



KÜHNE
LOGISTICS
UNIVERSITY

Future Vision for Green and Digital Logistics

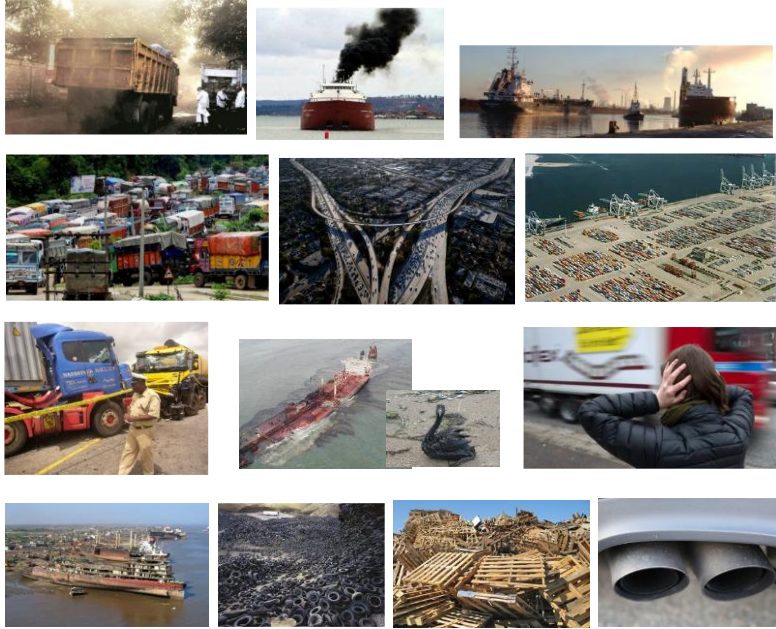
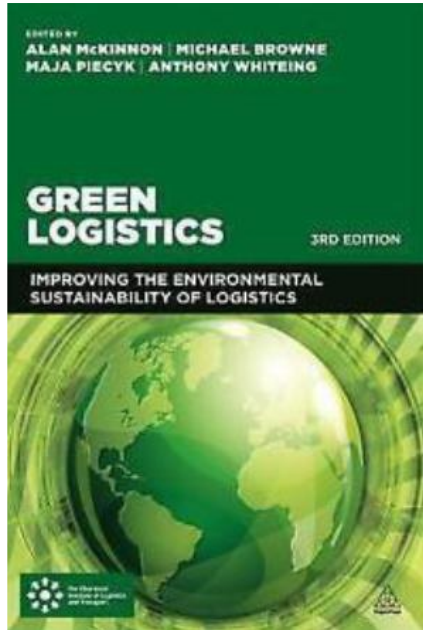
Professor Alan McKinnon

*Kühne Logistics University
Hamburg*

Greener Freight Made Easy Webinar

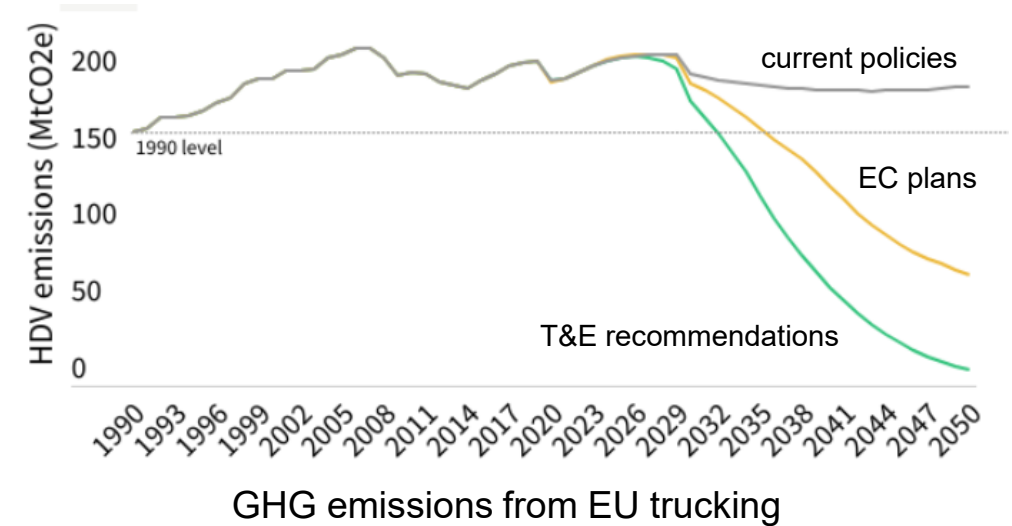
17 June 2025

Freight Transport - *Negative Externalities*



focus on
GHGs

- worsening of the climate crisis
- intensification of public policy
- strengthening of corporate commitments
- scale of the challenge



5 Freight Decarbonisation Levers

1. Reduce the total amount of freight movement
2. Shift freight to lower carbon transport modes
3. Optimise utilization of logistics assets
4. Improve energy efficiency of logistics operations
5. Cut carbon content of energy used by logistics

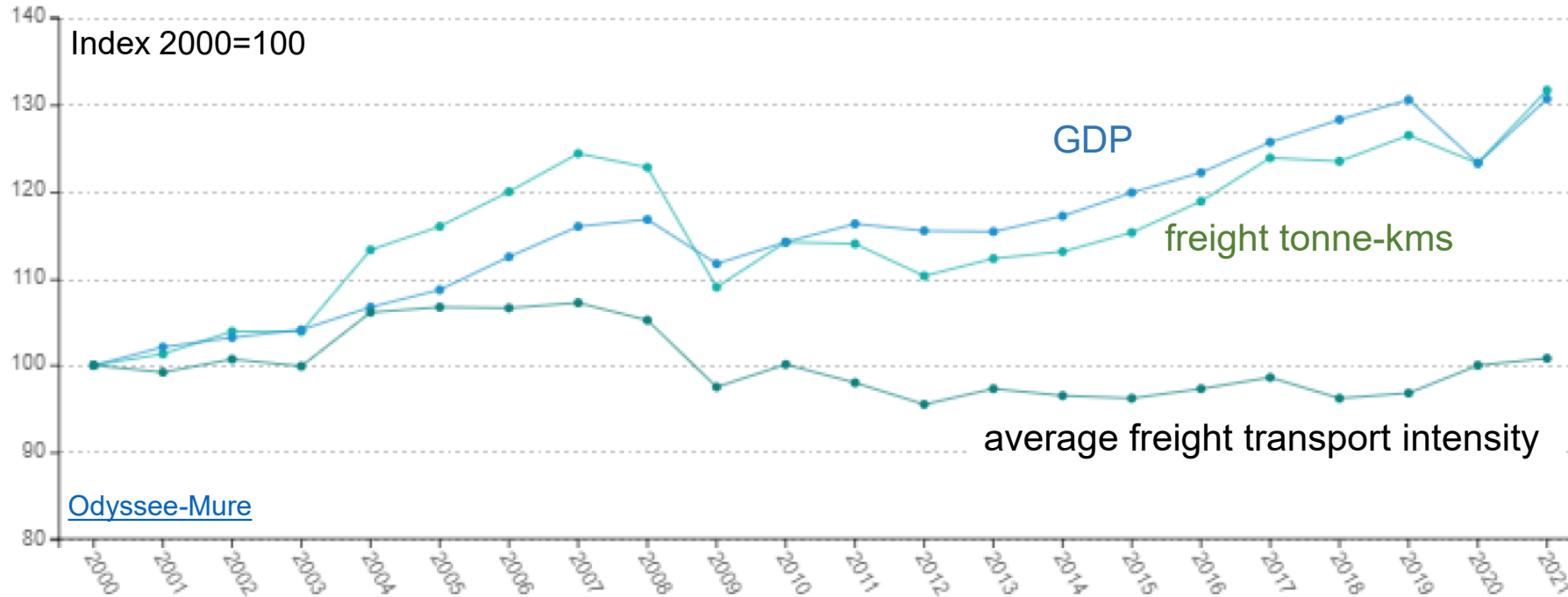
alice | Alliance for
Logistics Innovation
through Collaboration
in Europe

Roadmap towards Zero Emissions Logistics 2050



1. Reduce the total amount of freight movement / constrain the rate of freight traffic growth

EU reference scenario: **27% increase** in total freight tonne-kms between 2020 and 2030



'climate logistics'



circular economy



dematerialisation

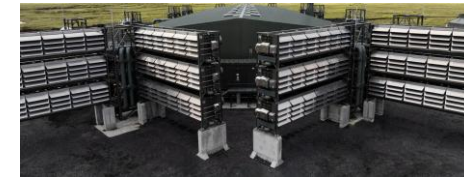


3D printing

Examples of future drivers of road freight demand pushing in opposite directions



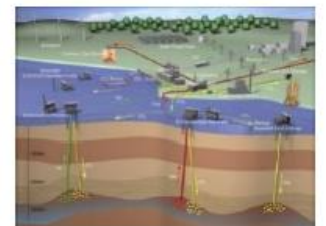
renewable energy infrastructure



carbon sequestration



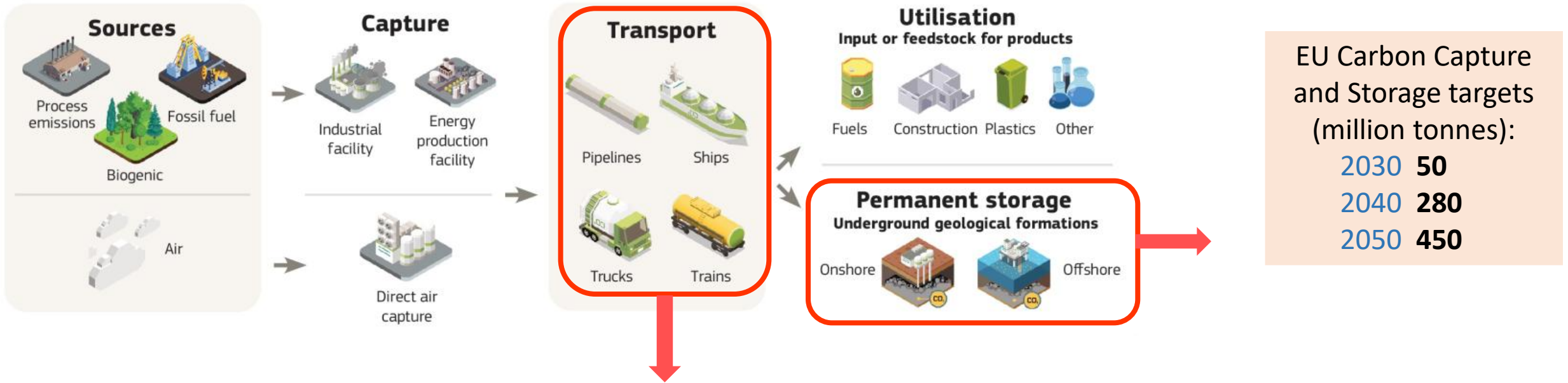
climate change adaptation



fossil fuel phase-out



Logistical Impact of Carbon Capture and Storage



Freight transport requirements of carbon dioxide removal

infrastructure

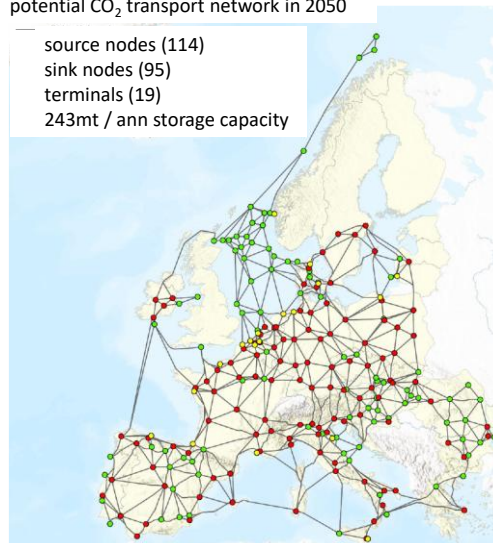
construction of CO₂ removal / storage facilities
electrical grid infrastructure for CDR facilities
pipeline networks for captured CO₂

equipment

supply chains for CO₂ removal devices and
vessels and vehicles to transport captured CO₂

potential CO₂ transport network in 2050

source nodes (114)
sink nodes (95)
terminals (19)
243mt / ann storage capacity



inputs

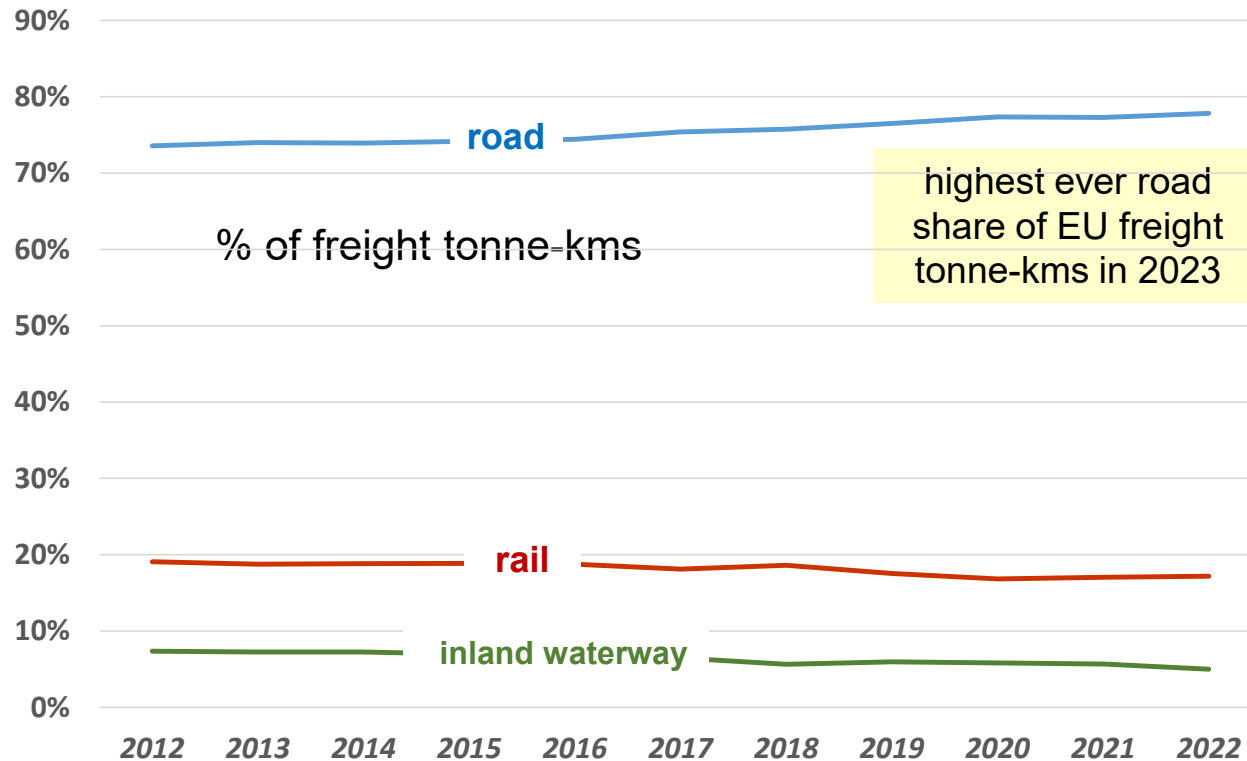
solvents / sorbents for the CO₂ removal process
biomass for BECCS
biochar, olivine, ocean fertilisation chemicals

outputs

captured CO₂ for storage or use
by-products of the sequestration process

2. Shift freight to lower carbon transport modes

Eurostat (2024)



EU reference scenario: 71% increase in rail freight tonne-kms between 2020 and 2040 – still only 19% modal share

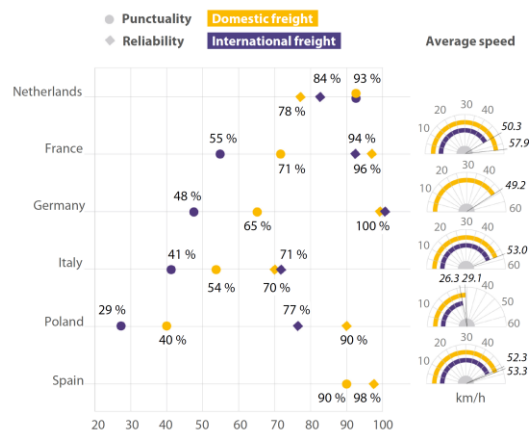
- history of over-ambitious freight modal shift targets not achieved
- long term 'logistical lock-in' to trucking is very difficult to reverse
- decarbonisation of EU economy depriving rail of fossil fuel traffic



EUROPEAN
COURT
OF AUDITORS

August 2023

'...unrealistic EU targets for 2030 and 2050 for the increased use of rail and inland waterways for the transport of freight. These targets were not based on robust simulations of how much modal shift could be achieved. We also found that the member states set their target for increasing rail freight without aligning it with the EU one and at an even more ambitious level.'



[EU Rail Market Monitoring Report](#)

- Need to predict **future** modal carbon intensity trends:
- Freight transport modes are decarbonising at different rates:
CO₂ advantage of rail and water over road likely to diminish

Need new sets of rail freight metric:

- *reflecting changing commodity mix*
- *more accurately measuring modal shift emission reduction*

3. Optimise the utilization of freight carrying capacity

Lack of macro-level data on capacity utilisation across all freight transport modes to monitor EU trends

only data for trucking and for **empty running**

no data on **average load factors by weight or volume**

little long term change in average % of truck-kms run empty

[Eurostat](#)

Year	Empty Running (%)
2010	24%
2023	22%

despite

Digitalisation of road freight market
increasing backloading opportunities



Efforts to promote supply chain
collaboration and asset sharing



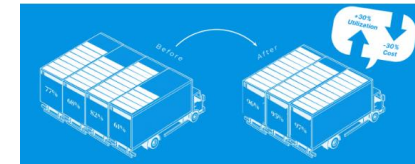
Economic efficiency benefits

€€€

Low or negative carbon mitigation costs

need for

Stronger public policy intervention?



Deployment of AI in
asset utilisation



Change in management practices



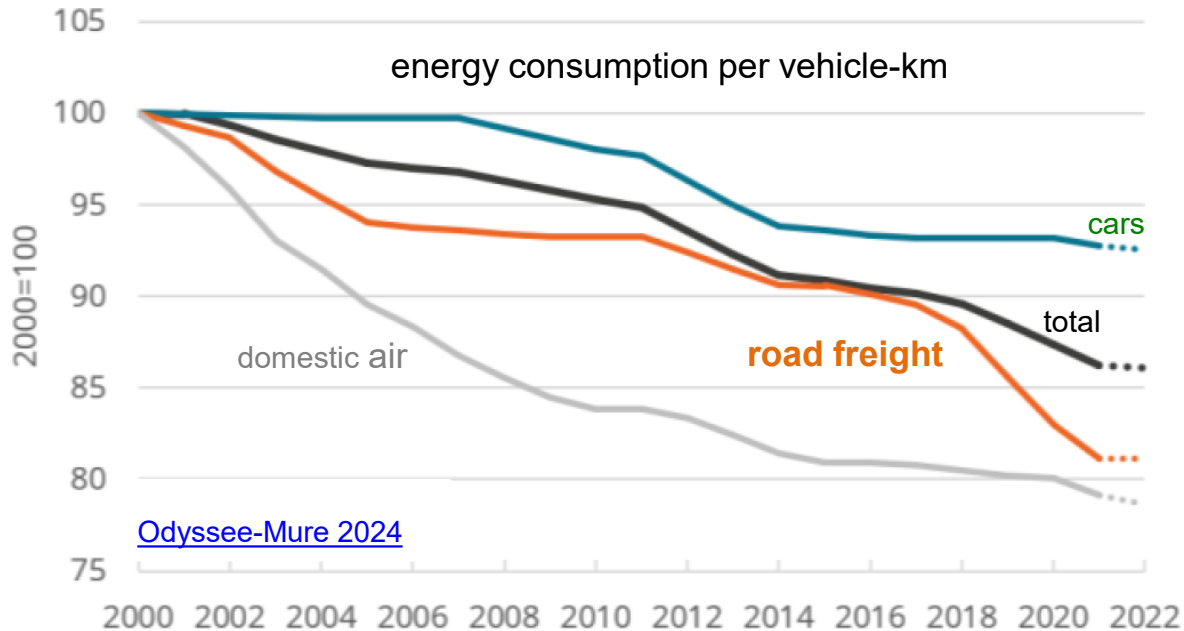
Relaxation of just-in-time



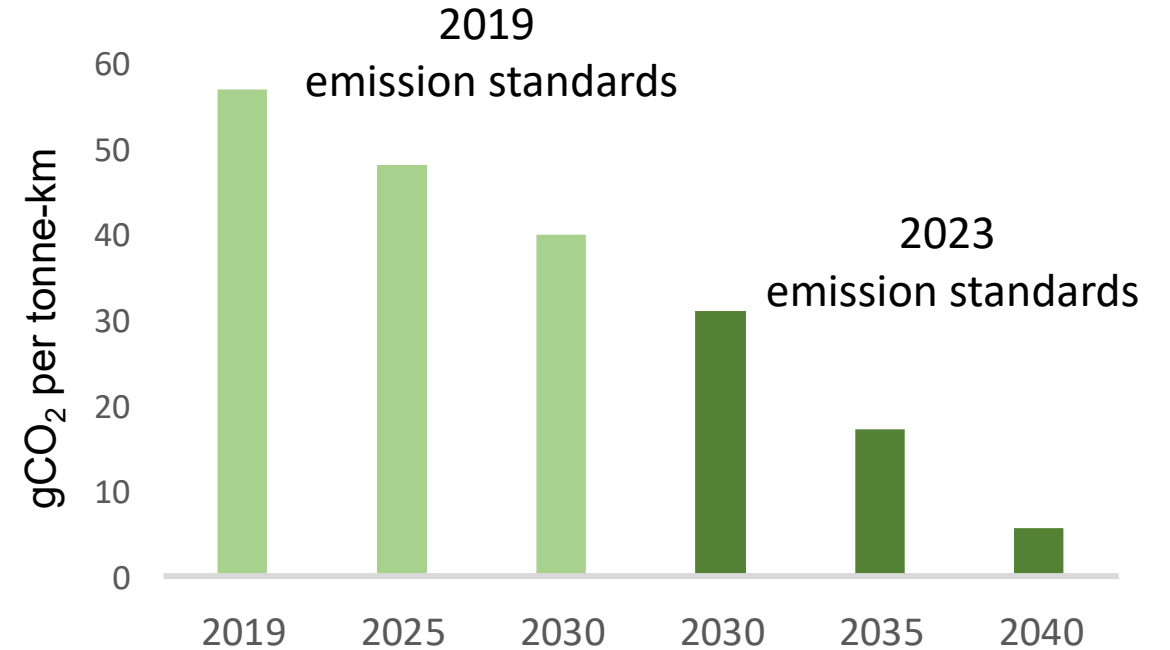
Physical internet

4. Improve the energy efficiency of freight transport

energy consumption per vehicle-km in the EU



EU fuel / CO₂ efficiency standards for new trucks



At average EU truck replacement rate of 5-7% per annum 15-18 years to replace entire truck fleet

short-to-medium term measures to improve the energy efficiency of existing fleets – *many are data-intensive*

driver monitoring, advice and training

platooning

vehicle automation

smart cruise control

tyre pressure monitoring

automated tyre inflation

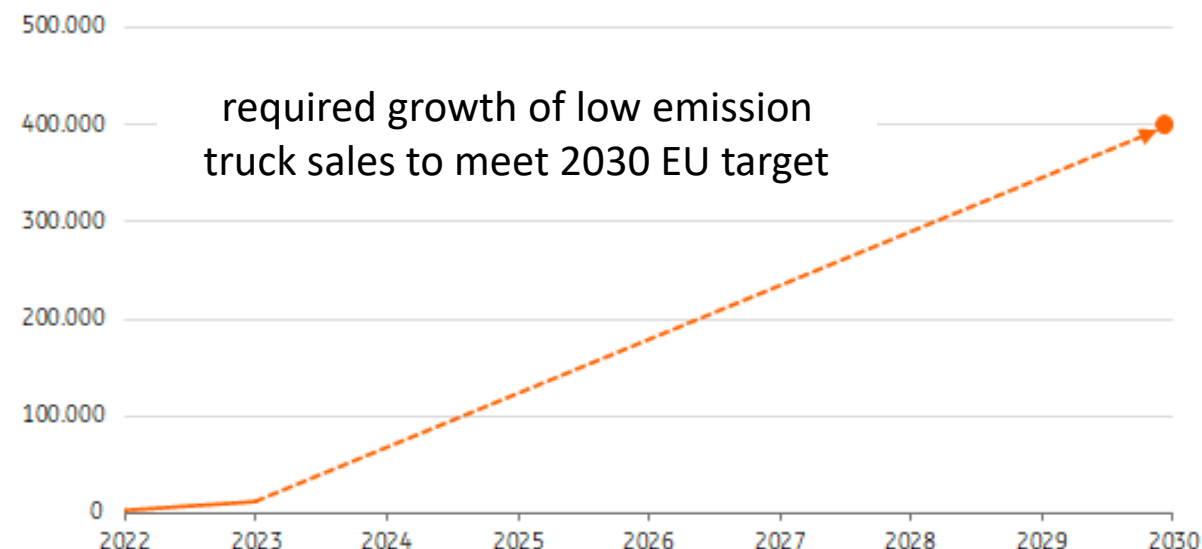
energy-efficient routing

vehicle component monitoring

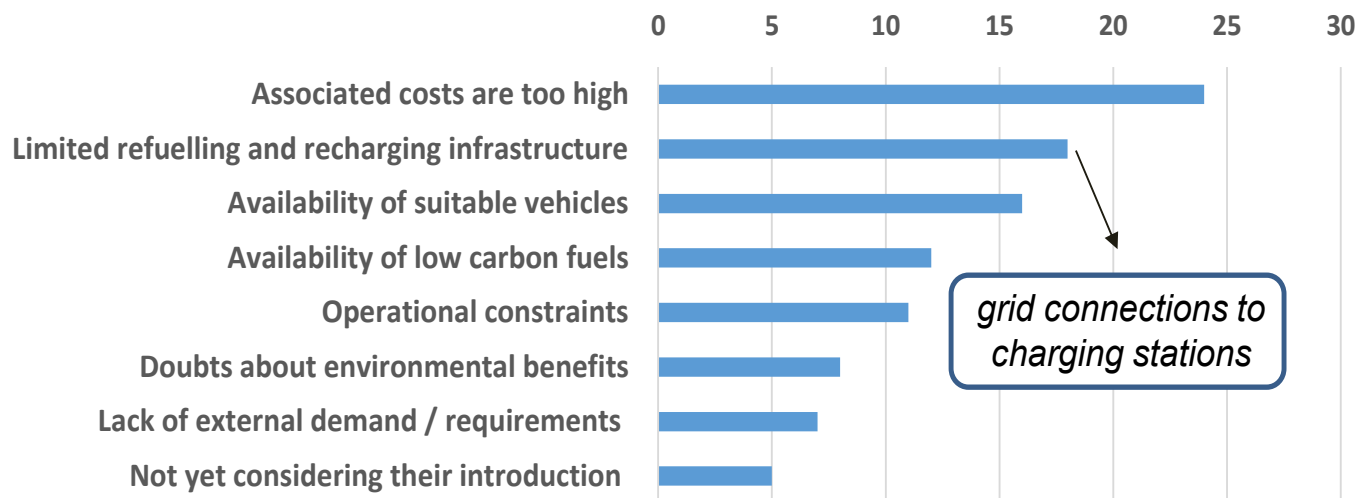
5. Transition freight transport to low carbon energy



slow transition: *coordinating the development of **transport and energy infrastructures** with the **manufacture of new low carbon vehicles** and **operators' fleet replacement cycles**.*



main barriers to implementing low/zero CO₂ emission fuels and vehicles
% of consolidated responses



Use of [Book and Claim](#) schemes to accelerate the switch to low carbon fuels in logistics

Decoupling **physical distribution and consumption** of fuel from the **carbon accounting process**

production / blending of low carbon fuel

despatch of fuel

enter attributes of fuel entered into Registry

delivery to fuelling location

allocation of Book and Claim Units (BCUs) to customers

fuel burned in vehicle / vessel

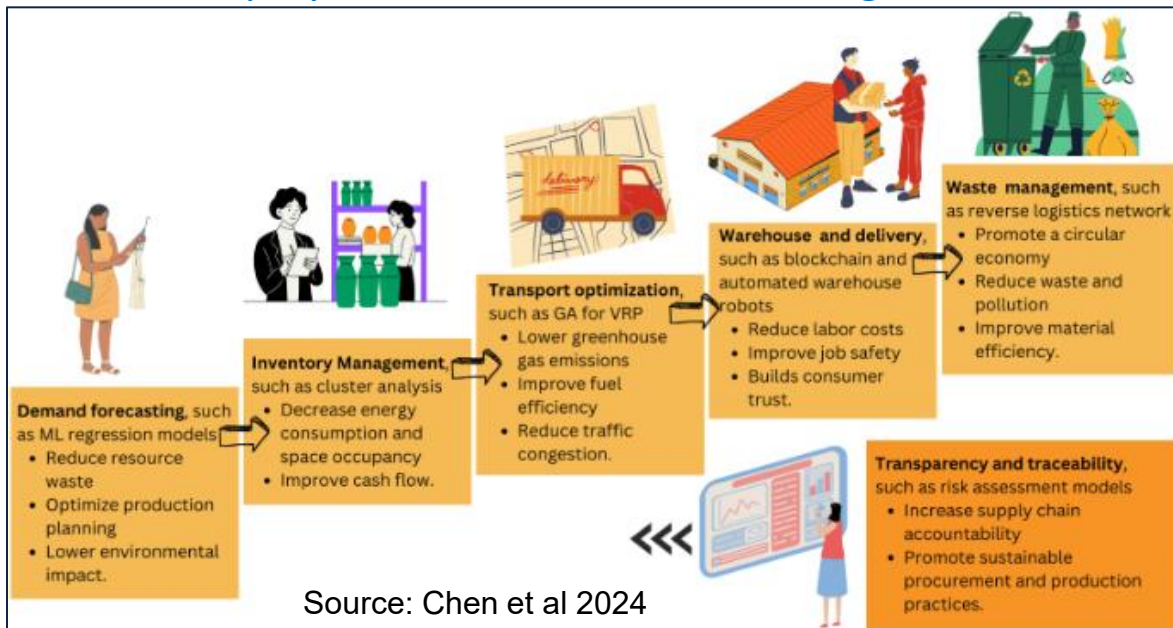
BCUs 'retired'

Data-driven Green / Low Carbon Logistics

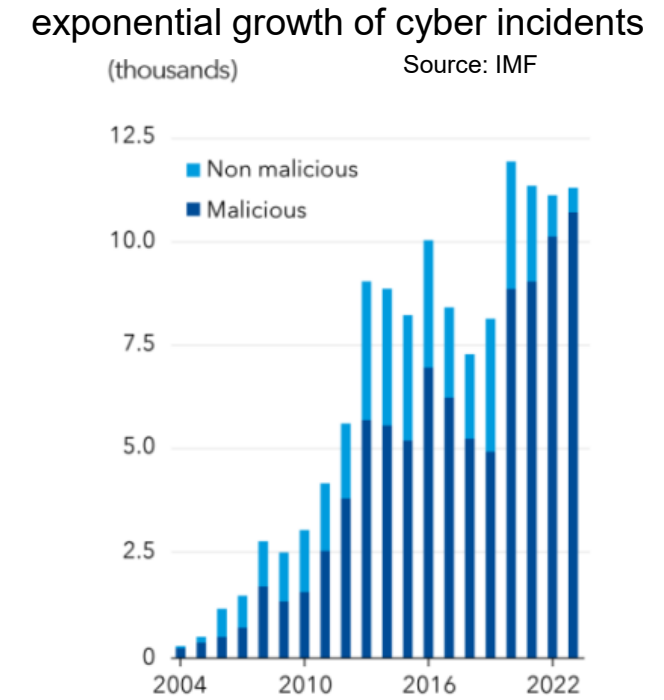
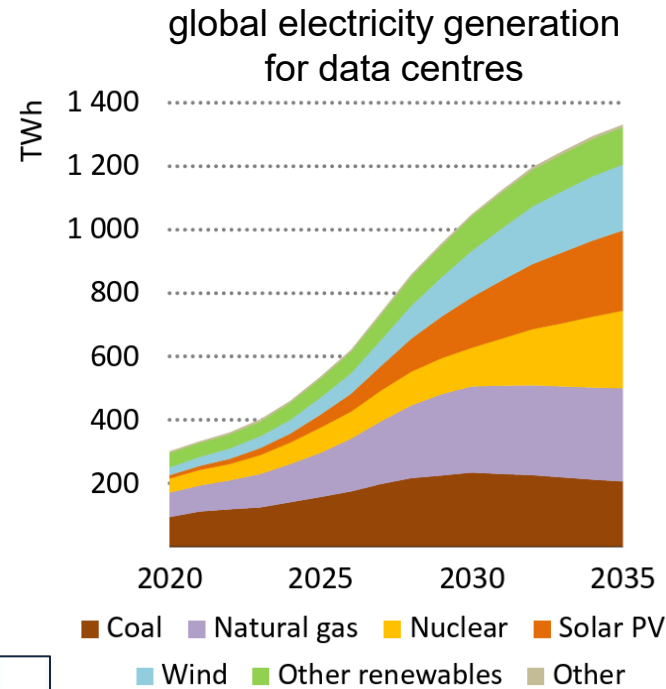
data requirements in the decarbonisation process

- *informing the selection of transport mode and carrier*
- *data-sharing for supply chain collaboration*
- *targeting-setting and monitoring of decarbonisation trends*
- *'book and claim' for low-carbon fuel procurement*
- *optimising routeing, asset utilisation and energy use*
- *monetising emissions for carbon pricing and taxation*
- *carbon labelling of products and services*
- *climate risk auditing and alerting*

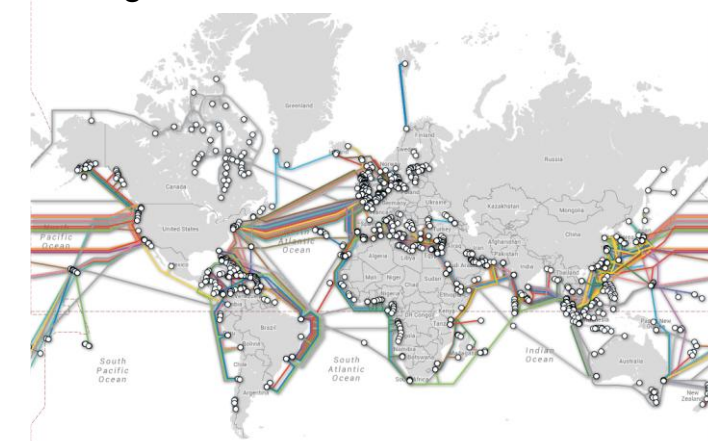
deployment of AI in sustainable logistics



Dark-sides of the digitalisation of logistics and supply chains



global sub-sea cable communication network



475 cables carrying over 95% of all internet data traffic, including 15 million financial transactions per day – worth \$10 trillion.

It would take only a few cable cuts to take out large swathes of the internet

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