ODYSSEE-MURE

Enerdata intelligence + consulting

Energy efficiency trends and targets in the EU

Odyssee-MURE webinar series on Energy Efficiency

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About ODYSSEE-MURE

Supported by LIFE-CET programme

Coordinated by ADEME AGENCE DE LA TRANSITION ÉCOLOGIQUE **with the support of** Enerdata intelligence + consulting → ODYSSEE; Fraunhofer ISI → MURE

Based on a network of 40 national partners

27 EU Member States + 9 Energy Community parties + Switzerland

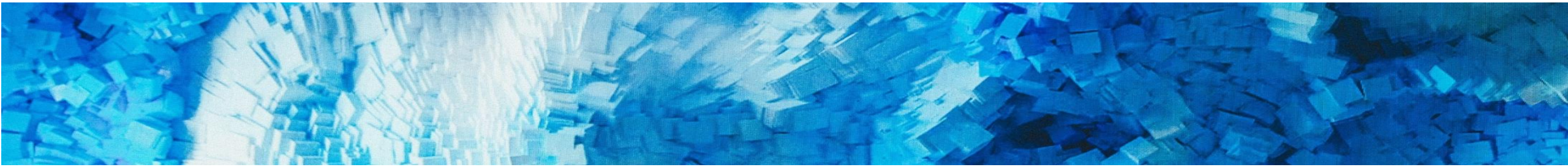
About ODYSSEE

- Data and energy efficiency indicators up to 2022:
  - From Eurostat for aggregate data (2022)
  - From national partners for detailed data (2021), supplemented by early estimates for 2022 computed by Enerdata

- Data and indicators available in a database and 5 tools : www.odyssee-mure.eu

Agenda

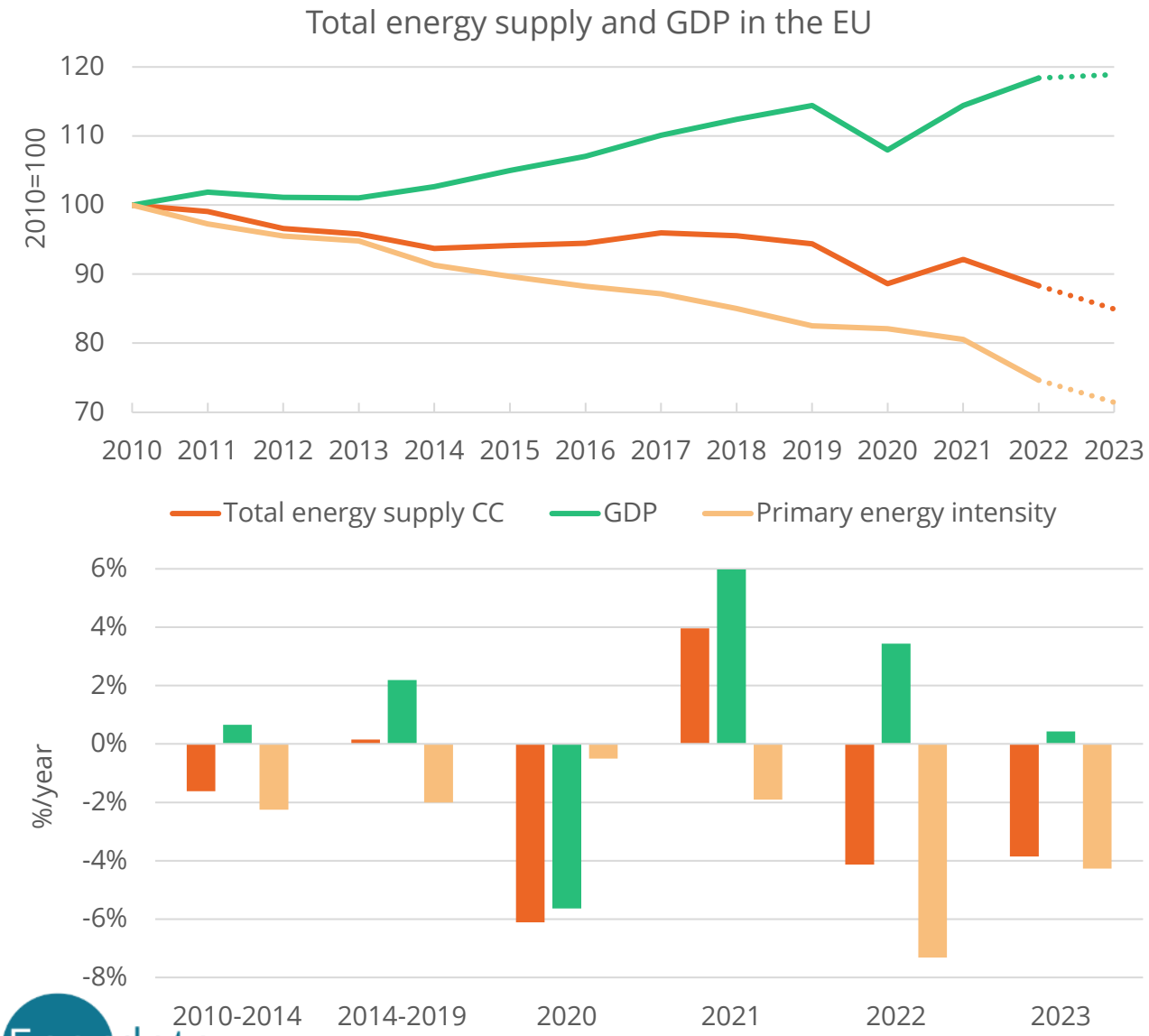
1. Energy consumption and emissions trends
2. Energy efficiency trends
3. Contribution of energy efficiency policies
4. Conclusion and Q&As



1 Energy consumption and emissions trends

Enerdata

Trends in total energy supply and GDP in the EU



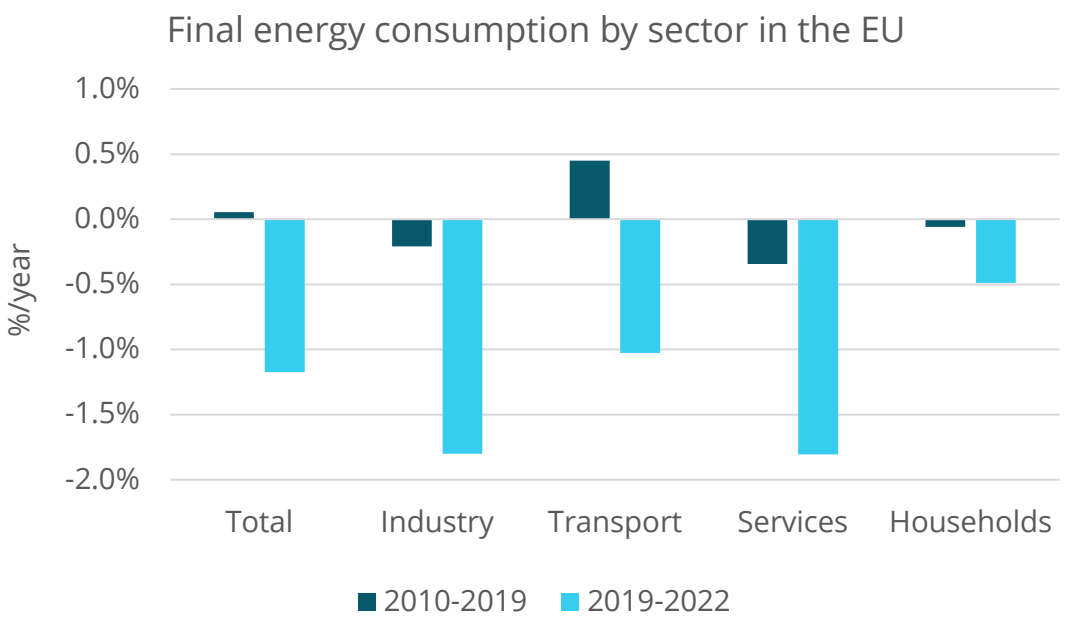
Large fluctuations in total energy supply since 2020:

- large decrease since 2022 (-4%/year), linked to slower economic growth in 2023 (+0.4%) and to price rises in 2022
- strong rebound in 2021 (+4%), below GDP growth (+6%), after the sharp drop in 2020 (-6%).

Decoupling of energy consumption and GDP, with a reduction of primary energy intensity **3 times higher since 2022** (-6%/year) than over 2010-2019 (-2%/year).

Source: ODYSSEE, based on Eurostat and early estimates by Enerdata; consumption at normal climate.

Final energy consumption by sector in the EU



Source: ODYSSEE, based on Eurostat; consumption at normal climate, non-energy uses excluded.

Over **2010-2019**, total final energy consumption remained almost **stable**, with a slight increase in transport (+0.4%/year) offset by decreases in other sectors.

Since **2019**, final consumption **declined in all sectors** (-1.2%/year overall), and much **faster** in **industry** and **services** (-1.8%/year). Most of this reduction is linked to the surge in energy prices (+70% in industry, almost 40% for households).

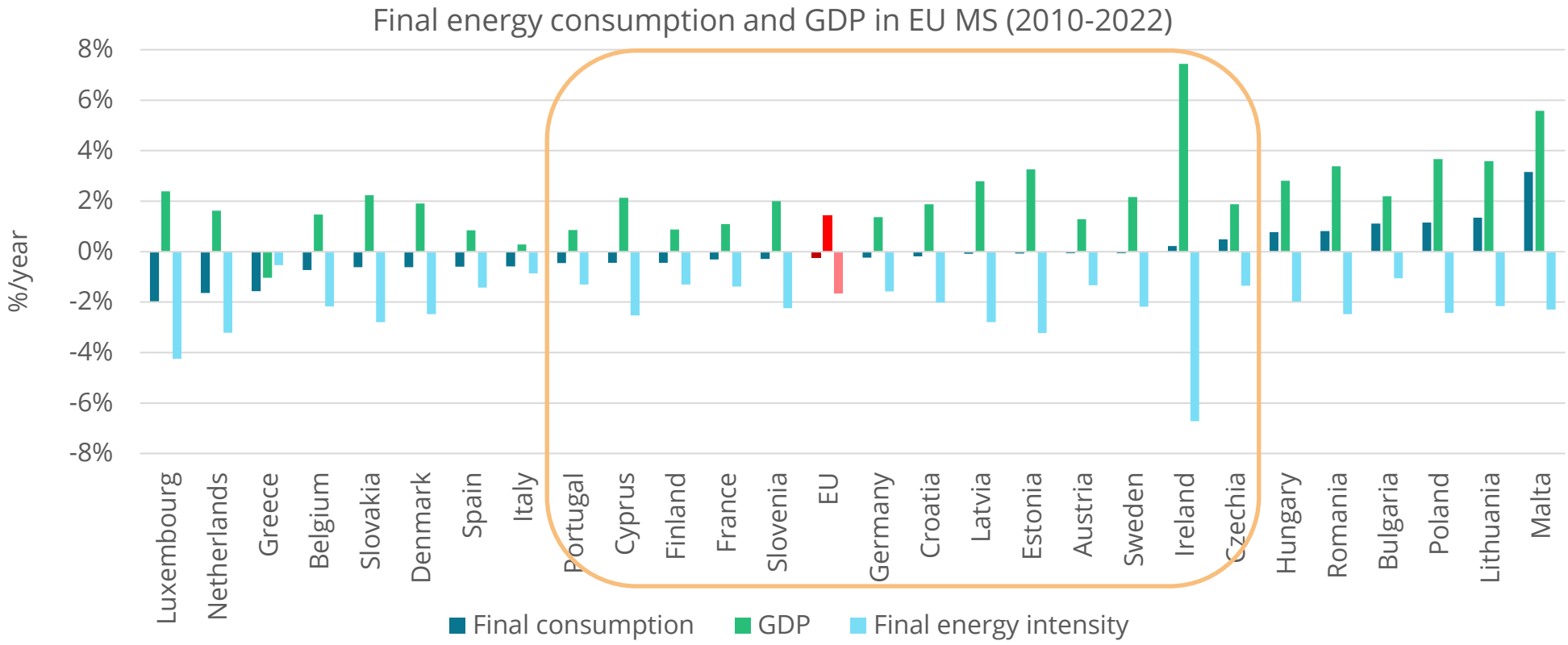
In **2023**, according to first estimates by Enerdata, and in 2022, final consumption **decreased by** almost **2%,** and the smallest contraction was in transport and the largest in industry.

Final energy consumption and GDP by country

Consumption remained roughly **stable** in **13 EU MS** and at **EU level**.

Consumption decreased despite economic growth in 8 countries and increased less rapidly than GDP in the other 6.

Final energy **intensity declined in all EU MS**, with a significant reduction in 4 countries, reaching -7%/year in Ireland and -4%/year in Luxembourg.

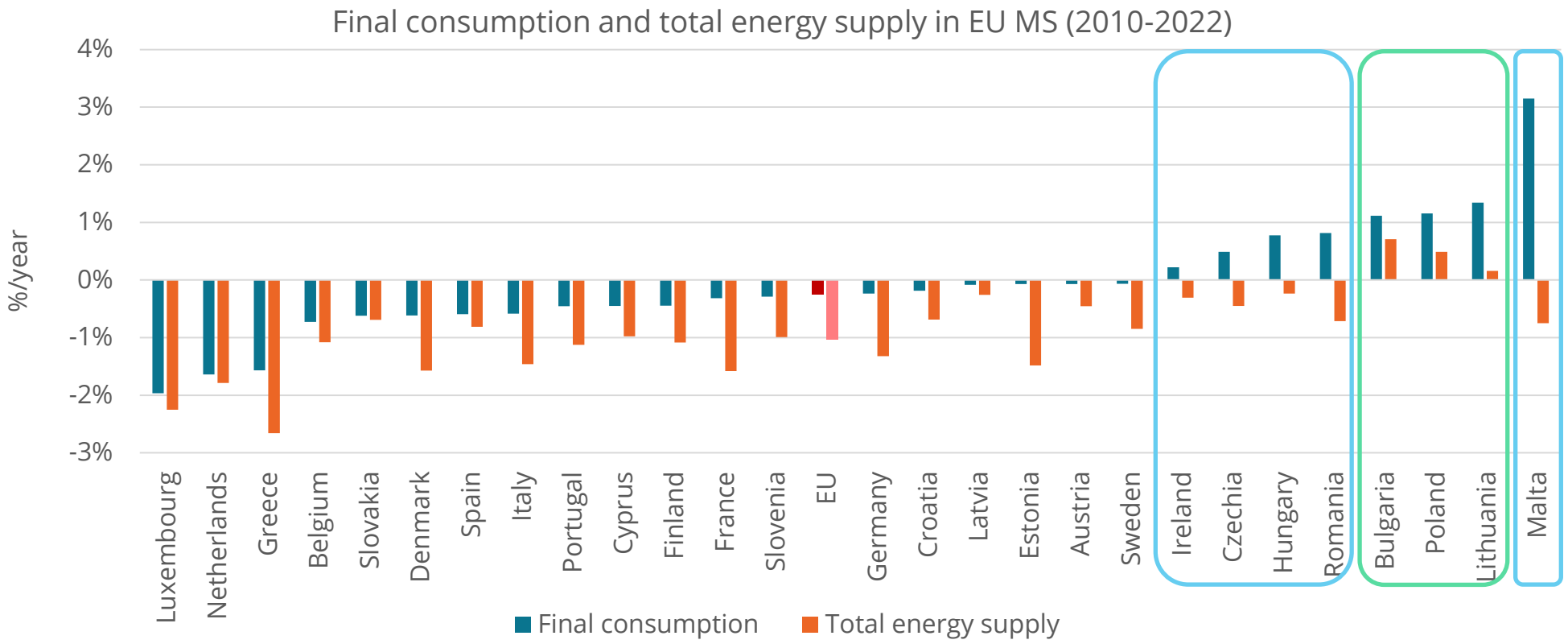


Source: ODYSSEE, based on Eurostat; consumption at normal climate.

Divergent trends for total energy supply and final energy consumption

Divergent trends explained by decreasing losses in power generation due to the development of renewables:

- **A faster decrease in total supply than in final consumption** in most EU MS and at EU level,
- In other MS, decrease in total supply despite an increase in final consumption (5 countries) or lower increase in total supply than in final consumption (3 countries).



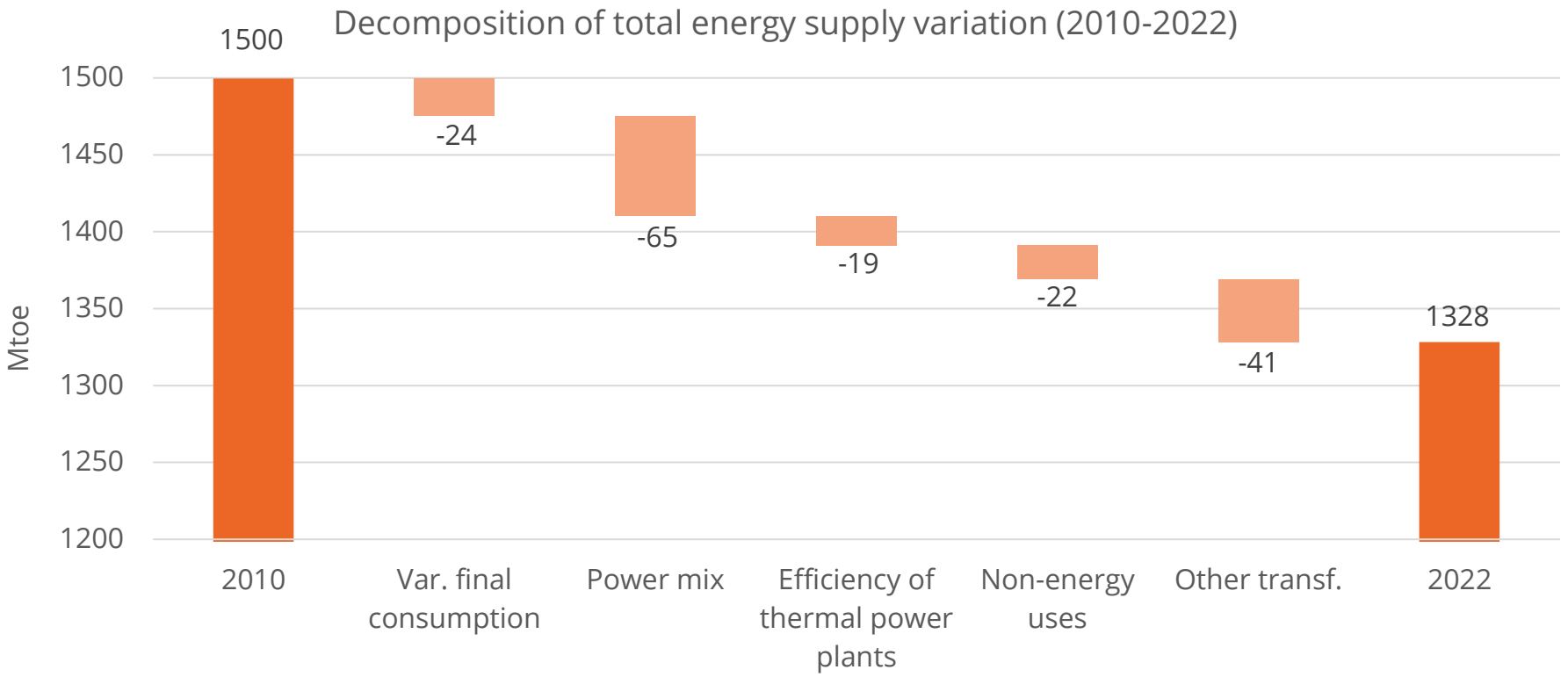
Source: ODYSSEE, based on Eurostat; consumption at normal climate.

Drivers of total energy supply variation (2010-2022)

Between 2010 and 2022, **total energy supply decreased more than final consumption**: **-171 Mtoe** compared to -24 Mtoe.

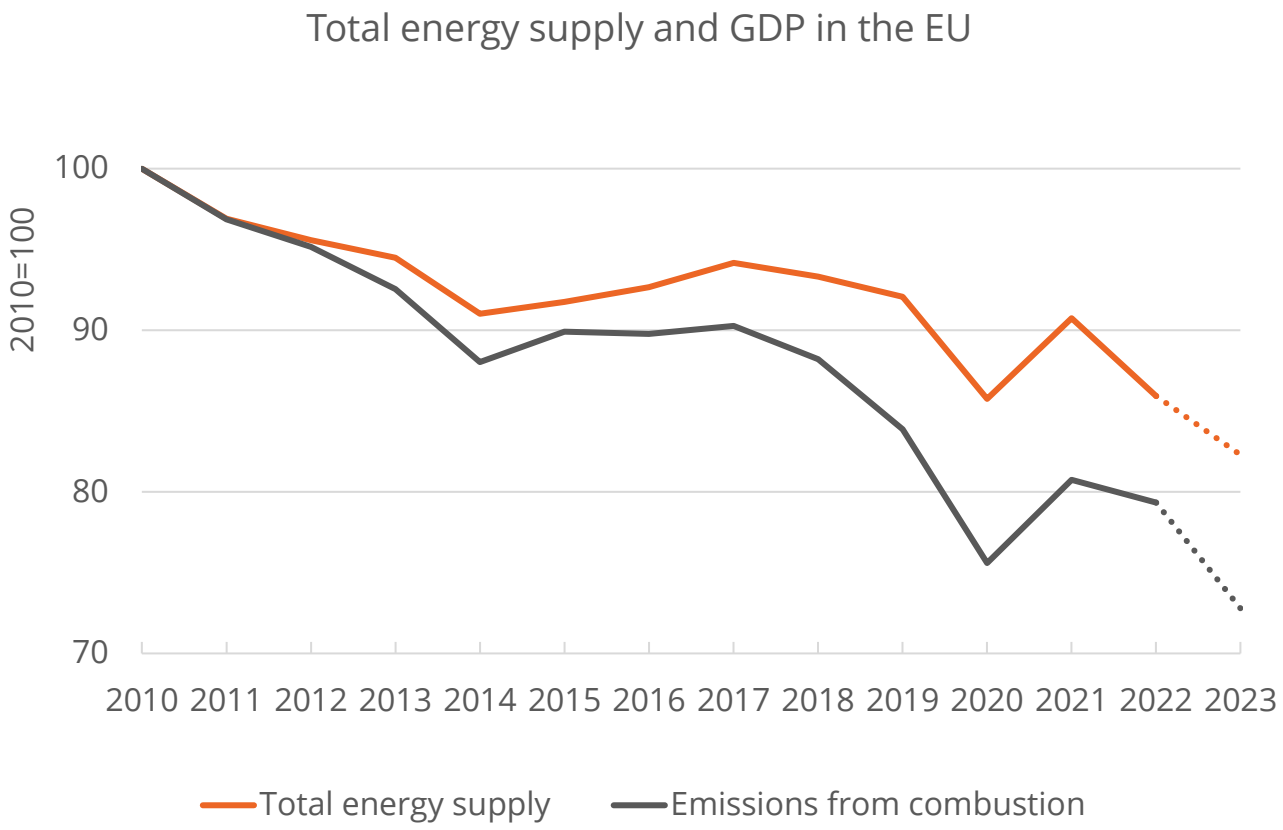
Half of this difference is explained by changes in the power sector:

- A **higher share of renewables** (+17 pts) and lower shares of nuclear and thermal (-7 pts each) reduced total supply by 65 Mtoe.
- An **improved efficiency of thermal generation** (+2.6 pts), thanks to a shift from coal to gas and more efficient plants, which contributed to a reduction of 19 Mtoe.



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

CO_2 emissions and total energy supply in EU



Source: Enerdata

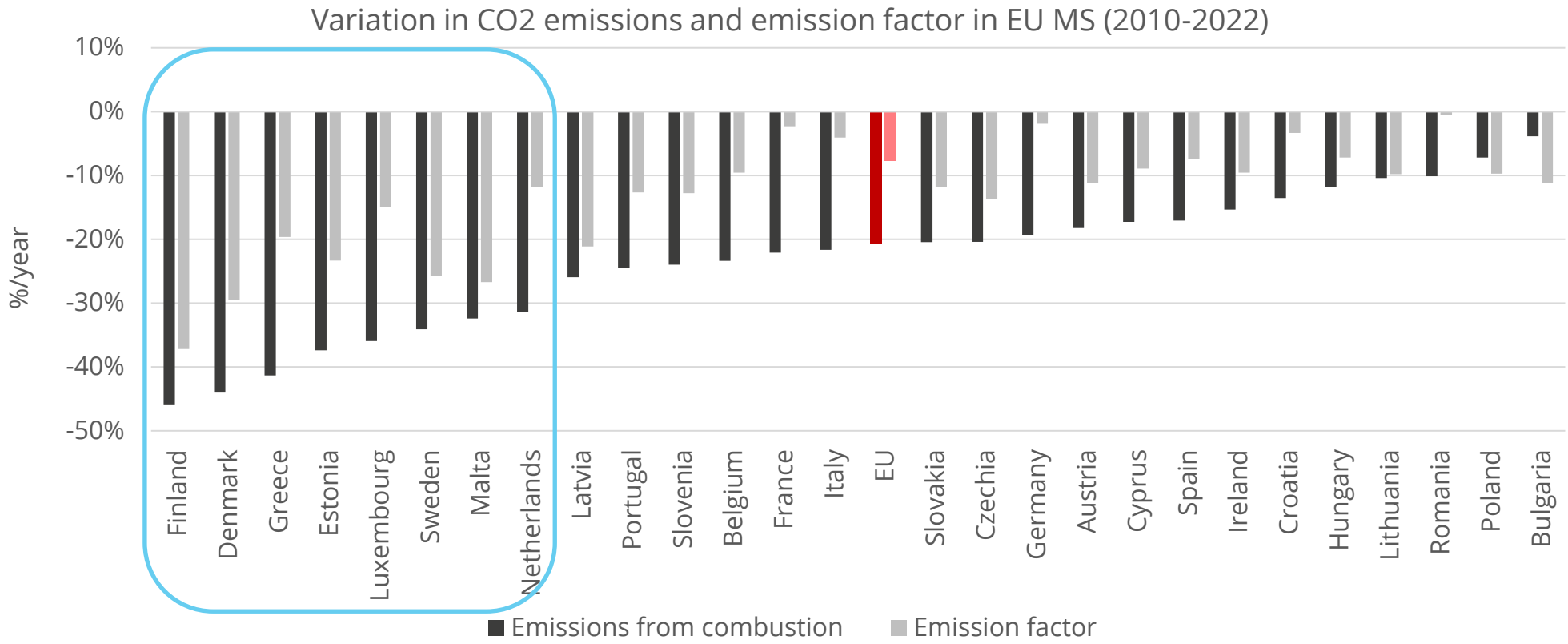
Decoupling of energy-related CO_2 emissions and total energy supply since 2010.

In 2023, CO_2 emissions were **27%** lower than in 2010: **60%** of this reduction is due to the decrease in energy supply and **40%** to decarbonization (decrease in the average emission factor from 2.06 to 1.82 tCO_2/toe).

Variations in CO_2 emissions from combustion and emission factor by country

CO_2 emissions decreased significantly in 8 countries (30-40%). In 3 of them (Greece, Luxembourg and Netherlands), this reduction is mainly due to a decrease in primary consumption.

The **emission factor decreased in all EU MS** except Germany, France and Romania (stable), with a high reduction in Finland, Denmark and Sweden (decarbonisation of the fuel mix), as well as in Estonia and Malta (switch to less carbonated fossil fuels).



Source: ODYSSEE, based on Eurostat; consumption at normal climate.

2 Energy efficiency trends

Enerdata

How is energy efficiency progress measured in ODYSSEE?

- Energy efficiency progress is measured by end-use or sub sector with various indicators of specific consumption measured in physical units selected to be as as close as possible to energy efficiency*:
  - For transport in l/100 km or toe/pkm for cars, in l/100 km and toe/tkm for trucks, etc.
  - For households in toe/m2 for heating, in kWh/appliance for large appliances, in toe/dwelling for cooking or water heating, etc.
  - For industry in toe/ton for energy intensive products (steel, cement, pulp and paper), in toe/IPI for other branches.

- From the different energy efficiency trends measured by end-use, sub-sector or transport mode, ODYSSEE calculates an **energy efficiency index** by sector, called "**ODEX**".
  - ODEX is calculated:

    - by expressing each trend in specific consumption by end-use or sub sector, as an index of variation;

    - then by calculating an average index for the sector weighted by the share of each end-use or sub-sector in the sector's consumption.

  - ODEX is calculated based on 30 end-uses, sub-sectors or transport modes**.

** Key indicators can be found in the Key indicators tool at https://www.indicators.odyssee-mure.eu/online-indicators.html*
*** For more information on ODEX: https://www.odyssee-mure.eu/publications/archives/odex-indicators-database-definition.html*

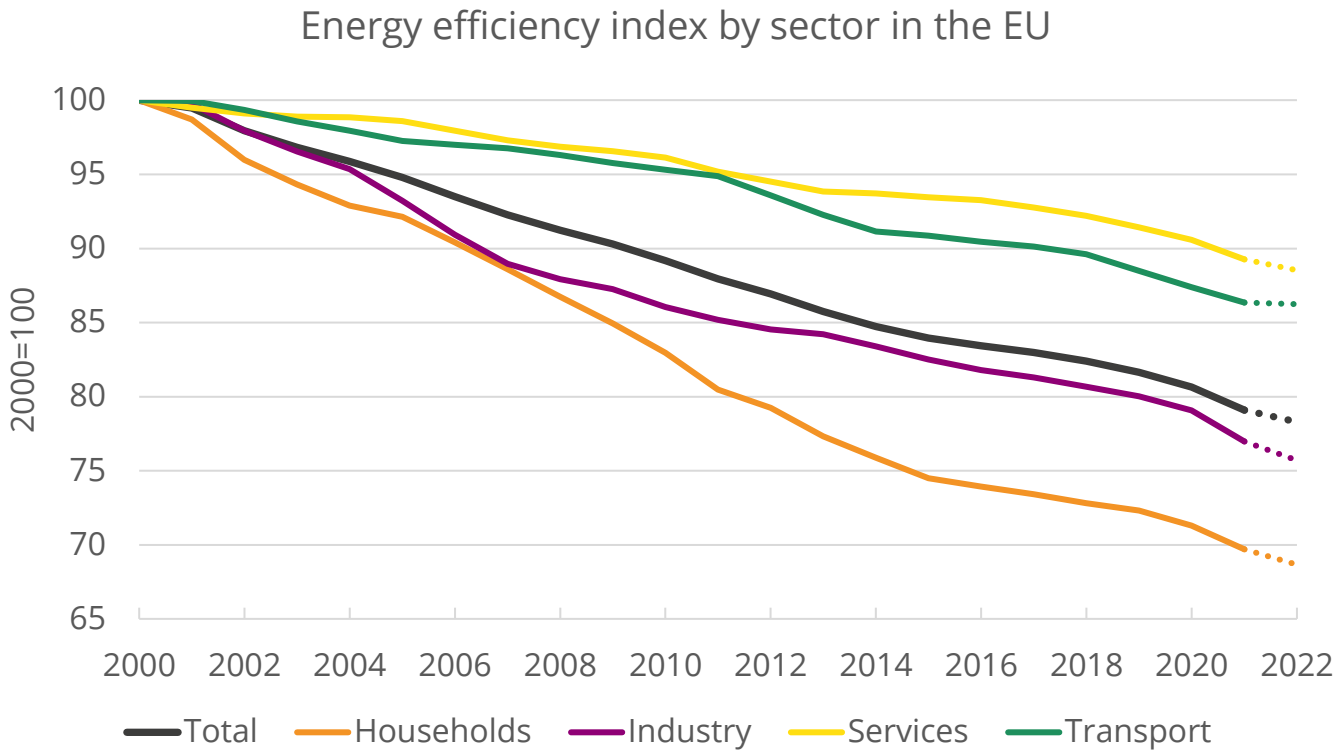
Energy efficiency trends in the EU: acceleration since 2019

Energy efficiency of final consumers has improved by **1.1%/year** since 2000 in the EU (i.e. by 22%). These improvements have accelerated **since 2019** (**1.4%/year**), after a slow progression over 2014-2019.

Largest improvements for **households** (31%, i.e. 1.7%/year), followed by **industry** (24%, i.e. 1.3%/year).

Transport and services are lagging behind with **0.7%/year** and **0.6%/year** improvement, respectively.

The recent intensification in energy efficiency progress may be partly linked to the high energy prices since 2021, which cannot always be well accounted for in indicators.

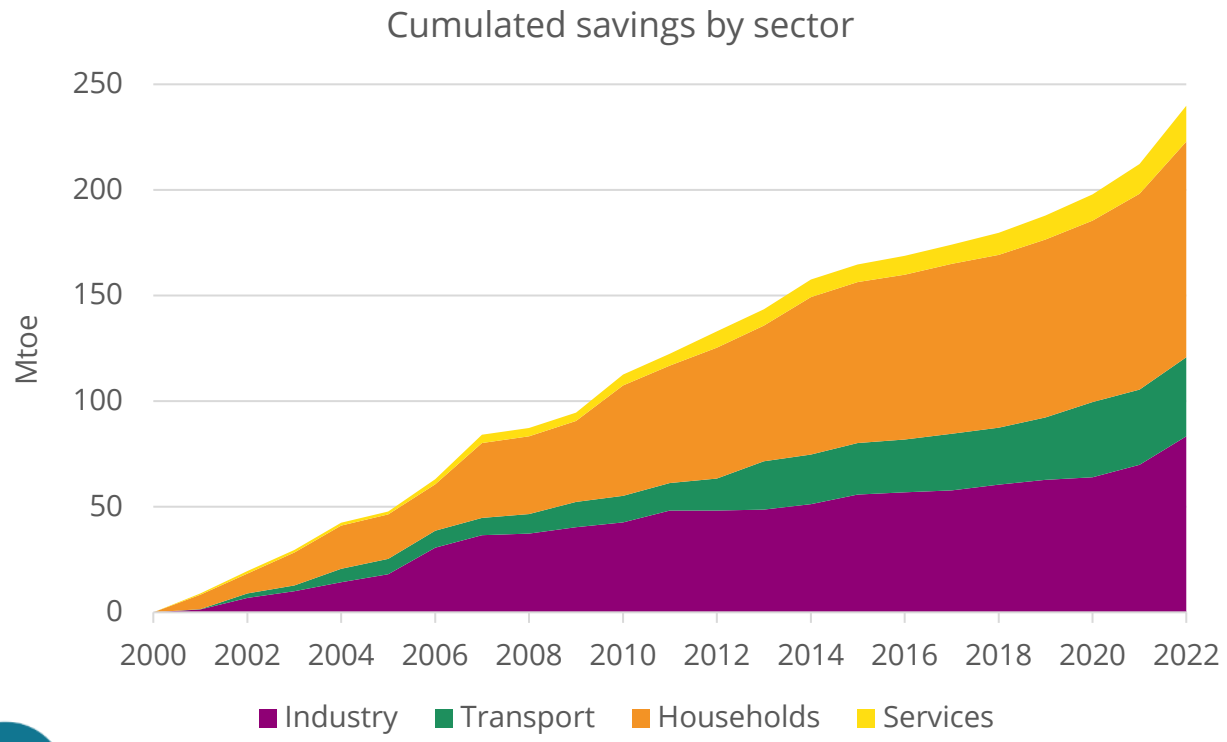


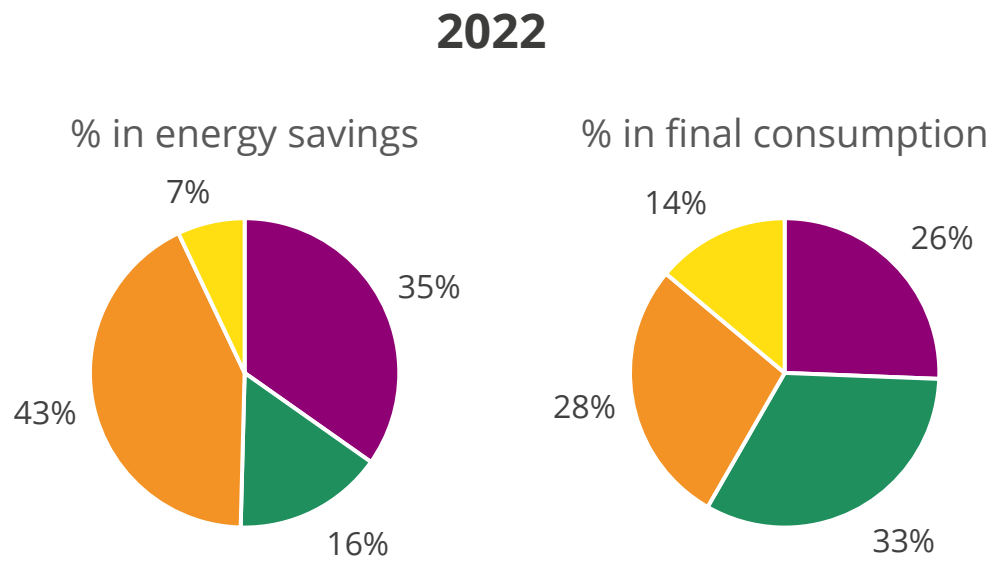
Source: ODYSSEE, ODEX indicators *https://www.indicators.odyssee-mure.eu/energy-saving.html*

Energy savings in transport lag behind the other sectors

In 2022, total final **energy savings** reached **240 Mtoe** in the EU (i.e. 27% of final consumption): without these savings, final consumption would have been **27% higher**.

Together, **industry** and **households** accounted for **77%** of these savings while representing 53% of final consumption. Transport and services lag behind as they only accounted for 16% and 7% of savings, respectively, shares twice lower than their shares in final consumption .





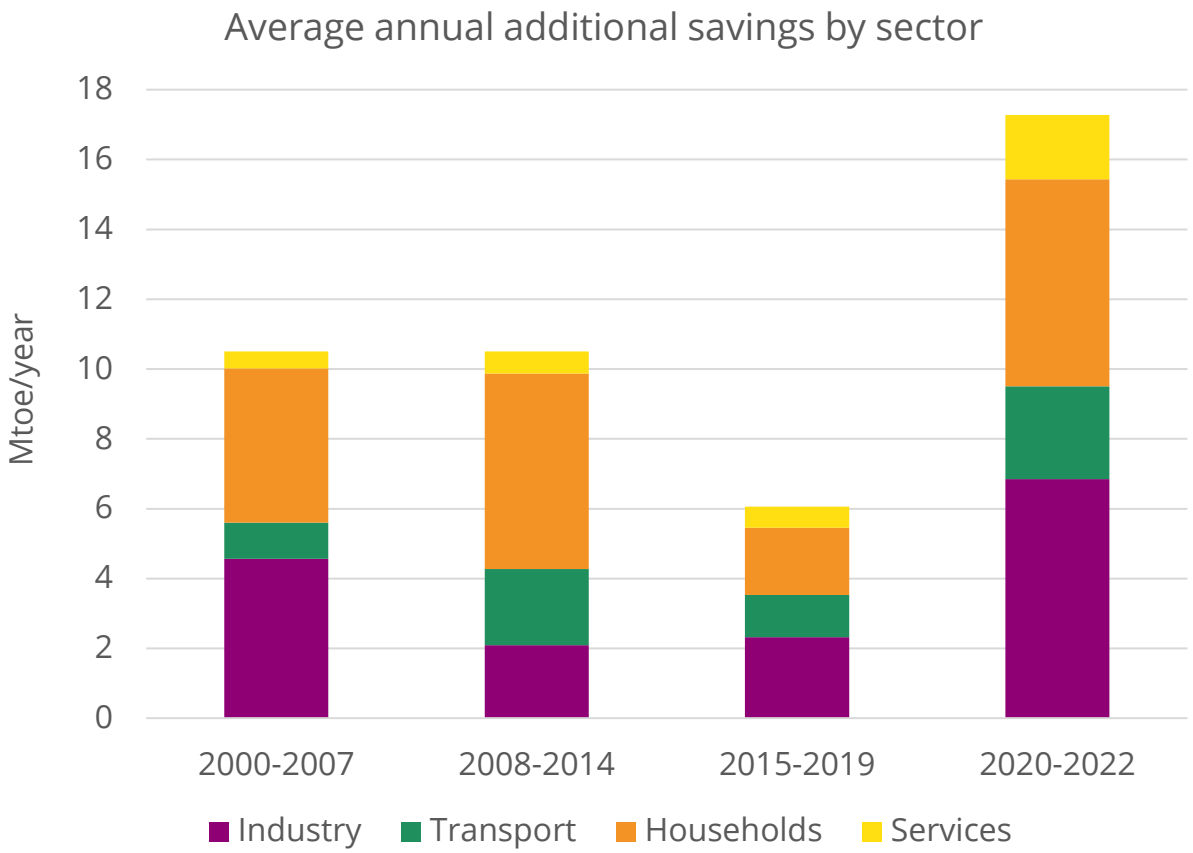
Source: ODYSSEE

Acceleration of energy savings since 2020

Between 2000 and 2014, energy efficiency progress has saved an additional volume slightly over **10 Mtoe per year** at EU level.

These additional savings slowed down considerably between 2015 and 2019 (-40%) before increasing significantly since 2020 (17 Mtoe/year).

Since 2020, **industry** and **households** accounted for most of these savings **(> 3/4,** of which **1/3** for **households)**, about the same as over 2015-2019.

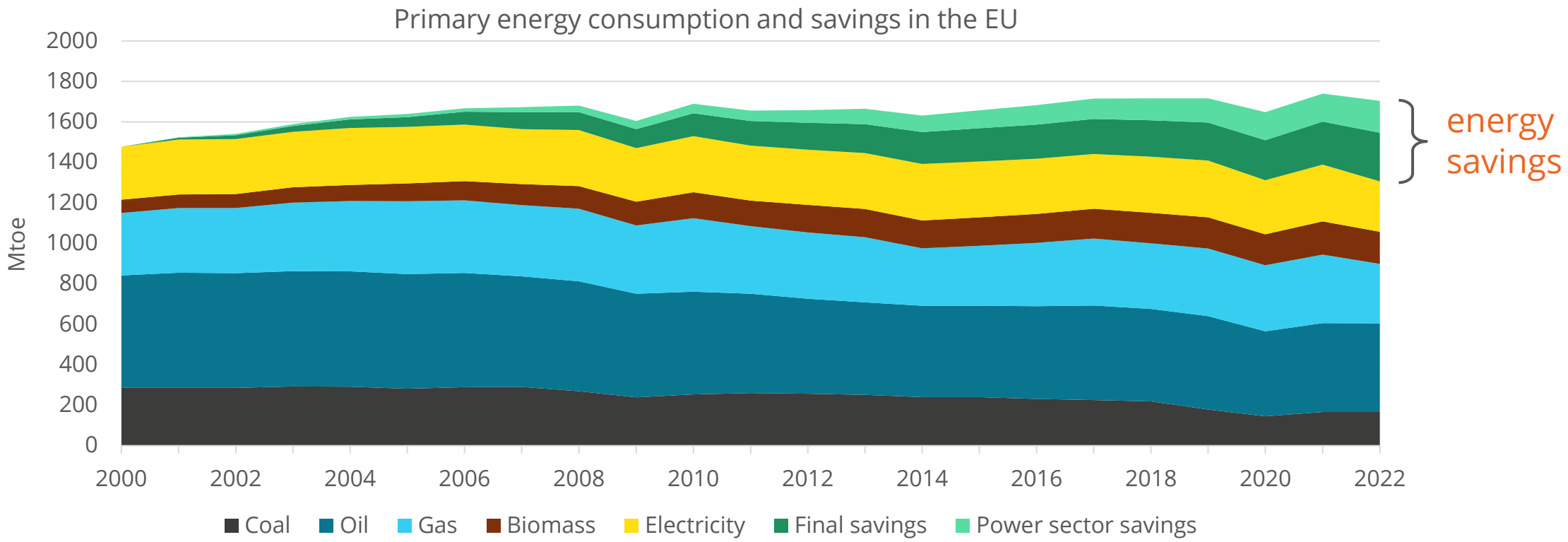


Source: ODYSSEE

Energy efficiency first principle

This graph shows how primary energy consumption would have developed without energy savings at the level of final consumers (dark green) and savings in the power sector due to changes in the power mix (larger share of renewables and better efficiency of thermal power plants, light green on top).

Total energy savings contributed to almost 400 Mtoe in 2022 (60% from final users and 40% from power sector), almost the first fuel, slightly behind oil. Starting in 1990, energy efficiency would be by far the **first fuel**.



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

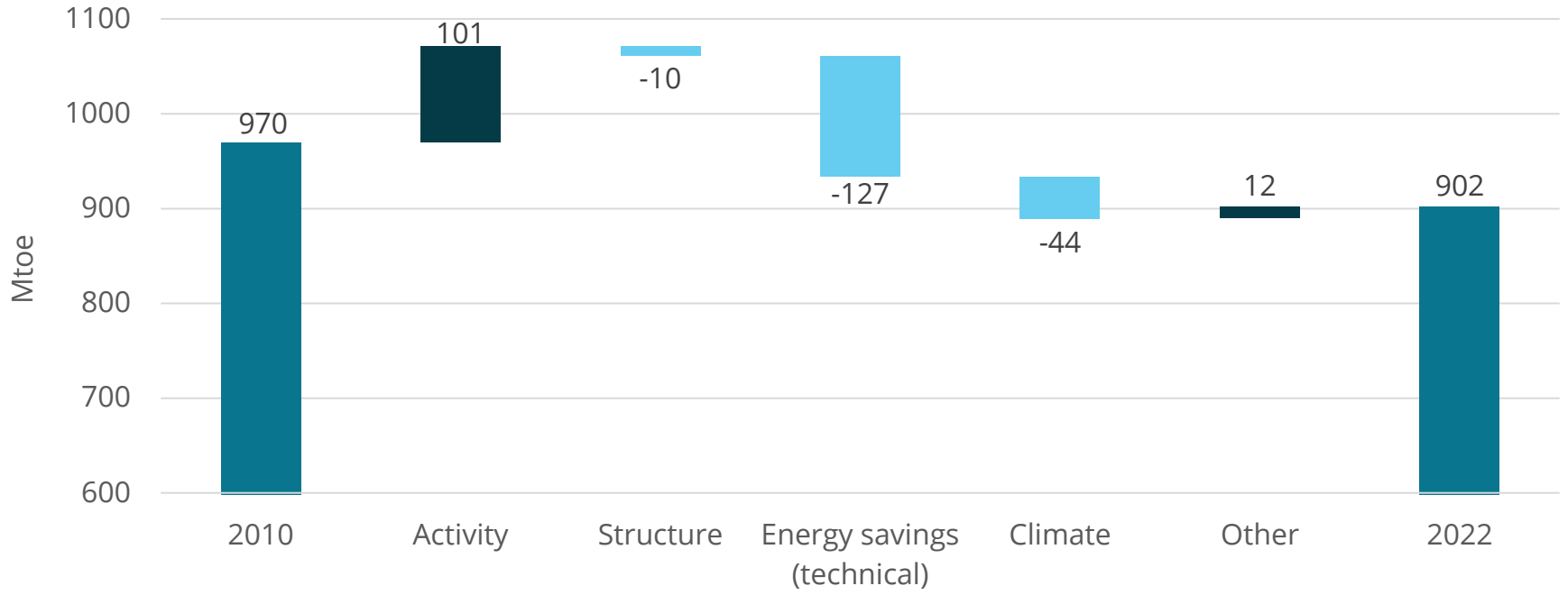
Drivers of final energy consumption variation (2010-2022)

Between 2010 and 2022, economic and demographic growth, increase in traffic and number of household appliances (**activity effect**) contributed to increase final consumption by **101 Mtoe** (35% in industry, 1/3 from households (half from demography), and almost 1/4 in services).

Energy **savings more than offset** this activity effect and reduced consumption by **127 Mtoe**, of which around 40% in households, 1/3 in industry, 20% in transport and around 10% in services.

Climatic differences between these two years were particularly significant (2022 being much warmer than 2010), and reduced consumption by a further **44 Mtoe**.

Decomposition of final energy consumption variation (2010-2022)



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

Drivers of final energy consumption variation in 2022

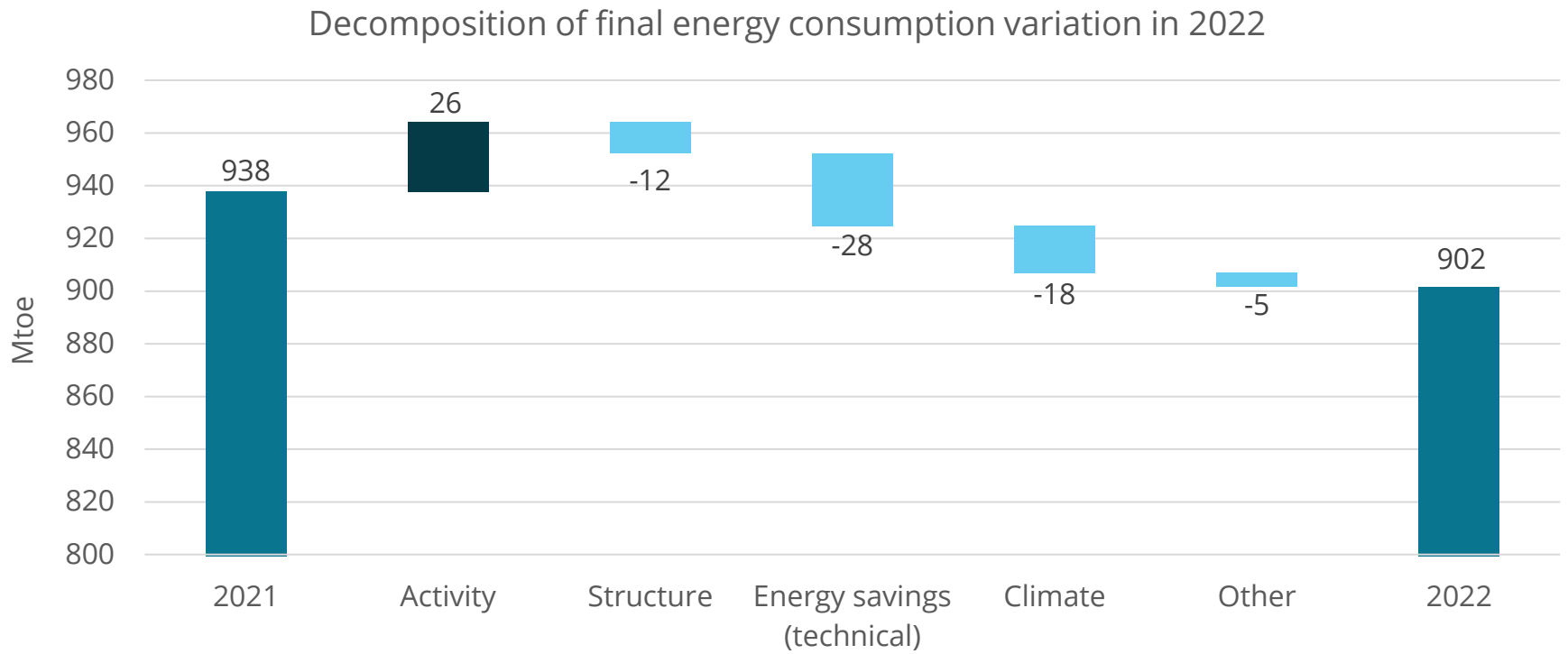
In 2022, final energy consumption decreased by 36 Mtoe.

The **activity effect** contributed to increase final consumption by **26 Mtoe** (**half** in **transport** and 30% in industry).

Energy **savings more than offset** this activity effect by reducing consumption by **28 Mtoe** (**half** in **industry** and 1/3 in households).

Climatic variations largely contributed to this reduction, cutting consumption by **18 Mtoe** (half the total reduction).

Structural changes, towards less energy-intensive branches in industry and towards more efficient modes in transport, further reduced consumption by **12 Mtoe** (of which 70% in industry).



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

Conclusions on energy consumption and energy efficiency

- Since 2020, there is a succession of unusual years, making it difficult to outline trends for the future: collapse of demand in 2020, strong rebound in 2021, drop in consumption since 2022 due to high prices and supply constraints.

- What is sure is that there will be an increasing decoupling between final and primary consumption, due to the growing share of wind and solar for power generation, with no losses accounted for in primary consumption.

- Energy efficiency improvement of final consumers seems to have accelerated since 2019 after slower progress over 2014-2019. This is partly due to higher energy prices and may be partially reversible.
- The progression of energy efficiency has been by far the strongest for households, due to multiple regulations and incentives at EU and national level.

More information about EnerFuture on
https://www.enerdata.net/research/forecast-enerfuture.html

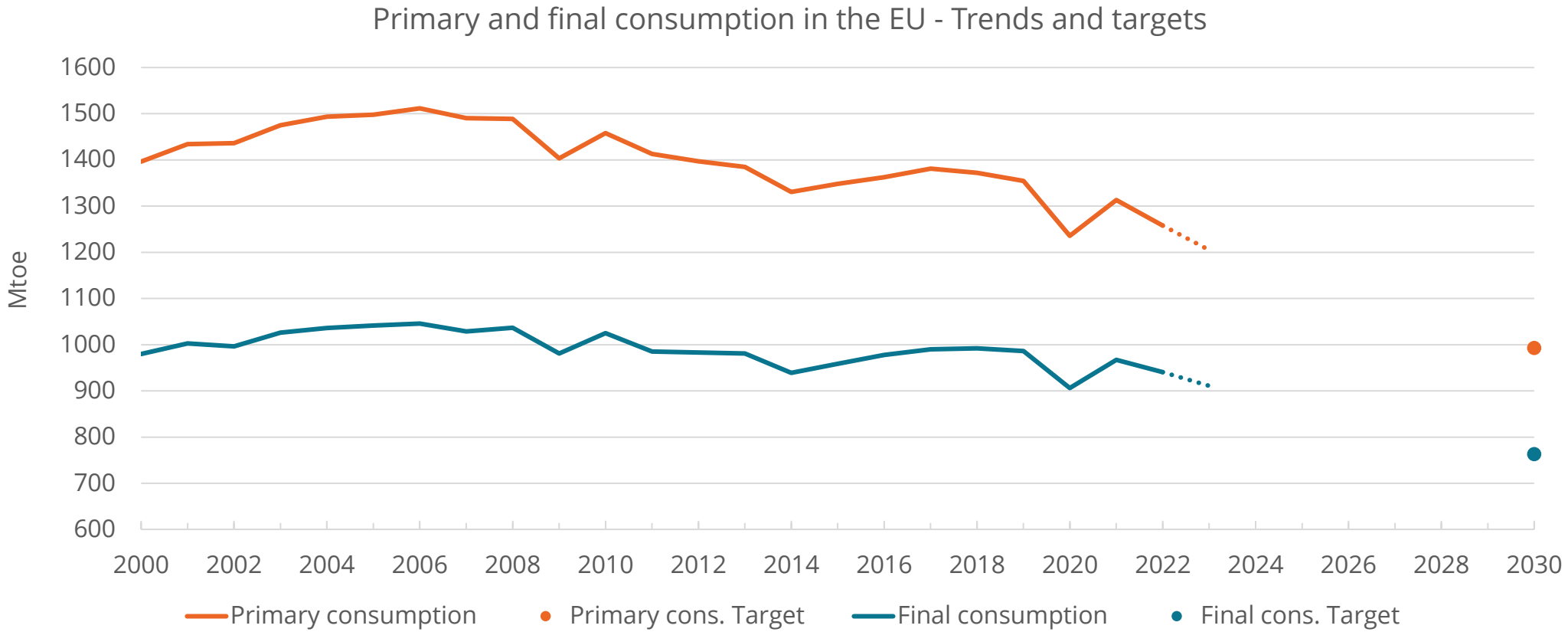
Enerdata

Are we on track with Article 4 of the EED?

Article 4 of EED targets an absolute level of consumption in 2030 for primary and final consumption.

As explained previously, the integration of renewables in the power mix is reducing rapidly primary consumption, which will continue by 2030, so the target should be reached.

For final consumption, this will depend on the rhythm of economic growth, the impact of energy efficiency policies, and consumer behaviors.



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

3 Contribution of energy efficiency policies

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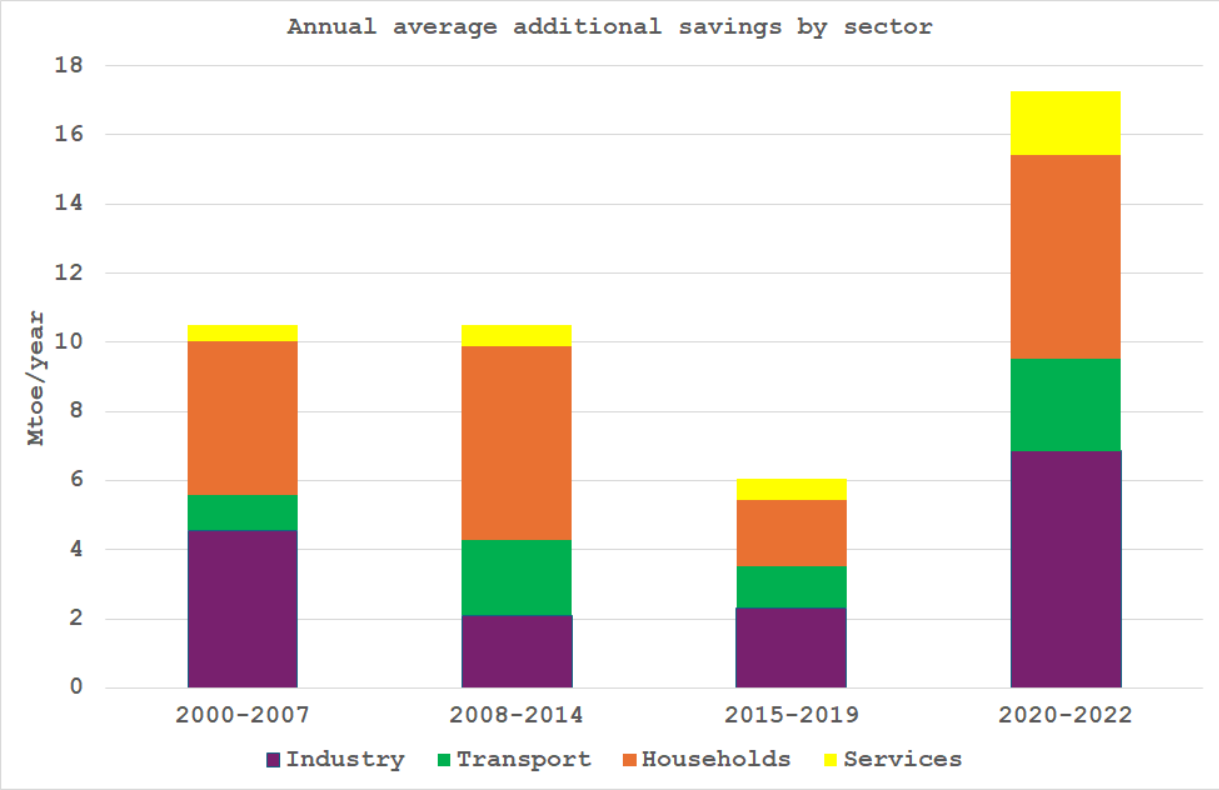
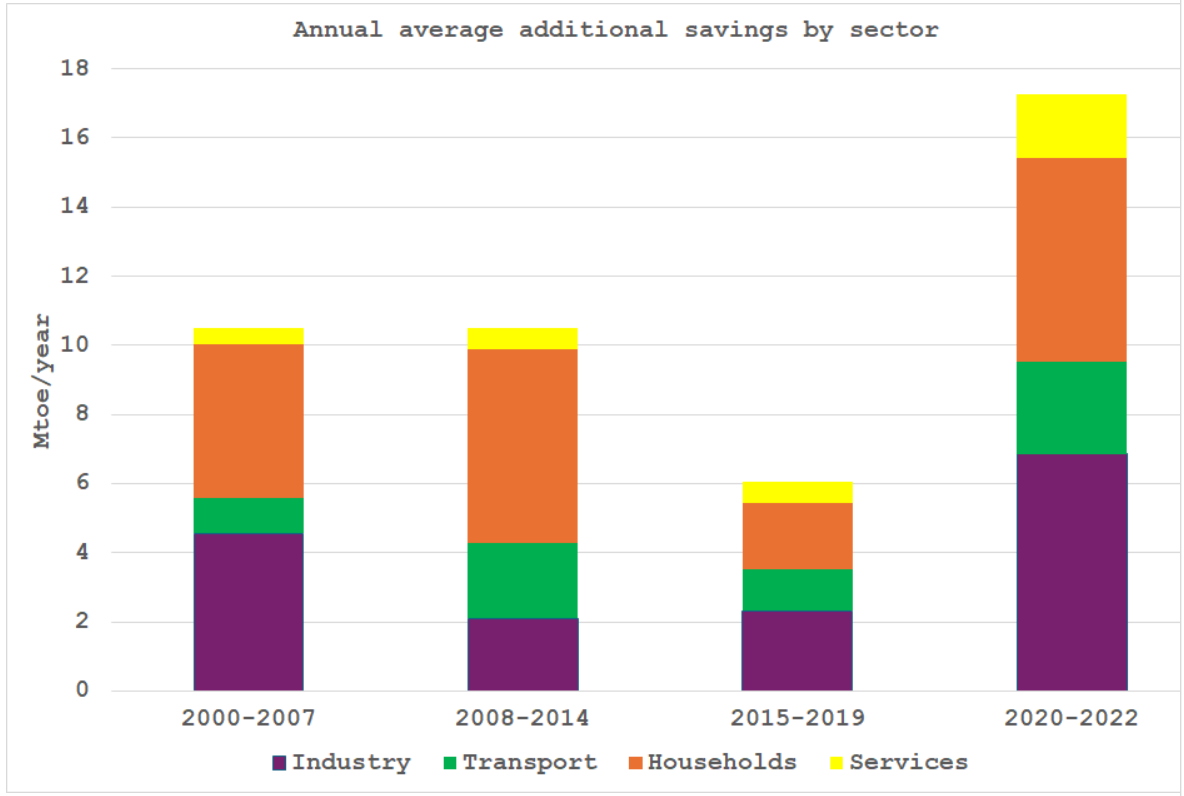
Trends in energy savings - Contribution of Energy Efficiency Policies

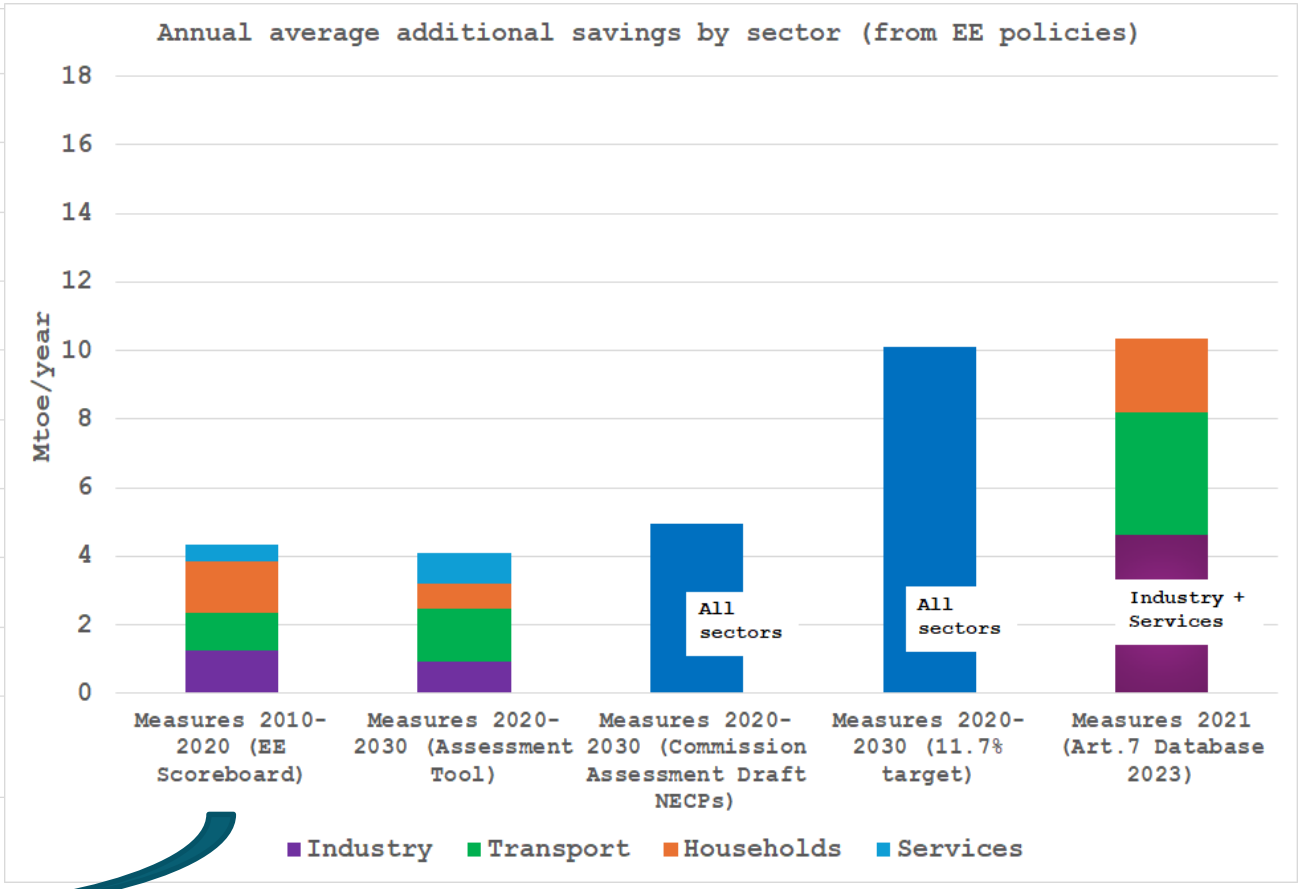


Source: ODYSSEE

Trends in energy savings - Contribution of Energy Efficiency Policies



Source: ODYSSEE



50% contribution from EE policies

Sources: MURE, EE Scoreboard, ODYSSEE-MURE Assessment Tool, EU Commission Assessment Draft NECPs, EU Commission Assessment Art. 7.

Conclusions on the contribution of Energy Efficiency Policies

- Over the period 2010-2020, Energy Efficiency Policies have contributed to save around 4.36 Mtoe/year (50% of the observed top-down savings). The remainder comes from autonomous savings and previous policies. (Analysis derived from the Odyssee-MURE/eceee EU EE Scoreboard).

- The analysis carried out on the MURE database using a newly developed Policy Assessment Tool, shows savings of around 4.10 Mtoe/year by 2030.

- A similar figure (4.97 Mtoe/year) results from the European Commission's analysis of Draft NECPs.

- The analysis of the EU Commission on the basis of Art. 7 (now Art. 8) contributions indicates for 2021 a substantial increase in measure impacts (in line with the observed increase in top-down savings in that period).

HELPING YOU SHAPE THE ENERGY TRANSITION

About Enerdata:

Enerdata is an independent research company established in 1991, specializing in the analysis and forecasting of energy and climate issues, at world and country level.

Leveraging our globally recognised databases, intelligence systems and models, we assist our clients in designing their policies, strategies and business plans.

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