

Energy efficiency trends in the EU: Have we got off track?

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

Bruno Lapillonne, Laura Sudries, Enerdata

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About ODYSSEE-MURE

- This webinar is organized in the framework of the ODYSSEE MURE Project.
- This project is supported by the H2020 programme of the European Commission. It covers 31 countries*, mainly energy efficiency agencies or Ministries; it is coordinated by ADEME, with the support of Enerdata and Fraunhofer-ISI.
- Its main objectives are to:
 - ✓ Evaluate and compare energy efficiency progress by sector, in relation to the observed trend in energy consumption and to the EU targets ;
 - ✓ Evaluate energy efficiency policy measures and identify the “best measures” .
- The project relies on two data bases:
 - ✓ **ODYSSEE** on energy efficiency indicators;
 - ✓ **MURE** on all policy measures implemented by sector, and their impact evaluation.

www.odyssee-mure.eu

**28 EU Member States (UK included)+ Norway, Serbia and Switzerland*

ODYSSEE-MURE The ODYSSEE data tools



ODYSSEE PROJECT

ABOUT THE ODYSSEE DATABASE

The Odyssee indicators are accessible under different data tools: the full data base, the key indicators facility, as well as five specific data facilities that focus on specific issues and provide some interpretation: market diffusion, decomposition, benchmarking, energy saving and indicator scoreboard. The access to the data base is restricted, whereas all other data tools are in public access.



The webinar is based on data and indicators prepared in the framework of the ODYSSEE-MURE project, and disseminated in a data base and 5 data tools

www.indicators.odyssee-mure.eu



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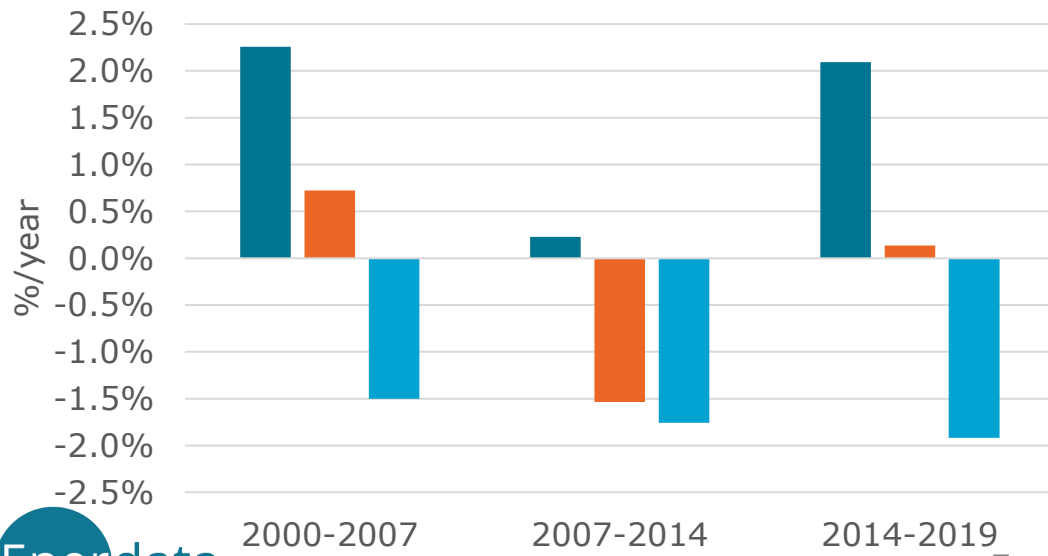
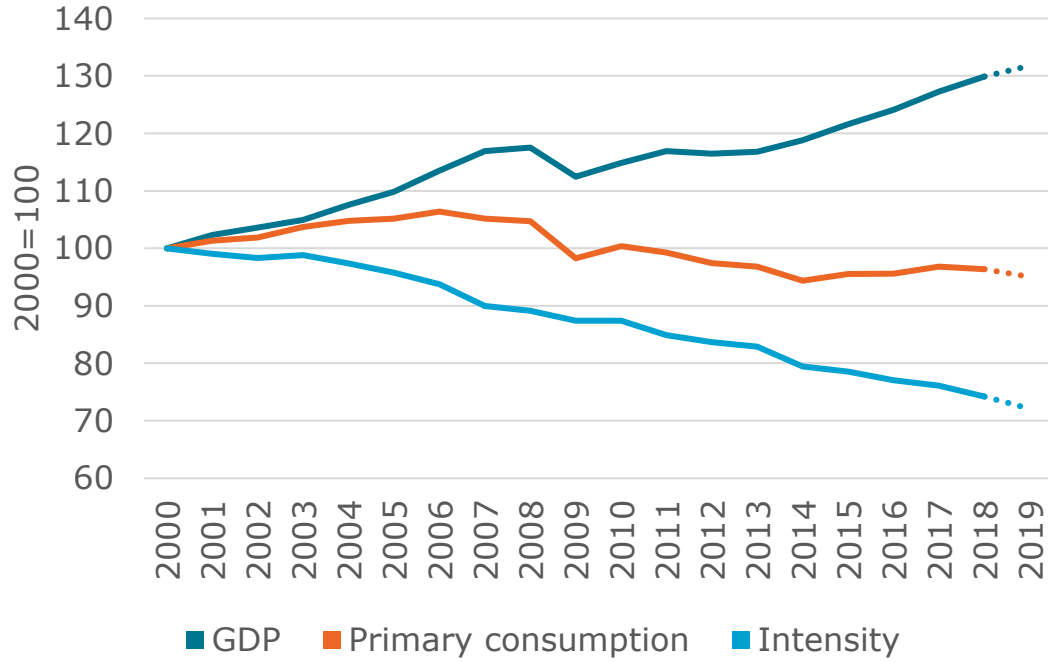
The data and indicators are updated to 2019 using final energy consumption data produced by Enerdata and “early estimates” of key indicators produced by ODYSSEE through a new methodology (to be revised later and included in data tools in October).

Outline

- Energy consumption trends
- Energy efficiency trends
- Conclusions : have we got off track?

Energy consumption trends

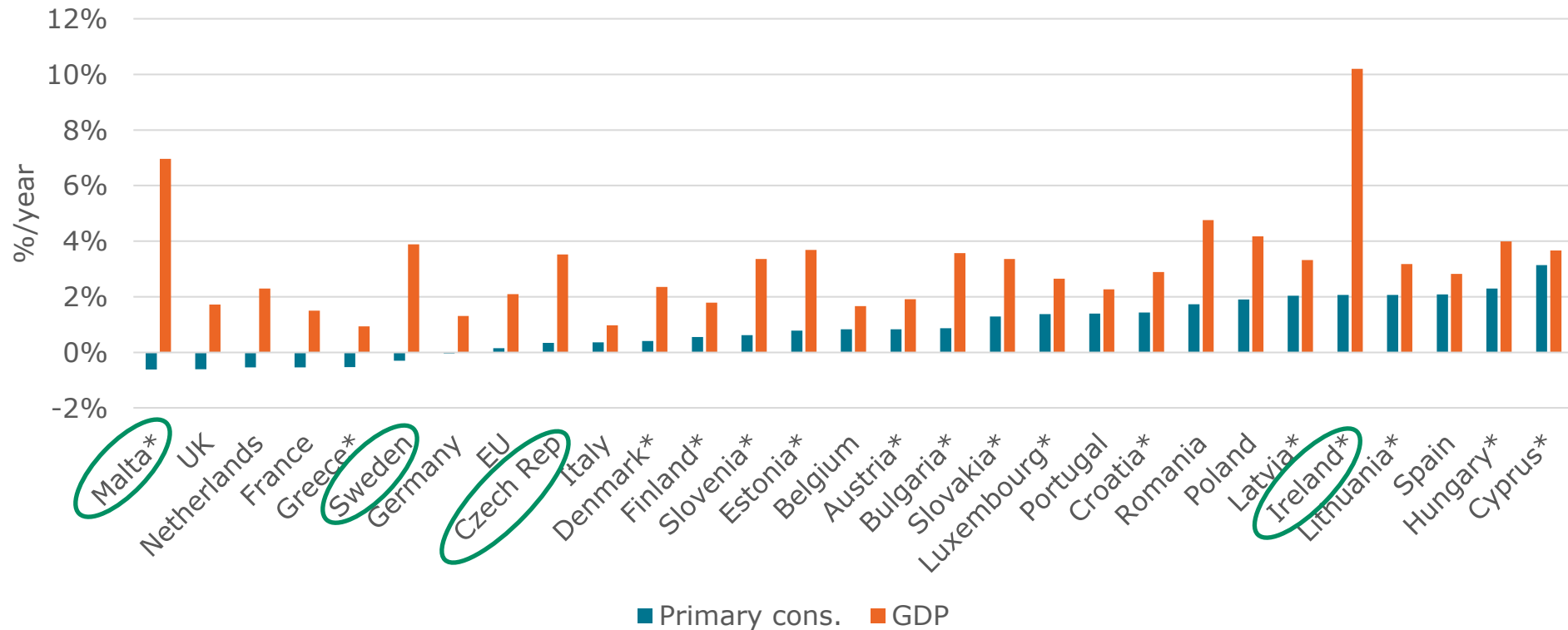
Primary energy consumption and intensity VS GDP



- **Stability** of the EU **primary consumption** (total energy supply) since 2014, although the **GDP** increased **by 2%/yr** with the return to economic growth.
- This follows a significant decrease of 1.5%/yr between 2007 and 2014 due to the financial crisis of 2009.
- **Regular and rapid decrease** of the primary energy **intensity** since 2007 (~1.8%/year), slightly faster than over 2000-2007 (+0.3 pt)

Primary consumption and GDP trends over 2014-2019

- Since 2014, decreasing primary consumption in 7 countries and low consumption growth below the 0.5%/year observed for the EU in 3 other countries.
- Everywhere the **consumption** is **progressing much slower than the GDP**, implying a decreasing energy intensity, especially significant in Ireland, Malta, Sweden and the Czech Rep (below 3%/yr).

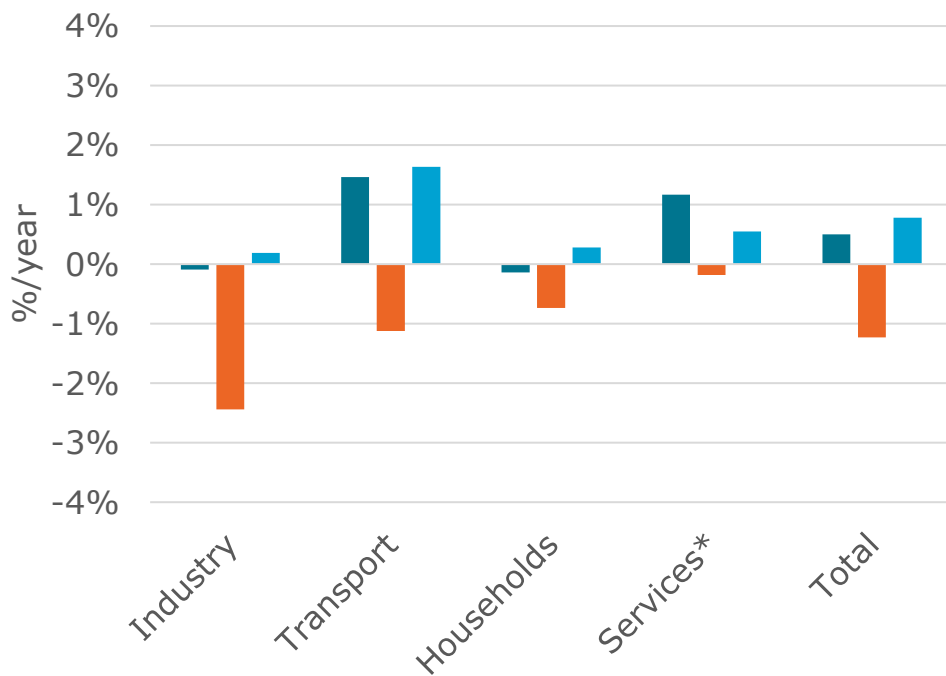


Consumption at normal climate; Sources: ODYSSEE until 2017, Enerdata for 2018 and 2019; *2014-2018.

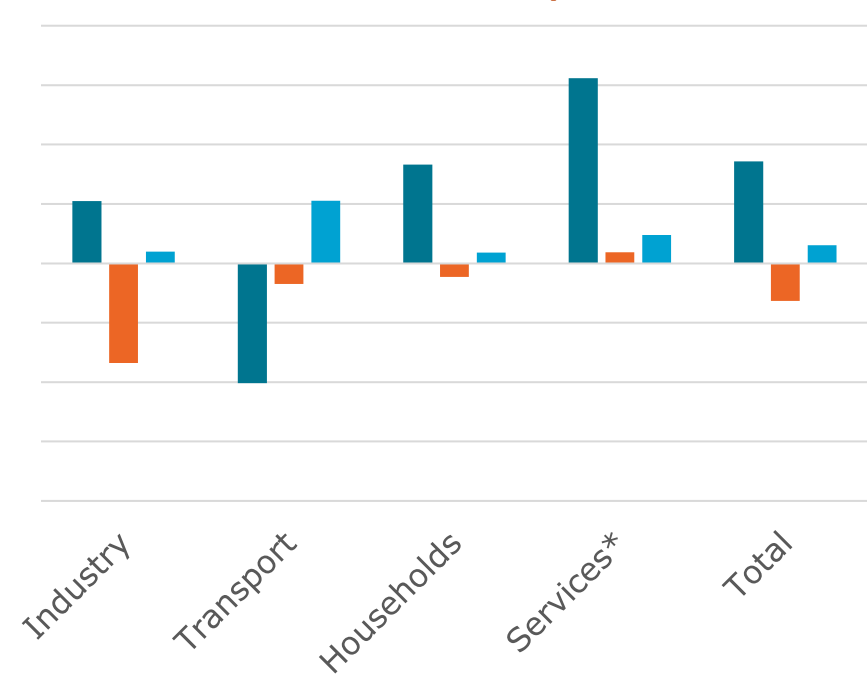
Final energy consumption trends

- **Final consumption**, i.e. consumption in industry, transport and buildings, grows again since 2014 with the economic rebound: 0.8%/year.
- This contrasts greatly with the **primary** energy consumption trend.
- **Electricity** grows much slower (0.3%/yr), as **opposed** to past trends.
- Transport is the most dynamic sector since 2014 (1.6%/yr, similar to 2000-2007 trend), while industry has the lowest progression (0.2%/yr).

Total



Electricity



■ 2000-2007 ■ 2007-2014 ■ 2014-2019

■ 2000-2007 ■ 2007-2014 ■ 2014-2019

Households and services at normal climate

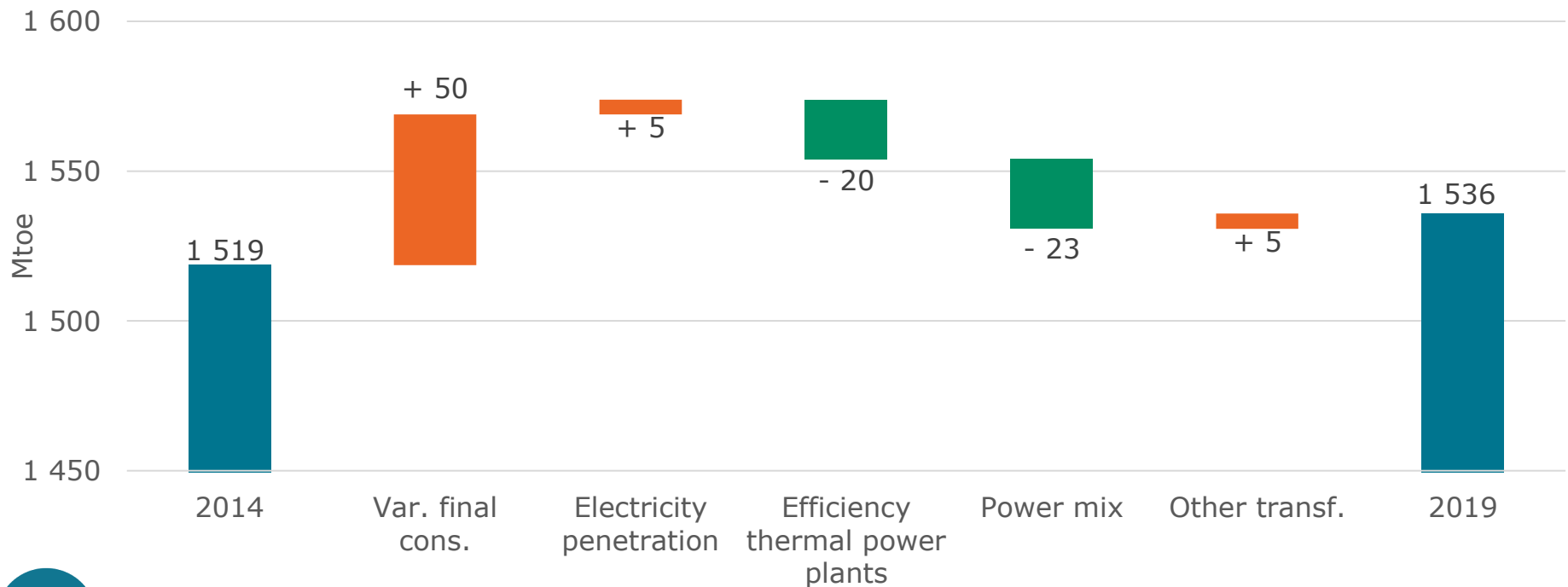
*Services include non-specified

Source: ODYSSEE

A higher progression of final energy consumption

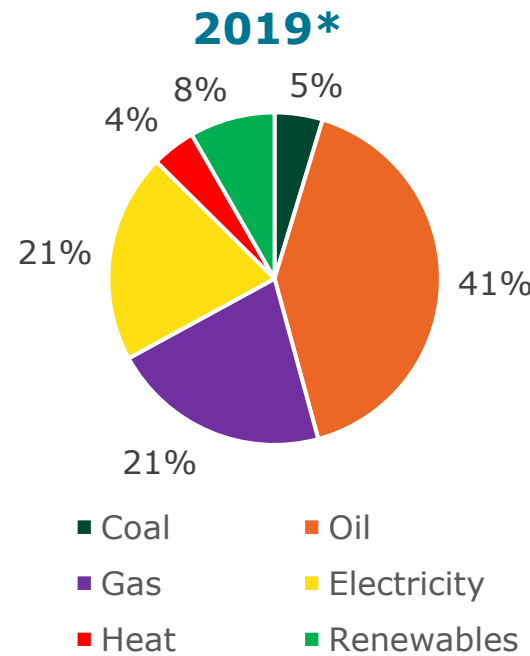
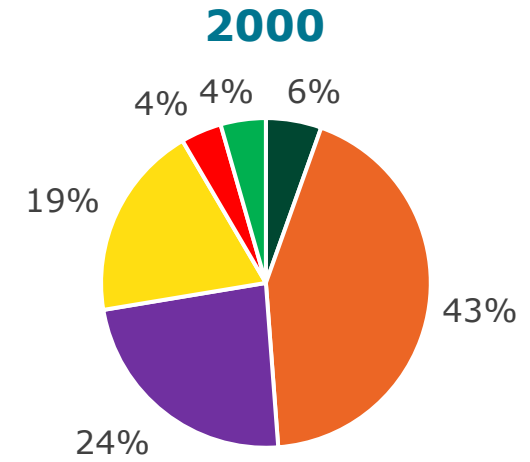
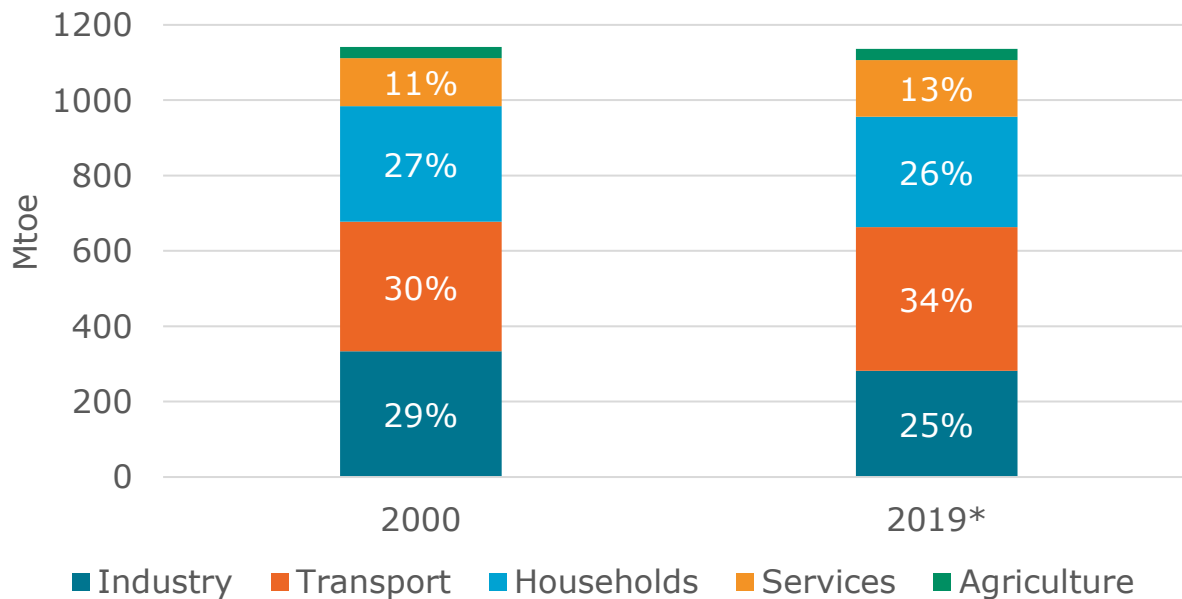
- Between 2014 and 2019, the **primary** consumption **increased** by **17 Mtoe**, compared to **50 Mtoe** for the **final** consumption.
- This much lower progression of the primary consumption is due to:
 - a significant change in the **power mix** (higher share of renewables, lower share of nuclear) which contributed to lower the increase in primary consumption by **23 Mtoe**
 - the **increasing efficiency** of thermal power plants (**-20 Mtoe**)

Drivers of primary energy consumption variation over 2014-2019



Final energy consumption by sector and by energy

- Increasing share of transport in total final consumption from 30% to 34% in 2019 while industry' share decreased by 4 pts, down to 25%.
- Doubling of the direct penetration of renewables (from 4 to 8% in 2019).
- Decreasing share for gas (from 24% in 2000 to 21% in 2019) and for oil (from 43% to 41%) while electricity share increased by 2 points.



At normal climate for households and services
Sources: 2000: ODYSSEE and 2019 : Enerdata

Energy efficiency trends

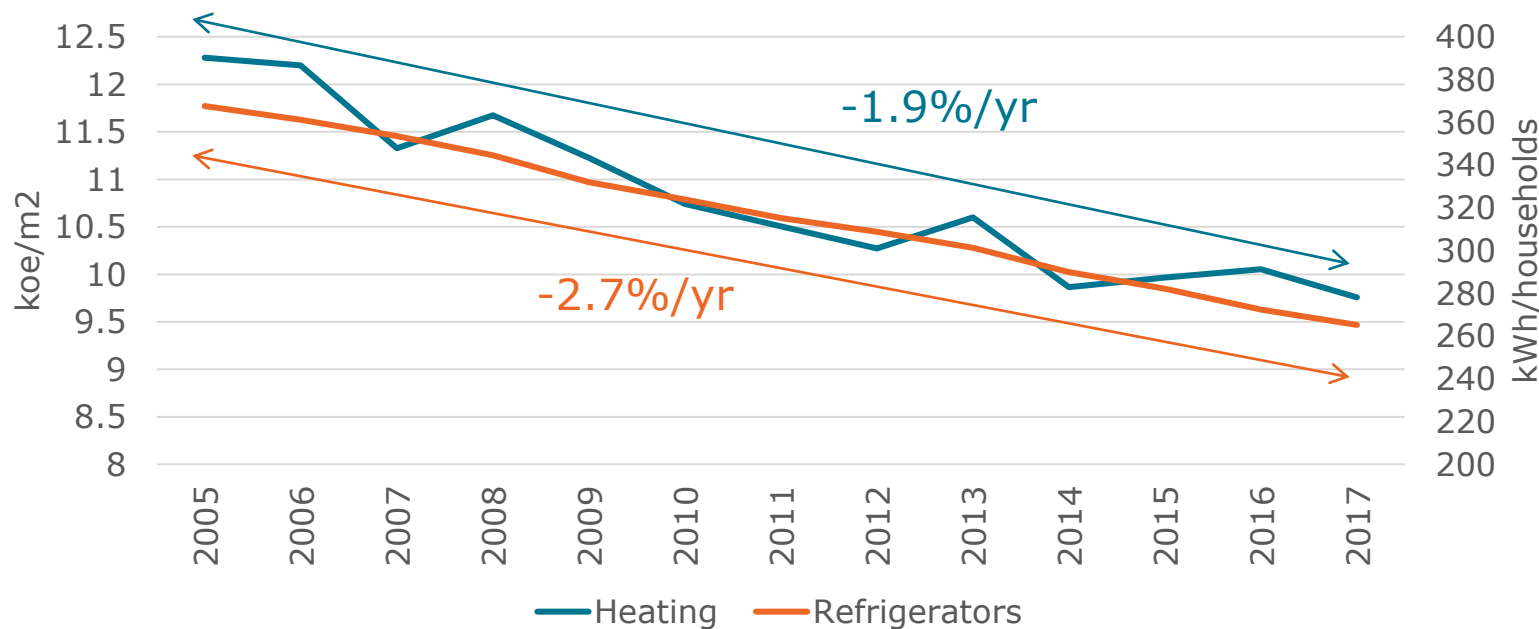
How is measured energy efficiency progress in ODYSSEE?

- At the level of **sub-sectors** or **end-uses**, energy efficiency progress is assessed through a wide variety of indicators of specific consumption, measured in **physical units**, such as:
 - ✓ toe/ton for steel, cement in industry (or GJ/t);
 - ✓ toe/pkm for cars, toe/tkm for freight in transport;
 - ✓ toe/m² for heating, kWh/household for electrical appliances and AC, ... for households ;
 - ✓ kWh/employee, per m², per bed ... in services.
- Examples of sectoral indicators are provided in the ODYSSEE “**key indicators tool**”*

* <https://www.indicators.odyssee-mure.eu/online-indicators.html>

The question now is how to measure energy efficiency progress at sector level?

- For households, we may obtain for instance different energy efficiency trends: 2.7%/yr for refrigerators and 1.9%/yr for heating.



- The question now is how can we combine the different assessments of energy efficiency progress by end-use to get one trend for the whole sector?
- This is the objective of the energy efficiency index, called "**ODEX**".

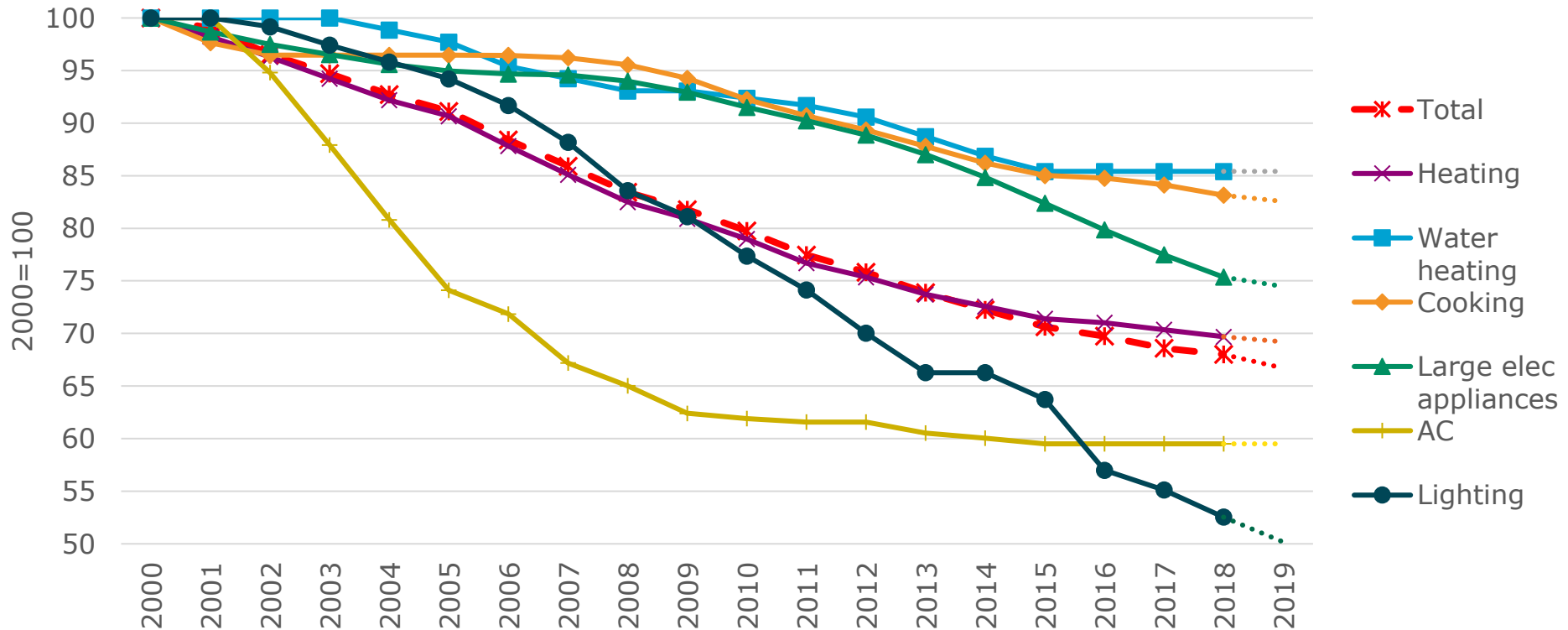
How is calculated ODEX?

- ODEX is calculated:
 - First, by expressing trends in specific energy consumption by end-use or sub-sector, as an **index of variation** ;
 - Then by calculating a average index for the sector **weighted** by the share of each end-use or sub-sector in the sector's energy consumption.
- As for each sub-sector, index of variation are used, specific consumption can be expressed **in different physical units** so as to be as close as possible to energy efficiency evaluation.
- ODEX is presently calculated on the basis of up to **40** sub-sectors (8 modes in transport, 11 end-uses for households, 14 branches in industry, 6 branches in services).

For more information on ODEX: <https://www.indicators.odyssee-mure.eu/odex-indicators-database-definition.pdf>

Example of ODEX: households in the EU

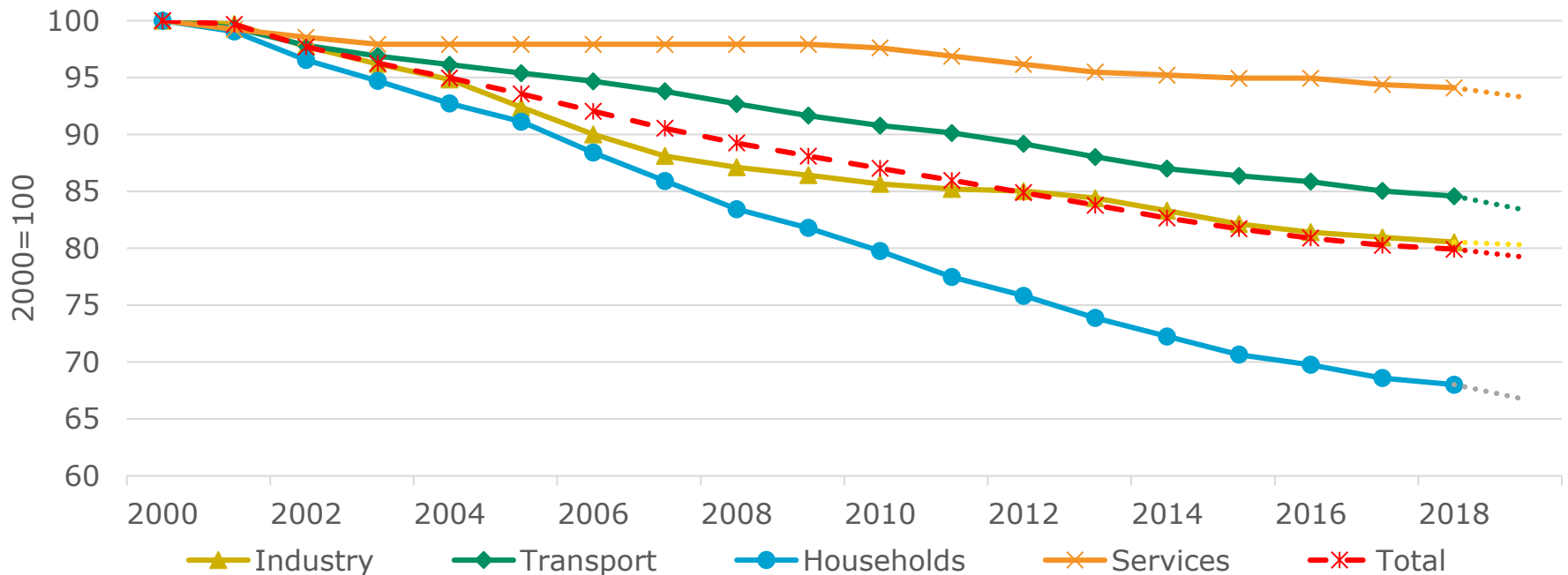
- ODEX equal 67 in 2019 → households energy efficiency has improved by 33% at EU level between 2000 and 2019 (or 2.1%/year).



Only main end-uses shown; ODEX calculated on the basis of 11 end-uses/large appliances : heating (toe/m²) (separation new/existing dwellings), water heating, cooking (toe/dwelling), cooling, lighting, refrigerator, freezer, washing machine, dishwasher, dryer, TV (kWh/appliance)

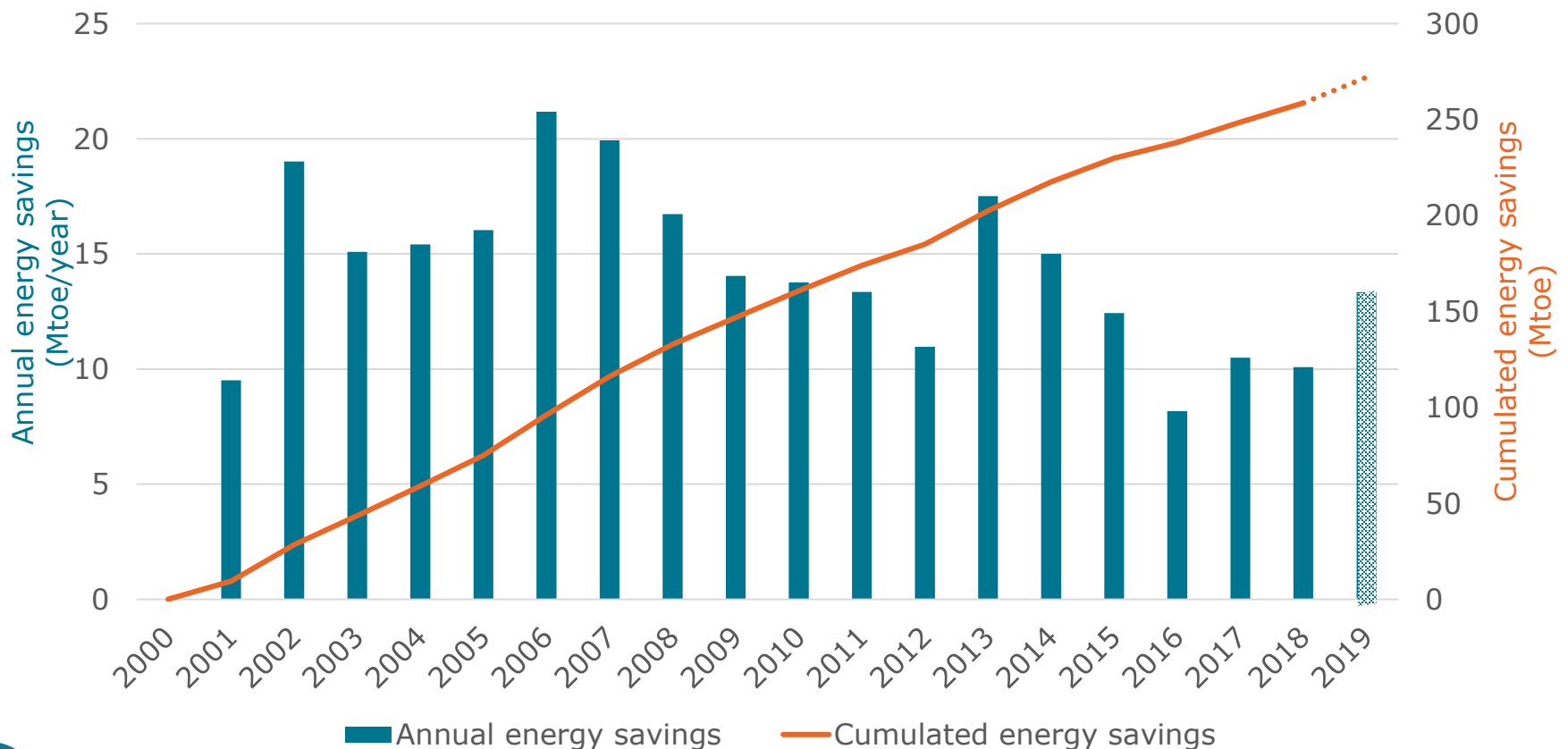
Energy efficiency index (ODEX) for final consumers

- Energy efficiency of final consumers improved by **1.2%/yr** from 2000 to 2019, with a slow down in recent years (0.9%/yr since 2014).
- **Larger gains for households** (2.1%/yr since 2000), with a net slow down since 2014 (1.6 %/yr).
- Rate of improvement **divided by more than 2 in industry**, since 2007 (0.8%/yr compared to 1.8%/yr before).
- Regular but limited improvement in transport (1%/year).



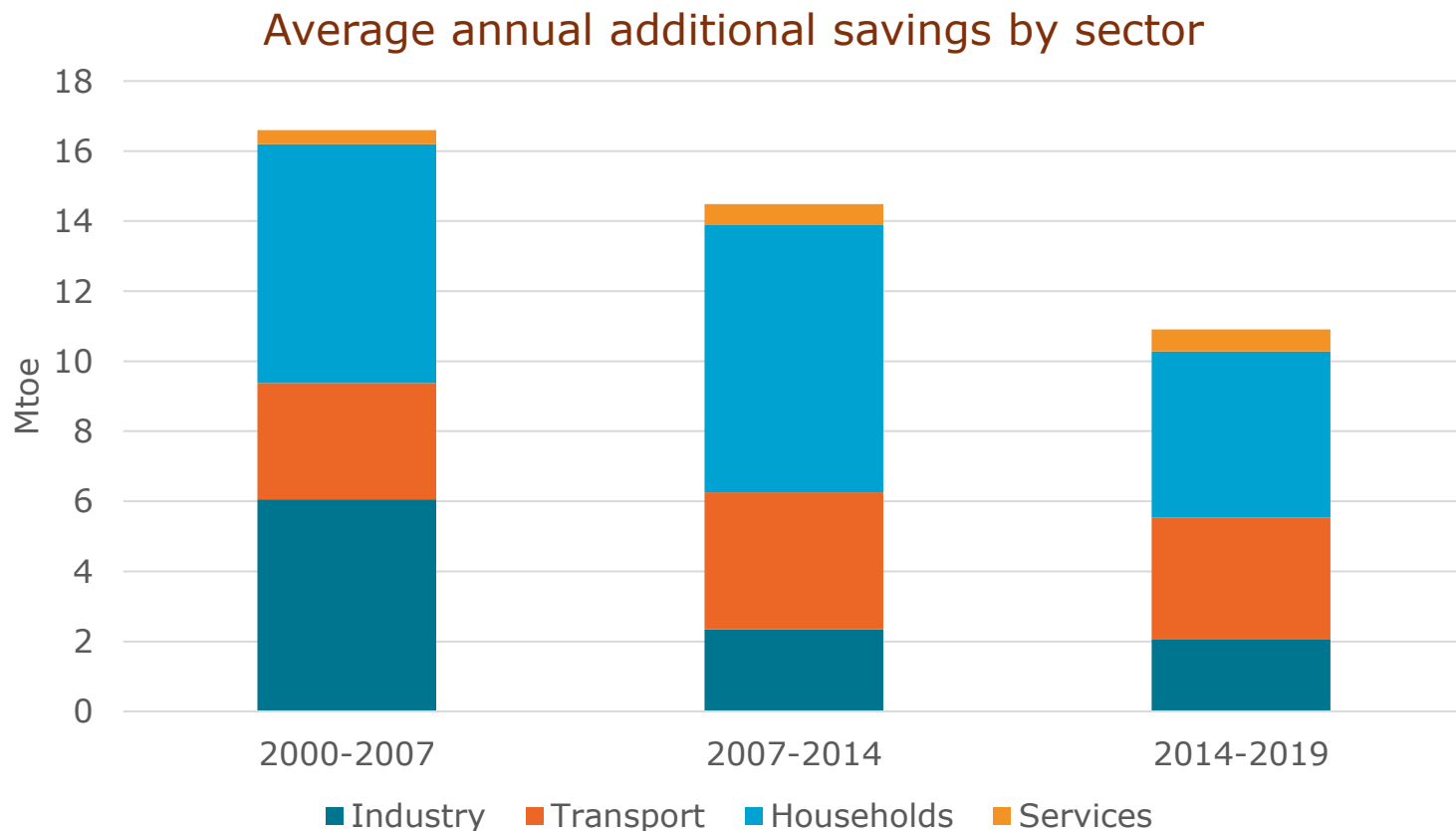
Energy efficiency progress results in energy savings

- Energy efficiency progress has saved **every year** since 2000, an additional volume of **14 Mtoe**.
- These annual savings are fluctuating but tend to decrease over time.
- Cumulated since 2000, these savings reached around **270 Mtoe** in 2019.



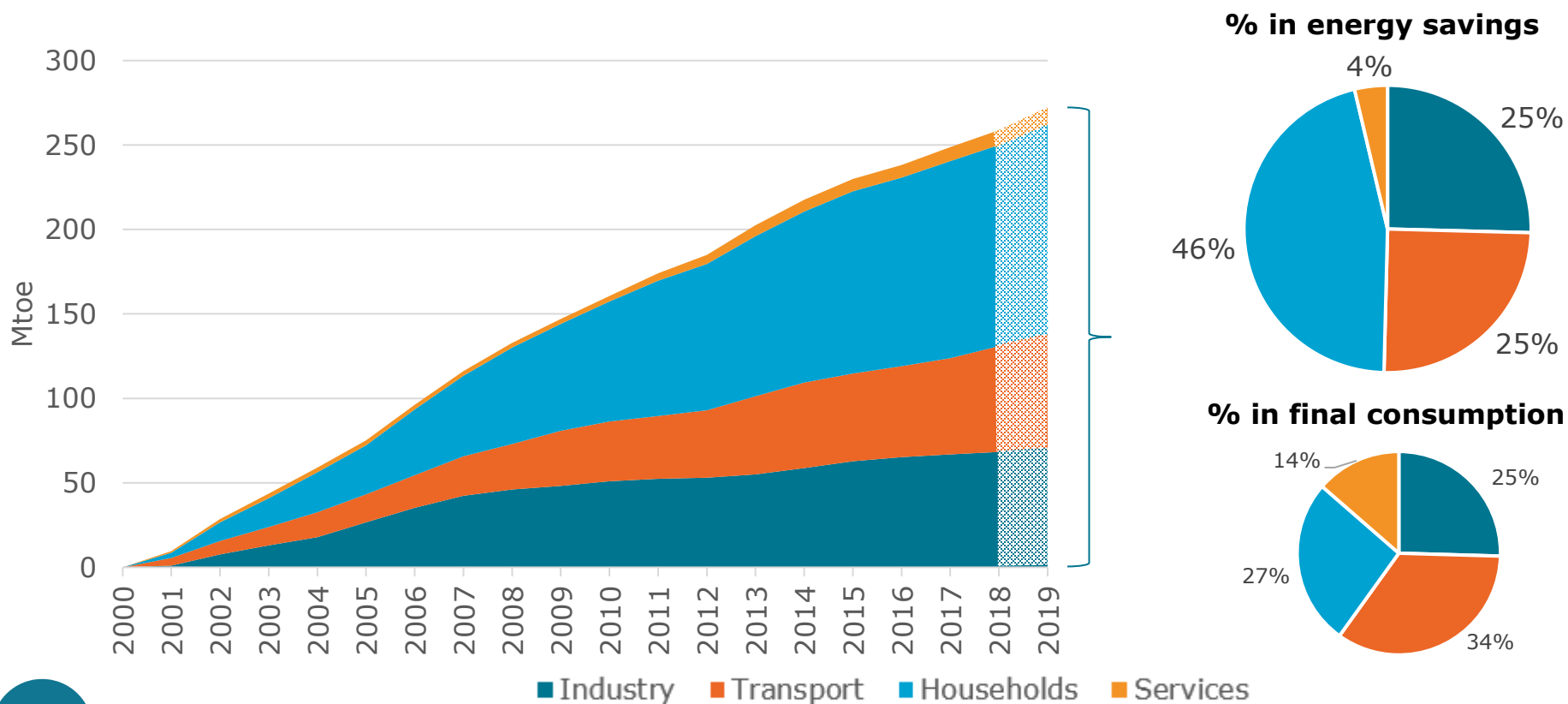
Regular decrease in energy savings

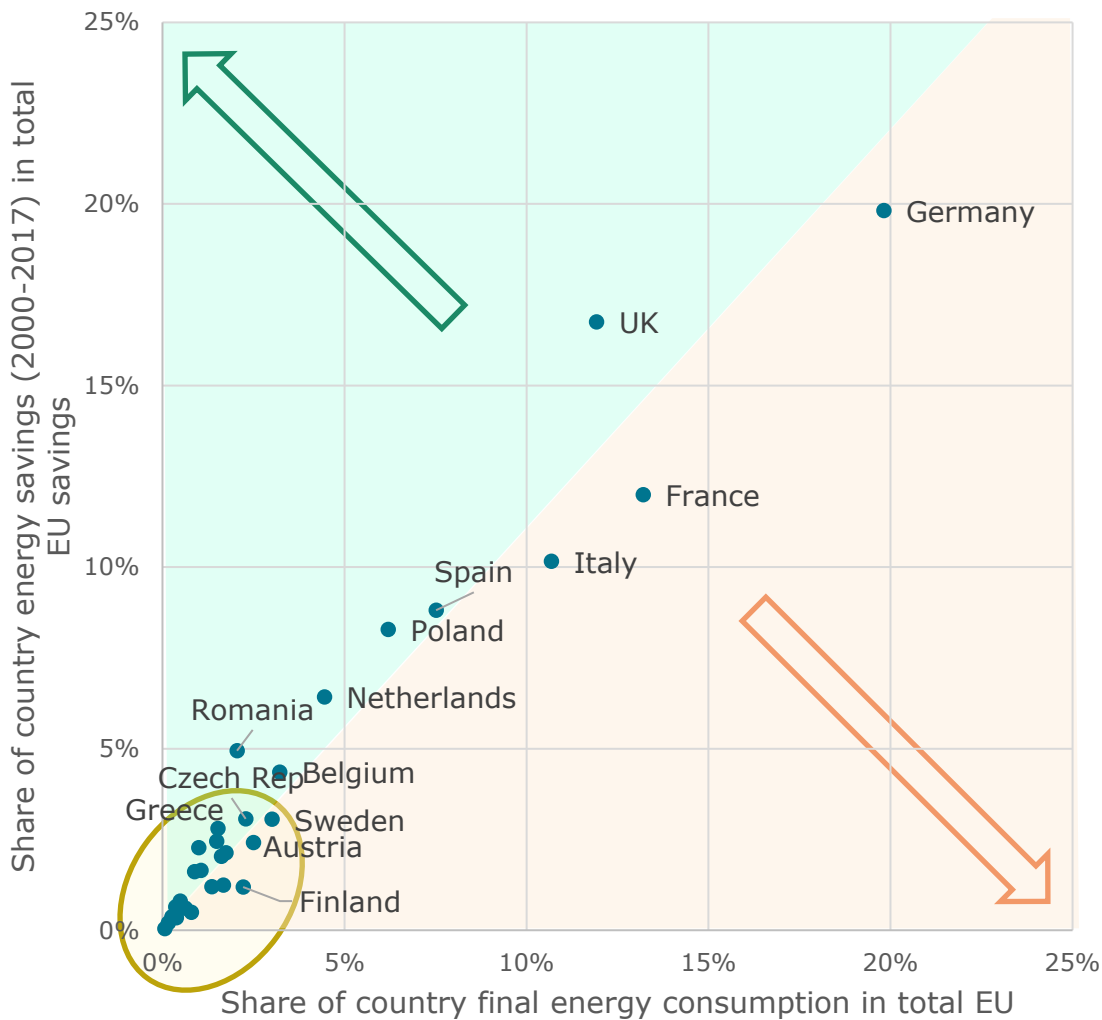
- Because of the slowing pace of energy efficiency improvement, the annual additional savings have been **regularly decreasing**: from an average volume of 16.5 Mtoe/yr over 2000-2007 to 14.5 Mtoe/yr over 2007-2014 (divided by 3 in industry) and 11 Mtoe/yr since 2014 (1/3 reduction for households).



Energy savings versus consumption

- The cumulated **energy savings** in 2019 since 2000 represents the equivalent of 25% of final energy consumption: in other words without these savings the **final consumption** would have been **25% higher**.
- Households, the sector with the highest number of regulations, is over represented, with a share of total savings (46%), much higher than its share in consumption (27%). On the other hand, savings in transport are much lower than their share in consumption (25% vs 34%).

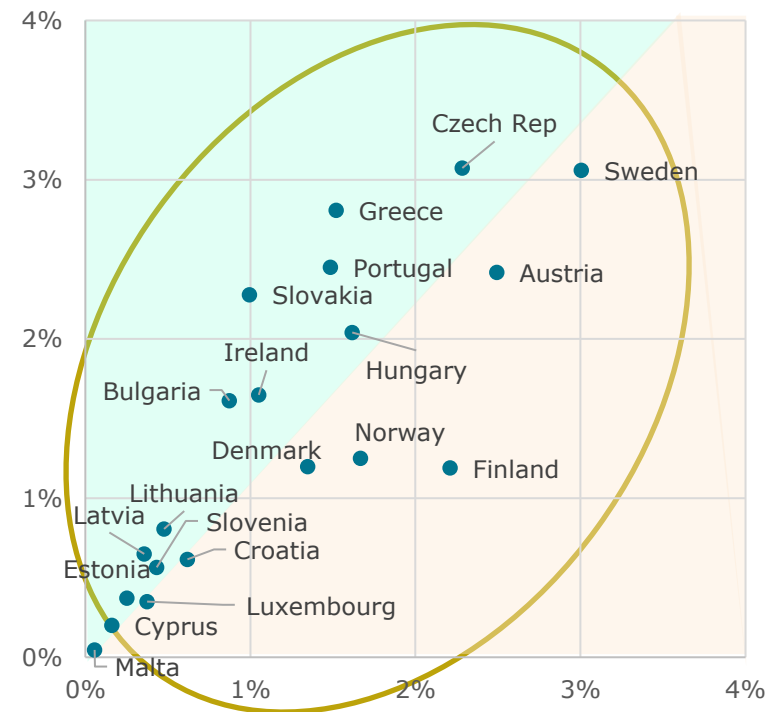




High share of energy savings in final consumption (>25%)

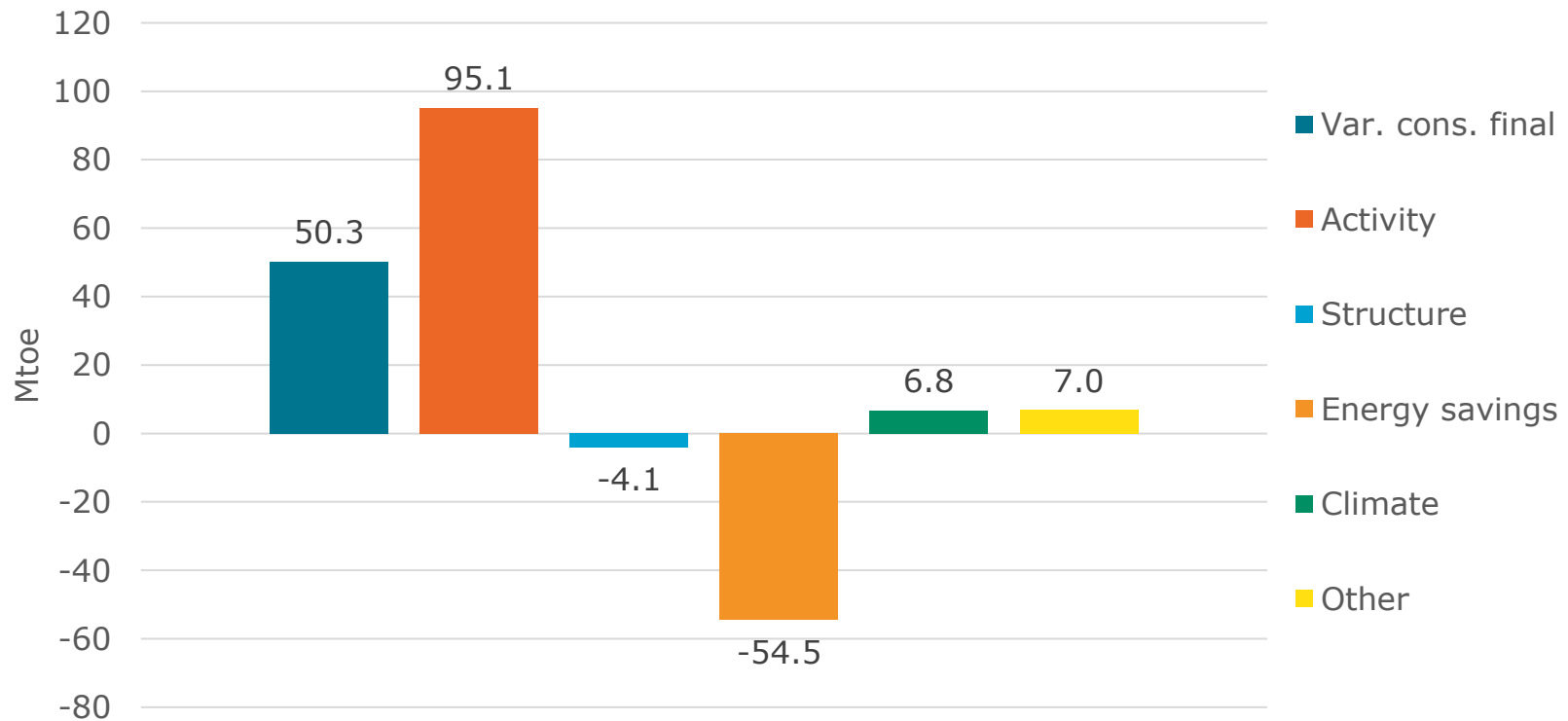
Low share of energy savings in final consumption (<25%)

- Long-standing EU Member States (e.g. Germany, Italy and France) have a relatively lower share of energy savings since 2000, as they had a greater effort before.
- New EU MS (e.g. Slovakia, Bulgaria or Latvia) have a higher share due to greater efforts in terms of energy savings since 2000



Drivers of final energy consumption variation: 2014-2019

- Between 2014 and 2019, the economic and demographic growth (“**activity**”) contributed to raise the final consumption by 95 Mtoe.
- **Energy savings** offset more than half of this activity effect by reducing consumption by 55 Mtoe.

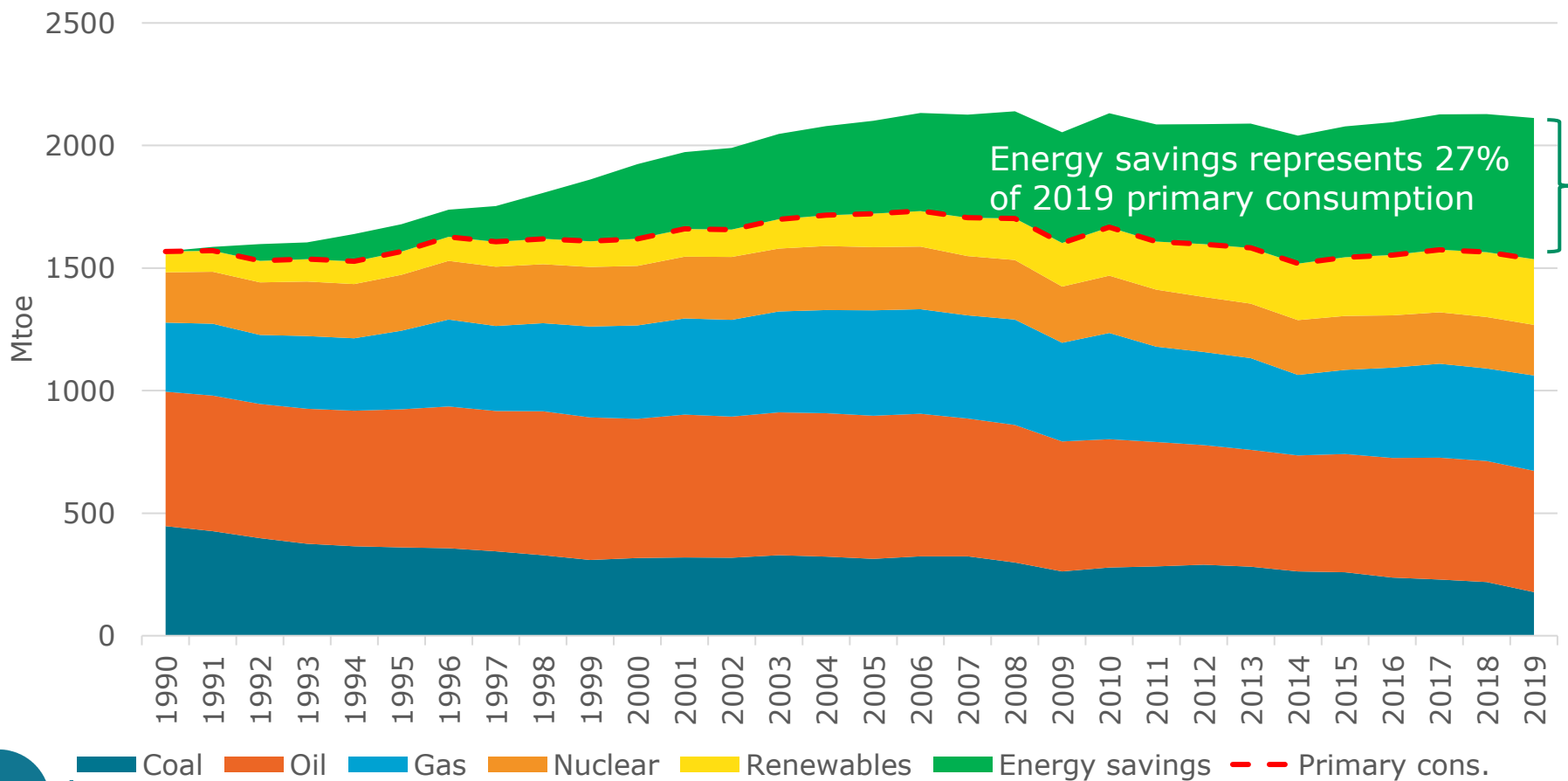


Activity effect : mainly economic growth, plus demography and lifestyle changes (appliance ownership and larger dwellings).

Source: ODYSSEE; decomposition tool <https://www.indicators.odyssee-mure.eu/decomposition.html>

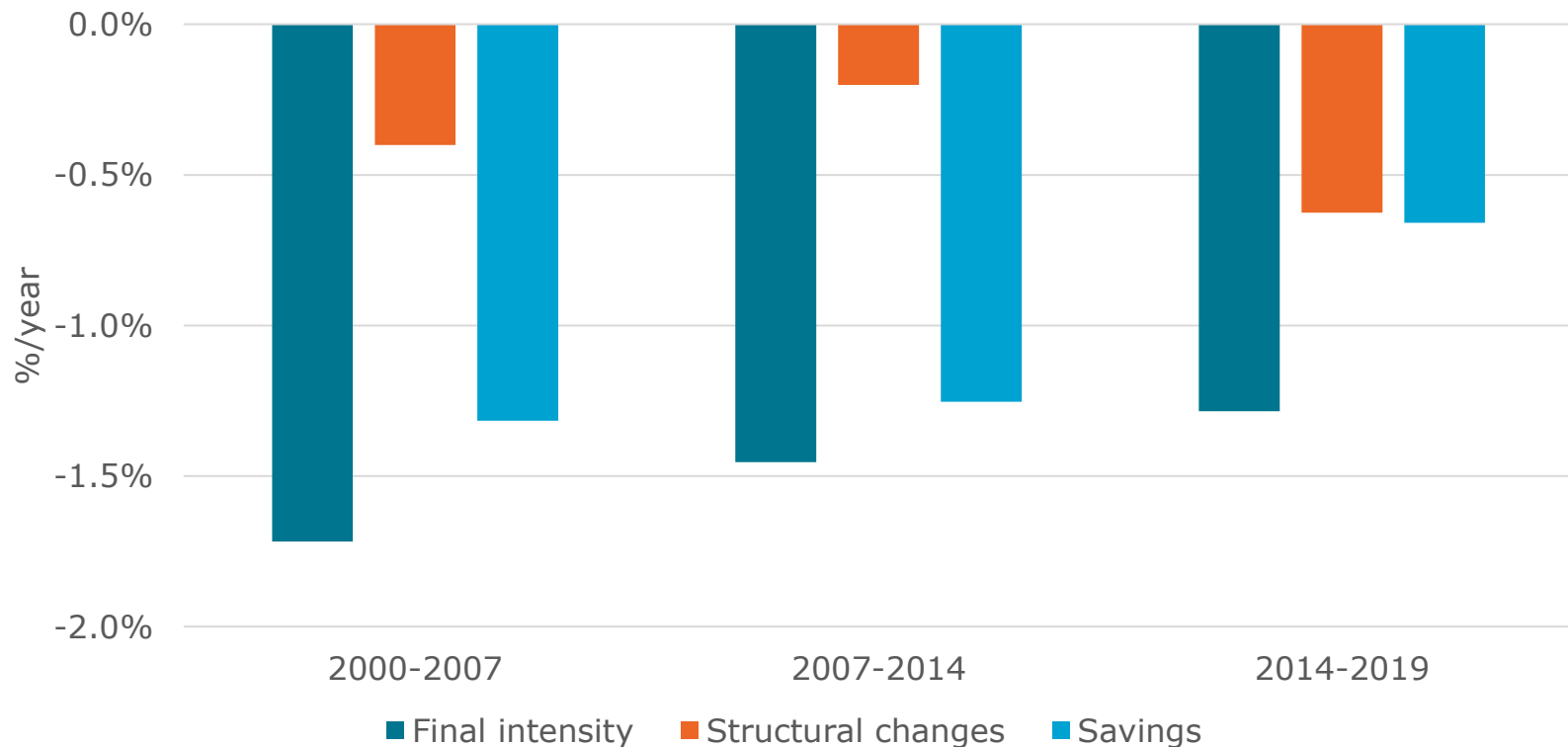
Energy savings first fuel in primary energy consumption

- Looking on a longer period, since 1990, energy savings have reduced primary consumption by around 580 Mtoe in 2019, i.e. the equivalent of 27% of that consumption.
- Energy savings is the first fuel in primary consumption in 2019 (4 points above oil with a share of 23%).



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%)...



Conclusions

Have we got off track?

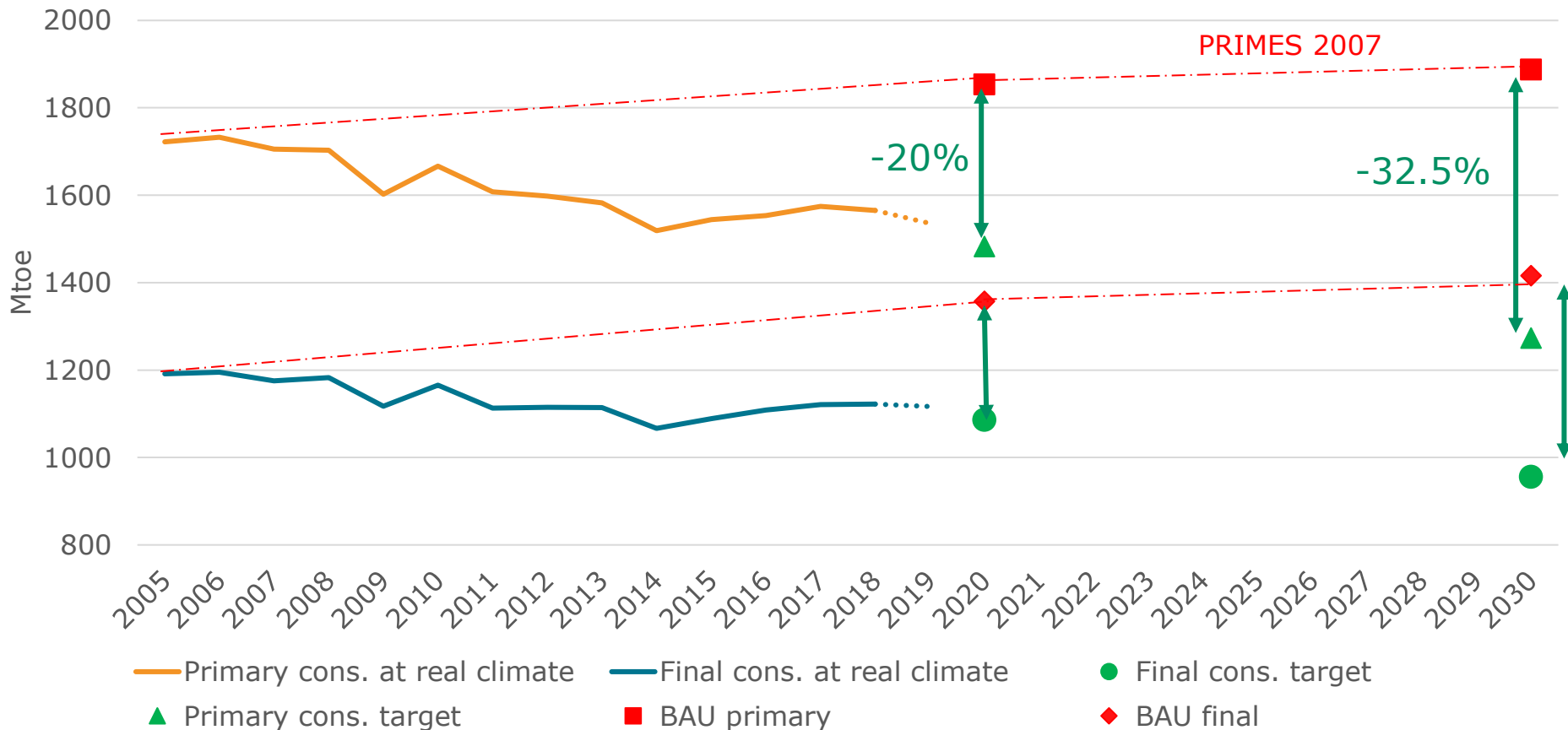
EU Energy efficiency targets

- Energy efficiency targets are always difficult to define, they can be expressed in terms of:
 - i. Energy intensity reduction, but as explained, variation in intensity include other factors than energy efficiency;
 - ii. Energy consumption reduction compared to a baseline;
 - iii. Energy savings;
 - iv. Energy consumption target level (i.e. absolute consumption cap)
- The EU has been using the 3 last types of targets, in a **complementary** way. If we refer to the most recent update of the EU energy efficiency law called EED (Energy Efficiency Directive), the EU has the following targets:
 - 32.5% energy saving target in 2030 (20% in 2020), for the EU as whole, compared to a Baseline projection*;
 - 1.5% additional energy savings until 2020 and 0.8% over 2021-2030 from energy savings obligation or policy measures (Article 7 of EED);
 - Primary and final energy consumption targets by country (Article 3).

* Referred to as PRIMES 2007 from the model name used

Primary and final energy consumption targets

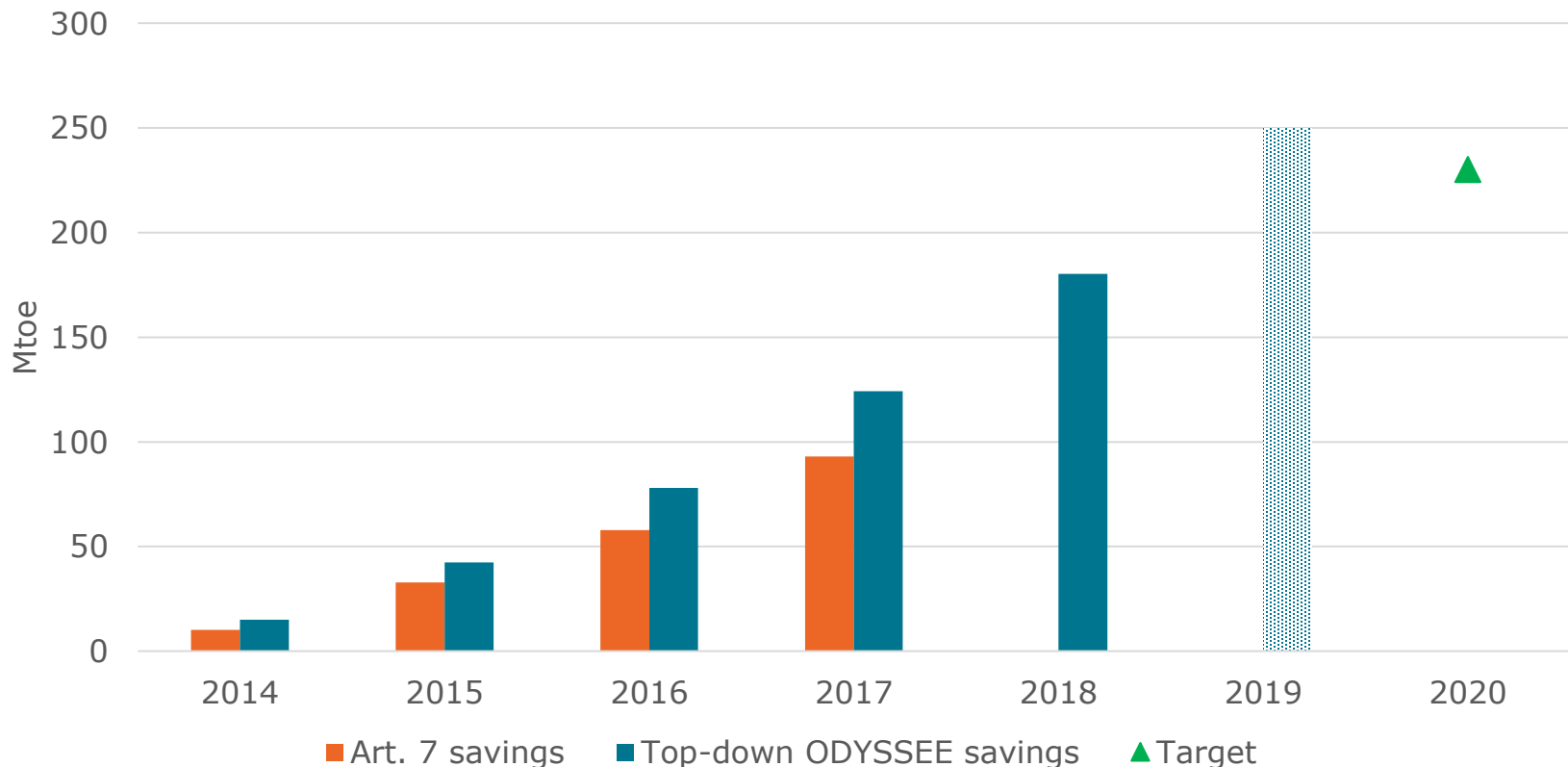
- In 2019, EU primary and final consumption were closed to the 2020 efficiency targets (around 4% and 3% above respectively).
- Warmer winters have helped achieving the targets (final consumption at normal climate 5% above target in 2019).
- Past trends do not enable to reach the 2030 targets.



Source: ODYSSEE

Article 7 imposes a certain level of energy savings

- 1.5% of additional annual savings according to Article 7 of EED for final consumers over 2014-2020 (and 0.8%/year from 2021 to 2030).
- Energy savings from Article 7 as reported by MS reached 40% of 2020 target in 2017, our estimate based on indicators exceed the target but our savings are broader than Article 7 savings (as they include all types of savings: policy related and from autonomous progress).



Conclusions

- Since 2014, the increasing share of renewables and more efficient thermal generation has offset 90% of the increase in final consumption.
- Energy efficiency improvement of final consumers has been much slower since 2007 in industry and since 2014 for households.
- The progression is the strongest for households (multiple regulations and incentives implemented at EU and national level).
- Have we got off track?
 - EU 2020 targets on primary consumption will be easily reached due to COVID crisis which will decrease consumption by 5 to 10% in 2020.
 - EU target to 2030 will not be reached with present trends and require additional measures, which is the purpose of Article 7.

Contact:

Bruno Lapillonne,
Scientific director
bruno.lapillonne@enerdata.net

Laura Sudries,
Energy efficiency analyst
laura.sudries@enerdata.net

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.

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