ODYSSEE-MURE

How to monitor Energy Efficiency in transport? The ODYSSEE-MURE european experience

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AGENCE DE LA TRANSITION ÉCOLOGIQUE

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The public tool for implementing the ecological transition in France

State operator under supervision:

- Of the Ministry for an Ecological Transition and Territorial Cohesion;
- Of the Ministry for the Energy Transition
- and the Ministry for Higher Education and Research.

Sectors of activity:

- Climate change;
- Air and mobilities;
- Energies;
- Sustainable production;
- Sustainable urban planning;
- Agriculture and forestry;
- Circular economy;
- Buildings;
- Behaviour change and mobilisation.

Budgets

- € 973 million in 2022;
- 2 billion as part of France Relance (2021-2022).

Our missions:

- Amplify the deployment of the ecological transition;
- Contribute to collective expertise;
- Innovate and prepare for the future.

Human ressources

- 919 employees, including 383 in the regions;
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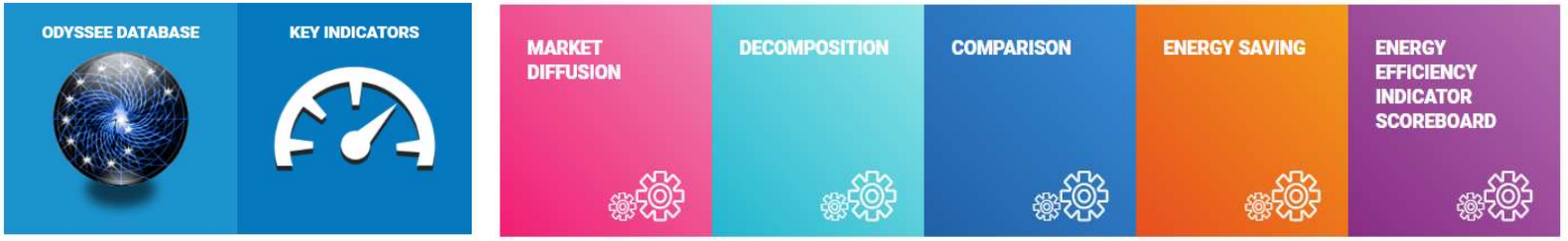
ODYSSEE-MURE 2022-2025 in brief

- **Programme** : LIFE-CET
- **Topic**: Towards an effective implementation of key legislation in the field of sustainable energy policy
- **Duration** : 30 months, starting October 1st 2022 and ending in March 31th 2025
- **Funding** : around 2 M€
- **40 partners of which 18 EnR members, 9 EnC (Energy Community countries), coordinated by ADEME, 30 letters of support including EnR club)**

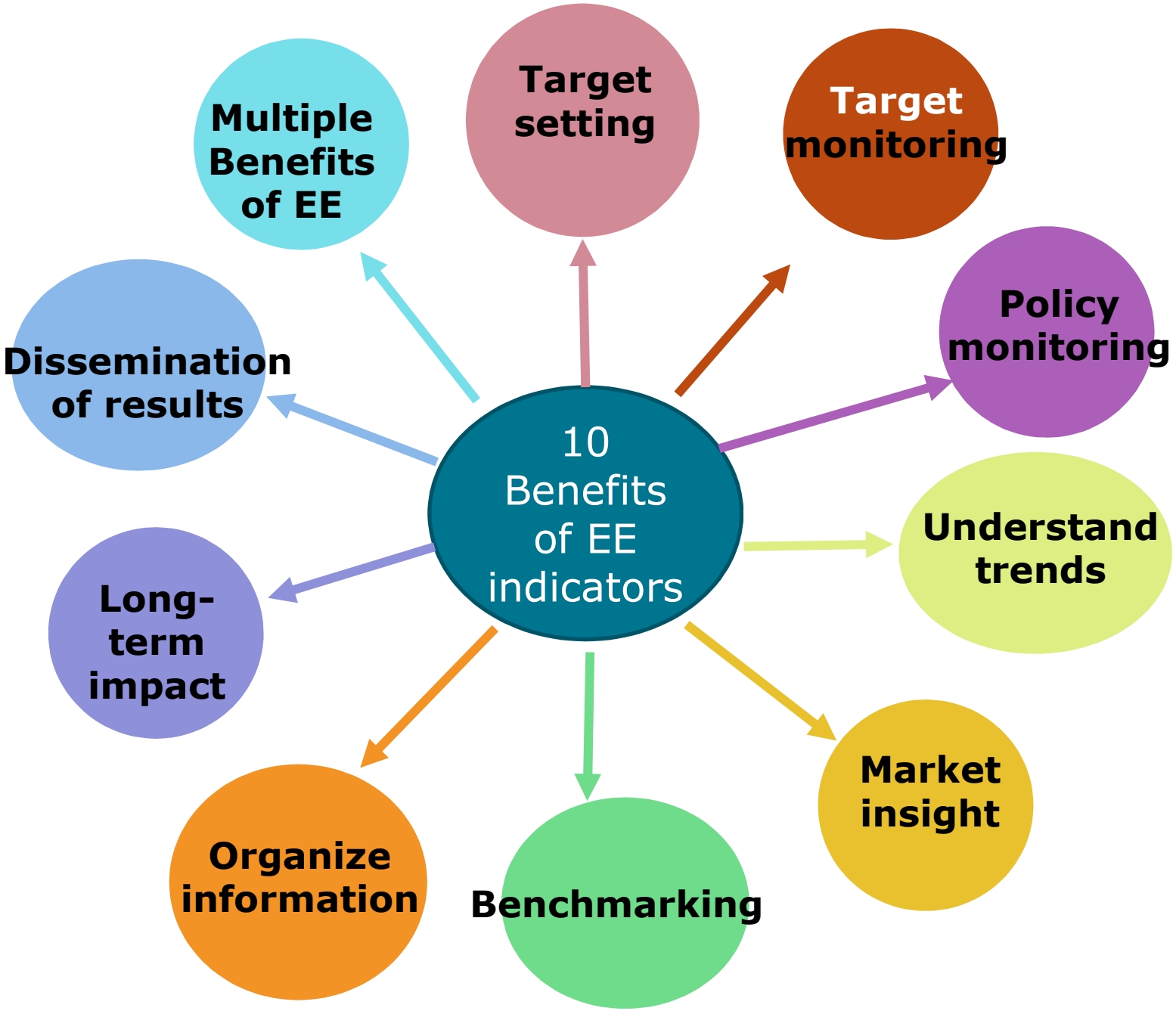
- Updates of ODYSSEE (3) and MURE databases (2) and facilities
- Support in capacity building for EC countries by Croatia and other partners
- Odyssee: New updating process, using more widely EUROSTAT data and horizontal sources
- Integration of a web-based Policy Assessment Tool Policy radar (based on Artificial Intelligence AI/Web scraping methods)
- Dissemination of the Odyssee-MURE Scoreboard: social media



Outline

- Some methodological aspects on Energy Efficiency Indicators (EEIs)
- Results at EU Level and countries
- Conclusions

Some methodological aspects


Multiple Benefits of EE
Target setting
Target monitoring
Dissemination of results
Policy monitoring
10 Benefits of EE indicators
Understand trends
Long-term impact
Organize information
Benchmarking
Market insight

Which types of evaluations do exist for assessing the impact of energy efficiency policies ?

	Ex-Ante	Ex-Post
Top-Down	Long term energy demand models (end-use and econometric models (Medpro, Threeme)	200 energy efficiency indicators at macro-sectoral levels (ODYSSEE
Bottom-up	Deemed savings : 300 sheets for EE Obligation MURE Data base (2500 national energy efficiency policies	See MURE data base (around 1/3 of the P&Ms have impact evaluation)

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The different Energy Efficiency indicators

Type	Level
1. Energy intensity	Final, by sector
2. Adjusted energy intensity	Final
3. Specific energy consumption	By modes and vehicles types
4. Specific energy consumption benchmark	Cars
5. Energy efficiency indices (ODEX, MEDEX)	By modes and vehicles types
6. Energy savings	By modes and vehicles types
7. Diffusion indicators	Ex: efficient cars
8. Intensity CO_2	By sector
9. Specific CO_2	By modes and vehicles type

Monitoring policies with EEI: why so many indicators are needed?

For a given sector or end-use several indicators can be considered, for different reasons:

- Energy efficiency has different meaning and frontiers (economic versus technical efficiency).

- EE P&Ms are designed and implemented at the level of end-use and equipment (e.g. labels or standards on lighting, cooling), or modes (e.g. voluntary agreements, audits). Therefore, the monitoring of each P&M requires detailed indicators (e.g. gCO_2 per km for car (Bonus-malus)).

- Interpretation of indicators is more powerful when combined; for instance, comparing trend in l/100 km and goe/pkm will show the impact of the change in occupancy rate (car pooling).

- Alternative indicators are often necessary to cope with possible data gaps.(Toe/equivalent car)

Data and indicators: transport

- Stock and sales of vehicules by type and fuel
- Average distance per vehicle
- Passenger and goods traffic in pass-km & ton-km
- Energy consumption by mode and by type of road vehicles
- Specific consumption by vehicle (average, new)

Data

INDICATORS

- Energy consumption per capita;
- Intensity;
- Energy cons. of road transport per vehicle;
- Unit consumption per car equivalent;
- Unit consumption per vehicle;
- Consumption per unit of traffic;
- Mobility in public transport per capita;
- Share of public transport for passengers;
- Share of non-road for goods.

Basic transport sector indicators

Indicators	Comments
Transport energy consumption per capita	Highly aggregated; includes variation in equipment rates
Energy consumption per unit of GDP: energy intensity of transport	Highly aggregated; measures the relative change between consumption and GDP
Road transport energy consumption per vehicle	Includes variation in the composition of the vehicle fleet
Transport fuel consumption per petrol vehicle	Includes variation in the composition of the vehicle fleet
Transport diesel consumption per diesel vehicle	Includes variation in the composition of the vehicle fleet
Energy consumption of road transport per car equivalent	Indicator cleaned of variations in the composition of the ODYSSEE fleet

Specific consumption indicators by mode

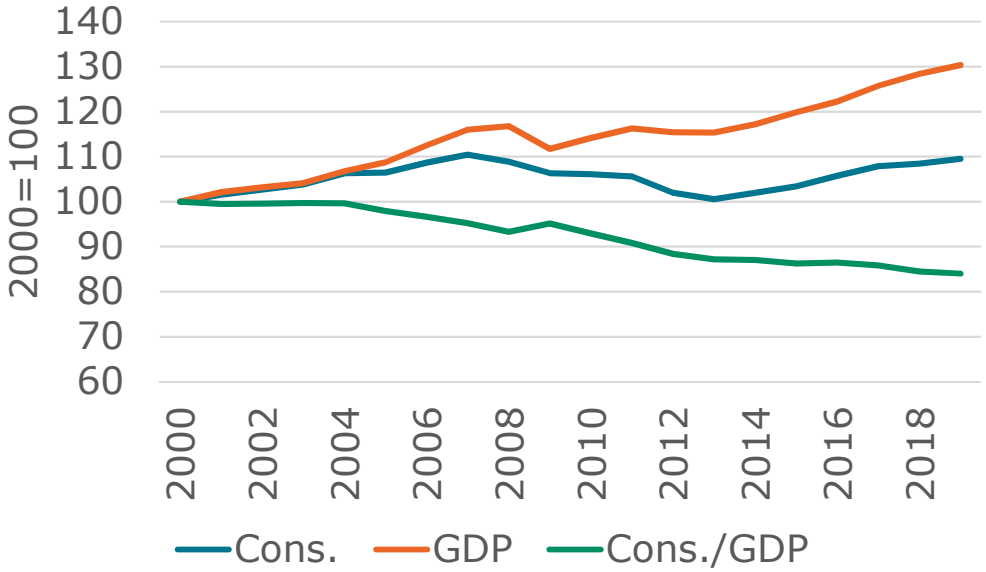
Indicators	Type
Energy consumption of air or rail transport per unit of traffic (passenger-km or tonne-km)	CS
Litres/100 km for road vehicles	CS
Litres/100 km for new road vehicles	CS
Share of efficient vehicles in new vehicles	
Energy consumption for passenger transport per traffic unit (cars, buses, rail)	CS
Energy consumption per road vehicle (toe/car, toe/truck, toe/van, toe/bus)	CS
Energy consumption of road freight transport per tonne-km	CS
Share of public transport for passengers Share of rail & waterways for goods	

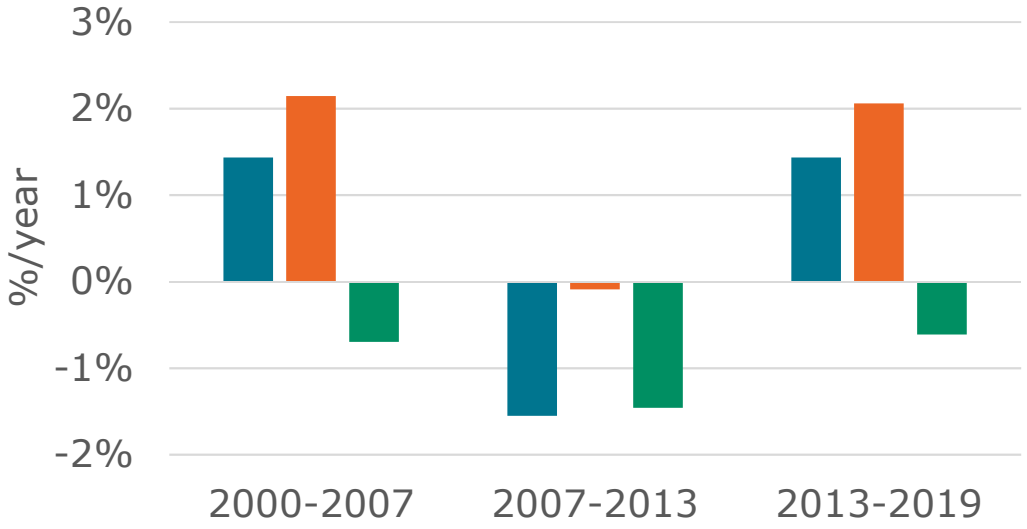
CS: Specific energy consumption

Results

Transport consumption trends in the EU
Energy efficiency trends

Transport energy consumption and GDP in EU27



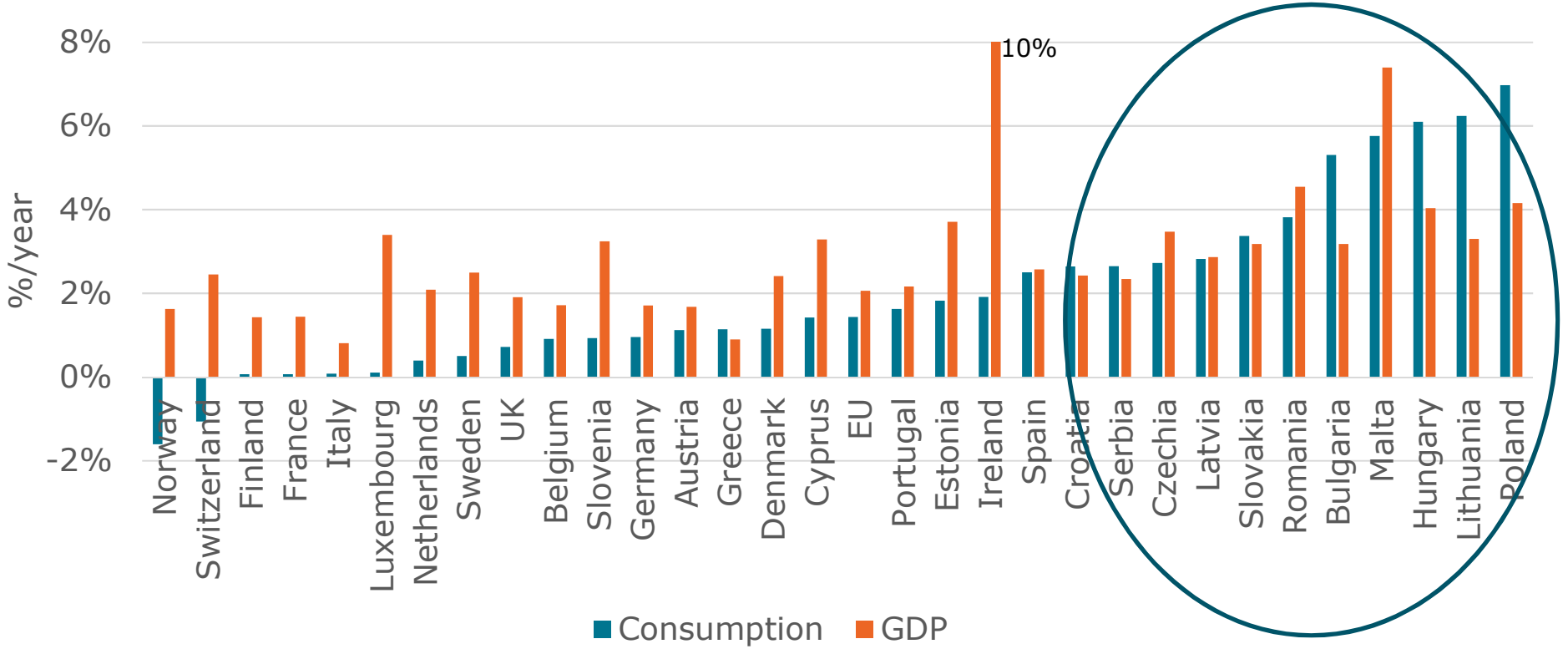


- Increasing consumption since 2013 (1.4%/yr), following the return to economic growth, back to the trend before the financial crisis.
- This follows a significant decrease of 1.6%/yr over 2007-2013.
- Since 2013, transport energy consumption increases 0.7 times less rapidly than GDP, (almost as before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

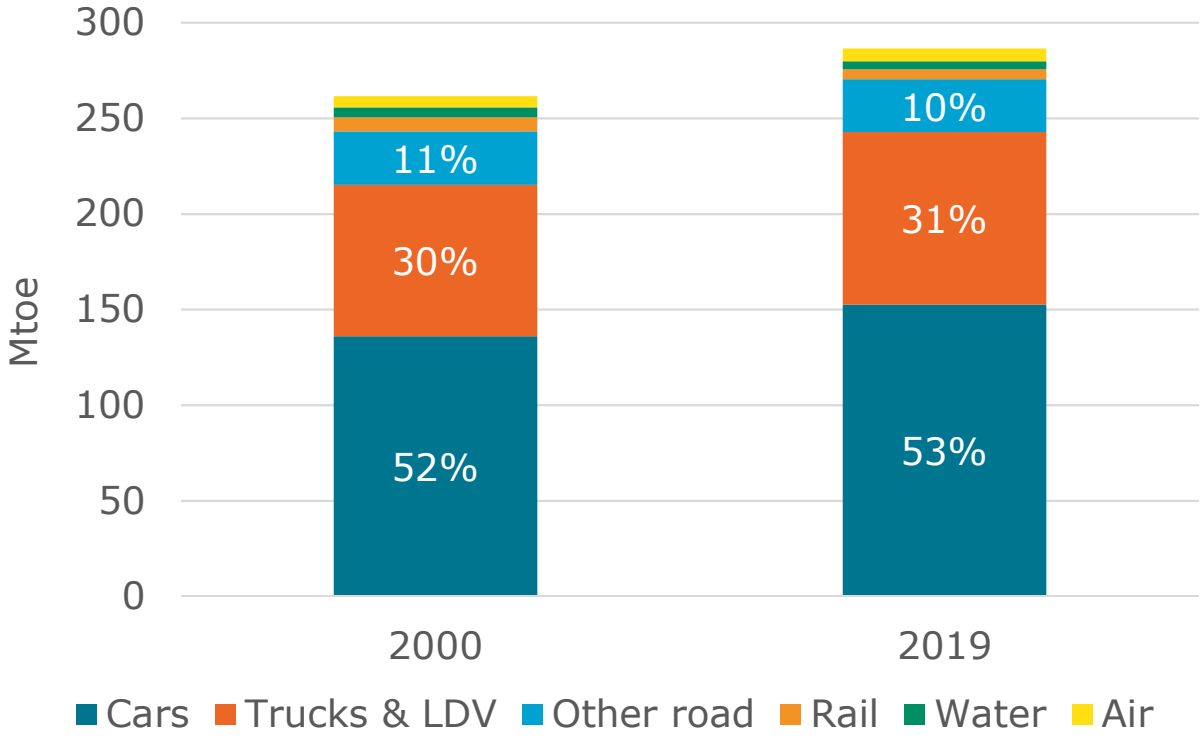
- Since 2013, transport consumption remained stable in 4 EU countries and decreased in Norway and Switzerland despite a sustained economic growth (~2%/year).
- It increased much less rapidly than GDP in 15 other EU countries.
- In 4 eastern European countries, transport consumption has grown almost twice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

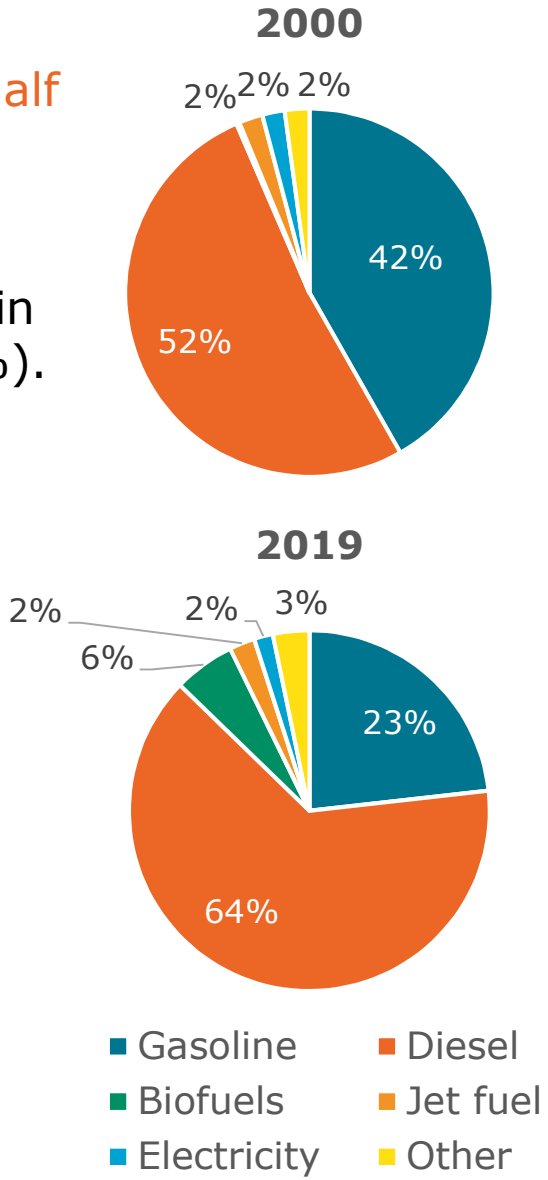


Source: ODYSSEE; 2013-2019

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%).

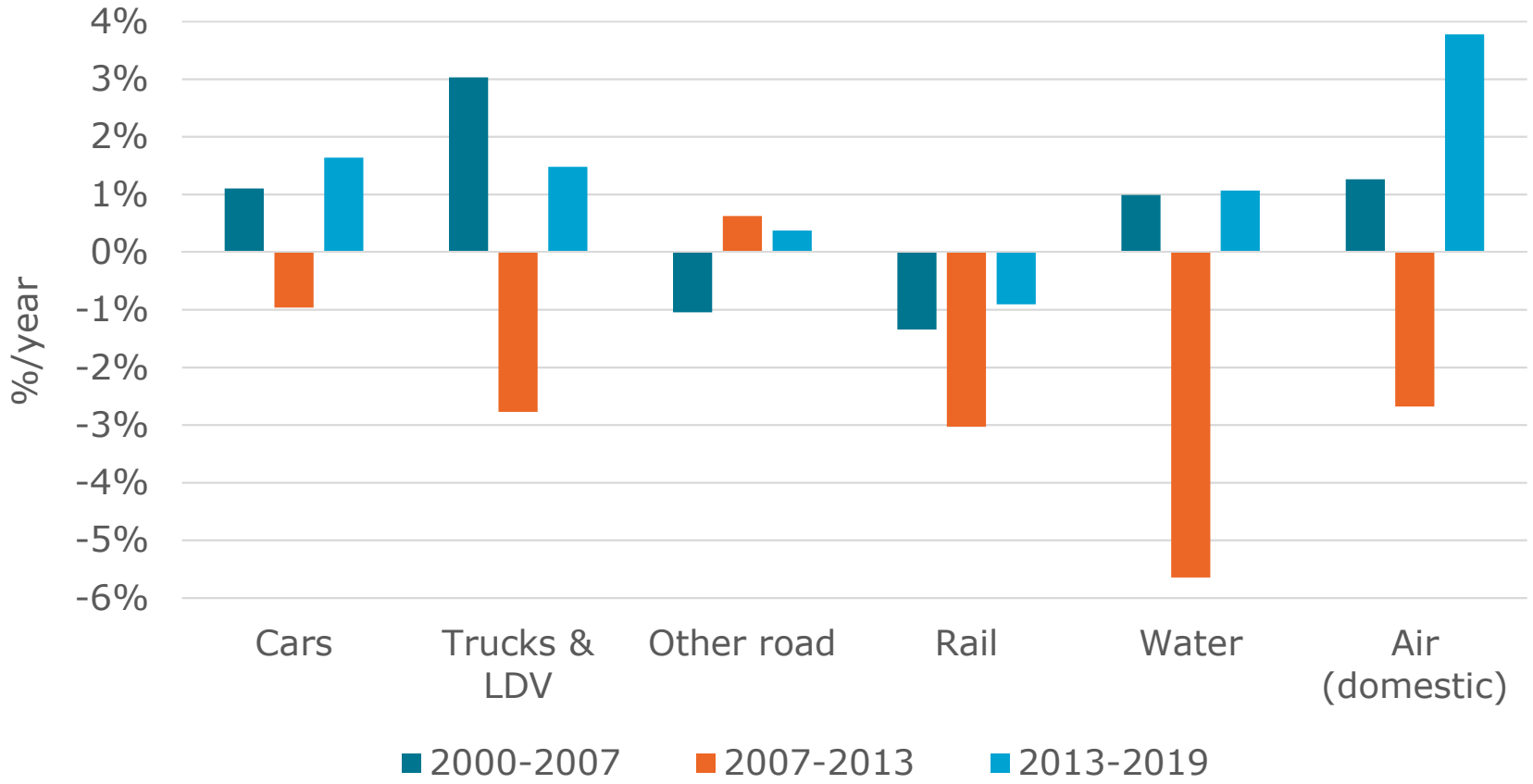




Source: ODYSSEE
Data on alternative fuel cars: https://www.indicators.odyssee-mure.eu/market-diffusion.html

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).



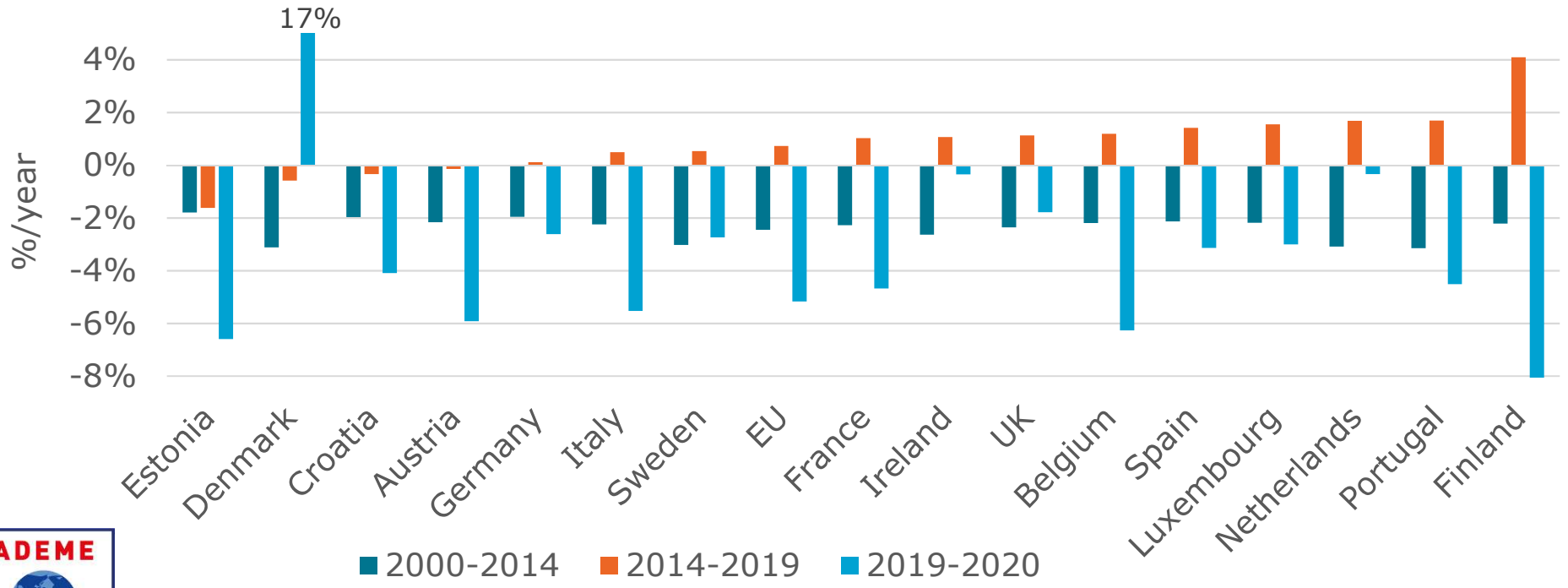
Source: ODYSSEE

Energy efficiency trends

Energy efficiency of new thermal cars improved in 2020

- The specific consumption of new diesel and gasoline cars has decreased again in 2020 in most countries, and quite significantly in some of them.
- This marked a net reversal of the trend 2014-2019, when this specific consumption increased in most countries and at EU level, 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%).

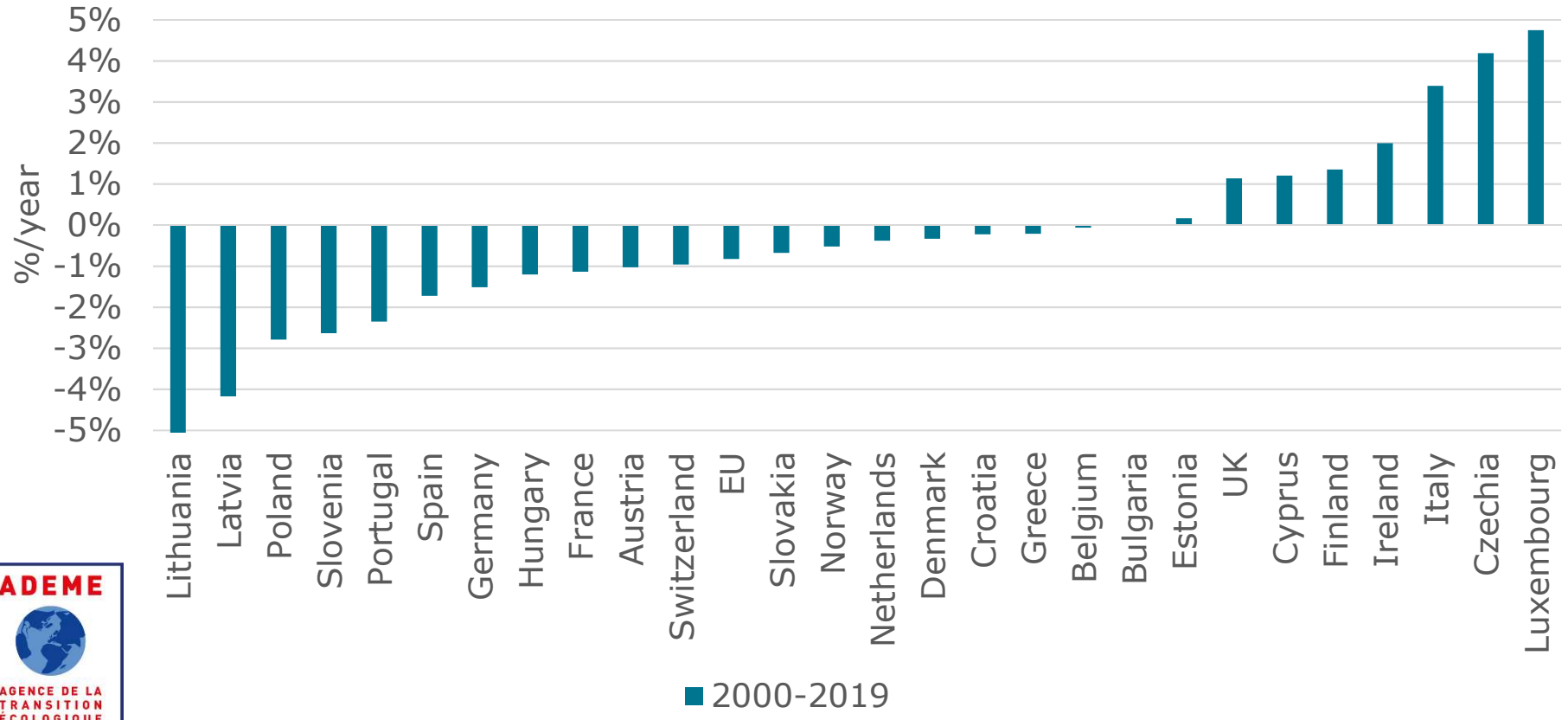
Test-cycle values for diesel and gasoline cars* (l/100 km)



**Source: ODYSSEE from EEA data corresponding to* NEDC cycles to avoid a break in time seri*; only countries with data since 2000 are shown.*

Energy efficiency of road freight transport (goe/tkm)

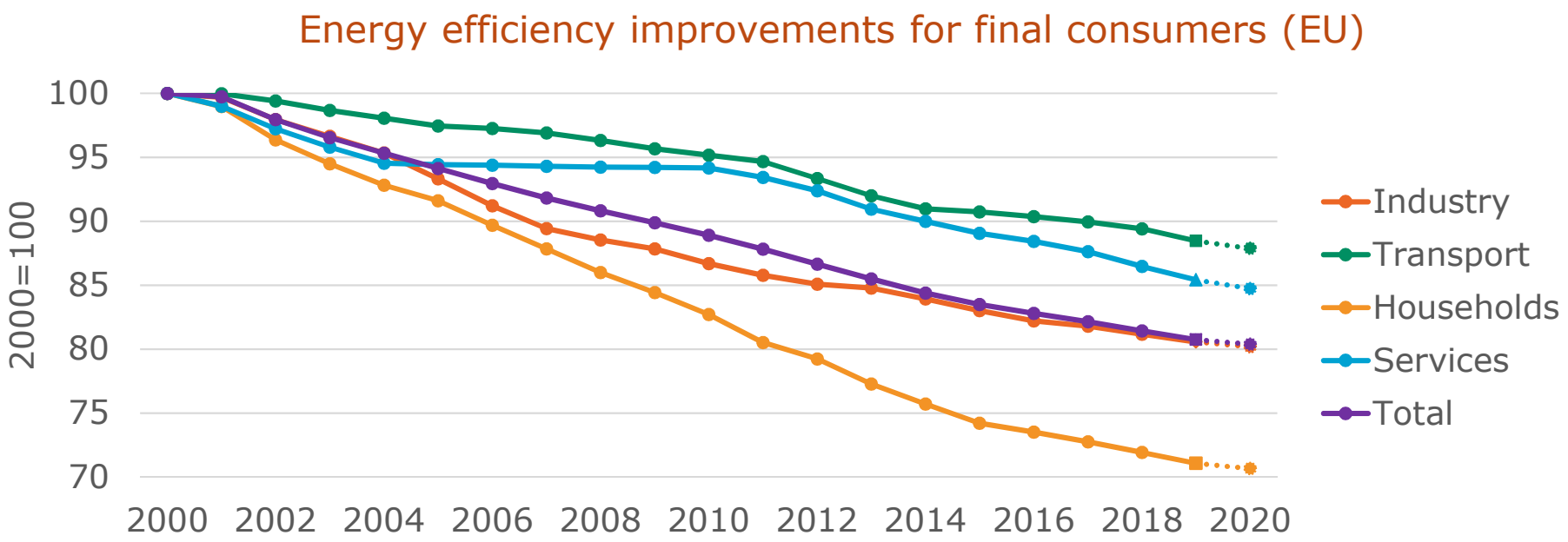
- In most countries the unit consumption of road freight transport (including trucks and light duty vehicles) has decreased since 2000, reflecting energy efficiency improvements.
- It has however increased in 7 countries.



Source: ODYSSEE

Energy efficiency slowed down again in 2020 according to preliminary estimates

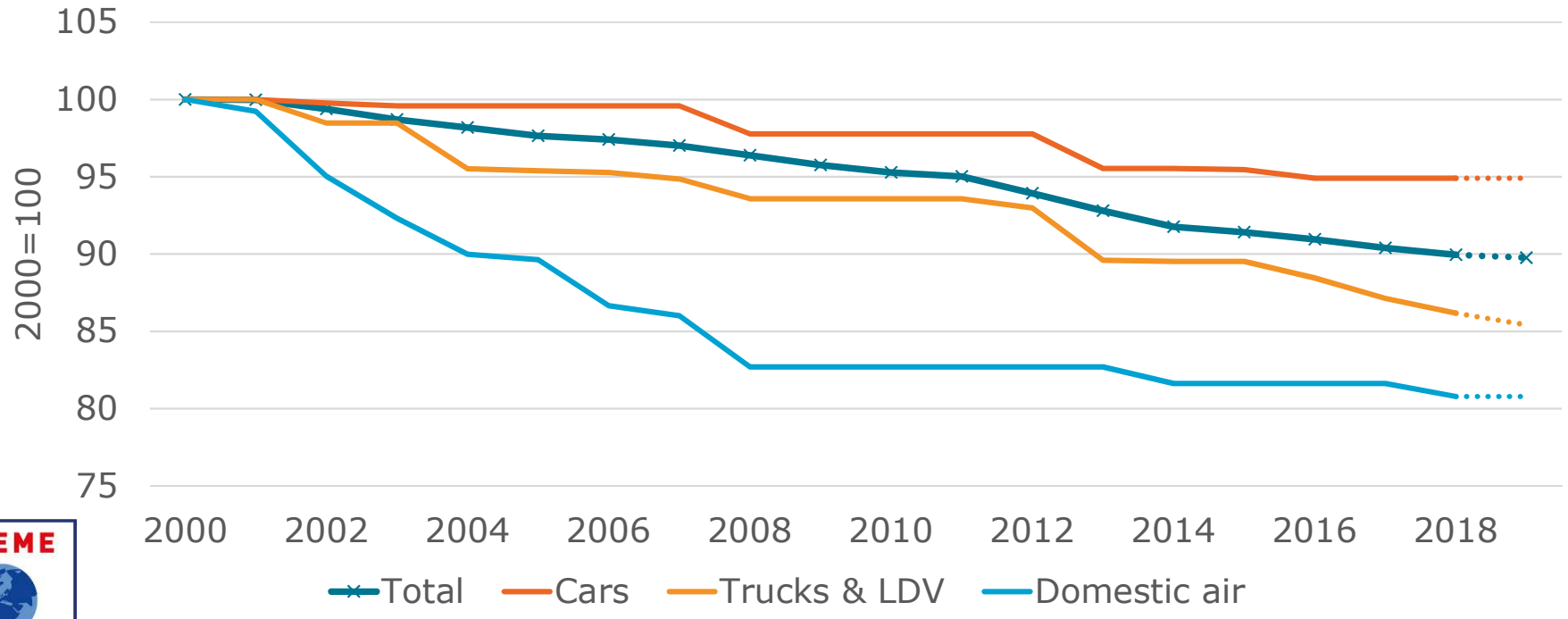
Efficiency of final consumers increased by around 0.5% in 2020 (compared to 0.7%/yr over 2014-2019), of which 0.4% for industry and 0.6% for households and transport.



Source: Enerdata preliminary estimates based on "Early estimates" from ODYSSEE (https://www.odyssee-mure.eu/private/methodology-efficiency-estimates.pdf)

Energy efficiency trends in transport in the EU27

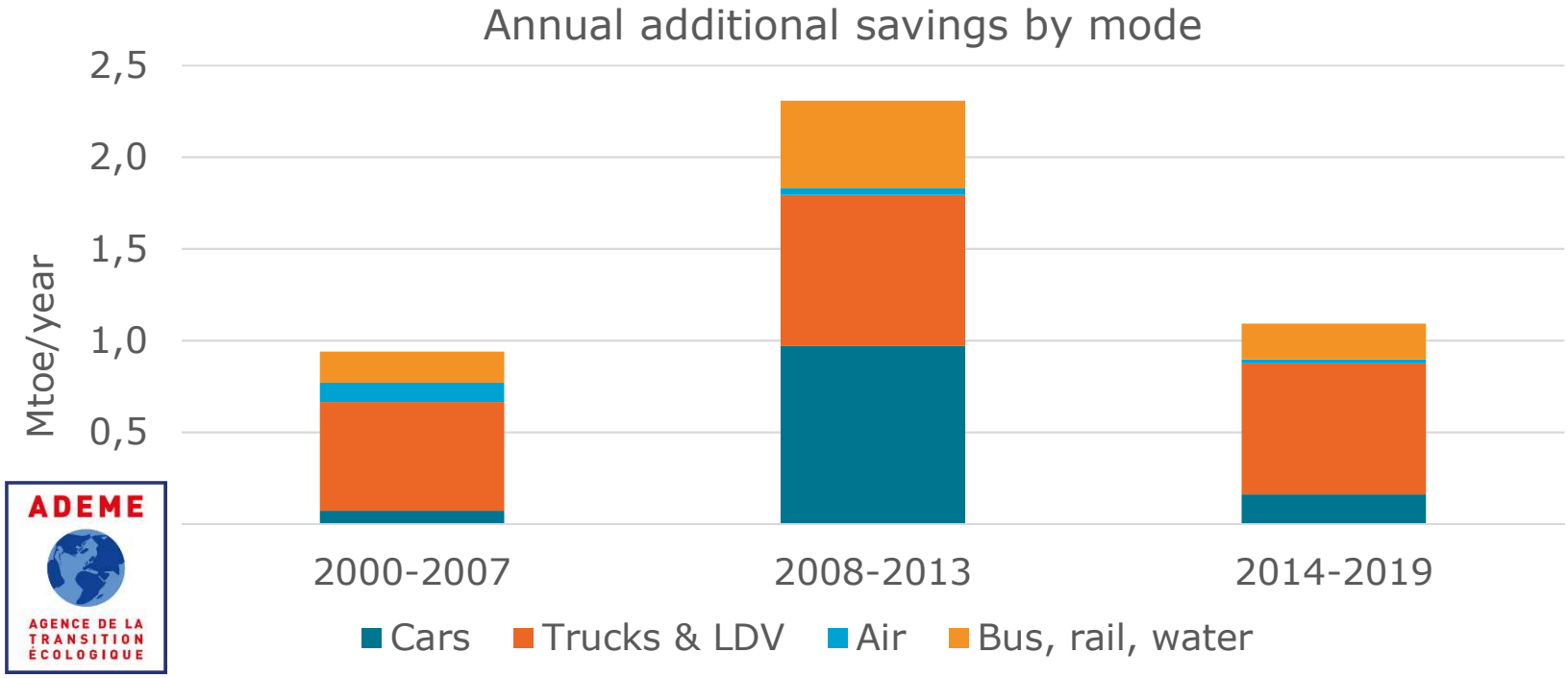
- The energy efficiency of transport improved by 0.6%/year in the EU since 2000 (10% compared to 2000 level).
- Greater progress was achieved for domestic air transport.
- Energy efficiency progress had stopped for trucks and light vehicles between 2008 and 2012 due to a less efficient operation of trucks (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

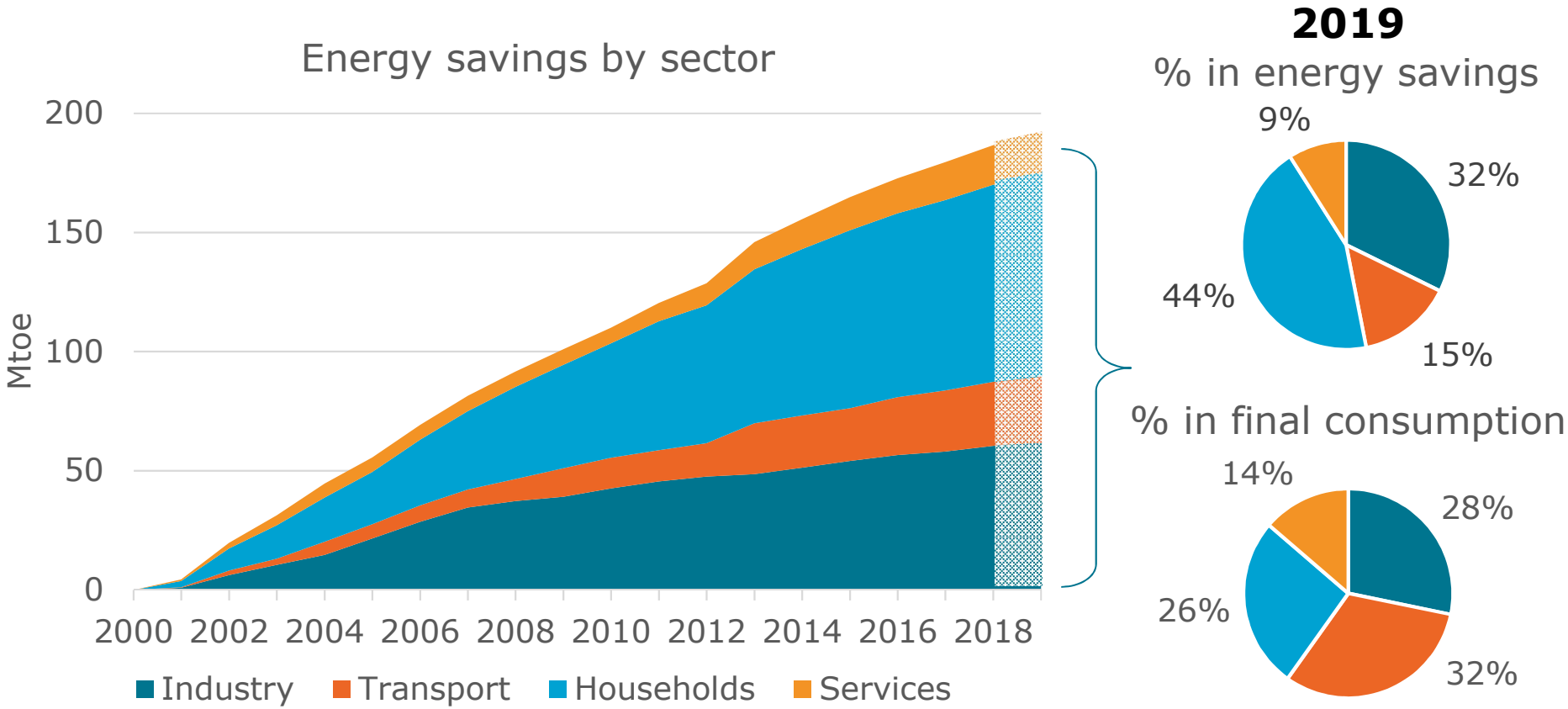
- Energy efficiency progress has saved every year since 2000 an additional volume of around 1.5 Mtoe. Over 2008-2013, annual savings reached 2.3 Mtoe/yr, twice more than since 2014.
- Cumulated since 2000, these savings reached 28 Mtoe in 2019 (i.e. 10% of transport consumption): without these savings, 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 improvments

- 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.

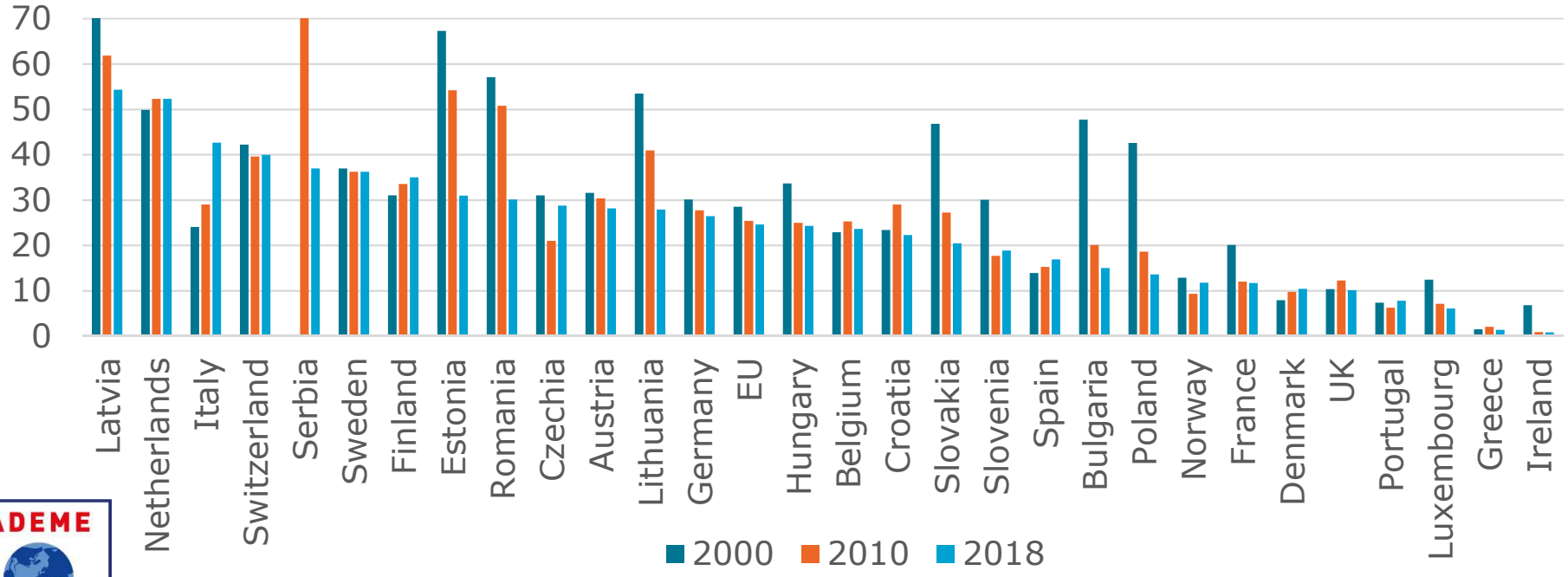


Source: ODYSSEE

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).

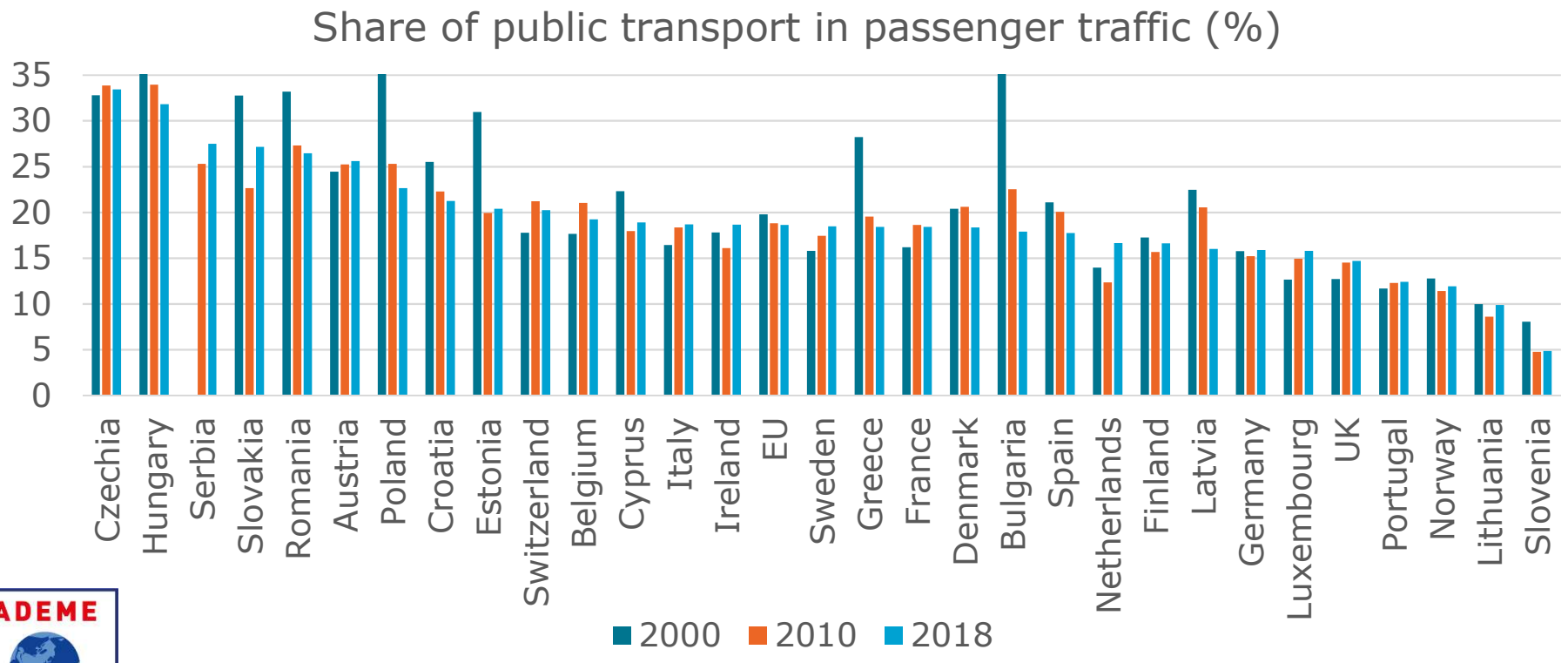
Share of rail and inland waterways in freight traffic (%)



Source: ODYSSEE, Enerdata

Modal shift - Passenger

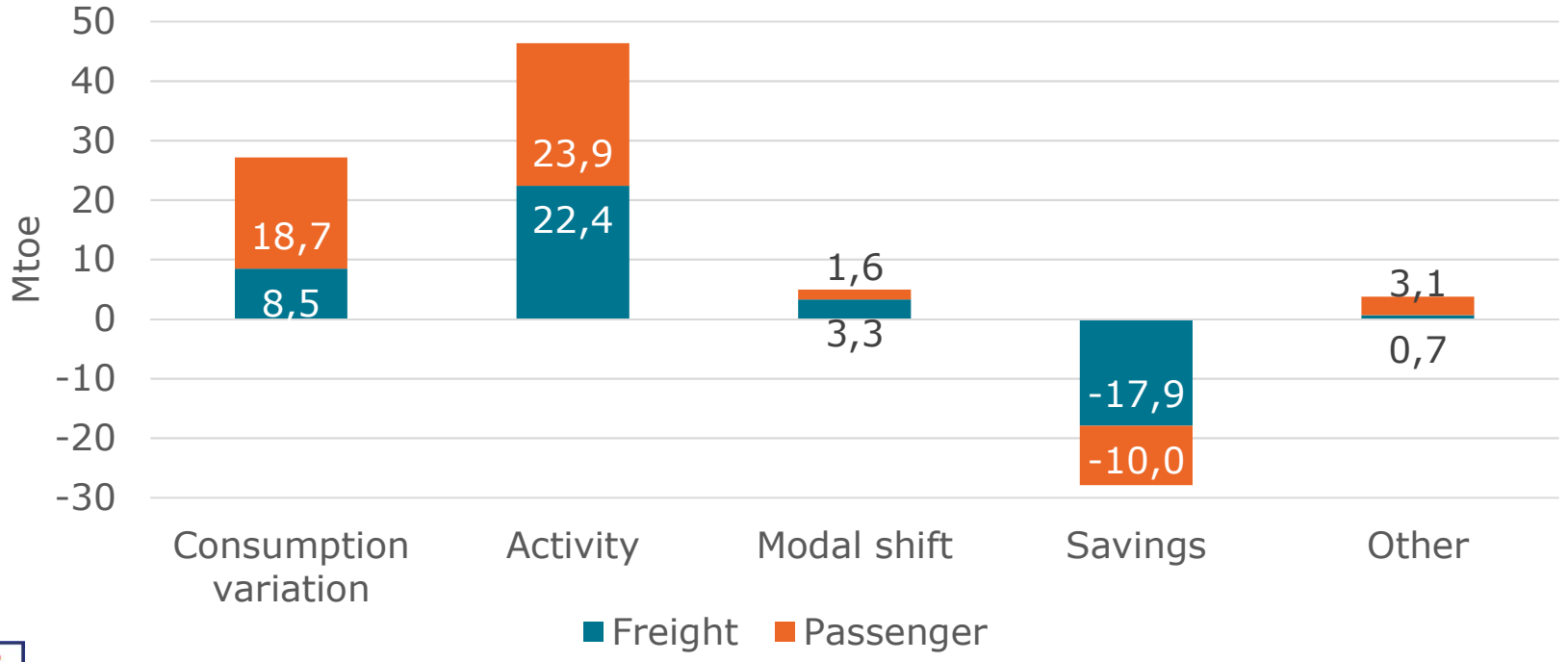
- For most countries, no significant shift to public transport since 2010. At EU level: stable share since 2010 and -1% pt before.
- Slovakia and the Netherlands increased the most the share of public transport since 2010 (+4.5 pts).
- Czech Rep and Hungary have the highest share of public transport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



Source: ODYSSEE-MURE, Enerdata

Drivers of transport consumption variation 2000-2019

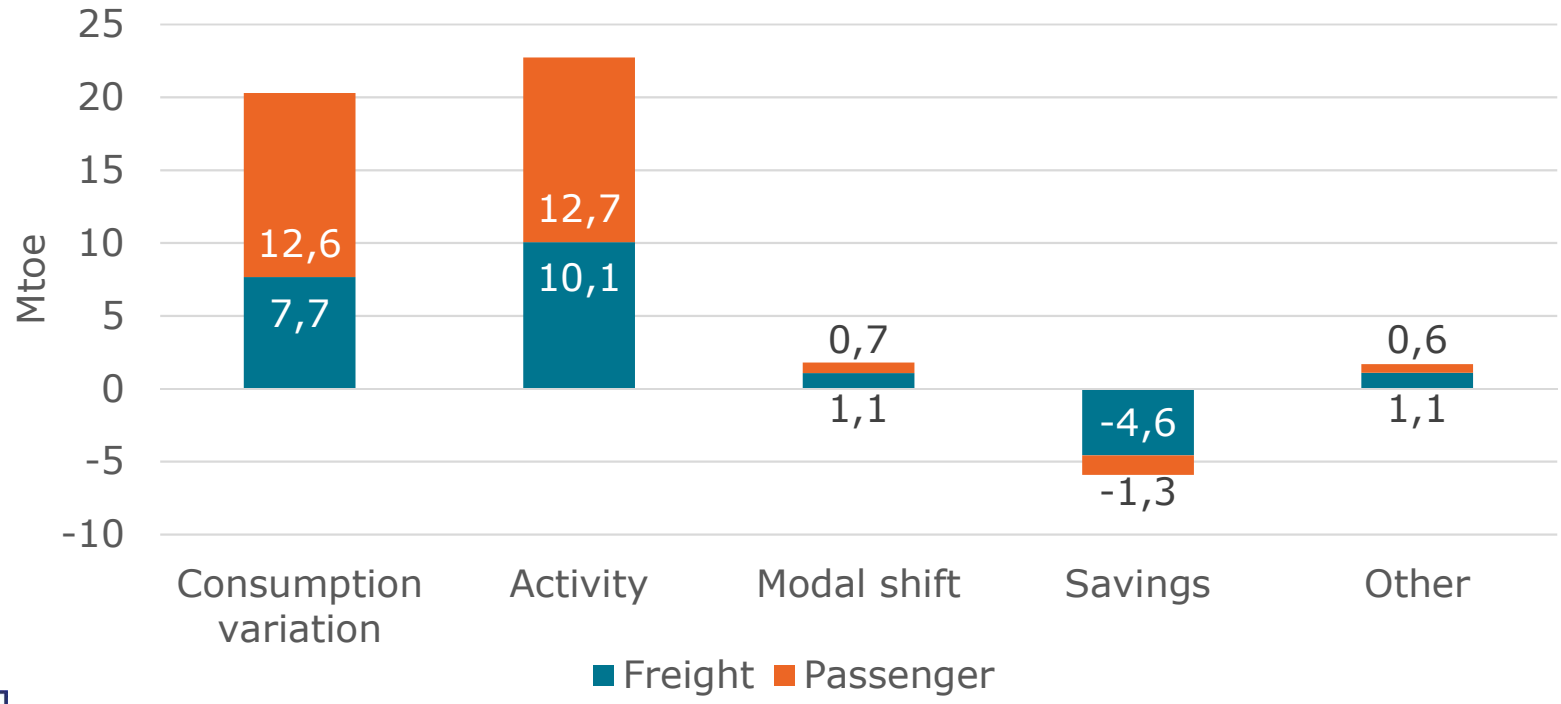
- Between 2000 and 2019, the increase in traffic ("activity") contributed to raise transport consumption by around 46 Mtoe.
- The increasing share of trucks in freight traffic and to a lower extent of cars in passenger traffic (modal shift) also contributed to raise consumption (5 Mtoe).
- Energy savings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



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

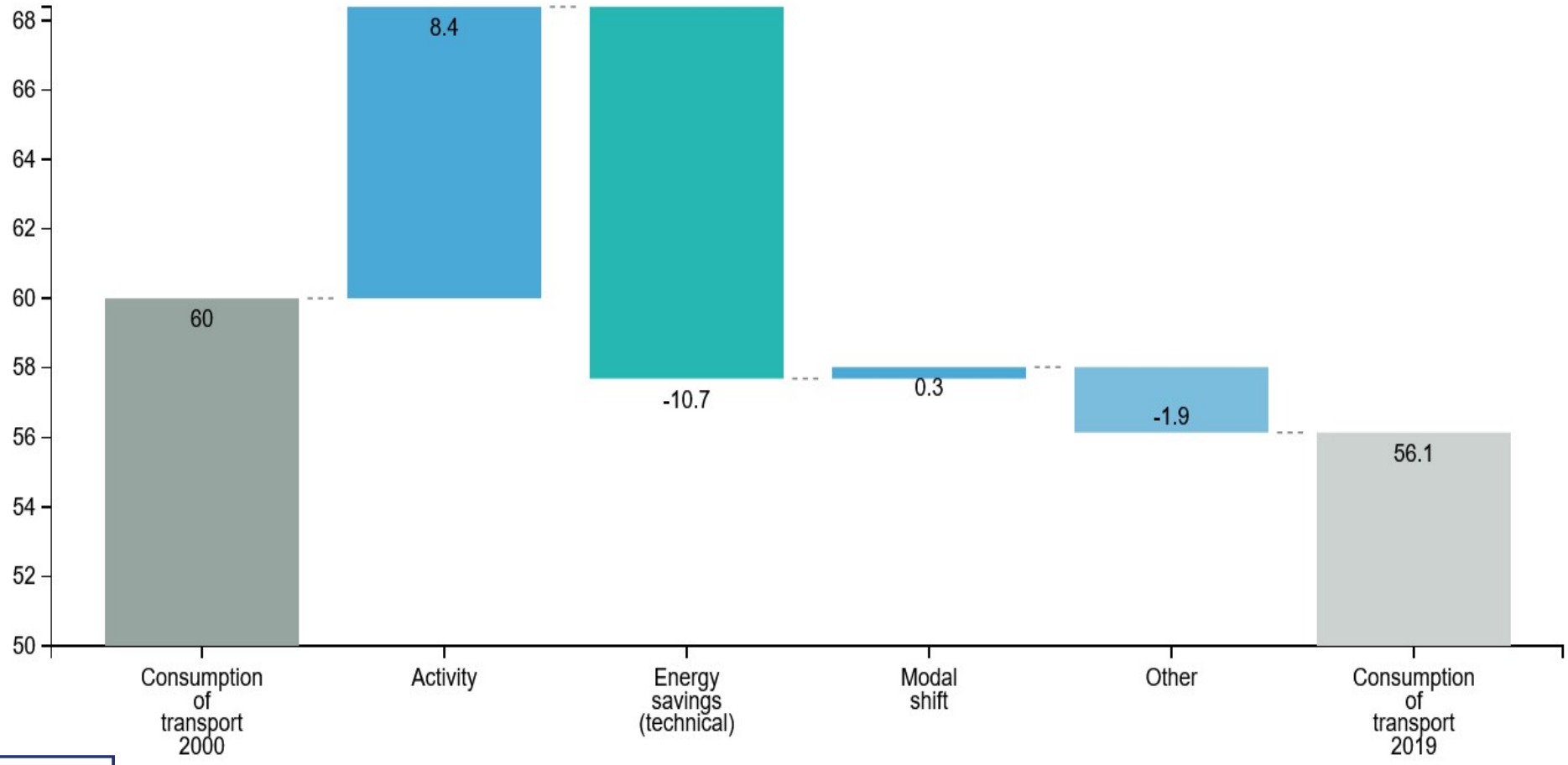
Drivers of transport consumption variation 2014-2019

- 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.



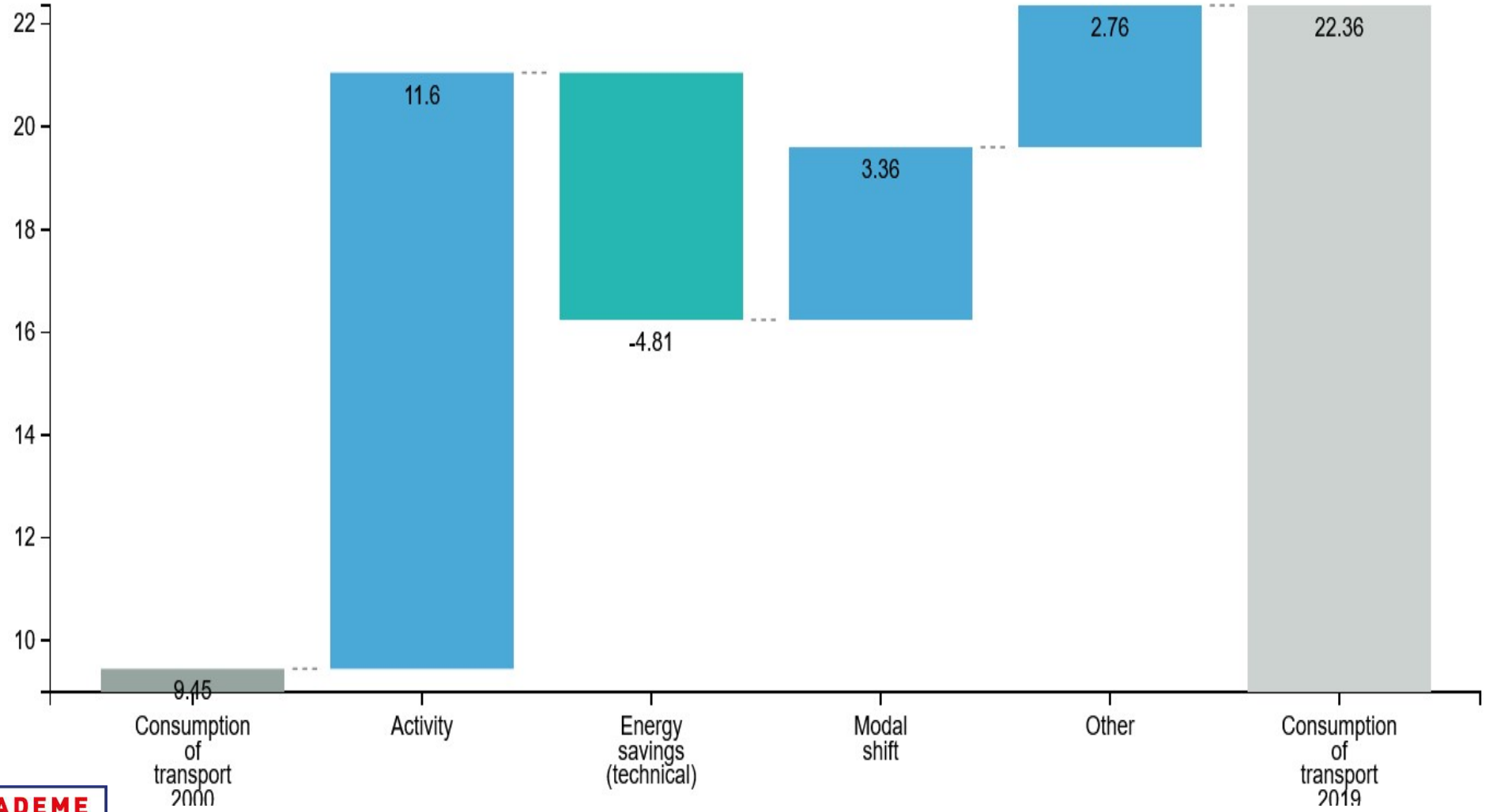
Source: ODYSSEE Decomposition tool (https://www.indicators.odyssee-mure.eu/decomposition.html)

Drivers of transport consumption for Germany variation (2014-2019)



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

Drivers of transport consumption for Poland (2000-2019)



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

Conclusions

Disapointing 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.

Thank you for your attention

For more information

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Annexes

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.

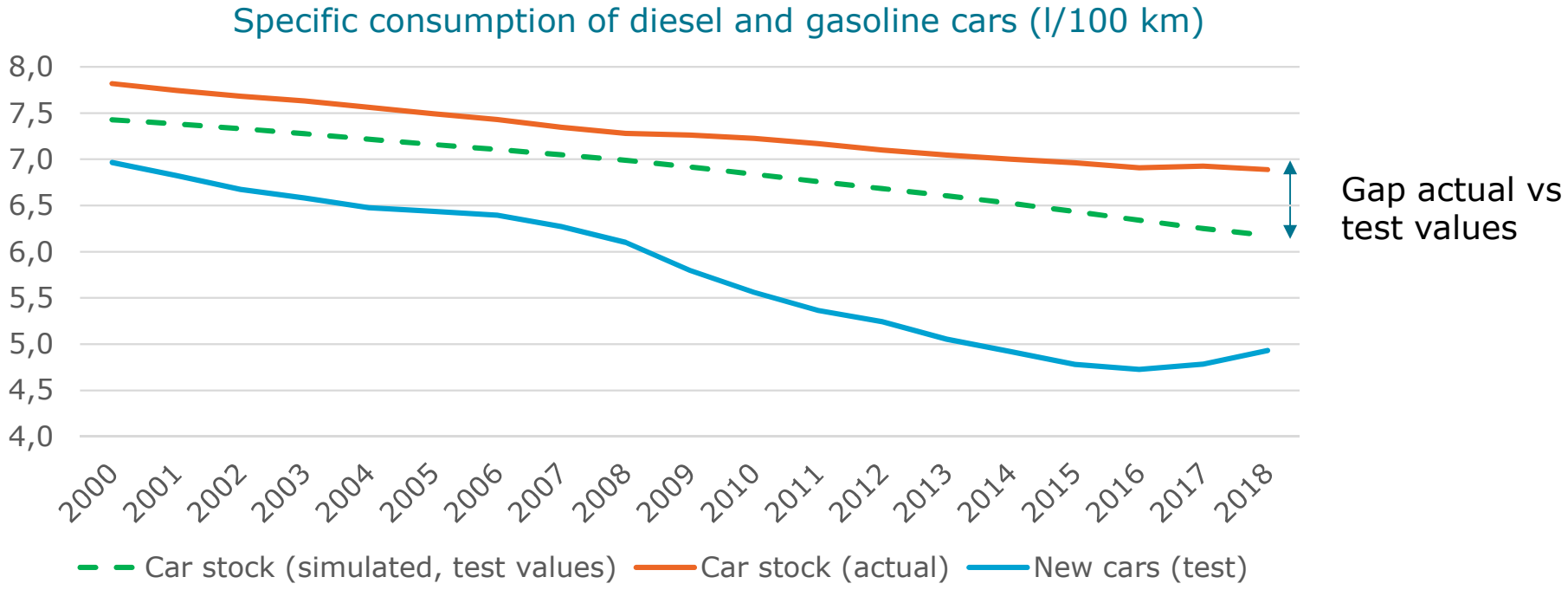
- ODEX is calculated on the basis of 8 modes of transport*.

- 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

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

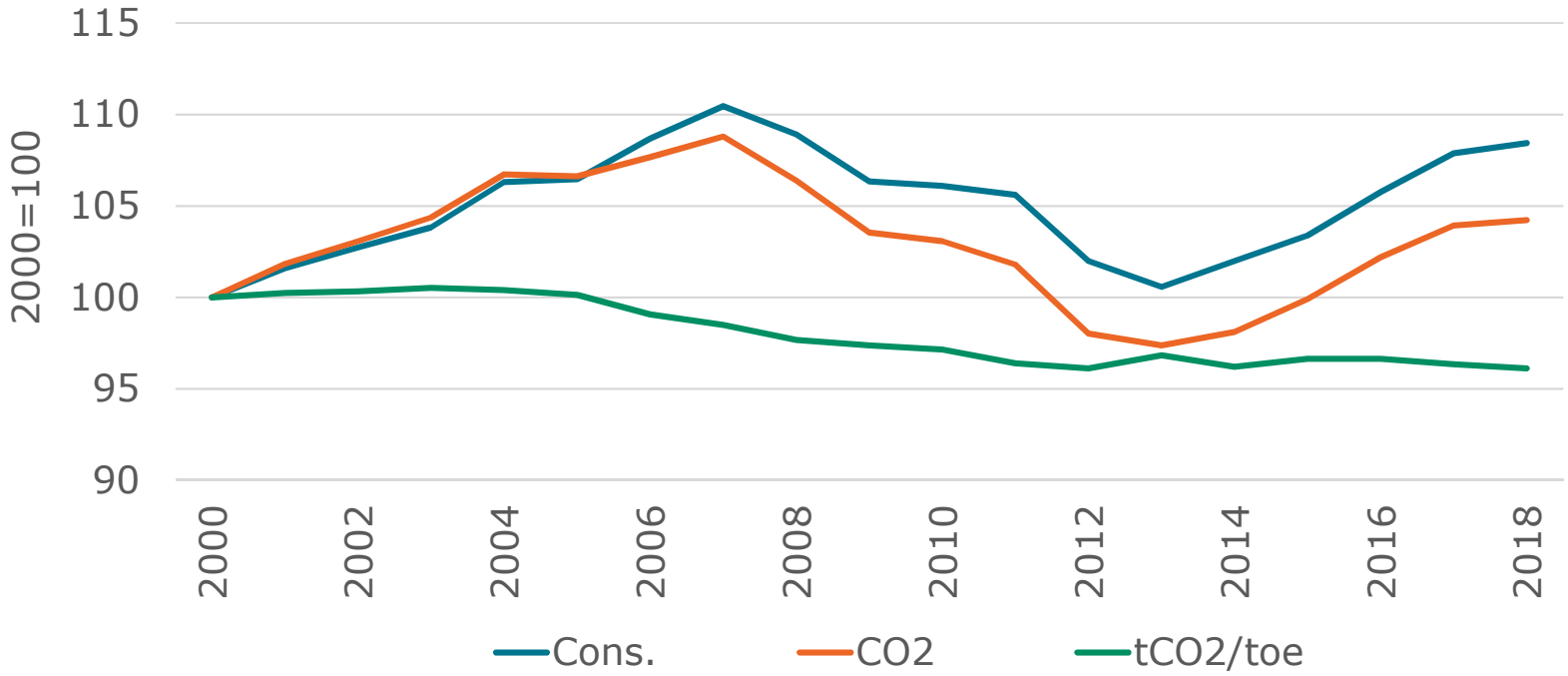
- The actual specific consumption of the stock of cars follows with a lag the trend of new cars: since 2014, they continue decreasing, i.e. a trend quite different as for new cars.
- Actual values reflect actual driving conditions, compared to test values for new cars: a simulation of the test value 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.



Source: ODYSSEE from EEA data

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.

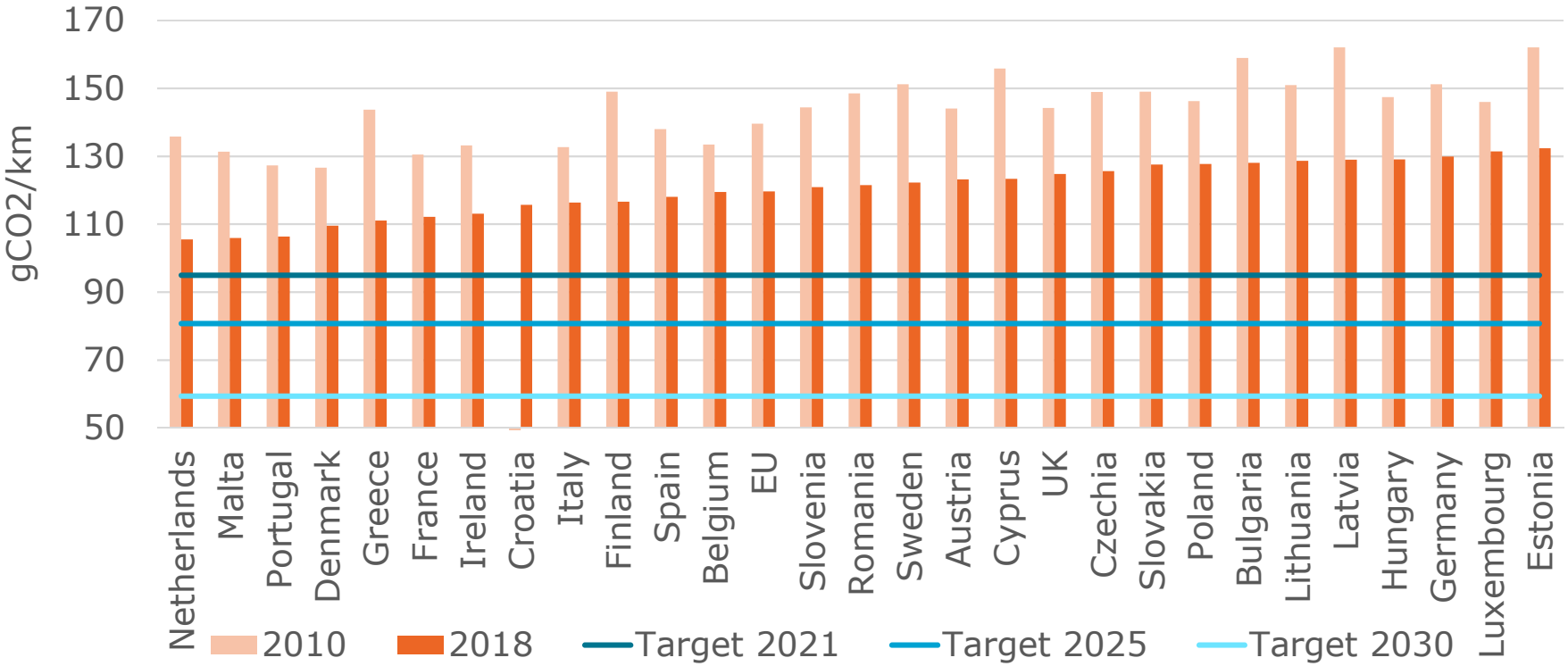


Only direct CO2 emissions, which do not include emissions due to electricity supply to electric vehicles

Source: ODYSSEE

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*