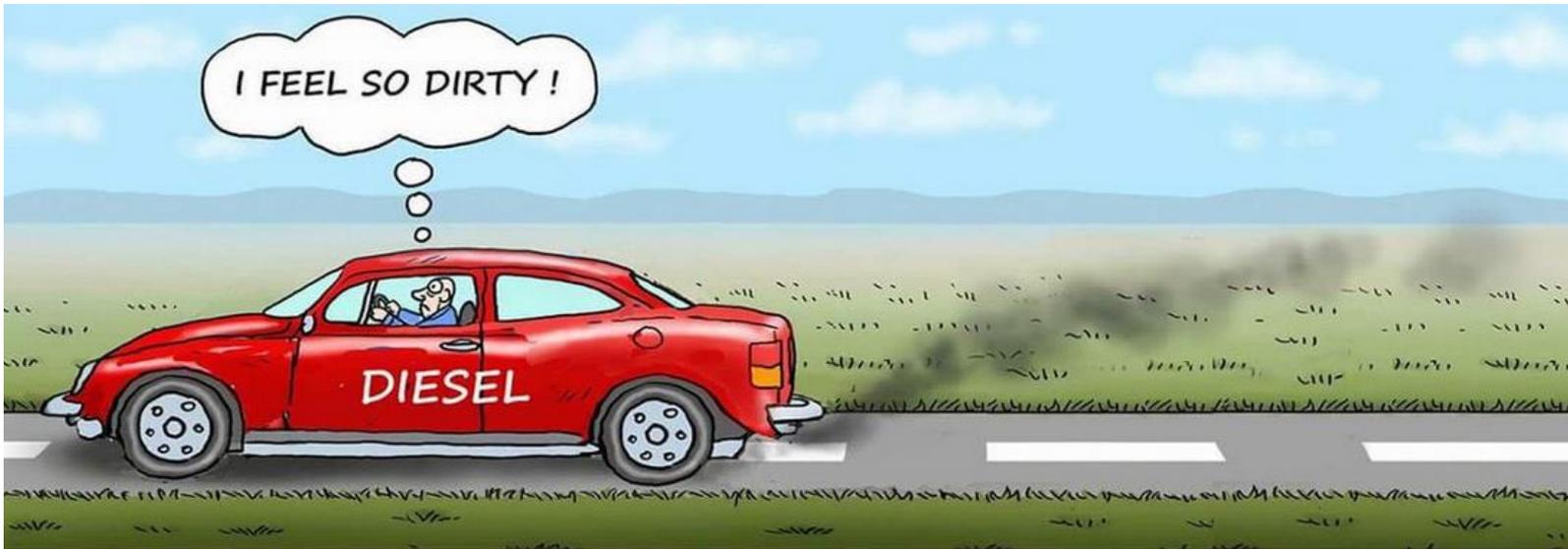
- road taxes
- annual circulation tax
- company car tax
- registration tax
- fuel consumption tax
- congestion charges



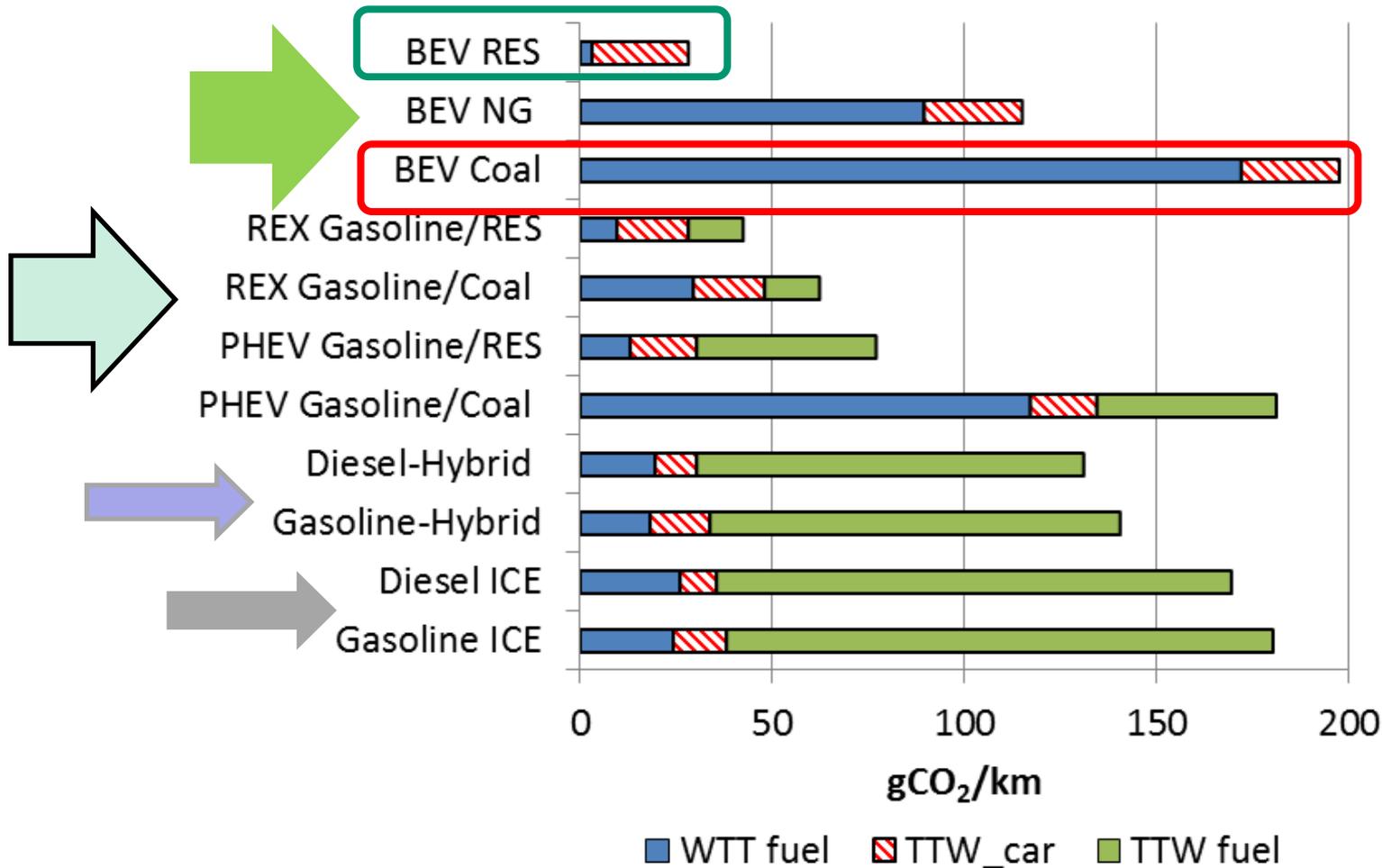
## Non-monetary measures

- 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

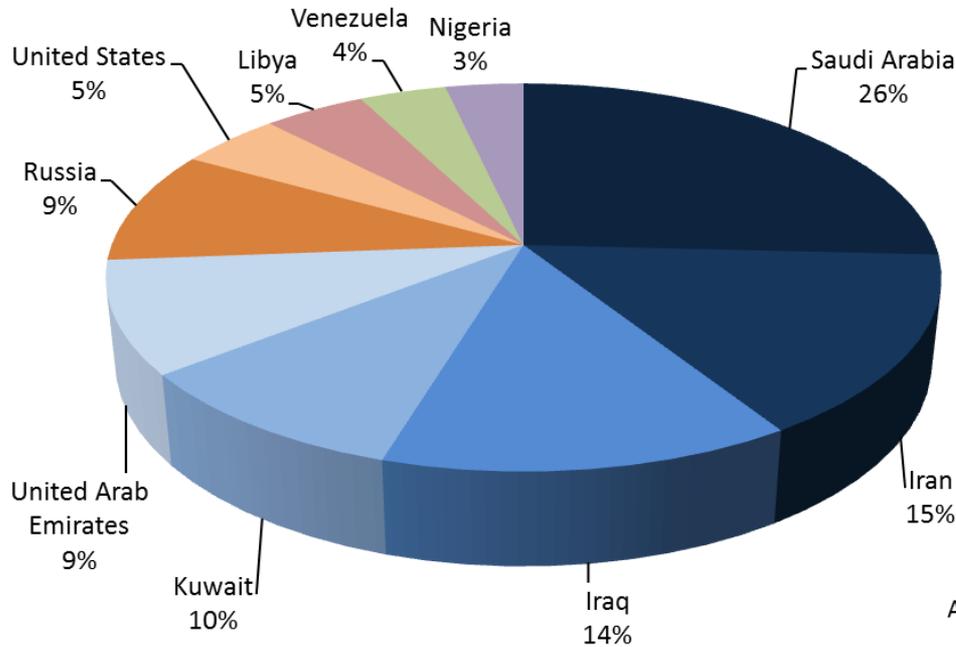




Artist: Marian Kamensky

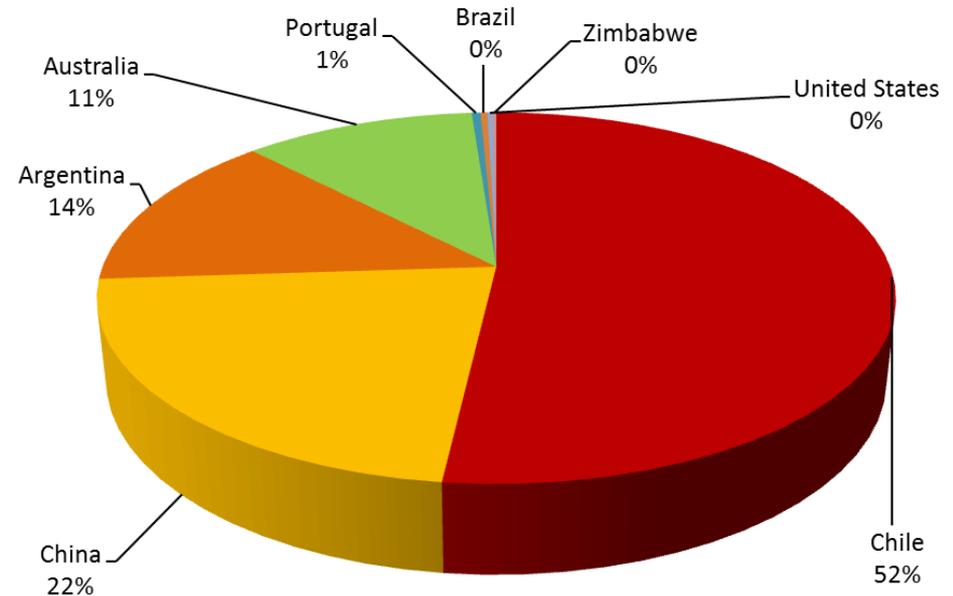


CO<sub>2</sub> emissions per km driven for various types of EVs in comparison to conventional cars (power of car: 80kW)

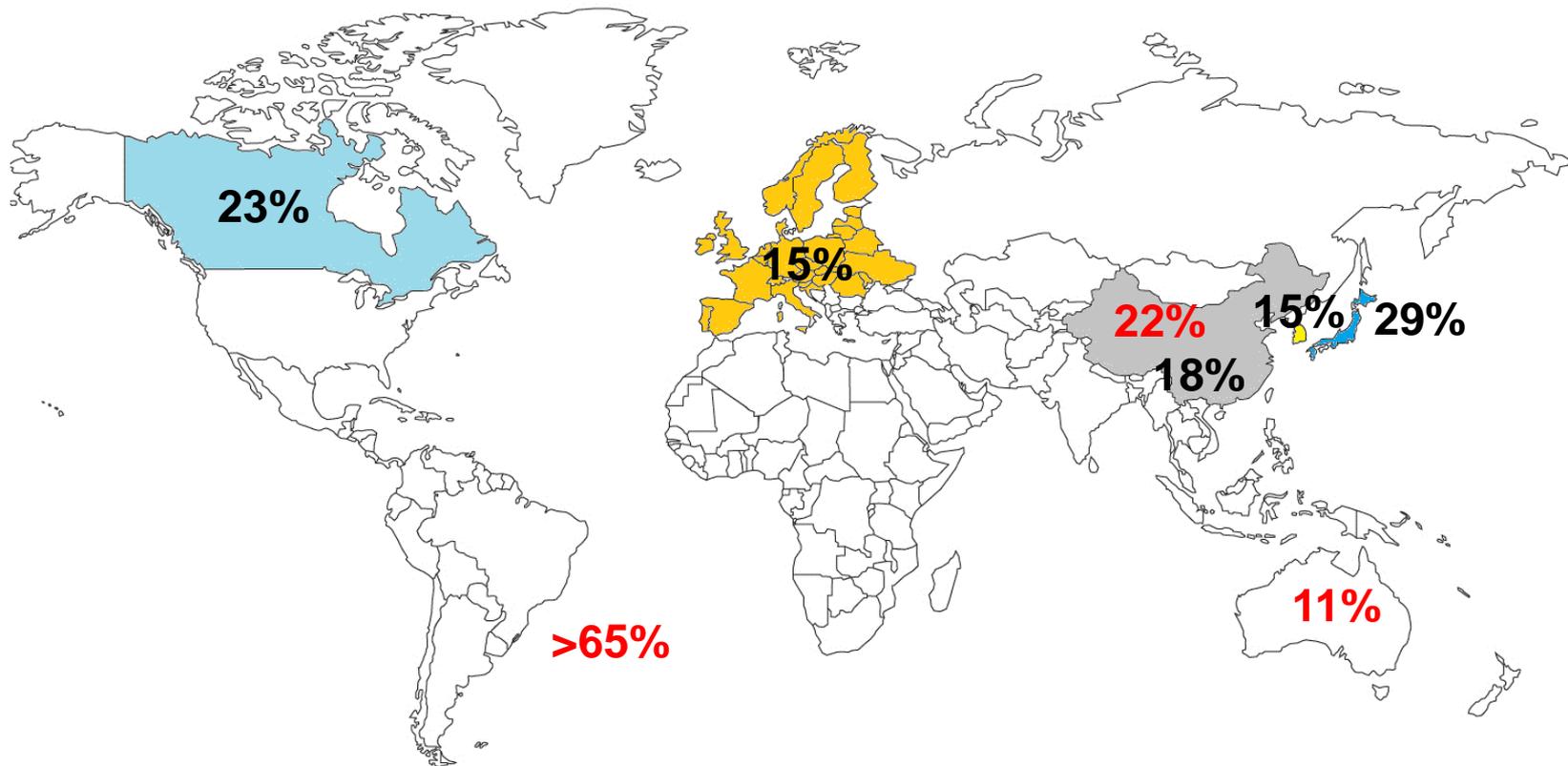


Countries with largest conventional oil reserves

World lithium reserves by country

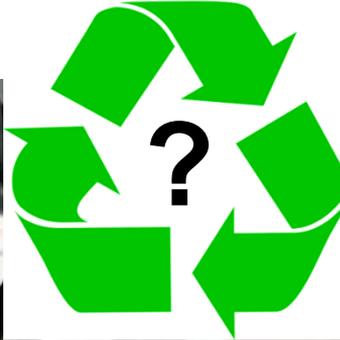


# Main battery cell manufactures



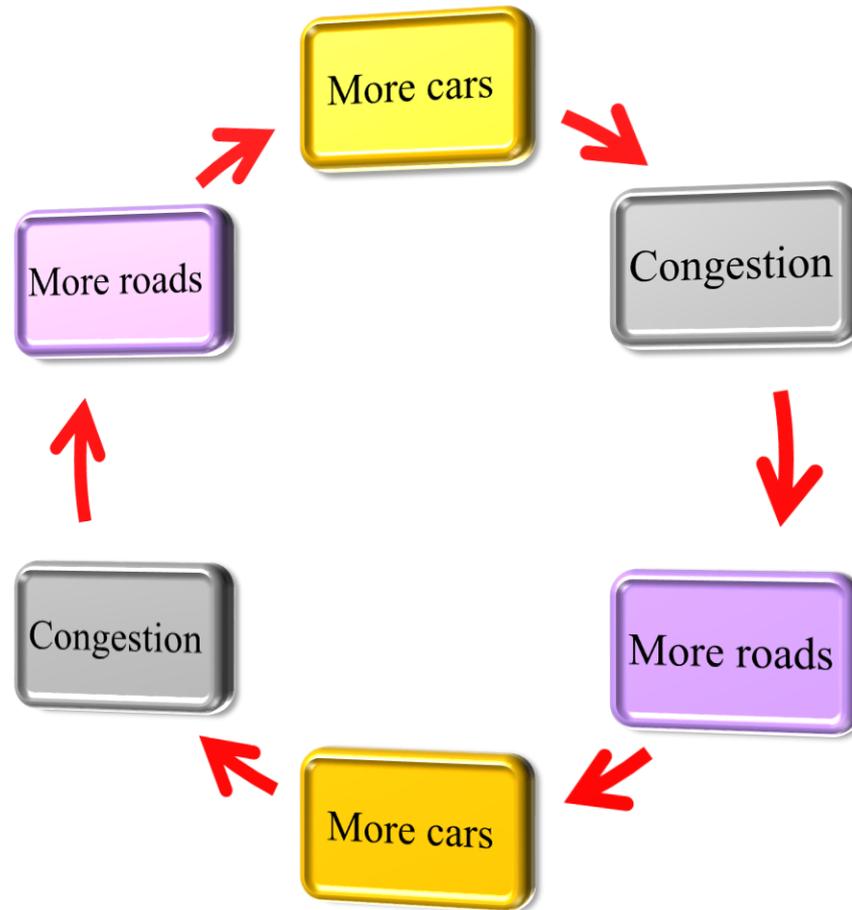
Li-ion battery	Demand (kg/kWh)	Demand for 1.6 billion EVs (1000 tonne)	World reserves (1000 tonne)
Lithium	0,15	6000	9900
Nickel	1,2	48000	71000
Cobalt	1,2	48000	6600
Manganese	1,2	48000	540
Phosphate	0,8	32000	16000
Aluminum	0,04	1600	n/a
Iron/steel	0,4	16000	77000

Demand for raw materials vs world reserves



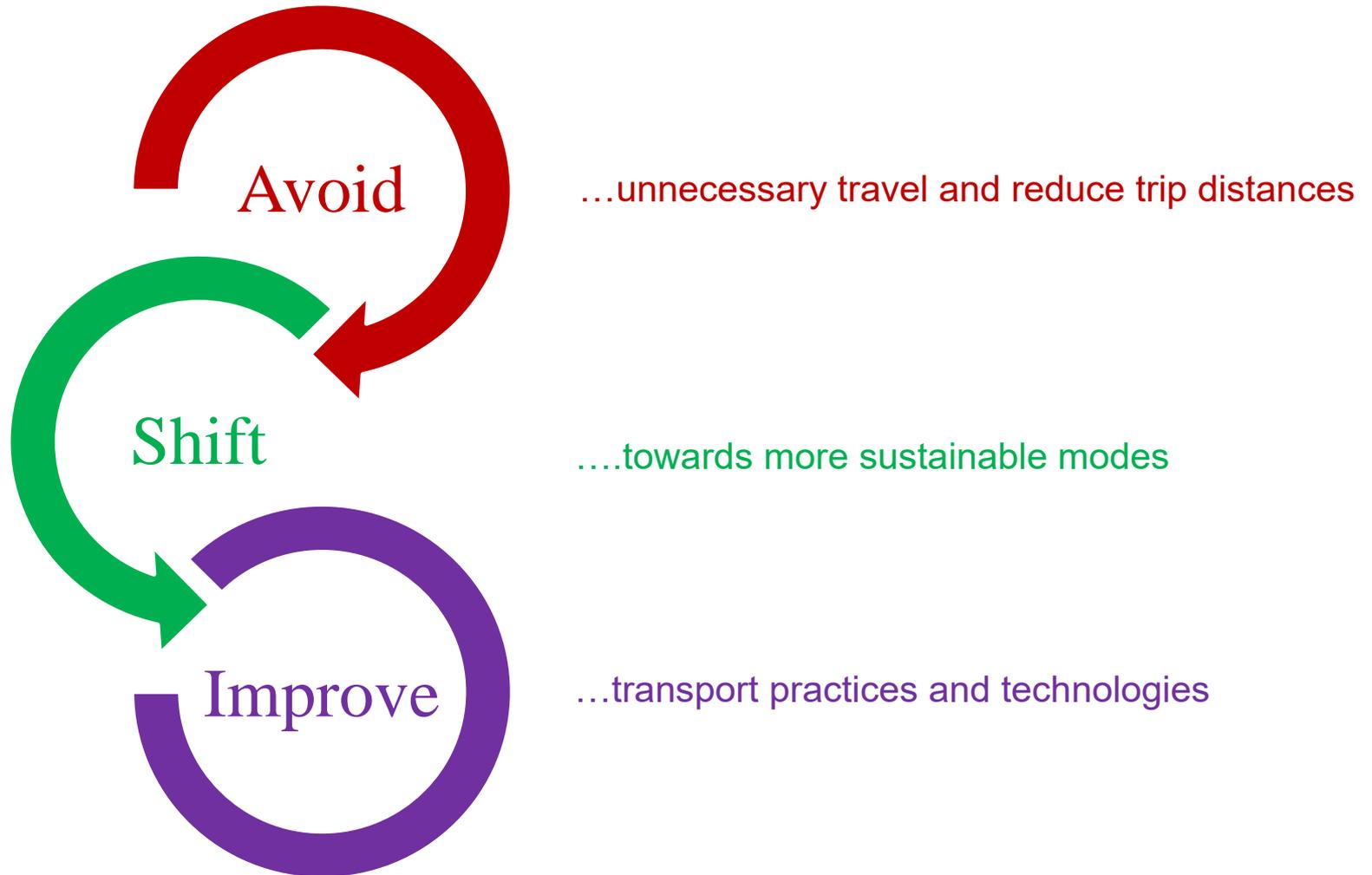
(©Jon Spaul/SciDev.Net)

# Car-oriented mobility

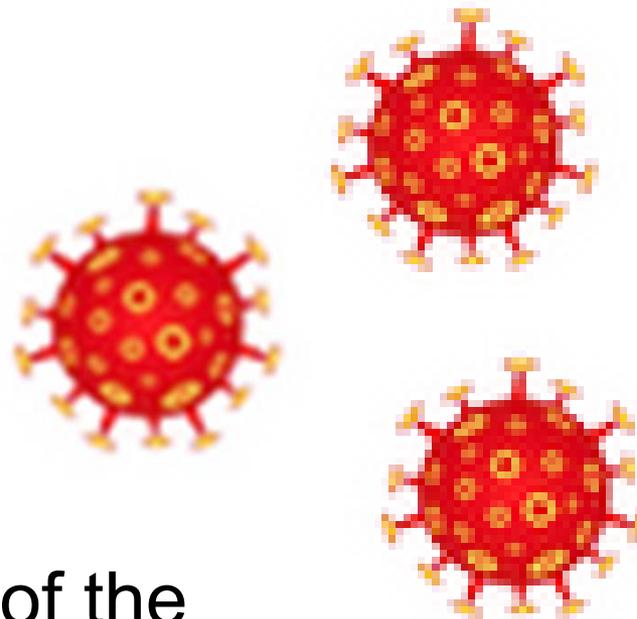




Car-oriented transport development

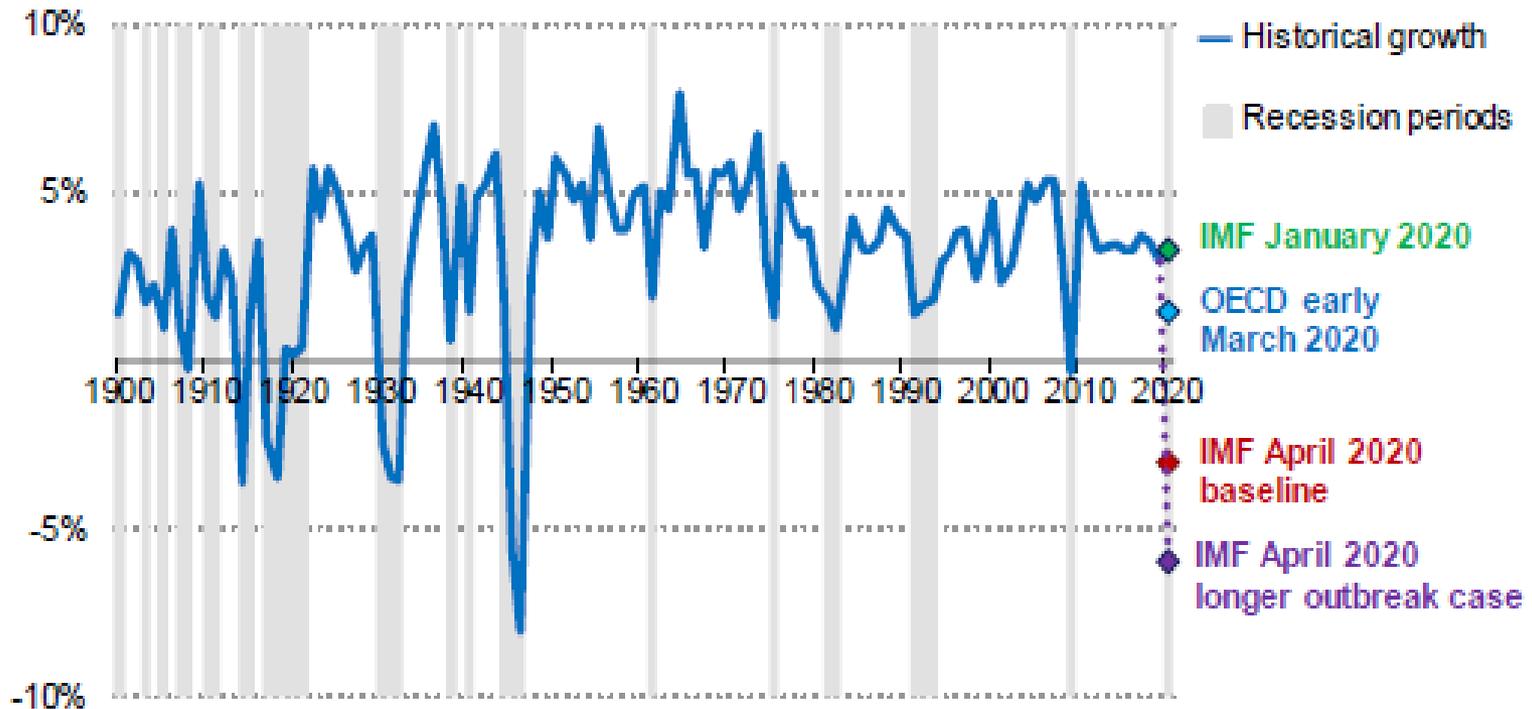


✓ 11 March 2020 – global pandemic



✓ Partial or total  
lockdowns....55% of the  
global population....60% of  
global GDP

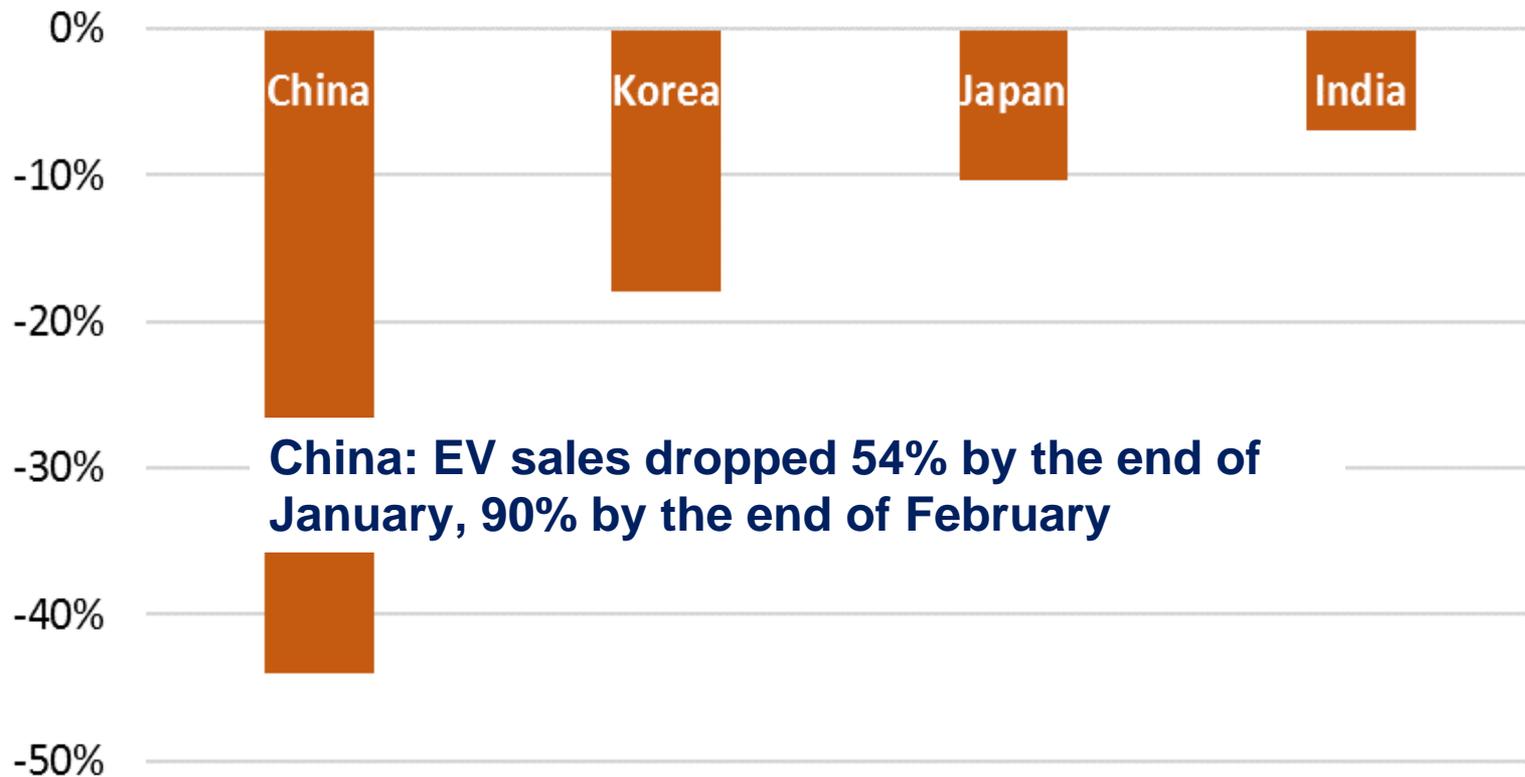
## Global annual change in real gross domestic product (GDP), 1900-2020



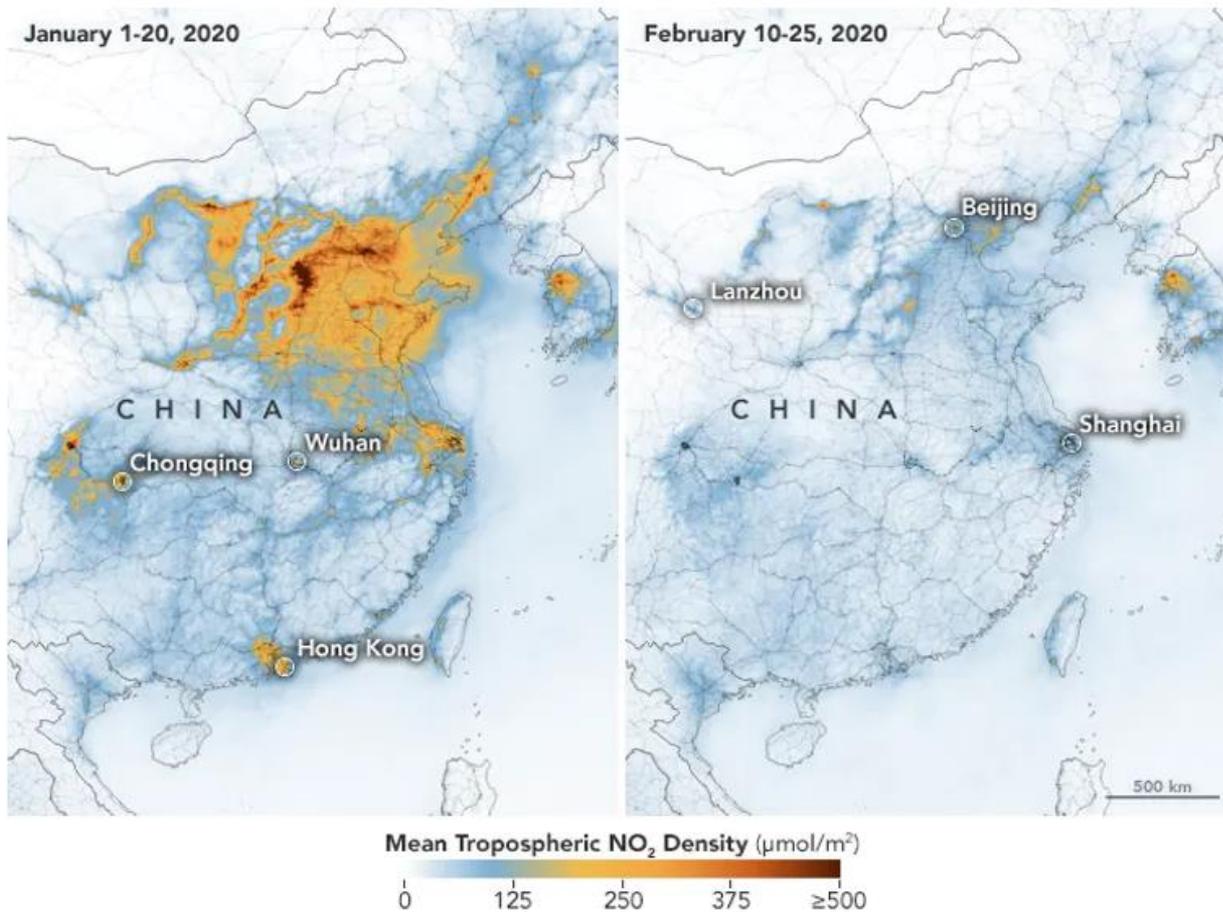
IEA 2020. All rights reserved.

Sources: IEA based on IMF World Economic Outlook (January and April 2020), OECD Interim Economic Outlook Forecasts (March 2020) and Maddison Project Database (2018).

Car sales decline in selected countries  
(January and February 2020)



- ✓ Change in modal split
  - ✓ Walking and cycling
  - ✓ Private cars
  
- ✓ New working and living habits
  - ✓ Home-working
  - ✓ Video conferences



As new daily cases of COVID-19 reached their peak in China, air pollution plummeted. ESA/NASA, Author provided

- EVs ...part of the solution...cost reductions, improvement of battery characteristics, as well as development of infrastructure
- Most of the policies implemented will be abolished with the increasing number of EVs...Future policy design should ensure high environmental benefits of EVs.
- High uncertainties regarding the long-term impacts of COVID-19 ...transport demand is reduced...increasing role of home-working, decrease of international travel...
- Investment in electric vehicles
- New mobility behavior...opportunity to rethink the transport system

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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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