ODYSSEE-MURE

The Energy Efficiency Academy 2025–2027

Webinar N°2 – Energy efficiency trends in industry

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About ODYSSEE-MURE

Supported by LIFE-CET programme

Coordinated by Fraunhofer ISI MURE **with the support of** Enerdata intelligence + consulting ODYSSEE **and** IEECP INSTITUTE FOR EUROPEAN ENERGY AND CLIMATE POLICY

Based on a network of 40 national partners

27 EU Member States + 9 Energy Community parties + Switzerland

Odyssee Database and tools

- Data and energy efficiency indicators up to 2023:
  - From Eurostat for aggregate data (2023)*
  - From national partners for detailed data (2023), supplemented by early estimates for 2024 computed by Enerdata

- Data and indicators available in a database and 6 tools : www.odyssee-mure.eu

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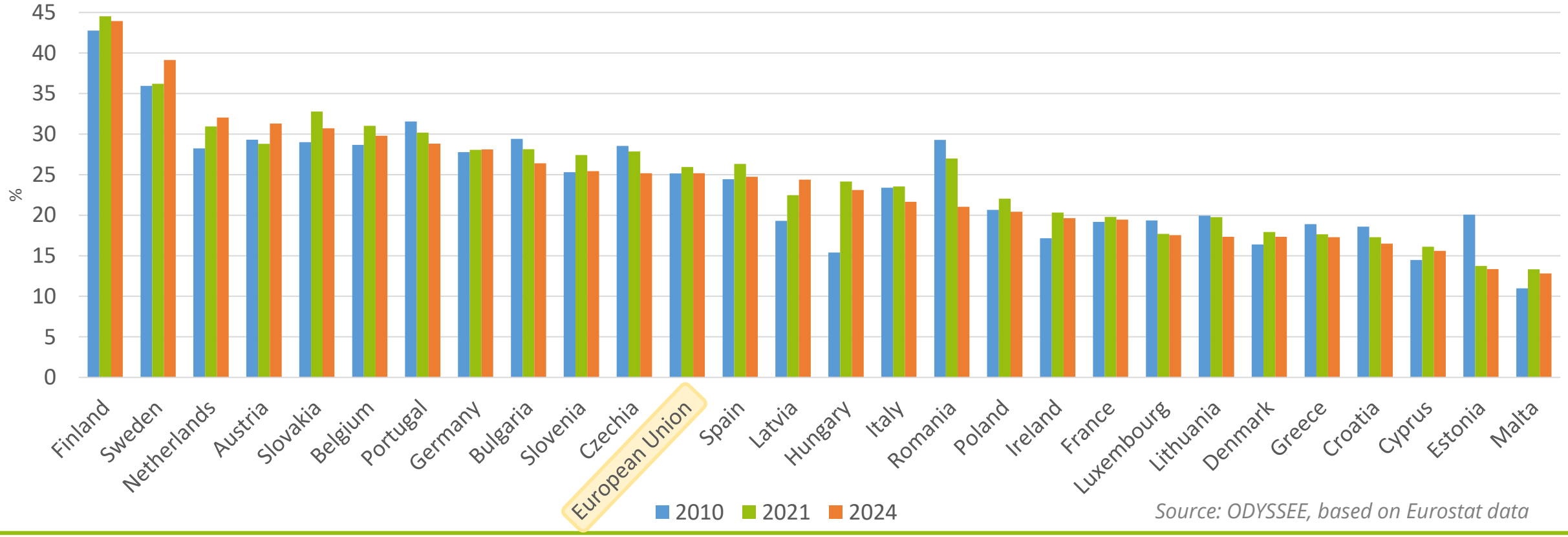
Industry : 25% of final energy consumption at EU level

Industry represents around **25%** of energy consumption at EU level, with a rather **stable share** since 2010.

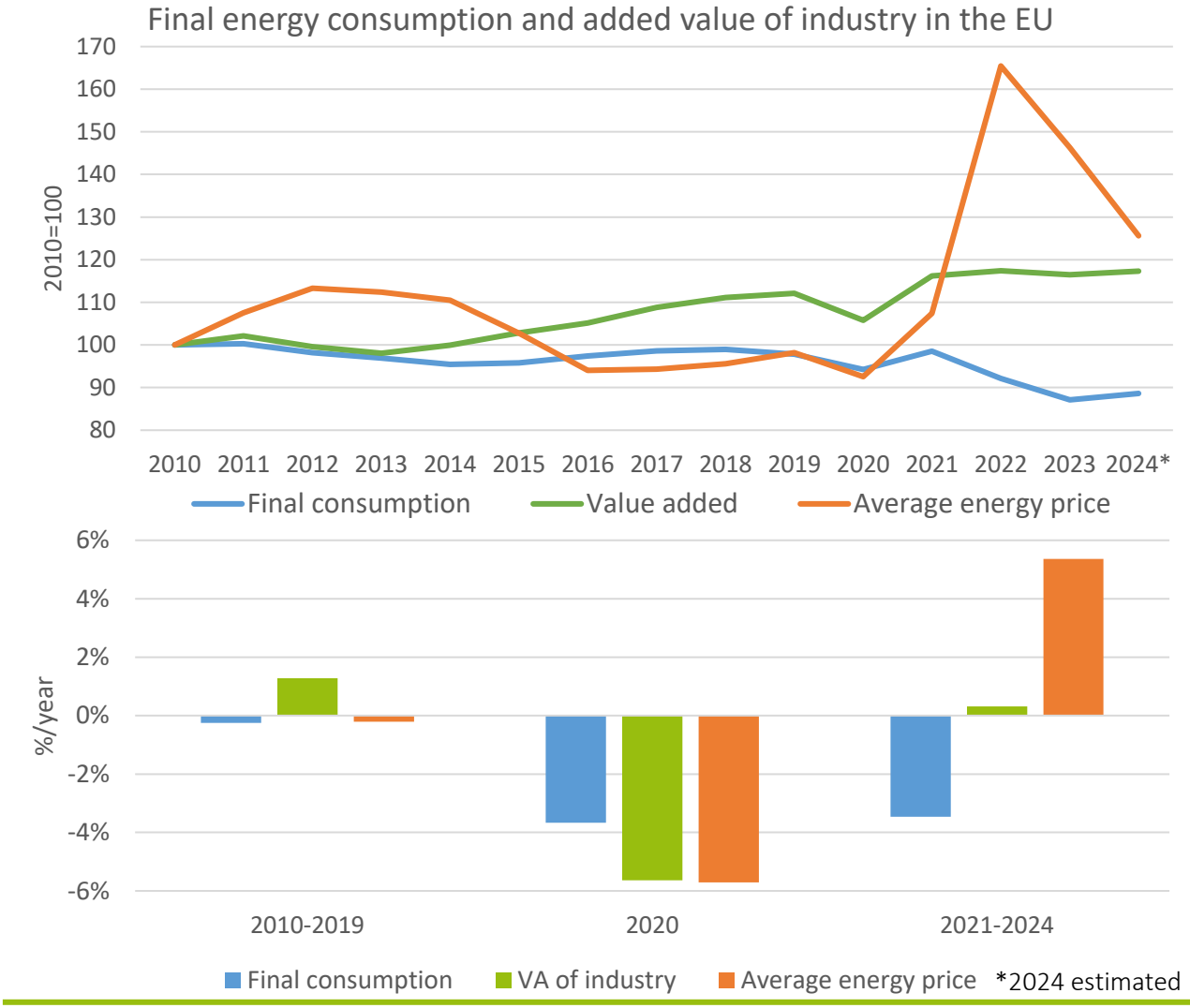
Significantly higher share in Finland and Sweden (> 35%) and in 4 other countries (~30%).

Increasing share in 9 countries, mainly in smaller EU countries, with highest increase in Hungary (+8 pts)



Source: ODYSSEE, based on Eurostat data

Industry energy consumption, activity and prices



- Energy consumption in industry decreased **sharply between 2021 and 2023** (-12% or -6%/year) due to surging energy prices. Early estimates for 2024 suggest a modest recovery, but consumption remains 11% lower than in 2010.

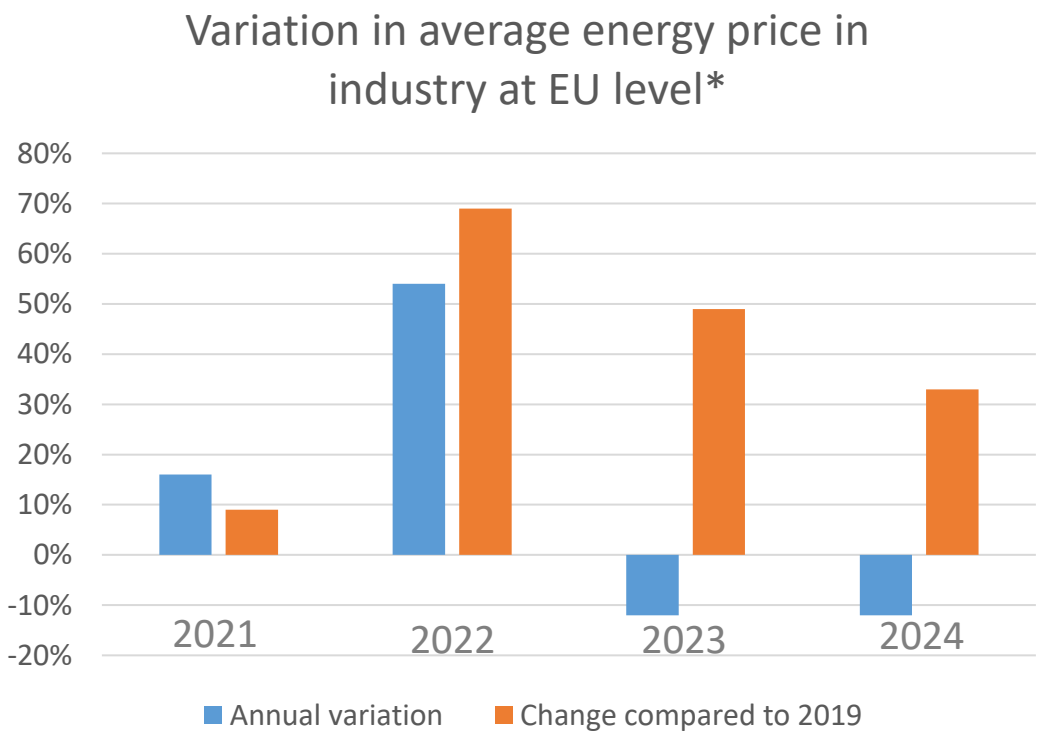
- Among large EU countries, **Poland** had the highest consumption reduction (-15% vs -12% for EU average); the other large countries contributing roughly according to their consumption share : 23% of total decrease for Germany, followed by **France**, **Italy and Spain**.

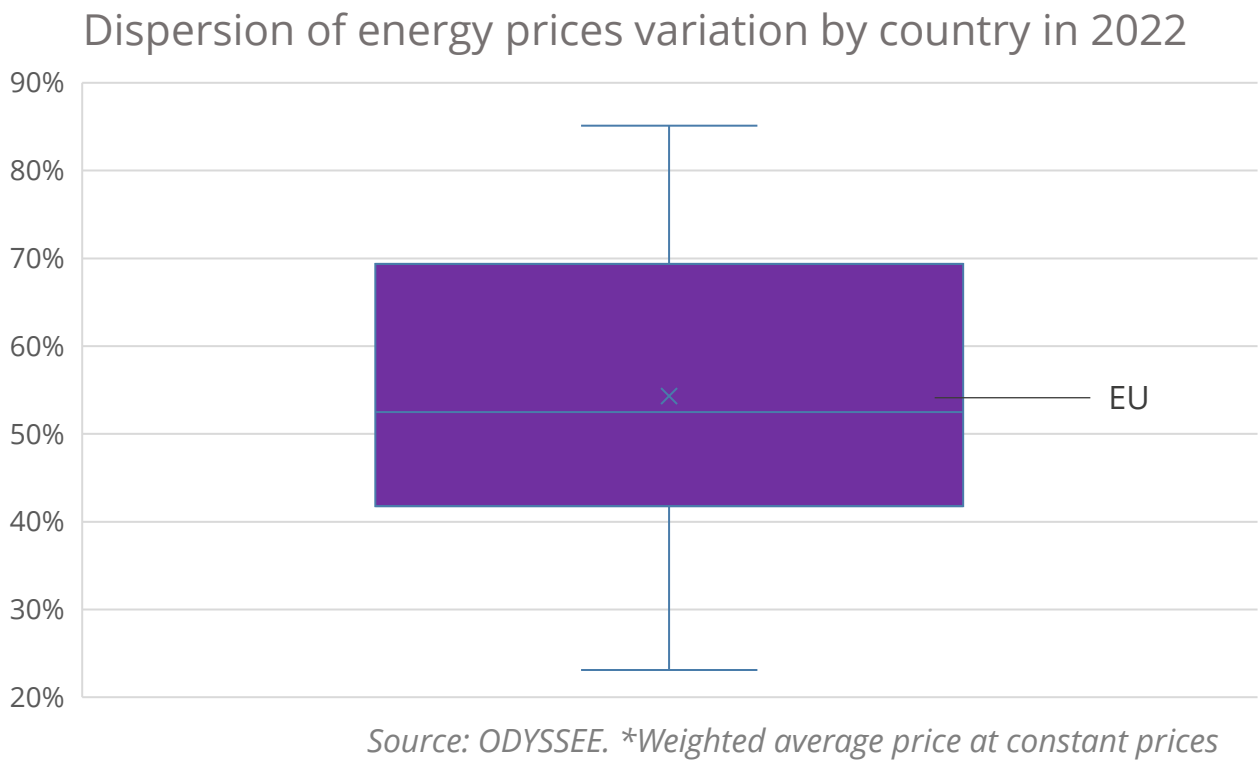
Source: ODYSSEE, based on Eurostat data and early estimates by Enerdata

Energy prices increased by 54% in 2022

In industry, energy prices increased by **54% in 2022**, after a 16% rise in 2021 and decreased by around 10% in 2023 and 2024. Compared to **2019**, these prices were **70%** higher in 2022 and still **50%** higher in 2023.

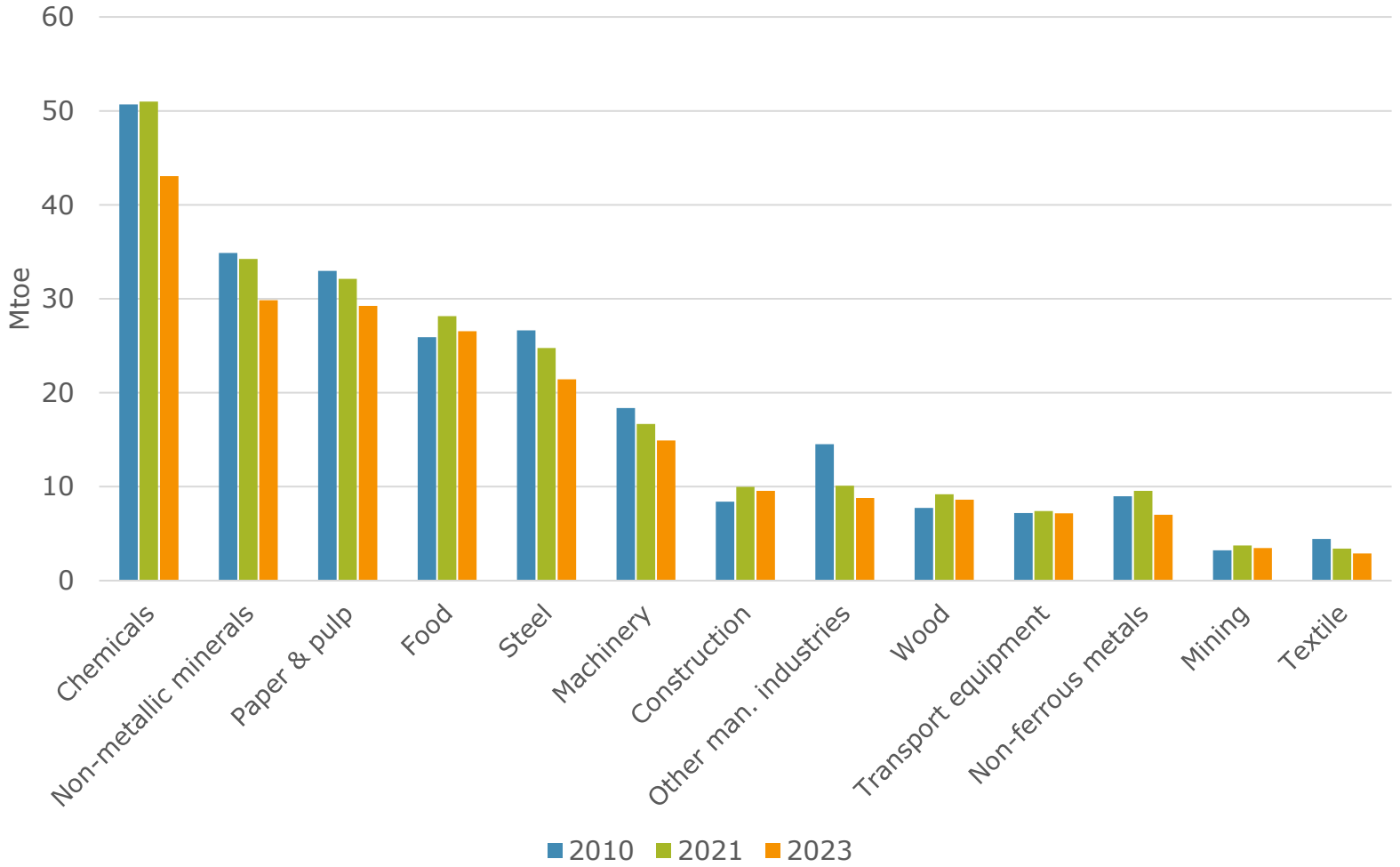
Prices increases in 2022 varied between 85% and 23% depending on the countries





*Source: ODYSSEE. *Weighted average price at constant prices*

5 branches represent over 70% of industry consumption



Source: ODYSSEE, based on Eurostat data

5 branches account for over **70%** of industry consumption : **chemicals** (20%), **non-metallic minerals** (14%), **paper** (14%) **food** (13%) and **steel** (10%).

From 2021 to 2023, **industry consumption decreased by 12% at EU level with a higher reduction** in 3 of these branches:

- **-16%** in **chemicals** (-26% in Poland and -19% in Spain) ,
- **-13%** for **non-metallic minerals** (-17% in Poland and -15% in Germany)
- **-13%** for **steel** (-24% in France and Poland).

These 3 branches explain around **55% of the total decrease** from 2021 to 2023, and even 2/3 in Poland.

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Measuring energy efficiency progress: The ODEX

- Energy efficiency progress is measured by branch with indicators of specific consumption measured in **physical units,** selected to be as as close as possible to energy efficiency*:

in toe/ton for energy intensive products (steel, cement, pulp and paper),

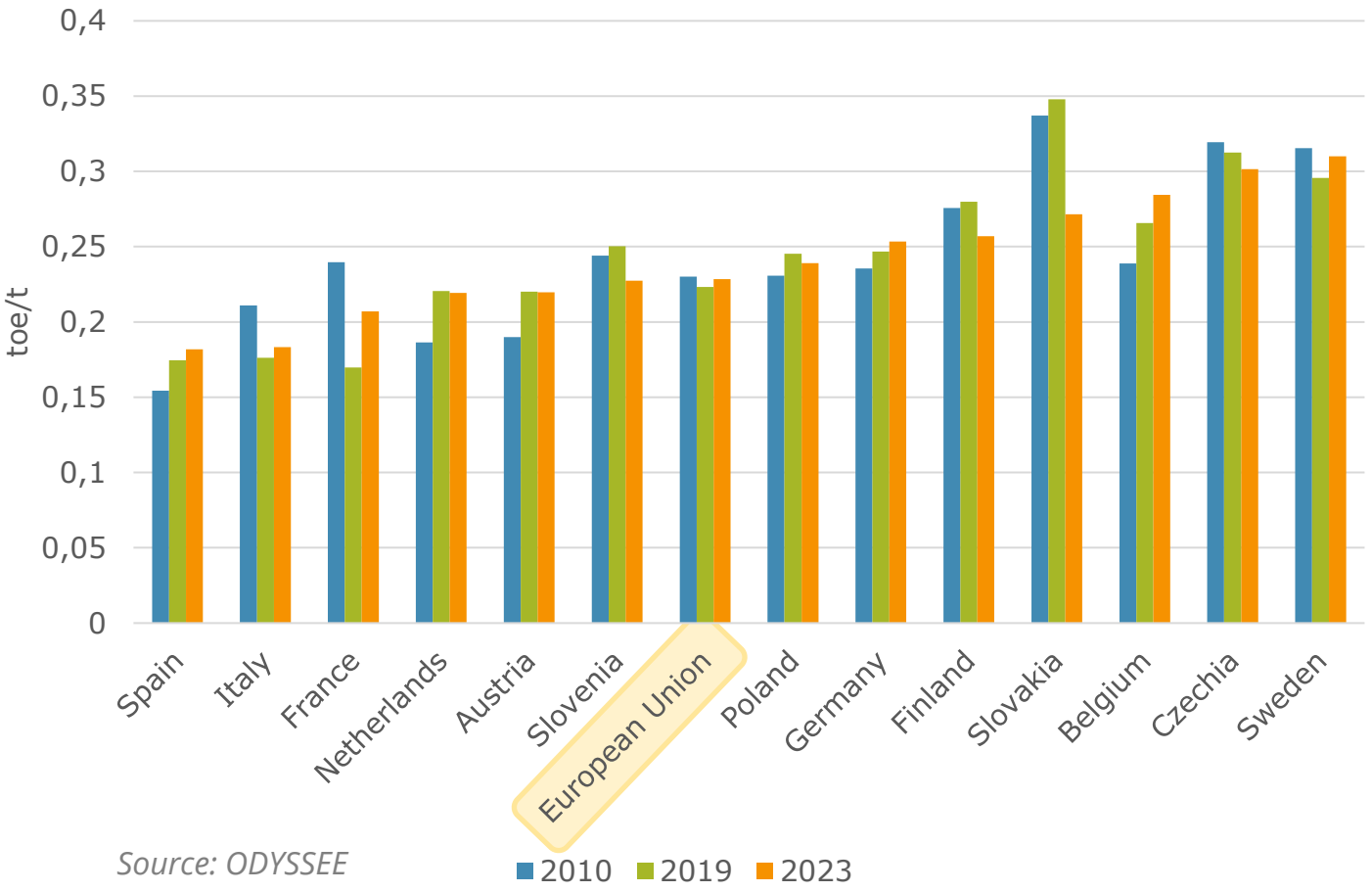
in toe/IPI for other branches (IPI: Index of Industrial Production).

- An **energy efficiency index** is then calculated for the **industry** sector, as a whole**,** called "**ODEX**".
  - ODEX is calculated*:

- by converting variations in specific consumption by branch into a variation **index** ;
- then by calculating an **average index** for the sector, **weighted** by the share of each branch in the industry's consumption.

  - ODEX is calculated based on 15 branches.
  - It is cleaned from **structural changes** between these 15 branches.

Divergent trends in specific consumption for steel production in EU MS (2010 – 2023)



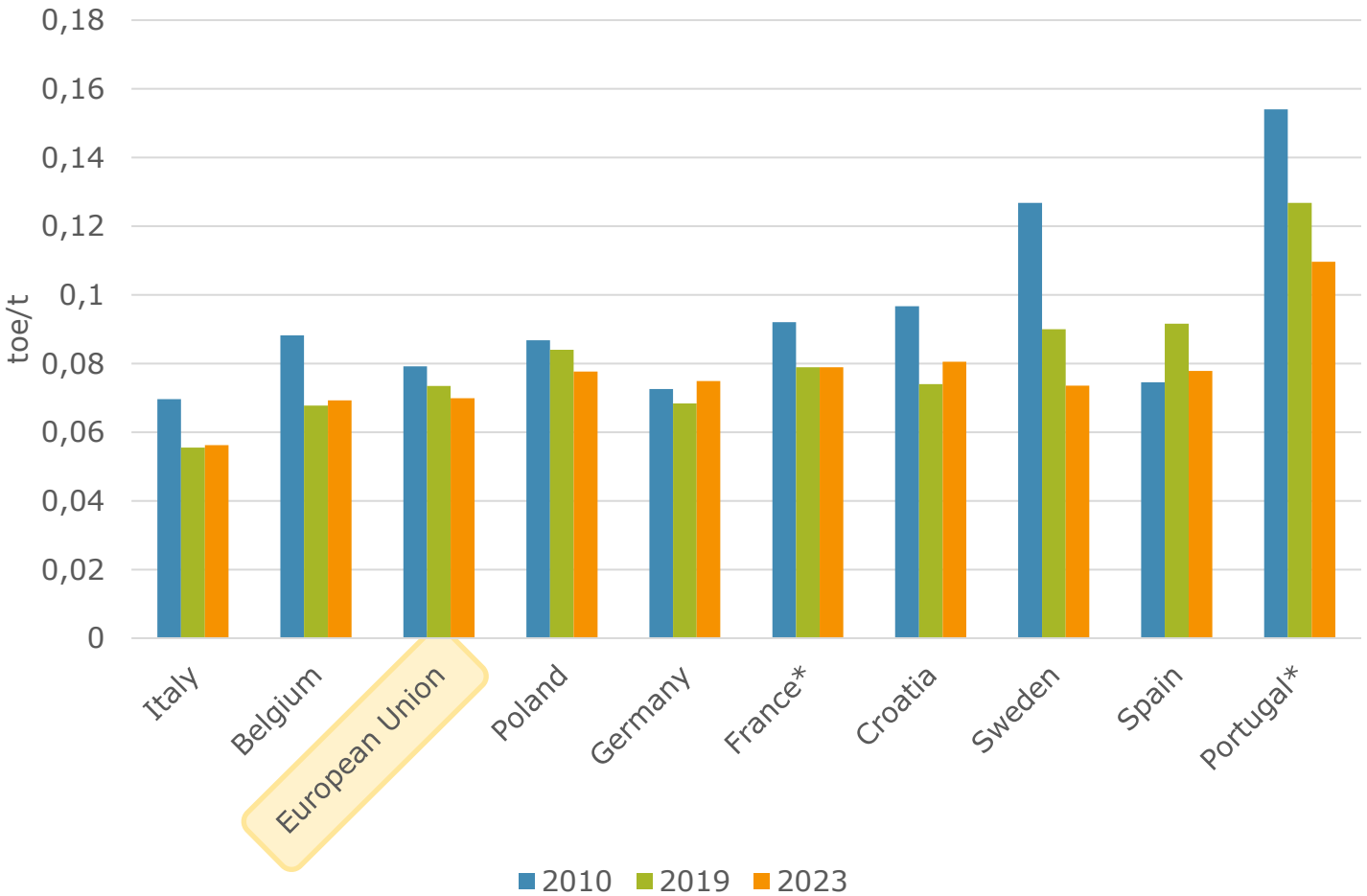
Source: ODYSSEE

Very slight decrease of EU specific consumption per ton of steel **between 2010 and 2023** (-0.7%) → small **decrease until 2019** (-3%), **almost counterbalanced** since then (+2.3%).

From 2010 to 2019, specific consumption per ton of steel **increased in 9 EU countries**, **decreased in 5 EU countries** and has been **roughly stable in 4 EU countries**.

Since 2019, energy efficiency in steel production improved in around **half of EU countries**, while the other half have seen an increasing specific consumption per ton of steel.

Specific consumption for cement production decreased in most EU countries (2010 – 2023)



Source: ODYSSEE

* For France and Portugal, data for 2023 is estimated

Decrease at EU level of specific consumption per ton of cement between 2010 and 2023 (-1%/year).

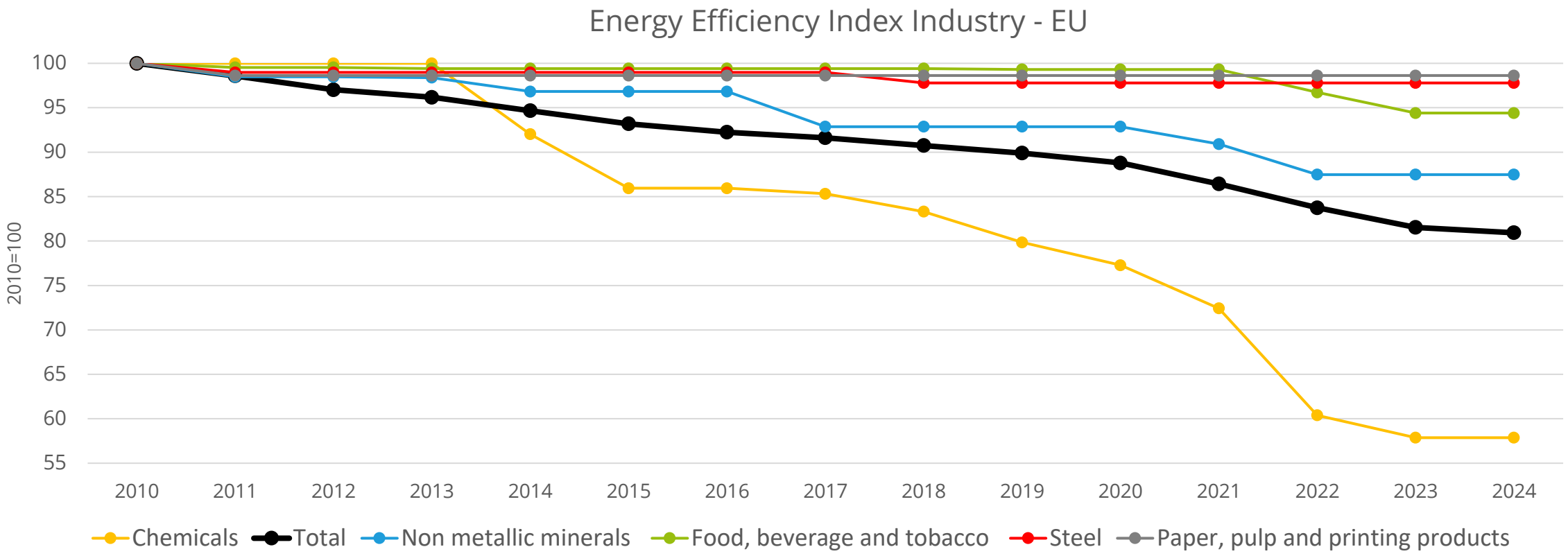
Between 2010 and 2019, specific consumption **decreased in most EU countries**, except those strongly affected by the economic crisis (e.g. Spain).

Since 2019, it **improved in most countries**, except in some where it remains **almost stable** (France, Italy, Belgium, Germany and Croatia).

Energy efficiency trends in the EU industry: The Chemicals branch leading efficiency improvements

Total energy efficiency improved by 19% since 2010 (1.5% per year).

Leaders: Chemicals (42%), Nonmetallic Minerals (13%) ; Lagging sectors: Steel, Paper, and Food (6% since 2021)

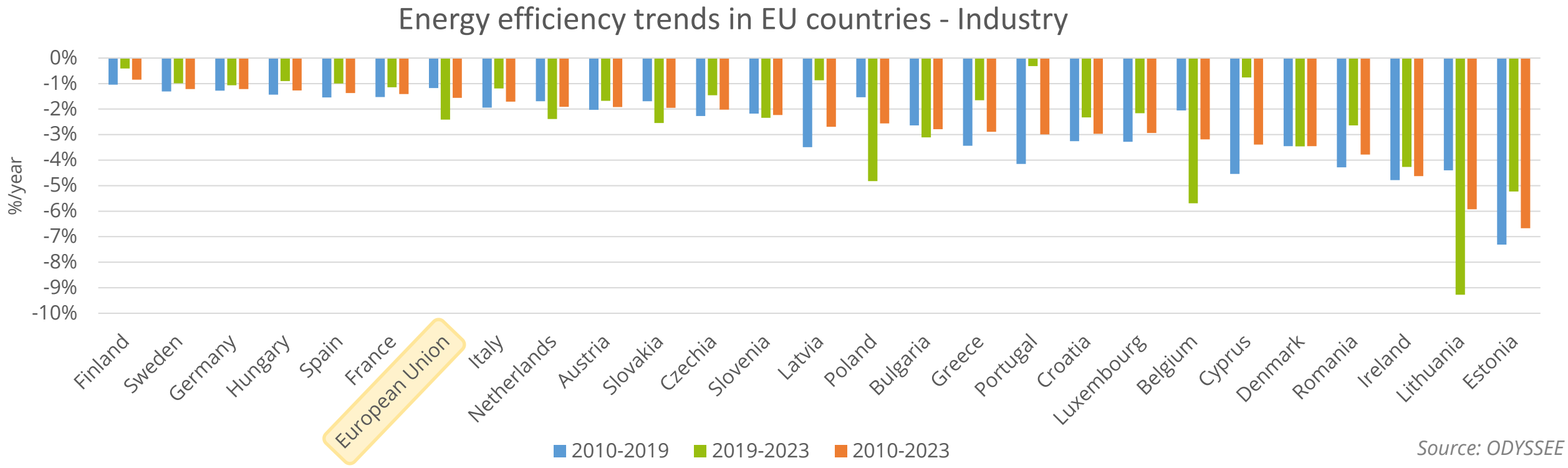


Source: ODYSSEE

Energy efficiency trends in the EU industry: acceleration from 2019 to 2023 and slow down in 2024

Acceleration of energy efficiency at EU level from 2019 to 2023 (2.4%/year compared to 1.2%/year in 2010-2019). Estimates of 2024 are showing efficiency progress is back to levels before 2019.

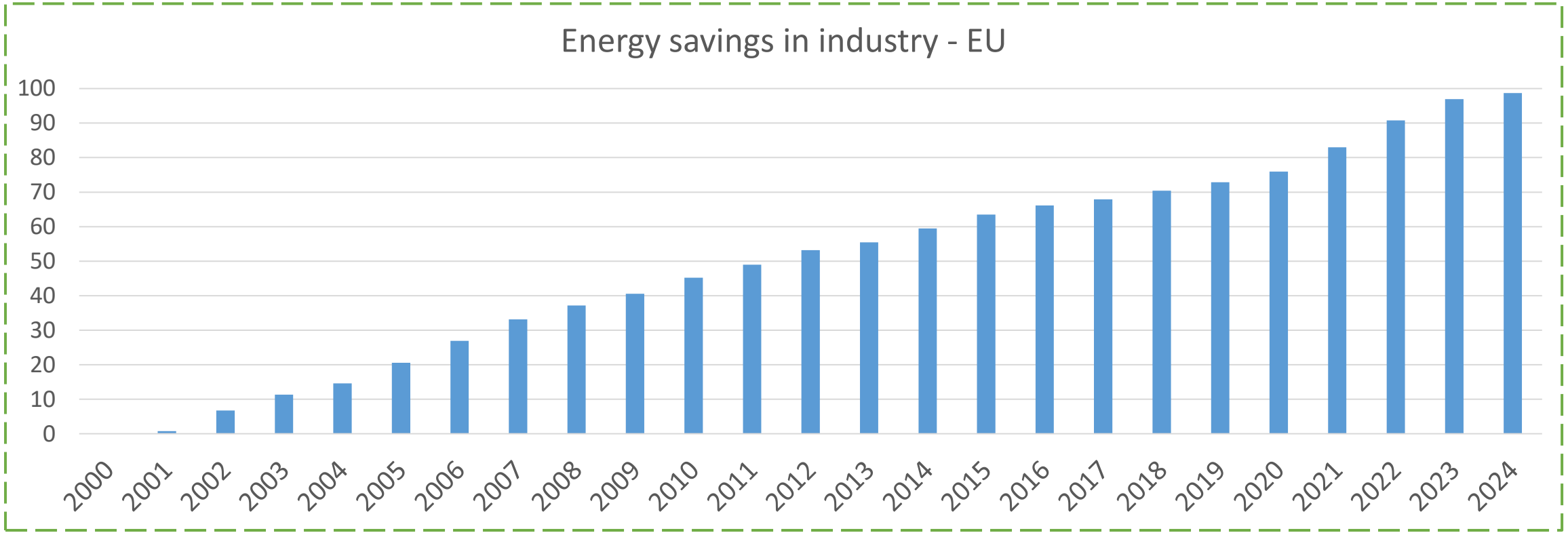
Acceleration since 2019 in 7 EU Member States and **slowdown in 17 MS** (limited in half of them). Denmark, Slovenia and Germany show a rather stable energy efficiency trend over the whole period.



Source: ODYSSEE

Energy savings in industry : 100 Mtoe since 2000

Energy savings in industry reached 100 Mtoe in 2024 at EU level since 2000 (of which, almost **60 Mtoe since 2010).** Without energy savings the consumption of EU industry would have been **100 Mtoe higher (30% higher).**



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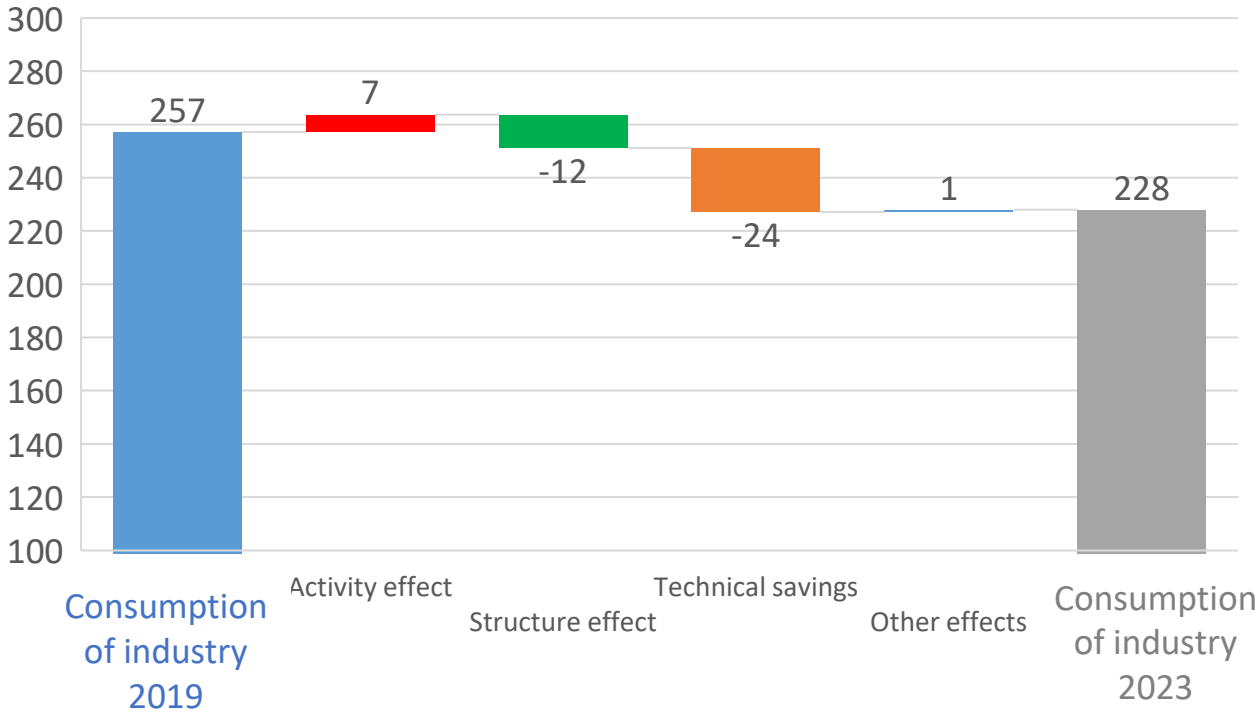
Drivers of energy consumption variation in industry (2019-2023)

Decomposition of final energy demand variation in the EU (2019 - 2023) (Mtoe)



The sharp decrease in energy consumption of industry at **EU** level between **2019** and **2023** (-29 Mtoe) is explained by :

- large **energy savings** (24 Mtoe) and
- **structural effects** within the 15 branches (12.5 Mtoe) (i.e. higher growth of less energy-intensive industrial branches)

→ These have more than offset the limited **industrial growth** (+6.5 Mtoe)

Source: ODYSSEE

Factors behind the acceleration of savings since 2020

Energy savings accelerated since 2020 according to ODYSSEE estimates, as explained previously. What are the possible factors behind this trend?

- Better management of energy use and emergency measures to face the huge prices increases, especially in 2022
- Investment in energy saving equipment and technologies (growth driven in 2021 and price driven in 2021-22)
- In some branches, part of the "measured savings" correspond to **structural effects within industrial branches ("product effects");** this was especially significant in **chemicals** with a high growth for pharmaceutical products (+28% over 2021-23) and a deep recession for basic chemicals (-14%).
- Enerdata **estimates,** at a **higher level of detail** for a limited number of countries, show that around 20% of the savings in EU since 2019 correspond to "**product effects".** These estimates are based on data published by Eurostat recently.

Source: ODYSSEE

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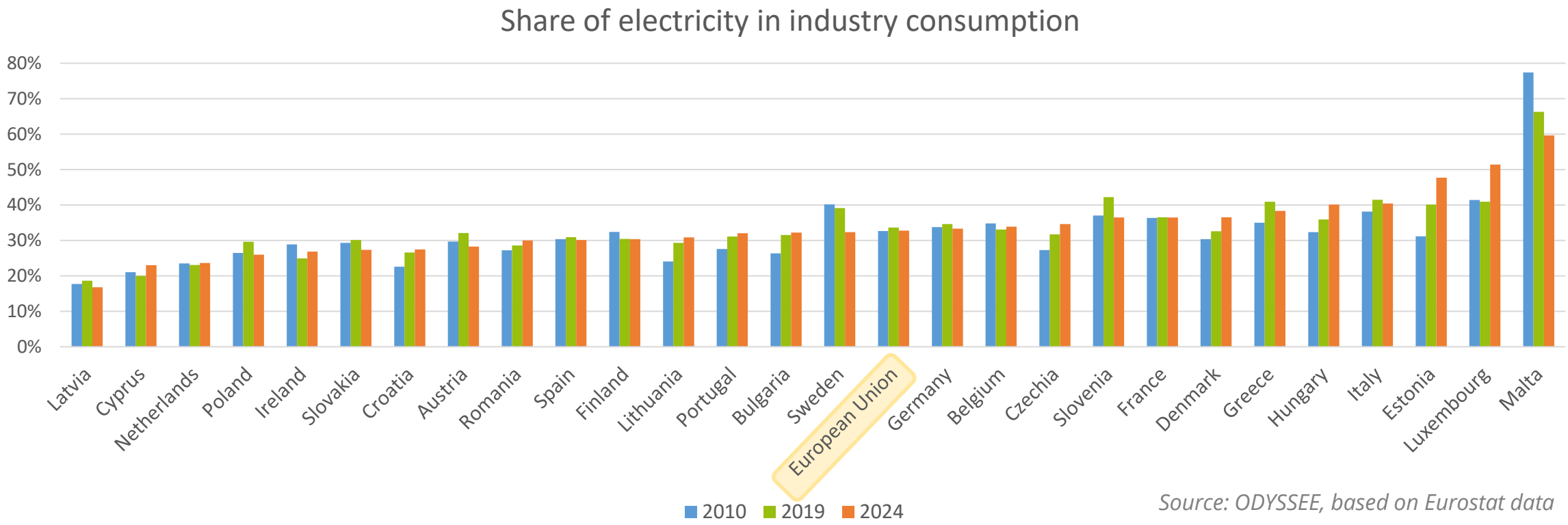
Electrification trends in industry since 2010

Very slow electrification of industry at **EU level since 2010: +0.5 points** at **33%** in 2024.

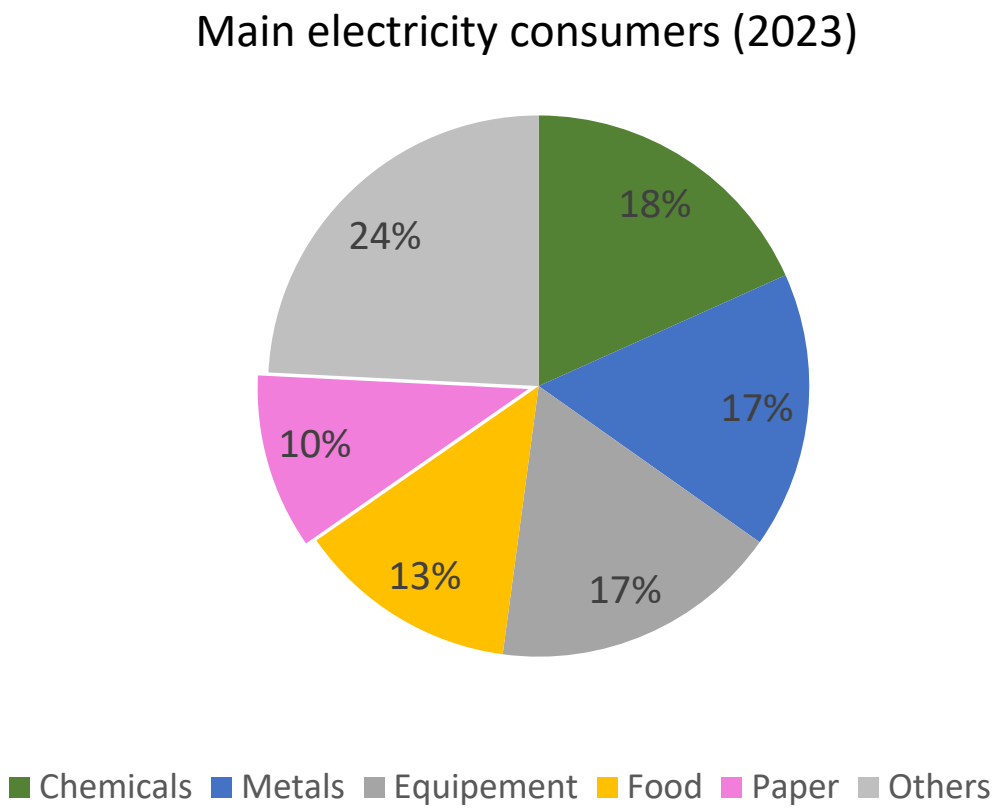
Important differences in the electrification rate in 2024 (24% in The Netherlands, 40% in Italy).

Decreasing electrification in half of EU countries: in 6 countries **since 2010**, of which Sweden (-8 points), and in 8 countries **since 2019** (**reversing trend)**, of which Poland and Italy.



Source: ODYSSEE, based on Eurostat data

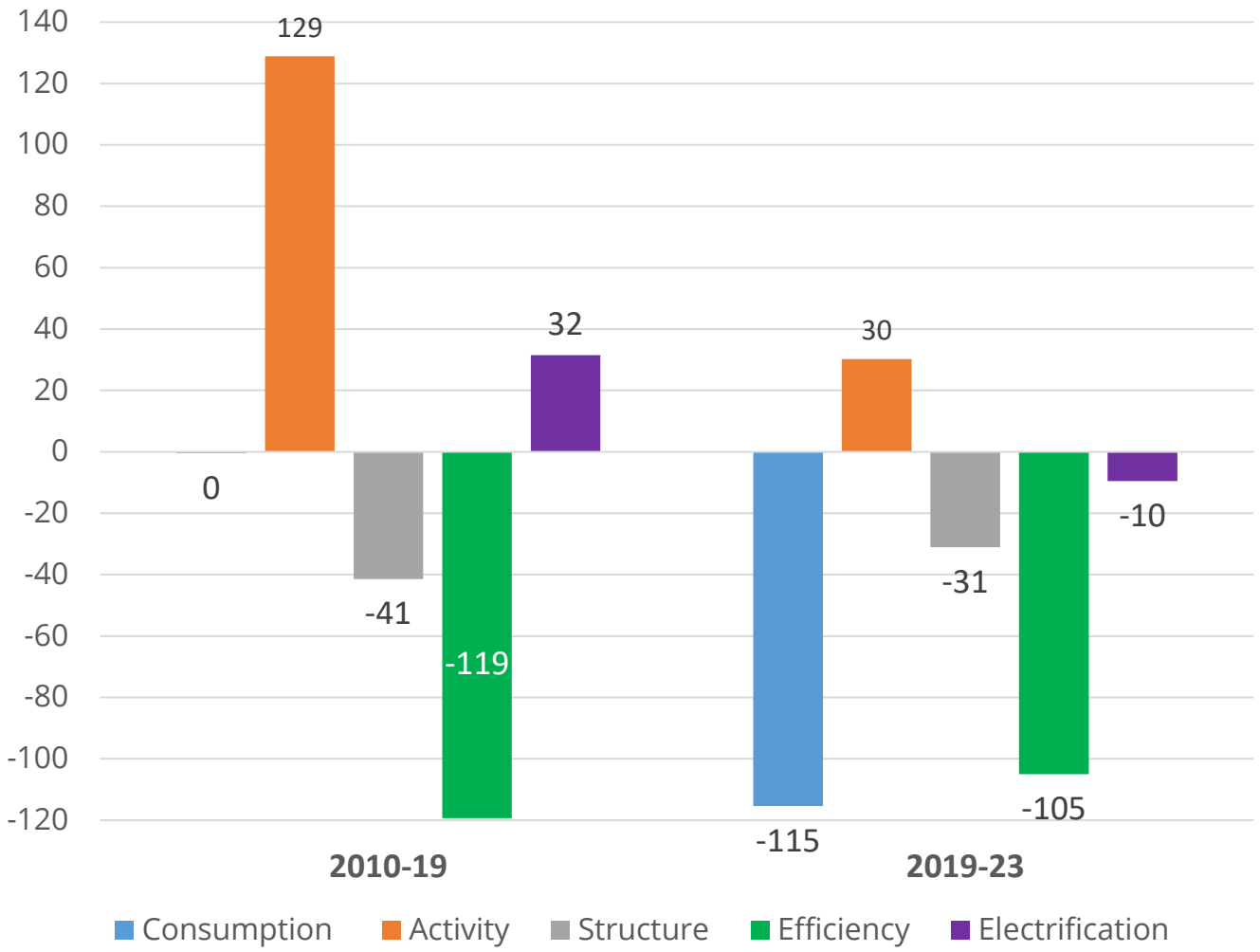
Main electricity intensive industry branches at EU level



Chemicals, metals and equipment absorbed over half of the EU industrial electricity consumption in 2023, with rather similar shares.

Source: ODYSSEE, based on Eurostat data

Drivers of electricity consumption variation at EU level



Between 2019 and 2023, electricity consumption of EU industry **decreased by 115 TWh (-12%)**, driven by energy savings (- 105 TWh) and structural changes (-31 TWh). The effect of **electrification** was **marginal** and **negative**.

In **2019**, industrial electricity consumption was at the same level as in **2010**: the effect of increased activity (+129 TWh) was almost offset by energy savings (-119 TWh) and, to a lesser extent, structural changes (- 41 TWh), linked mostly to a higher growth of equipment manufacturing. **Electrification** rose consumption by 32 TWh

Source: ODYSSEE, based on Eurostat data

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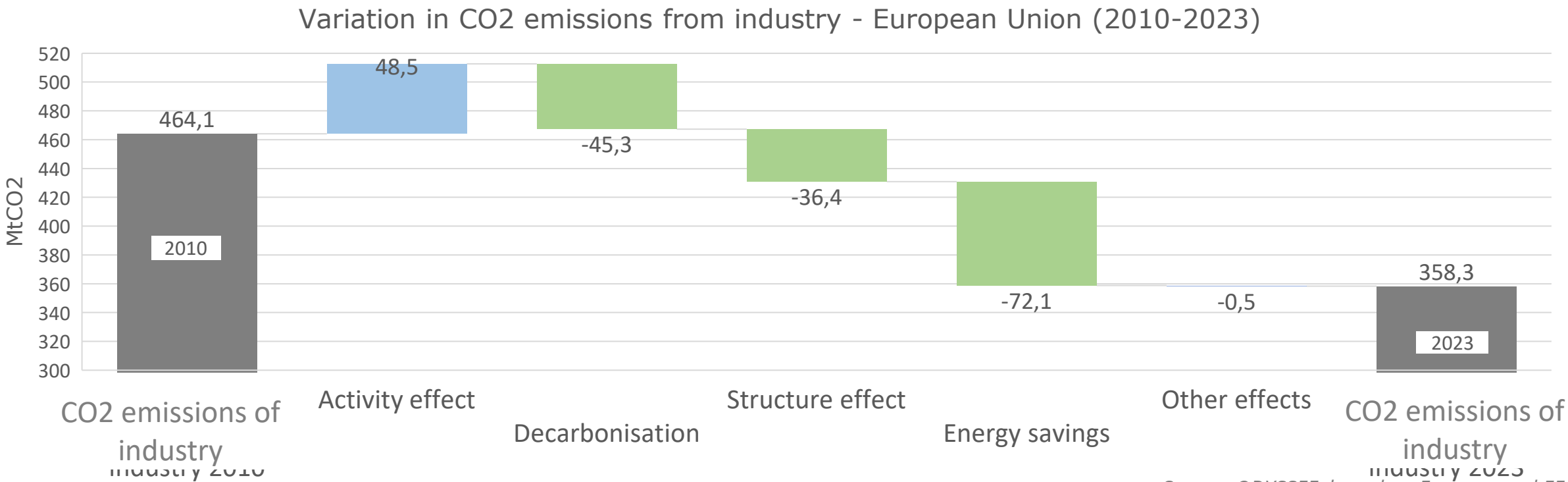
Drivers of CO_2 emissions variation in industry (2010-2023)

CO2 emissions of EU industry **decreased by 105 MtCO2** between 2010 and 2023 (-23%), because of 3 **main factors: energy savings** (-72 $MtCO_2$), **decarbonisation** (-45 $MtCO_2$) and **structural effects** (-36 $MtCO_2$), that more than offset activity (+ 49 $MtCO_2$) - **Decarbonisation** reflects the reduction in the average emission factor.



Source: ODYSSEE, based on Eurostat and EEA data

CO_2 emissions variation: real impact of decarbonisation

Decarbonisation, i.e. the reduction in the average emission factor comes from :

- substitution **between fossil fuels** (e.g. switch to gas) and
- substitution from fossil fuels to "**CO_2 free fuels**" (free at industry level according to CO2 inventory (electricity, biomass or heat).

In the case of the EU average, **2/3 of the decarbonisation** at the sector level over 2010- 2023 was linked to **substitution to CO_2 free fuels,** and **1/3 to substitution within fossil fuels.**

These so-called "**CO_2-free fuels**" are not entirely emissions-free, if there is a switch to electricity or heat, as they emit CO_2 at the level of power and heat plants): the magnitude of these "**indirect emissions**" depends on the power or heat mix, and varies significantly across countries.

At EU level, these **indirect emissions** were marginal as most of the shift to CO_2-free fuels involved biomass, as electrification remained marginal and the share of heat declined by 1 point.

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Energy consumption of industry **decreased rapidly** from 2021 to 2023 (12% in 2 years).

Chemicals is the **largest consuming** branch and the most affected since 2021 contributing to almost 30% of the energy consumption reduction.

Energy efficiency of industry **accelerated at EU level from 2019 to 2023** (2.4%/year, compared to 1.2%/year over 2010-2019), which may not continue. According to our estimates, **2024** is back to the pre-2019 trend. Part of this acceleration is due to some product effects (mainly in chemicals), that we will try to better capture in the future.

Conclusion

Since 2019, **energy savings** explain **2/3** of the sharp reduction of energy consumption in industry, and 1/3 is linked to **structural effects towards lower energy intensive branches.**

The electrification of industry is **slow at EU level** (+0.4 points since 2010); it is even decreasing in half of EU countries**.**

The reduction of CO_2 emissions of industry is mainly explained by **energy savings, decarbonisation** and **structural effects. Decarbonisation is apparent**, as it may imply additional emissions for power and heat generation: this was not the case for the EU as a whole.

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Thank you!

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