Decarbonising Long Haul Road Freight:

looking beyond the European debate on powertrain technologies

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7th International Workshop on Sustainable Road Freight

Webinar

28th October 2020

Need for rapid decarbonisation to stay within 1.5°C carbon budget

IPCC (2018)

Remaining CO_2 budget to have 2/3 chance of staying within 1.5°C global temperature increase

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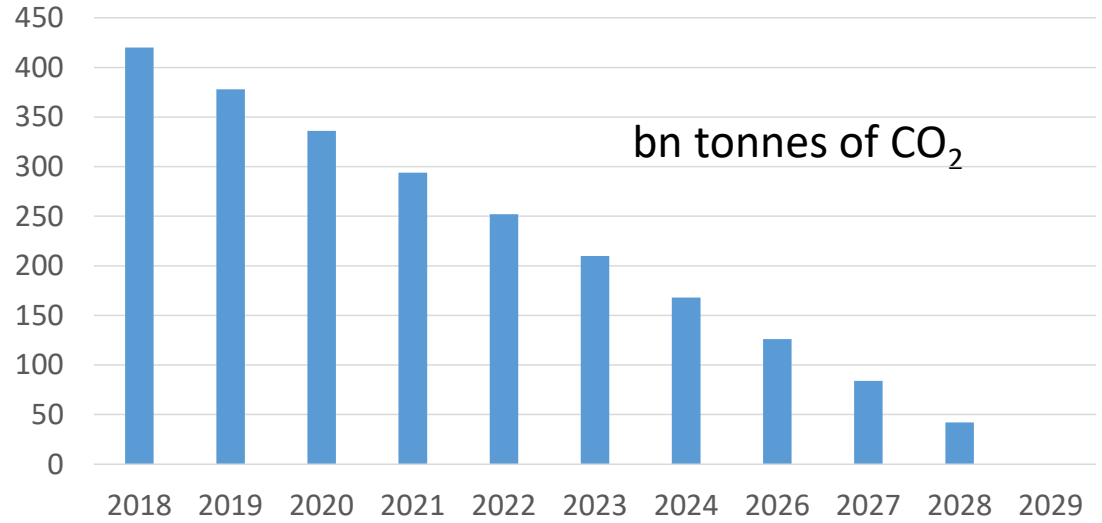
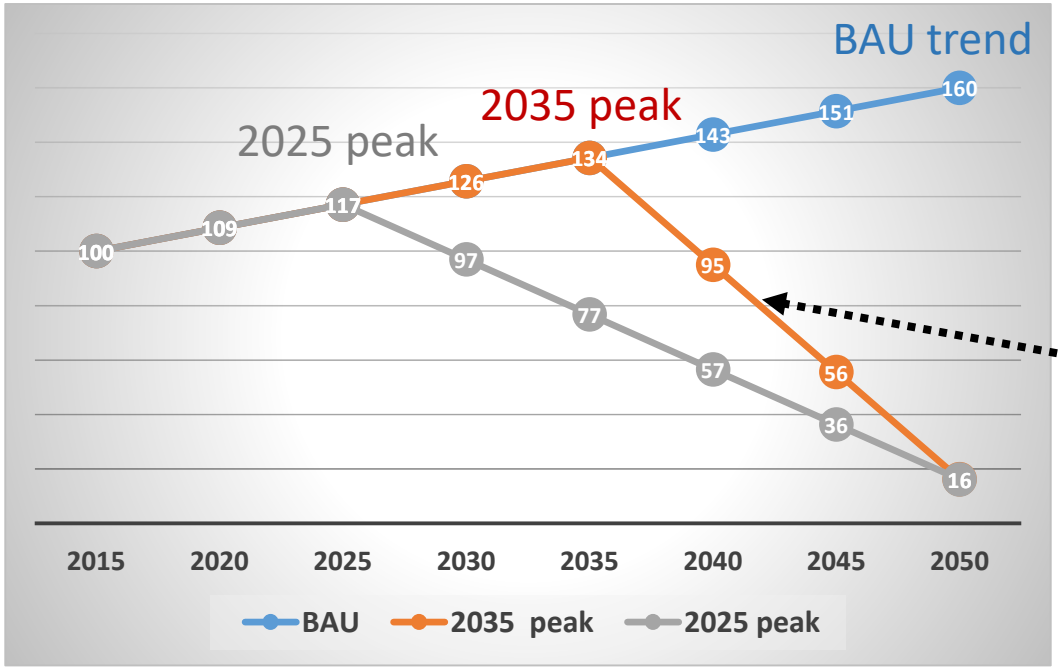


(assuming continuing annual emission rate of 42 Gt CO_2)

EU road freight decarbonisation trajectories



EU road tkm reference scenario (with constant carbon intensity)

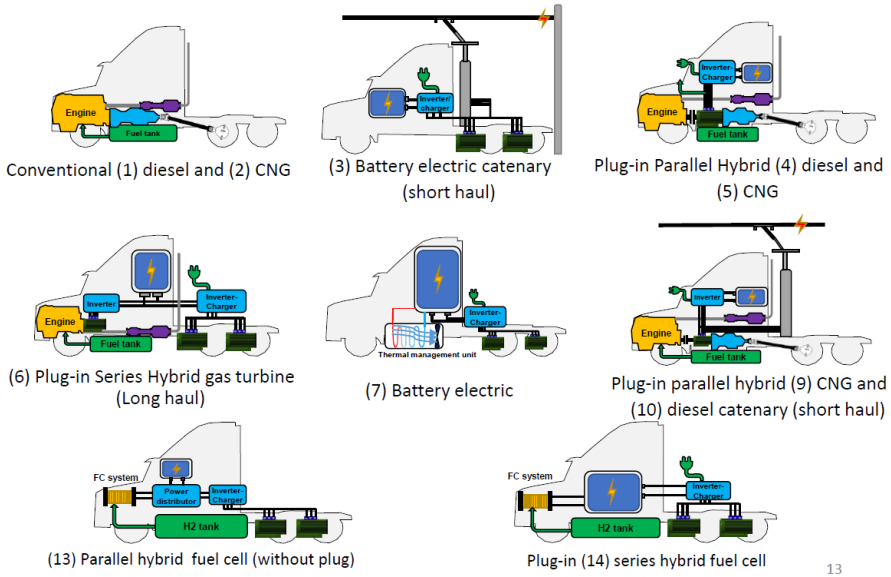
28% more accumulated CO_2 emissions by 2050

Intensifying debate over powertrain technologies / energies

Battery Electric BEV	Hydrogen Fuel Cell FCEV	Catenary Electric CAT

Synfuel	Biogas

hybrids



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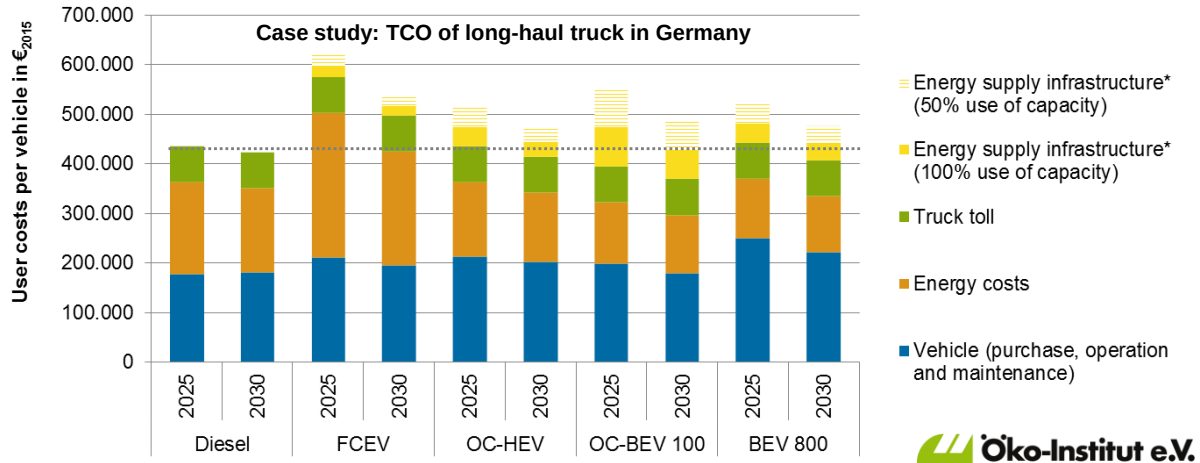

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Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

Powertrain options for trucks: Typical characteristics and evaluation

Criteria		ICE	SYT	BET	FCT	CAT
Eco-nomic	Vehicle investment	○	○	⊖	⊖	○
	Fuel cost	○	⊖	⊕	○	⊖
Techno-logical	Loading capacity	○	○	⊖	○	○
	Range	○	○	⊖	○	○
Eco-logical	CO_2	○	⊕	⊕	⊕	⊕
	Public acceptance	○	⊕	⊕	⊕	⊖
Characterization per powertrain		*"The environmental black sheep with long range."*	*"The clean version of traditional ICE with high energy demand."*	*"The most efficient lower range option."*	*"The alternative long range option with sector coupling."*	*"The very efficient underdog."*

Making zero-emission trucking a reality
Strategy&

⊖ Inferior[1] ○ Reference ⊕ Superior[1]

1) In comparison to user requirements

ICE – Internal Combustion Engine truck

September 2020
11

strategy&
Part of the PwC network

https://pwc.to/2HjH9Qe

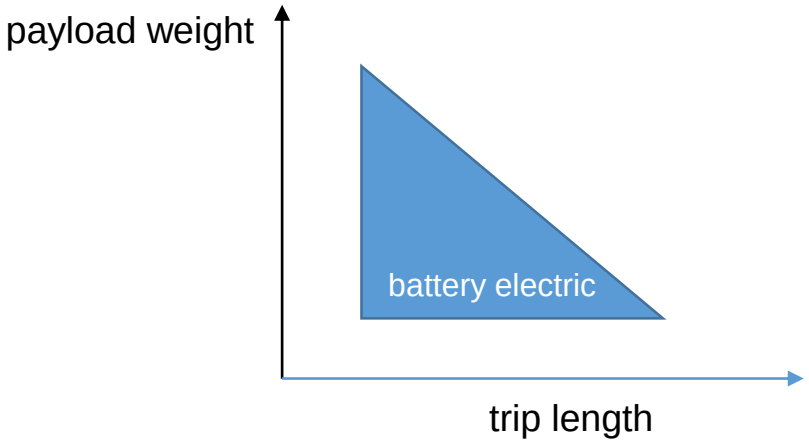
comparative studies of powertrain technologies use differing criteria and assumptions

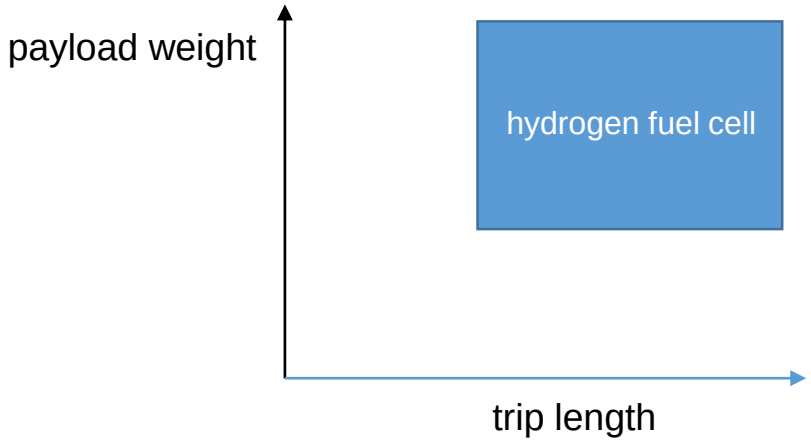
great uncertainty e.g. about future rates and costs of electricity decarbonisation and infrastructure development

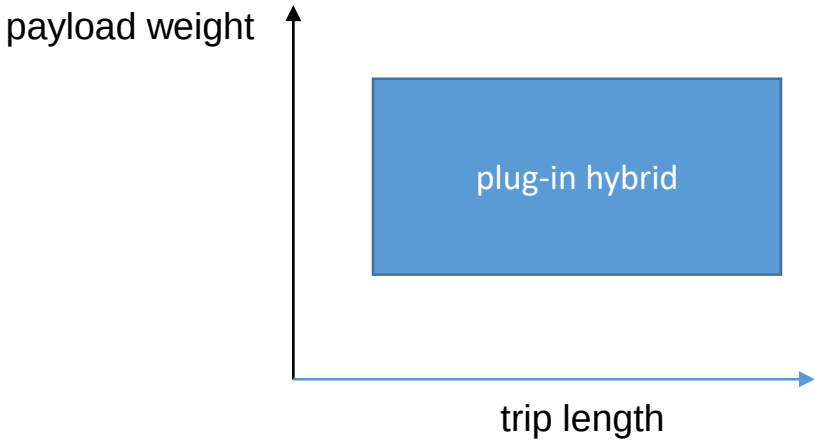
major OEMs have differing powertrain preferences amid uncertainty about future transformation of European truck market

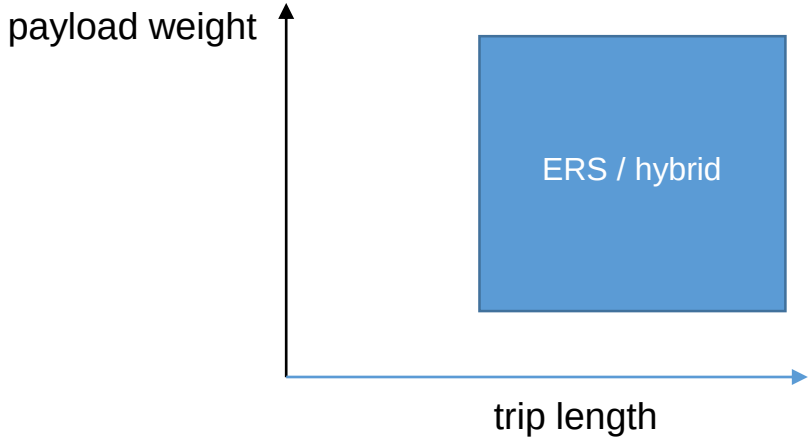
Deployment of multiple powertrain technologies: no '*one-size fits all*'

Operational 'sweet spots' for different decarbonisation technologies in long haul trucking









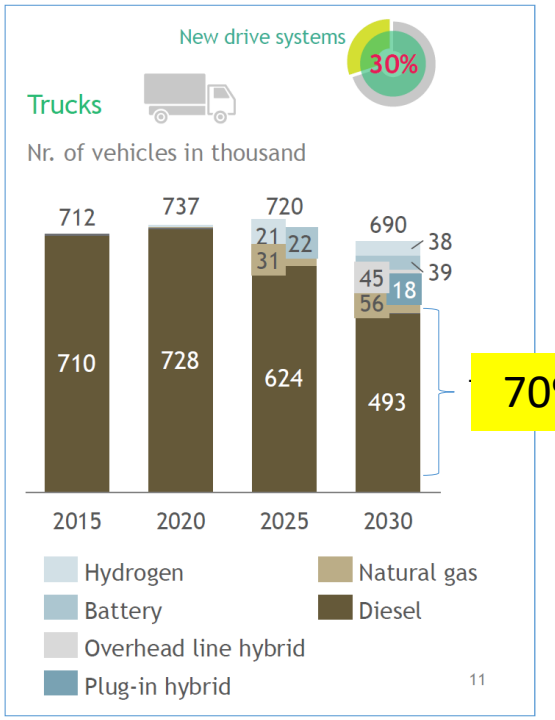
Adapted from North American Council for Freight Efficiency (2019)

- powertrain specialisation may work for some own account operations and specialist hauliers
- general road hauliers seek operational flexibility and ability to carry a variety of products over differing distances

risk of spreading available capital investment in truck manufacturing capacity and alternative energy infrastructures too thinly

Heavy dependence on ICE trucks for next 15-20 years

Germany



70%

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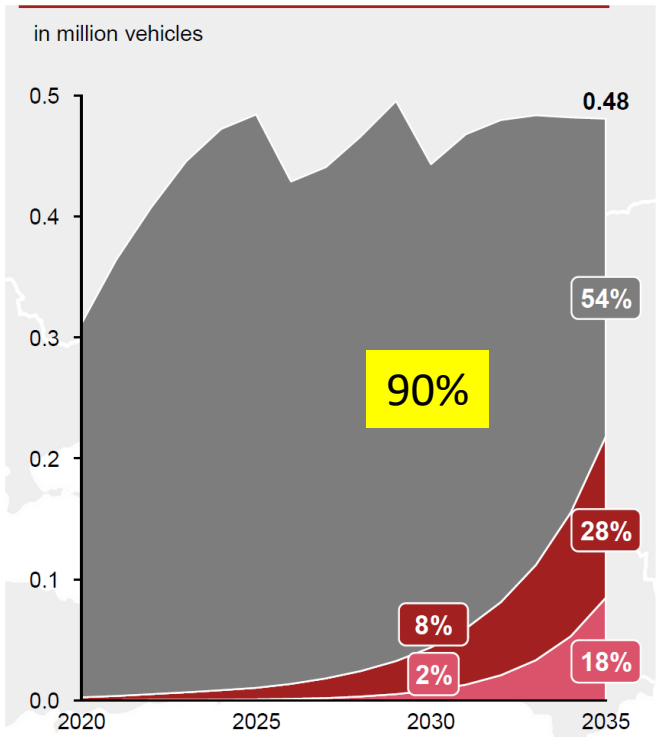
Europe +Turkey



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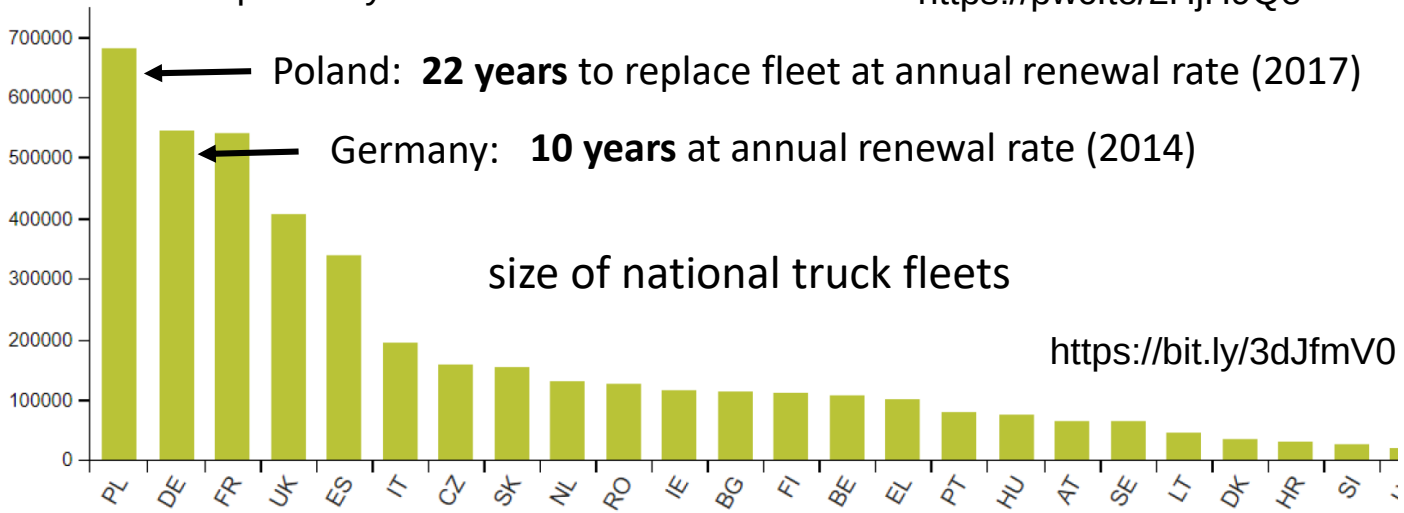

Poland: **22 years** to replace fleet at annual renewal rate (2017)

Germany: **10 years** at annual renewal rate (2014)

size of national truck fleets

https://bit.ly/3dJfmV0

Increasing fuel efficiency of new ICE trucks

EU fuel / CO_2 standards for new trucks

gCO_2/tonne-km

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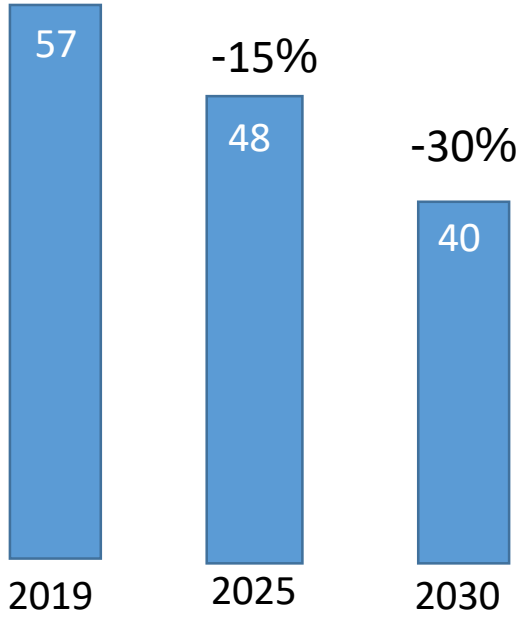


penalties per vehicle sold for non-compliance *per gCO_2 / tkm*

2025-2029
€4250

post 2030
€6800

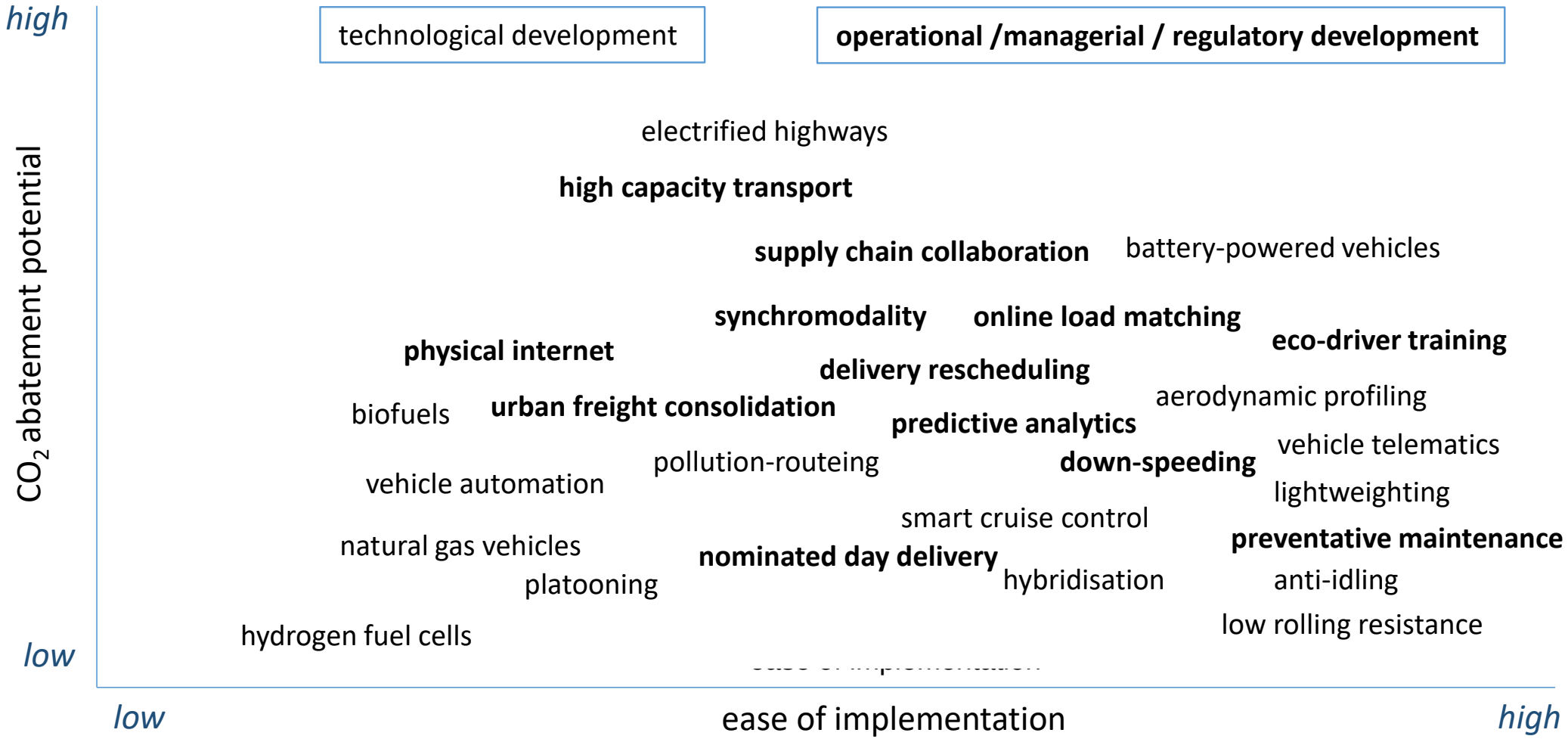
time to replace EU28 truck fleet (at 2017 rate)

12.7 years (unweighted)
13.9 years weighted by national road tonne-kms

accelerated by regulatory / fiscal pressures?

slowed by: *weak financial position post-Covid*
higher total cost of ownership
uncertainty about residual values
infrastructural provision

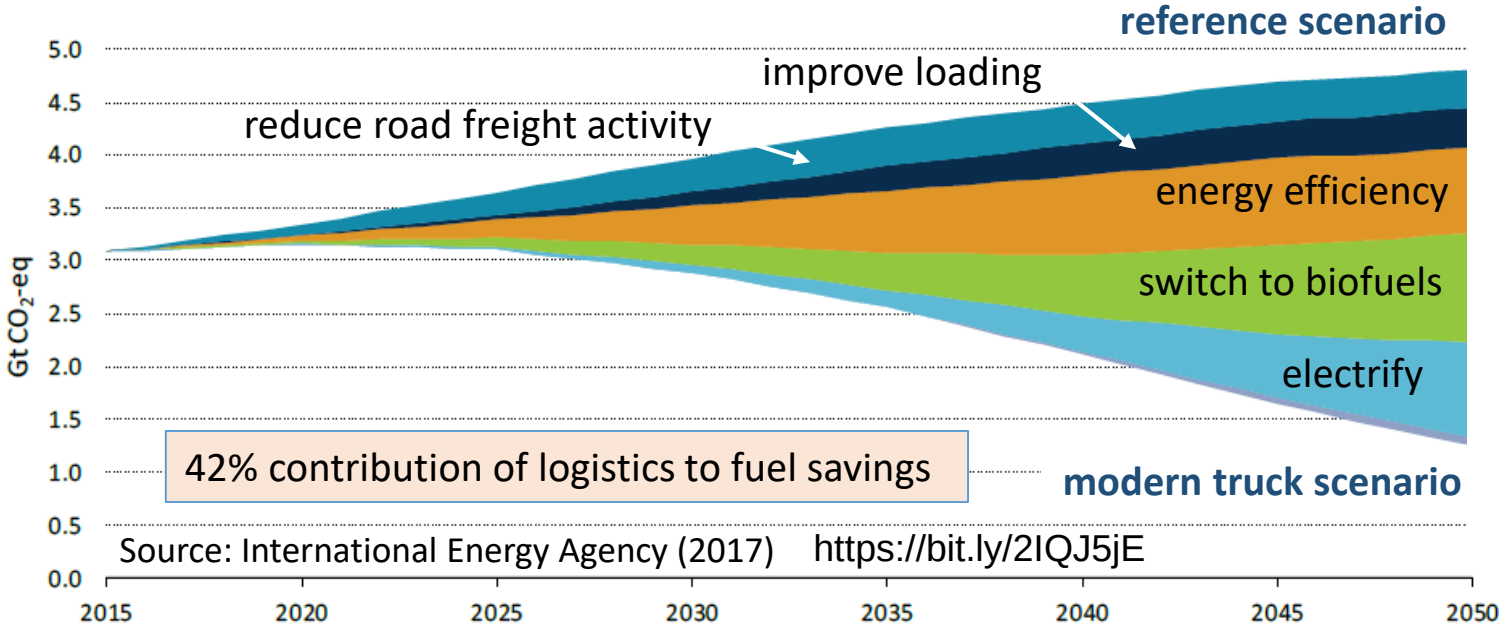
Logistics decarbonisation measures: *CO_2 abatement – implementation graph*



Adapted from Cebon (2017)

Technology and energy supply bias: *under-estimation of the possible contribution from logistics management*

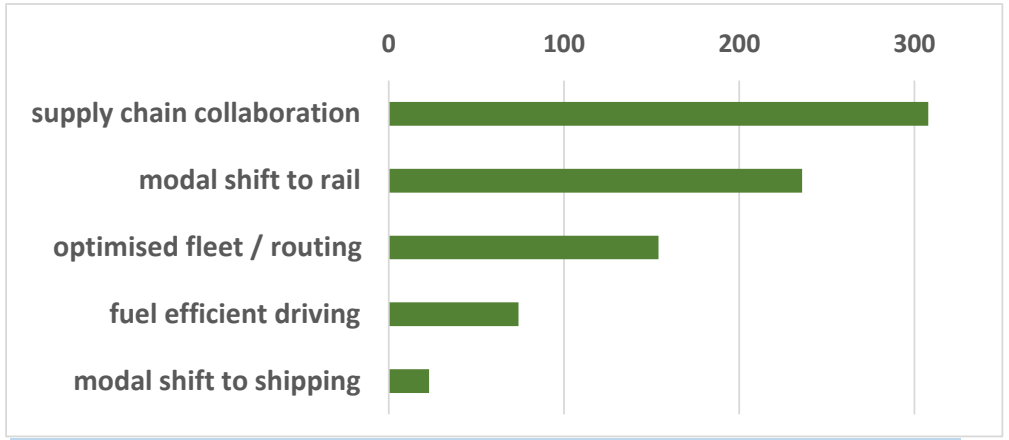
Contribution of Logistics Management Options to Road Freight Decarbonisation



42% contribution of logistics to fuel savings

Source: International Energy Agency (2017) https://bit.ly/2IQJ5jE

Mt CO_2 saved by 2040

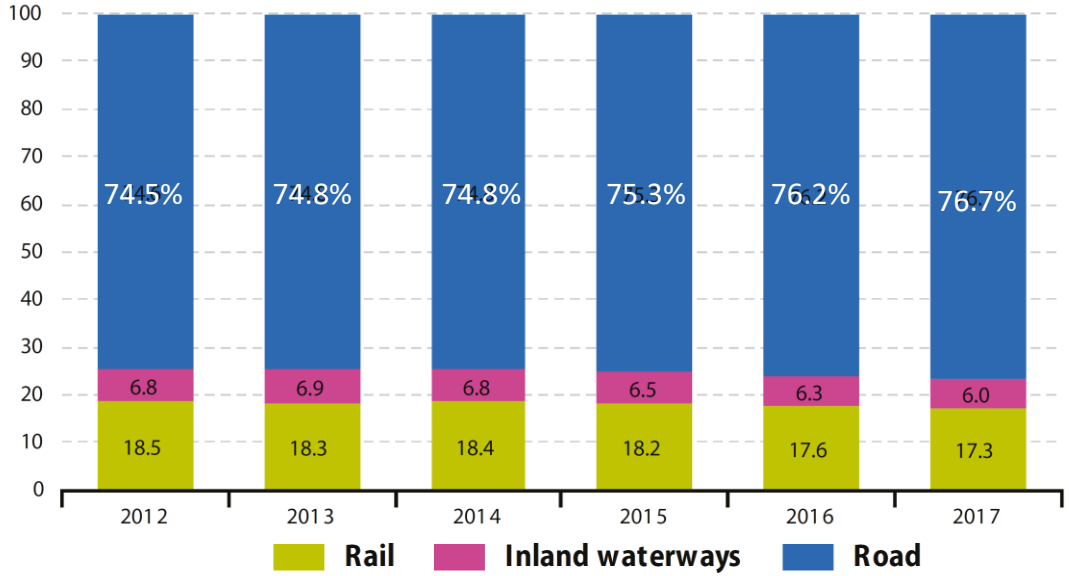


demand management can cut CO_2 emissions by 28% in heavy-road sector by 2050

Source: Energy Transitions Commission https://bit.ly/3jcc1is

limited evidence of key logistical metrics improving

EU28 freight modal split



empty running

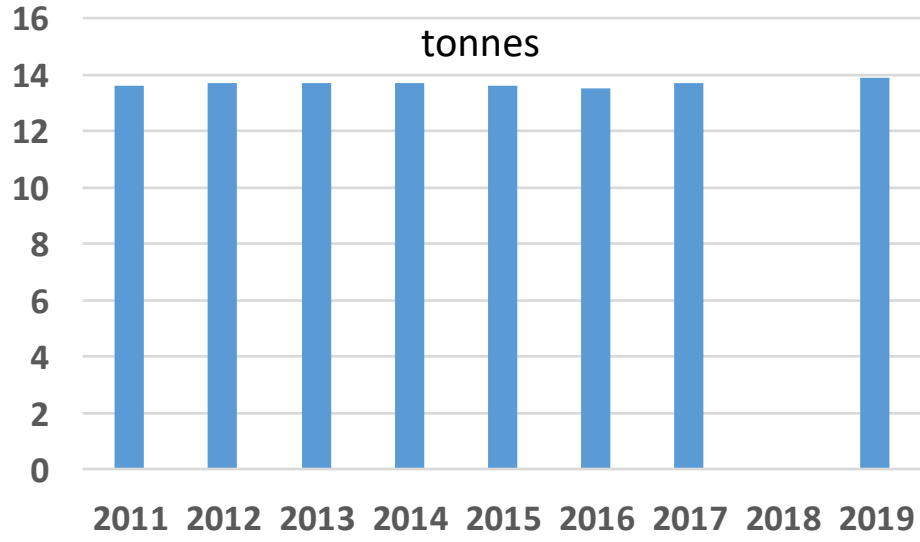
% of truck-kms run empty in EU28

2010: 22%

2018: 20%

https://bit.ly/3ocr3Zd

average payload weight on laden trucks (EU28)



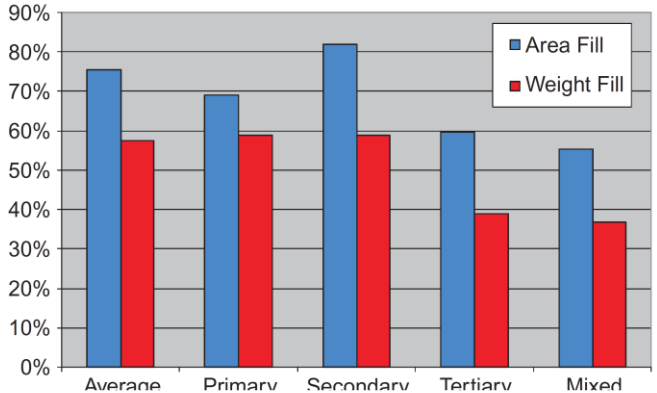
Vehicle Utilisation

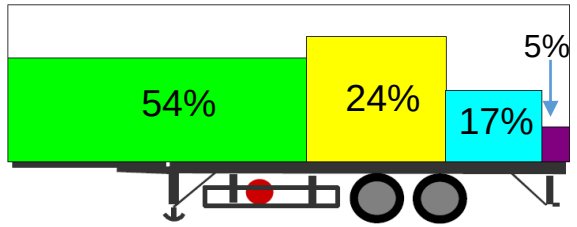
Lack of statistics to monitor trends in vehicle utilisation

REPORT PREPARED FOR THE 15th ACEA SCIENTIFIC ADVISORY GROUP MEETING
– BRUSSELS, 8th SEPTEMBER 2010

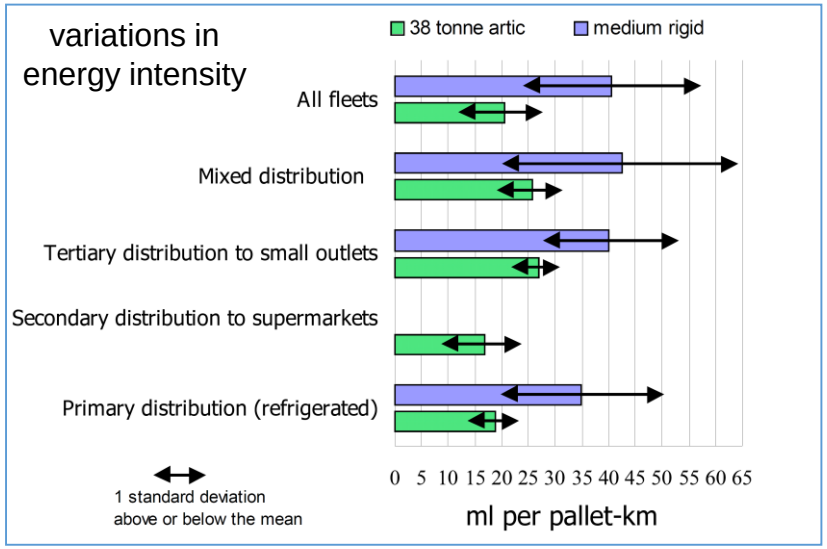
European Freight Transport Statistics:
Limitations, Misinterpretations and Aspirations

https://bit.ly/3m4XDKI





UK Transport KPI surveys 1997-2009



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Lack of co-ordination between transport policies

Impact of EU Mobility Package on empty running?

Vehicles must return to the member state of their 'establishment' at least once every 8 weeks

No assessment of the environmental impact prior to the measure being approved by European Parliament and EU Council

analysis of CO_2 impact being conducted by Ricardo for European Commission

https://bit.ly/3m9k8OM

KPMG study
Based on Bulgarian data

- average length of return trip 2000 km
- 46% of trips likely to be empty
- 2% increase in CO_2 emissions from international transport

https://politi.co/3m5BR9K

What will it take to induce wide and rapid uptake of logistics management options?

setting absolute carbon reduction targets

https://bit.ly/2IRo4W1

https://bit.ly/2QXOS7T

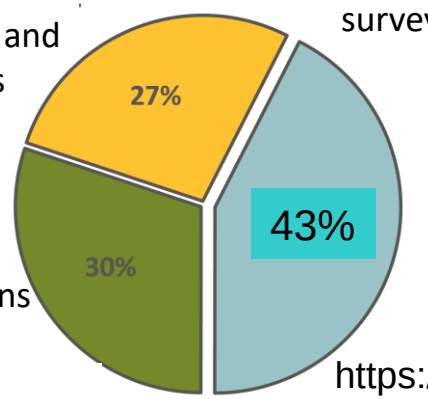
carbon-sensitive road freight procurement

https://bit.ly/3jbPdiU

advise / incentivise / require carriers to measure / report /reduce emissions

Transporean (2020) survey of 1200 carriers

calculate, breakdown and disclose emissions



not able to calculate emissions

only calculate emissions for whole company

https://bit.ly/35h2dil

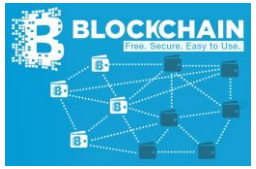
digitalisation of logistics

smart infrastructure

data pooling

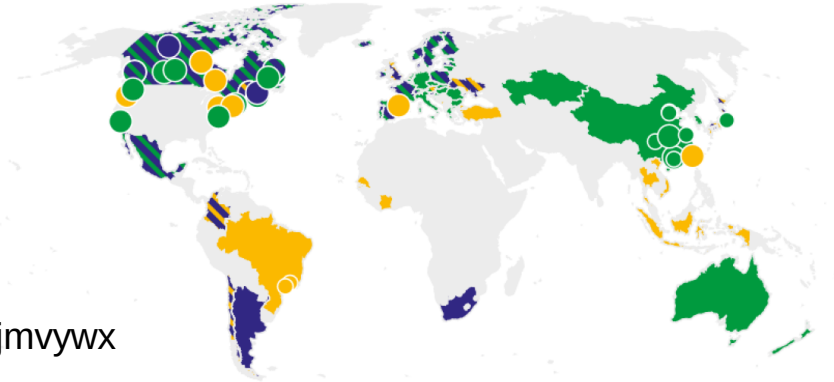
digital freight platforms

smart vehicles



monetising of GHG emissions: *decarbonisation game-changer*

World Bank dashboard of carbon pricing initiatives (2020)



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If all implemented would cover 22% of global GHG emissions

- ETS implemented or scheduled for implementation
- ETS or carbon tax under consideration
- ETS implemented or scheduled, ETS or carbon tax under c...
- Carbon tax implemented or scheduled for implementation
- ETS and carbon tax implemented or scheduled
- Carbon tax implemented or scheduled, ETS under consider...

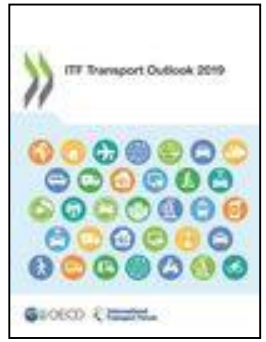
Very difficult to apply emissions trading in road freight sector?

Global variations in growth of road freight emissions and decarbonisation rates

International Transport Forum

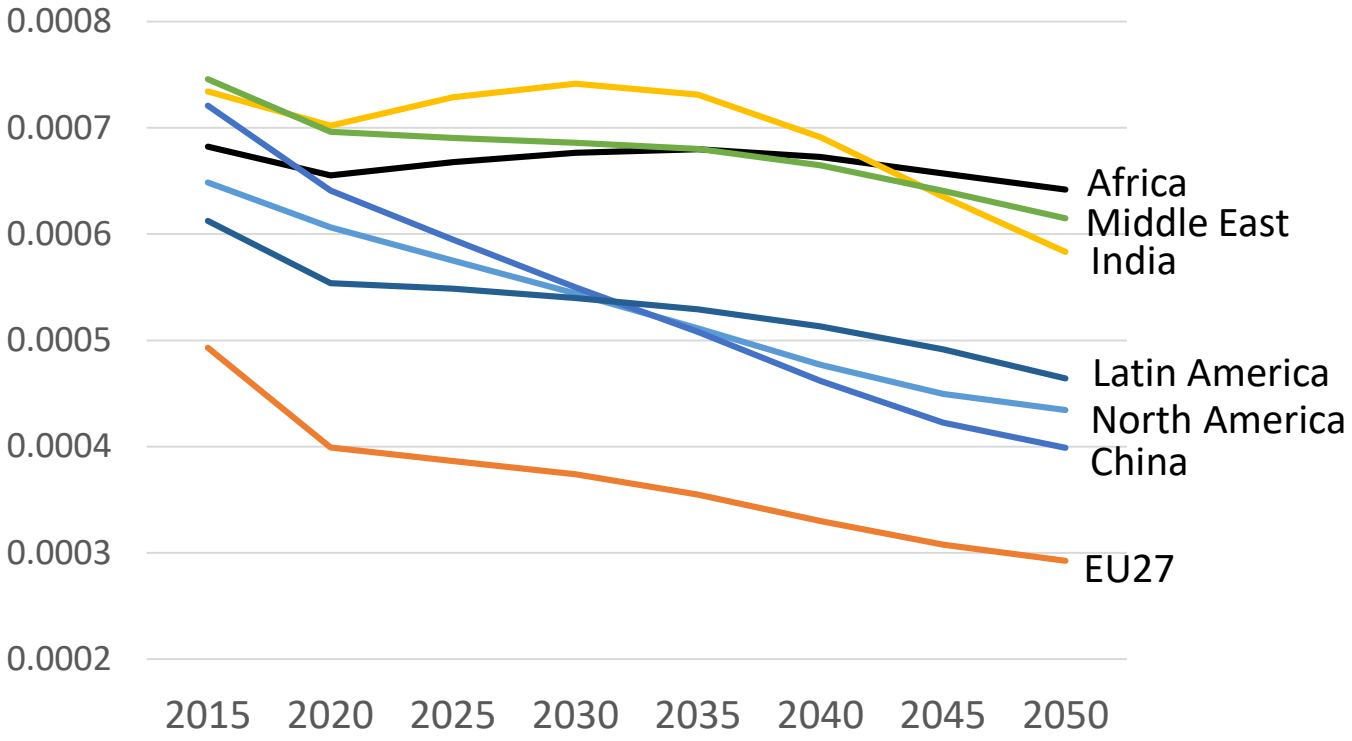
current ambition scenarios for 2030 and 2050

https://bit.ly/31slD2p

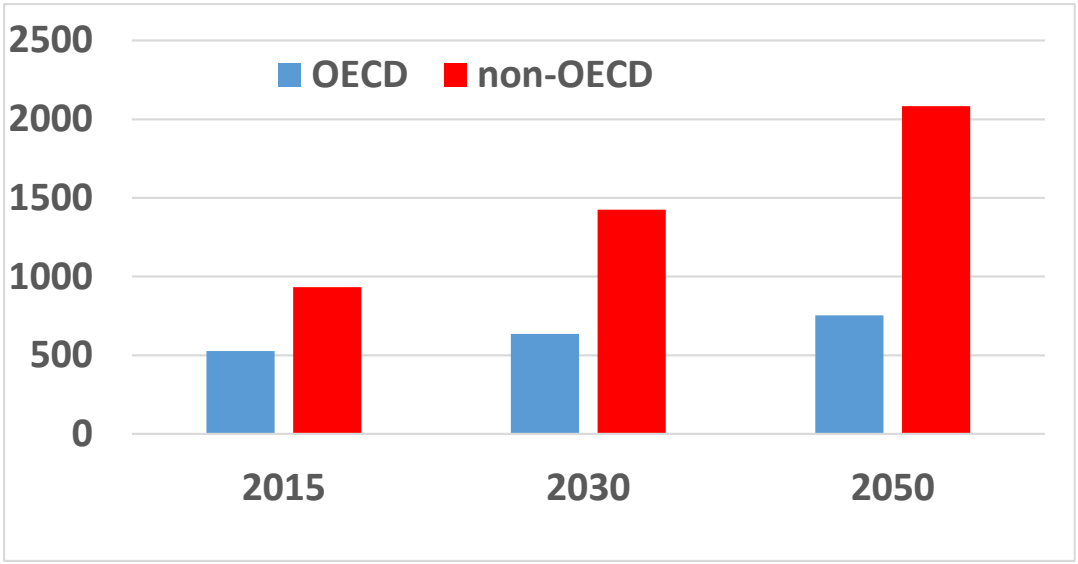


projected reduction in carbon intensity of road freight transport

tonnes CO_2 per vehicle-km



projected increase in CO_2 emissions from road freight transport



Main growth in road freight emissions in regions with much slower decarbonisation rate than the EU

Constraints on energy efficiency of road freight transport in less developed countries (LDCs)

subsidy as % of fossil fuel price

Iran	79%
Algeria	64%
Azerbaijan	43%
Egypt	42%
Ecuador	34%
Angola	33%
Indonesia	27%
Bolivia	20%
Gabon	15%
Bangladesh	14%
India	10%

source: IEA (2019)
https://bit.ly/3o9BVHf

diesel fuel subsidies

poor road infrastructure

chronic traffic congestion

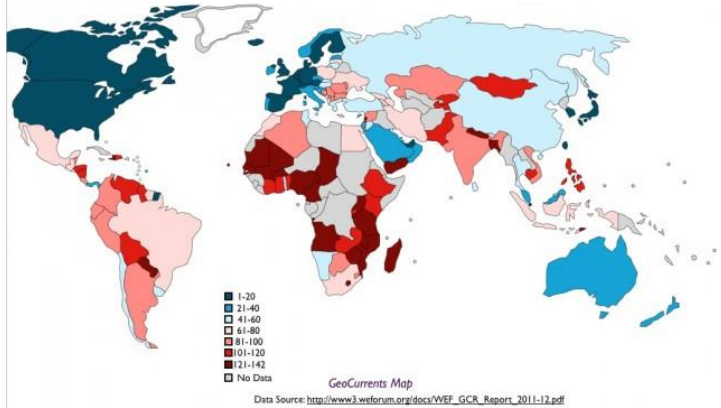
old and under-maintained truck fleets

lack of skills / training in fuel efficient driving

intense commercial pressures

weak regulation / low compliance

global infrastructure rankings



Source: World Economic Forum
https://bit.ly/35kDHwx

potential fuel / CO_2 saving

5-10%

eco-driver training

5-10%

telematic monitoring
guidance + incentives

Fuel Economy Standards for Heavy Duty Vehicles

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Japan				Phase 1										Phase 2
U.S.			Phase 1					Phase 2						
Canada			Phase 1					Phase 2						
China	Phase 1		Phase 2						Phase 3					
EU								15% less CO_2 by 2025 30% by 2030						
India							Phase 1		Phase 2					
Mexico									Phase 1					
S. Korea									Phase 1					

Hashed areas represent unconfirmed projections of the ICCT

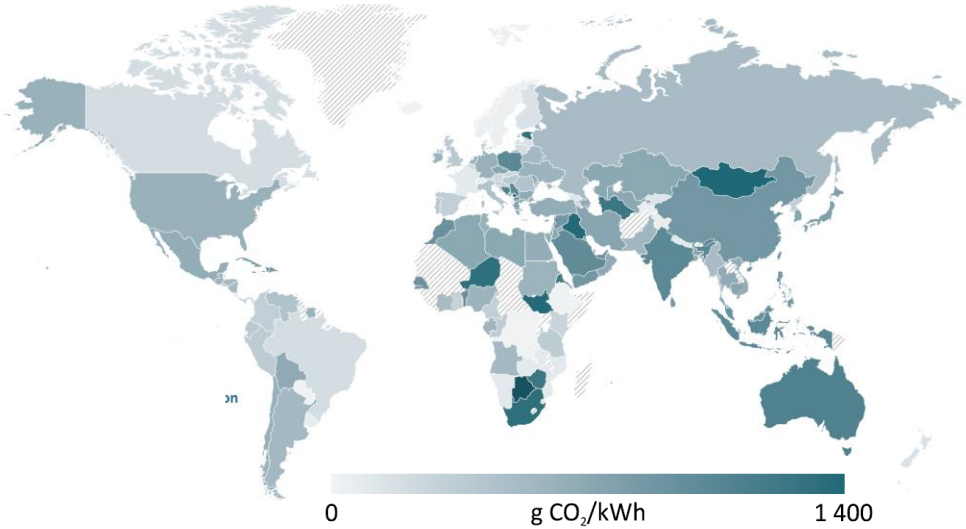
updated from ICCT (2015)

5-10 year lag before fuel economy standards reach LDCs in imported (degraded) second-hand vehicles

Slow Diffusion of Low Carbon Powertrain Technology into Less Developed Countries?

- *development of battery charging / gas fuelling networks*
- *decarbonisation of electricity grid*
- *grid capacity for truck charging*
- *construction e-highway infrastructure*
- *availability of hydrogen and biogas supply*
- *affordability of low carbon vehicles*
- *import market for these vehicles*

global variations in carbon intensity of grid electricity



Source: International Energy Agency (2019)

https://bit.ly/31rvsOn

transformation of global market and supply chain in used trucks?

surge in exports of used ICE trucks as Europe and North America switch to low carbon vehicles

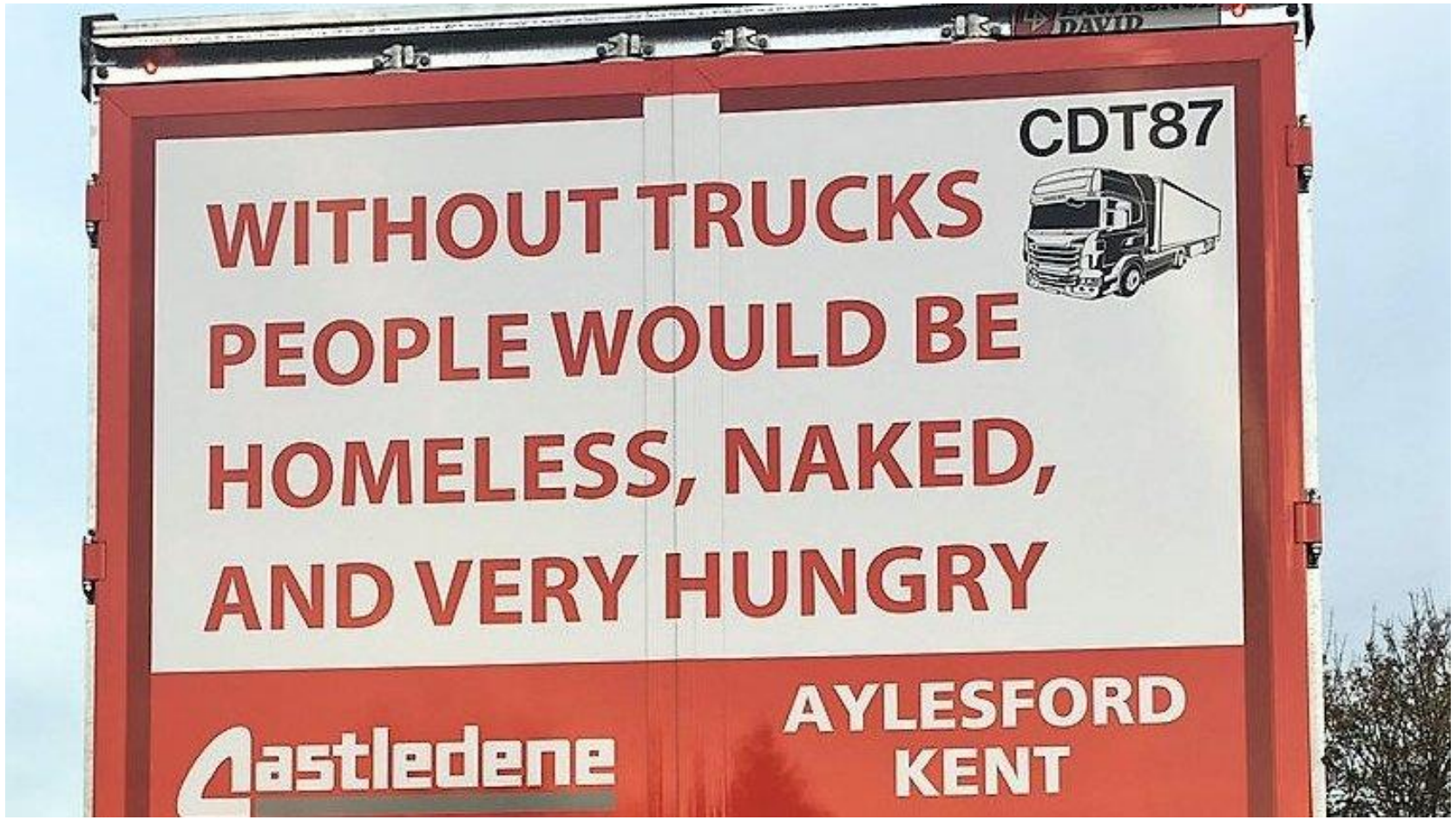
little incentive in LDCs to prepare infrastructure for low carbon trucks

depresses price of ICE trucks in LDCs– discouraging to switch low carbon vehicles

longer life of low carbon trucks will delay their export as used vehicles to LDCs

scarcity of materials and reliance on recycling will discourage export of used batteries and fuel cells

Get rid of trucks and save 2 billion tonnes of CO_2 emissions annually?



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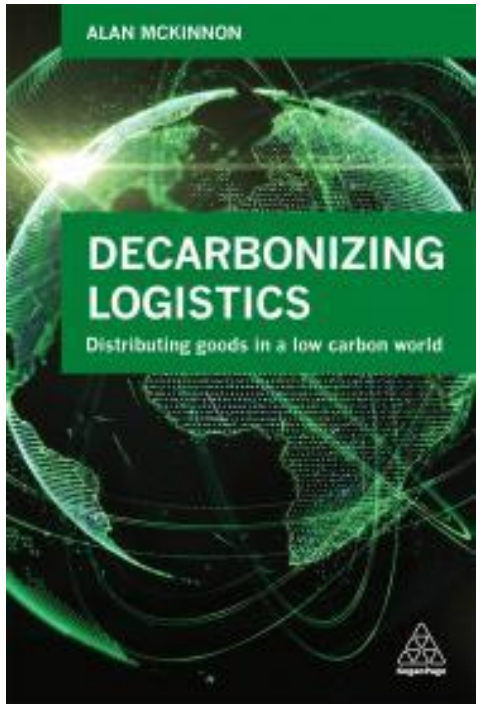

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