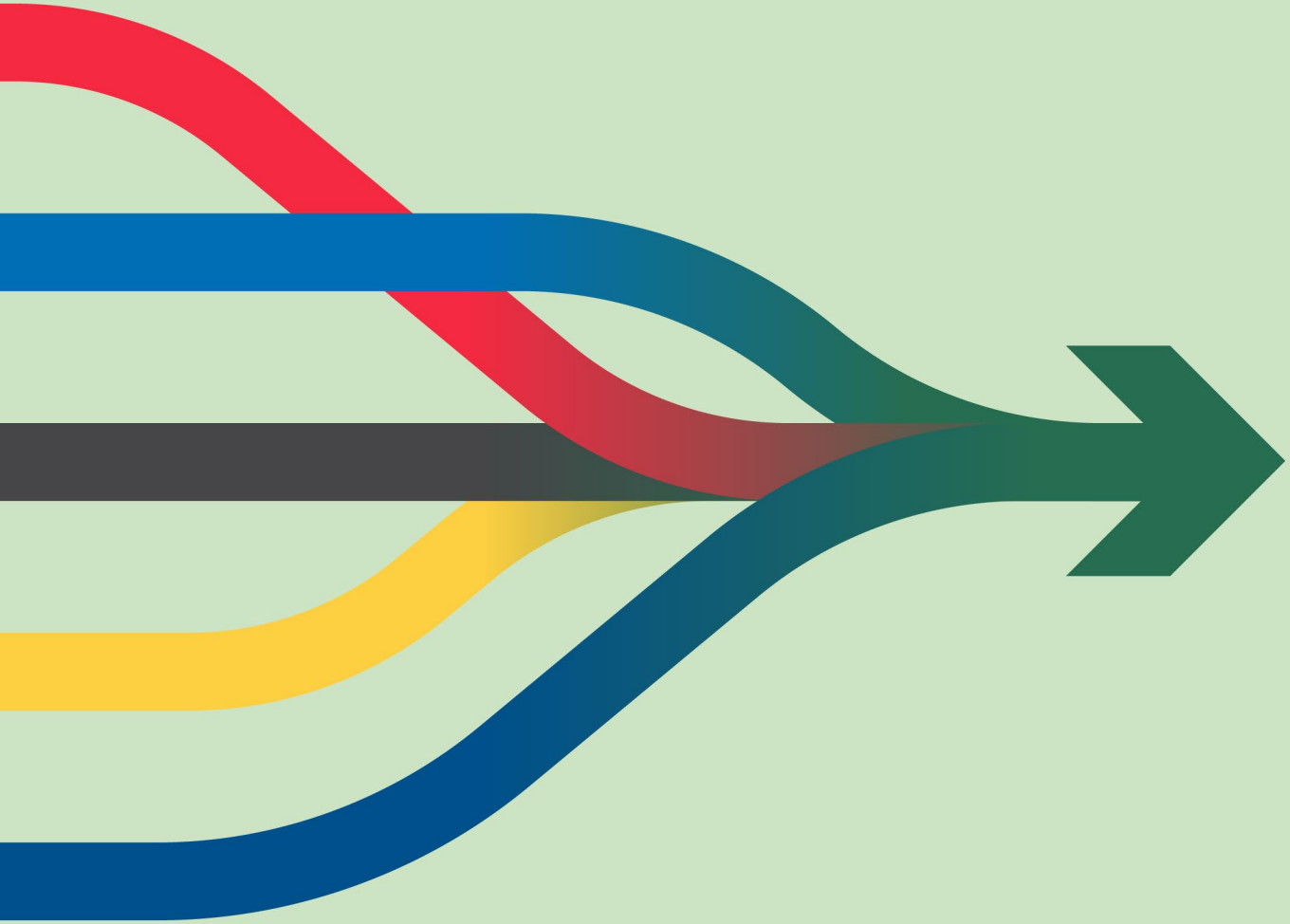


Mobility System and Digitalisation in Europe

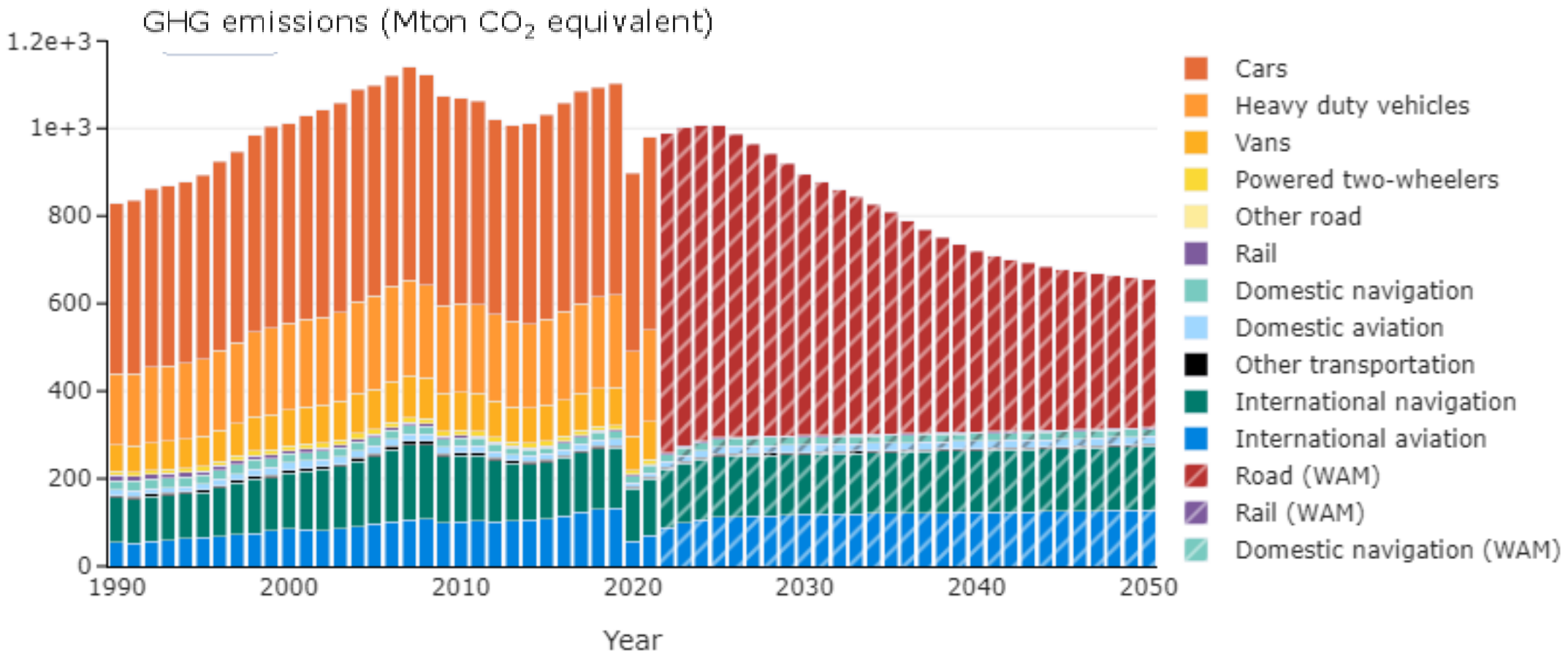
Tommaso Selleri, PhD

Expert in Climate Change, Energy, and Transport

European Environment Agency

Nordic Energy Research

Mobility is struggling to deliver significant greenhouse gases (GHG) reductions

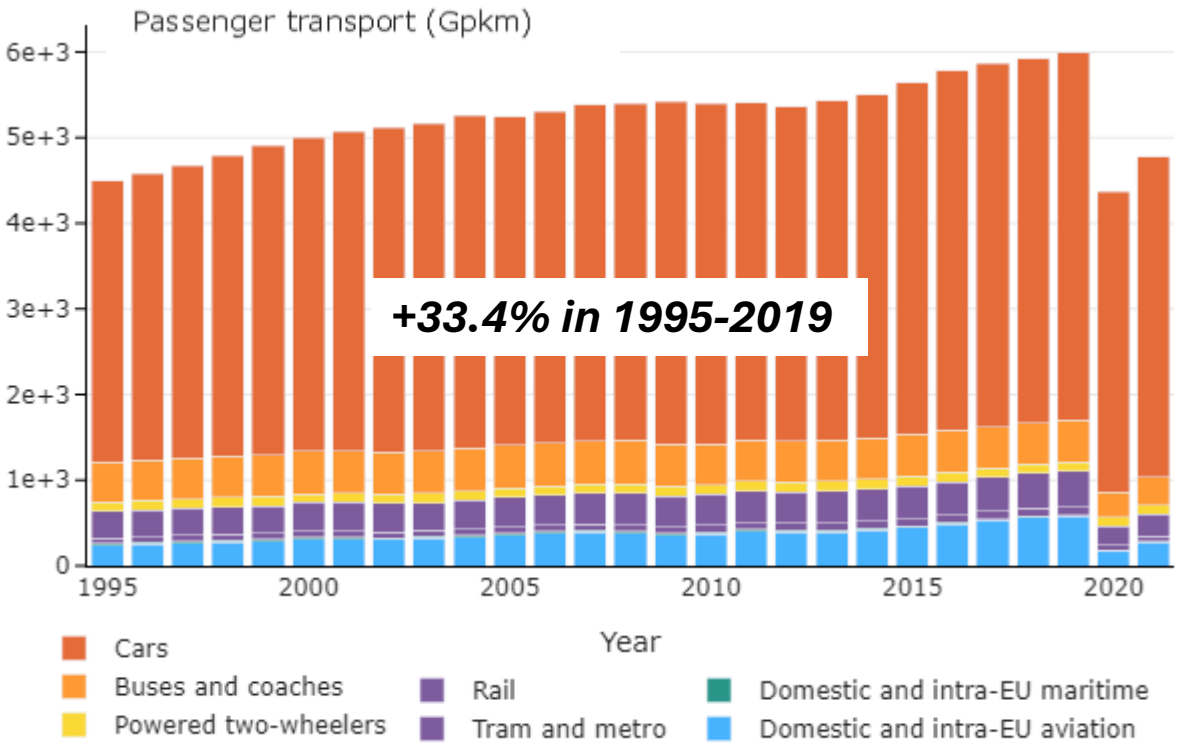


Additional complexities: allocation of international bunkers, non-CO_2 effects of aviation, monitoring of other compounds that are both GHG and air pollutants (CH_4, N_2O, …)

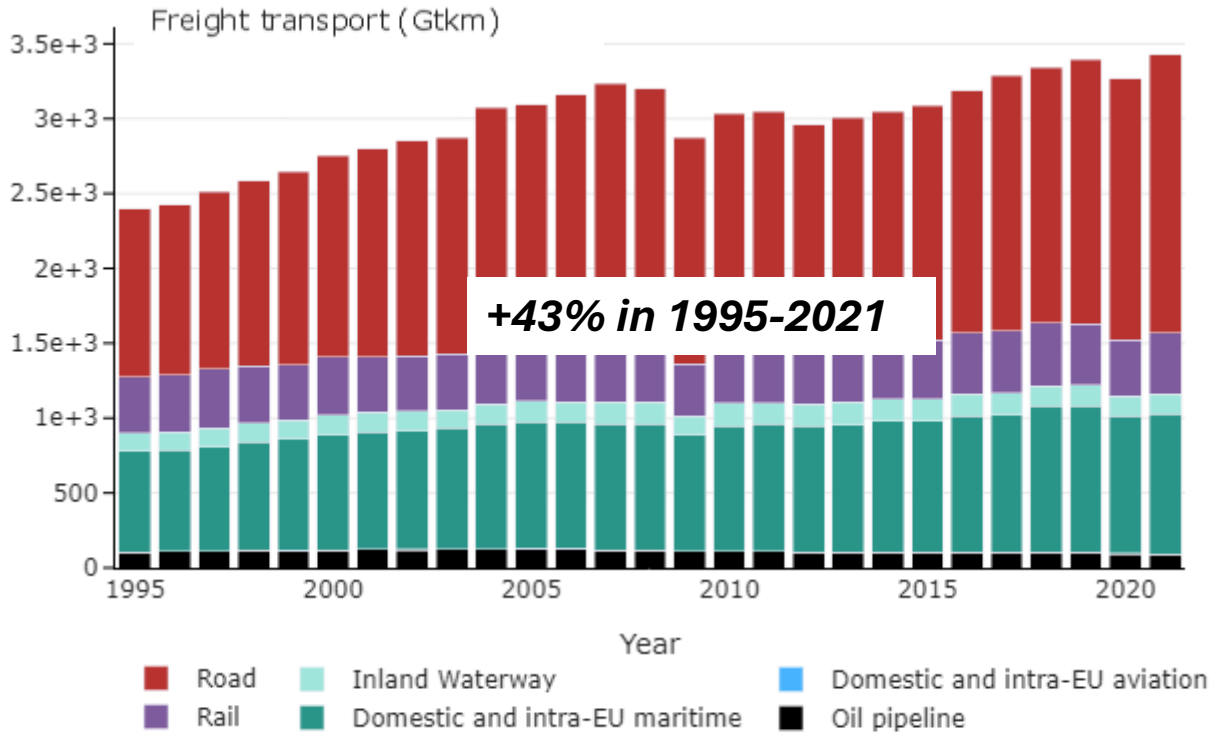
EEA greenhouse gases — data viewer — European Environment Agency (europa.eu)
EEA greenhouse gas projections - data viewer — European Environment Agency (europa.eu)

Increased efficiency overcompensated by significant increase in demand

Passenger transport volumes[1]



Freight transport volumes[1]



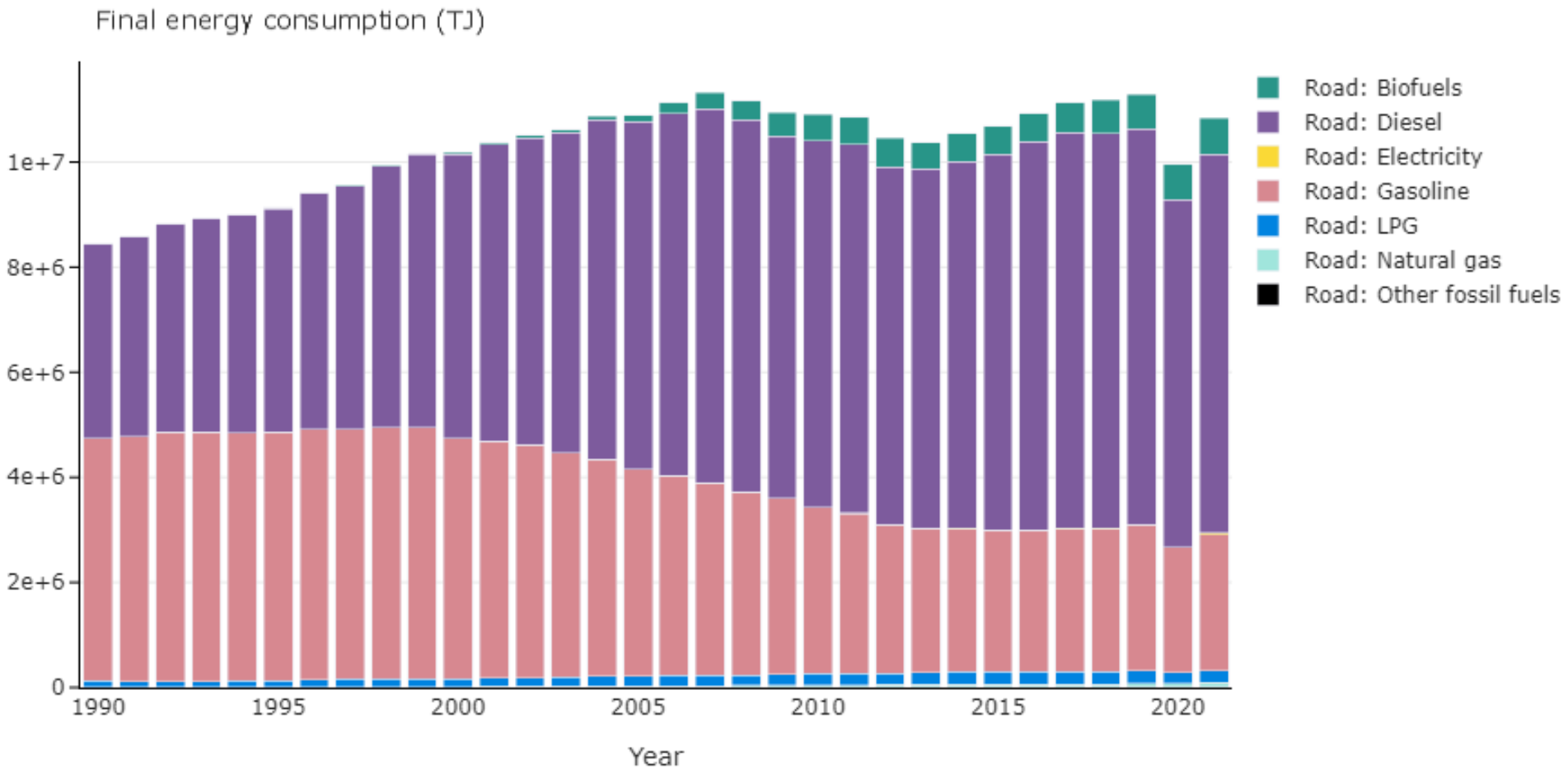
Many scenarios foresee an increase in volumes

EU reference scenario[2]	*+13% by 2030, +27% by 2050, baseline 2015*	*+31% by 2030, +55% by 2050, baseline 2015*
EU Climate 2040 target[3]:	*+26-27% by 2040, +32% by 2050, baseline 2015*	*+35-36% by 2040, +51% by 2050, baseline 2015*

1 EC, 2022, EU transport in figures. Statistical pocketbook 2023, Publications Office of the European Union, Luxembourg
2 EC, 2021, EU Reference Scenario 2020 Energy, transport and GHG emissions: trends to 2050, Publications Office of the European Union, Luxembourg.
3 2040 climate target - European Commission (europa.eu)

European Environment Agency

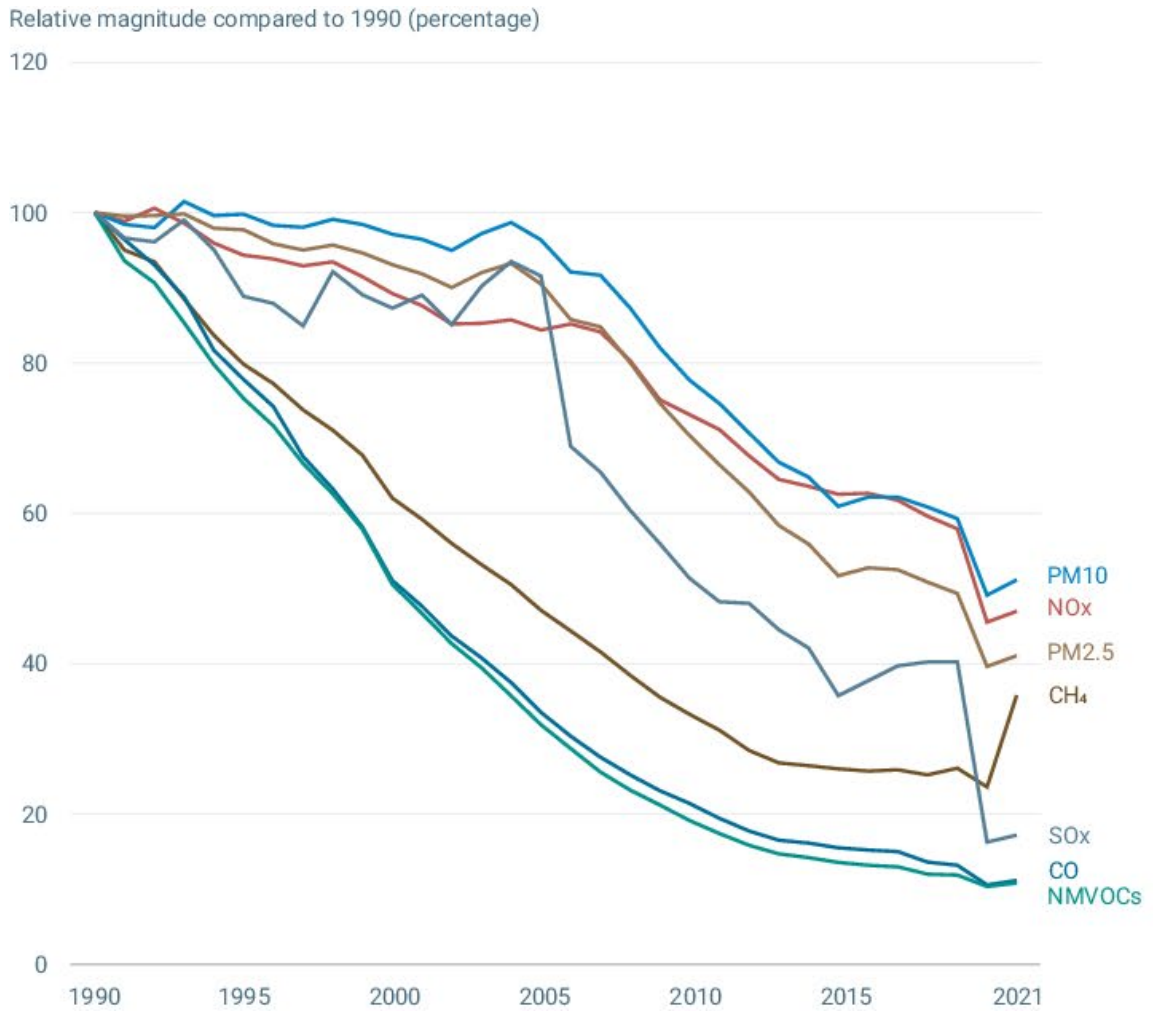
Mobility is still powered by conventional energy vectors (road example)

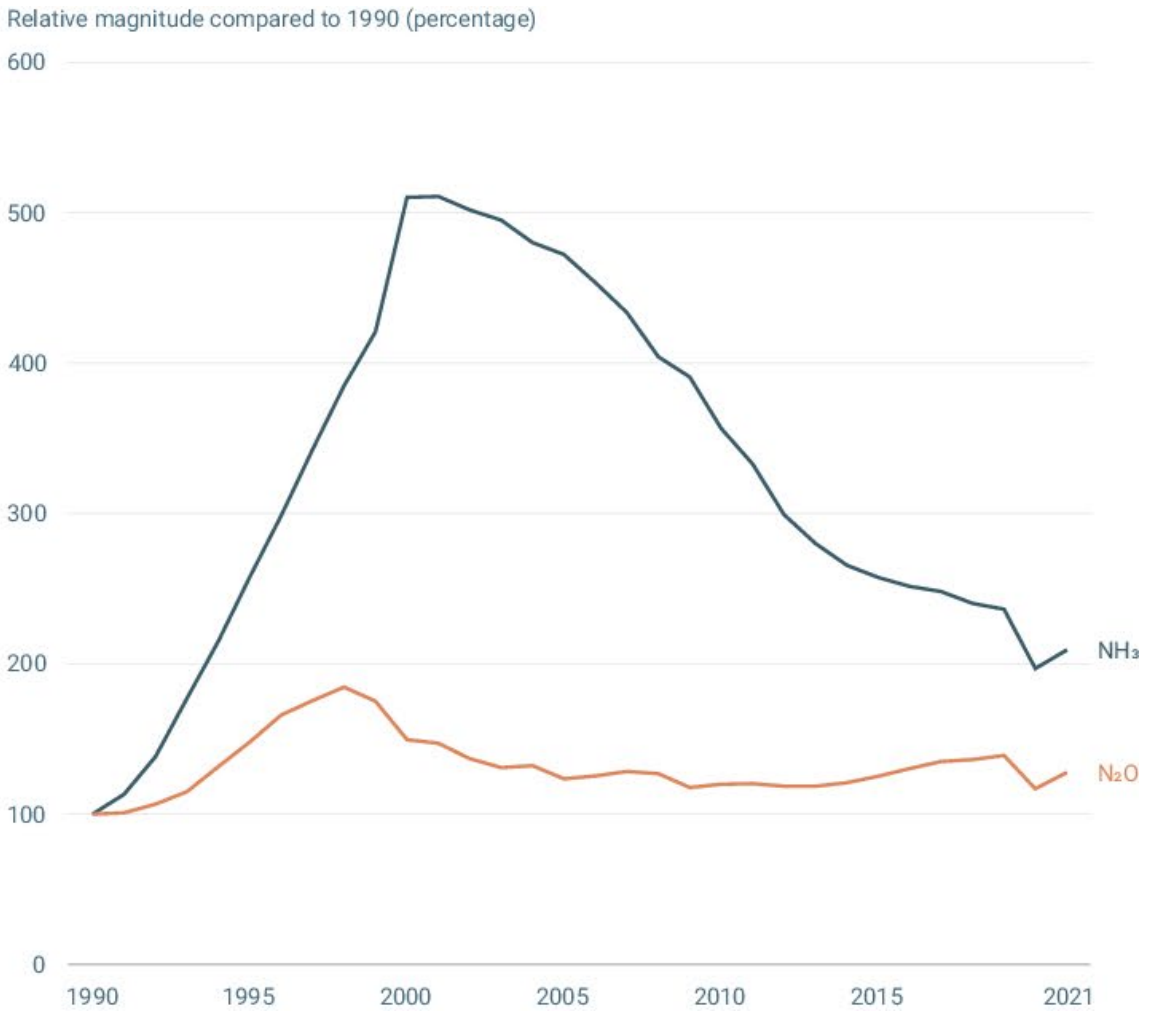


Situation is basically analogous for other transport modes (excluding rail which is mostly electrified). Energy transition (and the associated infrastructure for distribution) will require significant scale up in the near future across modes

Statistics | Eurostat (europa.eu)
EEA, TERM 2024, upcoming

Air pollution will still have to be addressed, even in a decarbonised system





Compared to GHG, situation is better for air pollution, mainly due to aftertreatment systems, not available for GHG.
However, new challenges awaits both from technical and a regulatory perspectives (non-exhaust, new energy vectors, …)

Emissions of air pollutants from transport in Europe (europa.eu)

Highlights from the latest **Transport and Environment Report 2022**

Developed by the **European Environment Agency** in collaboration with:

EIONET – mobility systems group (European Environment Information and Observation Network)

ETC CM – Transport and Mobility Leuven (European Topic Centre on Climate Change Mitigation)

Available here:
https://www.eea.europa.eu/publications/transport-and-environment-report-2022

Contact us:
tommaso.selleri@eea.europa.eu
climate-energy@eea.europa.eu

Nordic Green Transport Forum

European Environment Agency

Nordic Energy Research

What digitalisation could bring to the mobility system?

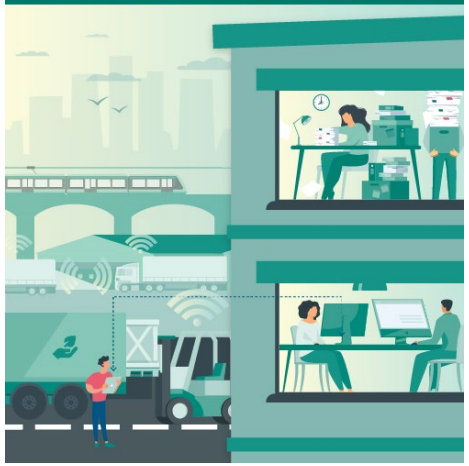
Teleworking and virtual mobility

Shared autonomous urban vehicles

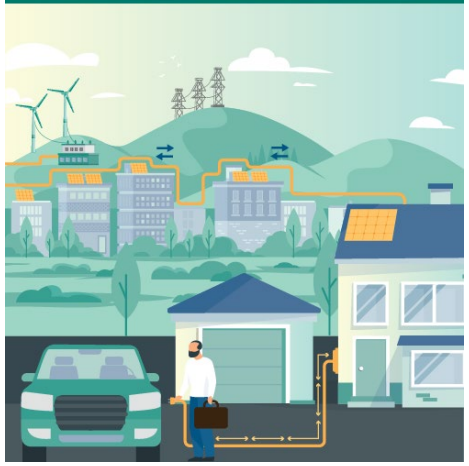
Autonomous freight transport

Multimodal digital mobility services in passenger road transport

Smart logistics



Vehicle-grid integration



Digitalisation in road transport pricing

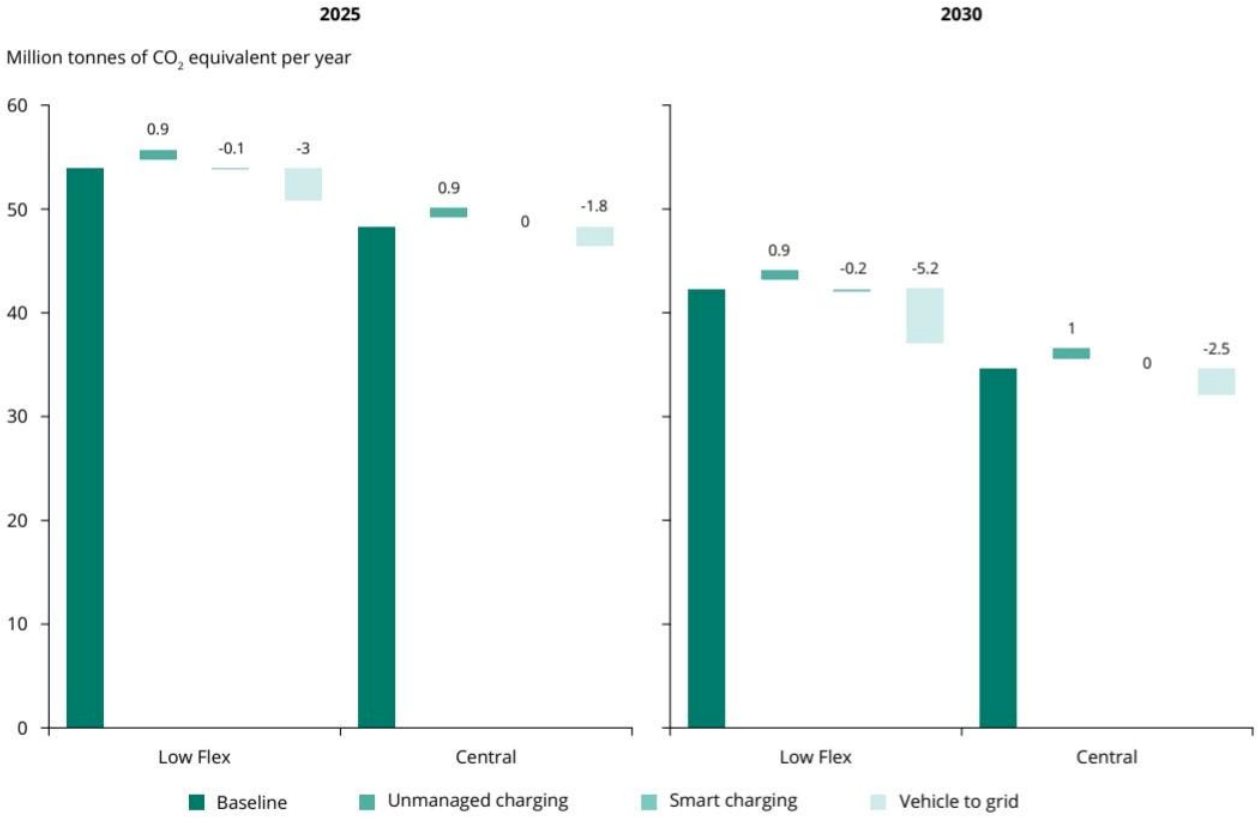
Air traffic management

Digitally-enabled monitoring tools

Nordic Energy Research

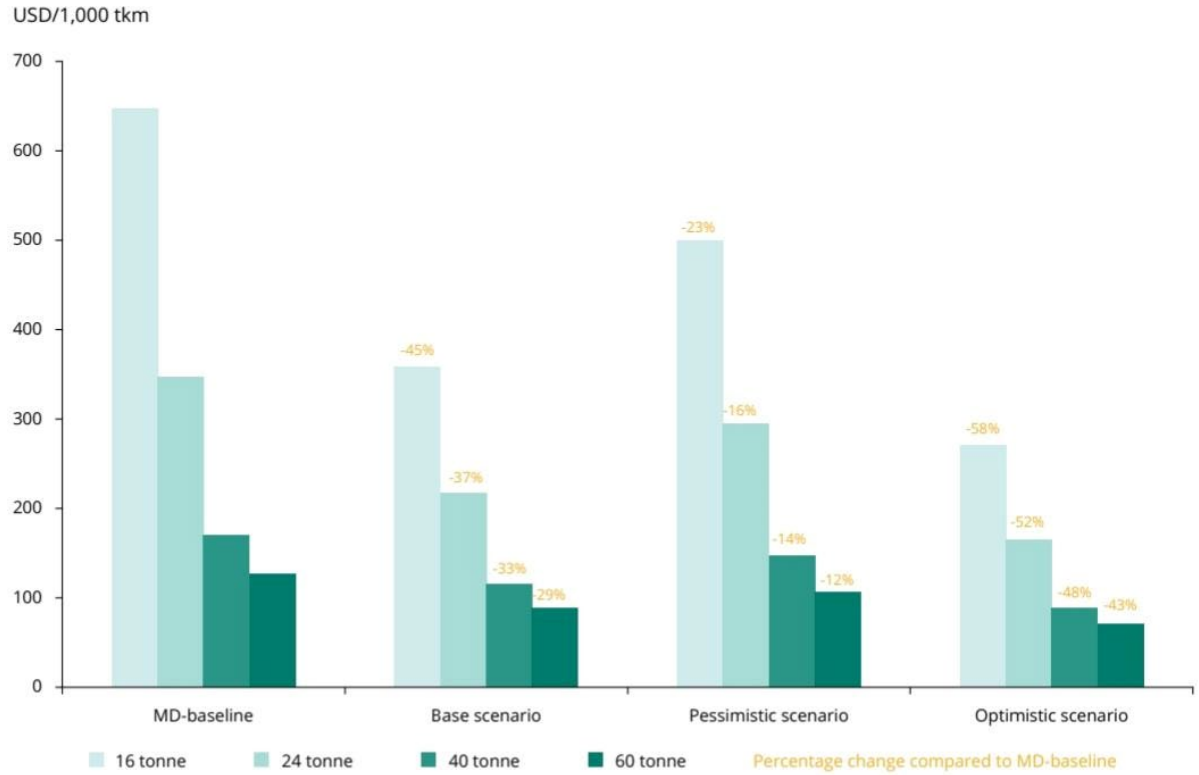
How digitalisation can impact? Some examples…

Vehicle to grid – electric system impact[1]



Source: Reproduced with permission from Aunedi and Strbac (2020). © IEEE 2020.

Autonomous trucks – transport cost reduction[2]



Note: The percentages represent the relative cost change from the MD-baseline.
MD, manually driven.
Source: Engholm et al. (2020).

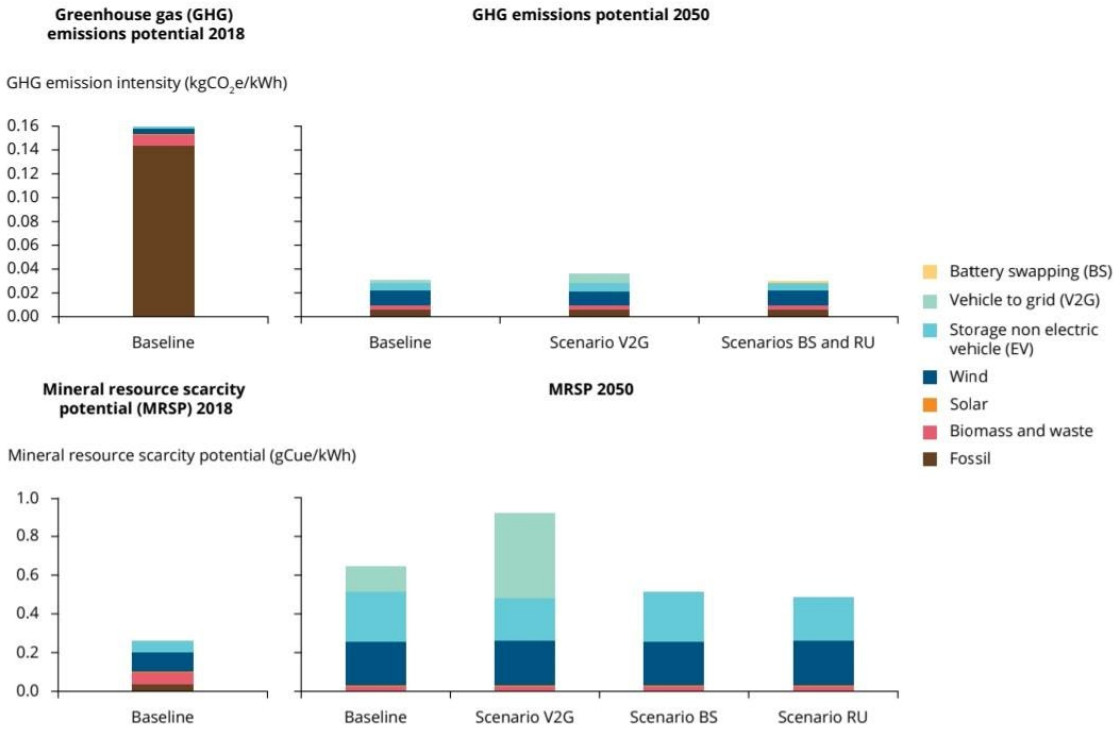
Benefits for the grid operators and users

Benefits for companies and users

1 Aunedi, M. and Strbac, G., 2020, Fifteenth International Conference on Ecological Vehicles and Renewable Energies (EVER), Montecarlo, Monaco, pp. 1-9.; 2 Engholm, A., Pernestål, A. and Kristoffersson, I., 2020, 'Cost analysis of driverless truck operations', Transportation Research Record 2674(9), pp. 511–524.

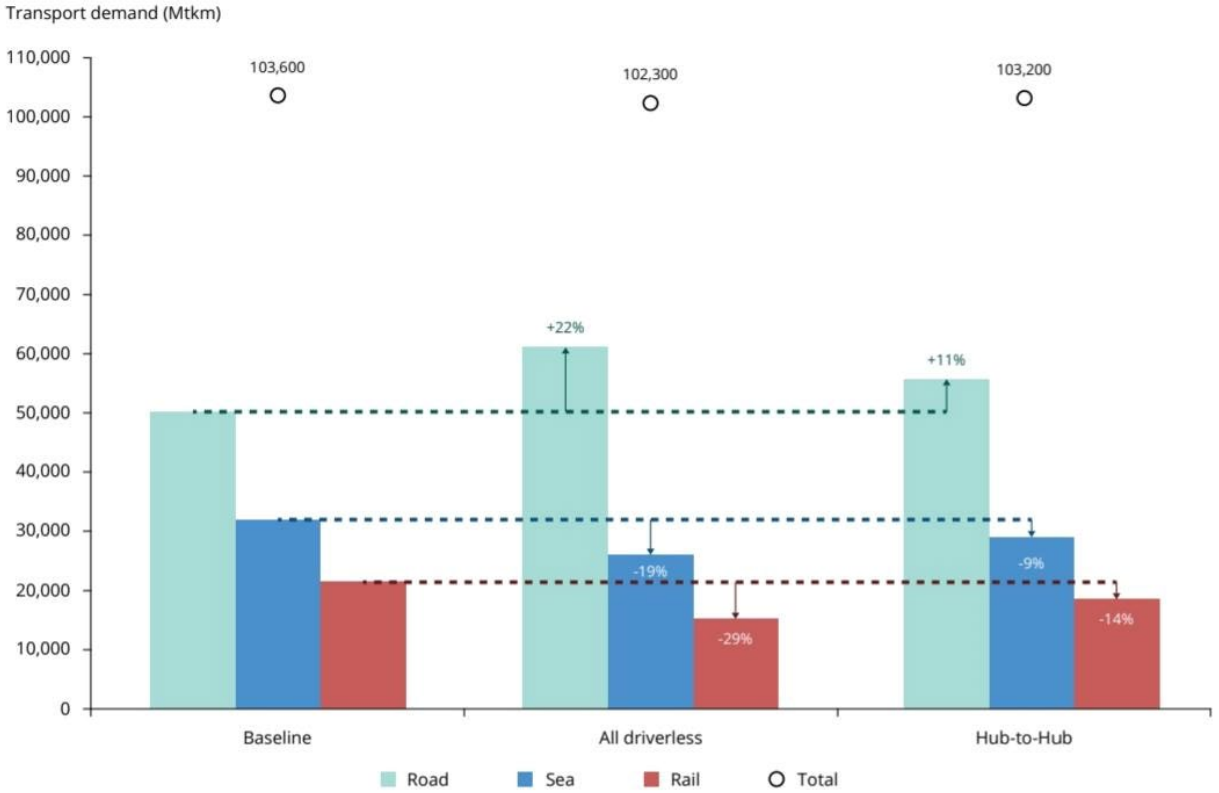
Is important to keep unwanted effects in check!

Vehicle to grid – resource impact[1]



Source: EEA compilation based on Zhao and Baker (2022).

Autonomous trucks introduction – Sweden example[2]



Note: The percentages represent the relative changes in tonne-km transported by the three modes in comparison with the baseline scenario.
Source: EEA compilation based on Engholm et al. (2021).

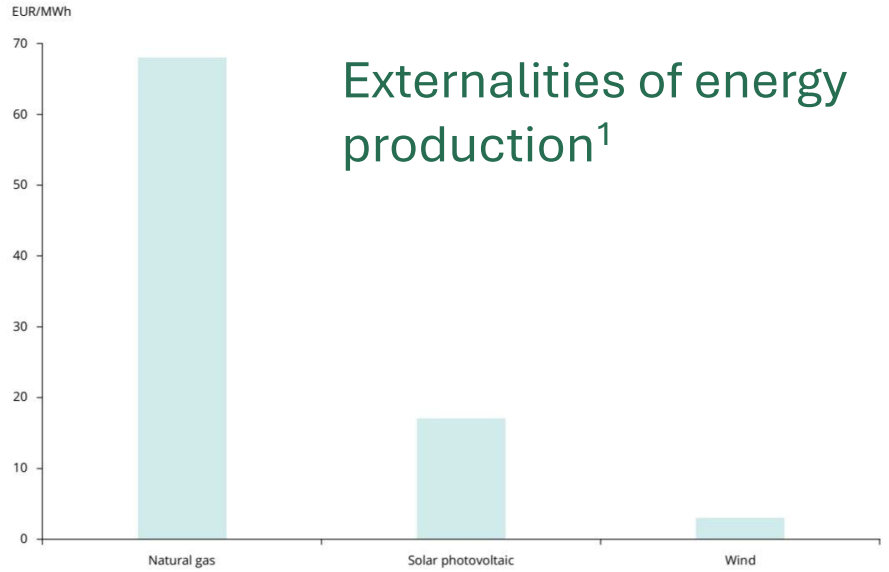
Increased impact on other systems

Reverse modal shift

1 Zhao, G. and Baker, J., 2022, 'Effects on environmental impacts of introducing electric vehicle batteries as storage — a case study of the United Kingdom', Energy Strategy Reviews 40, pp. 100819.; 2 Engholm, A., Kristoffersson, I. and Pernestal, A., 2021, 'Impacts of large-scale driverless truck adoption on the freight transport system', Transportation Research Part A: Policy and Practice 154, pp. 227–254.

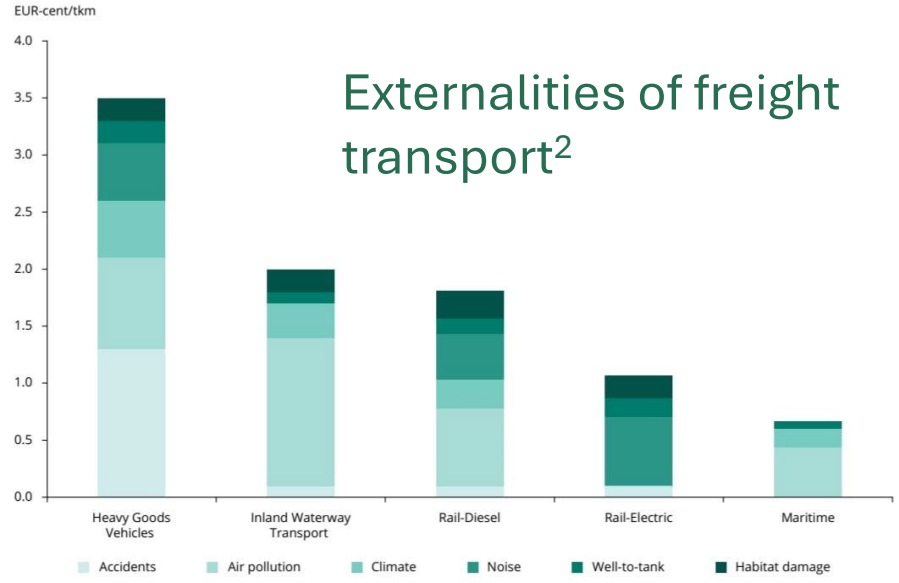
Pricing of externalities and demand management

Externalities of energy production[1]



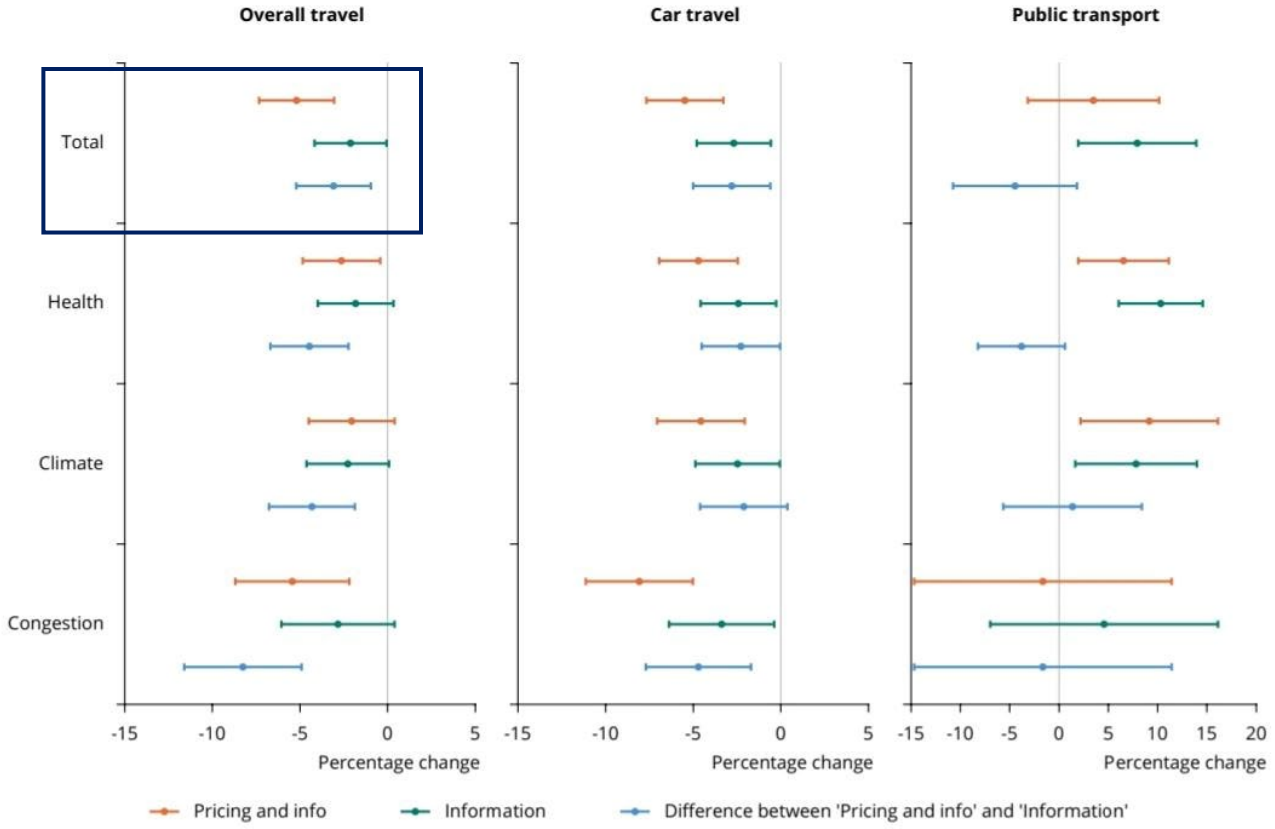
Note: Natural gas is a combination of combined cycles and open gas turbines. Wind is both on shore and off shore.
Source: EC (2020f).

Externalities of freight transport[2]



Note: Maritime refers to the average for selected EU-27 and UK ports.
Source: EC (2019a).

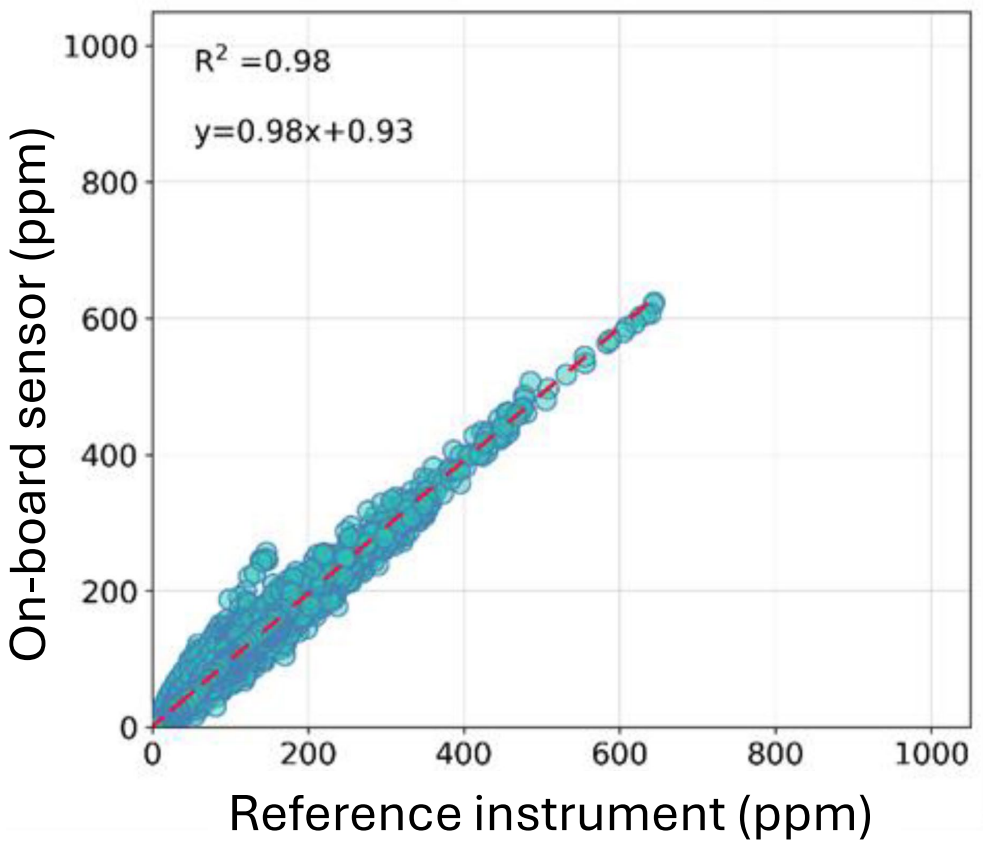
Demand management – case study for Switzerland[3]

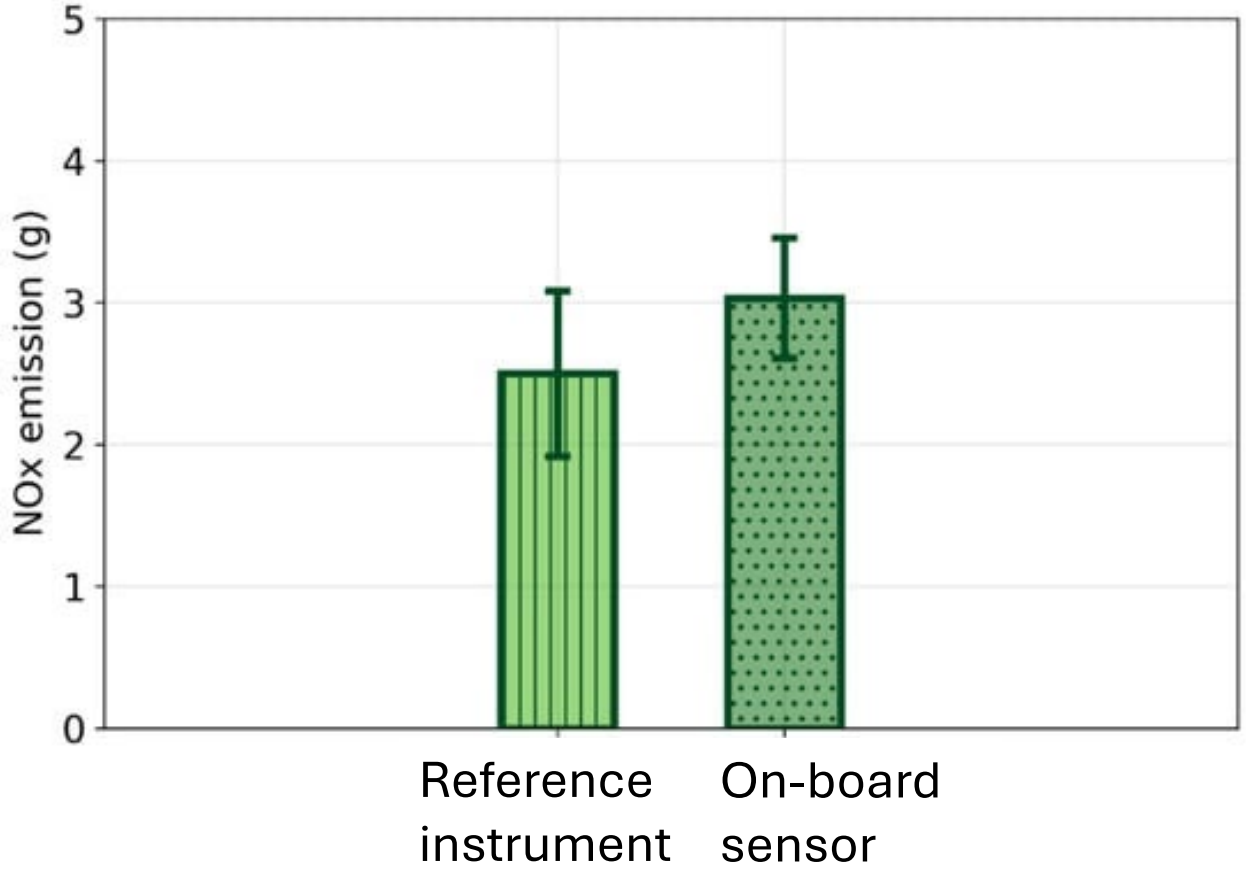


Note: The bars denote the 80% confidence intervals.
Source: Axhausen et al. (2021).

1 EC, 2020, Energy costs, taxes and the impact of government interventions on investments, Final Report, Publications Office of the European Union, Luxembourg.; 2 EC, 2019a, Handbook on the external costs of transport, Publications Office of the European Union, Luxembourg; 3 Axhausen, K., Molloy, J., Tchervenkov, C., Becker, F., Hinterman, B., Schoeman, B., Götschi, Th., Castro Fernandez, A. and Tomic, U., 2021, Empirical analysis of mobility behavior in the presence of Pigovian transport pricing, Forschungsprojekt ASTRA 2017/006 auf Antrag des Bundesamts für Strassen (ASTRA), ETH Zürich, Zürich, Switzerland.

Advanced monitoring for effective implementation

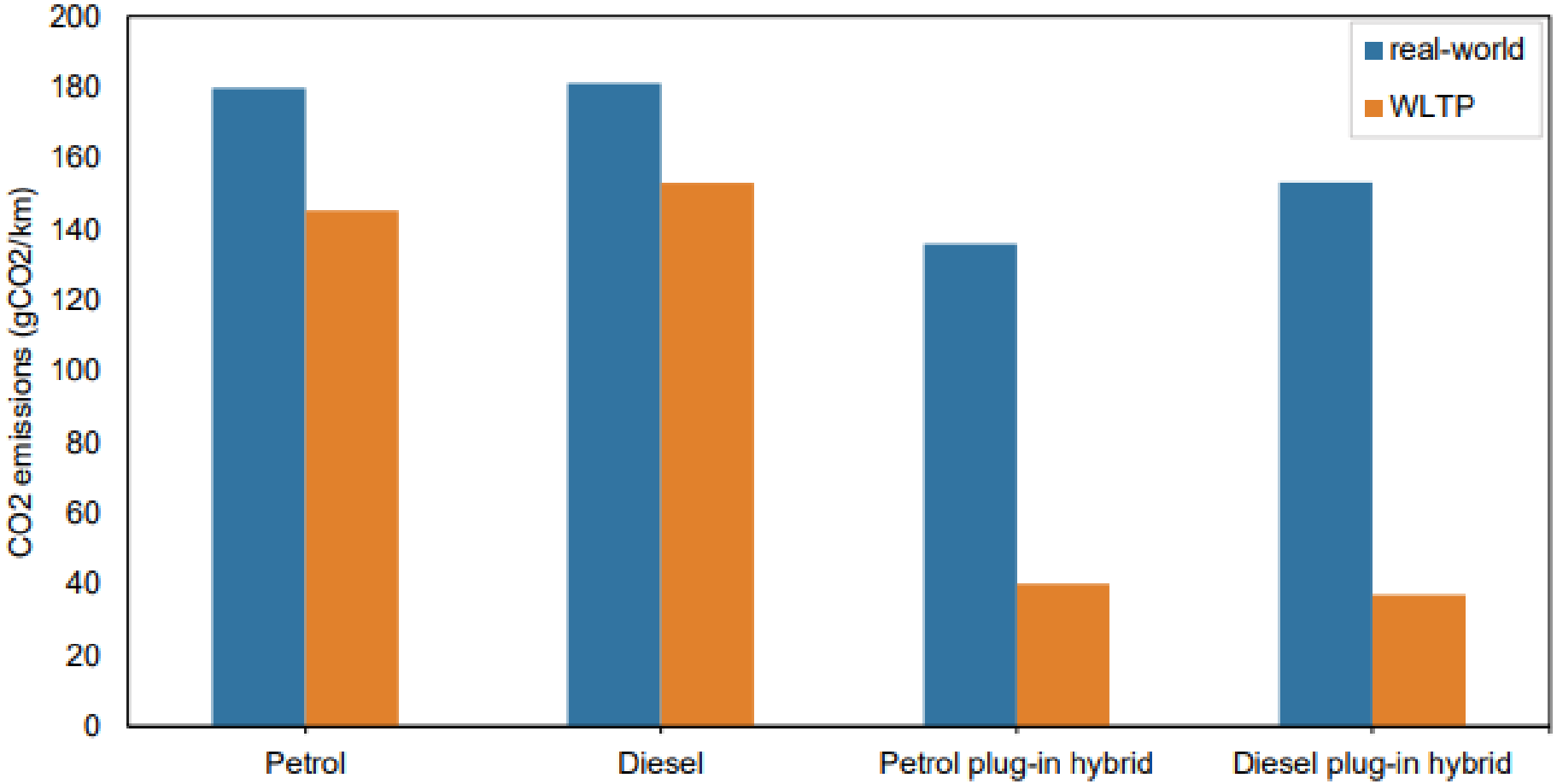




Real time measurement of air pollutant emissions is already technically possible...

Energies | Free Full-Text | Real-Time Measurement of NOx Emissions from Modern Diesel Vehicles Using On-Board Sensors (mdpi.com)

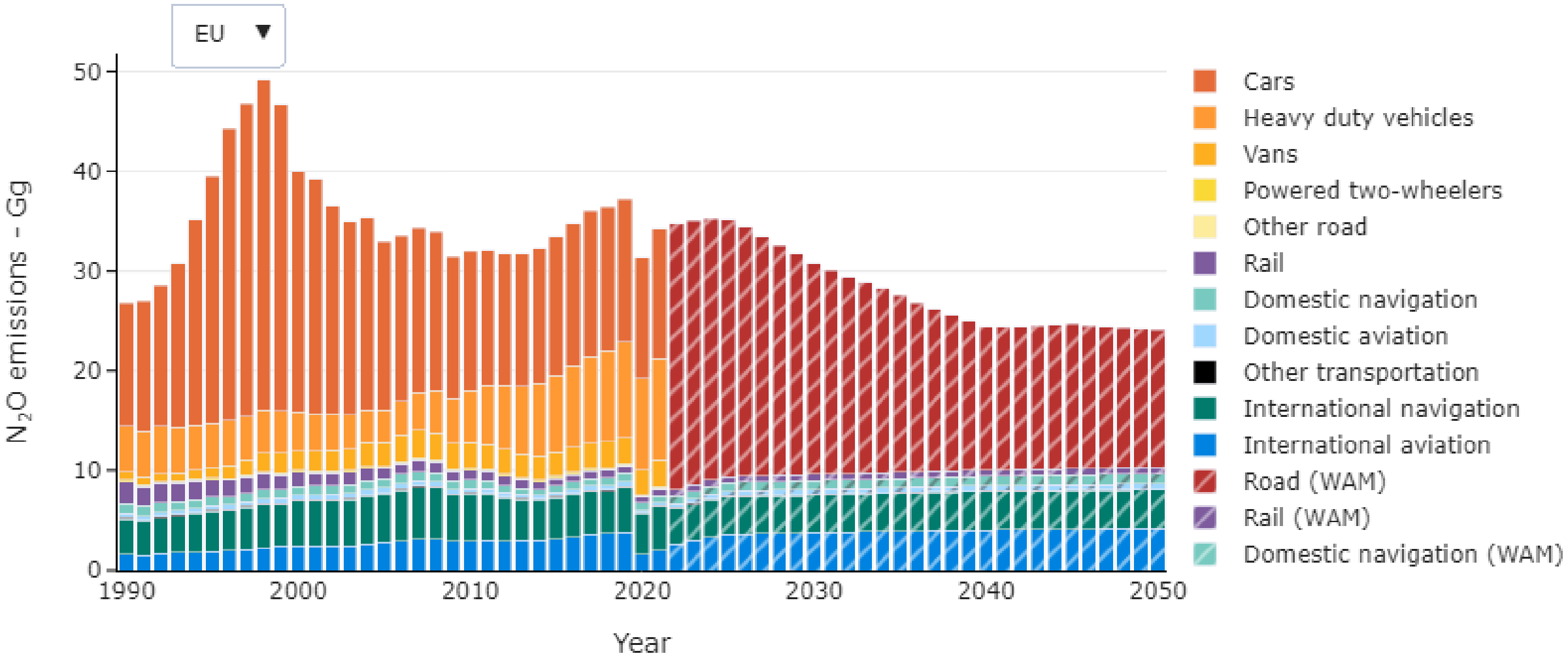
Advanced monitoring for effective implementation



...and ongoing for CO2!

Questions?

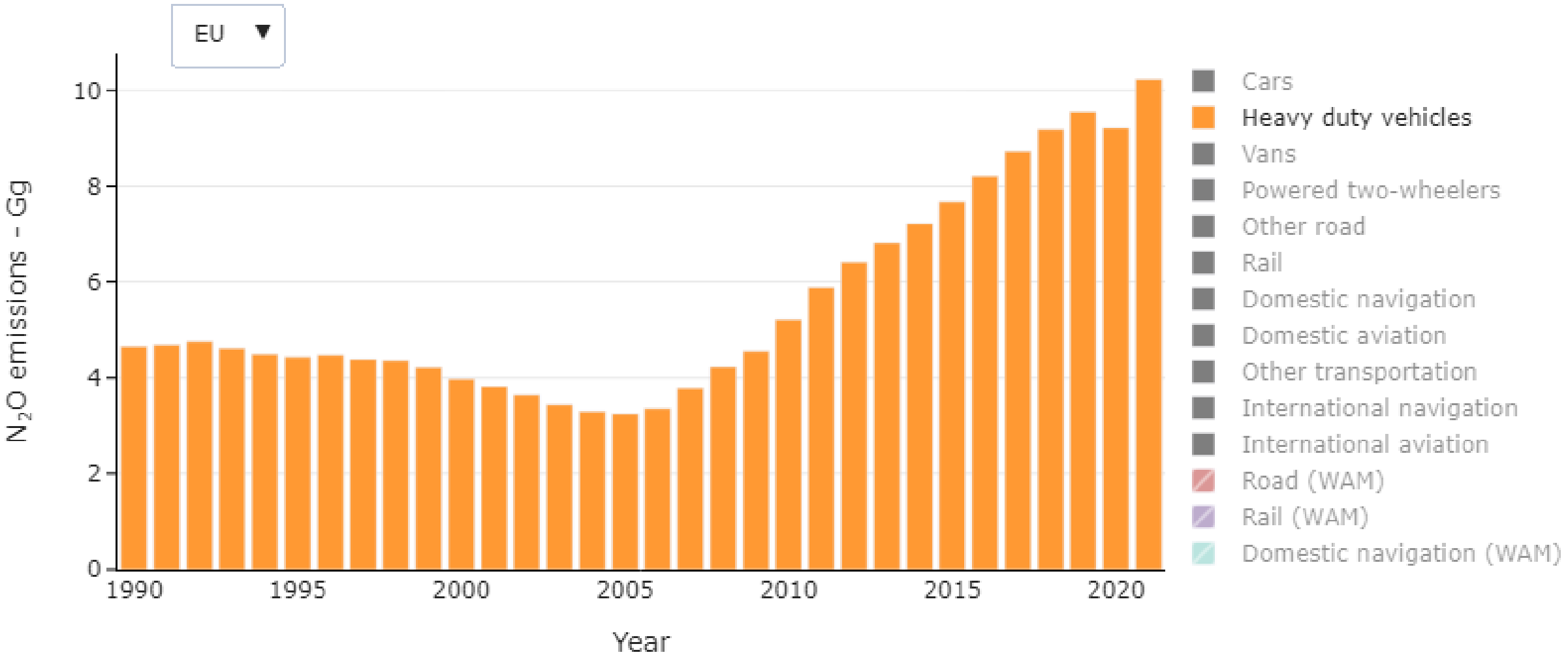
Nitrous oxide (N2O)



EEA greenhouse gases — data viewer — European Environment Agency (europa.eu)
EEA greenhouse gas projections - data viewer — European Environment Agency (europa.eu)

European Environment Agency

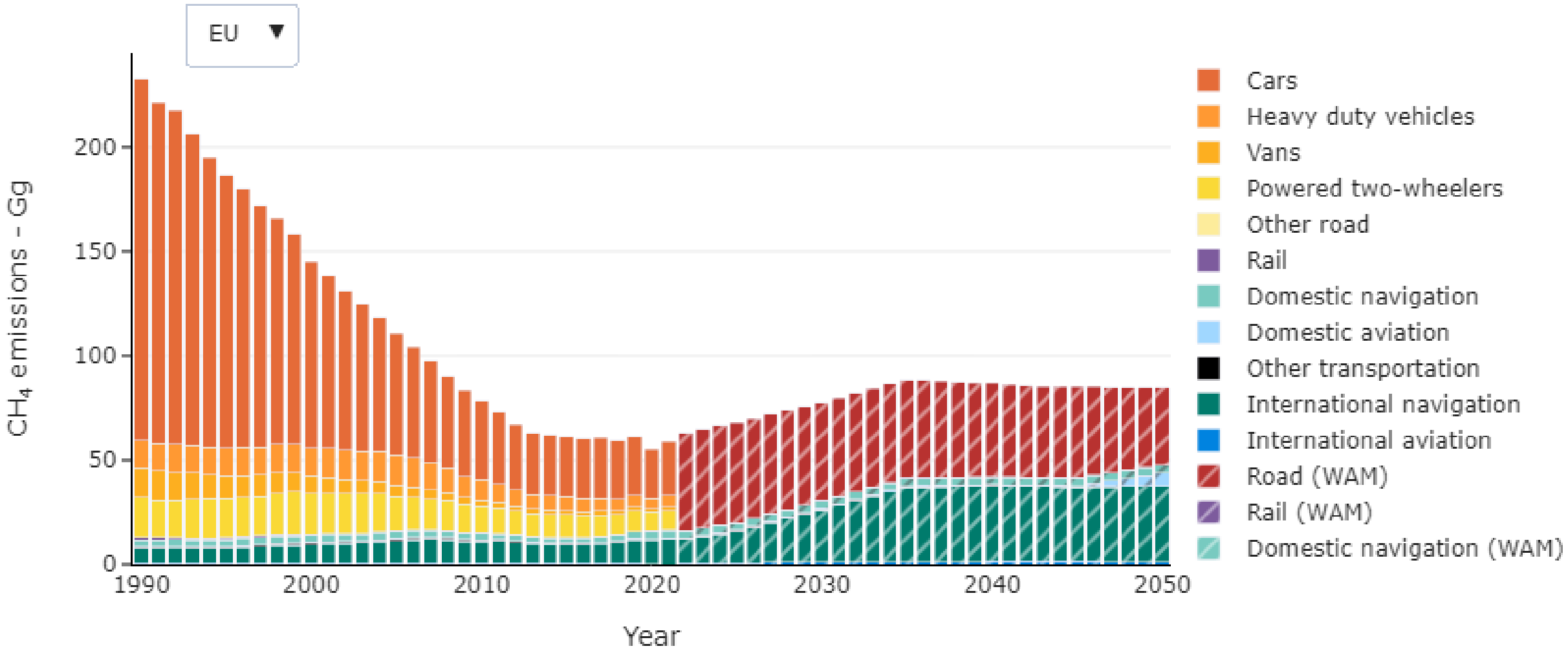
Nitrous oxide (N2O) - HDVs



EEA greenhouse gases — data viewer — European Environment Agency (europa.eu)
EEA greenhouse gas projections - data viewer — European Environment Agency (europa.eu)

European Environment Agency

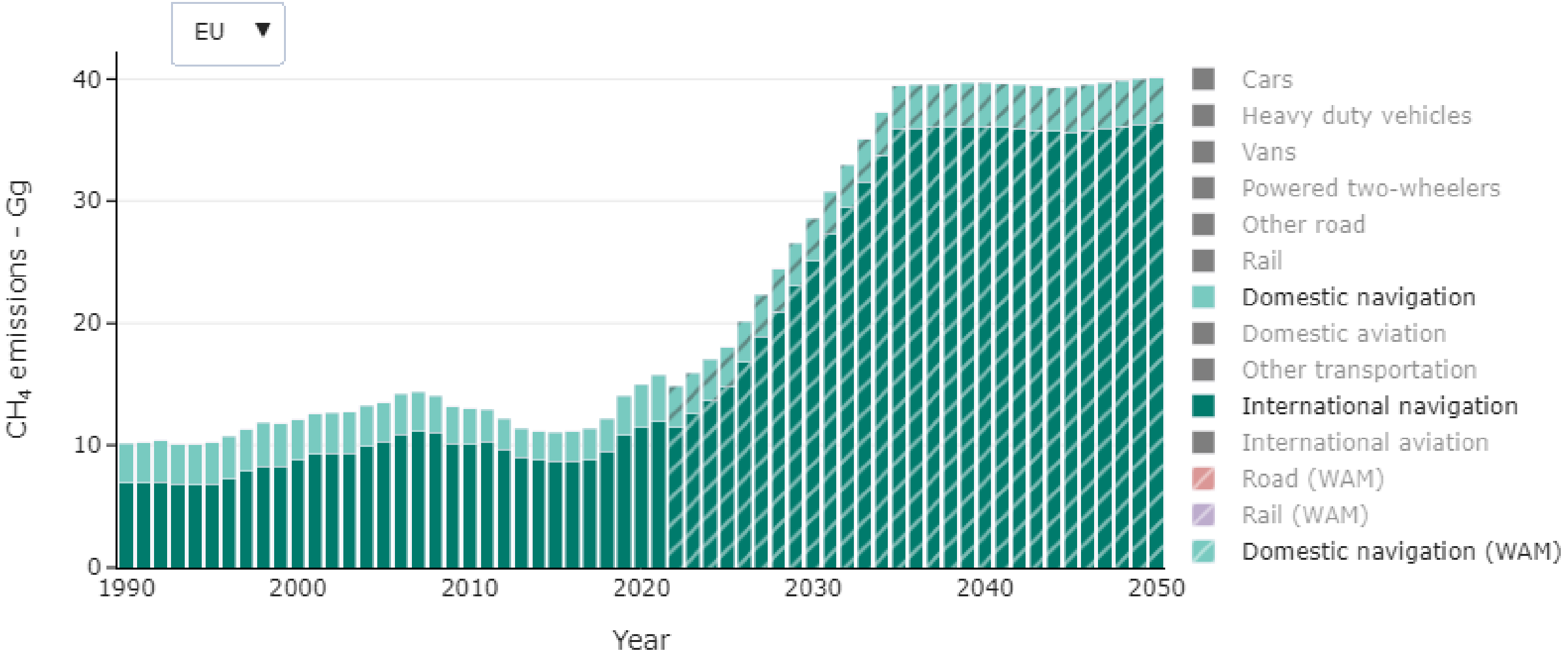
Methane (CH_4)



EEA greenhouse gases — data viewer — European Environment Agency (europa.eu)
EEA greenhouse gas projections - data viewer — European Environment Agency (europa.eu)

European Environment Agency

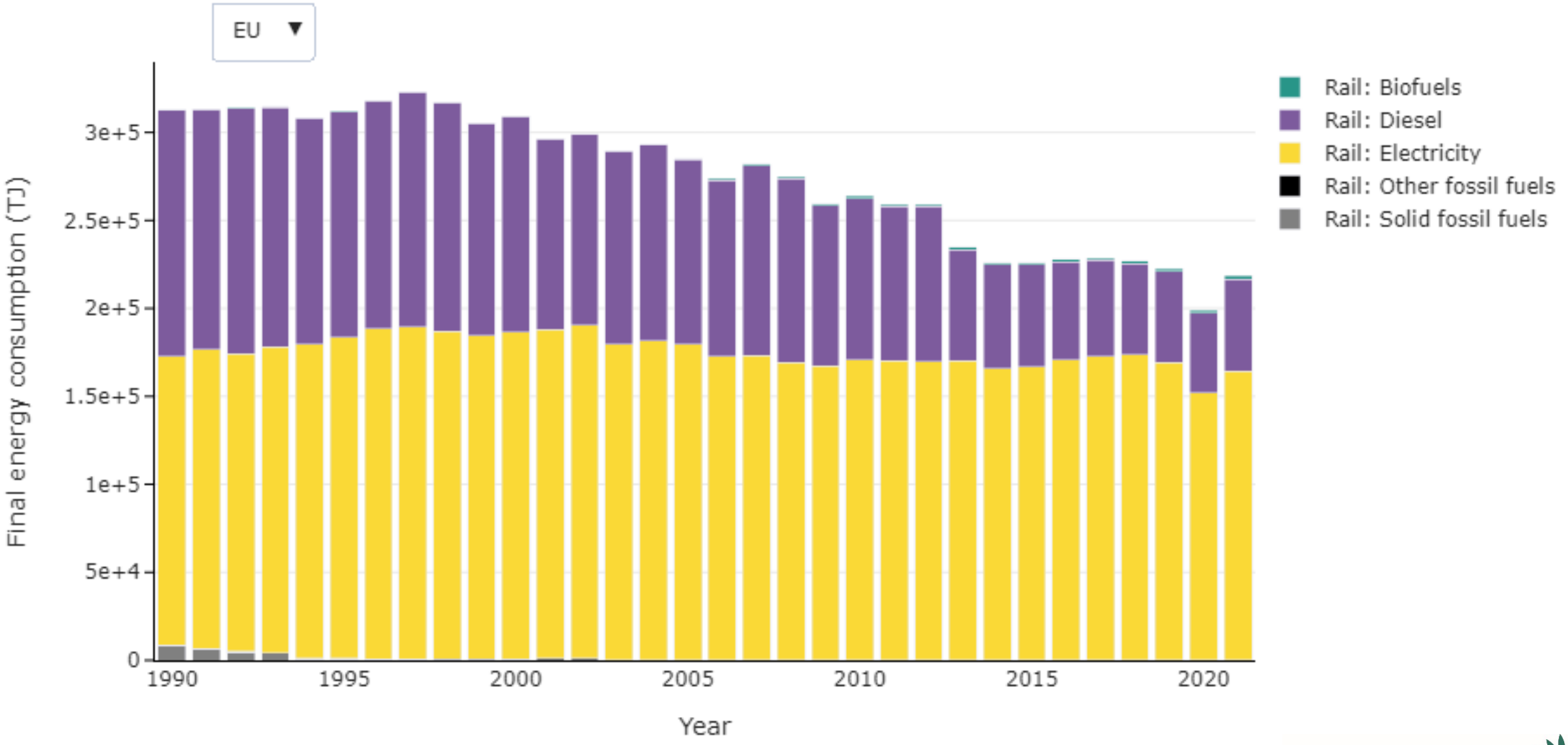
Methane (CH_4) – Navigation



EEA greenhouse gases — data viewer — European Environment Agency (europa.eu)
EEA greenhouse gas projections - data viewer — European Environment Agency (europa.eu)

European Environment Agency

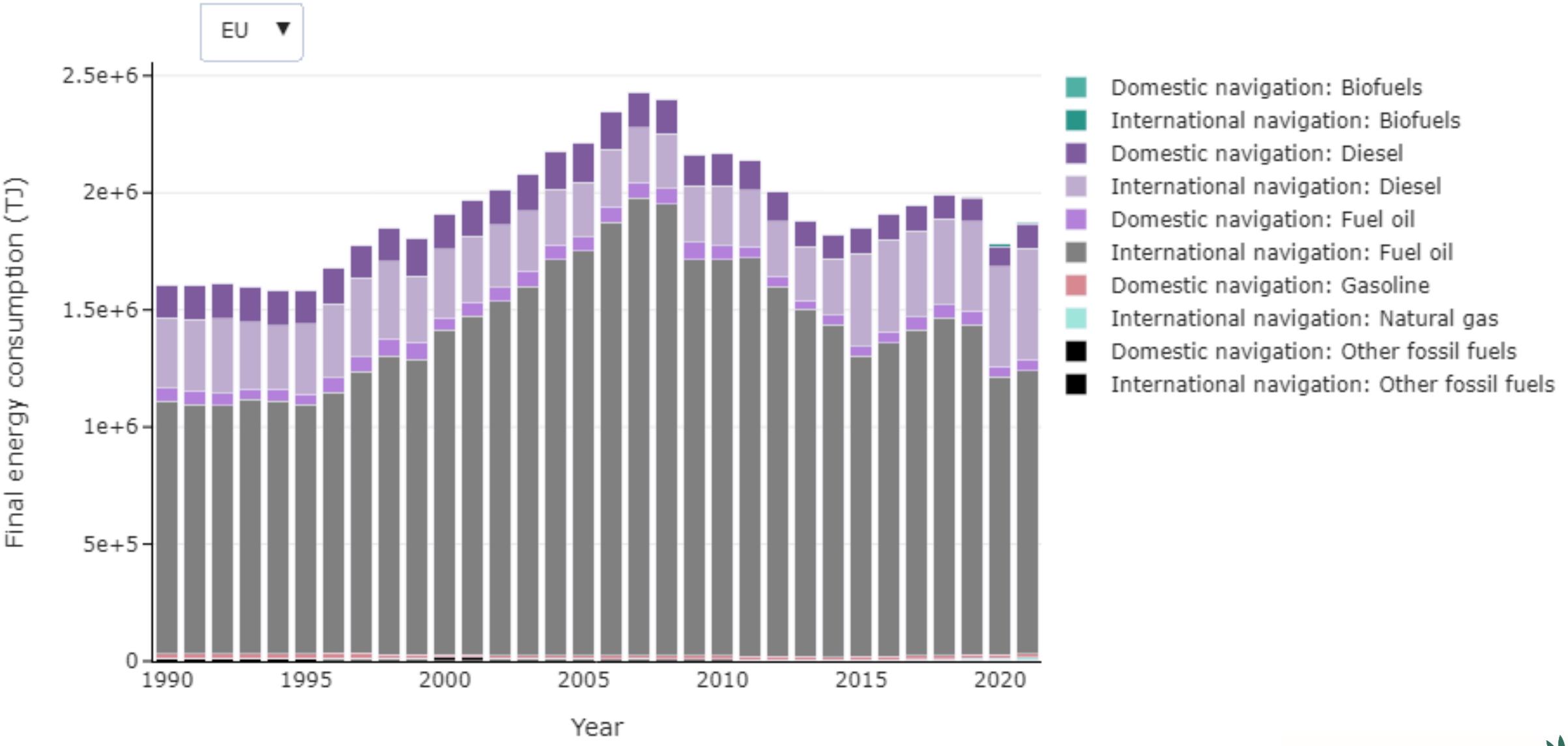
Mobility is still powered by conventional energy vectors (rail)



Statistics | Eurostat (europa.eu)
EEA, TERM 2024, upcoming

European Environment Agency

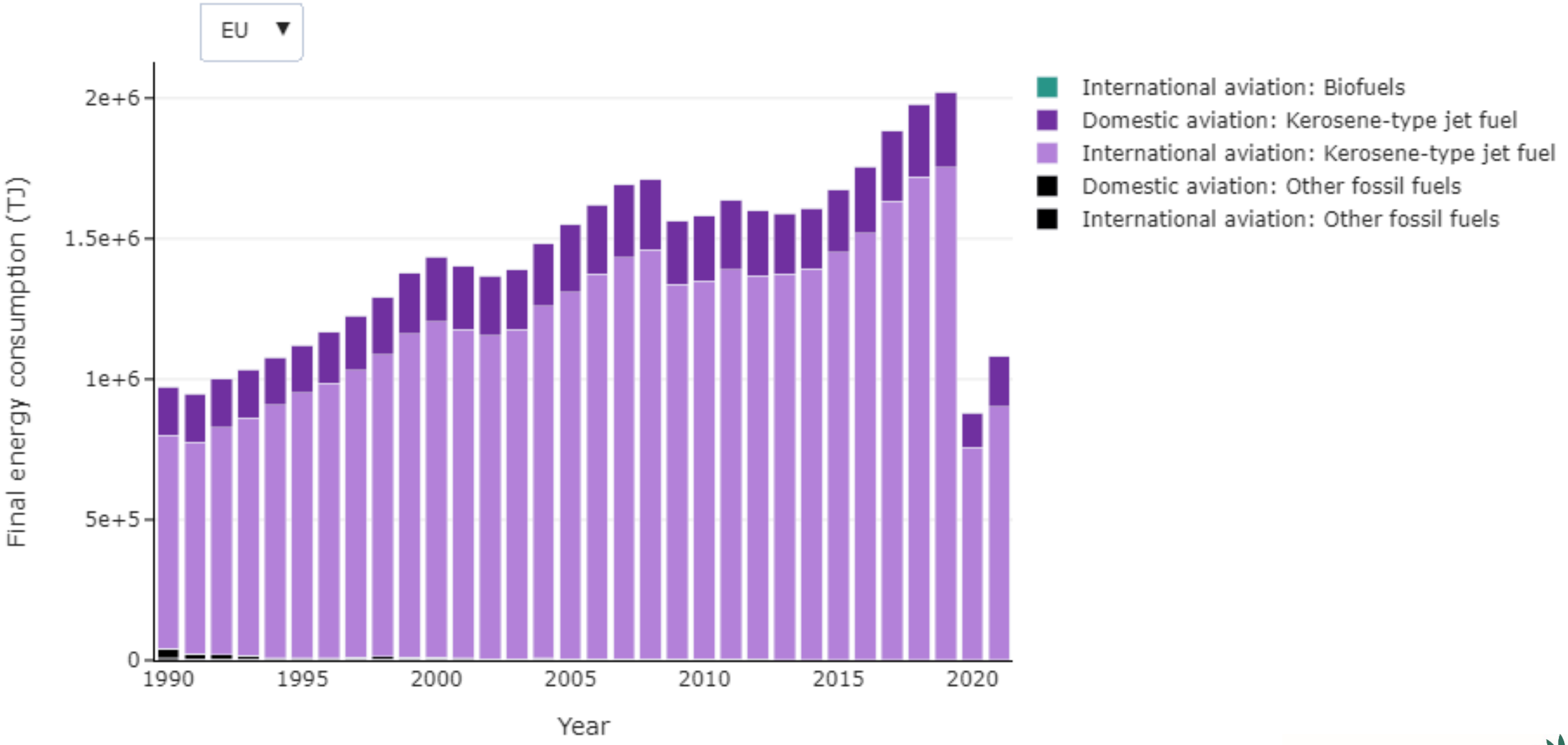
Mobility is still powered by conventional energy vectors (navigation)



Statistics | Eurostat (europa.eu)

EEA, TERM 2024, upcoming

Mobility is still powered by conventional energy vectors (aviation)



Statistics | Eurostat (europa.eu)

EEA, TERM 2024, upcoming

European Environment Agency