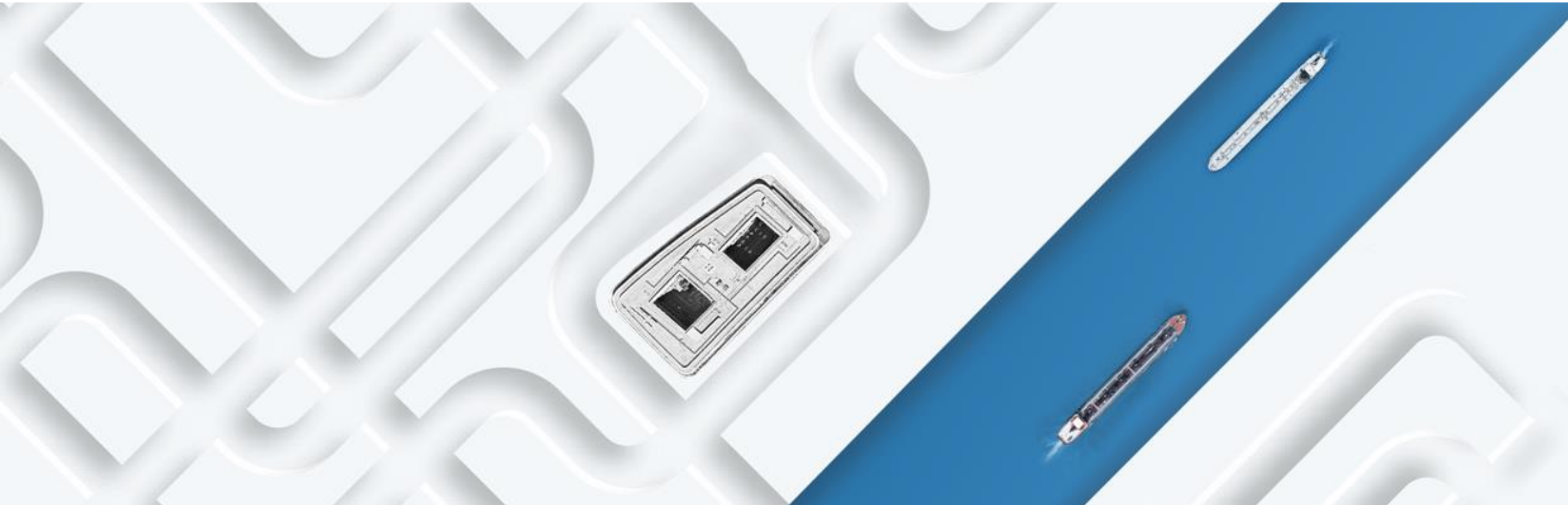
Kompendium 5.2
Section CO_2 emissions

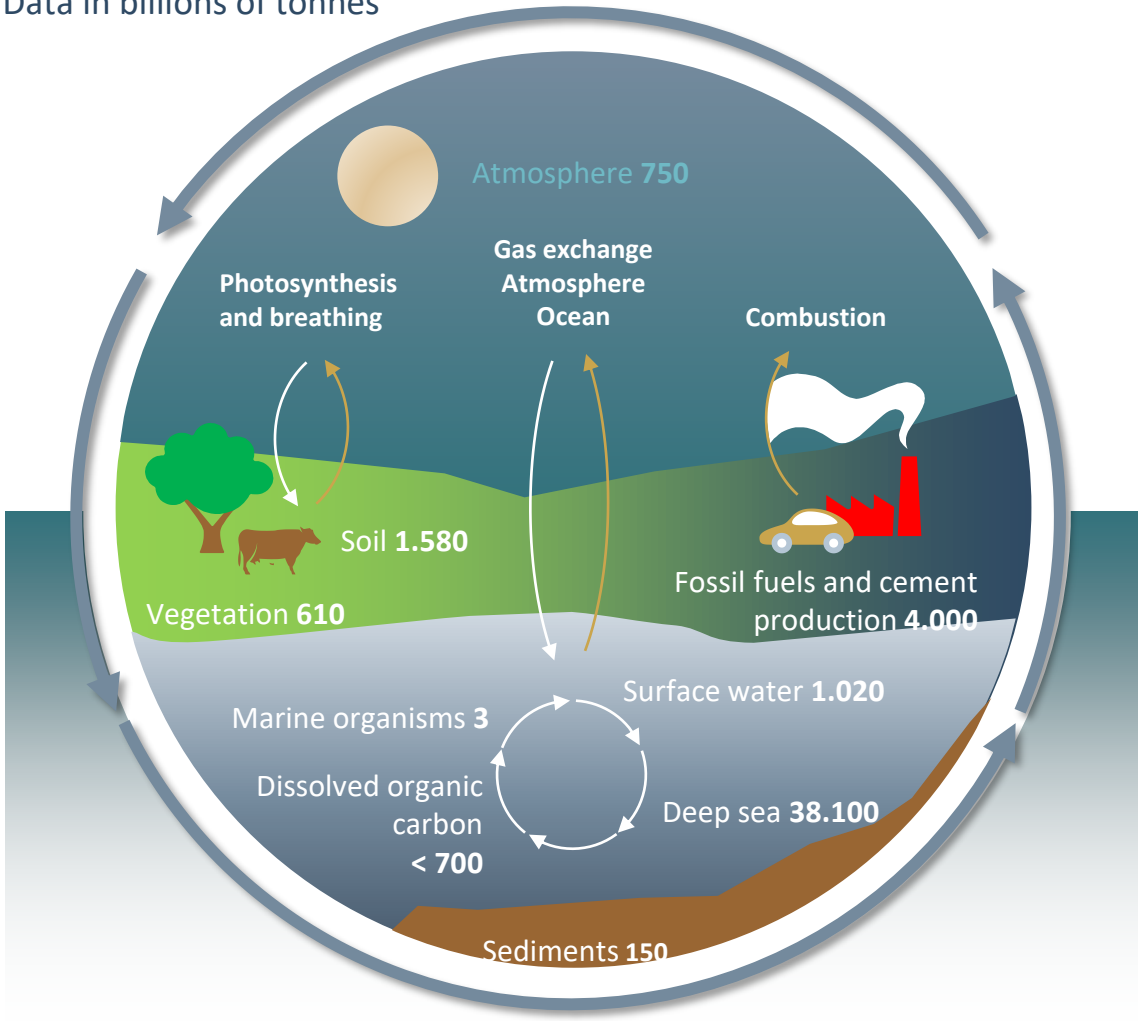


INSTITUT DER DEUTSCHEN WIRTSCHAFT

Basics: The carbon cycle and CO_2-concentrations

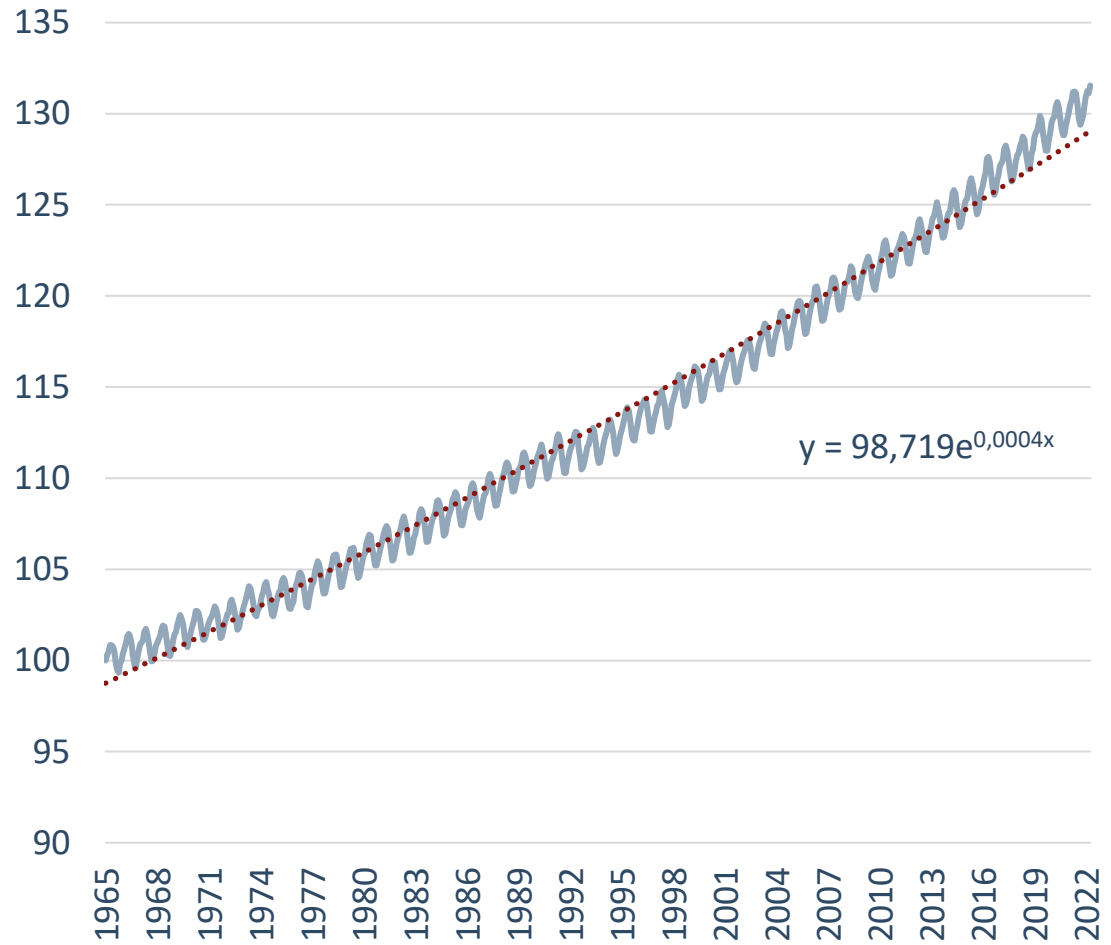
The ocean is the most important carbon store

Data in billions of tonnes



CO_2-concentrations on Mauna Loa (Hawai)

January 1965 = 100

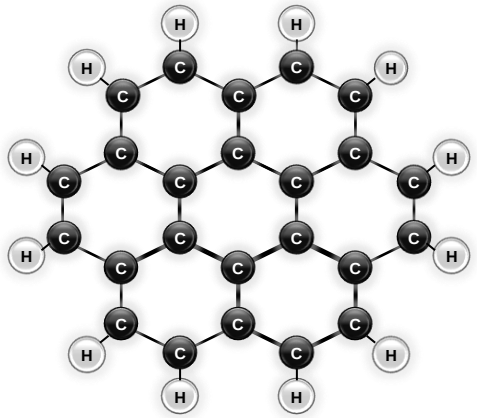


Source: Umweltbundesamt, 2021

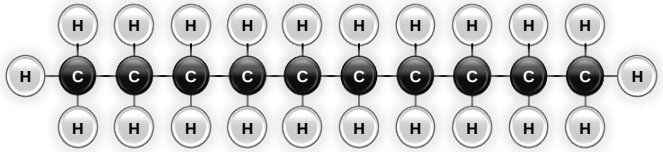
Basics: Hydrogen to carbon ratio of fuels

Typical structure

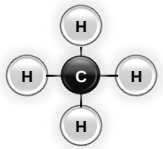
Carbon
(Coronen)
H:C = 0,1:1



Mineral oil
(Decan)
H:C = 2:1



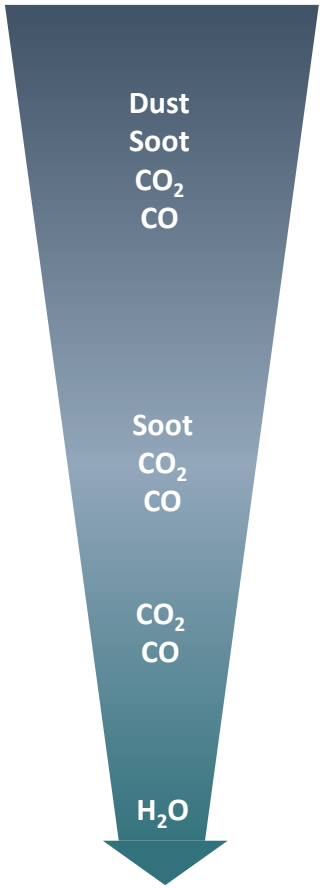
Natural gas
(Methan)
H:C = 4:1



Hydrogen
(Molekular)
H:C = 2:0

Source:

Main emissions

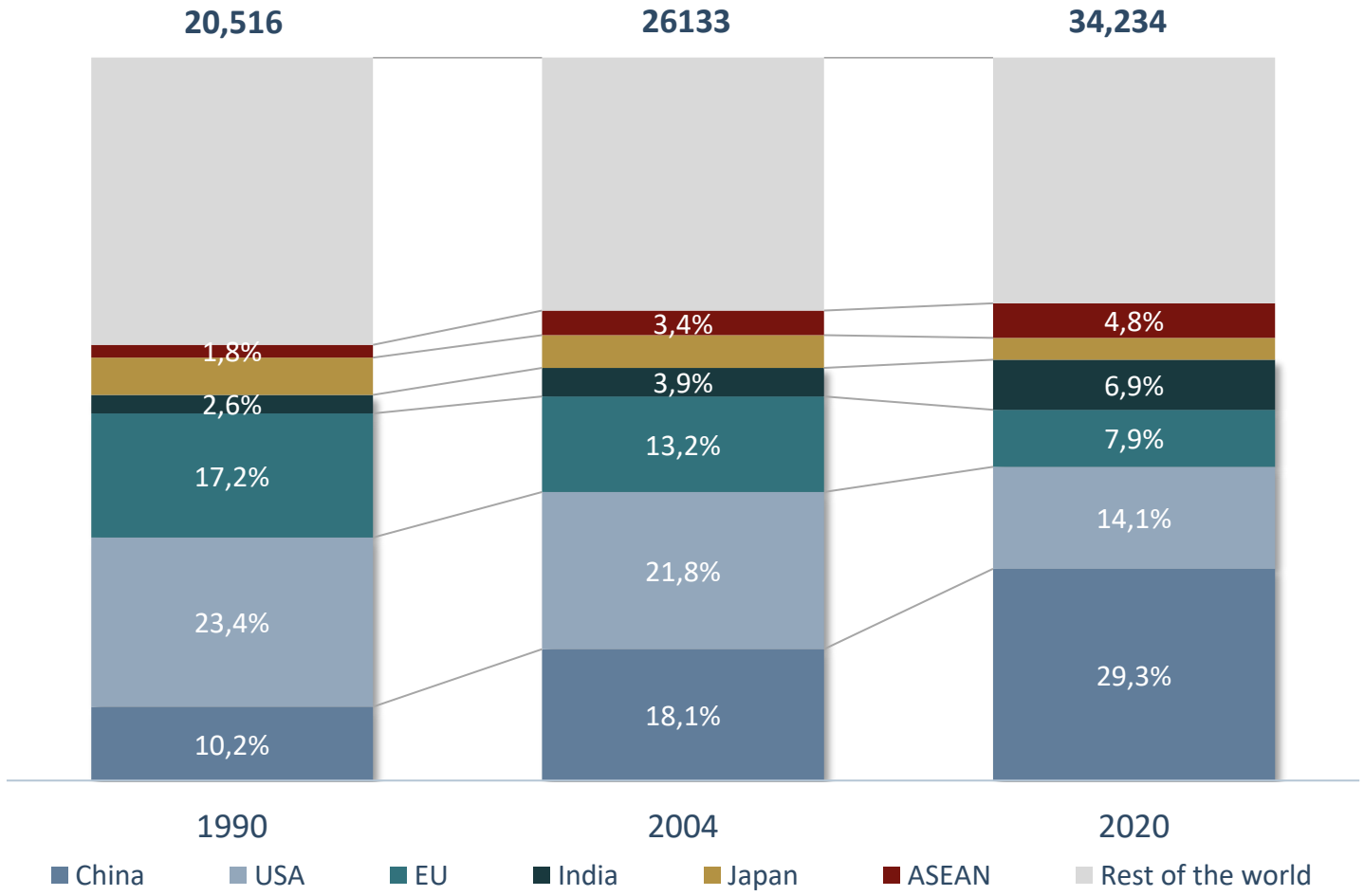


Direct emissions
in g CO_2/kWh

Brown coal	up to 1.150
Black coal	up to **950**
Diesel	266,36
Premium gasoline	262,13
Natural gas (H)	200,00
Hydrogen	0,0

Global CO_2-Emissions: Europe's share continues to decline sharply

Emissions from fuel use in millions of tons

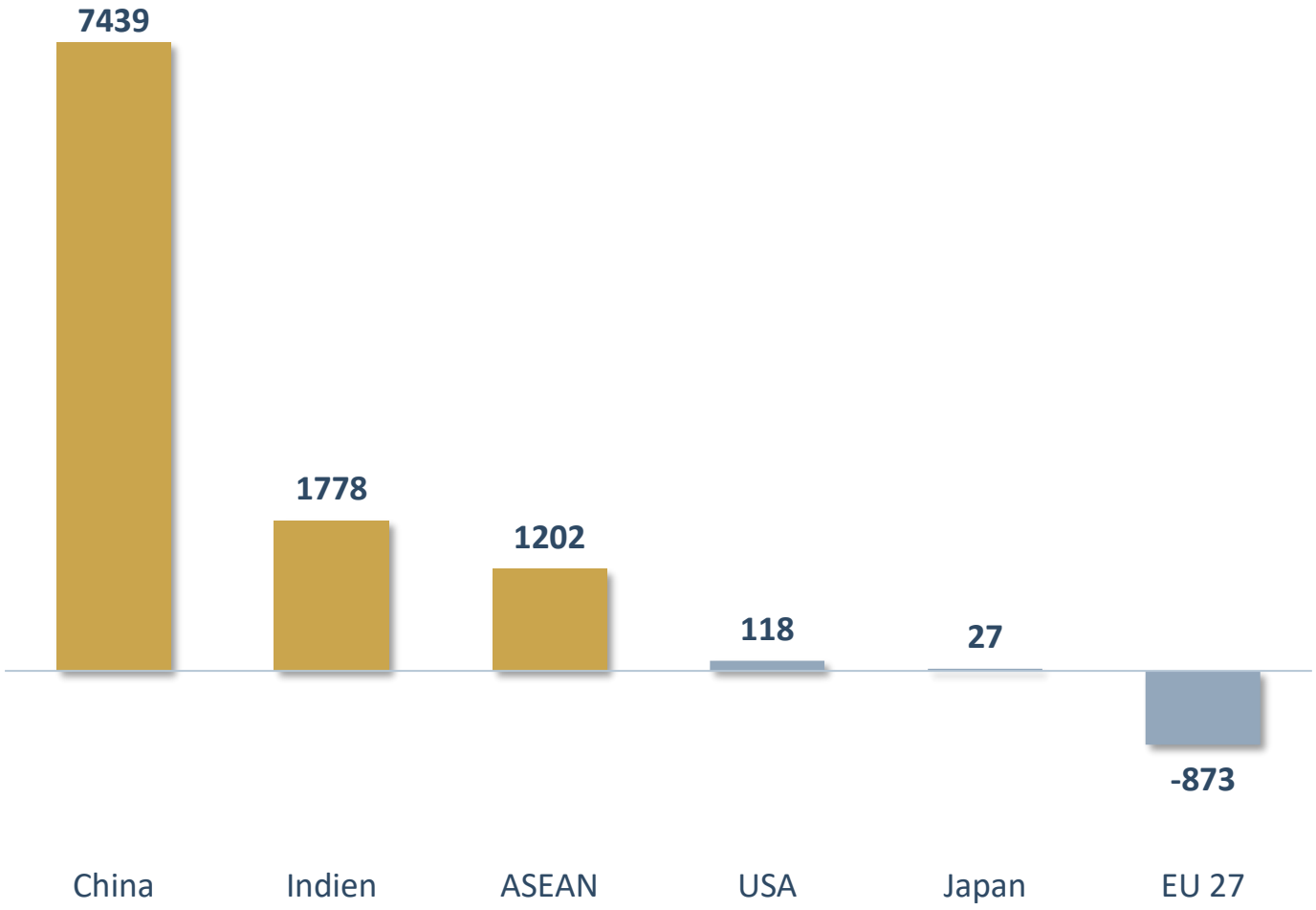


- Compared to the year 1990, absolute CO_2 emissions have so far only fallen in Europe and Japan. The decrease in the EU 27 will be around 870 million tons by 2019, Japan's around 21 million tons.
- The USA reported plus 18 million tons in 2019.
- The influence of European regulations on global CO_2 emissions continues to decline.

Source: IEA, CO_2 Emissions from Fuel Combustion – 2021

Europe reduced - Asia grows strongly

Emissions from fuel use* – Changes between 1990 and 2019 in millions of tons



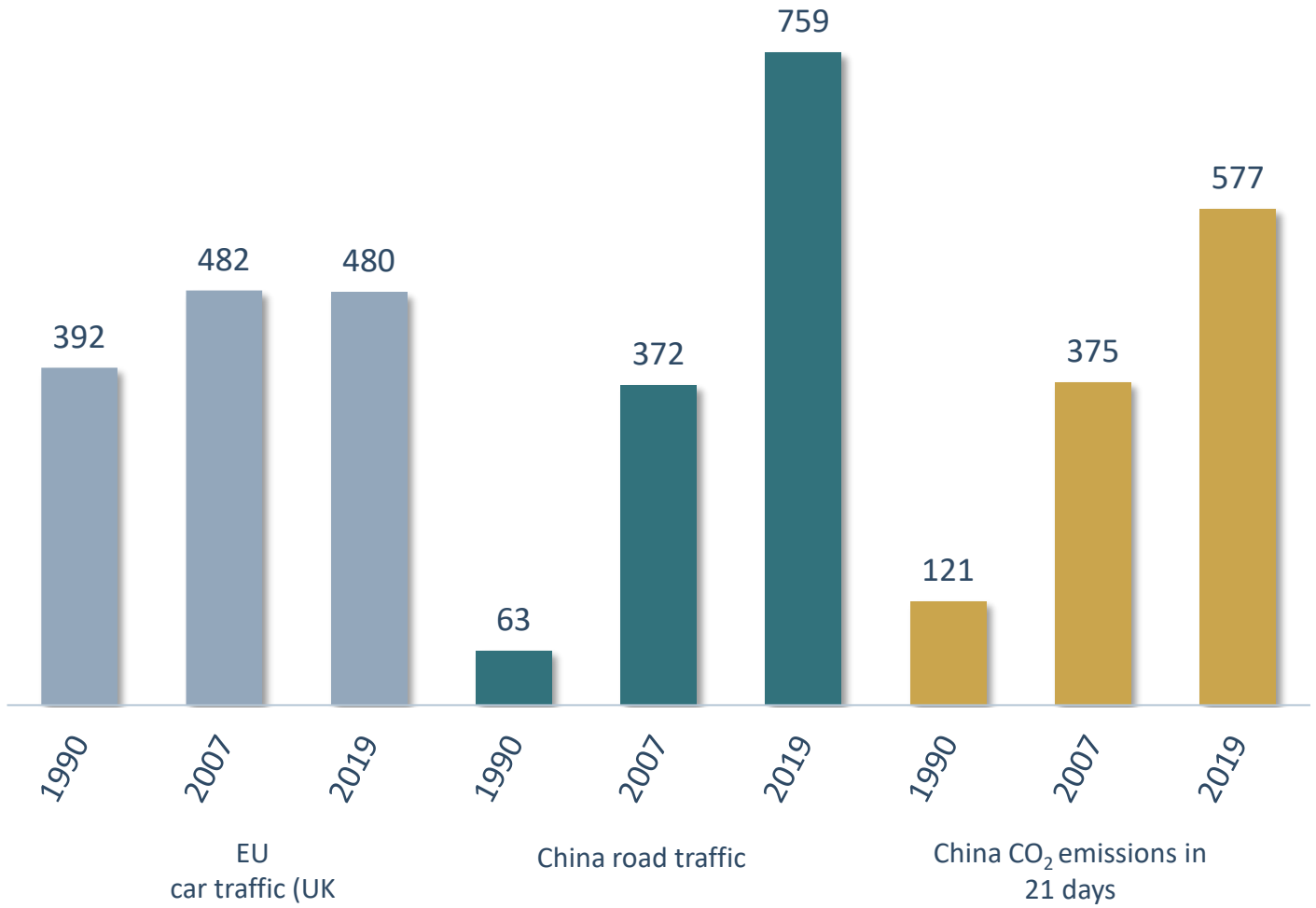
- While China grew by a good 351 percent in the years 1990–2018, the EU reduced it by 21.7 percent.
- China grew by a good 744 million tons between 2016 and 2019.
- In India, emissions have grown 350 percent since 1990.
- The EU (excluding UK) reduced its emissions by almost 140 million tons of CO_{2eq} in 2019.

* Corresponds to category 1A according to UNFCCC classification

Source: IEA, CO_2 Emissions from Fuel Combustion – 2021

EU cars – Relevant, but not crucial

CO_2-emissions in millions of tons

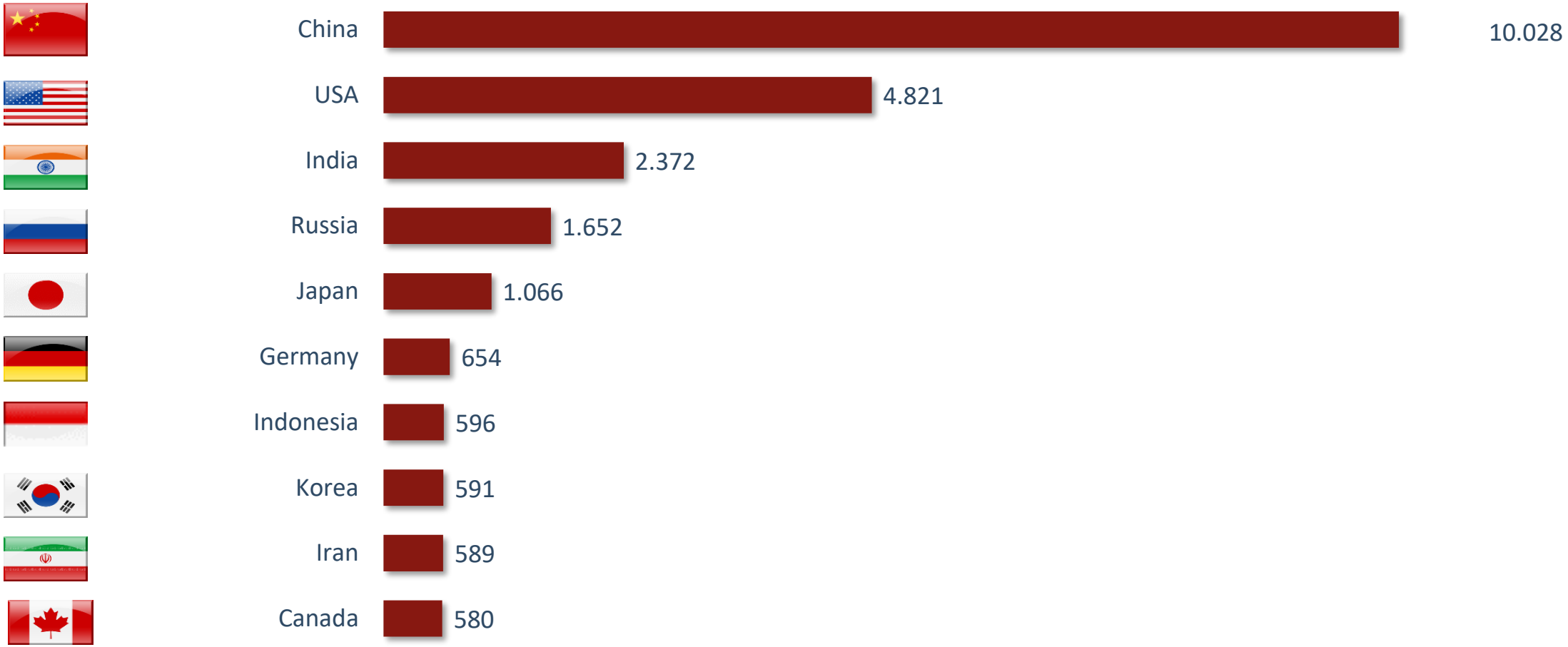


- Relevant: All EU 27 car traffic emitted a good 480 million tons of CO_2 in 2019. About 4 million t more than in the previous year.
- Crucial? In three weeks, China emits 100 million tons more through the use of fossil fuels, as does car traffic in the EU 27 over a whole year.
- Dynamics: Since 2007 the emissions of road traffic in China doubled.

Sources: EEA, 20 21 (v24); IEA, CO_2 Emissions from Fuel Combustion – November 2021

10 states – two thirds of the CO_2-Emissions

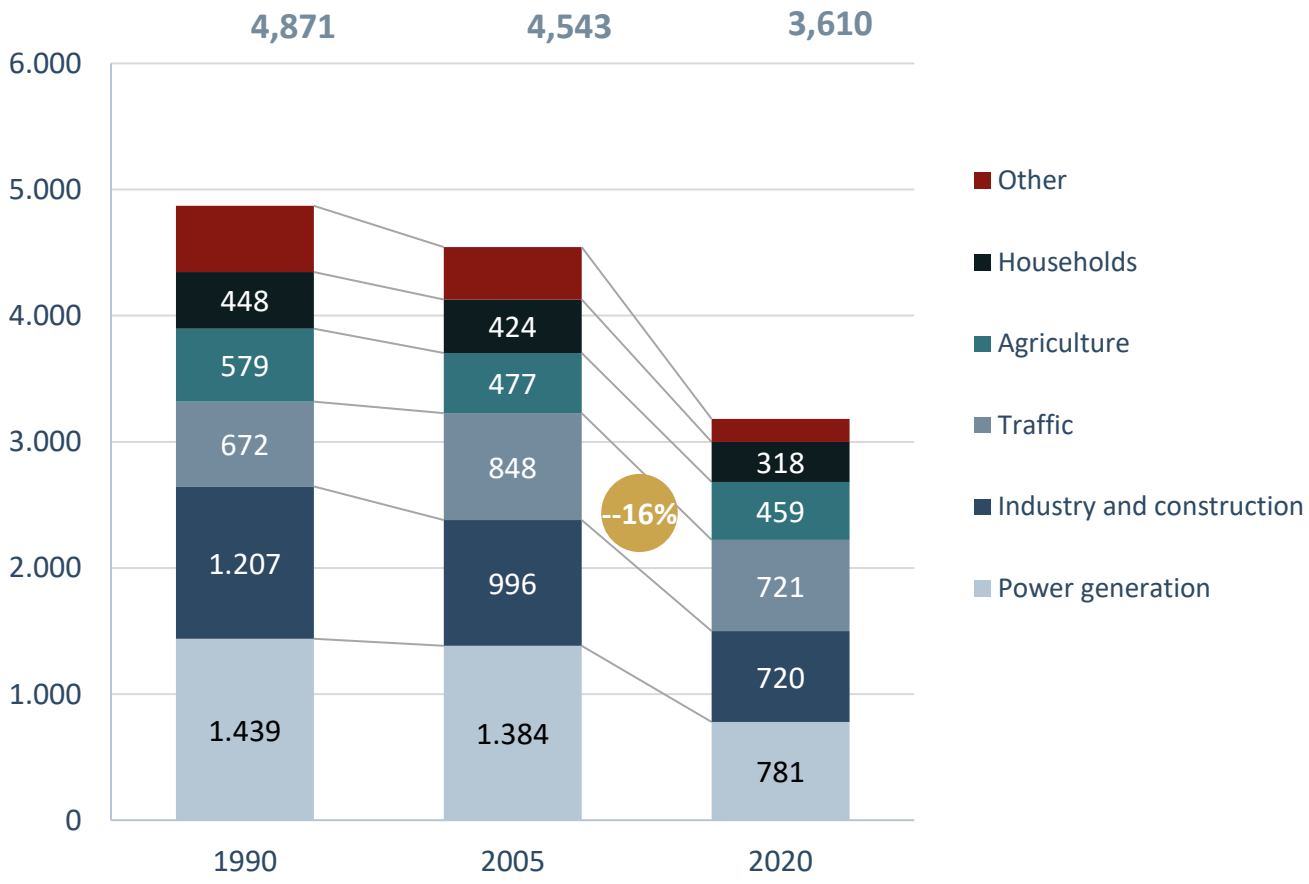
CO_2-Emissions of the year 2019 in million tons



Source: IEA, CO_2 Emissions from Fuel Combustion – 2021

Sector development

Greenhouse gas emissions in the EU27 (UK excluded) by sectors in million tons

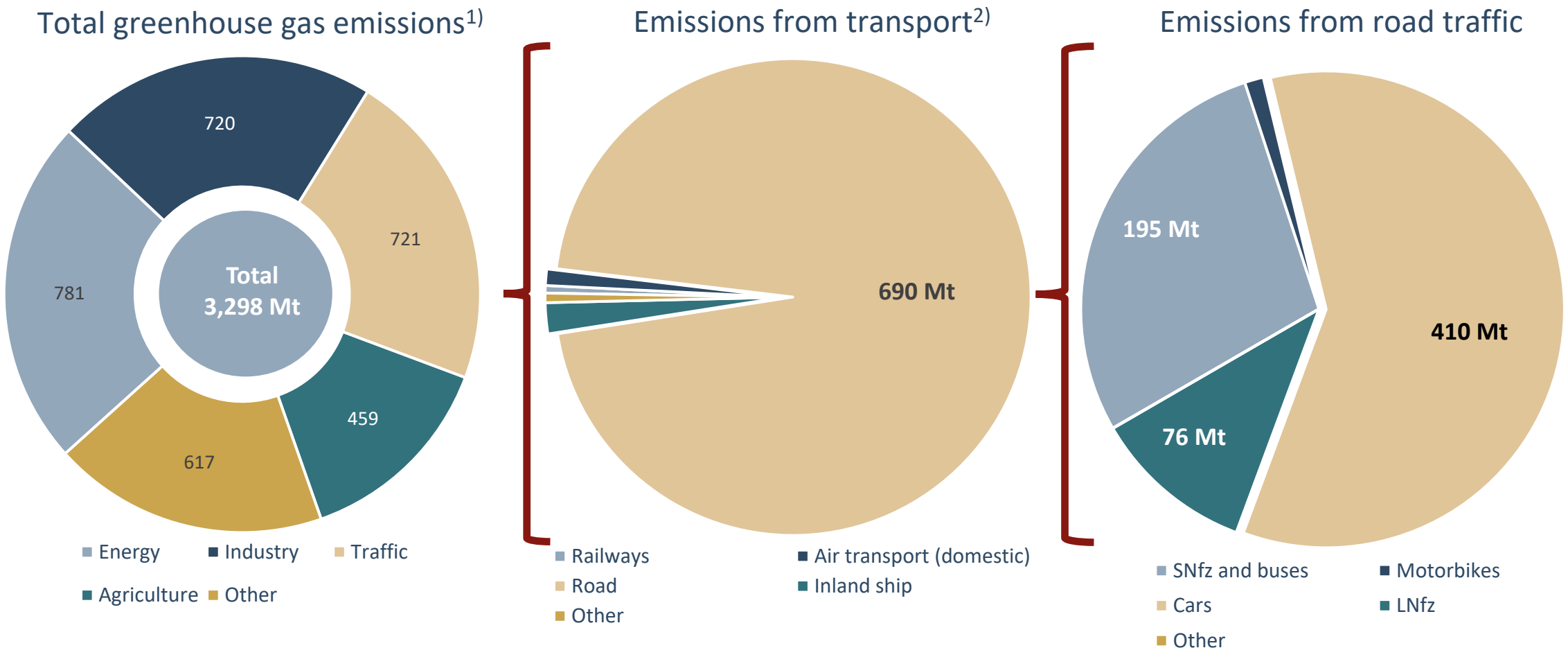


Quelle: EEA, 2022 (v25)

- Split development after the fall of the Iron Curtain.
- Emissions from traffic rose rapidly after 1990, as Eastern Europe was integrated into the European economic area. After 2007, emissions also fell in traffic, but rose visibly again from 2014 onwards. In 2018, emissions from traffic fell again for the first time.
- Industry and power generation realized huge savings in the early 1990s. Then their emissions stagnated until about 2007 and fell with the crisis.

Road traffic plays a central role in Europe

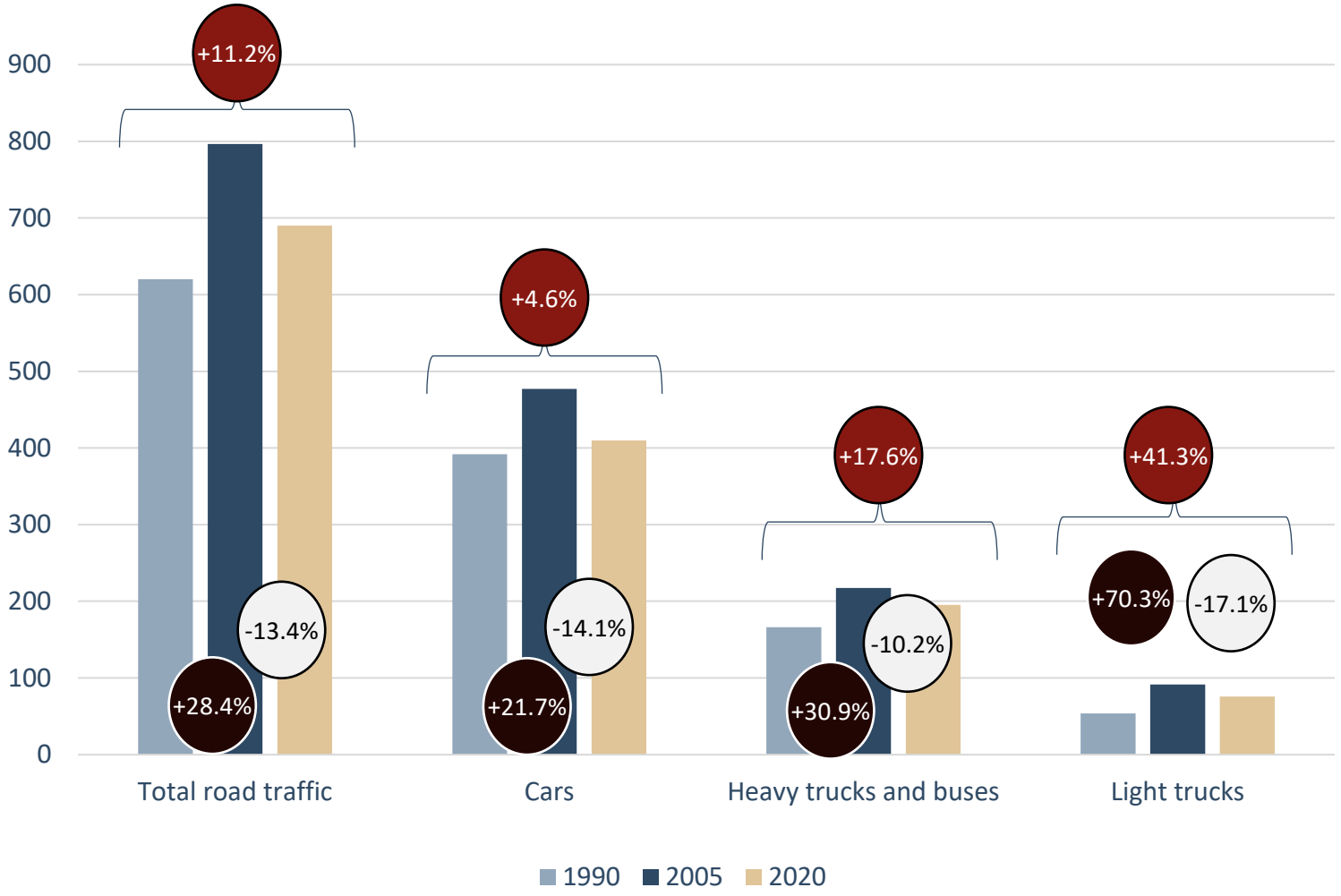
Figures for the EU27 in 2019 in megatons CO_{2eq}



[1] With sinks
[2] Excluding international air and sea transport
Source: EEA, 2022 (V25)

EU road traffic: Emissions growth especially in the 90s

In million tons CO_{2EQ}

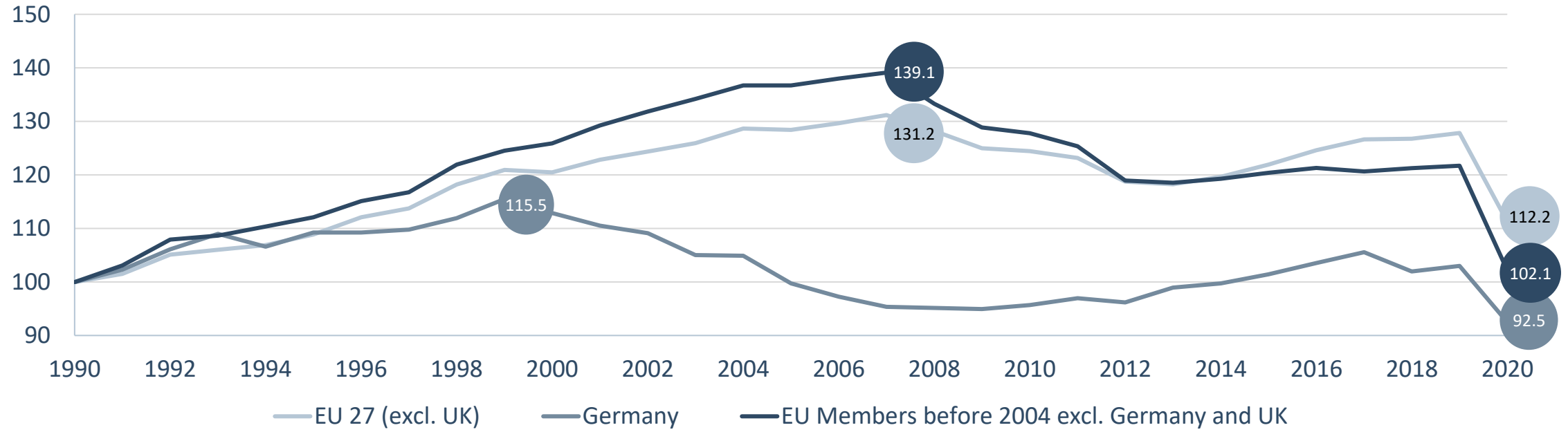


- The EU wants to reduce emissions from traffic by 30 percent between 2005 and 2030.
- EU road traffic emissions peaked in 2007.
- Between 2007 and 2013 CO_2 emissions from road transport in the EU fell. They have been increasing again since 2013.
- The greatest growth in emissions was recorded by light commercial vehicles, which, however, make up a relatively small proportion of total emissions.
- The growth in emissions in car traffic was more moderate. Emissions have stagnated since around 2004 and declined between 2007 and 2012. They have been rising again since 2013.

Source: EEA, 2022 (v25)

Atypical course in Germany

CO_{2EQ} emissions of road transport, 1990 = 100

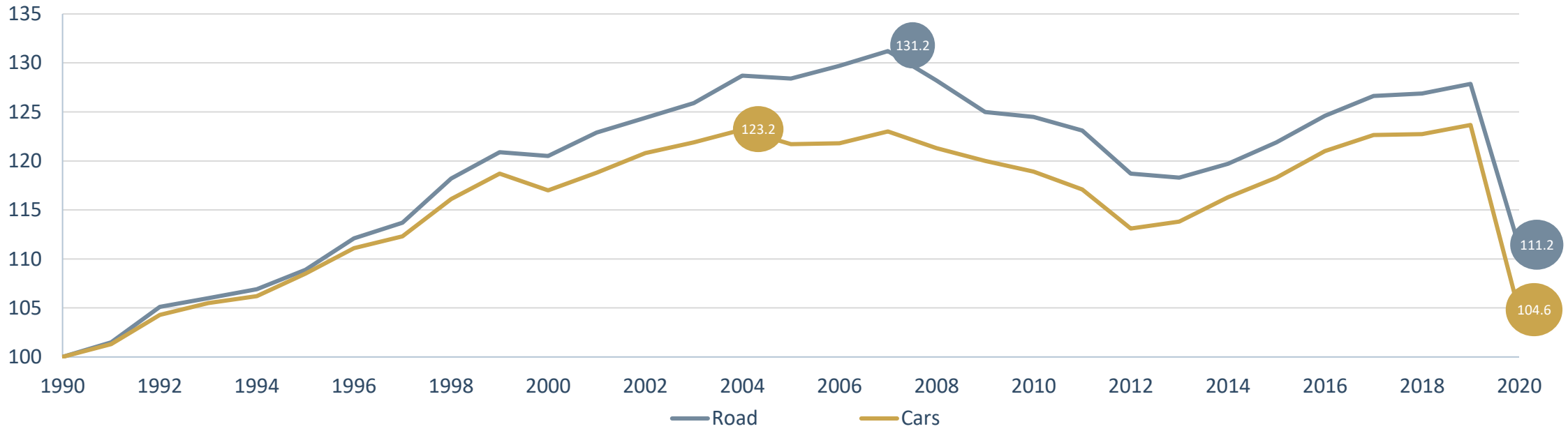


- In Germany, emissions fell by 24 million tons between 1999 and 2007. After that, they rose again and were at the level of 1990 in 2015. In 2018, emissions fell noticeably by almost 6 million tonnes. The strongest emission growth took place in the EU10.
- In the EU 28, the trend reversed only with the crisis in 2008. Emissions rose again from 2014.
- Between 2014 and 2019, emissions rose significantly again.

Quelle: EEA, 2022 (v25)

Passenger car traffic in the EU 27: CO_2 emissions rise again

Absolute CO_{2EQ} emissions, 1990 = 100

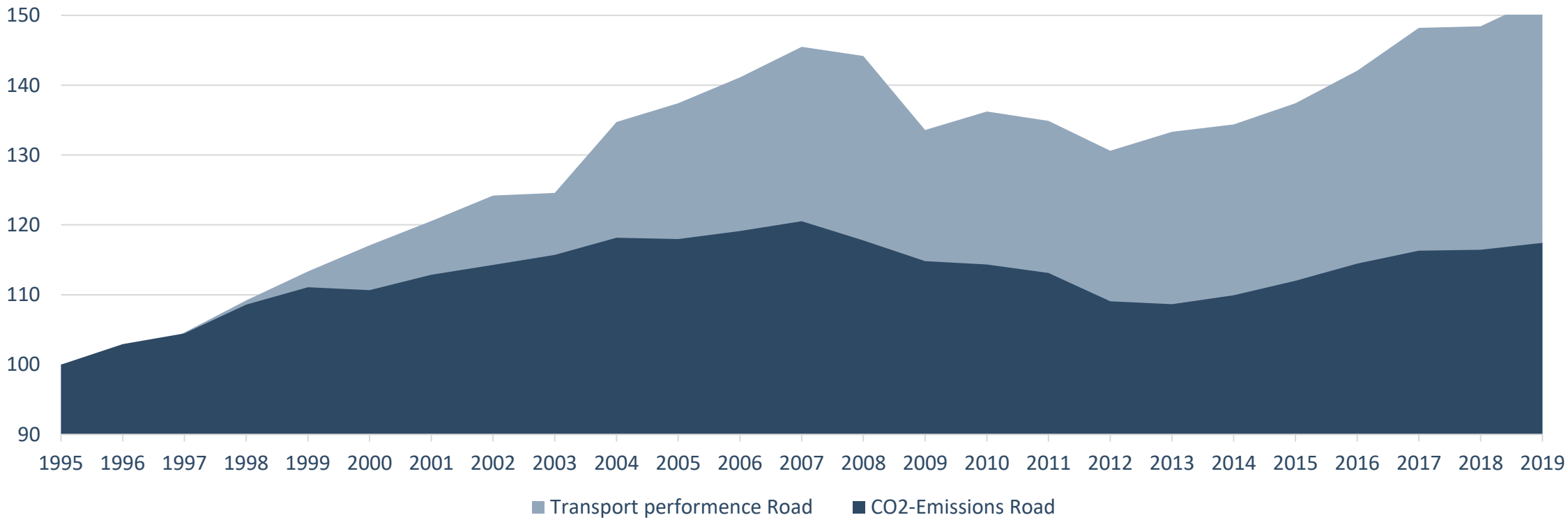


- Emissions from passenger cars have less risen than those from all road traffic. Significant reductions in emissions in 2011, but there is a rise since 2013.
- Passenger car emissions have largely stagnated since 2002 and collapsed in 2011, but have been rising again since 2013. Only in 2018 did the increase came to a standstill.

Source: EEA, 2022 (v25)

Traffic growth dominates the balance sheet

Development of road transport performance and CO_2 emissions from road transport in the EU 27 since 1995



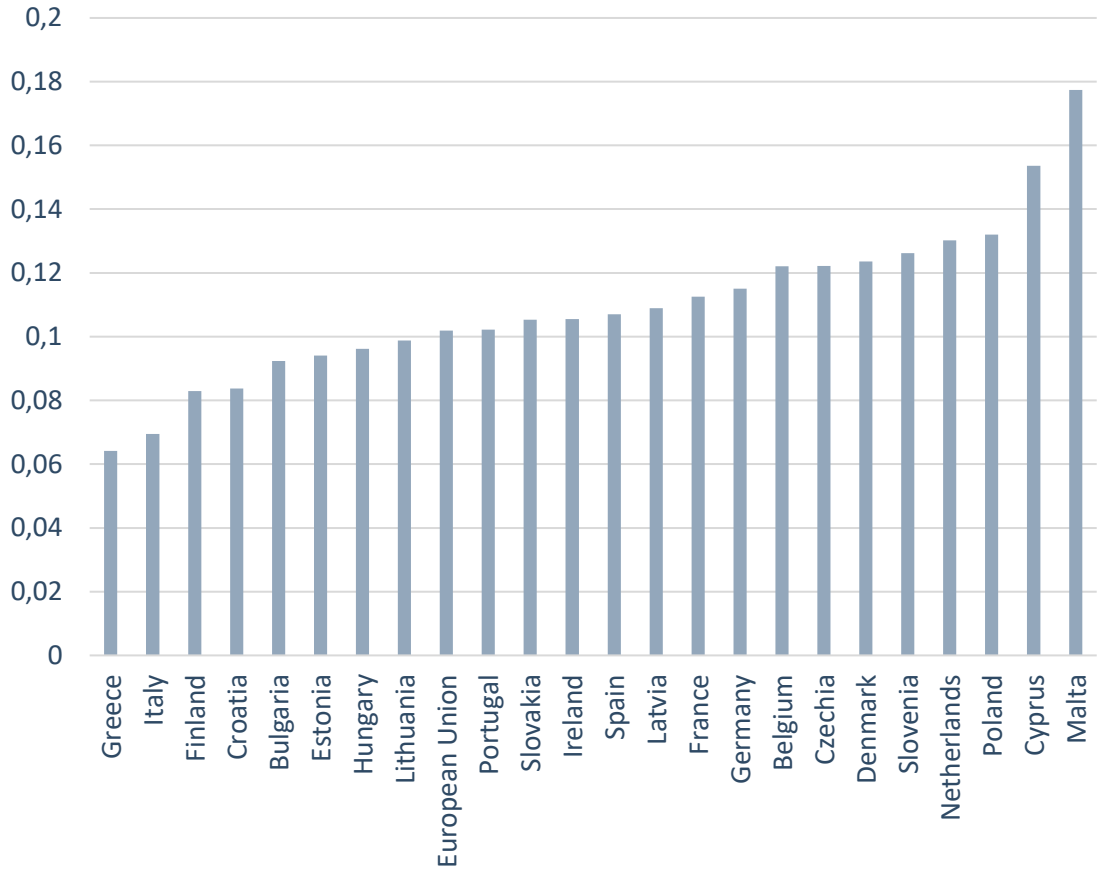
Calculation of traffic performance is analogous to the approach of the Arbeitsgemeinschaft Energiebilanzen with the Factor 1tkm = 10 pkm

Source: Odyssee Database, 2021; EEA, 2021 (v24); own calculations

CO_2 efficiency in passenger car traffic in the EU

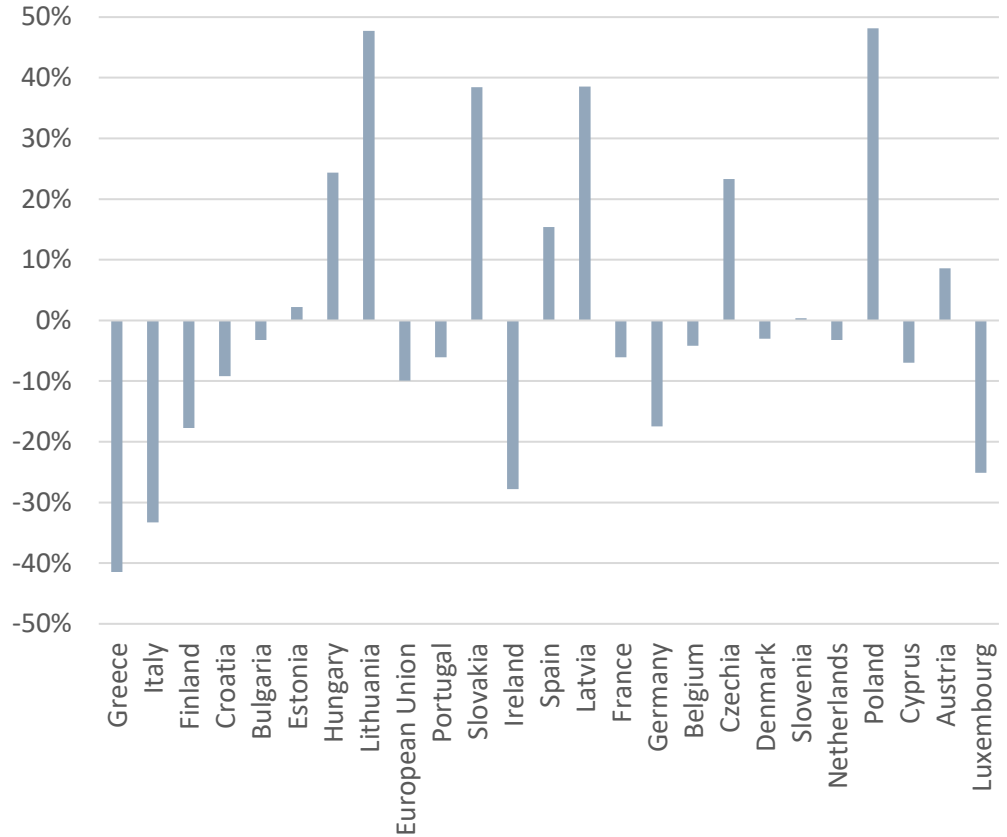
CO_2 efficiency by states* in the year 2019

Measured in kg CO_2/pkm



Change in CO_2 emissions per passenger kilometer

Information for the period 2000 to 2019

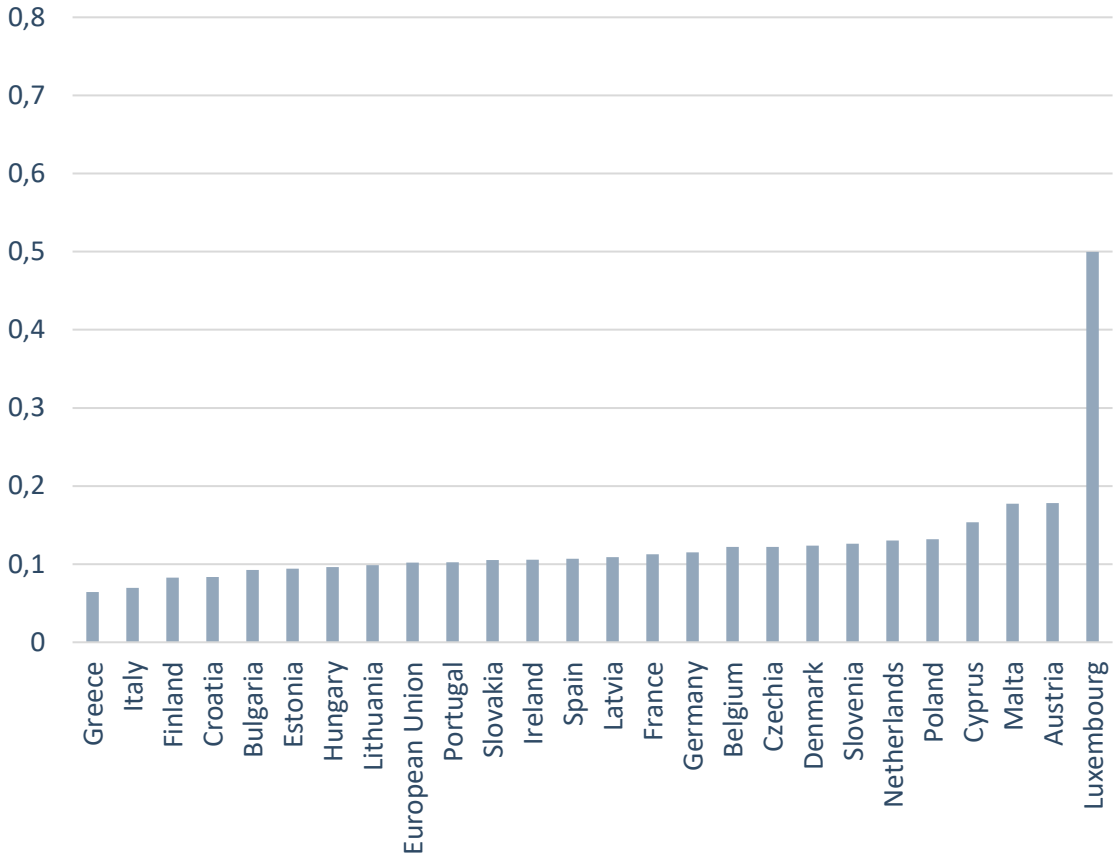


*Belgium and Slovakia as of 2017; no information available for Romania, Sweden
Source: Odyssee Database, 2021

CO_2 efficiency in road freight transport of the EU

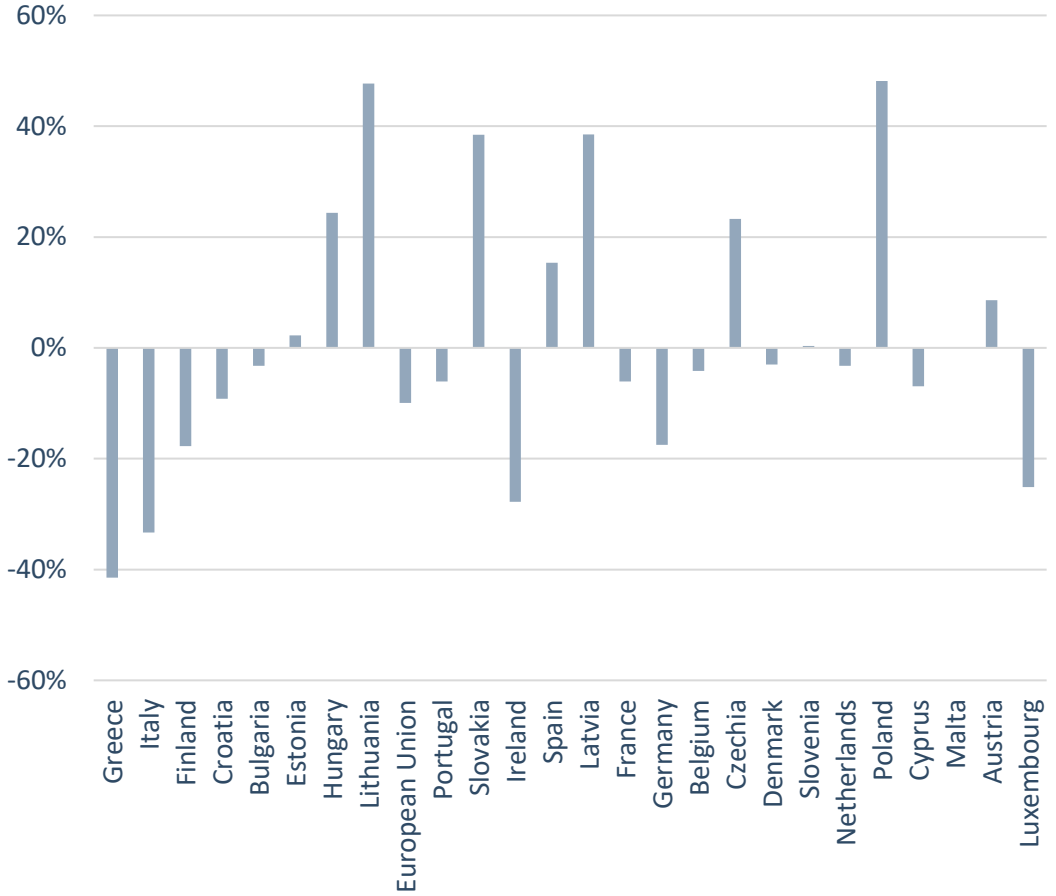
CO_2 efficiency by states* in the year 2019

Measured in kg CO_2/tkm



Change in CO_2 emissions in ton kilometres

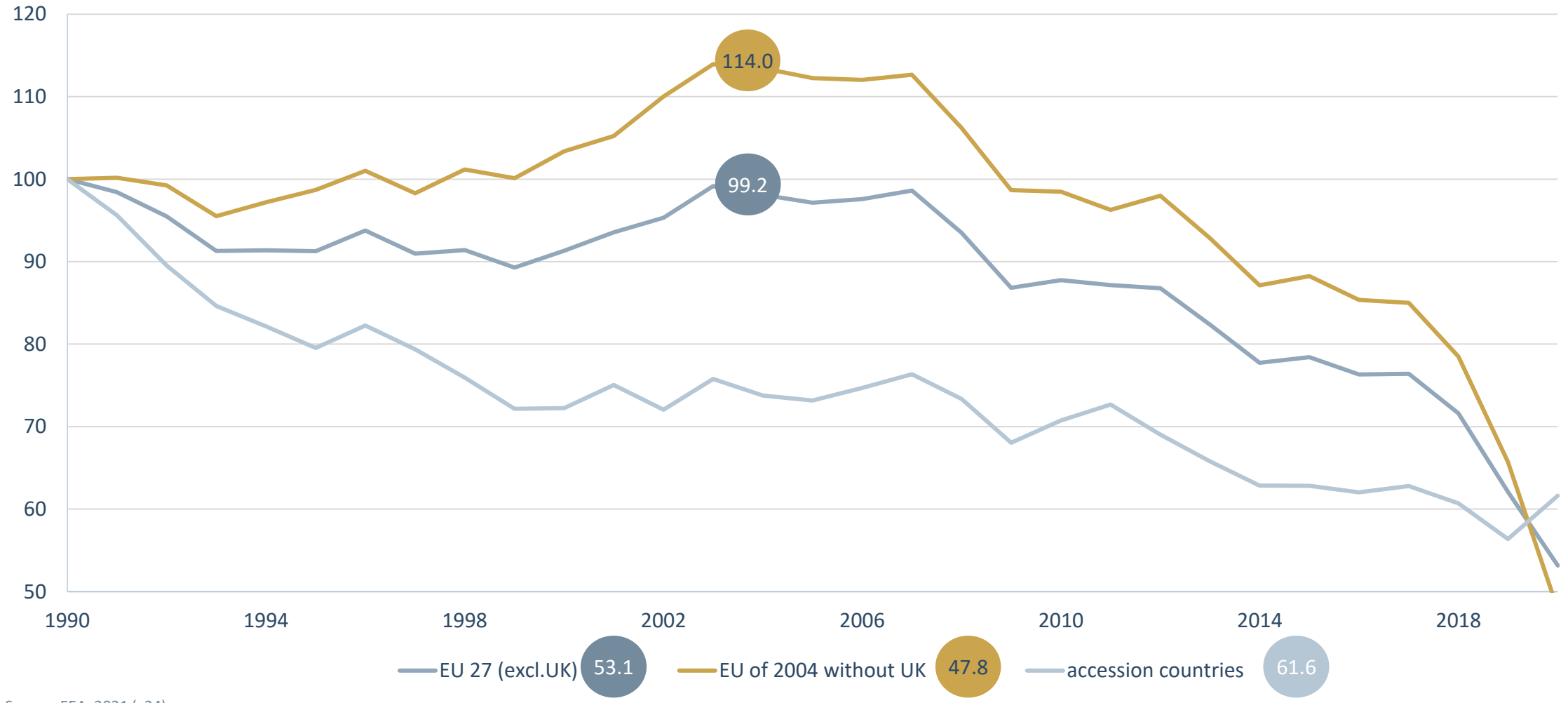
Data for the period from 2000 to 2019



*Belgium as of 2017; No data available for Malta, Romania, Sweden
Source: Odyssee Database, 2020

Stronger declines in the East, but the West is catching up fast

CO_{2EQ}- emissions from public electricity and heat generation, 1990 = 100

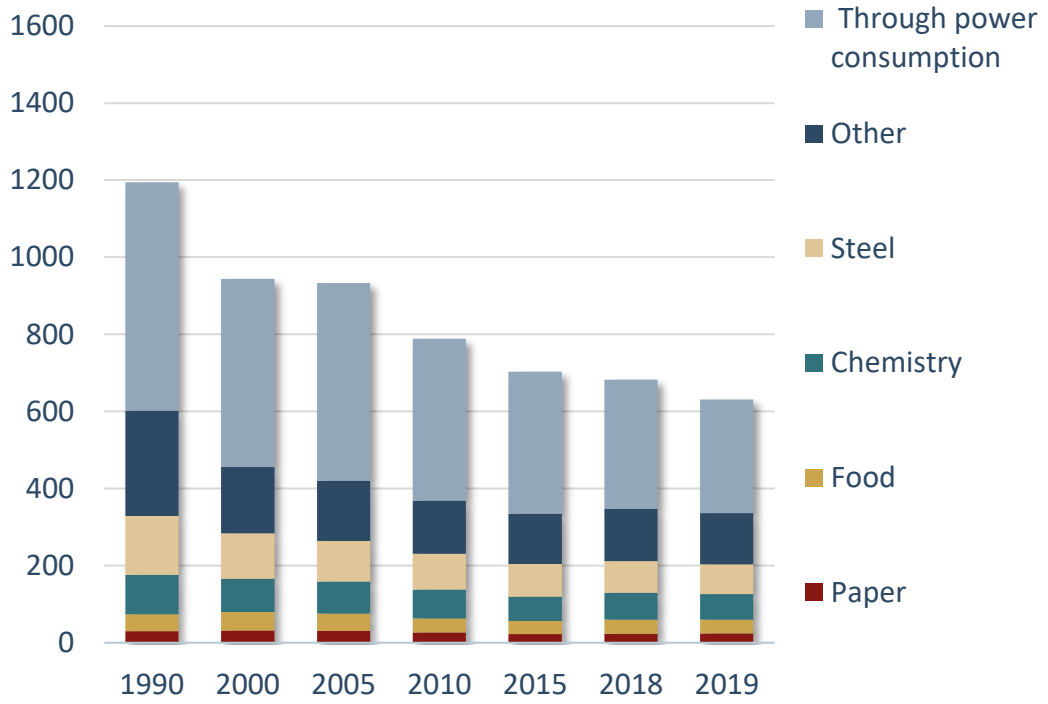


Source: EEA, 2021 (v24)

Industry in the EU 27: Falling emissions, rising efficiency

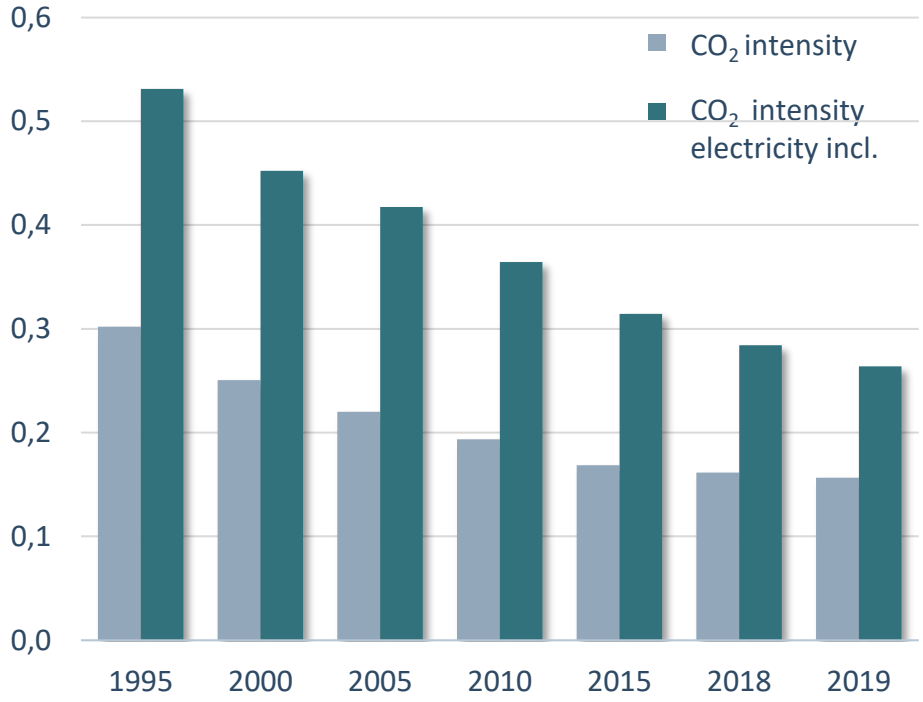
CO_2 emissions from industry are falling: -25% since 1995

in millions of tons CO_2



Halved since 1995: Emissions per euro of value added

kg CO_2/Euro2010



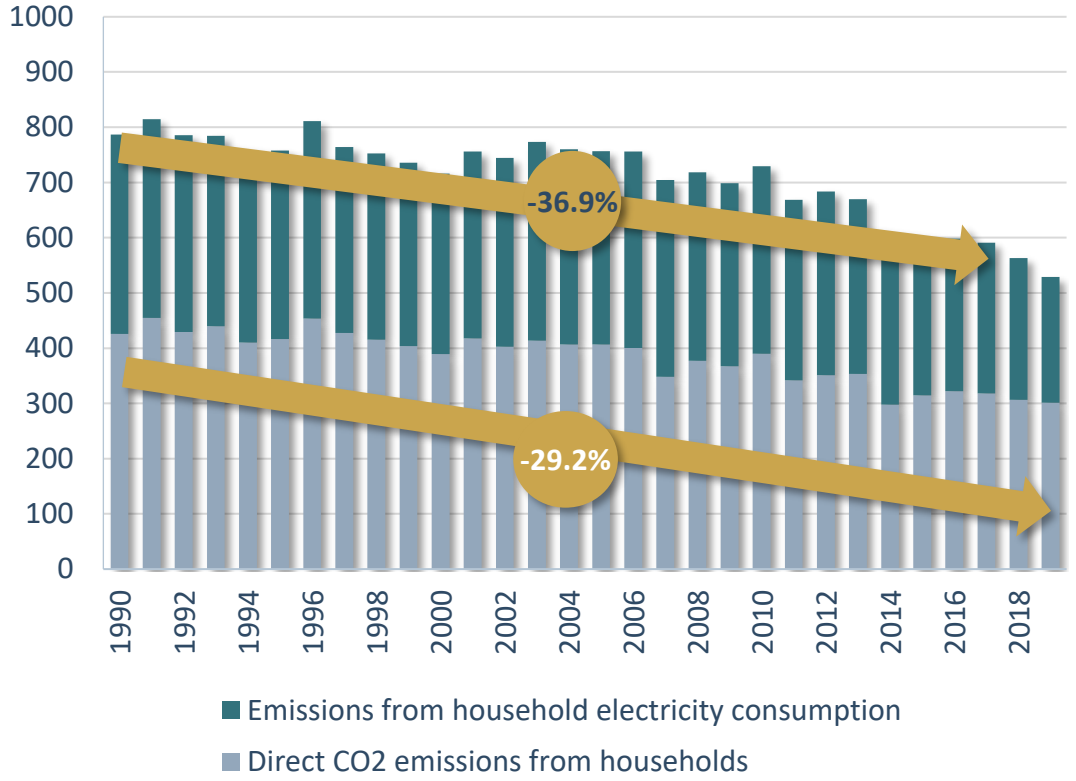
- Regulation: Most of the CO_2 emissions caused by industrial activities fall under emissions trading.
- Increased efficiency: Emissions per unit of gross value added have fallen by a good 40 percent since 1995.
- Deindustrialisation: The migration of industry from many European states reduced CO_2 emissions in the EU.

Source: Odyssee Database November 2021

Households: Falling CO_2 emissions despite higher demands on living space

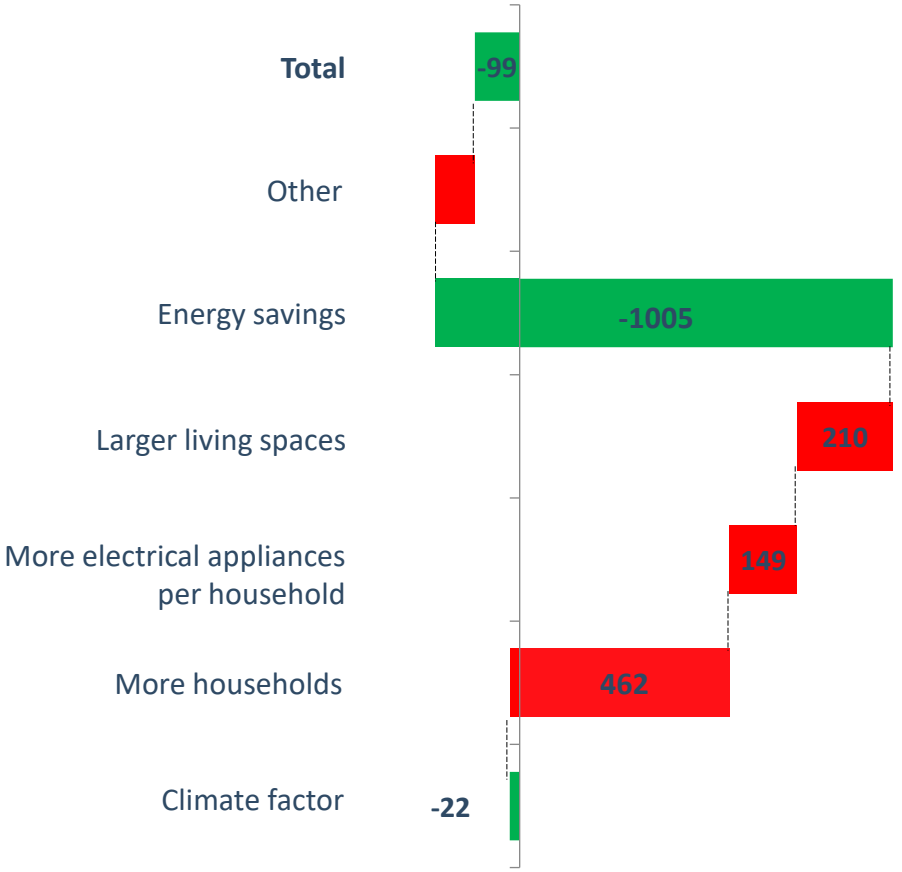
CO_2 emissions from households in the EU27 since1990

measured in millions of tonnes CO_2



Change in energy consumption from 2000 to 2018

Component decomposition, in terawatt hours (TWh)



Source: Odyssee Database November 2021