

— Lessons learned from EU's major decarbonisation projects and technologies

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VKG

Tallinn · 9/9/2026



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European Union medal

20 years of European public service — Samuele Furfari, 1982-2002

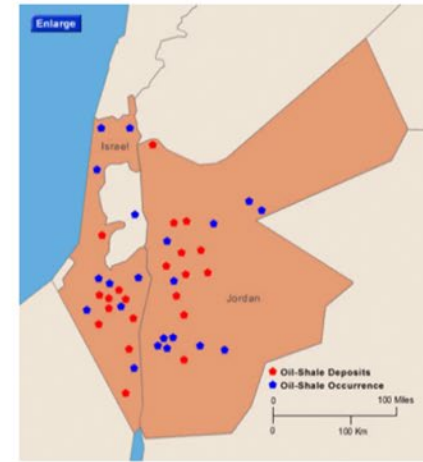


Université libre de Bruxelles medal

Tribute to Professor Samuel Furfari, 1978-2018

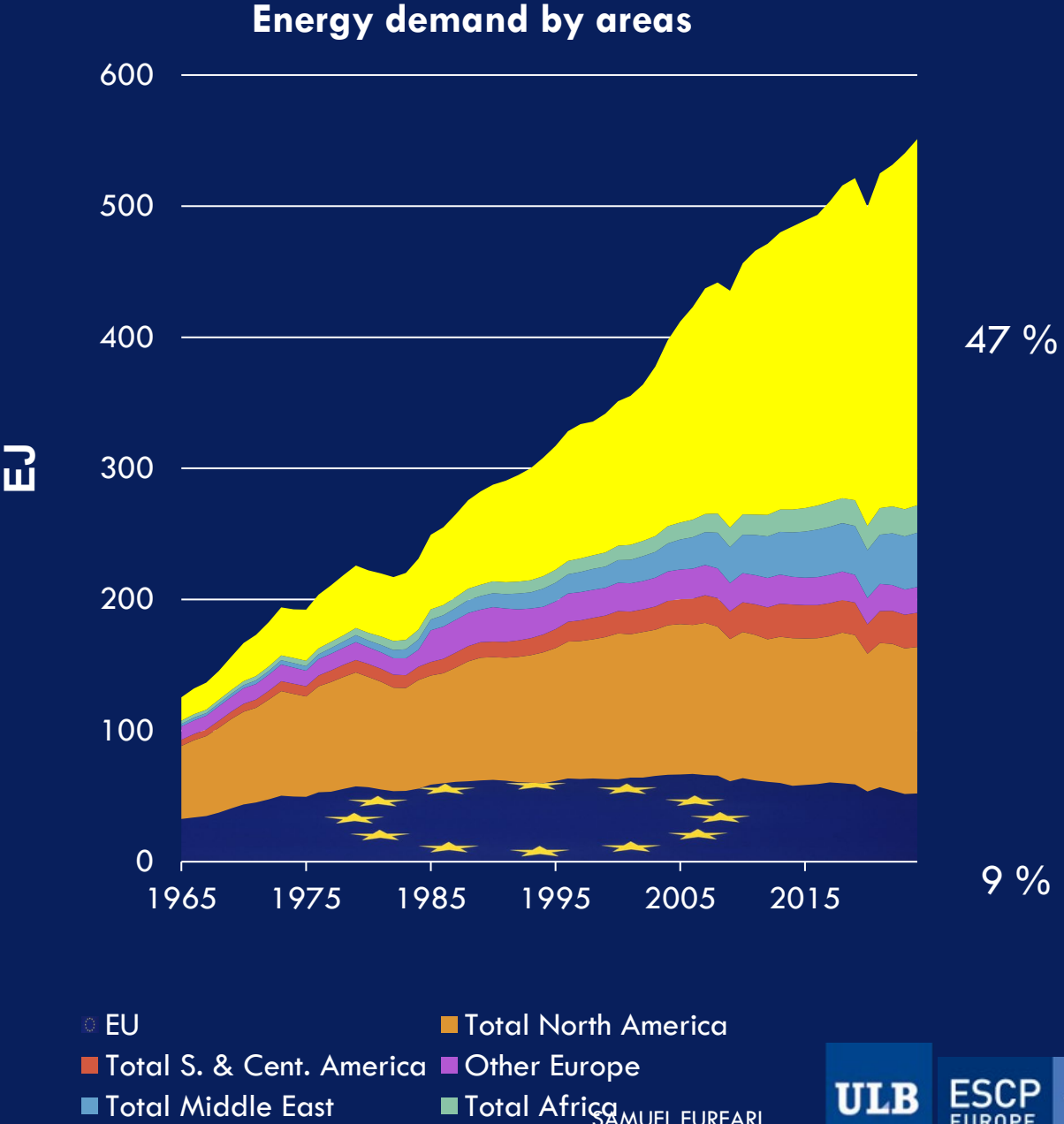
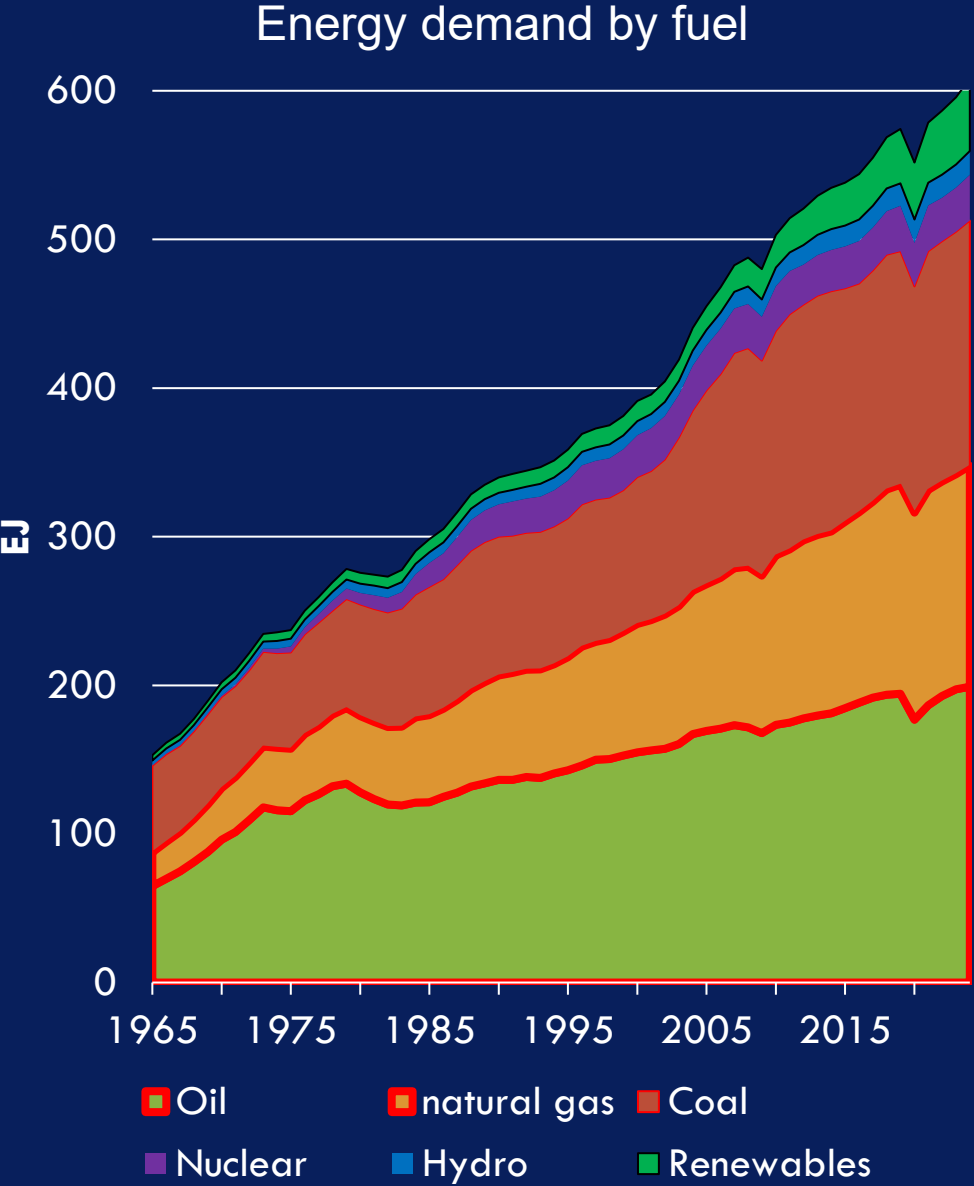


Oil shale $\neq$ shale oil



The world and the EU energy situation

Growing primary energy demand for all energies

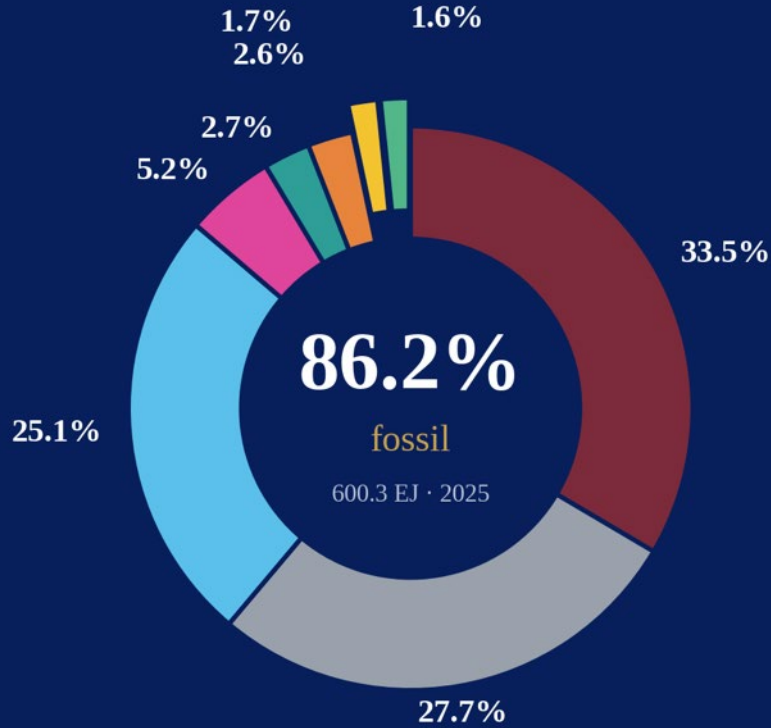


Data: Energy Institute, 2025, Samuel Furfari

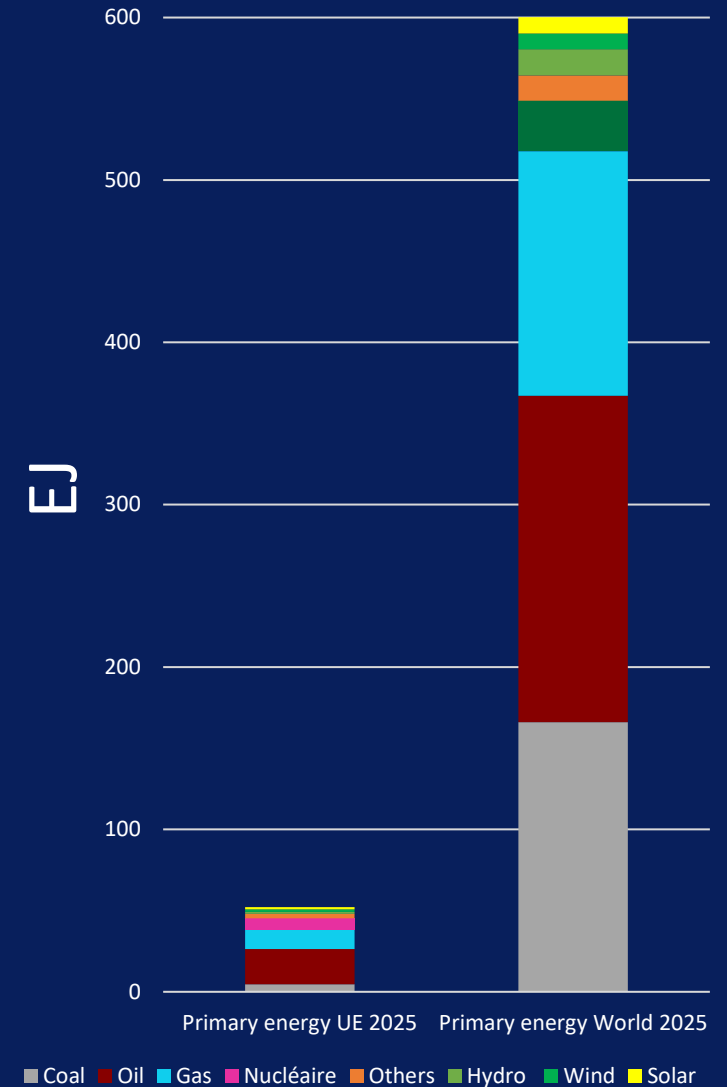
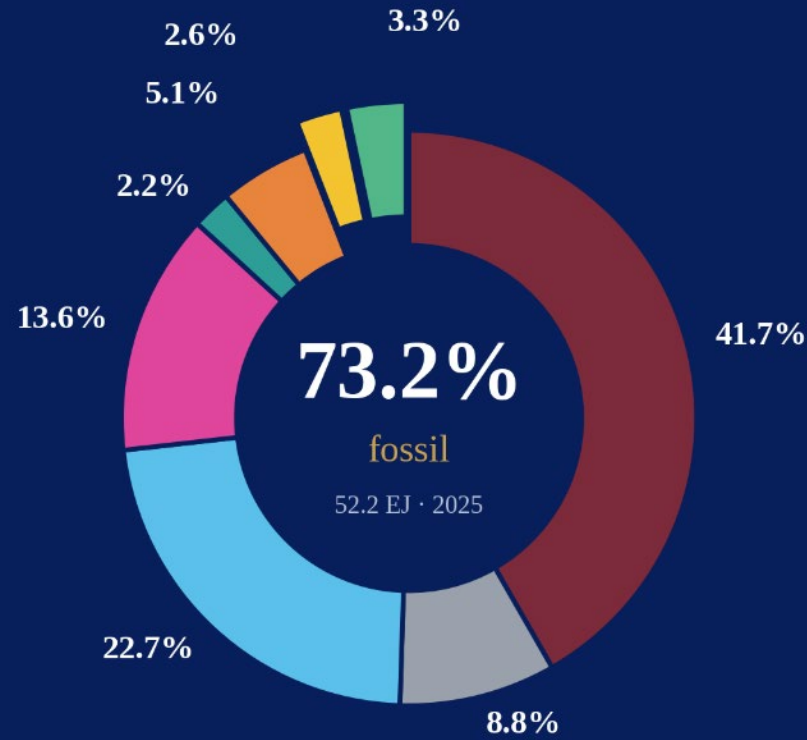
Fossil-fuel dominance

World and EU energy consumption, 2025

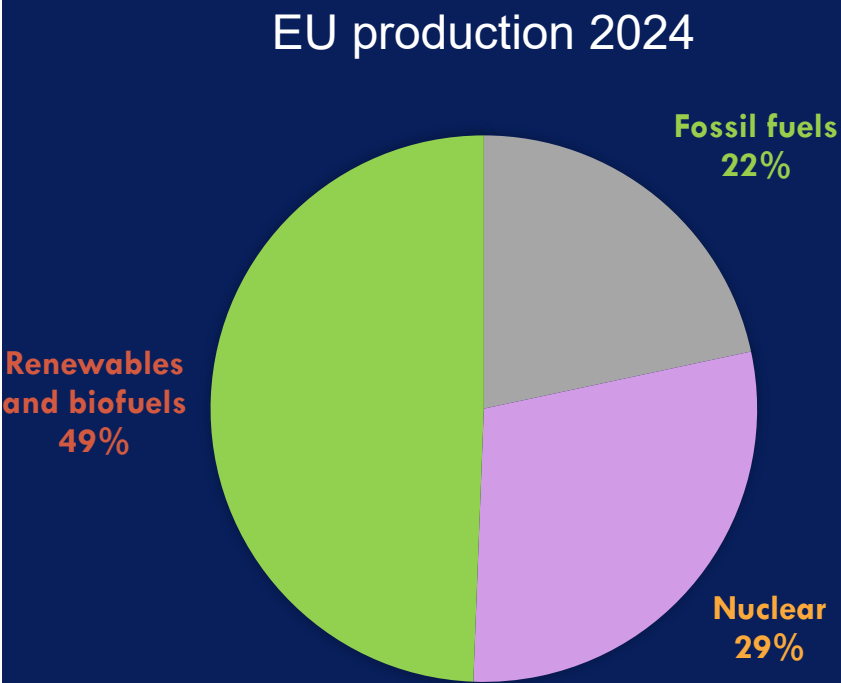
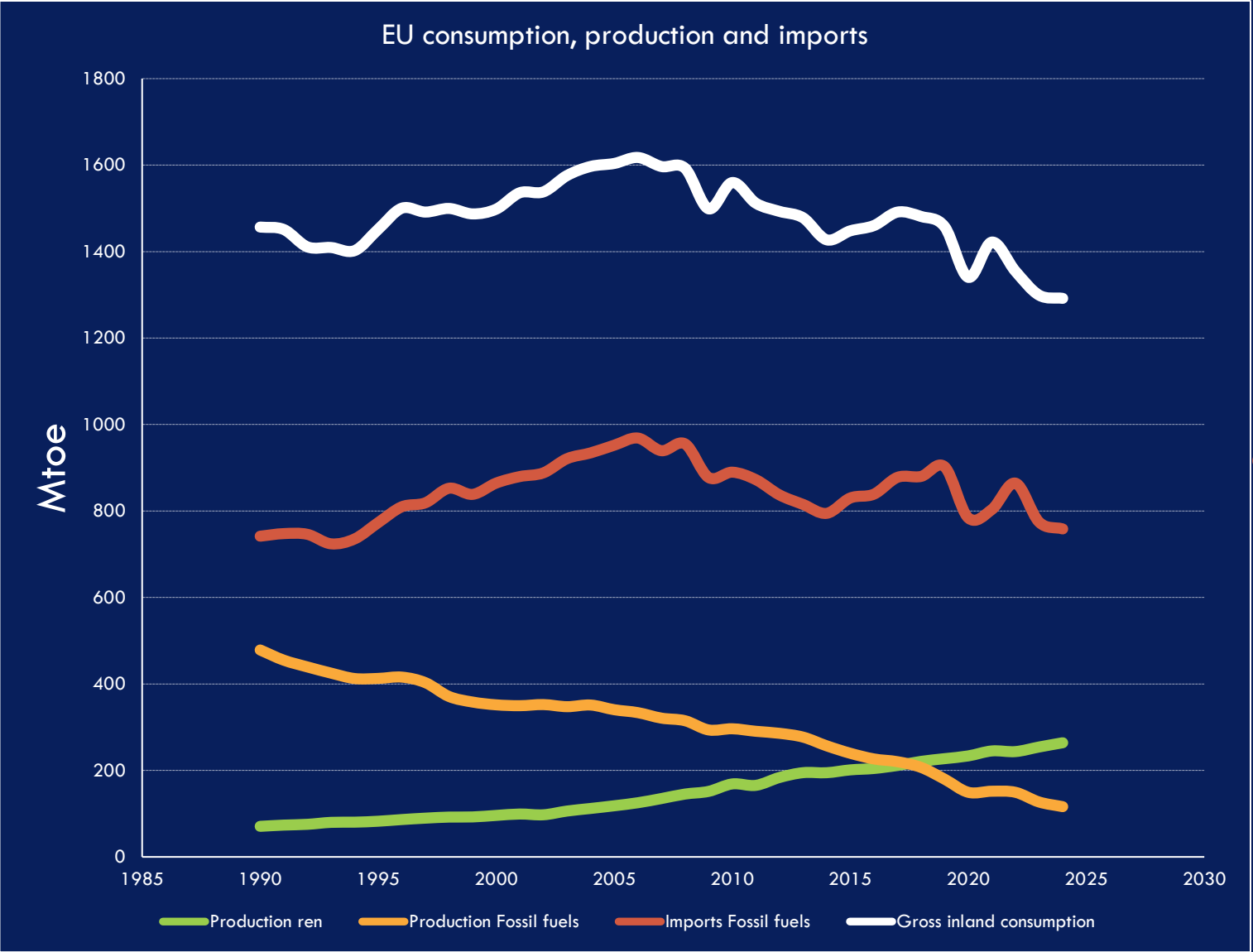
World



EU

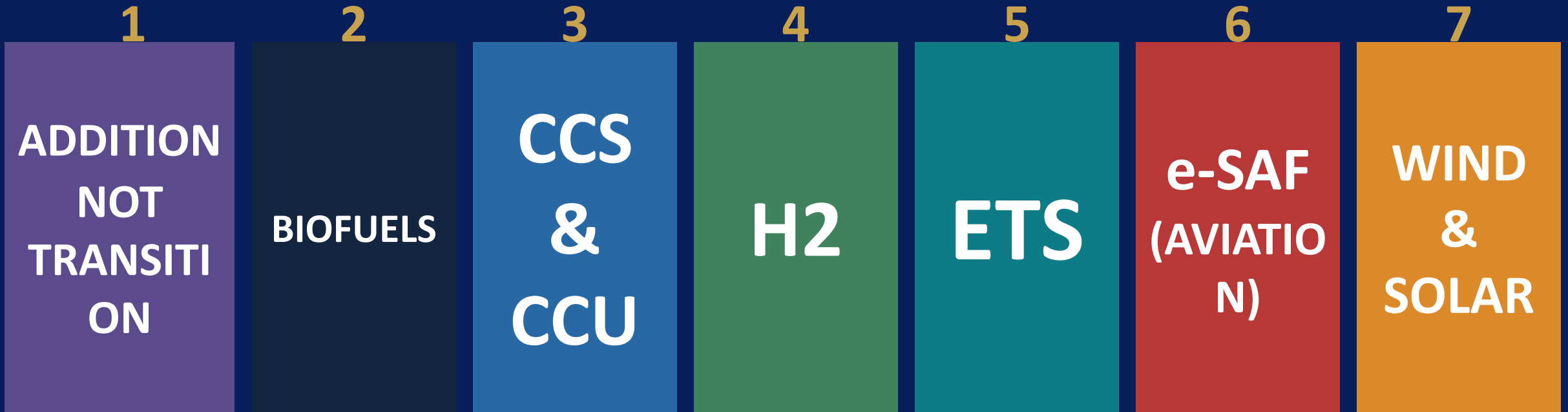


The EU does not produce enough energy



Seven case studies, a consistent pattern

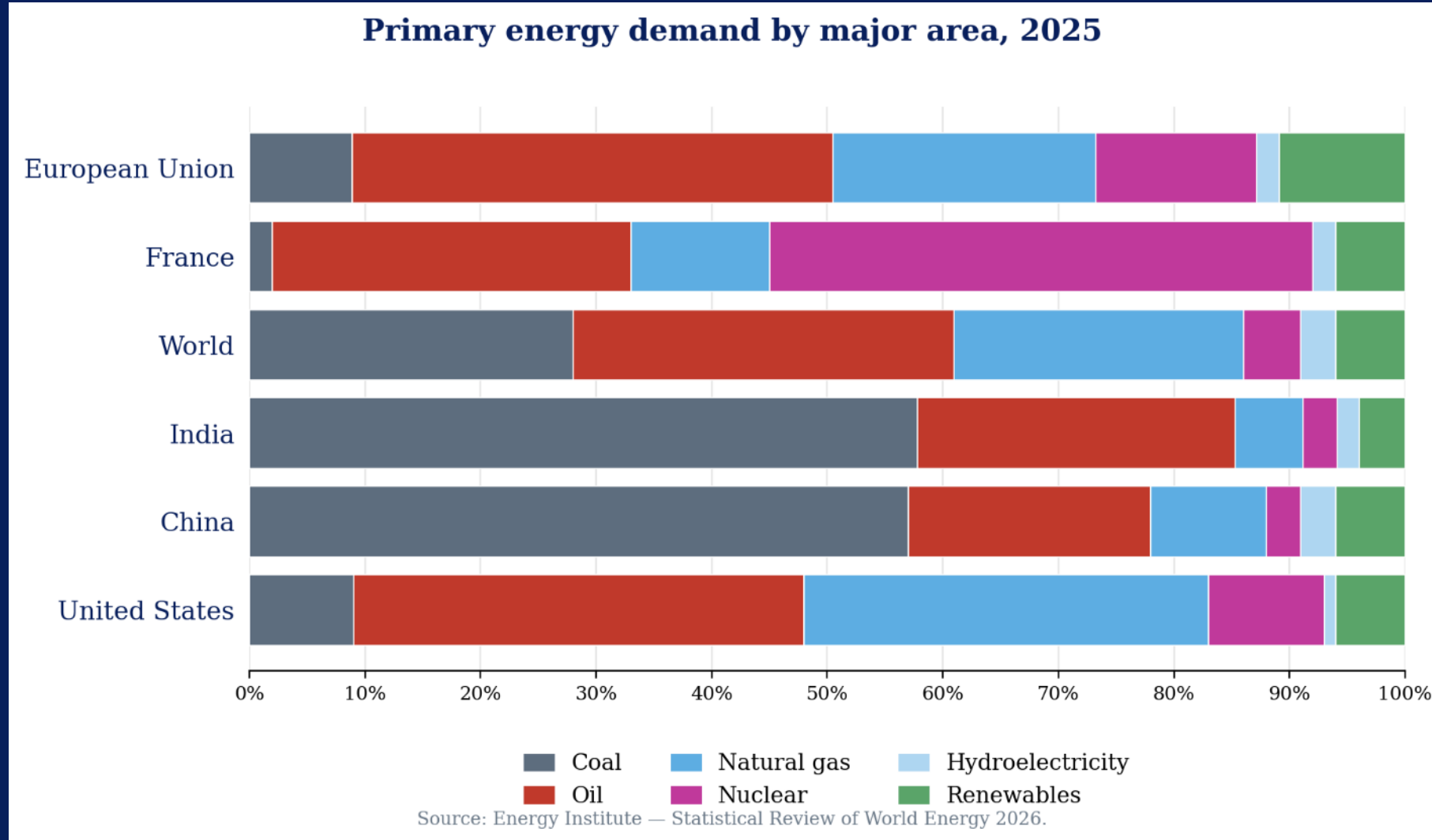
Each dossier is tested in the same way — the promised mandate is compared with what the Commission's own evidence now shows





Energy transition

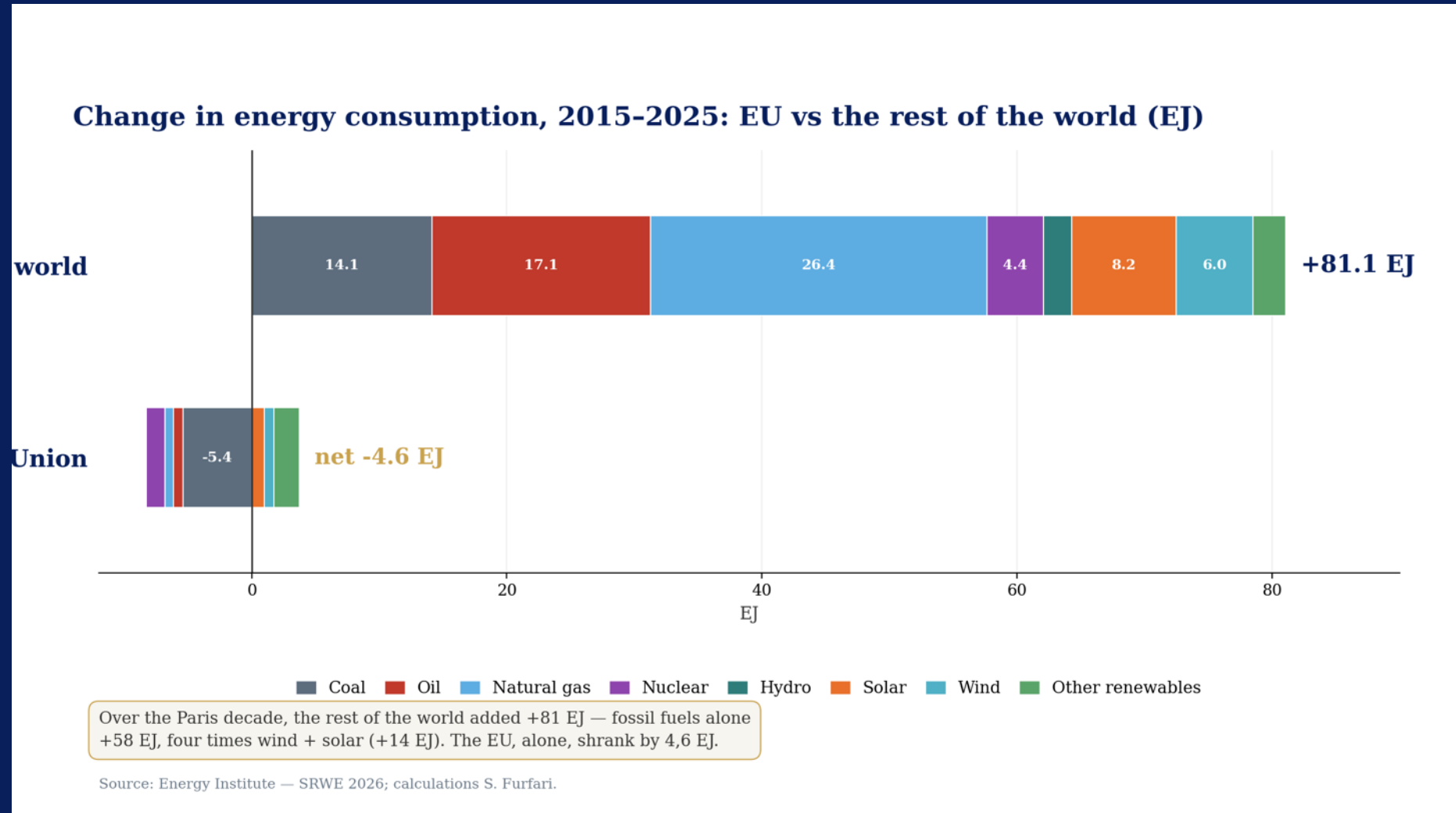
Primary energy portfolio of main actors



Careful with final energy !!

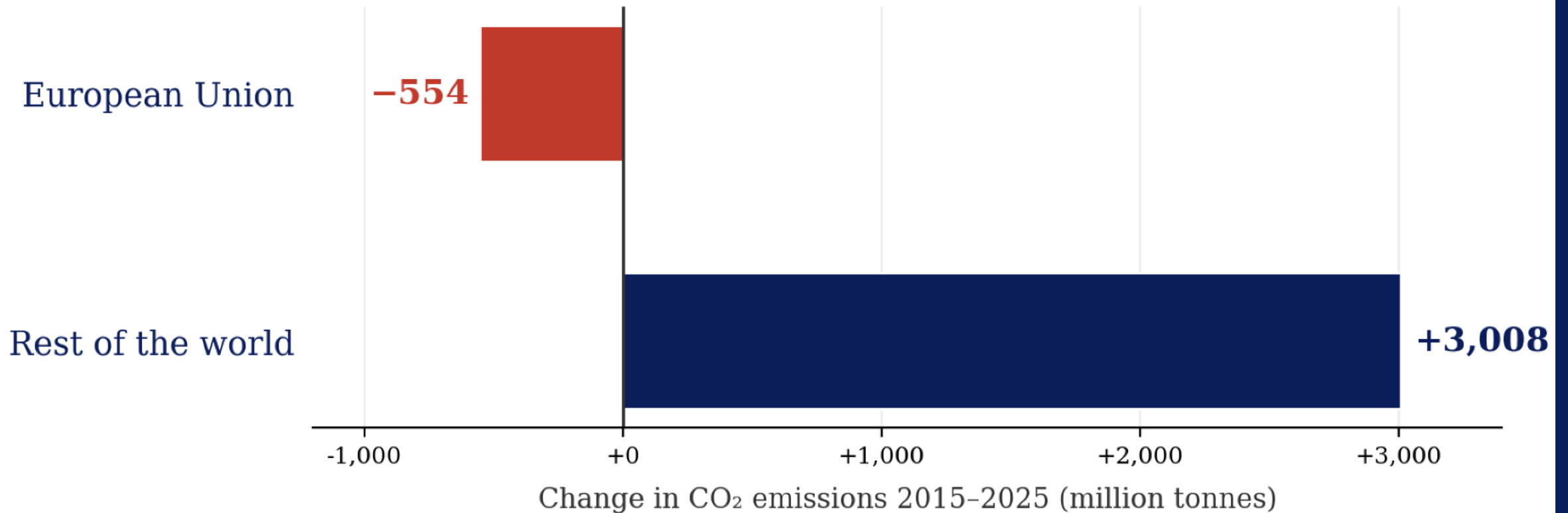
Energy added since the Paris Agreement, 2015–2025

The rest of the world: +81 EJ — fossil fuels added four times as much as wind and solar; the EU alone shrank by 4.6 EJ



Decarbonisation since the Paris Agreement, 2015–2025

While the EU cuts, the rest of the world increases



Source: Energy Institute — Statistical Review of World Energy 2026; calculations S. Furfari.

■ Addition, not transition

Across the world, energy is the nerve of sovereignty — not a moral variable.

China, India and the United States add coal, oil, gas and nuclear to fuel growth and power. New sources are piled on the old — they do not replace them.

The EU decarbonises alone, at the cost of its competitiveness — a reduction swallowed almost instantly by the rest of the world.

A challenge for the EU industry



“EU companies still face electricity prices 2 to 3 times higher than in the United States and natural gas prices 4 to 5 times higher.”

If Europe cannot become more productive, we will be forced to choose. We will not be able to become a leader in new technologies, a beacon of climate responsibility and an independent player on the world stage at the same time. We will not be able to finance our social model. We will have to scale back some, if not all, of our ambitions. ”

“We have reached the point where, if we do not act, we will have to compromise our well-being, our environment or our freedom.”

Mario Draghi

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Biofuels since 2009

5.6.2009

EN

Official Journal of the European Union

L 140/16

**DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE
COUNCIL**

of 23 April 2009

**on the promotion of the use of energy from renewable sources and amending and
subsequently repealing Directives 2001/77/EC and 2003/30/EC**

4. Each Member State shall ensure that the share of energy from renewable sources in all forms of transport in 2020 is at least **10 %** of the final consumption of energy in transport in that Member State.



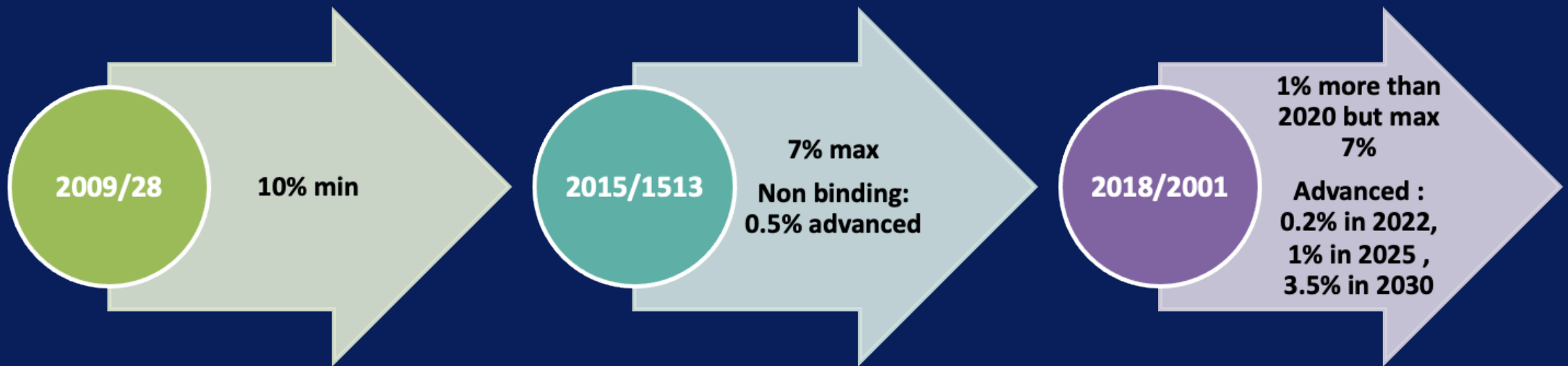
Overview of EU Biofuel Policy

Renewables and CCS Policy Unit
DG Energy
European Commission



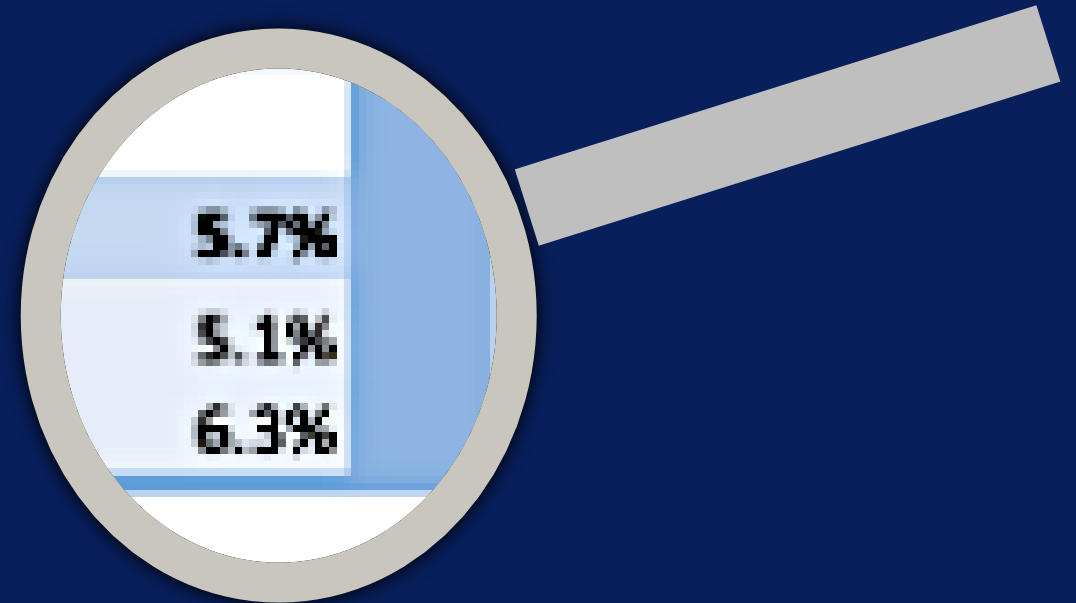
The target, rewritten twice

10% minimum → 7% cap, non-binding → capped again, advanced sub-targets crawling to 3.5% by 2030



Target: 10% by 2020. Reality, 2024: 5.7%

Energy Statistics for:				
	2021	2022	2023	2024
Transport Fuels				
Production biofuels [ktoe]	15987.1	15543.7	15903.6	16117.3
Pure biogasoline	2386.5	2517.9	2533.6	2794.4
Pure biodiesel	13003.0	12596.6	12915.3	12836.9
Other liquid biofuels	597.6	429.2	454.8	486.0
Final consumption biofuels [ktoe]	17698.9	17735.2	18613.1	17572.1
Pure biogasoline	2.5	1.9	1.9	2.9
Blended biogasoline	3053.5	3264.4	3578.4	3745.0
Pure biodiesel	562.1	642.8	851.2	1494.3
Blended biodiesel	13917.9	13699.8	14053.1	12219.6
Other liquid biofuels	162.9	126.2	128.5	110.2
Final consumption petroleum products [ktoe]	306 408.8	311 081.3	305 042.8	308 408.2
of which LPG	15 662.0	16 106.4	15 790.9	16 077.2
of which motor gasoline	63 877.1	67 718.6	70 317.1	72 937.6
of which Gas/Diesel oil	226 869.8	227 256.2	218 934.8	219 393.4
Final consumption natural gas [ktoe]	3531.8	3325.5	3190.6	3198.8
Biofuels Production Capacity [kton/year]	36189.6	35101.2	34937.7	35824.6
Biogasoline	6823.4	6768.4	6720.7	6789.2
Biodiesel	22915.0	21768.0	21479.1	21770.5
Other liquid biofuels	6451.2	6564.8	6737.8	7264.8
Share of Biofuels in Transport Fuels [%]	5.8%	5.7%	6.1%	5.7%
of Biogasoline in Motor Gasoline [%]	4.8%	4.8%	5.1%	5.1%
of Biodiesel in Gas/Diesel Oil [%]	6.4%	6.3%	6.8%	6.3%





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CCS & CCU

Hiding the CO₂

CCS & CCUS: the promise

The EEPR funded six demonstration projects in 2009–2010 — €1 billion was on the table.



CCS: the judgment of the Court of Auditors

The Court of Auditors closed the file in 2018: the intended progress had not been achieved.



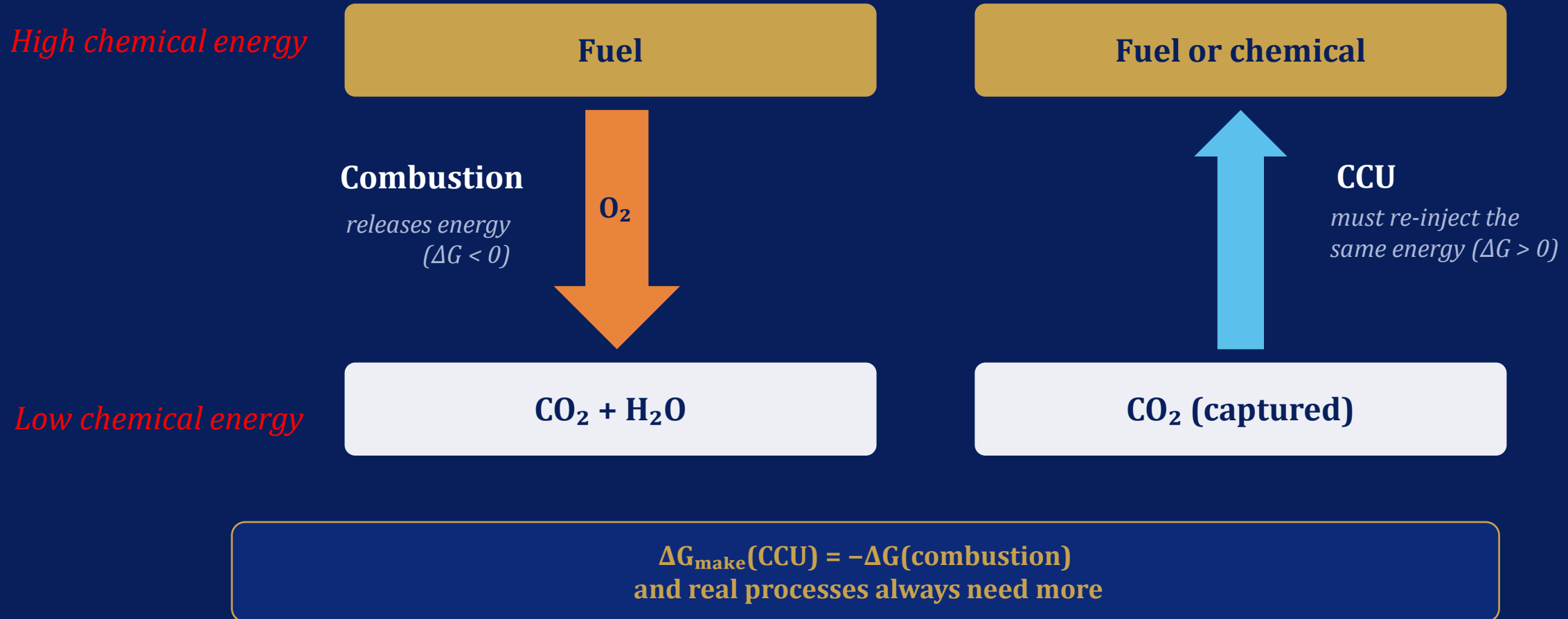
The screenshot shows the official website of the European Court of Auditors. At the top left is the logo with the text 'CURIA RATIONUM' and 'EUROPEAN COURT OF AUDITORS Guardians of the EU finances'. A navigation bar contains links for 'Home', 'Our work', 'Our products', 'International cooperation', and 'Newsroom'. Below this, a breadcrumb trail reads 'Home > Document Item : Special report No 24/2018: Demonstrating carbon capture and storage and innovative renewables at commercial scale in the EU: intended progress not achieved in the past decade'. The main heading of the report is displayed in large blue text: 'Special report No 24/2018: Demonstrating carbon capture and storage and innovative renewables at commercial scale in the EU: intended progress not achieved in the past decade'. Below the heading is a green icon of a lightbulb with a plant growing inside it. To the right of the icon, the date '23/10/2018' is shown, followed by a paragraph of text: 'To help achieve its 2020 and longer term climate and energy objectives, the EU launched two large funding programmes in 2009 to support carbon capture and storage (CCS) and innovative renewables: the European Energy Programme for Recovery (EEPR) and the NER300 programme. While the EU is likely to meet its

Source: European Court of Auditors, Special Report 24/2018

CCS in the EU is gaining momentum on paper — with a handful of storage sites entering operation in 2026 and dozens more announced — but it remains a heavily subsidized, early-stage market still far short of the 50 Mt CO₂ target for 2030 .

[EC Report link](#)

Gibbs' law: the thermodynamic wall of CCUS

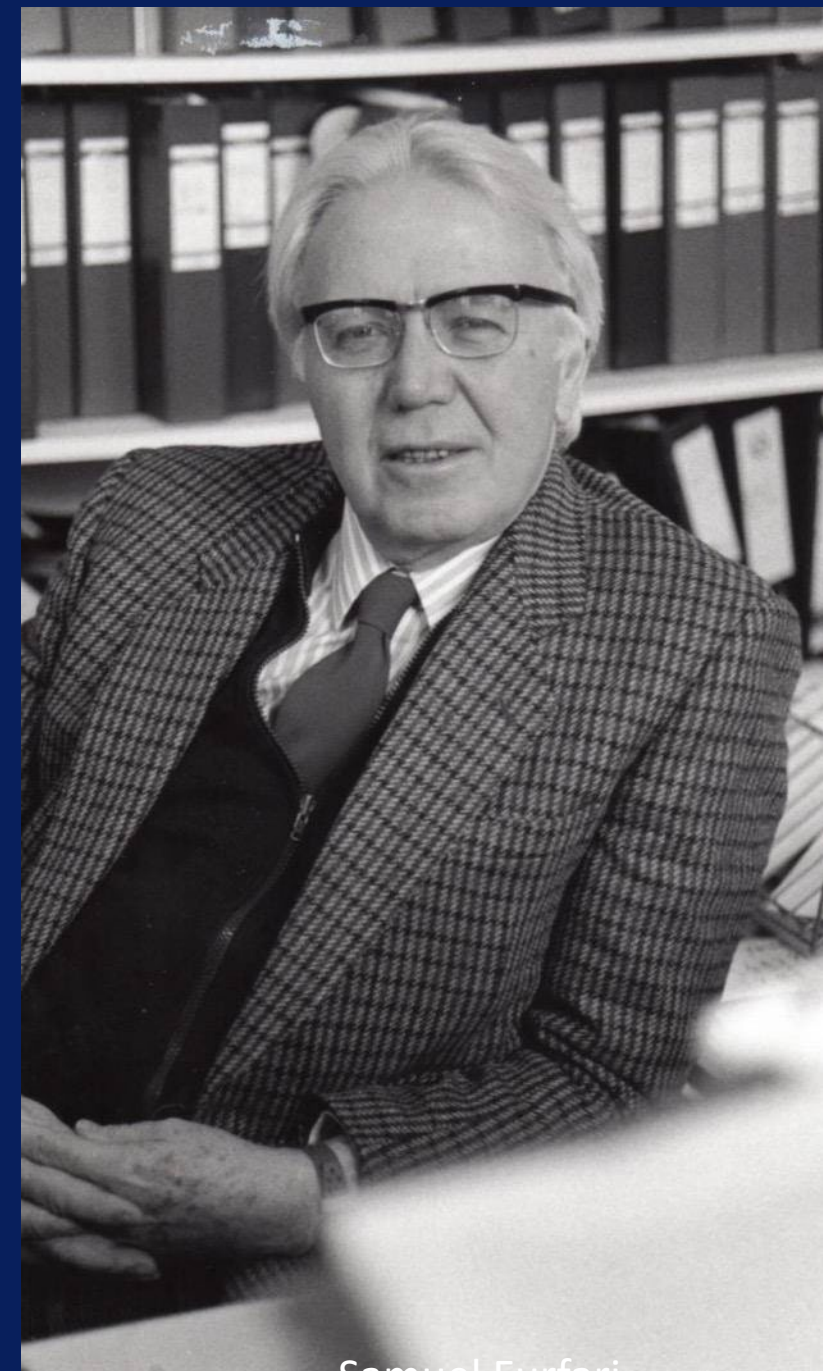
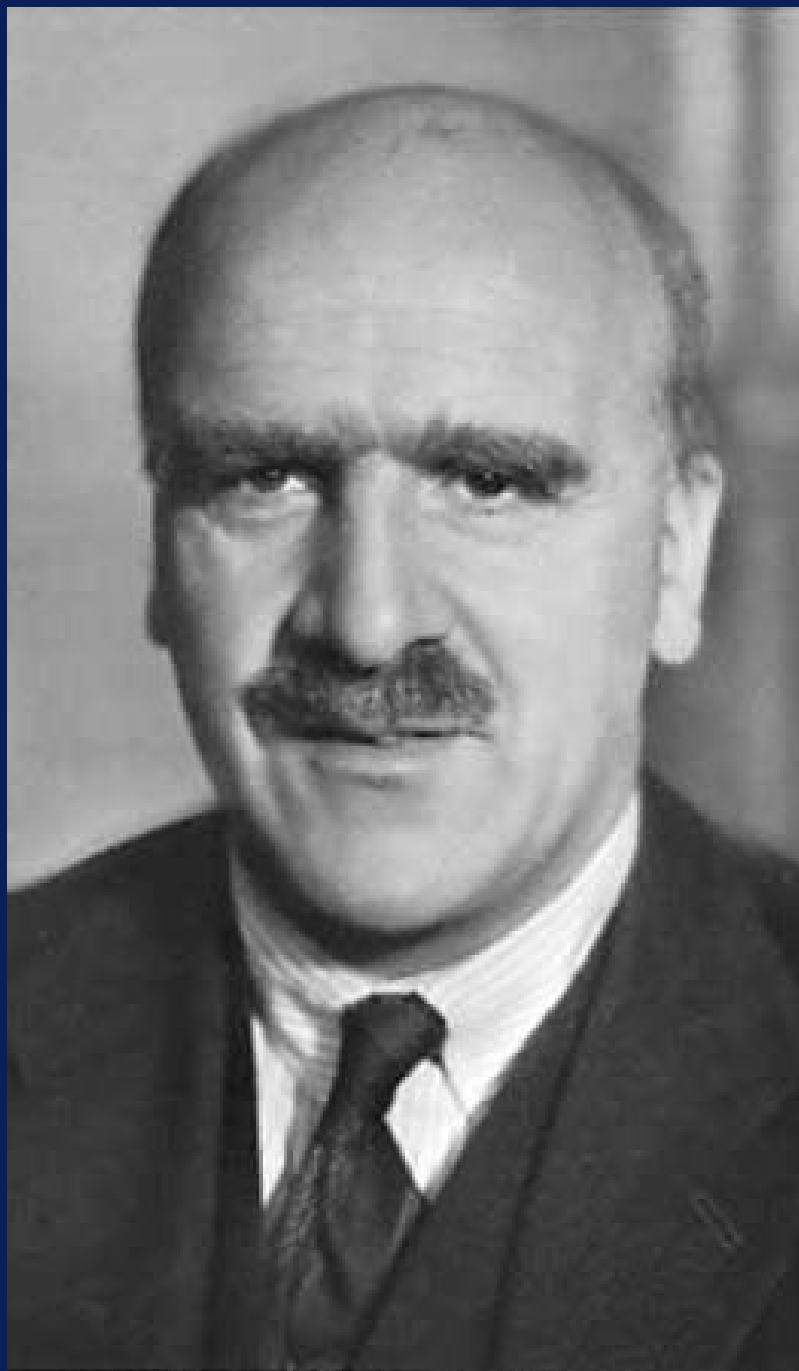


CCS?

- expensive
- green opposition
- lack of adequation between emission sites and appropriate geological plays

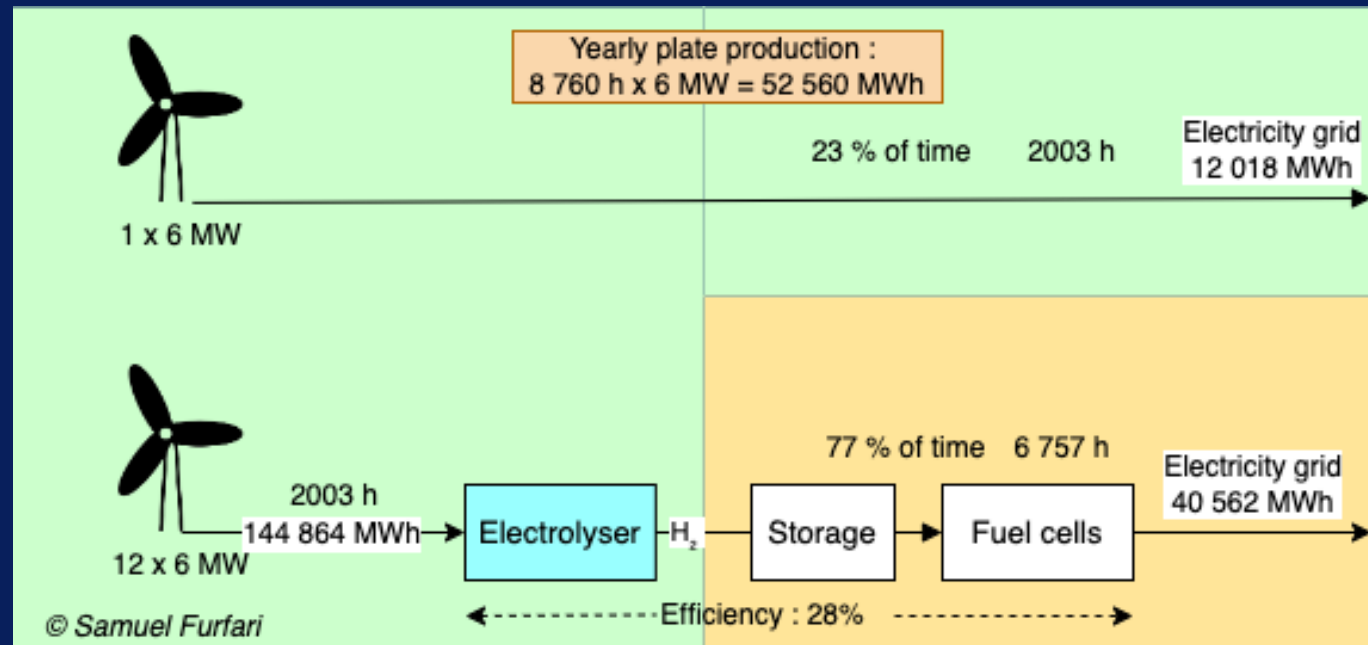
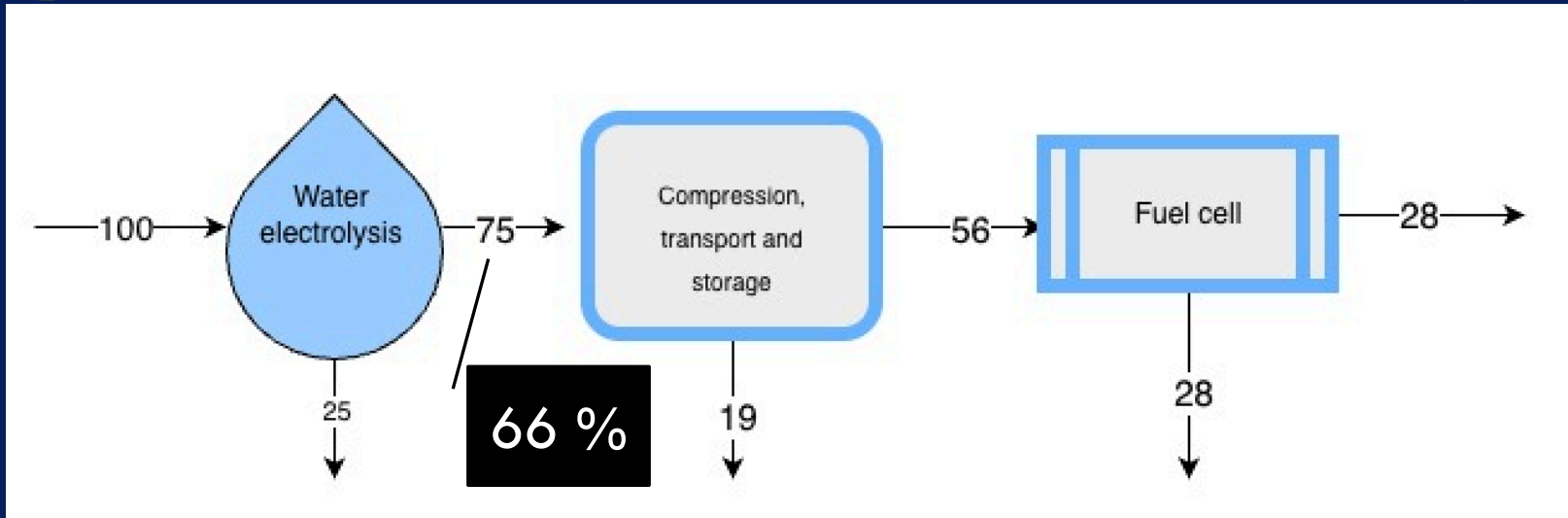
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The EU's hydrogen quest since 1960



Samuel Furfari

Very inefficient H₂ storage!



Hydrogen, the key molecule of chemical and petrochemical industry

Chemistry

Ammonia — nitrogen fertilizers

Methanol — solvents and resins

Hydrochloric acid — industrial acid

Petrochemical refining

Hydrocracking — heavy oil into fuels

Hydrotreating — sulfur removal

Isomerization — octane boost

Metallurgy & materials

Direct ore reduction — iron sponge

Tungsten, molybdenum — pure metals

Float glass — protective atmosphere

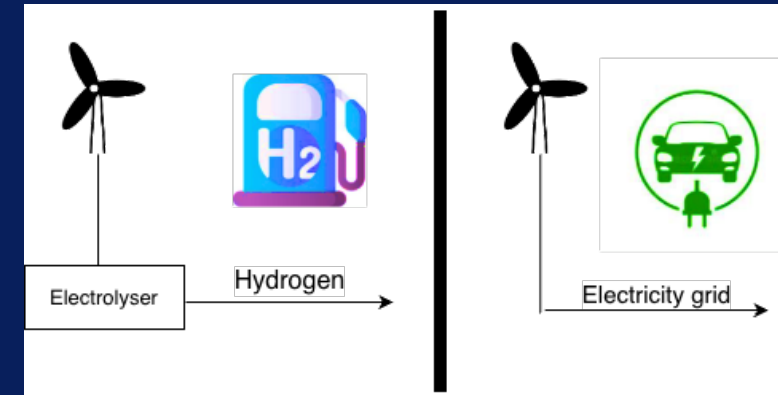
Food & other industries

Fat hardening — margarine, shortening

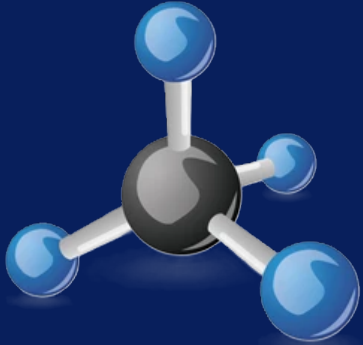
Silicon purification — semiconductors

Vitamin synthesis — pharmaceuticals

Cannibalisation



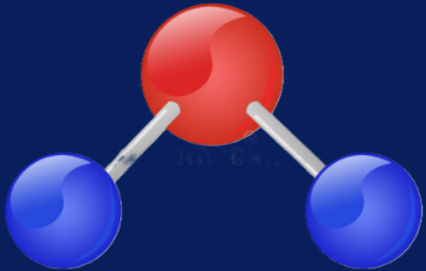
Why H₂ is produced with hydrocarbons?



shutterstock.com · 213161875



$$\Delta H = -164.7 \text{ kJ}$$



$$\Delta H = -285.8 \text{ kJ}$$

$$\frac{4 \times 285.8}{164.7} = 6.9$$



[Link](#)

«98% of the 142 GW project pipeline remains at the concept or feasibility stage

Projects	Place
H2UB Boxberg	Boxberg, Saxe
FlagshipONE	Örnsköldsvik, Ørsted
Neste, Porvoo	Porvoo
Repsol	Cartagena
H2Sines.Rdam (Shell & Engie)	From Sines to Roterdaal
Lhyfe	France
Plug Power	Antwerpen
ArcelorMittal	Dunkerque
HyScale100	Heide



« It is a fantasy to believe Europe's steel industry can fully decarbonise by 2033 without affordable clean electricity and hydrogen.

„Yet the biggest question remains unanswered: where will the affordable electricity and hydrogen come from? Companies are still being asked to invest billions without knowing whether the electricity and hydrogen infrastructure will be ready, whether sufficient clean electricity will be available, or whether they will be delivered across the EU at prices that keep European steel and its downstream value chains globally competitive.“



Axel Eggert
DG of EUROFER



ETS



TAX OR MARKET?

Legal form versus economic substance



- Fiscal substance → unanimity argument

Four reasons to withdraw

CONSTITUTIONAL

**Energy-mix
sovereignty**

ECONOMIC

**Competitiveness
penalty**

EMPIRICAL

**Negligible
global impact**

SOCIAL

**Heating &
mobility burden**

AFFORDABLE • ABUNDANT • SECURE ENERGY

“

Despite some positive aspects, the ETS proposal falls clearly short of what is needed to stop rising carbon costs and restore industrial competitiveness.



»

This also applies to the ETS benchmarks update for 2026-2030. For the chemical industry, the results are largely excessive, unrealistic, and do not reflect the seriousness of the situation our industry is facing. These updates are a substantial setback to European industry's competitiveness.

Markus Kamieth

EU, Meloni: ETS proposal does not satisfy us; united front within the EU on a change of approach

Interview with *Milano Finanza*: 'The migrant crisis shows that Europe must protect its borders'

by Rome Editorial Staff
14 August 2026

 Aggiungi Il Sole 24 Ore
ai preferiti su Google



▲ La premier Giorgia Meloni REUTERS

Italy calls for suspension of EU carbon market



"The EU Emissions Trading System, in its present form, has ceased to be an efficient environmental instrument and has become an additional tax on Europe's energy-intensive industries. By raising electricity and production costs, it weakens the competitiveness of Italian and European firms against competitors in China and the United States, where comparable carbon constraints do not apply. Italy therefore calls for the ETS to be suspended pending a thorough reform that restores technological neutrality, protects industrial employment and prevents decarbonisation policy from becoming a mechanism for deindustrialising Europe."

Adolfo Urso



e-SAF

RefuelEU: MANDATE VS INDUSTRIAL REALITY

The mandate advances faster than supply



A4E:
2030 target
“not tenable”

**Projects with
FID:**
0.71% of EU
2030 need

**Global SAF
2026:**
~0.8% of
aviation fuel

The chemistry: Fischer-Tropsch

Patented in 1925; used industrially today in South Africa (coal) and Qatar (gas)



- Anderson-Schulz-Flory distribution
- 20–25% straight-run Jet-A1 yield by weight
- 40–45% with hydrocracking — at large extra cost

A GEOPOLITICAL COMPETITIVENESS PROBLEM

Europe imposes mandates; most competitors do not

EU

Mandatory SAF / e-SAF
Rising incorporation
targets

UNITED STATES

No comparable federal
mandate
More voluntary incentives

ASIA • AFRICA • LATAM
MIDDLE EAST

No comparable e-SAF
mandate

EU AIRLINES
higher structural fuel costs

Travelers will be paying more without any advantages



Wind and solar

The tolerated energy sources

Evolution of the EU Renewable Energy Directive

From RED (2009) to RED II (2018) and RED III (2023) — binding EU renewable energy targets

2009

2018

2023

RED

Directive 2009/28/EC

Target year: 2020

Overall RES share (EU)

20%

Transport

10%

First EU-wide binding renewable energy target for Member States and a binding transport target

RED II

Directive (EU) 2018/2001

Target year: 2030

Overall RES share (EU)

32%

Transport

14%

Binding EU-level target; no longer binding per member state

RED III

Directive (EU) 2023/2413

Target year: 2030

Overall RES share (EU)

42.5%

45% aspirational target

Transport

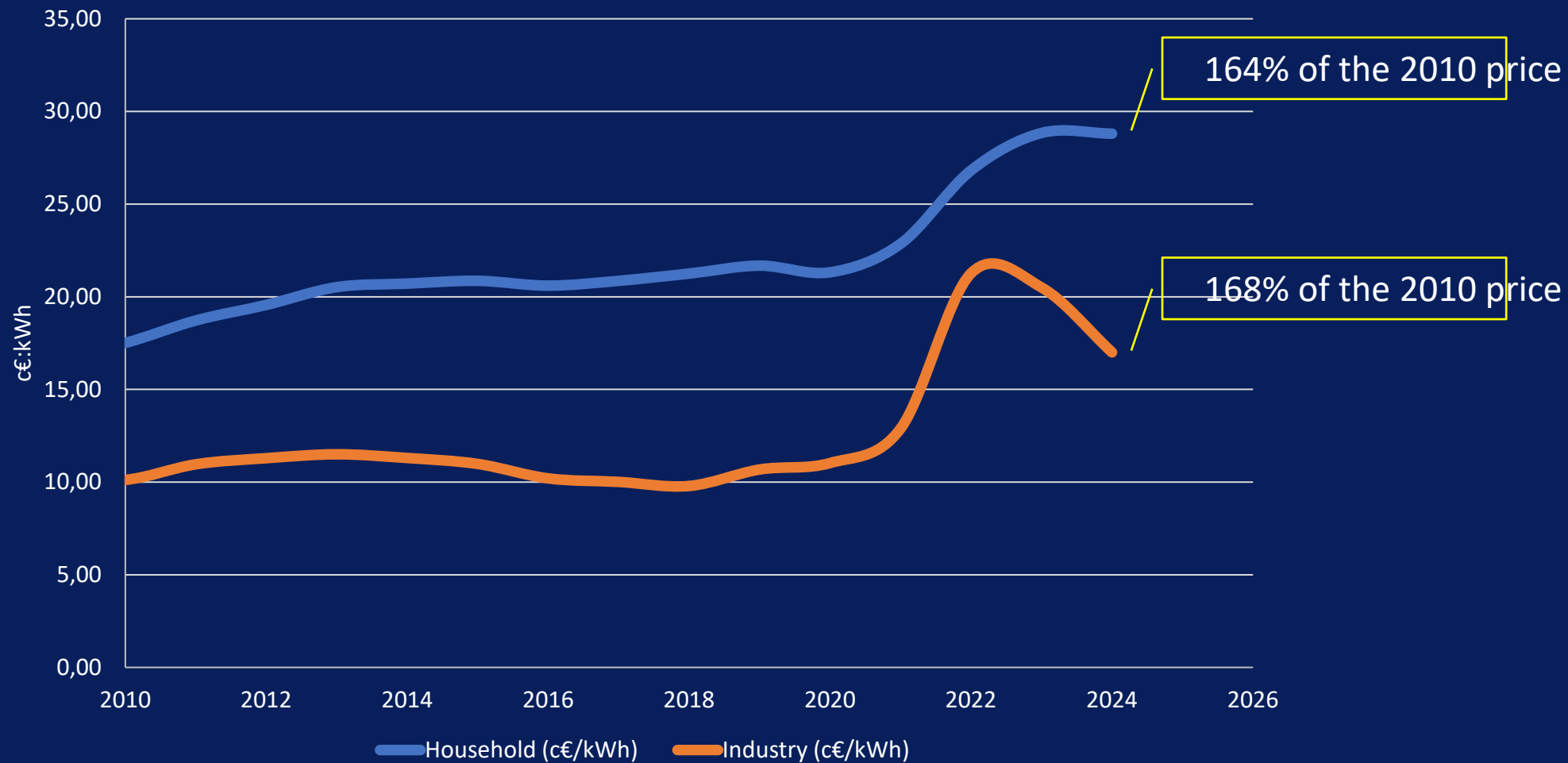
29%

or -14.5% GHG intensity

Adopted as part of the Fit for 55 / REPowerEU package

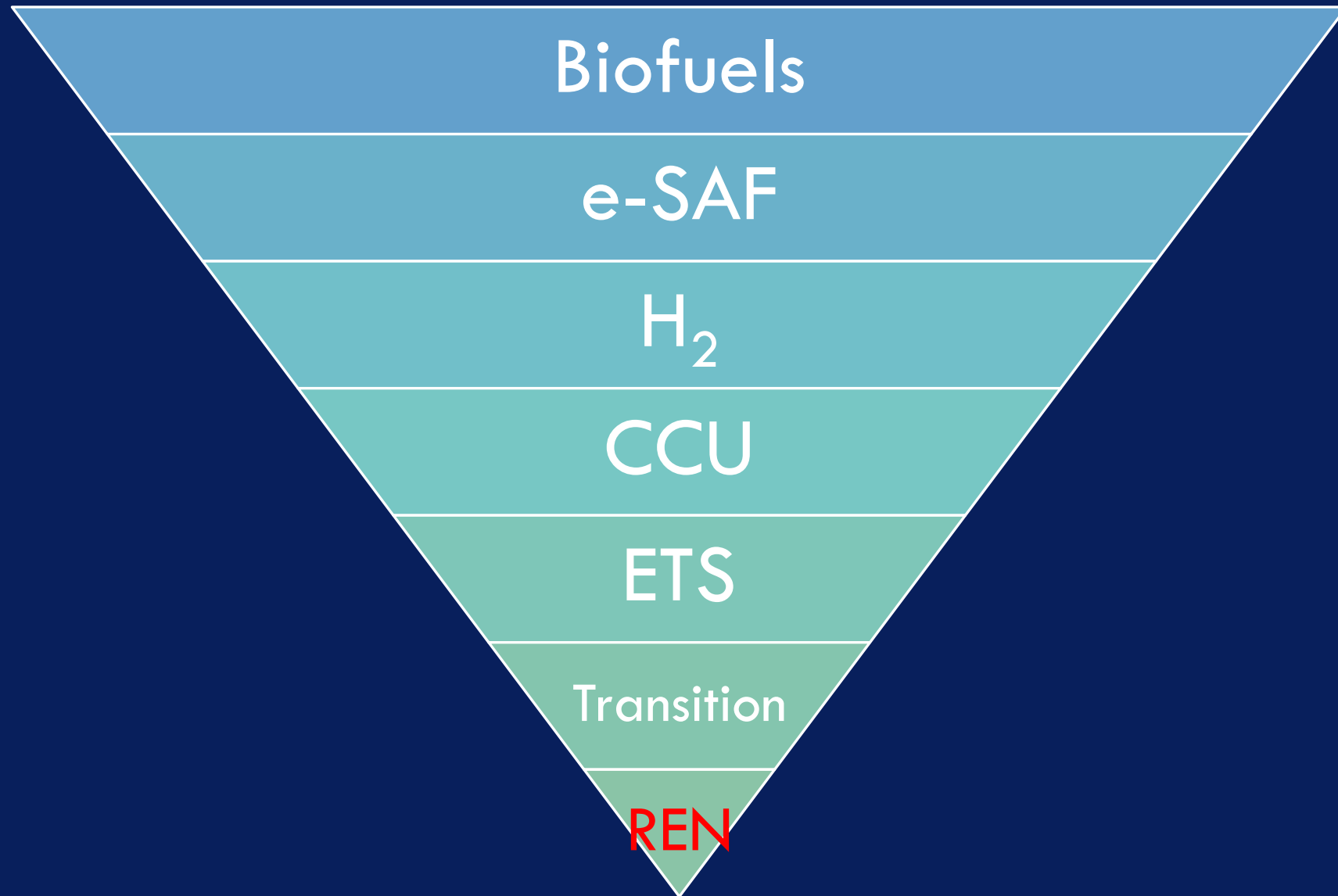
Evolution of EU electricity prices

Households vs industry, EU average, 2008–2024 (c€/kWh)



Conclusions

Variable renewable energy, the linchpin



— Not a technology failure — a governance failure

Seven case studies, one root cause

- **Command and control, not a common market**
- **Technologies may be technically feasible, but not economically viable**
- **Freedom of enterprise and choice are the casualties**
- **The illusion of decarbonisation**
- **A national competence, overridden**
- **A strong EU is not a statist EU**

Returning to Maastricht



European Commission



Council of the EU



European Parliament



The way forward is not more mandates — it is the EU of the common market: prosperity and liberty, ...as before Maastricht.

Thank you for your attention.

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