ODYSSEE-MURE

Enerdata intelligence + consulting

Energy efficiency trends in transport in the EU

Odyssee-Mure webinar series on Energy Efficiency
organised by Leonardo ENERGY

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with Estelle Payan - Enerdata

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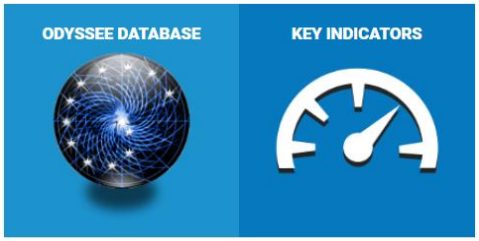
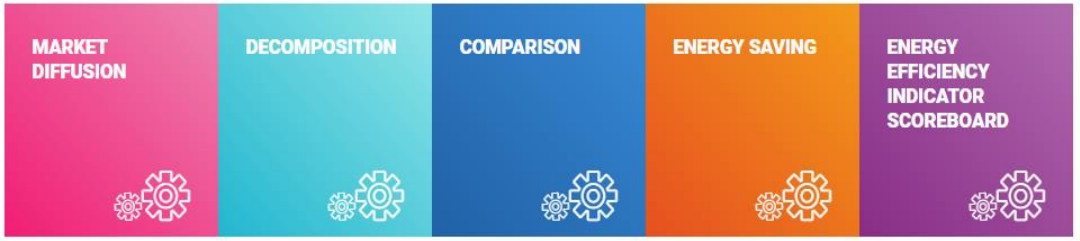
AGENCE DE LA TRANSITION ÉCOLOGIQUE

About ODYSSEE-MURE

- This webinar is organized in the framework of the ODYSSEE-MURE project, that is supported by the H2020 programme of the European Commission. The project is coordinated by ADEME, with the support of Enerdata and Fraunhofer-ISI. www.odyssee-mure.eu
- The webinar relies on data and energy efficiency indicators prepared in the framework of the project and disseminated in a database, called **ODYSSEE,** and in 5 data tools.
- ODYSSEE covers 31 countries*. It is updated up to 2018 from national sources and completed by Enerdata with early estimates for 2019**.
- EU corresponds to EU27 (i.e. without UK)





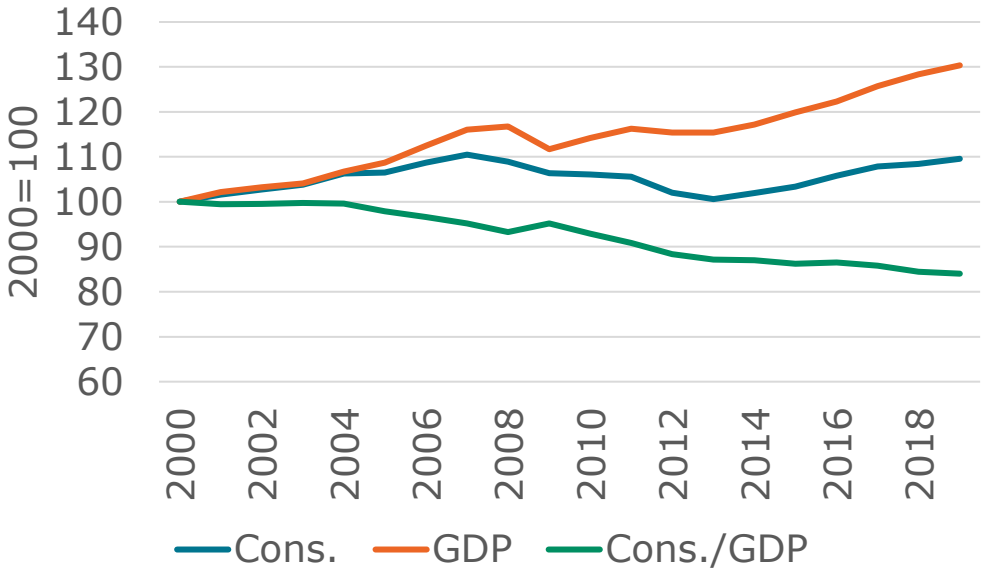
** 27 EU Member States + UK, Norway, Serbia and Switzerland*
*** See methodology at https://www.odyssee-mure.eu/publications/other/early-estimates-methodology.html*

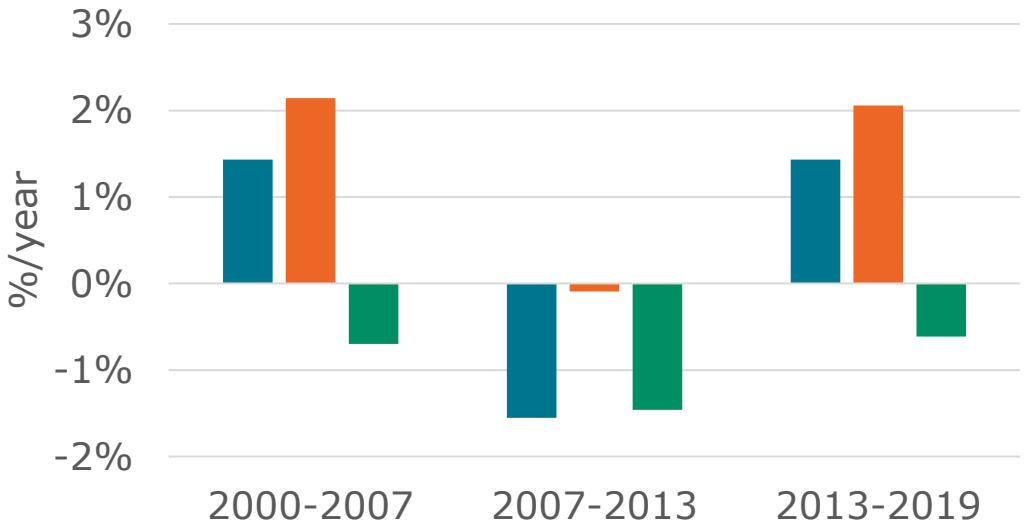
Outline

- Energy consumption and emission trends
- Energy efficiency trends
- Conclusions

Energy consumption and emissions trends

Transport energy consumption and GDP in EU27



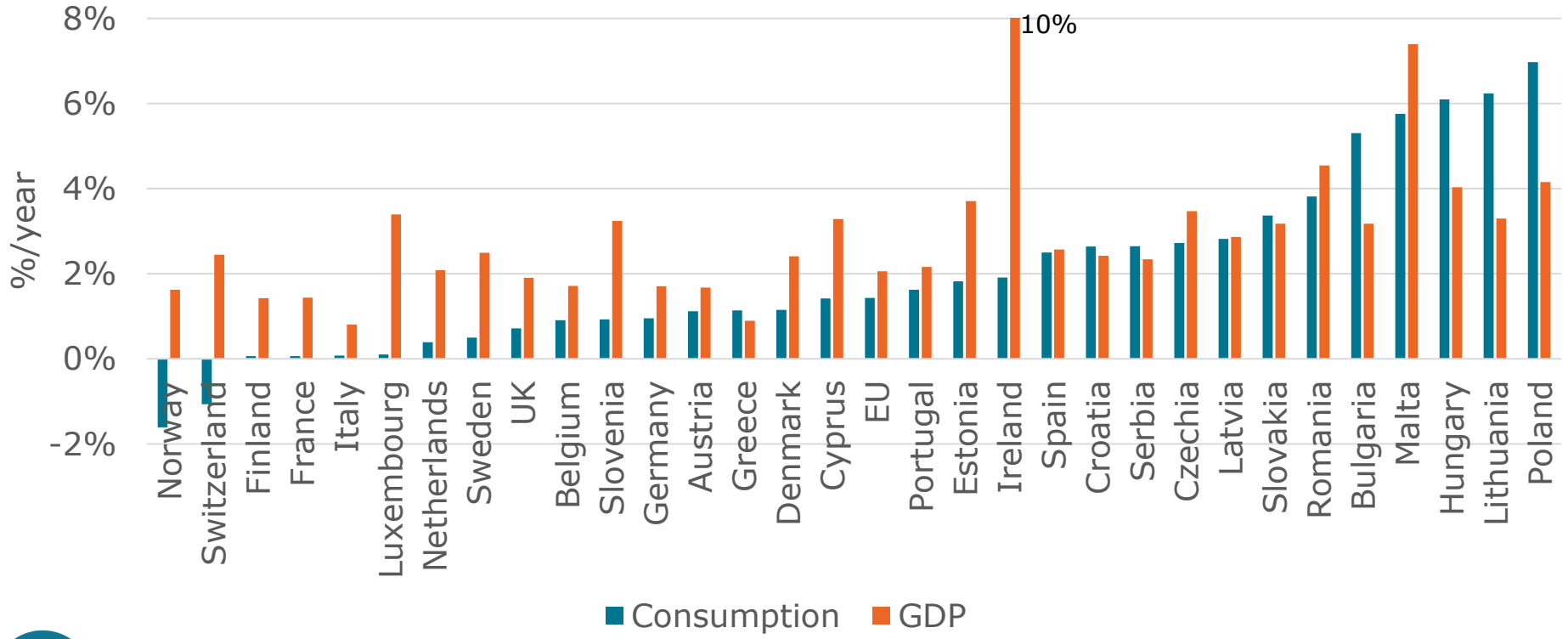


- Increasing consumption since 2013 (1.4%/yr), following the return to economic growth, back to the trend before the financial crisis.
- This follows a significant decrease of 1.6%/yr over 2007-2013.
- Since 2013, transport energy consumption increases 0.7 times less rapidly than GDP, (almost as before 2007); this implies a decrease of the consumption per unit of GDP by 0.6%/year.

Source: *ODYSSEE*

Transport energy consumption and GDP since 2013

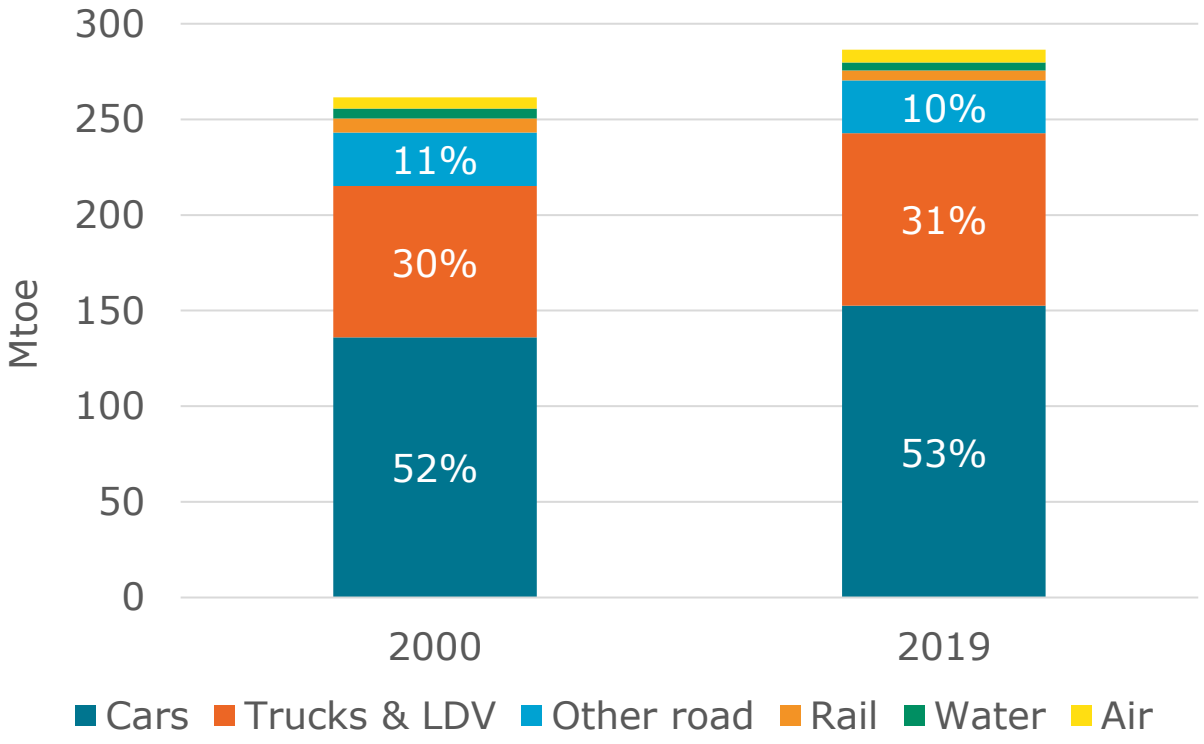
- Since 2013, transport consumption remained stable in 4 EU countries and decreased in Norway and Switzerland despite a sustained economic growth (~2%/year).
- It increased much less rapidly than GDP in 15 other EU countries.
- In 4 eastern European countries, transport consumption has grown almost twice faster than GDP.

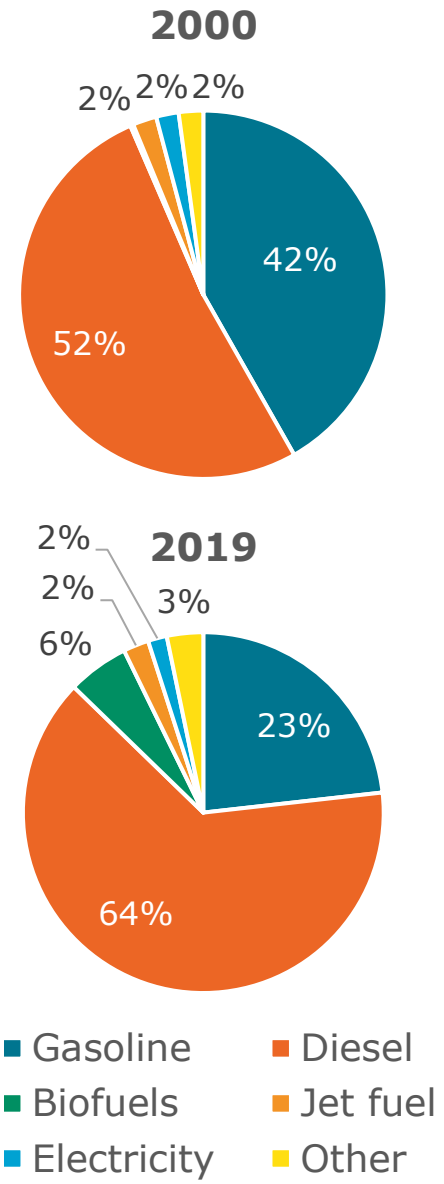


Source: ODYSSEE; 2013-2019

Transport consumption by mode and by fuel in EU27

- The split of consumption by mode only changed slightly between 2000 and 2019, with more than half of transport consumption going to cars.
- The share of diesel has increased by 12 pts in the energy mix until 2010, replacing gasoline, and is stable since then. Biofuels reached a share of 6% in 2019. The share of electricity remained stable (2%).

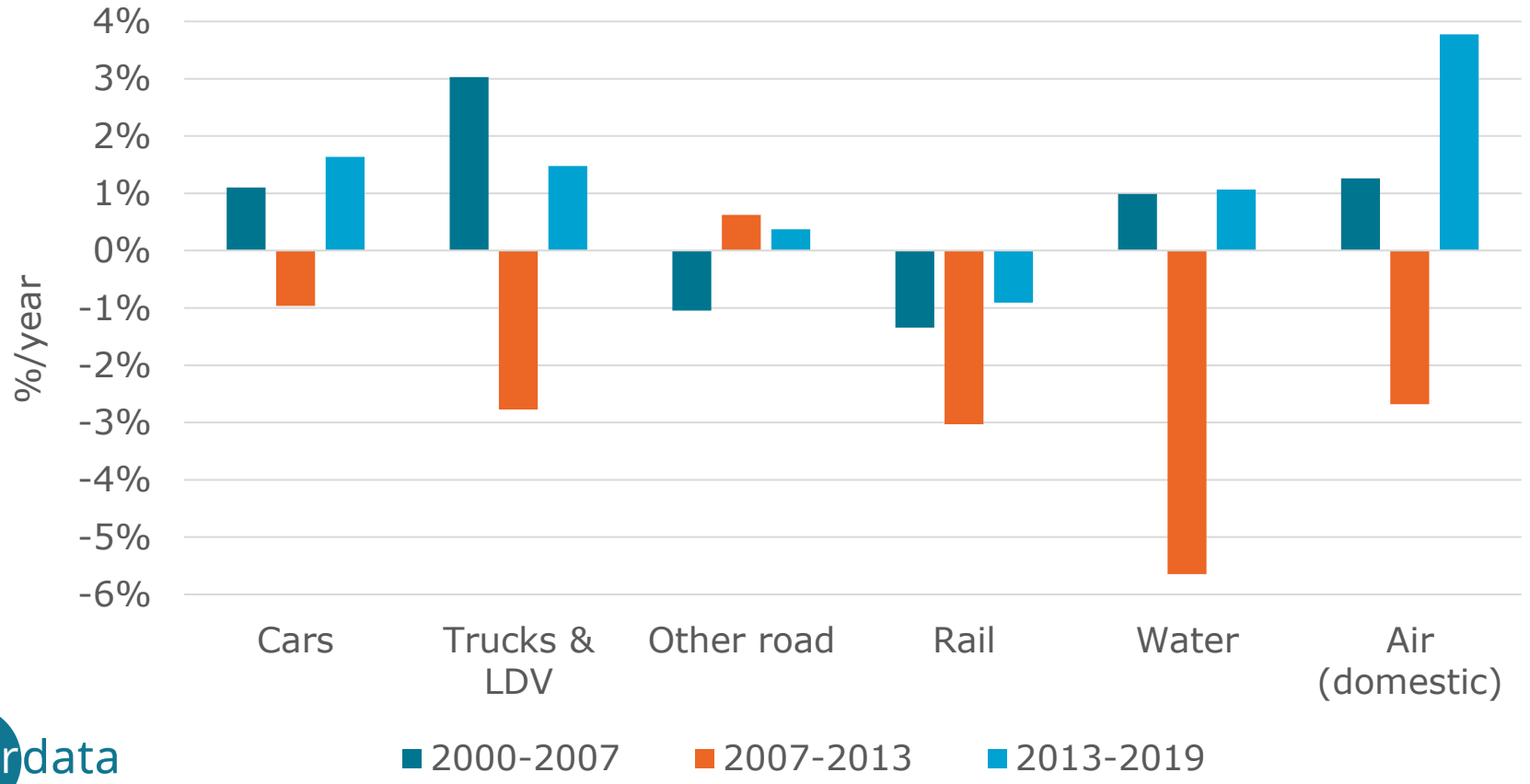




Source: ODYSSEE
Data on alternative fuel cars: https://www.indicators.odyssee-mure.eu/market-diffusion.html

Transport consumption trends by mode in EU27

- Consumption of domestic air transport and cars is growing since 2013 much faster than before the financial crisis: 3 times faster for air, 50% faster for cars (traffic growing twice faster).
- The consumption of trucks & LDV is however growing twice less than before 2007, despite a similar economic growth, because of a slower growth in traffic and number of LDV (70% slower for both).

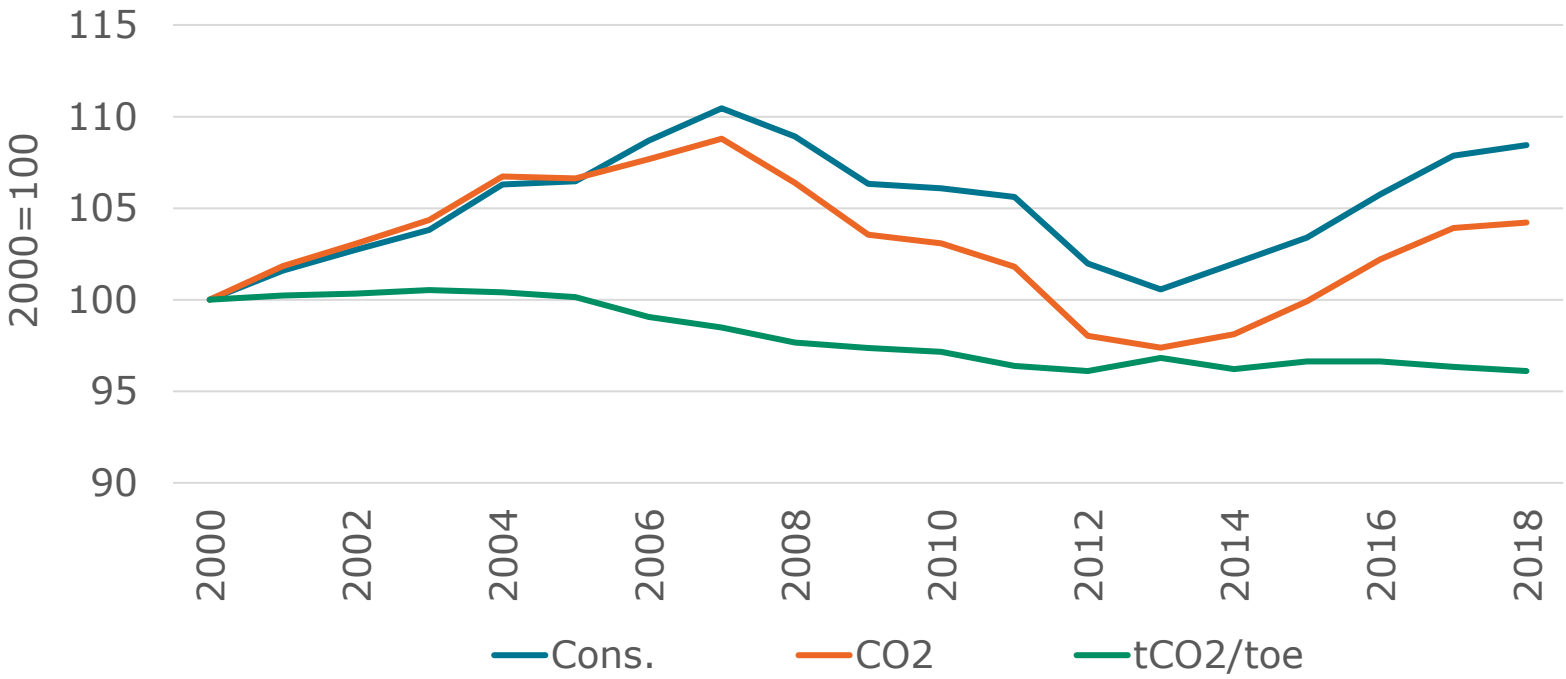


Enerdata

Source: ODYSSEE

Transport consumption and CO2 emissions in EU27

- CO2 emissions follow the trends of consumption, with a decoupling from 2004 to 2013, due to a regular decrease of the carbon emission factor (tCO2/toe).
- Stagnation since then, as the share of non carbonated fuels (biofuels and electricity) has stopped increasing; their share in total transport consumption had increased from 2% in 2004 to 7% in 2013.

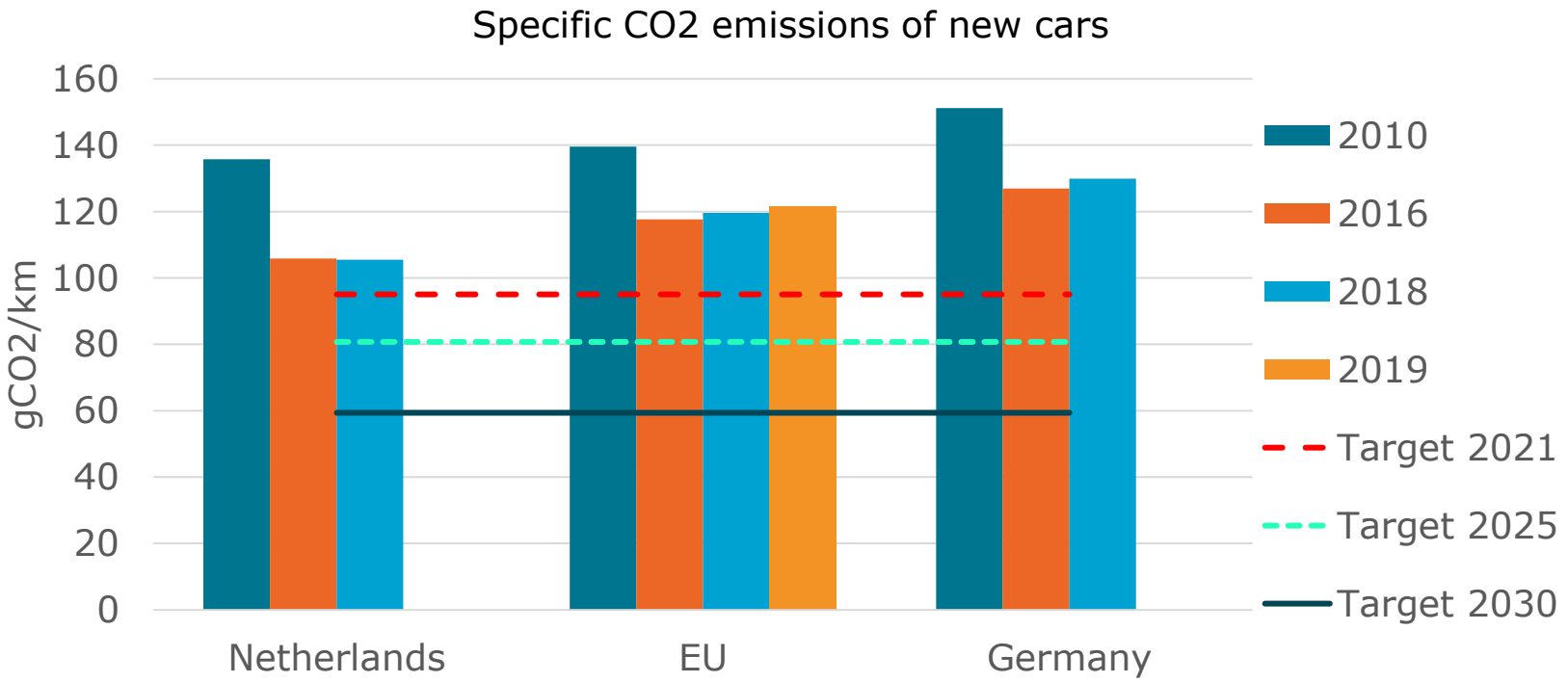


Only direct CO2 emissions, which do not include emissions due to electricity supply to electric vehicles

Source: ODYSSEE

Measures in transport: CO2 emissions of new vehicles

- Measures on new vehicles have been the main policy tool in transport: EU standards & labels and national measures (fiscal and incentives).
- They focused on specific CO2 emissions in gCO2/km.
- At EU level, emissions of new cars fell by 16% between 2010 and 2016 but have increased since then mainly because of the larger share of SUV.
- Germany and The Netherlands are the main countries at the two extremes.
- The 2021 target will probably not be reached (95 gCO2/km) and the targets for 2025 and 2030 remain ambitious.



Source: ODYSSEE, from EEA (test values); see in Annex data by country

Energy efficiency trends

How is energy efficiency progress measured in ODYSSEE?

- Energy efficiency is first assessed at the level of each mode and types of vehicles with indicators of specific consumption measured in different physical units, e.g. l/100 km, koe/km, koe/pkm, koe/tkm* for freight, or for light duty vehicles.

- For cars different indicators can be used depending on the definition of energy efficiency: for instance, their technical efficiency is better captured by l/100 km, and their overall efficiency by koe/pkm*, that includes the effect of change in load factor and fuel mix.

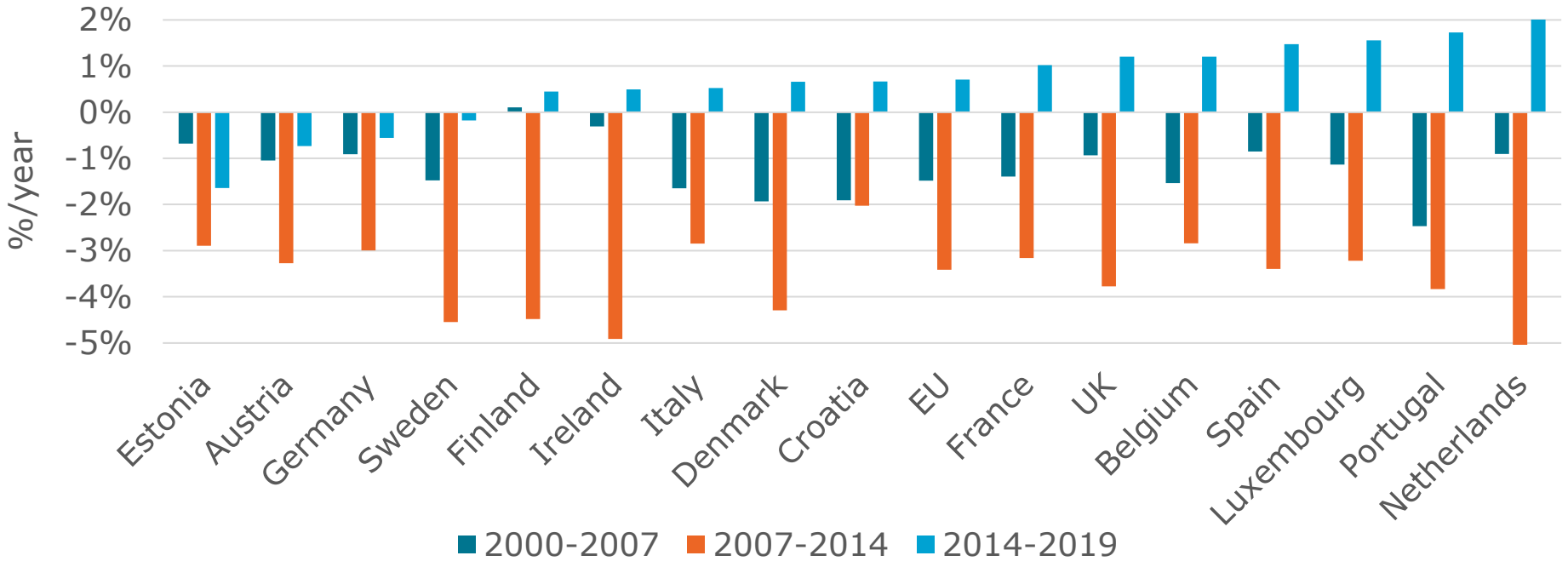
- For cars, l/100 km refer to test values for new vehicles and to observed values under real conditions of use and real motor fuel composition (share of biofuels not considered in the test).

- Trends for new cars are interesting to track as most measures to improve the energy efficiency of cars address new vehicles.

**koe= kilogram oil equivalent (1 koe = 10^{-3} toe)*

Energy efficiency of new cars (l/100 km)*

- The specific consumption of new diesel and gasoline cars has decreased everywhere until 2014, and especially over 2007-2014.
- Since 2014, there is a reverse trend in most countries, and a net slowdown in the others, due to two main factors: a decrease in diesel shares (from 56% in 2012 to 34% in 2019 at EU level) and a growing share of SUV (from 25 to ~40%).



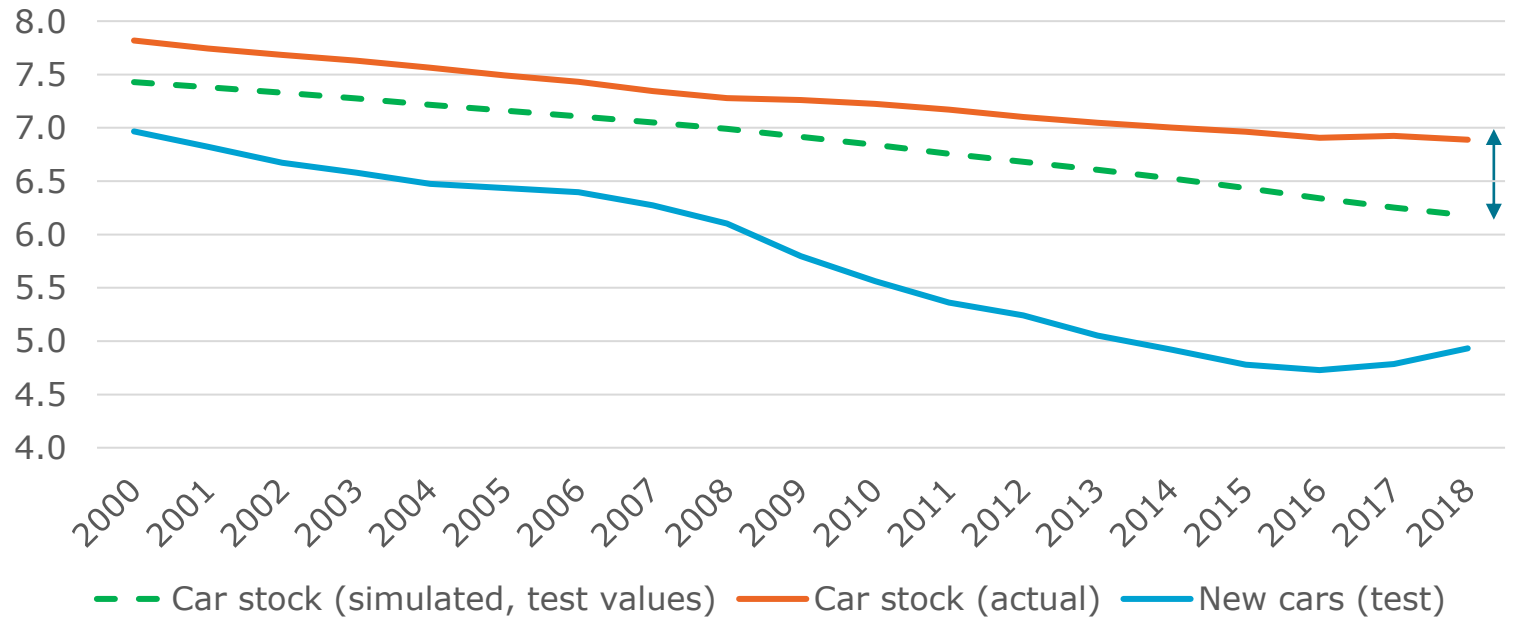
Test-cycle values for diesel and gasoline cars; only shown countries with data since 2000

Source: ODYSSEE from EEA data

Technical efficiency of car stock twice slower than for new cars at EU level

- The actual specific consumption of the stock of cars follows with a lag the trend of new cars: since 2014, they continue decreasing, i.e. a trend quite different as for new cars.
- Actual values reflect actual driving conditions, compared to test values for new cars: a simulation of the test value of the stock of cars, taking into account test values of new cars, estimates the gap between test and actual values at around 10% in 2018 (green line) and this gap is growing.

Specific consumption of diesel and gasoline cars (l/100 km)



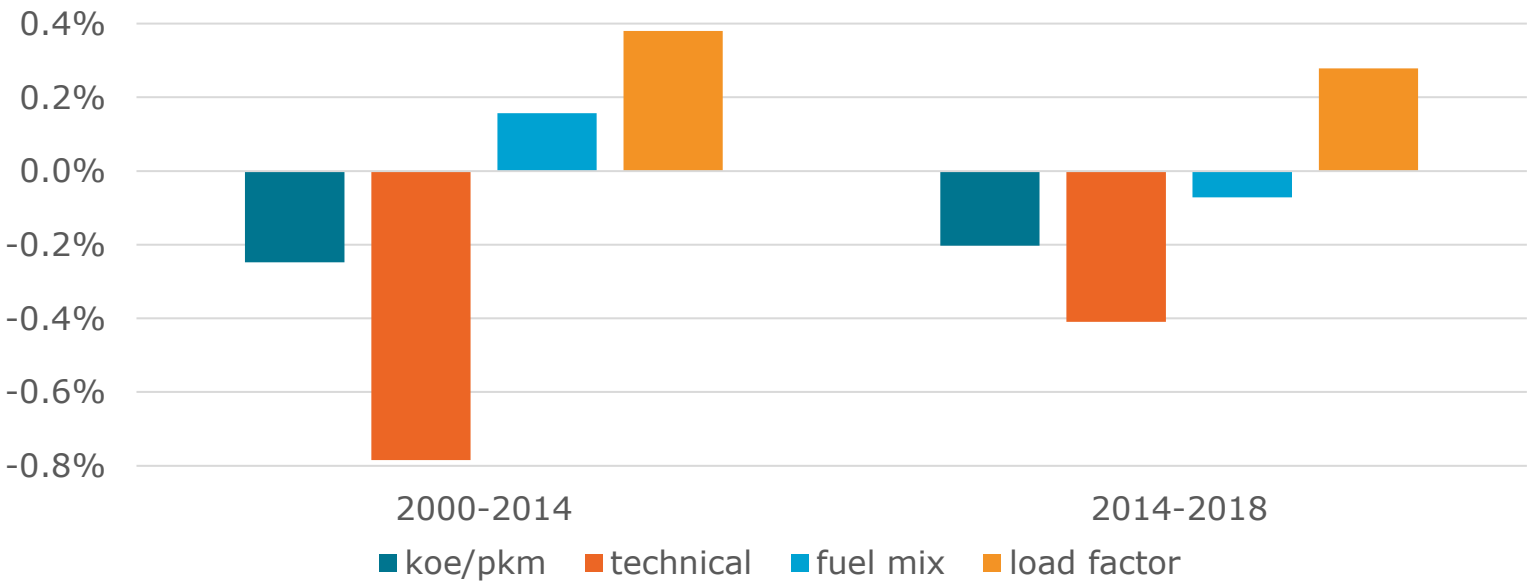
Gap actual vs test values

Source: ODYSSEE from EEA data

How to assess the energy efficiency of cars?

- If we focus on overall efficiency (koe/pkm) ("preferred indicator" for EU Commission), the progress has been low since 2014 (0.2%/yr) with technical efficiency contributing for 0.4%/year, while the decrease in the rate of occupancy of cars contributed to lower efficiency progress by 0.3%/year; the effect of change in fuel mix is limited.
- Before 2014, overall efficiency improvement was about the same, however with more rapid technical improvements (0,8%/yr), partly offset by a decrease in car occupancy and the effect of fuel mix.

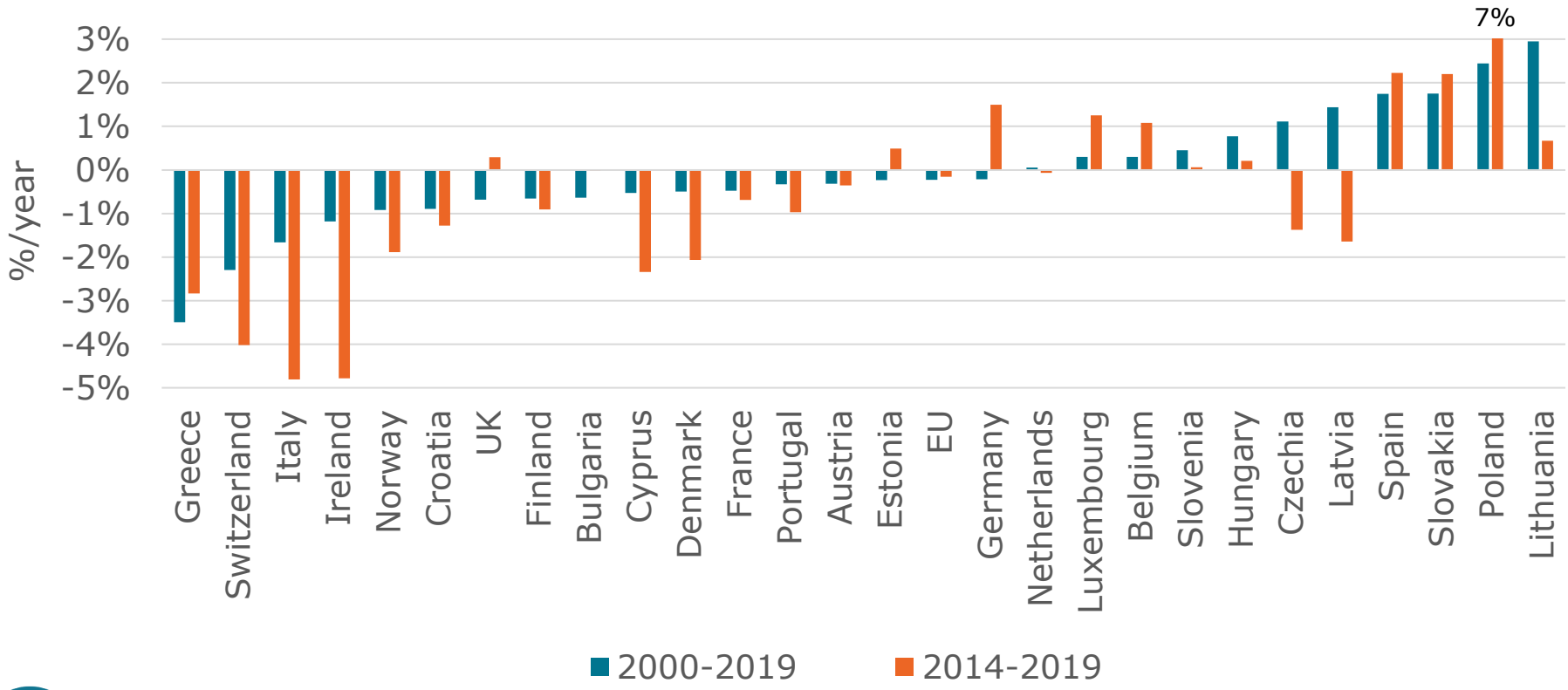
Factors of variation of the overall efficiency of cars (koe/pkm) (%/yr) (EU)



Source: ODYSSEE, Enerdata

Energy efficiency of car stock (koe/pkm)

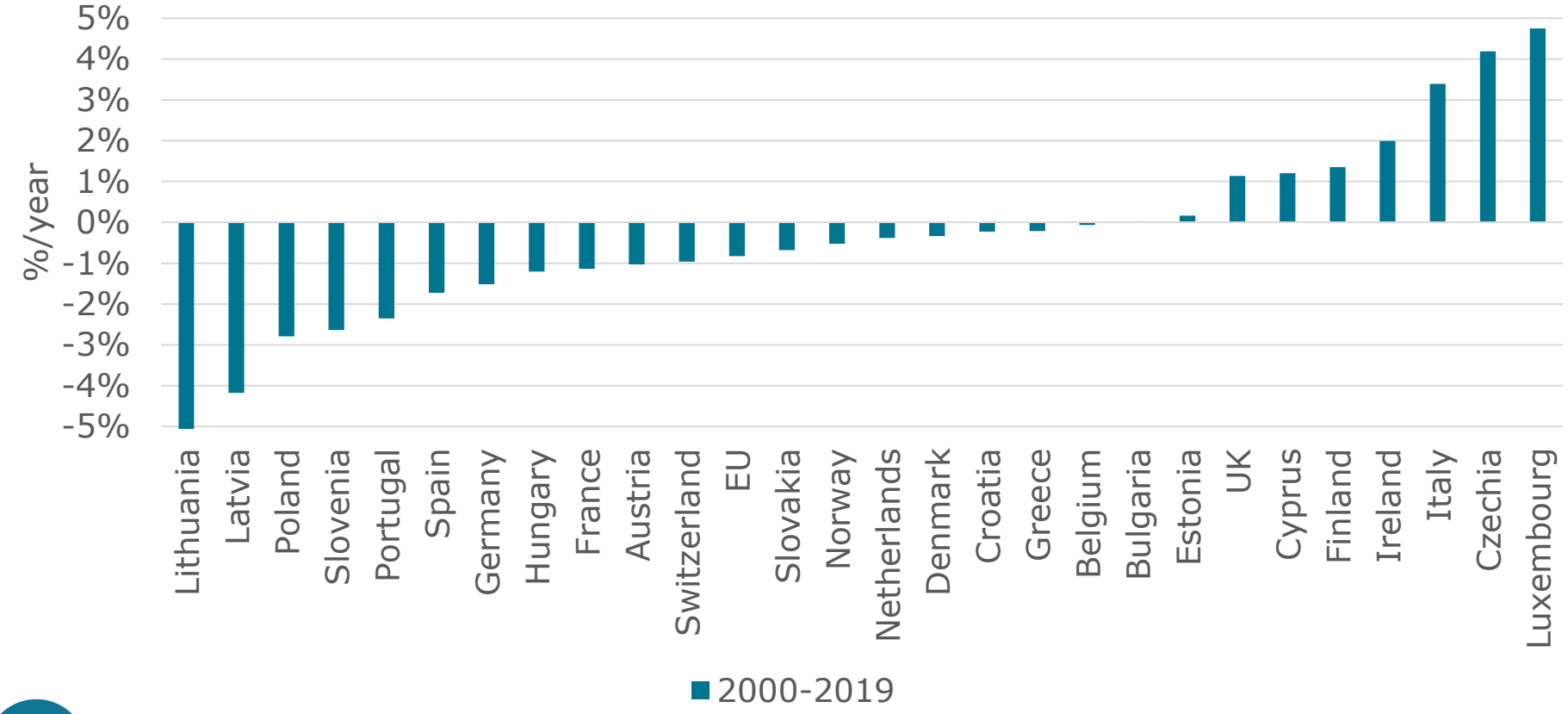
- Energy efficiency improvements for cars at country level show contrasted situations, with significant improvements over the whole period in some countries (Greece, Italy or Ireland in the EU; Switzerland and Norway).
- Many countries have better results since 2014.



Source: ODYSSEE, Enerdata

Energy efficiency of road freight transport (goe/tkm)

- In most countries the unit consumption of road freight transport (including trucks and light duty vehicles) has decreased since 2000, reflecting energy efficiency improvements.
- It has however increased in 7 countries.



Source: ODYSSEE

How to assess the overall energy efficiency of transport ?

- From the different energy efficiency trends measured for each transport mode, an energy efficiency index for the whole transport sector is derived in ODYSSEE: it is called "ODEX".

- ODEX is calculated:
  - First, by expressing trends in specific energy consumption by mode, as seen before for cars and trucks, as an index of variation;
  - Then by calculating an average index for the sector weighted by the share of each transport mode in the sector's consumption.

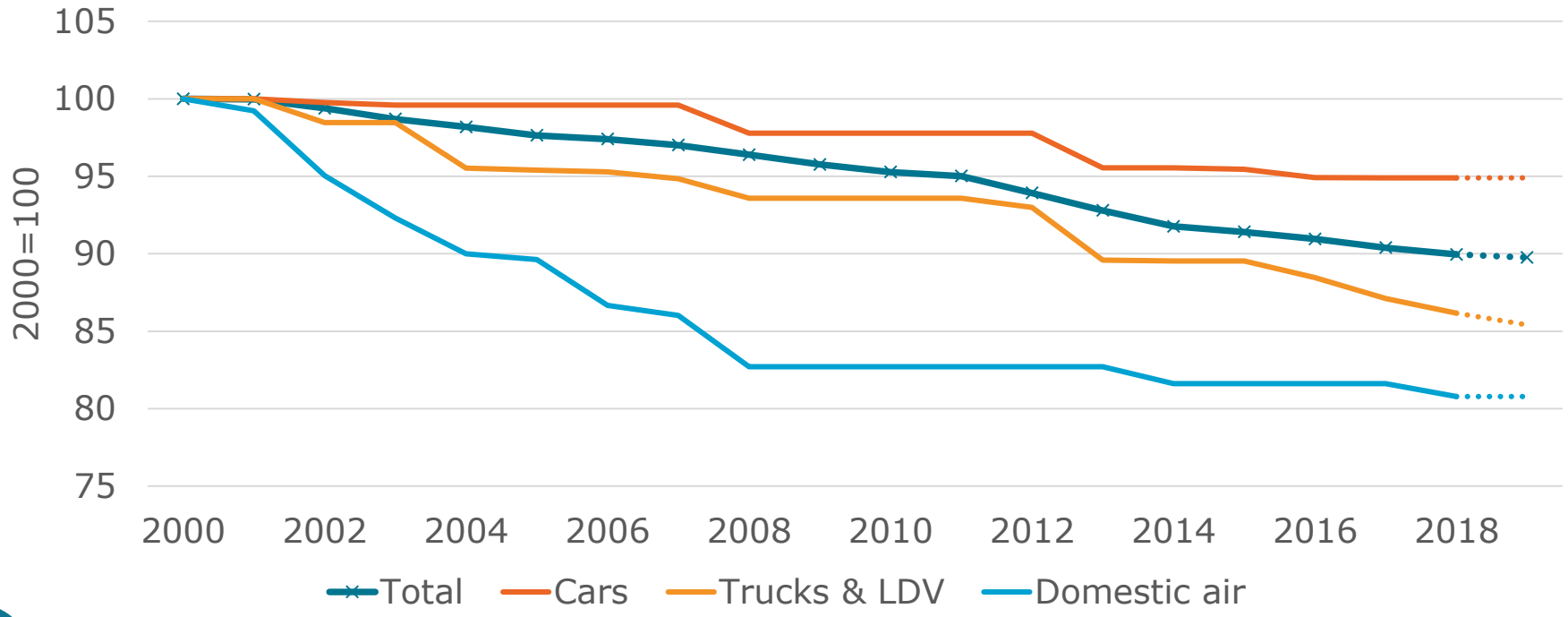
- ODEX is calculated on the basis of 8 modes of transport*.

- Specific consumption are expressed in different physical units so as to be as close as possible to energy efficiency (*koe/pkm for cars, buses and aviation, koe/tkm for trucks and water, koe/vehicle-km for light duty vehicles, toe/vehicle for motorcycles, koe/tkbr for rail*).

** Cars, buses, motorcycles, trucks, light vehicles, rail, water and domestic air.*
For more information on ODEX: https://www.odyssee-mure.eu/publications/archives/odex-indicators-database-definition.html

Energy efficiency trends in transport in the EU27

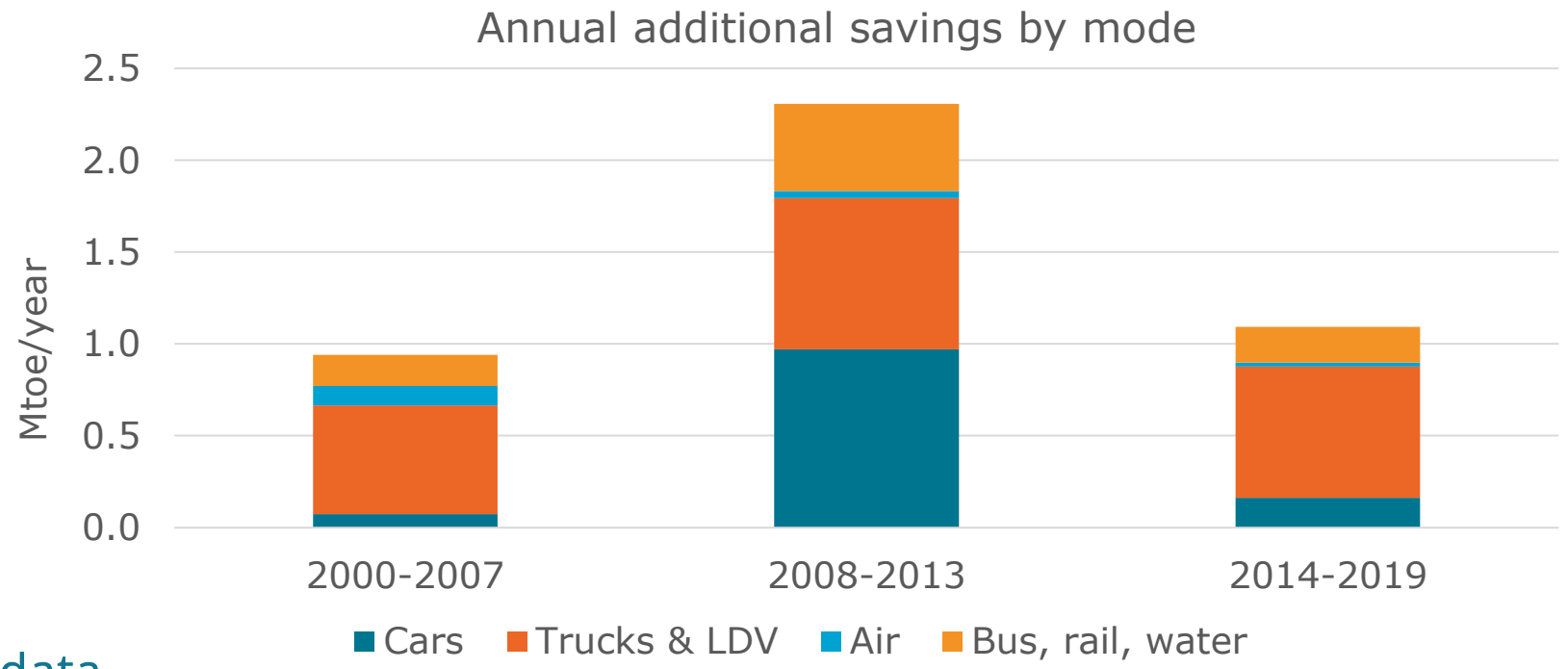
- The energy efficiency of transport improved by 0.6%/year in the EU since 2000 (10% compared to 2000 level).
- Greater progress was achieved for domestic air transport.
- Energy efficiency progress had stopped for trucks and light vehicles between 2008 and 2012 due to a less efficient operation of trucks (less loaded and empty running) following the financial crisis but is back again.
- There is no more progress for cars since 2013.



Source: ODYSSEE; only most important modes shown

Trends in energy savings by mode

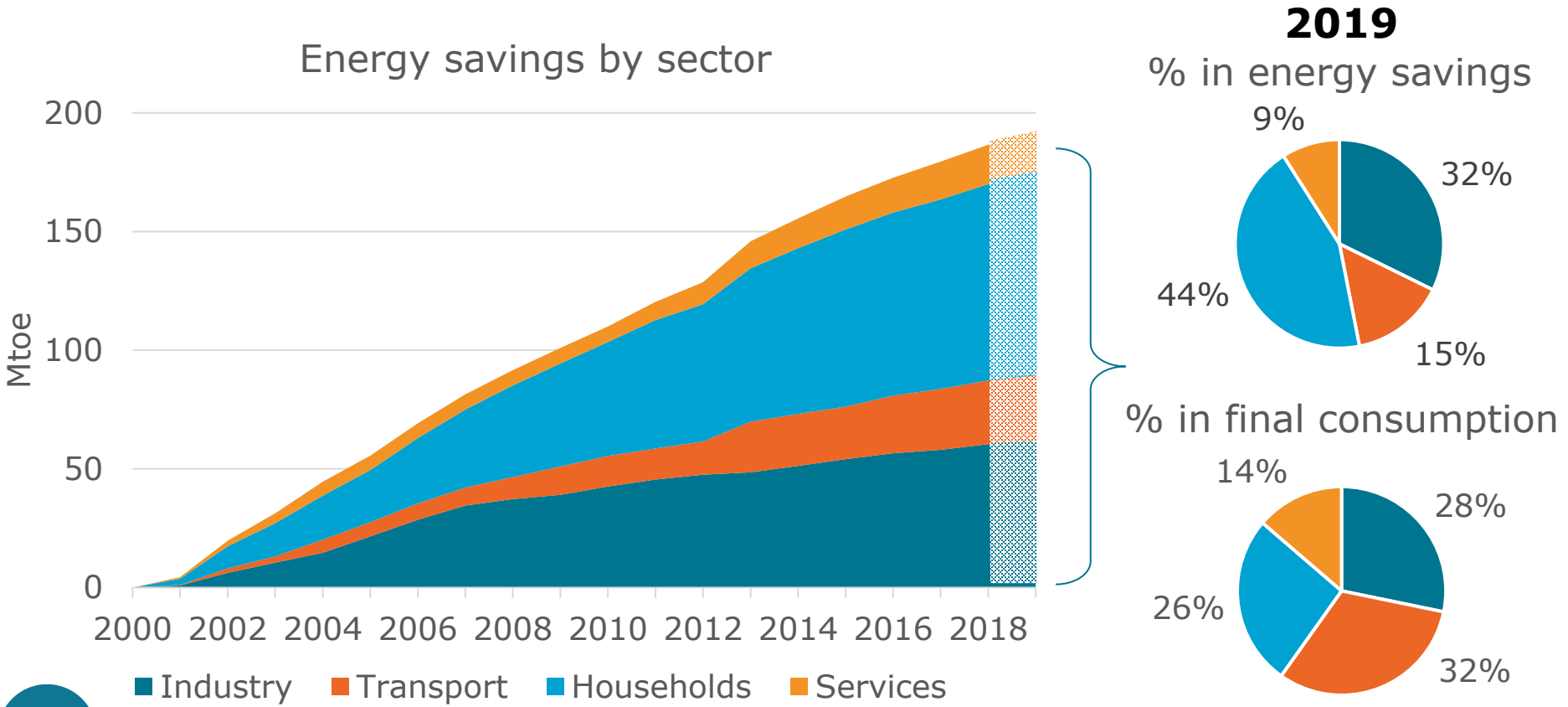
- Energy efficiency progress has saved every year since 2000 an additional volume of around 1.5 Mtoe. Over 2008-2013, annual savings reached 2.3 Mtoe/yr, twice more than since 2014.
- Cumulated since 2000, these savings reached 28 Mtoe in 2019 (i.e. 10% of transport consumption): without these savings, transport consumption would have been 10% higher.
- Trucks and LDV are over-represented, with half of total savings, i.e. a share much higher than their share of consumption (31%). Conversely, savings of cars are much lower than their share in consumption (26% vs 53%), which is all the more surprising as most measures target cars (and also LDV).



Source: ODYSSEE

Transport lags behind the other sectors in terms of energy efficiency immurements

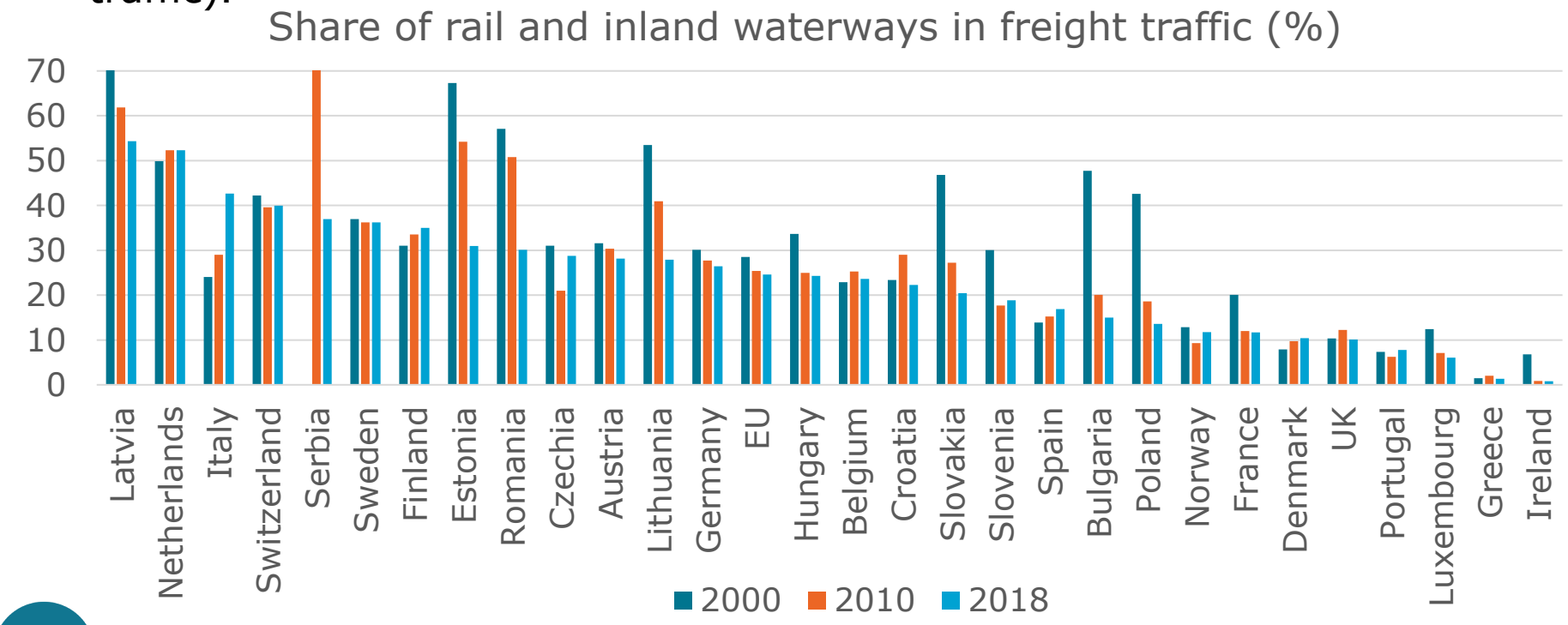
- In 2019, total final energy savings reached 190 Mtoe in EU27.
- The share of transport in these savings was only 15%, a share more than twice lower than its share in consumption (32%), due to much slower energy efficiency progress than in other sectors.



Source: ODYSSEE

Modal shift - Freight

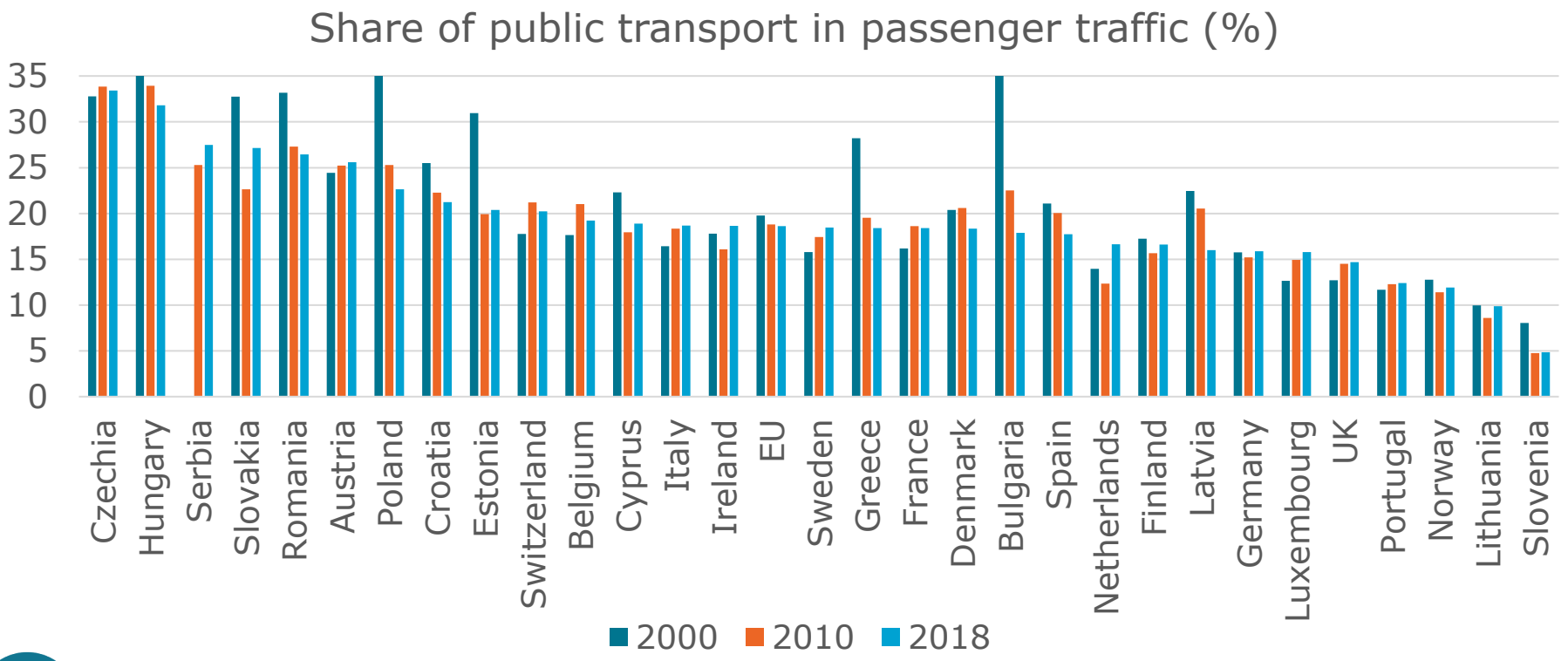
- In 20 EU countries the share of rail and inland waterways has decreased since 2000; the trend is in general slower since 2010.
- At EU level, decrease by 4 pts since 2000 (only 1 pts since 2010).
- A few countries have experienced a rapid shift from road to rail & water since 2000, among which Italy (+19 pts; sea motorways), Finland, Spain and Denmark (+3-4 pts) and, since 2010, Czech Rep (+7 pts).
- Latvia and the Netherlands are leading in terms of level with a share > 50%, (good quality rail lines to seaports combined with high maritime traffic).



Source: ODYSSEE, Enerdata

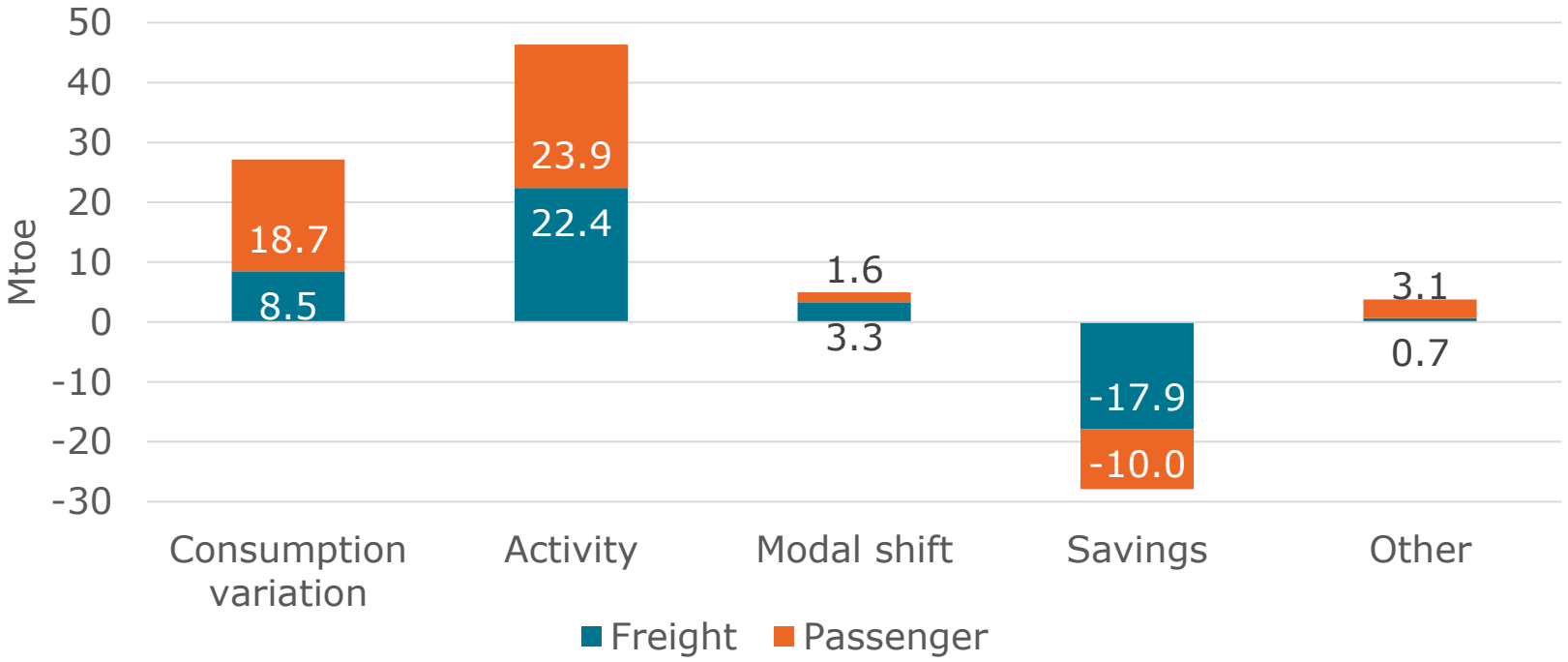
Modal shift - Passenger

- For most countries, no significant shift to public transport since 2010. At EU level: stable share since 2010 and -1% pt before.
- Slovakia and the Netherlands increased the most the share of public transport since 2010 (+4.5 pts).
- Czech Rep and Hungary have the highest share of public transport (~35%), followed by Serbia, Slovakia and Austria (~25%).



Drivers of transport consumption variation 2000-2019

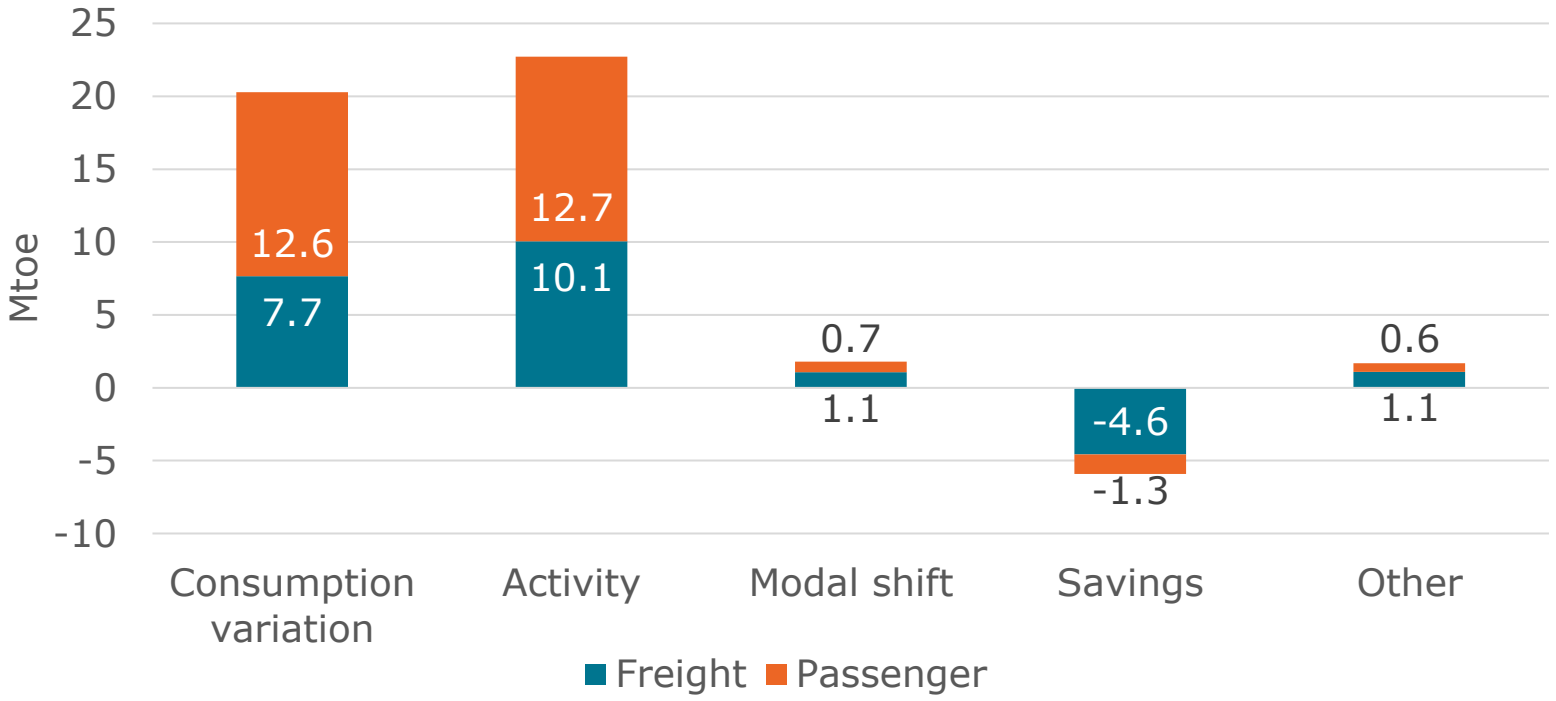
- Between 2000 and 2019, the increase in traffic ("activity") contributed to raise transport consumption by around 46 Mtoe.
- The increasing share of trucks in freight traffic and to a lower extent of cars in passenger traffic (modal shift) also contributed to raise consumption (5 Mtoe).
- Energy savings offset around half of the activity and modal shift effects by lowering the consumption increase to 28 Mtoe.



Source: ODYSSEE Decomposition tool (https://www.indicators.odyssee-mure.eu/decomposition.html)

Drivers of transport consumption variation 2014-2019

- Since 2014, the increase in traffic ("activity") contributed to raise final consumption by 23 Mtoe.
- Modal shift effect increased consumption by 1.8 Mtoe.
- As energy savings offset only a quarter of the activity effect (6 Mtoe), the consumption increased by ~20 Mtoe.



Source: ODYSSEE Decomposition tool (https://www.indicators.odyssee-mure.eu/decomposition.html)

Conclusions

Disappointing results in transport

- Energy efficiency progress for new cars has slowed down or even reversed stopped 2014, due to SUVs and the lower share of diesel cars.
- Energy efficiency progress of the car' stock is very low in most countries, and far from the theoretical performance of new vehicles (test vs real driving conditions, increasing share of biofuels).
- Trucks and LDV have better results and represent half of total energy savings in transport, i.e. much more than their share of consumption (31%).
- Transport lagged behind the other sectors in terms of energy efficiency improvements.
- The objective to raise the share of efficient mode of transport (public vs cars for passenger or rail or water vs trucks) is far from showing positive developments, except in a very few countries.
- All these factors explains why the consumption, and emission, are back since 2014 to their trend before the financial crisis.

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About Enerdata:

Enerdata is an energy intelligence and consulting company established in 1991. Our experts will help you tackle key energy and climate issues and make sound strategic and business decisions.
We provide research, solutions, consulting and training to key energy players worldwide.

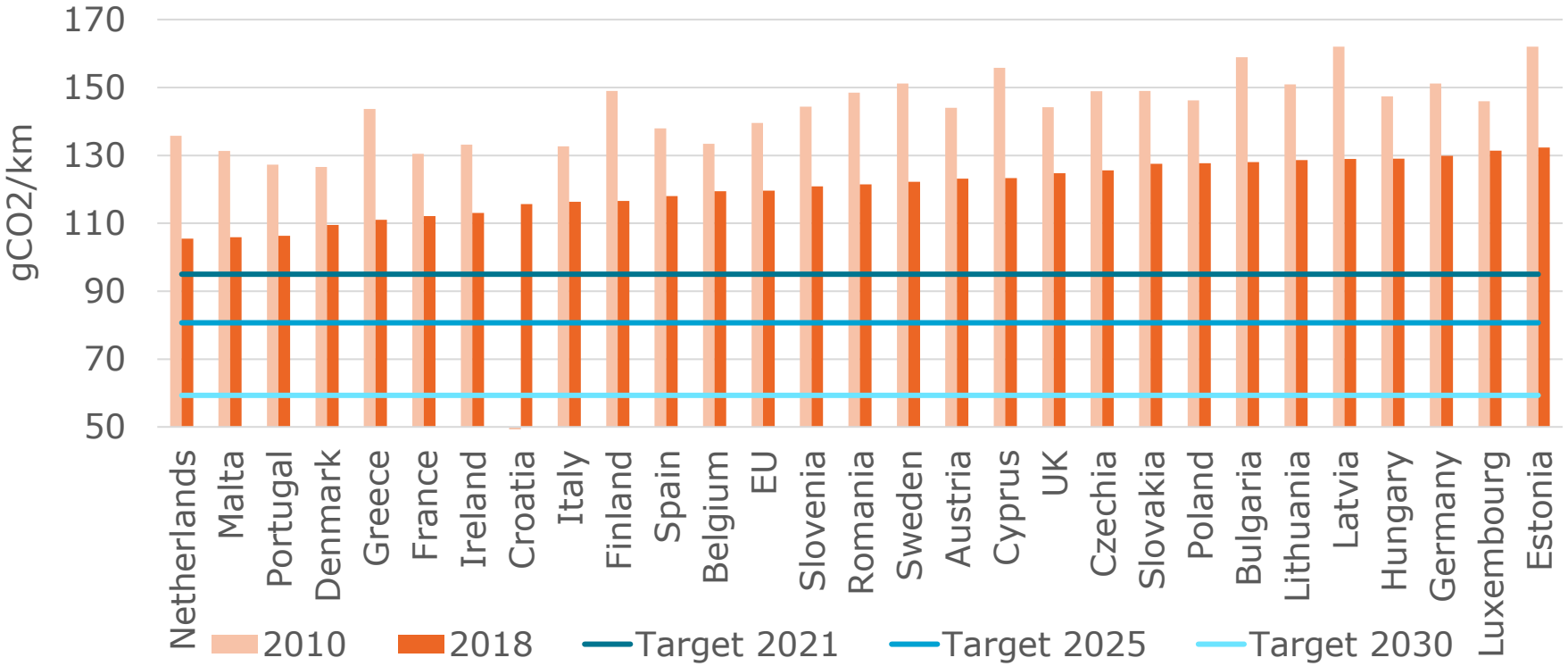
www.enerdata.net

Thank you for your attention !

Annex: Specific CO_2 emissions of new vehicles

CO2 emissions of new cars (gCO2/km)

- At EU level, emissions from new cars fell by 14% between 2010 and 2018 down to 120 gCO2/km, thanks to EU standards & labels* and national measures (fiscal and incentives).
- At this rate, the 2021 target will not be reached (95 gCO2/km).
- The targets for 2025 (~81 gCO2/km) and 2030 (~59 gCO2/km) remain ambitious.

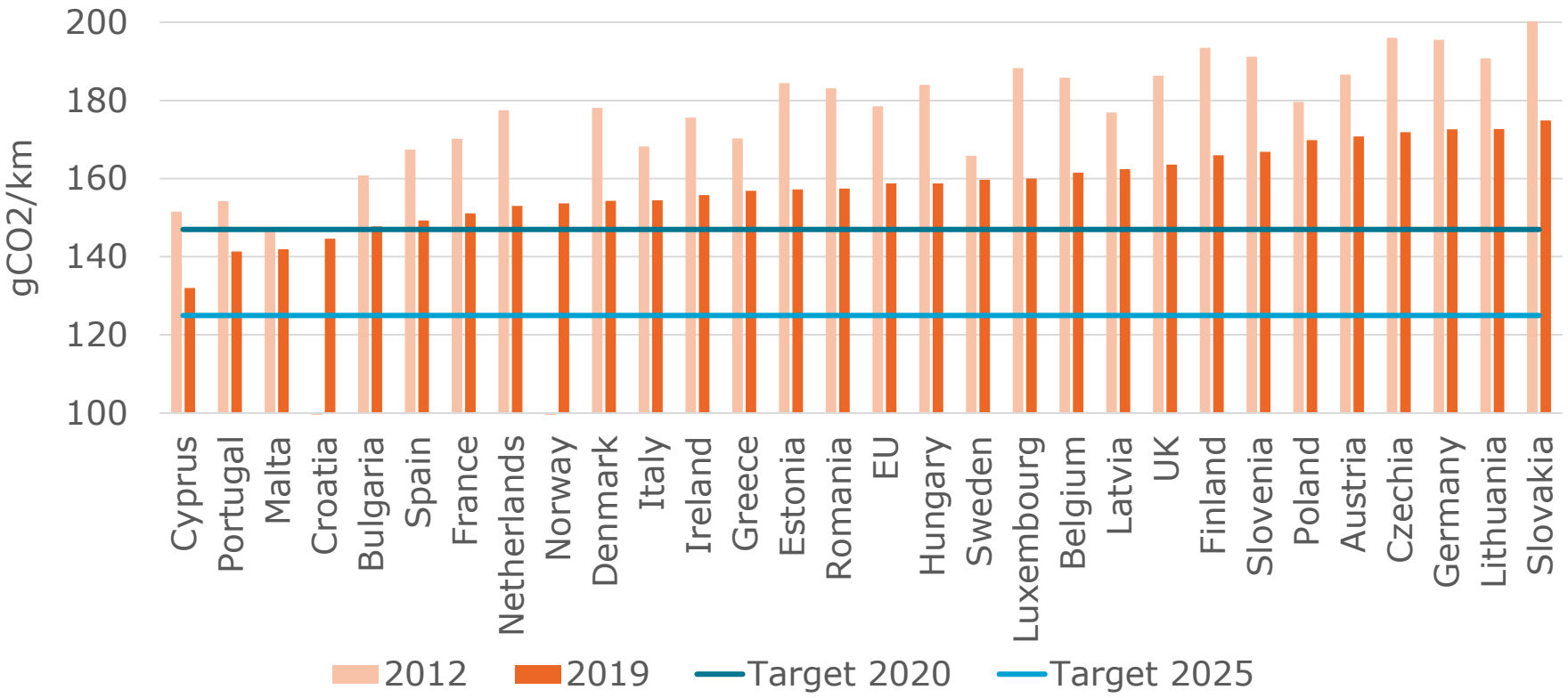


Source: ODYSSEE

** Responsible for at least 2/3 of the reduction since 2009 according to DG Clima*

CO2 emissions of new vans (gCO2/km)

- At EU level, emissions from new vans fell by 11% between 2012 and 2019 down to 159 gCO2/km, thanks to European directives.
- At this rate, 2020 and 2025 targets will not be reached.
- In 2019, some countries had already reached the 2020 target.



*Source: ODYSSEE, from EEA; targets: 147 gCO2/km for 2020; -15%*level 2021 for 2025 ~ 125 gCO2/km; -31.5%*level 2021 for 2030~ 101 gCO2/km*