Co-funded by the Horizon 2020 programme of the European Union

ODYSSEE-MURE

Second meeting of the project *"ODYSSEE-MURE, Monitoring EU Energy Efficiency First Principle and Policy Implementation"*
November 12th 2020, Visio Conference

Energy efficiency trends in the EU

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Enerdata intelligence + consulting

Outline

- Energy consumption trends
- Energy efficiency trends
- Conclusions

- *Sources of data for the EU:*
  - ✓ *2000-2018: Eurostat when available, if not sum of countries or average of representative countries based on national data from ODYSSEE data base.*
  - ✓ *2019: Enerdata estimates for final energy consumption and "early estimates" for key indicators produced from ODYSSEE (https://www.odyssee-mure.eu/private/methodology-early-estimates.pdf)*
- *EU includes UK.*
- *International air transport excluded from energy consumption data and indicators.*

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Energy consumption trends

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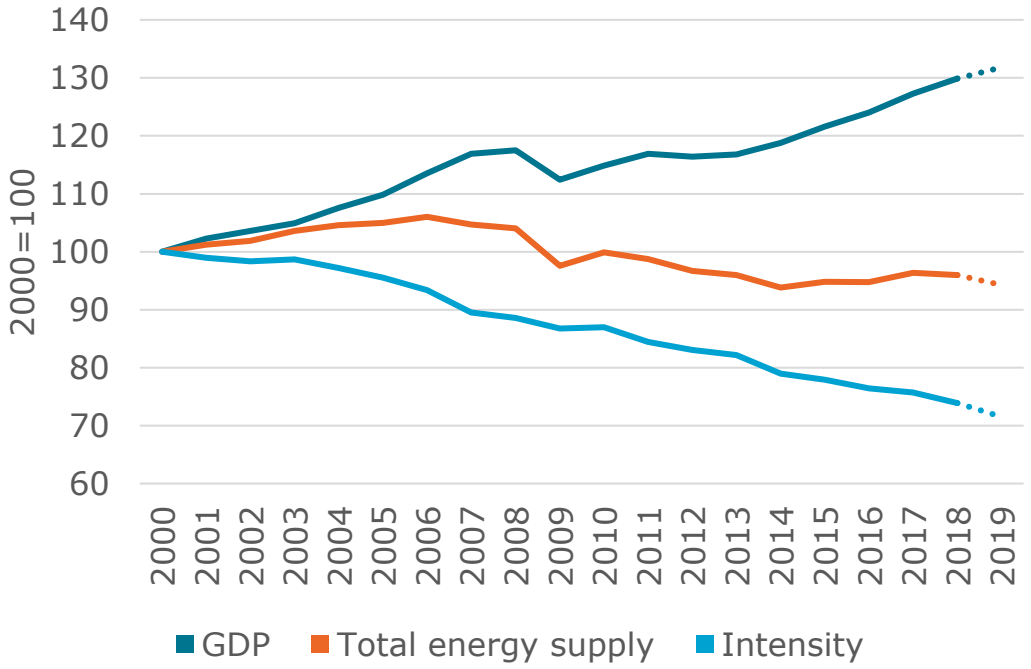
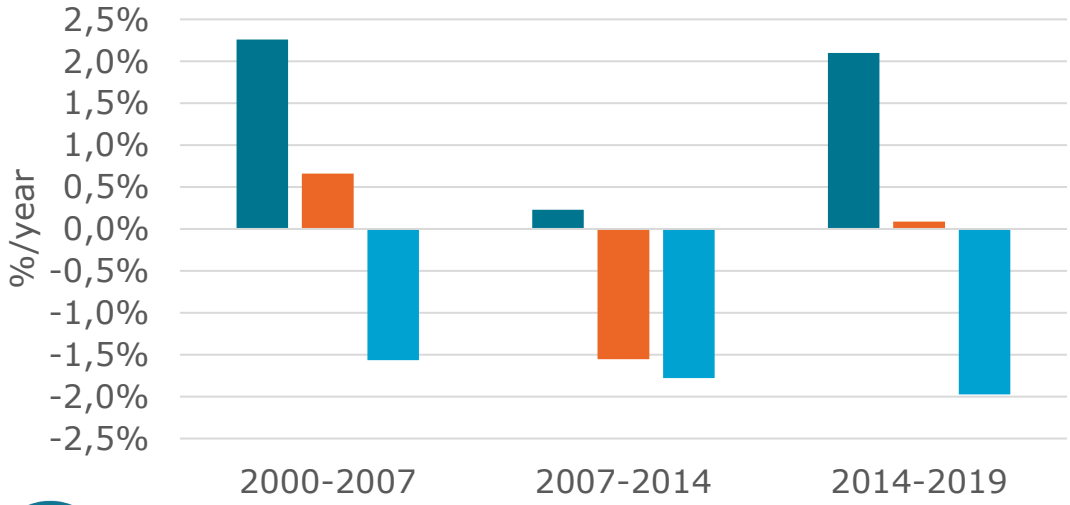
Total energy supply and intensity VS GDP





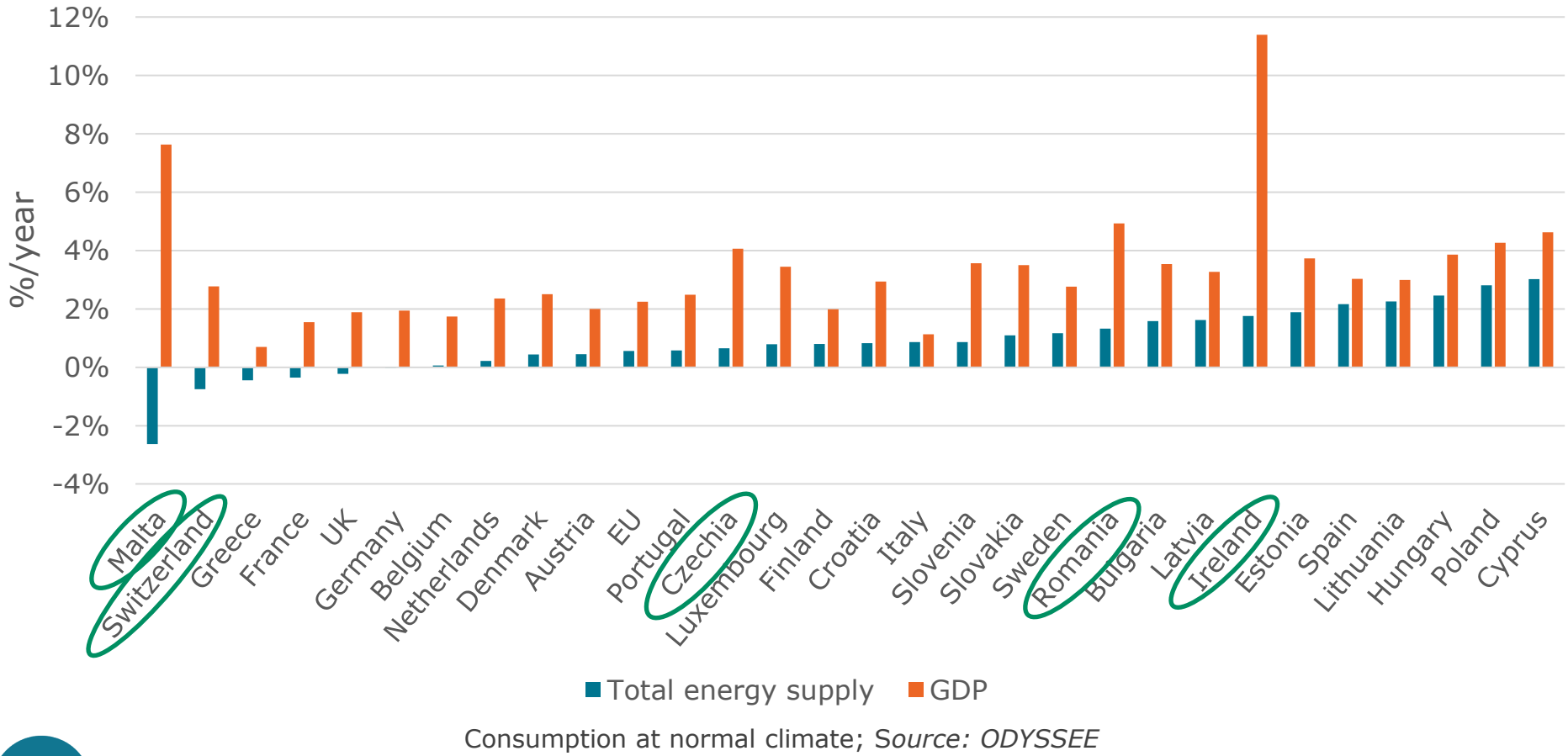
- Relative stability of EU total energy supply since 2014, although GDP increased by 2%/year with the return to economic growth.
- This follows a significant decrease of 1.6%/year between 2007 and 2014 due to the financial crisis of 2009.
- More rapid decrease of the primary energy intensity since 2014 (~2%/year), slightly faster than over 2000-2007 (+0.4 pt) and 2007-2014 (+0.2 pt)

Consumption and intensity at normal climate

Source: ODYSSEE : Eurostat until 2018; Enerdata estimates for 2019

Total energy supply and GDP trends over 2014-2018

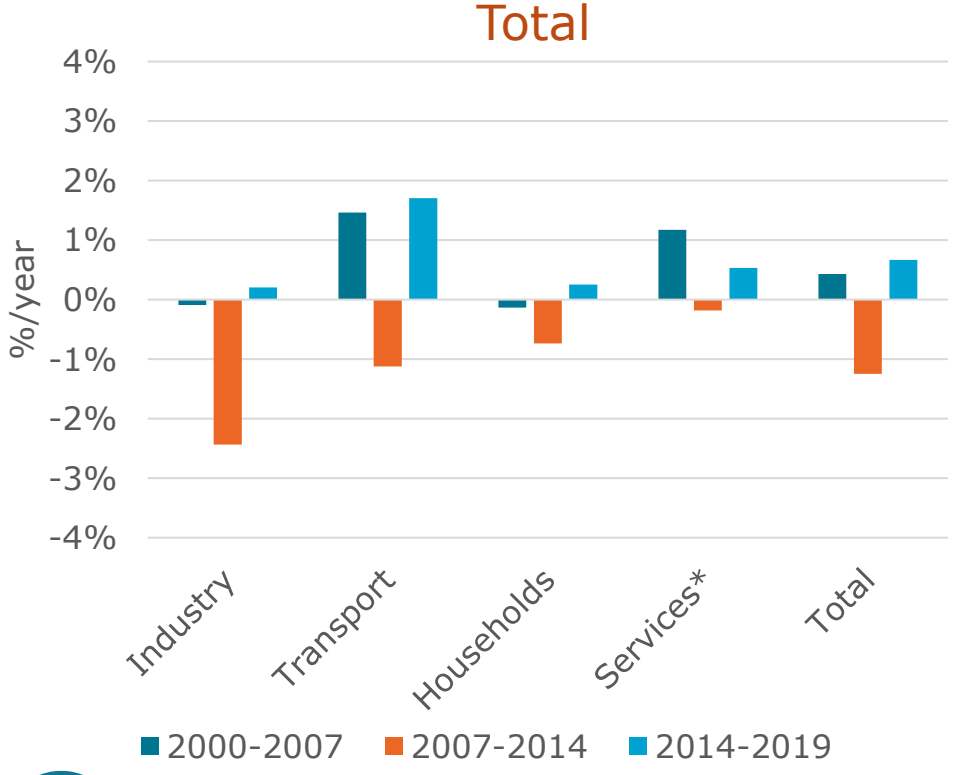
- Since 2014, decreasing total energy supply in 6 countries and low consumption growth below the EU average in 4 other countries.
- Everywhere the consumption is progressing much slower than the GDP, implying a decreasing energy intensity, especially significant in Ireland, Malta, Romania, Switzerland and Czechia (more than 3%/year decrease).

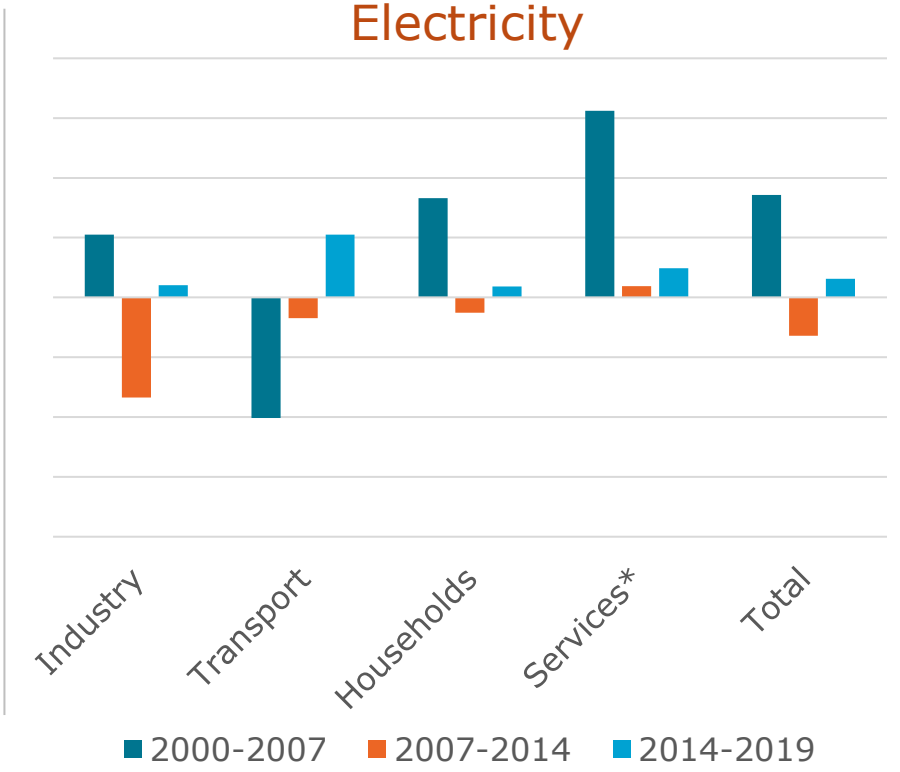


Consumption at normal climate; *Source: ODYSSEE*

Final energy consumption trends

- Final energy consumption grows again since 2014 with the economic rebound (+0.7%/yr), which contrast greatly with total energy supply.
- Electricity consumption growth is much slower (0.3%/yr) than before the financial crisis.
- Transport is the most dynamic sector since 2014 and is back to the trend before 2007 (1.7%/yr).
- Industry has the lowest progression (0.2%/yr).

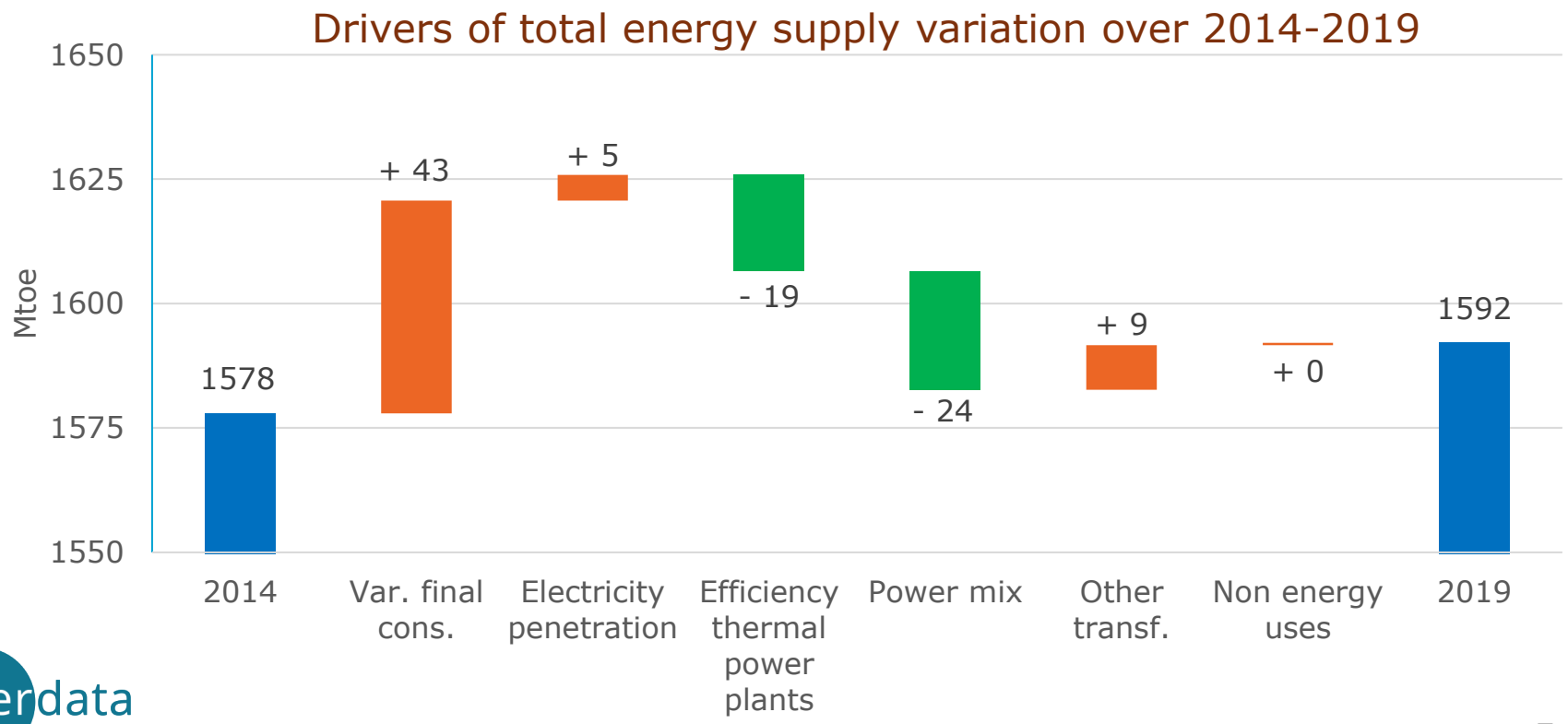




Households and services at normal climate
*Services include non-specified
Source: ODYSSEE

A progression of final consumption due to power mix

- Between 2014 and 2019, total energy supply increased 3 times less than final consumption: 14 Mtoe compared to 43 Mtoe.
- This lower progression was explained by changes in the power mix:
  - changes in the power mix with a higher share of renewables (+4.5 pts) and a lower share of nuclear (-2 pts) and thermal (-2.5 pts), which reduced the total energy supply increase by 24 Mtoe;
  - a higher efficiency of thermal generation (+ 2.5 pts) with a shift from coal to gas (-11 pts for coal,+8 pts for gas), which contributed to a reduction of 19 Mtoe.



Source: ODYSSEE Decomposition tool

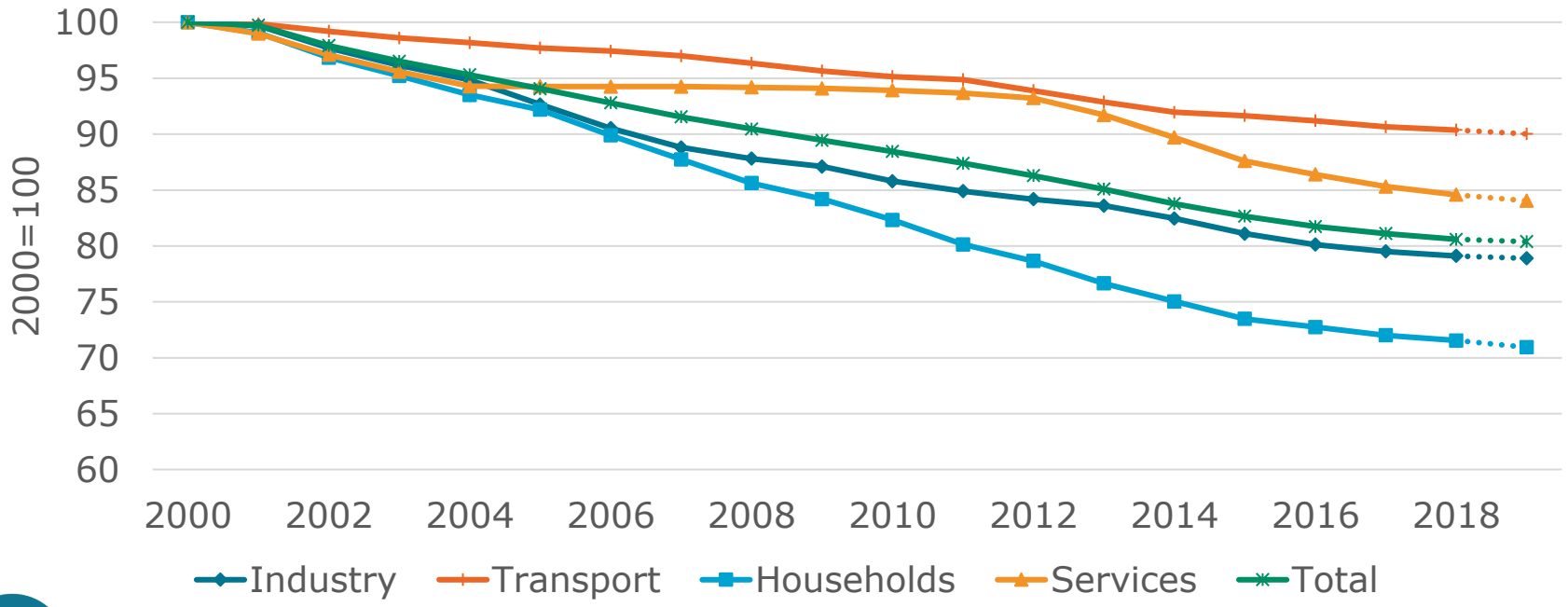
Energy efficiency trends

Enerdata

Lower energy efficiency improvements since 2014

- Efficiency of final consumers increased by 0.8%/yr since 2014, compared to 1.3%/yr between 2000 and 2014).
- Larger gains for buildings: 1.3%/yr for services since 2014; 1.1 %/yr for households, however with progress twice lower since 2014.
- Strong slow down in industry since 2007 (0,9%/yr since 2014; down from 1.7%/year before 2007 and 1.1%/yr over 2007-2014).
- Lower improvement in transport (0.4%/yr since 2014), twice less than over 2007-2014) because of no more progress for cars (penetration of SUV).

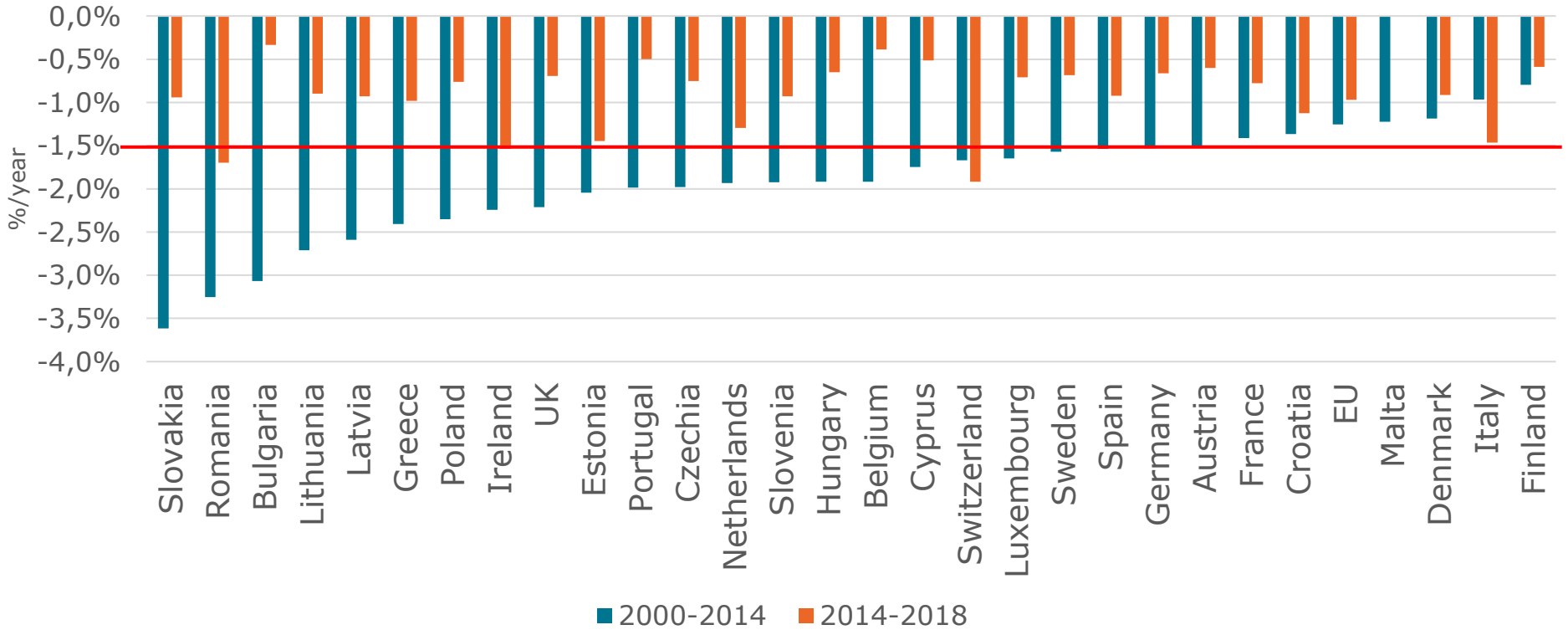
Energy efficiency improvements for final consumers (EU)



Source: ODYSSEE, measured with ODEX, Odyssee Energy Efficiency Index; ODEX=80.4 in 2019 ➔ 19.6% energy efficiency improvement since 2000; for services new calculation ***by branch instead of at aggregate level.***

- In most countries (except Italy and Switzerland), energy efficiency is progressing much slower since 2014.
- Progress in a range of 0.5 to 1%/yr in most countries since 2014 with 8 countries around 1% and 4 below 0.5%/yr, compared to 3/4 of countries above 1.5%/year* before 2014.

Energy improvement of final consumers by country**



As a comparison with Article 7 target of EED
***As measured with the energy efficiency index ODEX.*

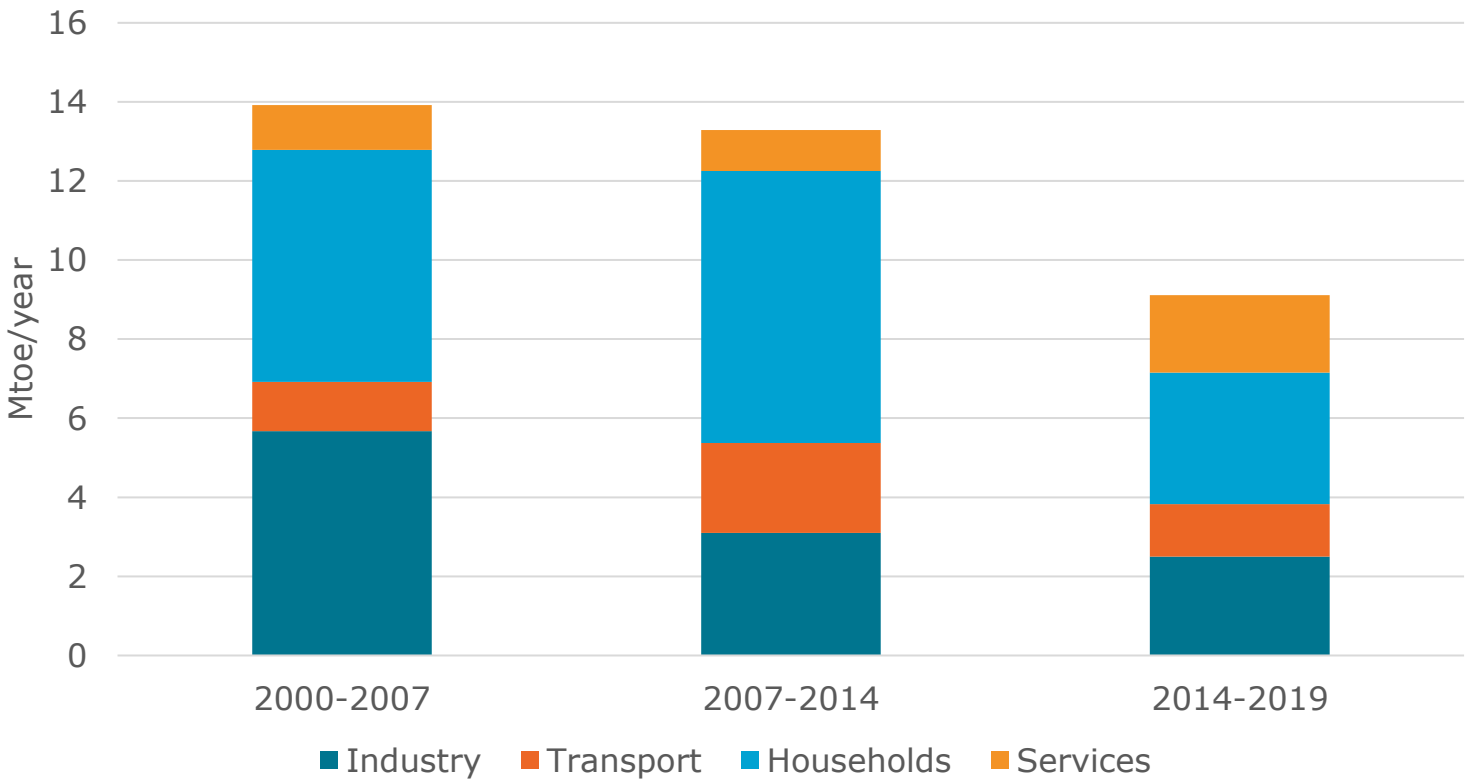
Source: ODYSSEE

Enerdata

Regular decrease in energy savings

- Because of the slowing pace of energy efficiency improvement, the annual additional savings have been decreasing since 2014: from an average volume of 13,5 Mtoe/year over 2000-2014 to 9 Mtoe/year since 2014.
- They have been divided by 2 since 2007 in industry and since 2014 for households.

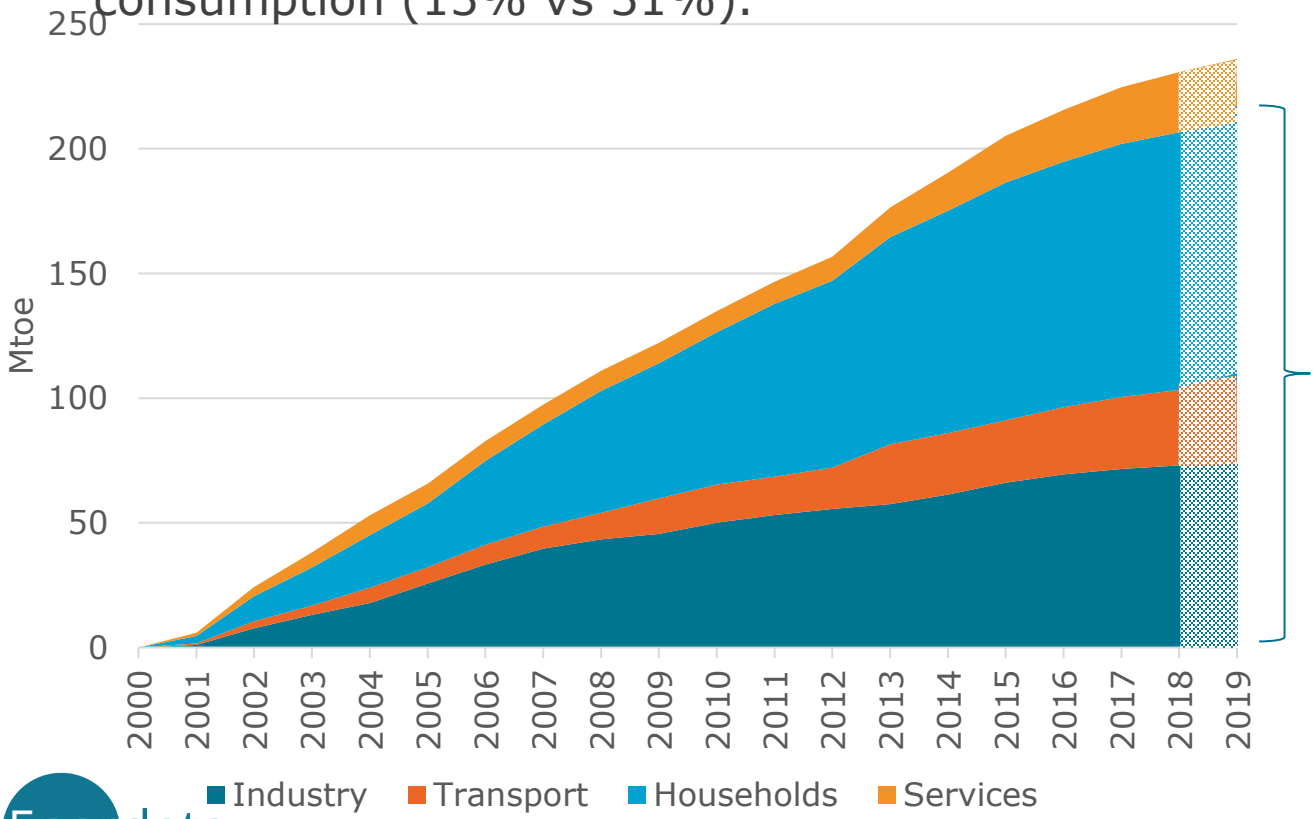
Average annual additional savings by sector



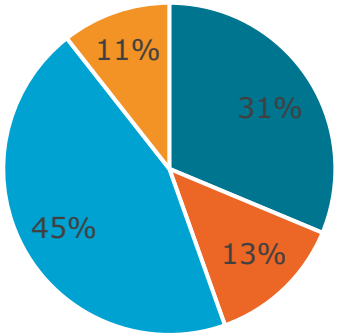
Source: ODYSSEE

Energy savings vs. consumption

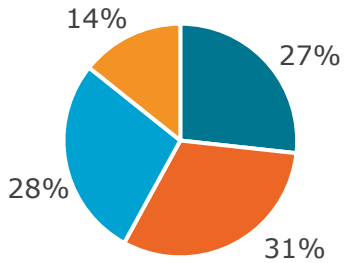
- The cumulated annual energy savings since 2000 represents the equivalent of 22% of final energy consumption in 2019: without these savings the final consumption would have been 22% higher.
- Households, the sector with the highest number of regulations and financial measures, is over represented, with a share of total savings (45%) much higher than its share in consumption (28%).
- On the other hand, savings in transport are much lower than their share in consumption (13% vs 31%).



% in energy savings



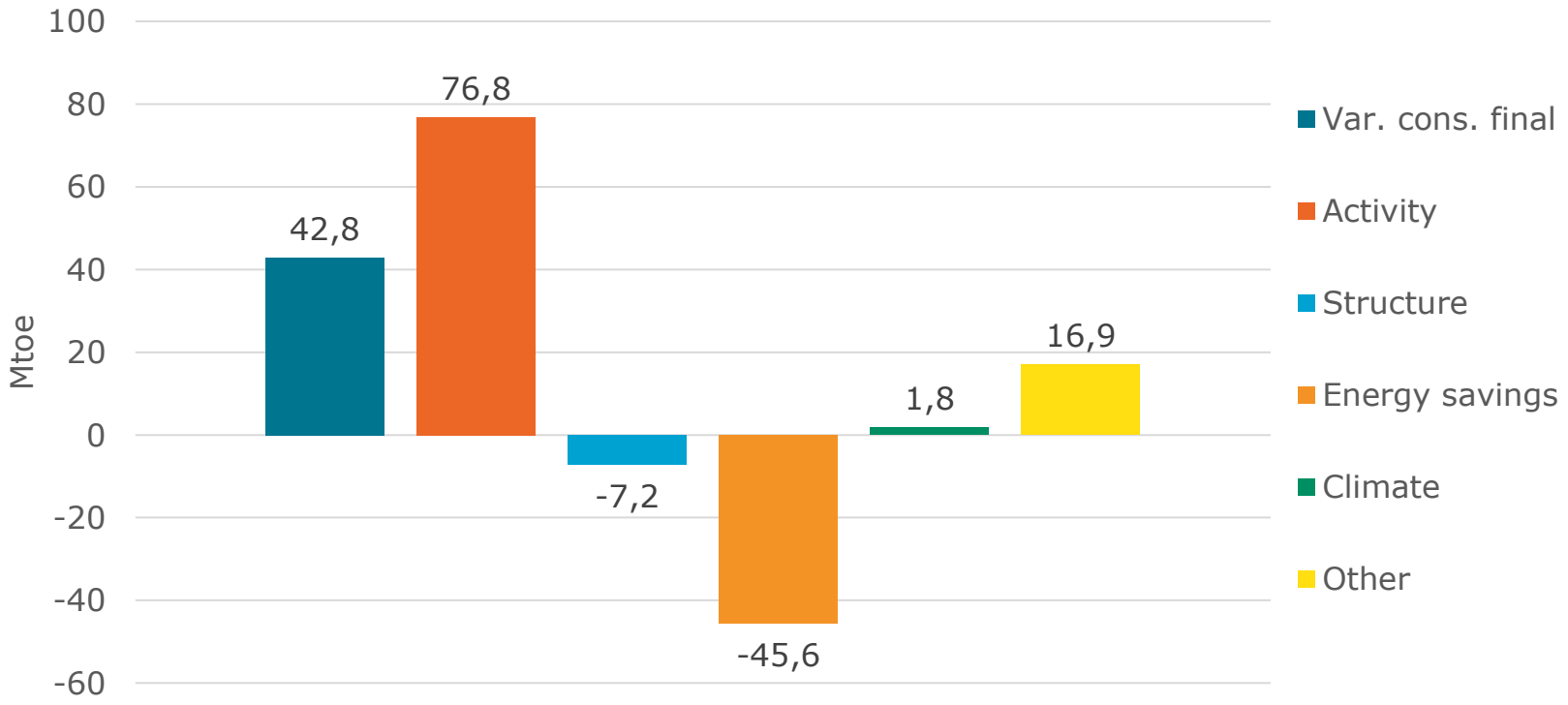
% in final consumption



Source: ODYSSEE

Drivers of final energy consumption variation: 2014-2019

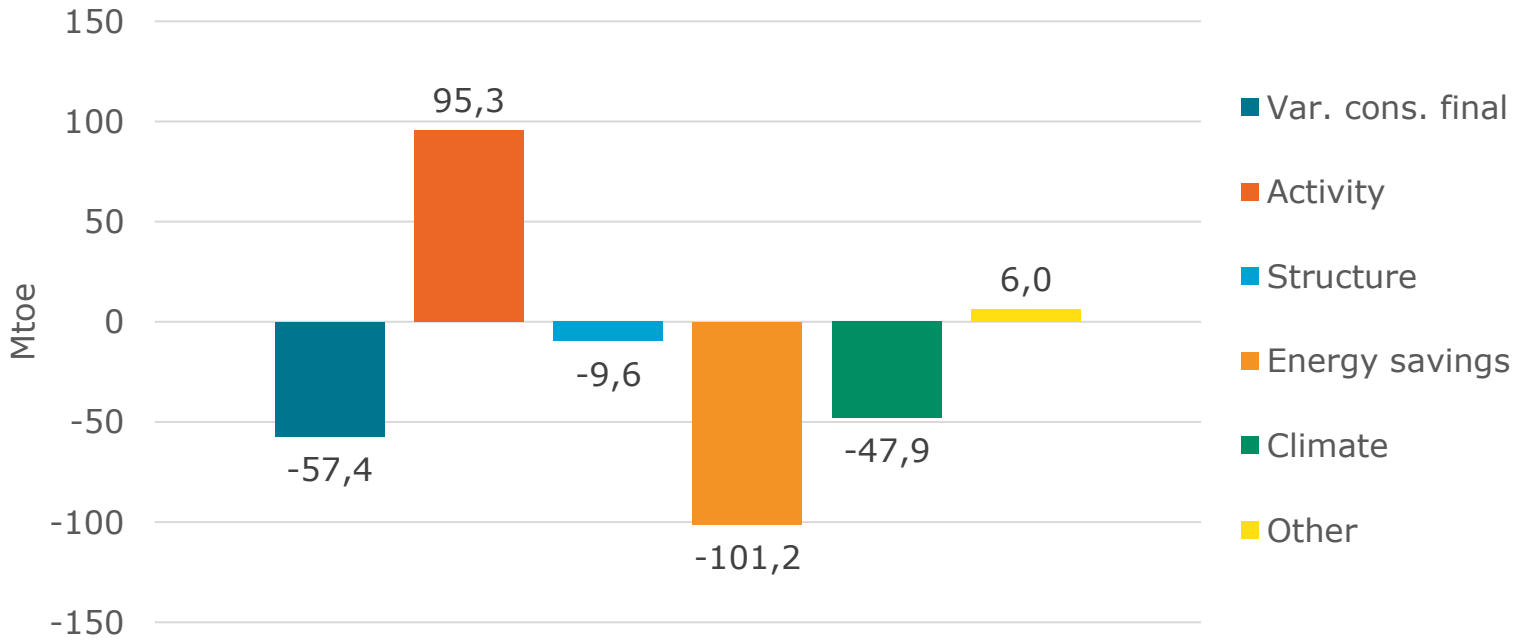
- Between 2014 and 2019, final consumption increased by 43 Mtoe.
- The "activity" effect" contributed to raise final consumption by 77 Mtoe.
- Energy savings offset more than half of this effect by reducing consumption by 46 Mtoe.



Final consumption at real climate
Activity effect : mainly economic growth, plus demography and lifestyle changes (appliance ownership and larger dwellings).
Source: ODYSSEE; decomposition tool https://www.indicators.odyssee-mure.eu/decomposition.html

Drivers of final energy consumption variation: 2010-2019

- Between 2010 and 2019, final consumption decreased by 57 Mtoe.
- The "activity" effect contributed to raise this consumption by 95 Mtoe.
- Energy savings totally offset the activity effect.
- The climate had a significant impact and lowered consumption by 48 Mtoe, due to a much warmer 2019 winter compared to 2010.
- Structural changes in industry and modal shift in transport also contributed to decrease consumption (-10 Mtoe).



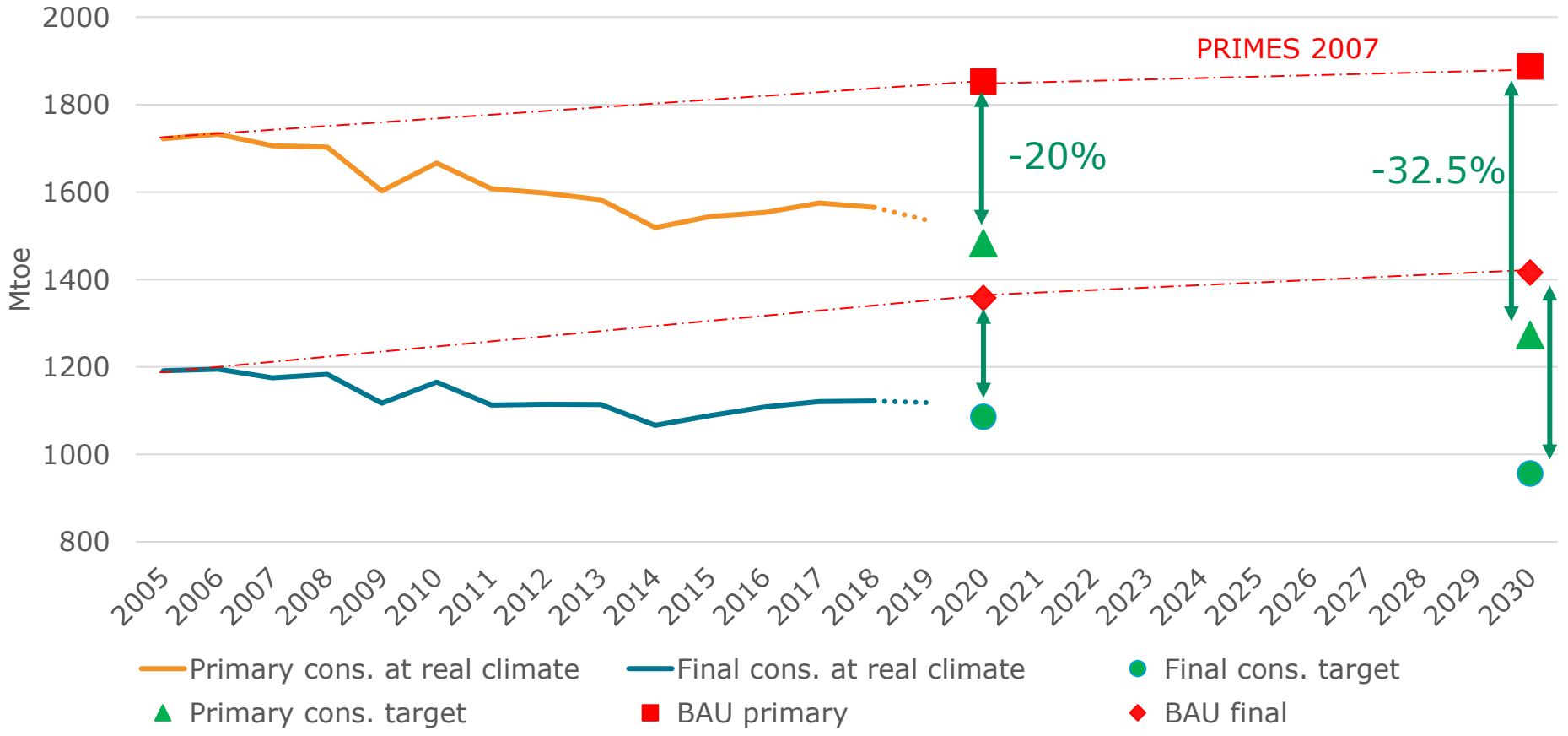
Final consumption at real climate

Activity effect : mainly economic growth, plus demography and lifestyle changes (appliance ownership and larger dwellings).

Conclusions

Primary and final energy consumption targets

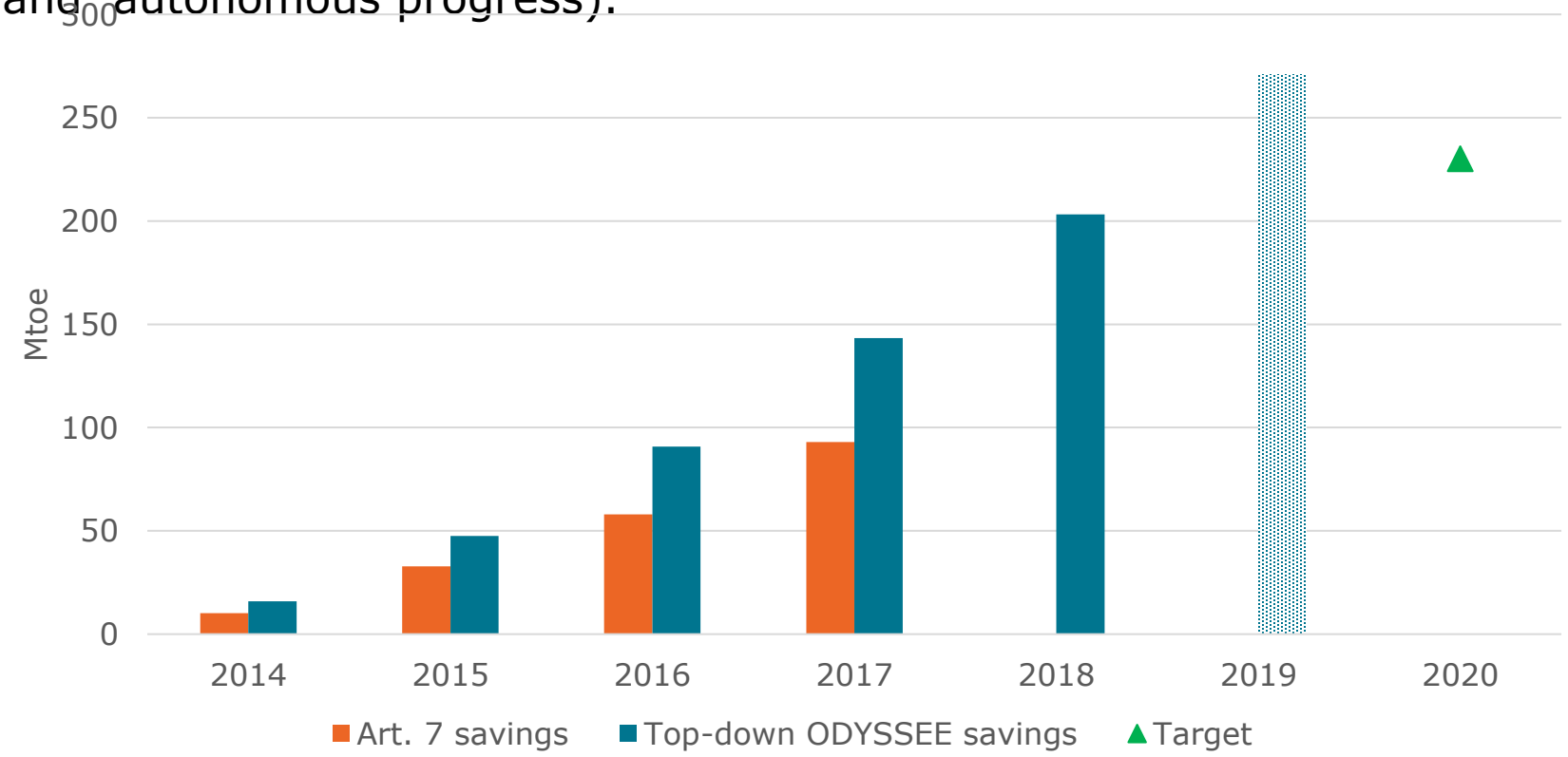
- In 2019, EU primary and final consumption were closed to the 2020 efficiency targets (both 3% above).
- Warmer winters have helped achieving the targets (final consumption at normal climate 5% above target in 2019) .
- Past trends do not enable to reach the 2030 targets.



Primary energy consumption (Europe *2020-2030*)
Source: ODYSSEE

Energy savings and Article 7

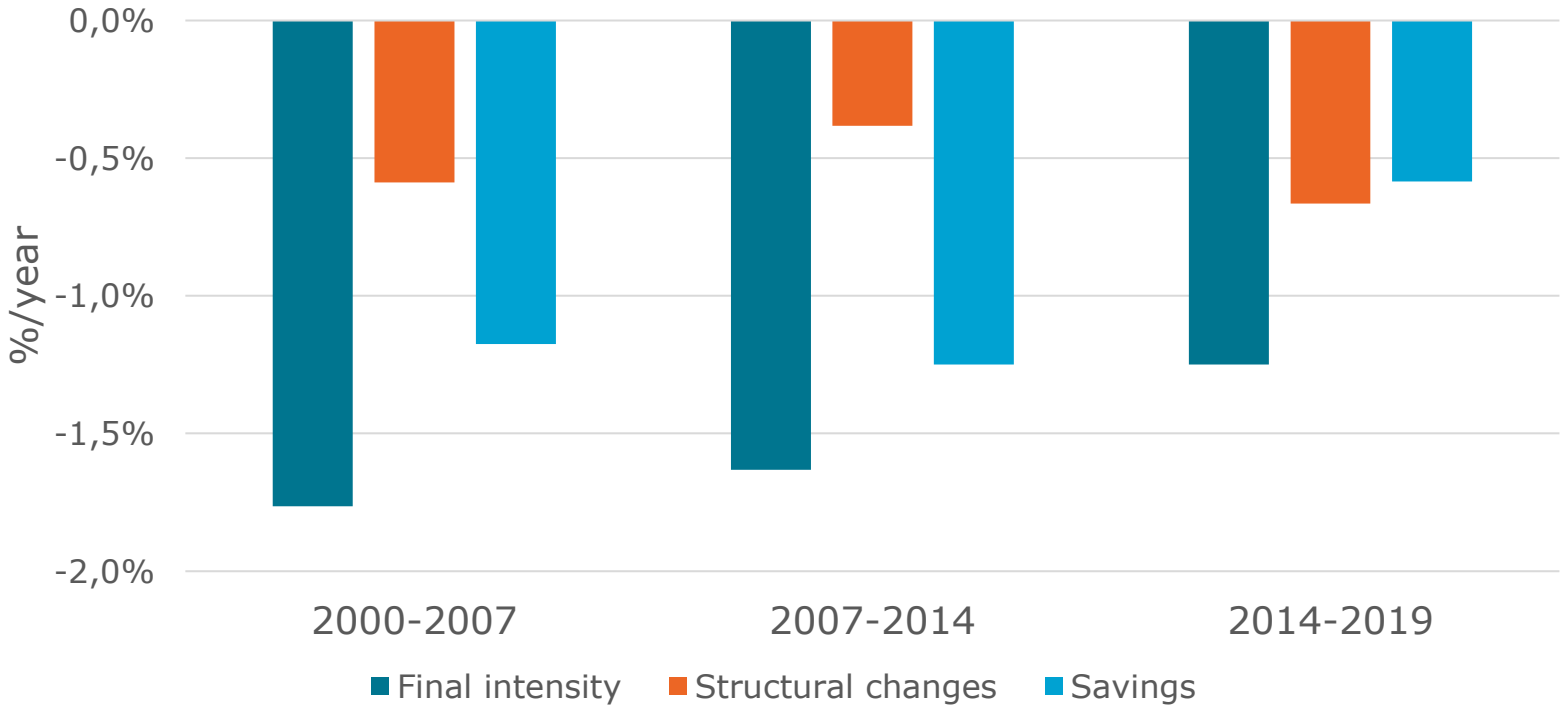
- 1.5% of additional annual savings according to Article 7 of EED for final consumers over 2014-2020.
- Energy savings from Article 7 as reported by MS reached 40% of their 2020 target in 2017.
- Top-down Odyssee estimates for 2019 exceed the target but are broader than Article 7 savings (as they include all types of savings: policy related and autonomous progress).



Source: ODYSSEE energy saving tool https://www.indicators.odyssee-mure.eu/energy-saving.html

Final energy intensity and energy efficiency trends

- Since 2014 energy efficiency only explains half of the final energy intensity reduction.
- Different types of structural changes (e.g. towards less energy intensive sectors (services) and industrial branches, saturation effects, higher value added products…) have contributed as much to the intensity reduction.
- Before 2014 most of the intensity decrease was due to energy efficiency improvements (around 80%).



Source: *ODYSSEE*

Conclusions

- Since 2014, the increasing share of renewables and natural gas has offset 90% of the increase in final consumption.
- Energy efficiency improvement of final consumers has been much slower since 2014.
- Depending on the period energy savings offset entirely of partly the effect of economic and growth.
- EU 2020 targets on primary consumption will be exceeded with the COVID crisis but was already closed to be achieved.
- EU target to 2030 will not be reached with present trends and require additional measures.
- Since 2014 various types of structural changes have contributed as much as energy efficiency to the energy intensity reduction.