ODYSSEE-MURE

Energy efficiency trends for households in the EU

Odyssee-MURE webinar series on Energy Efficiency

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Bruno Lapillonne, Zineb Raji – Enerdata

About ODYSSEE-MURE

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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

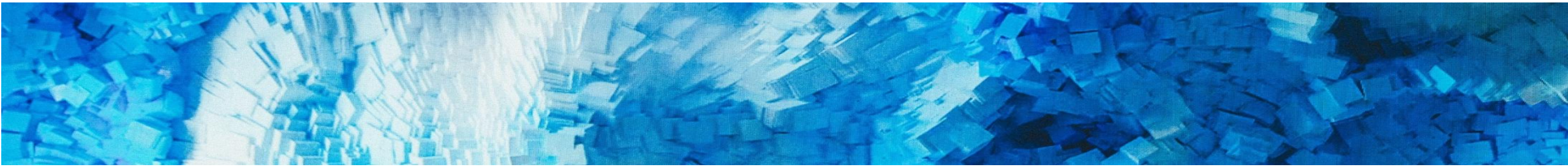
About ODYSSEE

- **Source of data :**
  - **Eurostat for aggregate data**
  - **National partners for detailed data (up to 2022), supplemented by early estimates for 2023 computed by Enerdata.**
  - **Ambient heat from heat pumps has been removed from consumption and indicators.**

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

Agenda

1. Introduction: The household sector at a glance
2. Energy consumption trends
3. Energy efficiency trends
4. Conclusion and Q&As



Introduction

Introduction

Several policies and measures have been developed at the European level (EED, Ecodesign, EPBD) and implemented at the national level, alongside national initiatives primarily focused on supporting renovations.

EPBD 2024

A binding target to increase the average energy performance of the national residential building stock:

- by 16% by 2030 in comparison to 2020
- by 20-22% by 2035.

A unified energy rating scale for all Member States:

- A, the standard for net-zero emission buildings
- G, the category for the worst performing properties
- The possibility to define an A+ category

Obligation for property owners to provide an EPC to buyers or tenants

RENOVATION WAVE STRATEGY

An action plan with regulatory, financing and enabling measures to boost building renovations:

- Double the annual energy renovation rate by 2030
- Foster deep renovation.

EU household sector at a glance

Stable share in consumption and direct CO_2 emissions

Increasing share of electricity, heat and renewables

Decreasing share in CO_2 emissions

	2023	Trend since 2010 (2)
Share of households in final consumption (1)		
• Total(1)	28%	+0.4 pp
• Electricity	29%	stable
Share of households in buildings consumption	67%	1.4 pp
Energy shares in household sector		
• % of electricity	33.5%	+2.6 pp
• % of biomass, heat and solar	28,4%	+3.3 pp
Share of households in CO_2 emissions		
• In direct emissions	11%	-1 pp
• Including indirect emissions from electricity	18%	-3 pp
Emission factor (tCO_2/toe)	1.14	-18%

(1) Final consumption without non energy uses (data at normal climate).
(2) pp: percentage points

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1 Energy consumption trends

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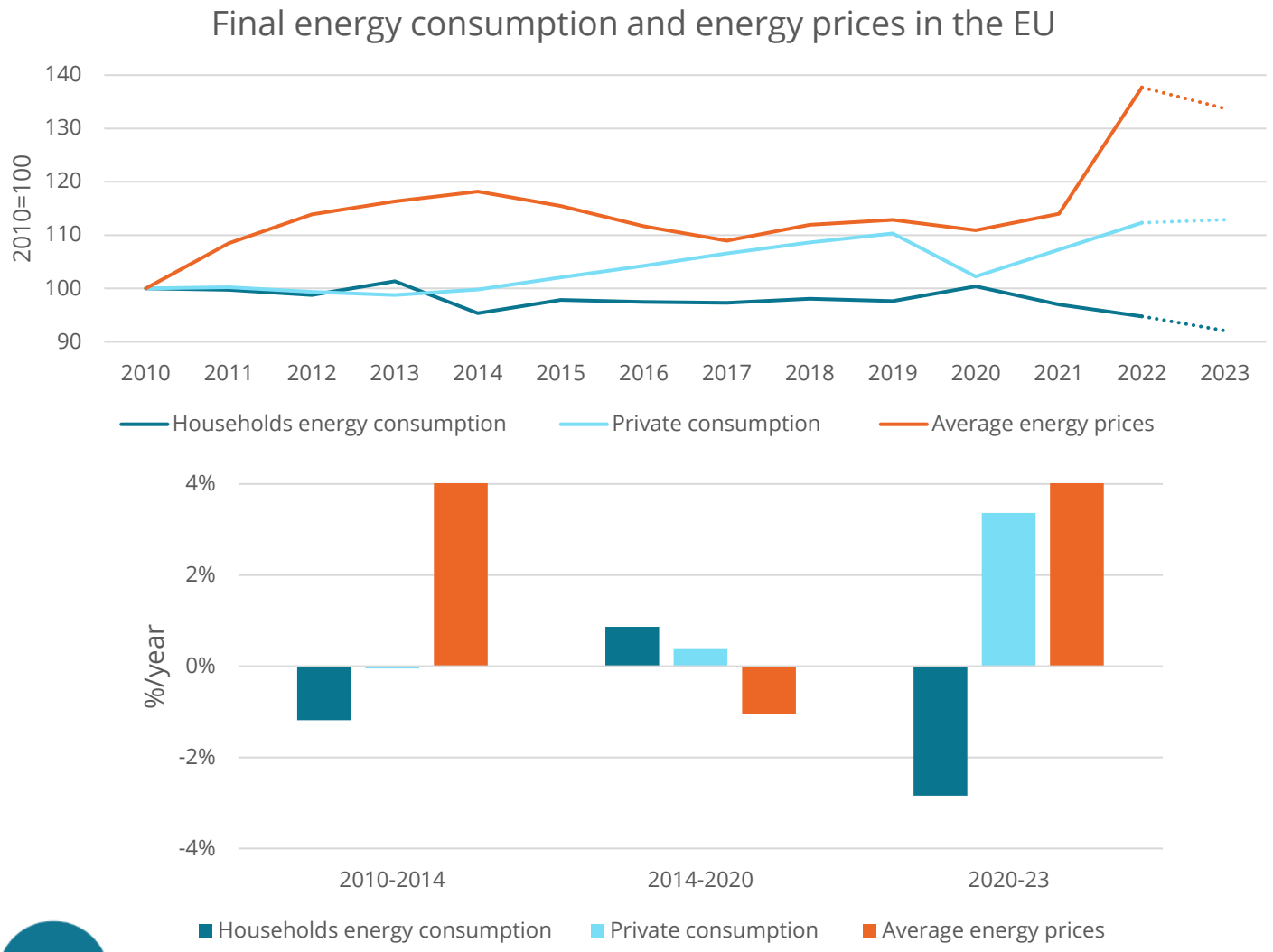
Trends in household energy consumption, private consumption and energy prices in the EU

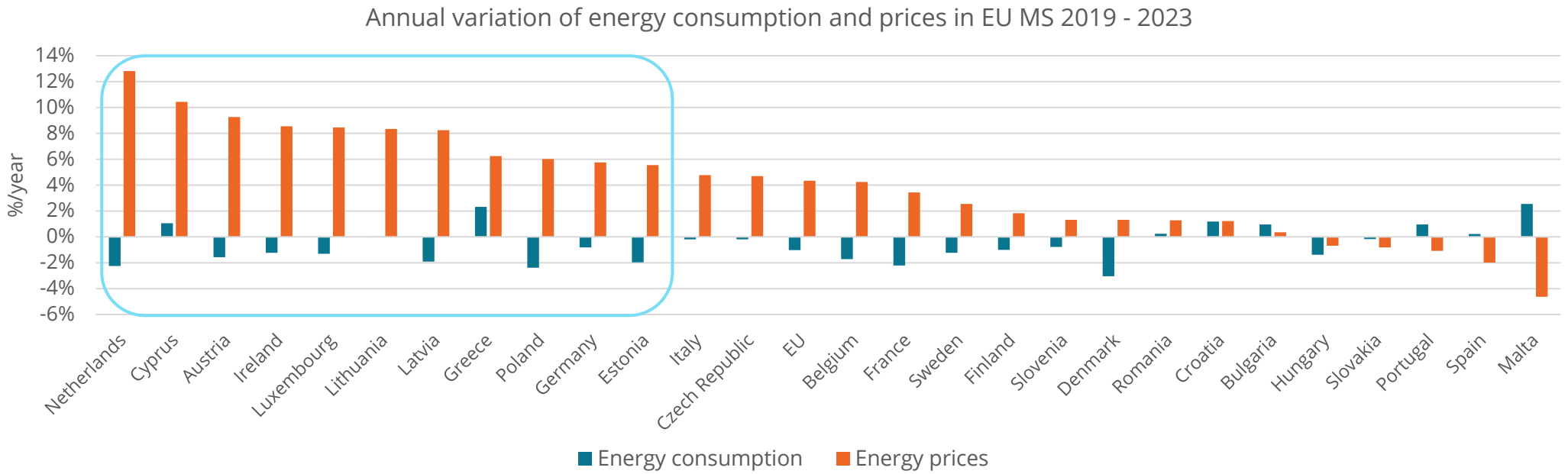


Source: ODYSSEE, based on Eurostat and early estimates by Enerdata; consumption at normal climate.

Decreasing energy consumption since 2020

- Decline by 3%/yr of the energy consumption since 2020 as energy prices soared by 6%/yr on average since 2020, especially in 2022 (+**20%**).
- Slight increase in energy consumption over 2014 – 2019, with a rebound in private consumption (+2%/yr) and declining prices.
- Consumption decrease over 2010-14 (-1%/yr) , with increasing prices and flat private consumption.

Trends in household energy consumption and energy prices in EU MS



Prices* increased in most EU MS

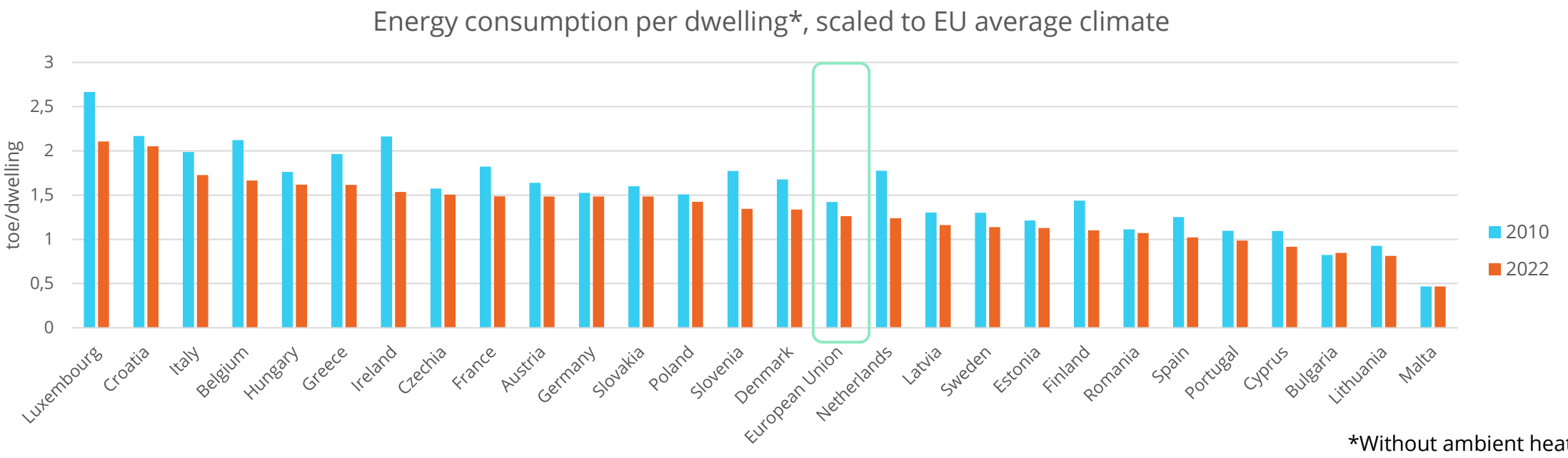
- Household energy prices increased in most EU Ms since 2019, with significant disparities, depending on fuel mix and national policies.
- Most of the increase took place in 2022
- Prices increased, exceeding 5%/year in 11 countries

Energy consumption impacted by prices in MS

- Energy consumption dropped with price increases in most countries, with different magnitudes.
- 2 countries show a contrasting trend, with energy consumption dropping despite a decline in energy prices

Source: ODYSSEE, based on Eurostat and 2023 early estimates by Enerdata
Consumption at normal climate; energy prices in real terms

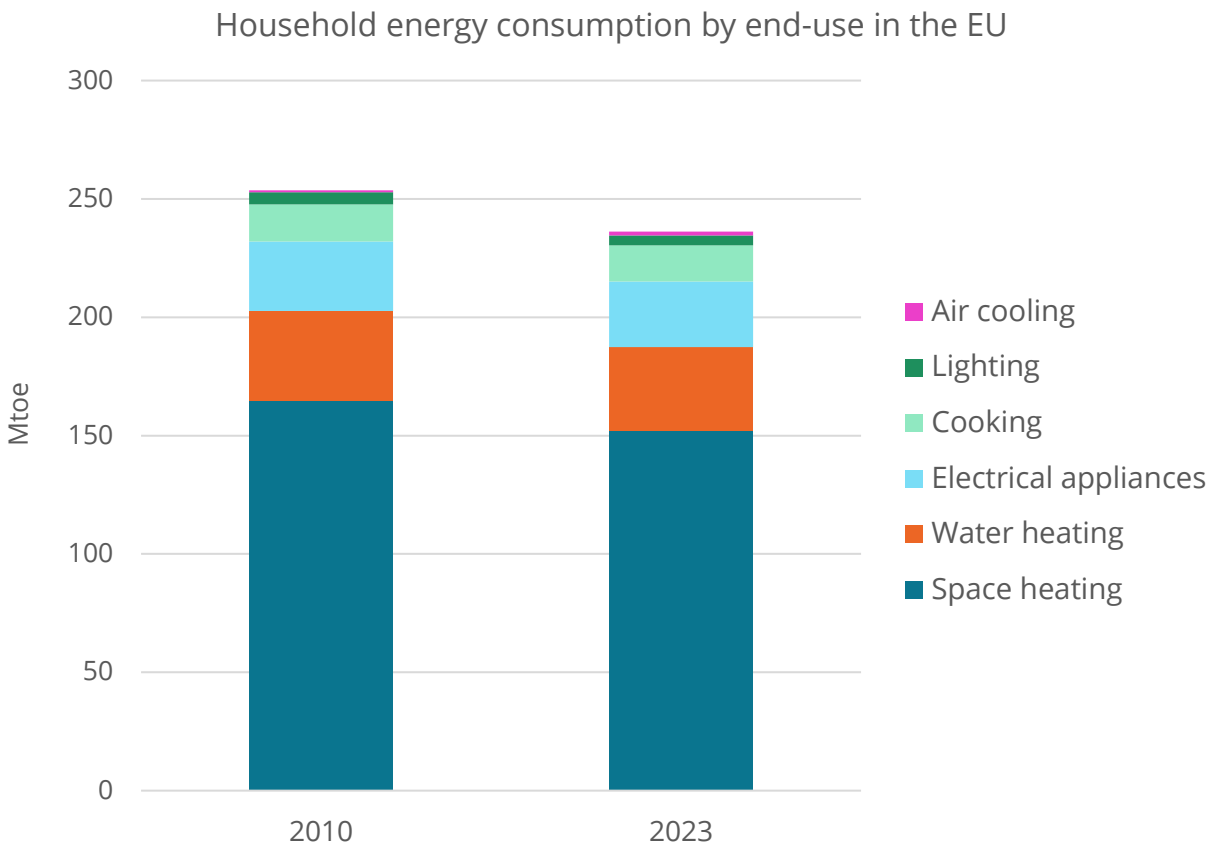
Energy consumption trends for households in EU MS



*Without ambient heat

- In 2022, the average energy consumption in the European Union was 1.26 toe/dwelling.
- Significant disparities between countries, **even after adjustment to the same climate**, with consumption ranging from 0.47 toe/dwelling in Malta to 2.1 toe/dwelling in Luxembourg.
- Overall, unit consumption has been declining in most EU MS since 2010 (-1%/year at EU level).

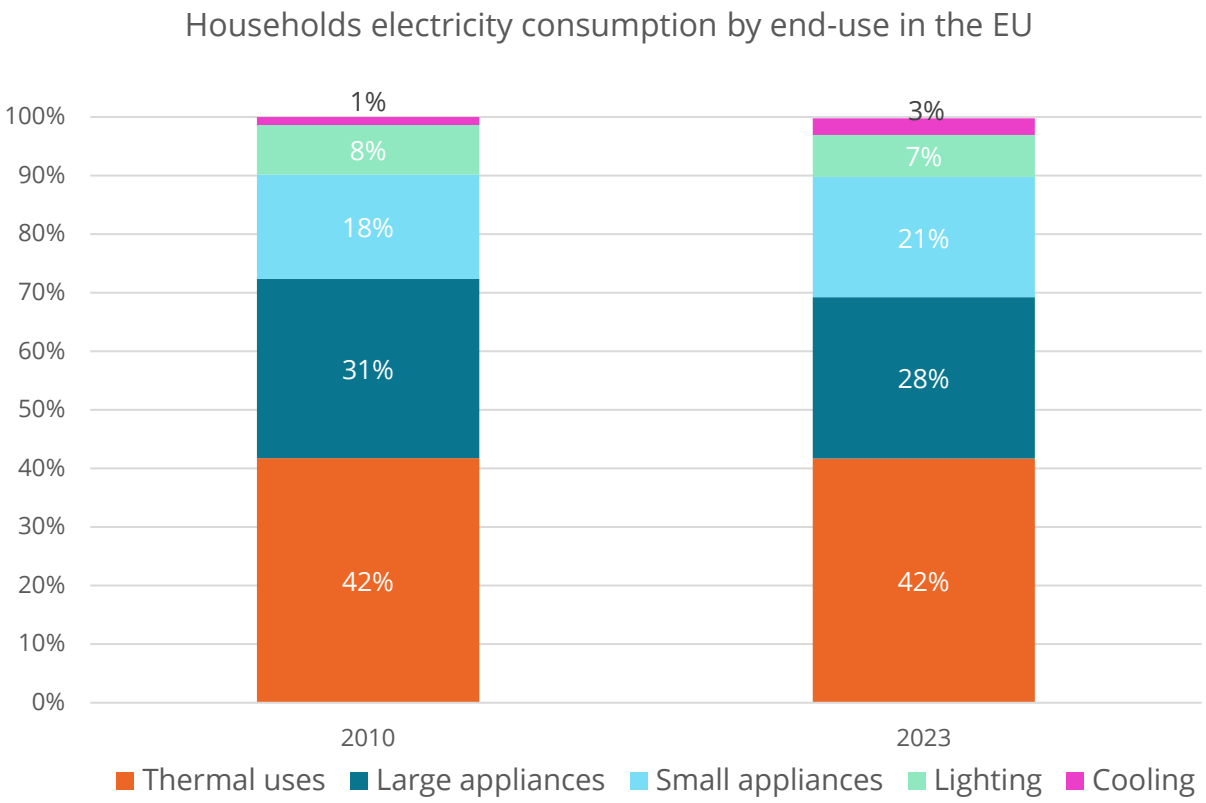
Energy consumption for households by end–use in the EU



2023 : early estimates

- Slightly decreasing consumption and share for space heating since 2010 (-0.6%/year), the dominant end-use with 64% of household consumption in 2023.
- Relatively stable consumption and share for water heating (15%), electrical appliances (12%), and cooking (6%).
- Decreasing consumption for lighting (-1.6%/year) but a relatively stable share (2%)
- Growing consumption for cooling (+5.5%/year) which remains marginal (0.7%).

Trends of electricity consumption in the residential sector



- In 2023, 79% of the electricity used for captive uses (i.e. outside thermal uses) was used for electrical appliances : since 2010, consumption of large appliances has decreased (-1.2%/year), while it has increased for small appliances (+0.8%/year).
- Electricity consumption for lighting is declining (-1.6%/year since 2010) but its share has remained stable. It now represents 12% of the household captive electricity consumption.
- Cooling accounts for a marginal share (5%) but has shown significant growth since 2010 (+5.5%/year)

Large appliances: TV, refrigerator, freezer, washing machine, dishwasher, dryer

2023 : early estimates

2 Energy efficiency trends

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How is energy efficiency progress measured by end–use in ODYSSEE?

To closely track energy efficiency, various indicators of specific consumption are calculated by end-use :

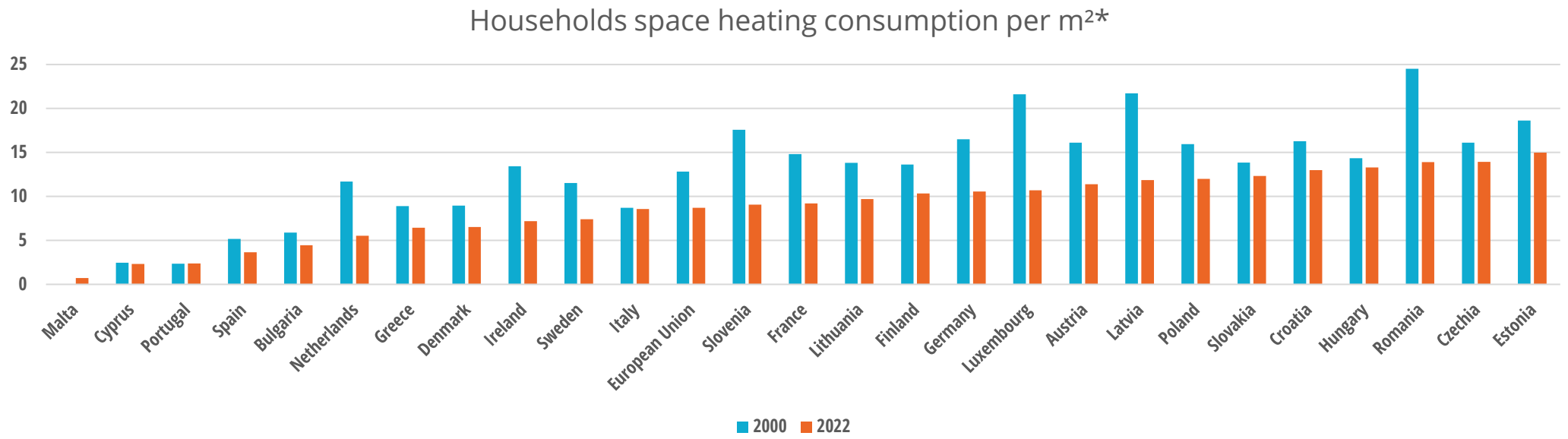

toe/m2 for heating,


toe/household for water heating and cooking,


kWh/dwelling for lighting,


kWh/appliance for appliances and cooling.

Specific energy consumption for household space heating

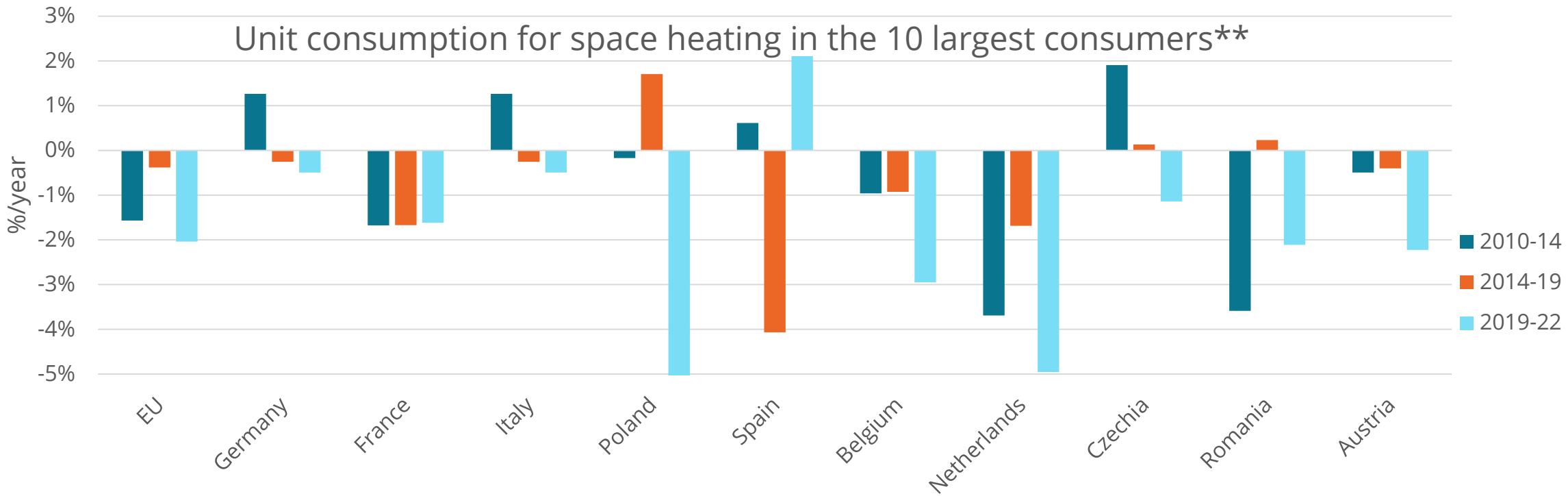


The specific consumption of households for heating has decreased in all countries since 2000 (-1.7%/year on average in the EU).

The reduction was very rapid in 6 countries, above 2.5%/year (Ireland, Latvia, Luxembourg, Netherlands, Romania, Slovenia)

**At normal climate; ambient heat excluded; 2003 for Portugal;. No data before 2016 for Malta ; No data on m2 for Belgium*

Heating consumption per m2*: acceleration since 2019

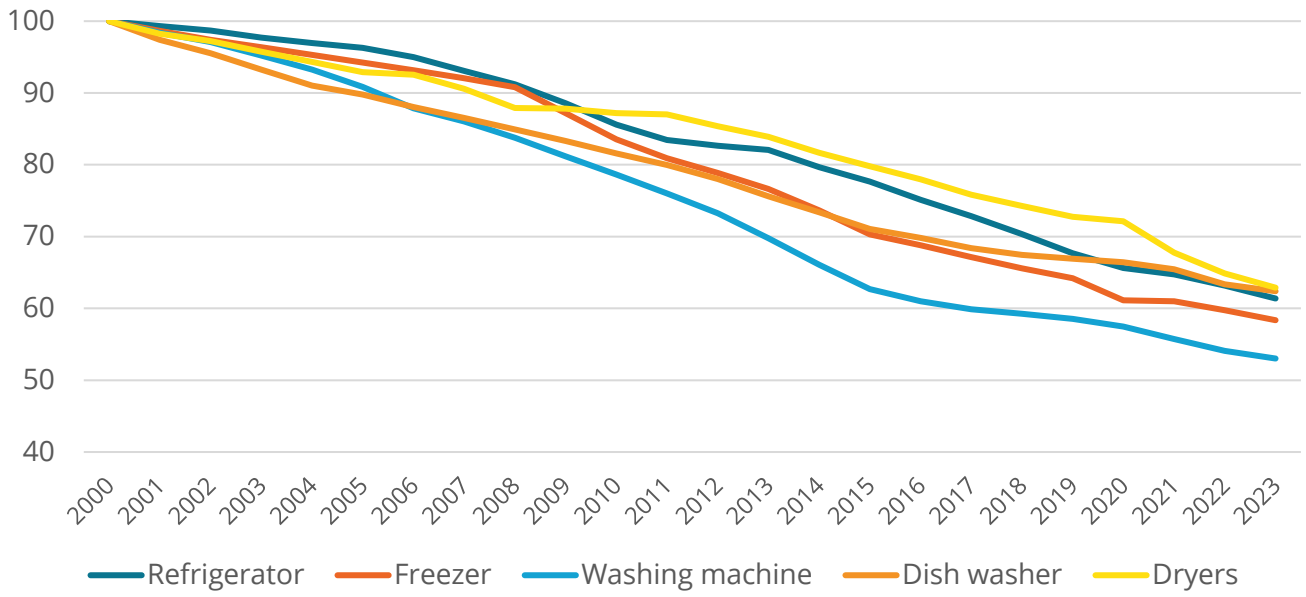


- Net acceleration since 2019 of the reduction of the heating consumption per m2 (-2%/yr at EU level, i.e. above pre-2014 trends) and rapid reduction in 60% of the largest consumers; this reflects the strong price increases in 2022 and maybe a sustained effort in energy efficiency, although difficult to confirm because of limited data, especially on renovation works
- Low decrease over 2014 - 2019 in half of the countries, especially in some of the largest ones (e.g. Germany, The Netherlands) or increase in Poland, partly driven by low prices and income increase.

** Belgium toe/dwelling*
***Countries representing 85% of the EU heating consumption of households, of which Germany 25%, France 17%, Italy 13%, Poland 8%.*

Energy efficiency trends: large household appliances

Specific energy consumption of large appliances (EU average



- Specific consumption of large appliances (measured in kWh per appliance) has decreased steadily since 2000 thanks to labelling and eco-design measures.
- Washing machines achieved the highest (5%/year), followed by cold appliances (refrigerators and freezers), dish washers, and dryers (4%/year).

2023 : early estimates

How is energy efficiency progress measured for households in ODYSSEE?

Different energy efficiency trends can be observed for households depending on the end-use, for instance for the EU since 2010:

- -1.4%/year for unit consumption for heating per m2
- -0.8%/year for water heating consumption per household
- -2%/year for refrigerators for unit consumption in kWh/appliance

etc....

What is the overall energy efficiency progress for the sector ?

ODEX

How is the energy efficiency index (ODEX) measured in ODYSSEE?

What is ODEX ?

ODEX is an index that measures in ODYSSEE energy efficiency progress at sector level.

How is it calculated for households?

1. Trends in specific energy consumption by end-use are expressed as variation index to account for the diversity of units used (11 end-uses for households)

2. An average index is then calculated for the sector, by weighting the indices by end-use by the share of each end-use in the household energy consumption.

Interpretation of ODEX

An index of 80 in 2022, with a base year 2000, corresponds to a reduction of the index by 20%: this means that energy efficiency improved by 20% or 1%/yr*

For more information on ODEX: https://www.odyssee-mure.eu/publications/archives/odex-indicators-database-definition.html

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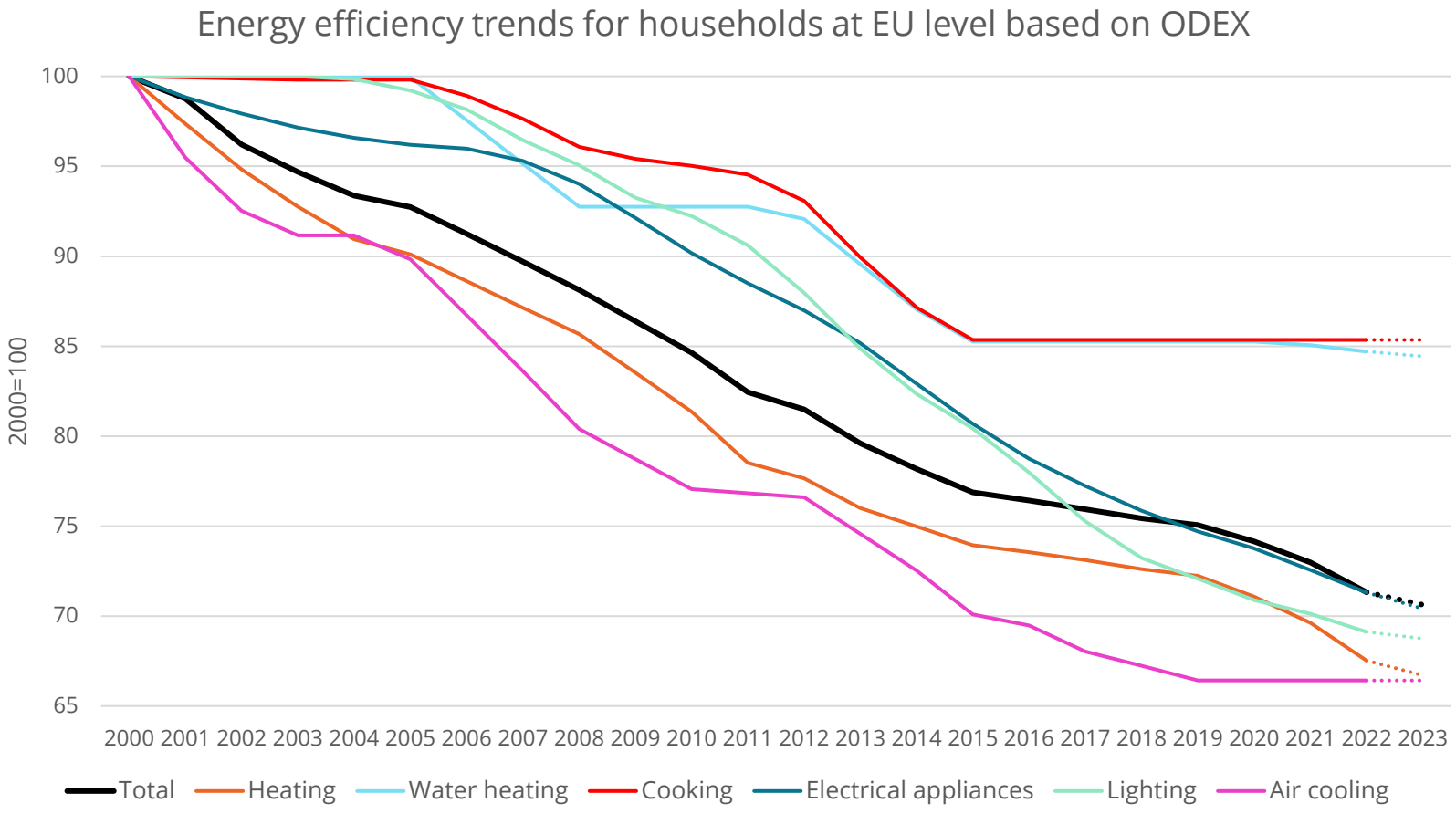
* (80/100)^(1/22)-1 =1%/yr

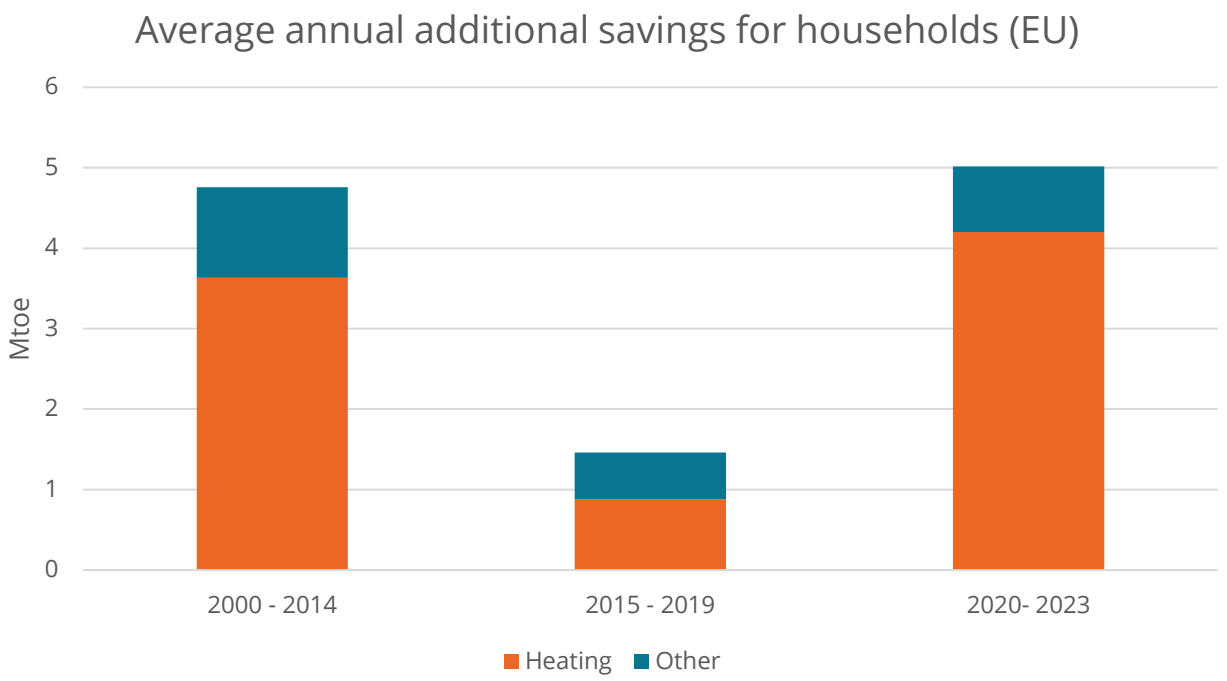
Energy efficiency trends for households



2023 : early estimates

- Household energy efficiency improved by 30% or 1.5%/yr since 2000, most progress was achieved before 2014 (1.7%/year), and after 2019, with a net slow down over 2014-19 (0.8%/year).
- Progress has mainly been mainly driven by efficiency gains for heating , lighting and appliances, whereas no improvement has been recorded for cooking and water heating since 2014.

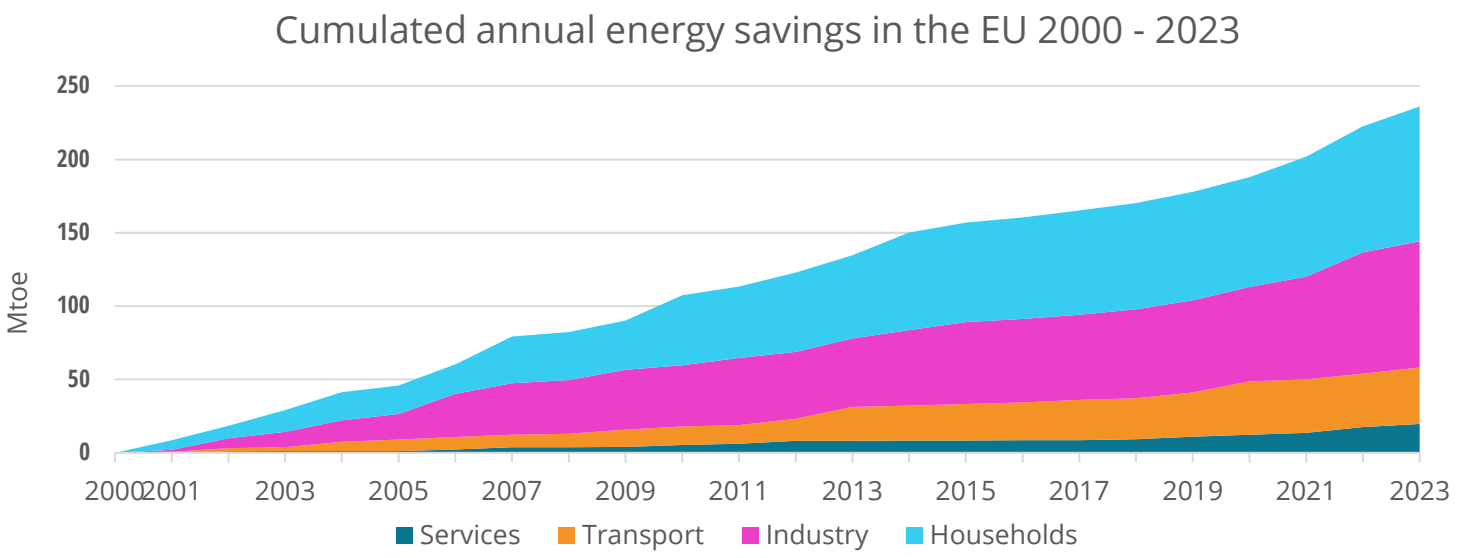
Since 2020, annual additional energy savings for households are back to their historical progression

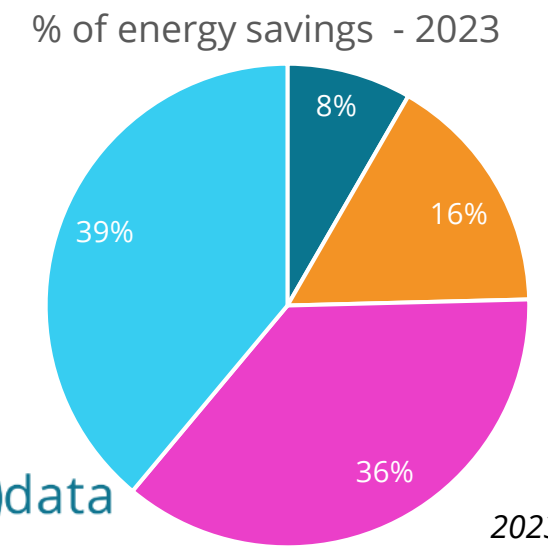


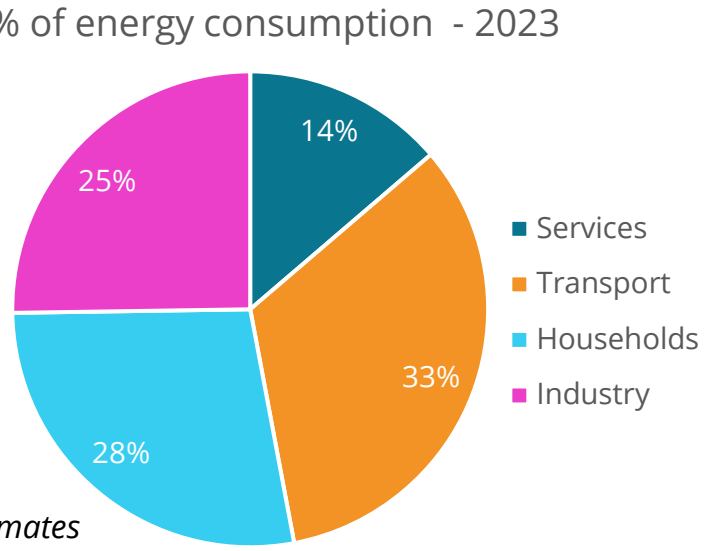
2023 : early estimates

- Average annual additional savings have rebounded since 2020 back to their historical level of around 5 Mtoe/year.
- This represents the equivalent of 2% of household's consumption, which is higher than Article 8's target (1.35% on average over 2021-2030 for all sectors).
- These annual savings slowed down significantly over 2015 – 2019.
- Heating represents the bulk of these savings, with a share higher than their consumption share (share of savings of 84% since 2020 and 76% over 2000-14 compared to a share of 64% of consumption).

Energy savings vs. Consumption by sector





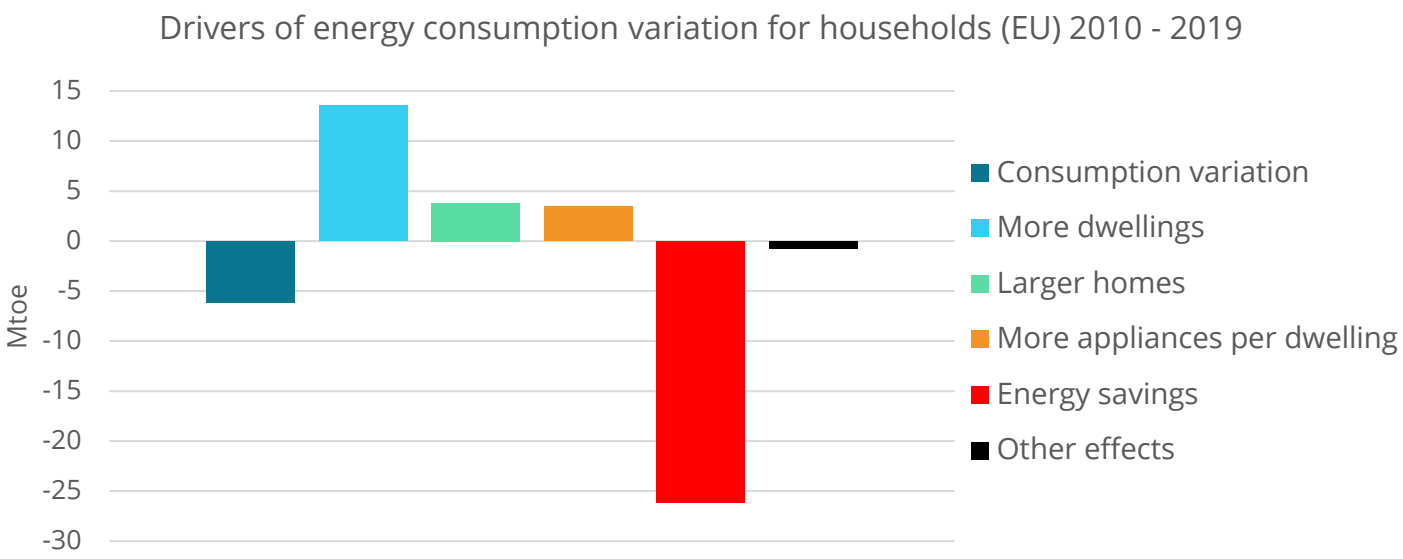


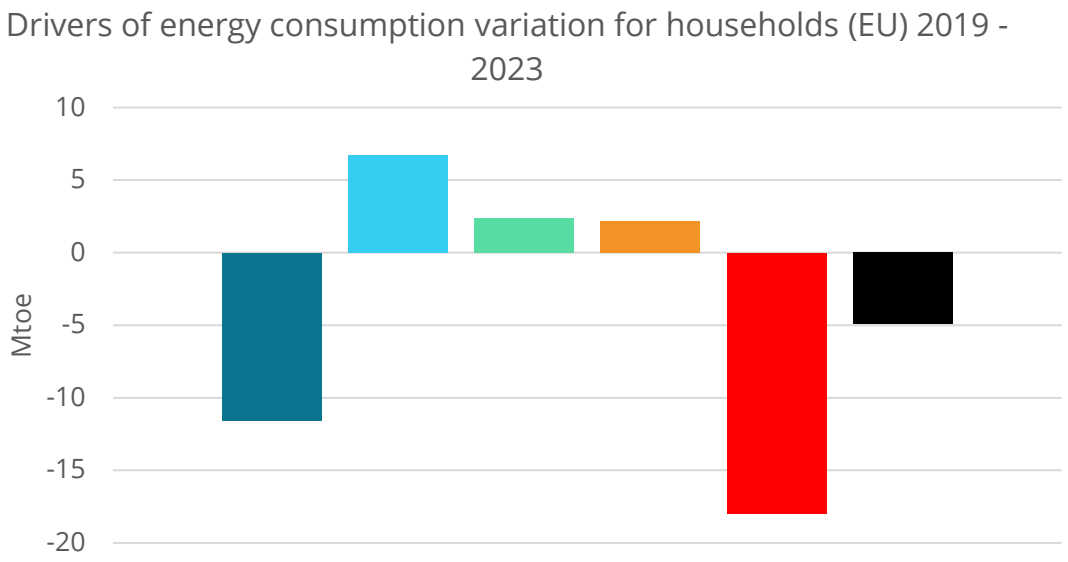
2023 : early estimates

For households, cumulated annual energy savings since 2000 reached 92 Mtoe in 2023, i.e. the equivalent of 39% of household consumption that year. Without savings, energy consumption would have been 39% higher in 2023.

Households are overrepresented in total savings, with a share of total savings much higher than its share in consumption (39% vs 28%). This is the sector with the highest number of EU measures (over 50%).

Driver of households' consumption variation (normal climate)

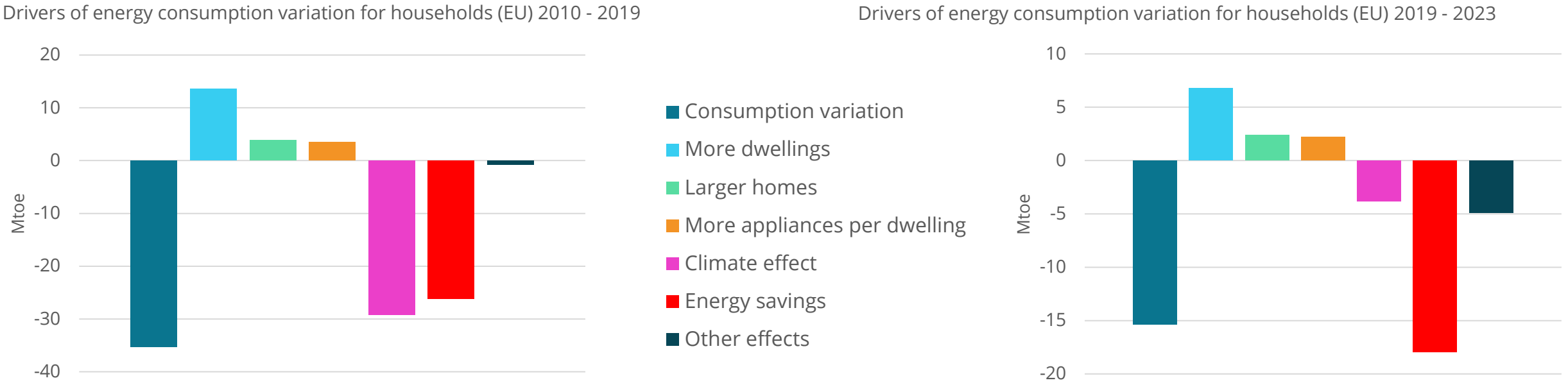




- Consumption decreased by only 6 Mtoe at EU level from 2010 to 2019: the increase in the number of (dwellings) and lifestyle (more appliances per dwelling, larger homes) ("activity effect") contributed to raise the consumption by 21 Mtoe, which was more than offset by energy savings (26 Mtoe).
- Since 2019, consumption decreased sharply, by 12 Mtoe, the activity effect (+11 Mtoe) was more than offset by energy savings (-18 Mtoe) while **behaviours** further reduced consumption by 5 Mtoe (price effect and sufficiency)

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

Driver of households' consumption variation (real climate)



- At real climate, consumption decreased significantly between 2010 and 2019 (- 35 Mtoe), as 2019 had much warmer winter in 2019, which contributed to most of this reduction (-29 Mtoe); the other effects are the same as at normal climate: with an activity effect raising consumption by 21 Mtoe, and energy savings reducing it by 26 Mtoe).
- Between 2019 and 2023, the climate effect had also an impact (warmer climate in 2023), almost equivalent to the behavioural effect.

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

3 Conclusion

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Conclusion : Key messages

Consumption

- Rapid decline of household's energy consumption since 2020 (by 3%/year) due to increasing energy prices.
- Diverse impacts of price increases among countries.
- Because of large climate variations over the years, it is important to analyse trends at normal climate.
- Ambient heat from heat pumps should not be included in household consumption as it gives a wrong signal as to the actual consumption variation: for instance the space heating consumption per m2 has decreased by 1.3%/year at EU level without ambient heat but by only 0,9% if ambient heat is included.

Conclusion : Key messages

Energy efficiency gains

- Household energy efficiency improved by 1.5%/yr since 2000, with most progress achieved before 2014 and after 2019.
- Progress has mainly been driven by efficiency gains for heating, lighting and appliances.

Energy savings

- Energy savings for households reached 92 Mtoe in 2023, with annual savings back to their historical trend since 2020 (5 Mtoe/year).
- Since 2019, consumption at normal climate decreased by 12 Mtoe, driven by energy savings (-18 Mtoe) and behaviours (-5 Mtoe), which more than offset the activity effect (+11 Mtoe).

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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