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Europe's Energy Evolution: Conquering Challenges, Gaining Insights

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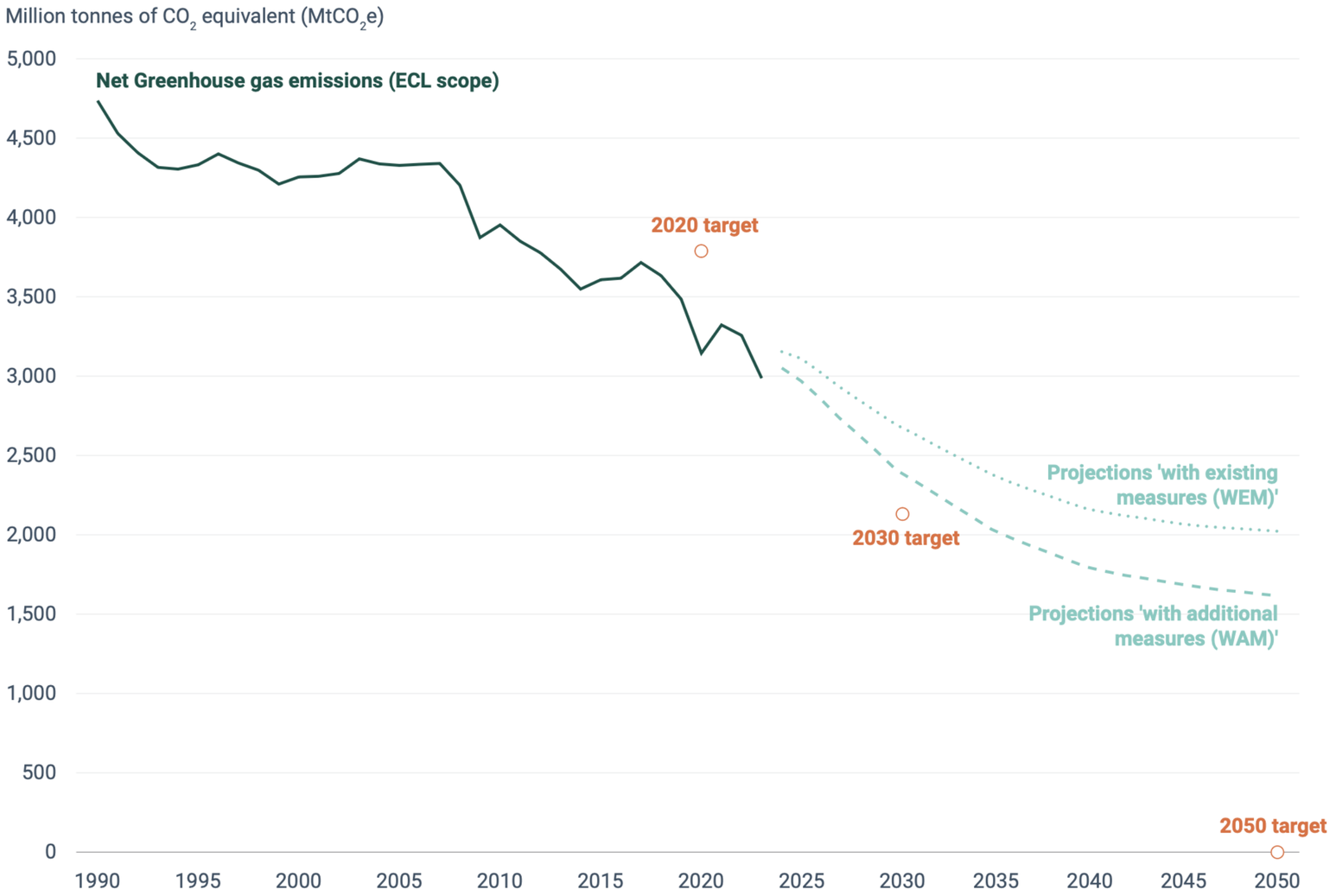
Content

- GHG Emissions
- Economic development/Competitiveness
- Energy prices
- Energy security
- Electrification
- Renewable energy
- Energy policy development and outlook for 2025

European Energy Highlights

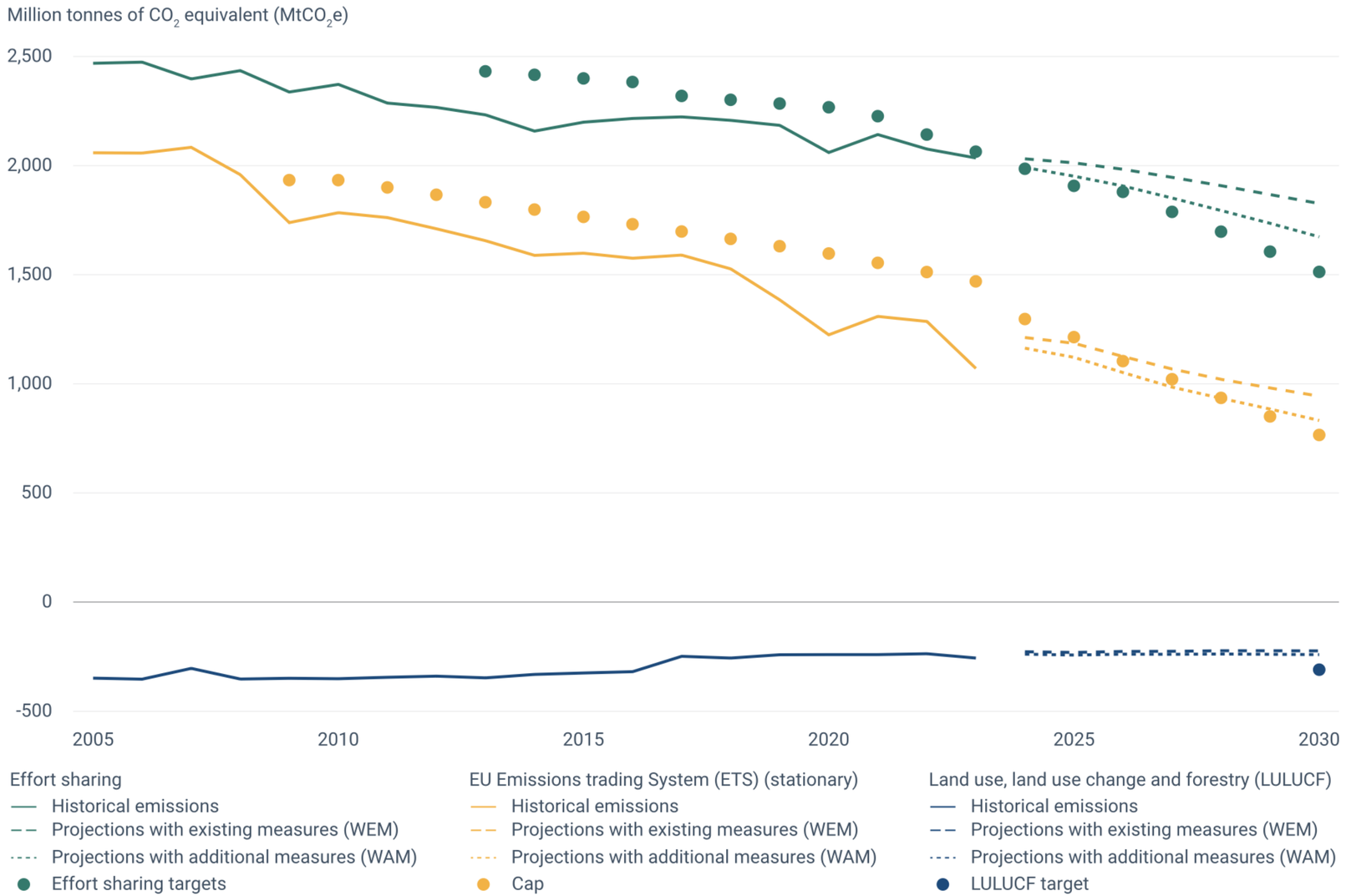
GHG Emissions Reduction

Progress towards climate targets in the EU



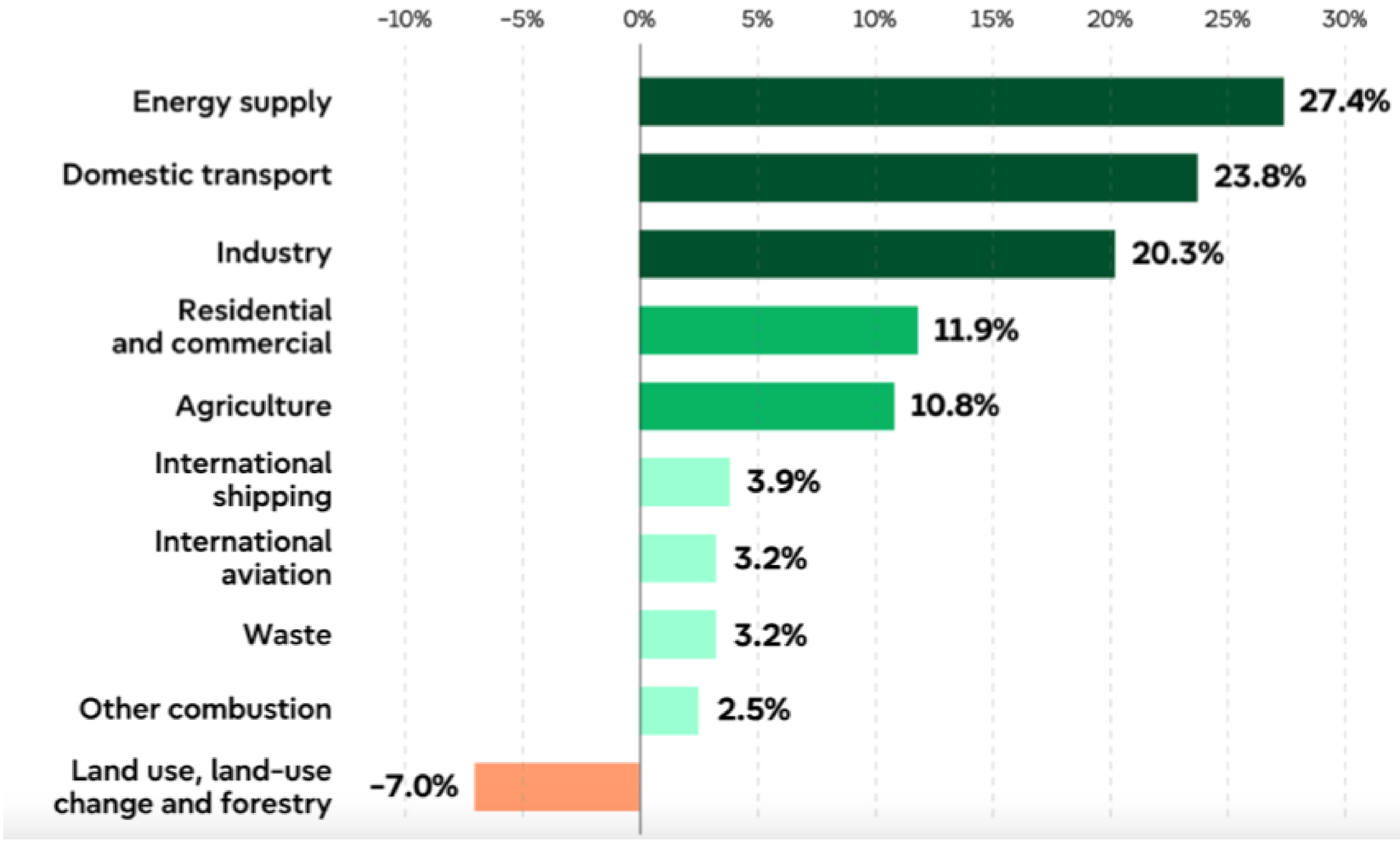
Source: EEA

Effort Sharing, ETS, LULUCF trends



Source: EEA

GHG Emissions in the EU by sector

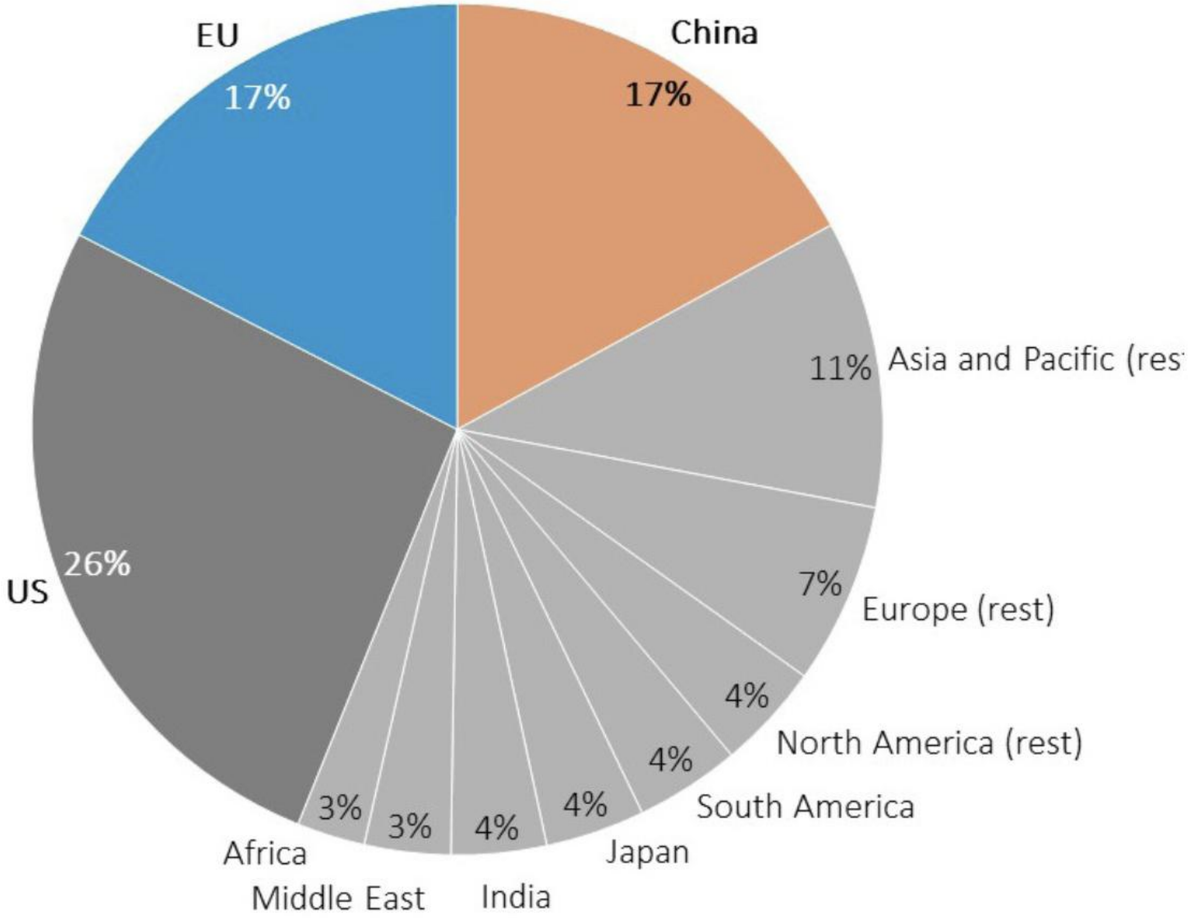


Source: EC

Economic development/Competitiveness

Europe has a good basis to be a highly competitive economy

GDP at current prices, 2023



Source: IMF, 2024

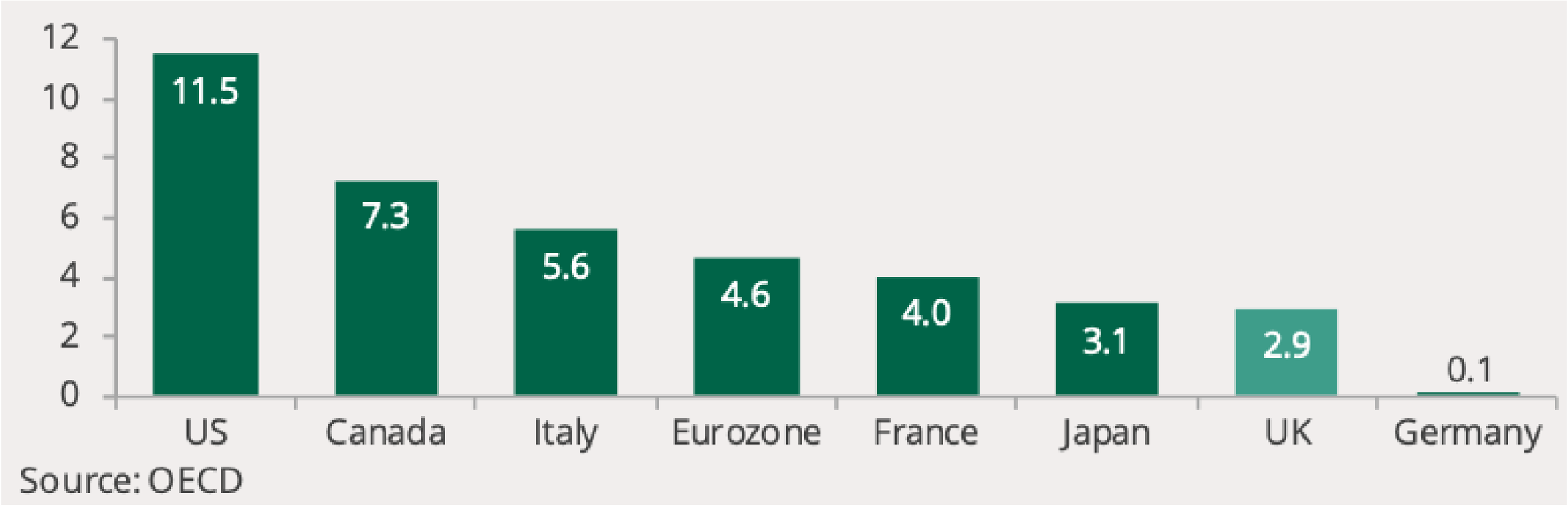
Real GDP growth forecasts (% change)

	IMF (Jan 2025)			OECD (Dec 2024)		
	2024	2025	2026	2024	2025	2026
UK	0.9	1.6	1.5	0.9	1.7	1.3
France	1.1	0.8	1.1	1.1	0.9	1.0
Germany	-0.2	0.3	1.1	0.0	0.7	1.2
Eurozone	0.8	1.0	1.4	0.8	1.3	1.5
US	2.8	2.7	2.1	2.8	2.4	2.1
Japan	-0.2	1.1	0.8	-0.3	1.5	0.6
China	4.8	4.6	4.5	4.9	4.7	4.4
India*	6.5	6.5	6.5	6.8	6.9	6.8
Brazil	3.7	2.2	2.2	3.2	2.3	1.9
World	**3.2**	**3.3**	**3.3**	**3.2**	**3.3**	**3.3**

Note: *For fiscal years (April-March)

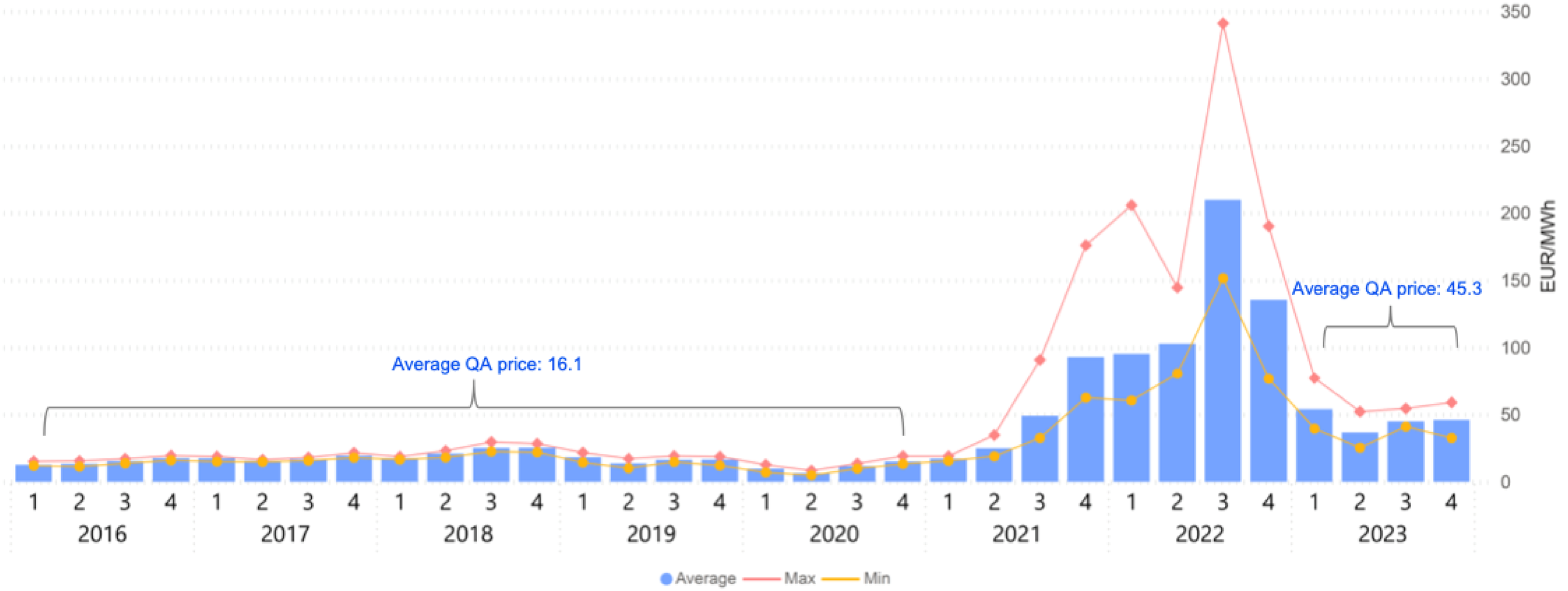
Sources:IMF World Econ Outlook Jan'25; OECD Econ Outlook Dec'24

G7 real GDP % change (Q3 2024 against Q4 2019)



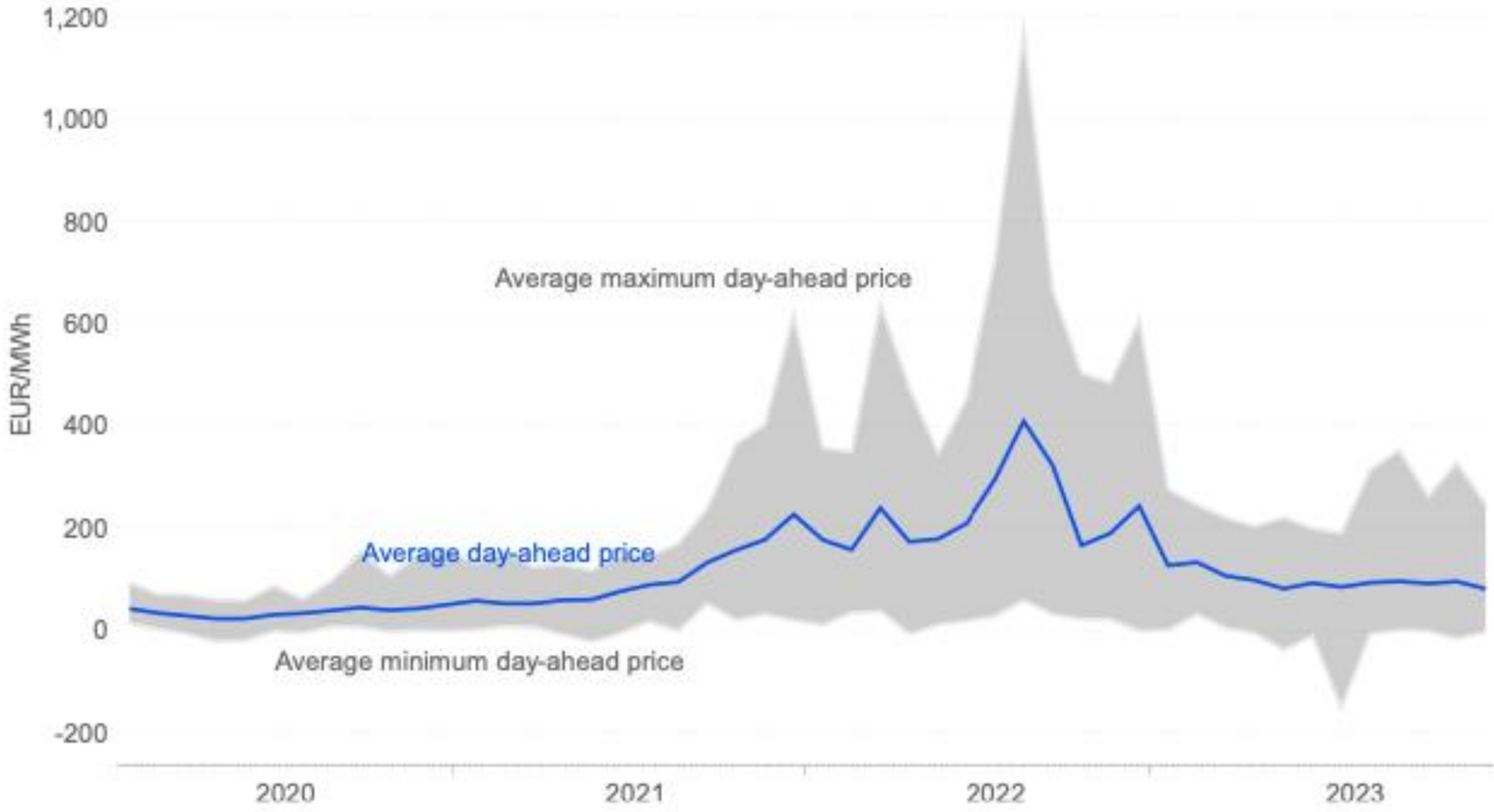
Energy prices

Gas wholesale prices, 2016-2023 (TTF’s QA)



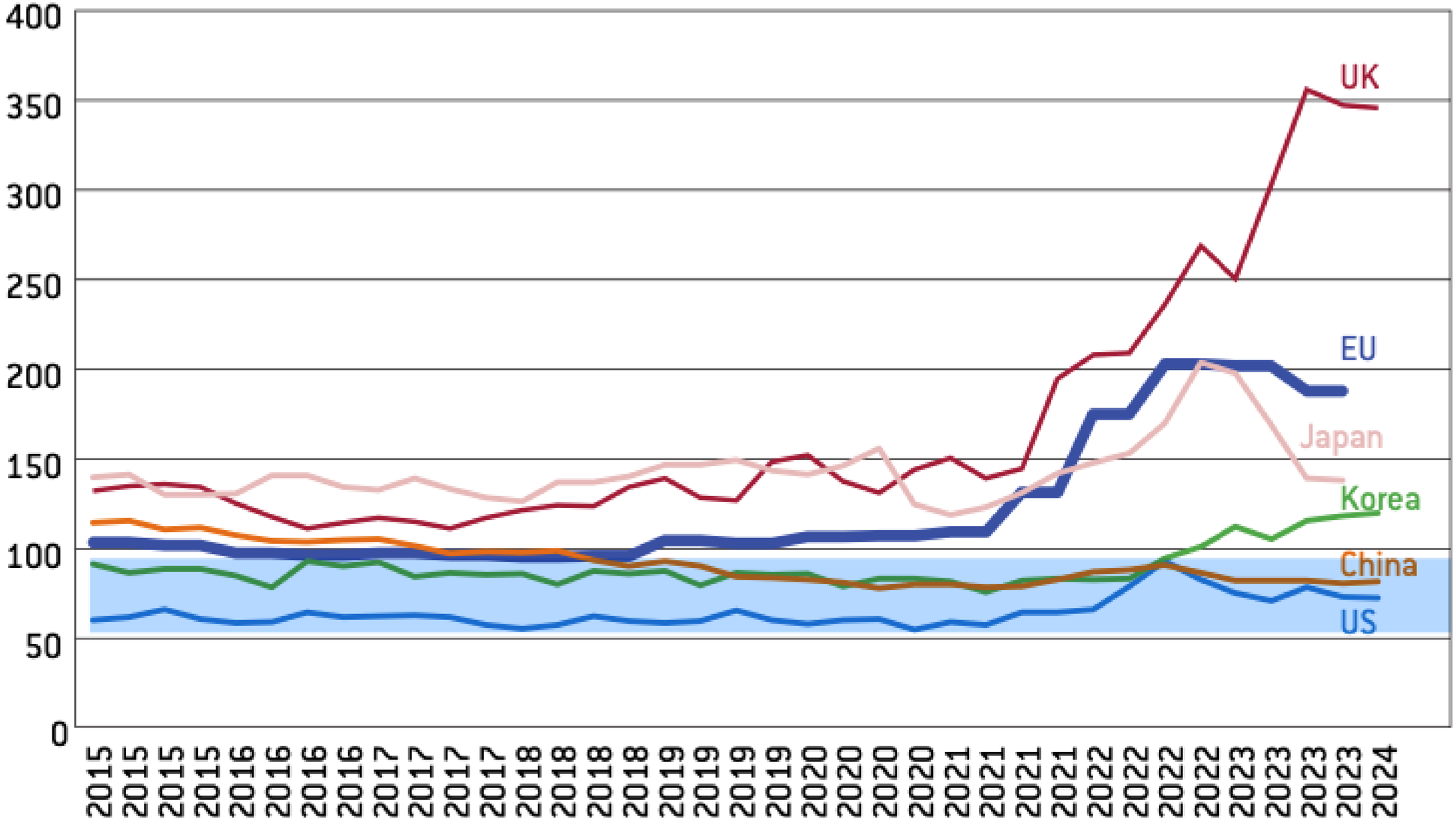
Source: ACER

Electricity day-ahead prices, 2019-2023



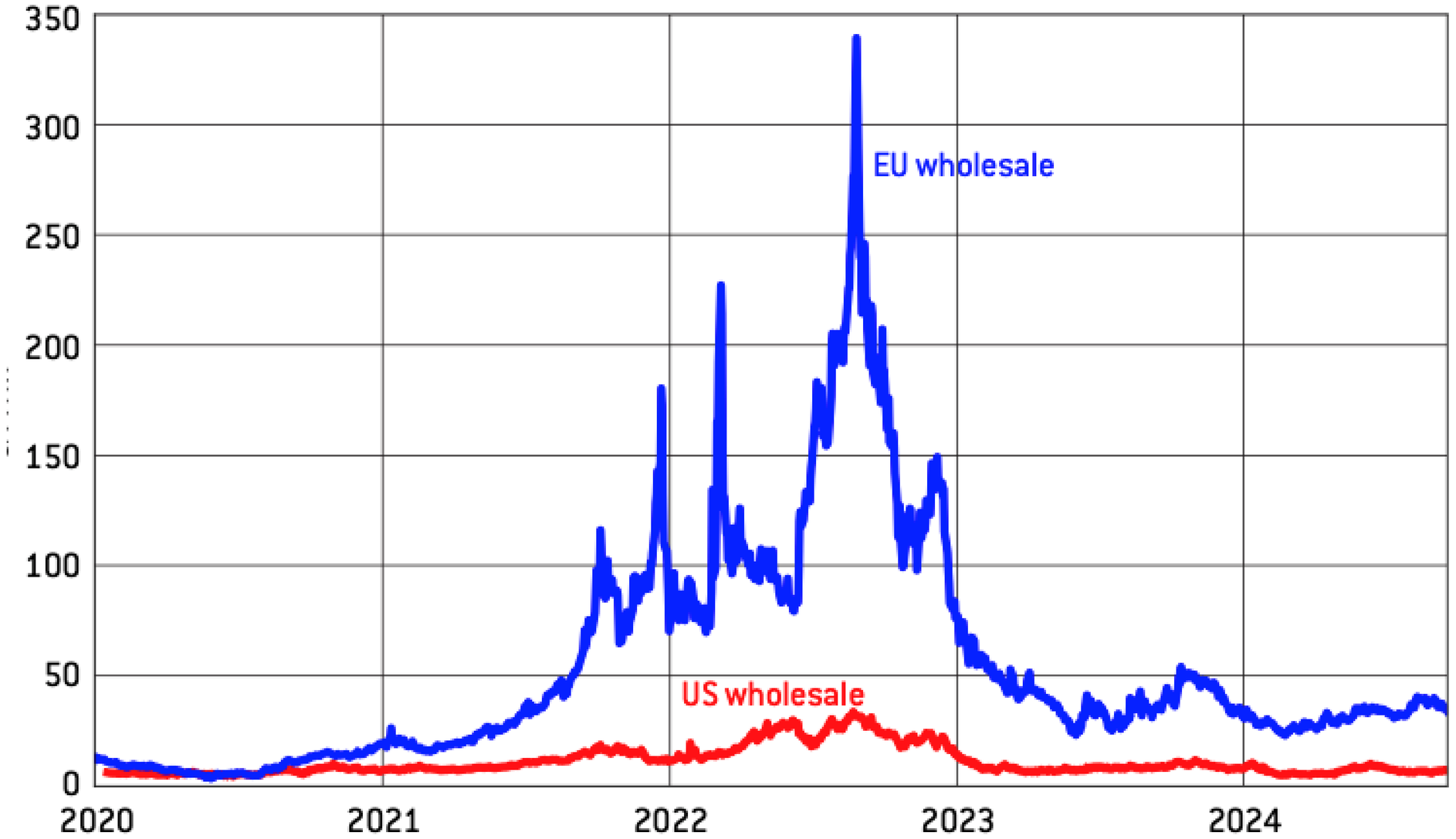
Source: ACER

Industrial retail electricity prices (EUR/MWh)



Source: Brugel

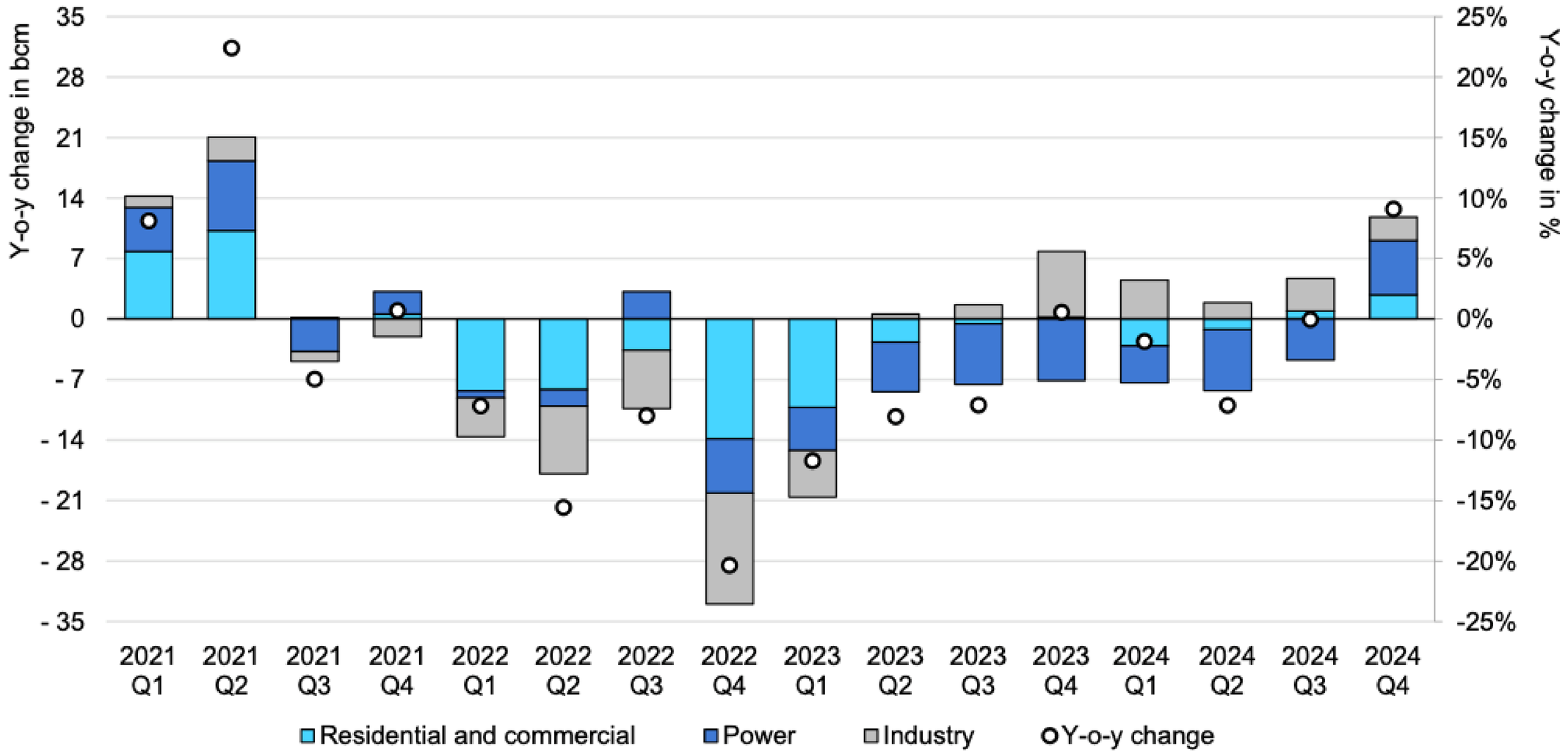
Wholesale gas prices (EUR/MWh)



Source: Brugel

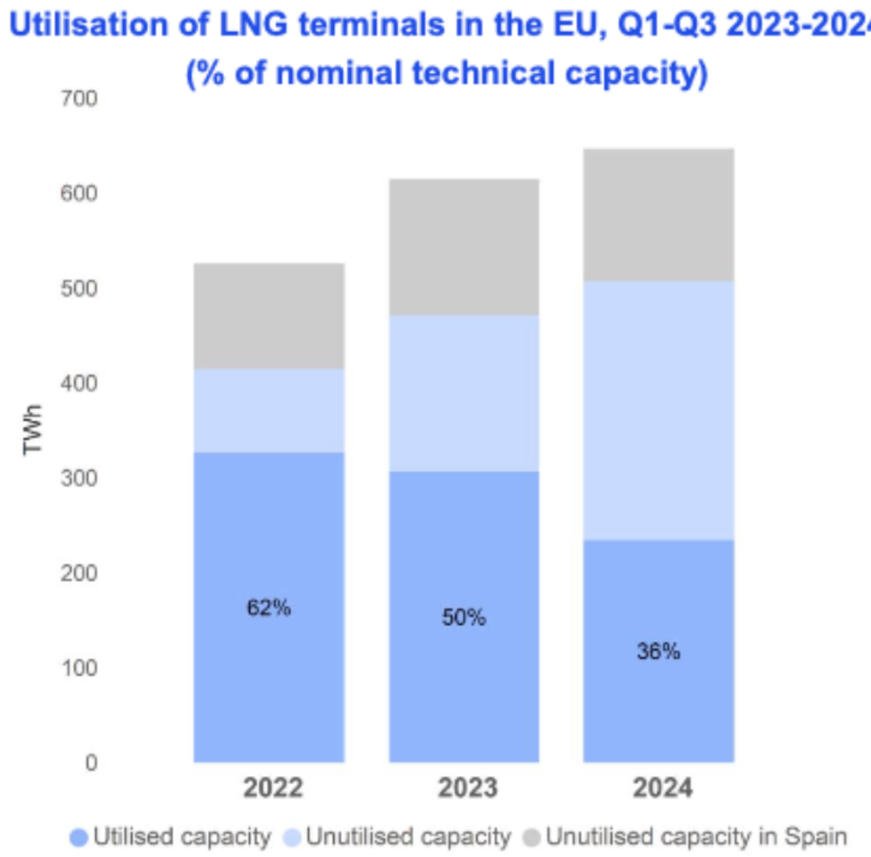
Energy Security

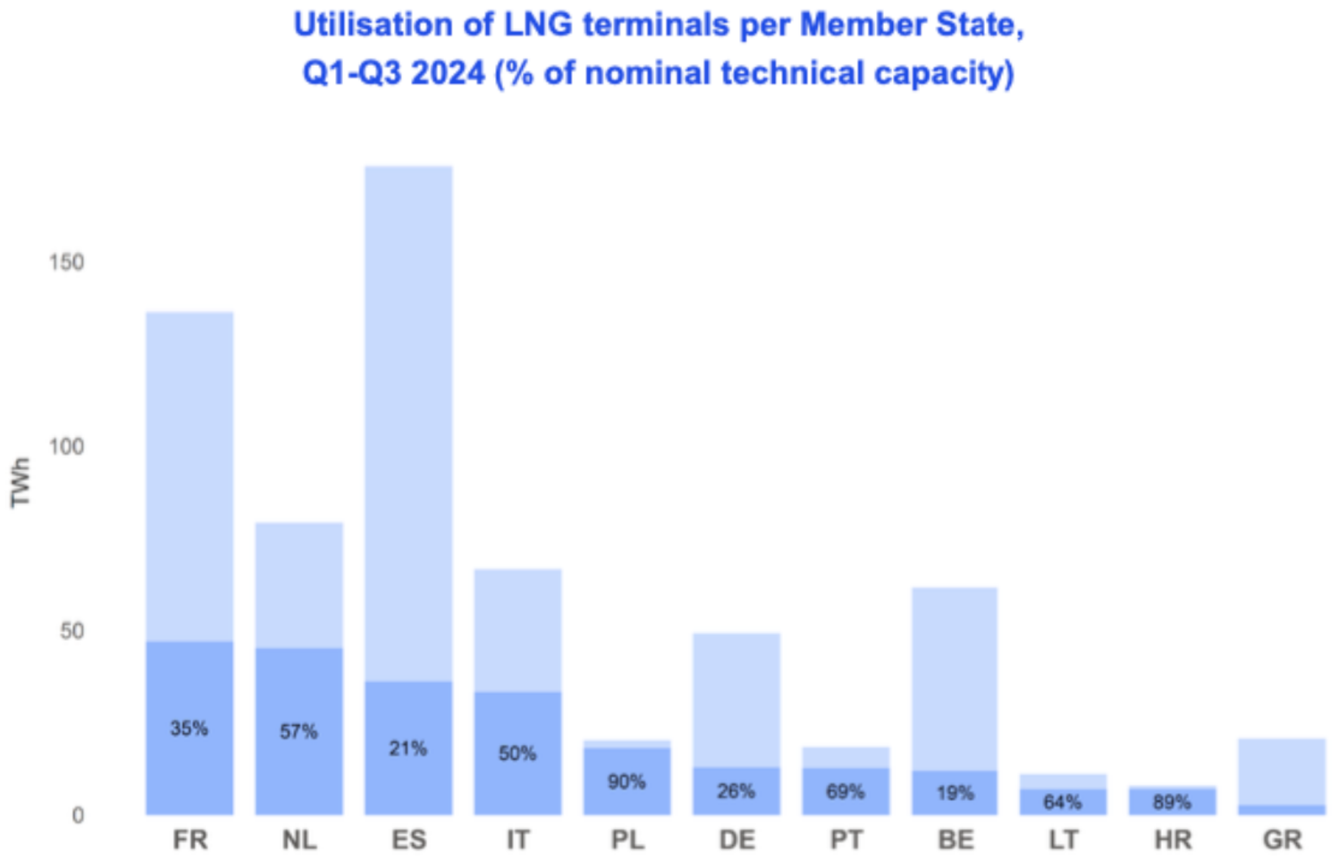
Natural gas demand slowly recovering



Source: IEA

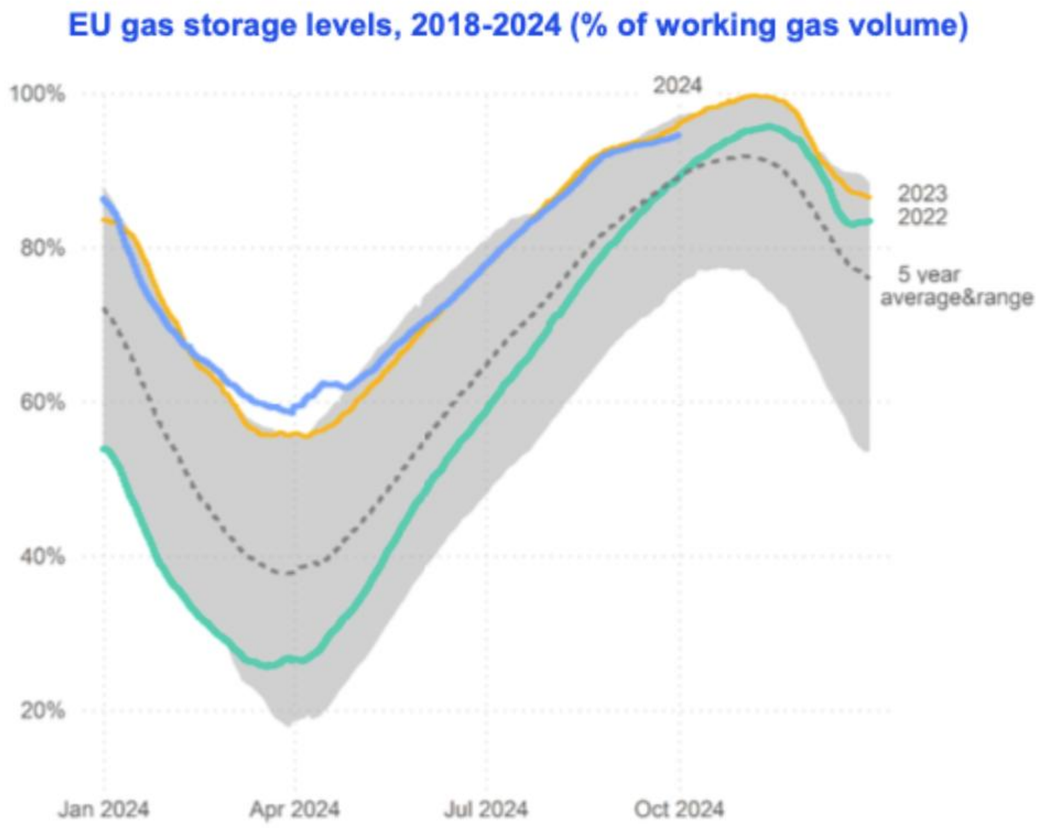
A lot of LNG terminal capacity unused

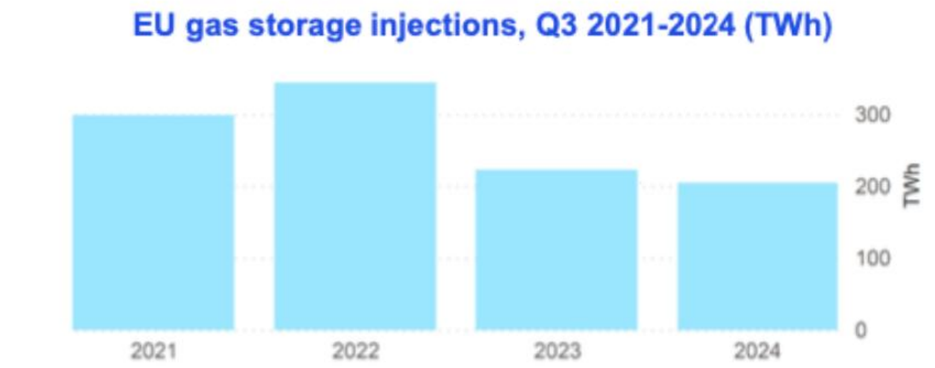


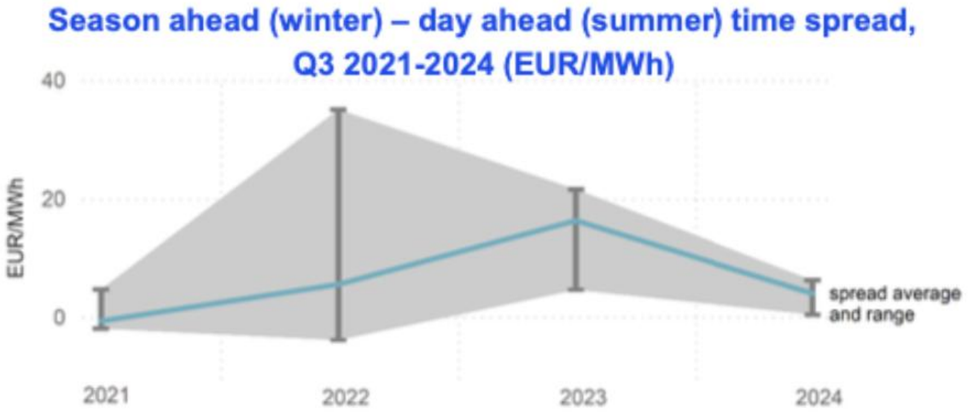


Source: ACER

Gas storage capacity use responding to the demand







Source: ACER

Electricity system maintains reliable supply

100%

Reliable power supply and no demand disconnections in 2023.

€7.4 bn

Cost of capacity mechanisms in 2023. This is a 40% rise from 2022.

85%

Of long-term contracts through capacity mechanisms directed to fossil-fuel generatios in 2035.

10

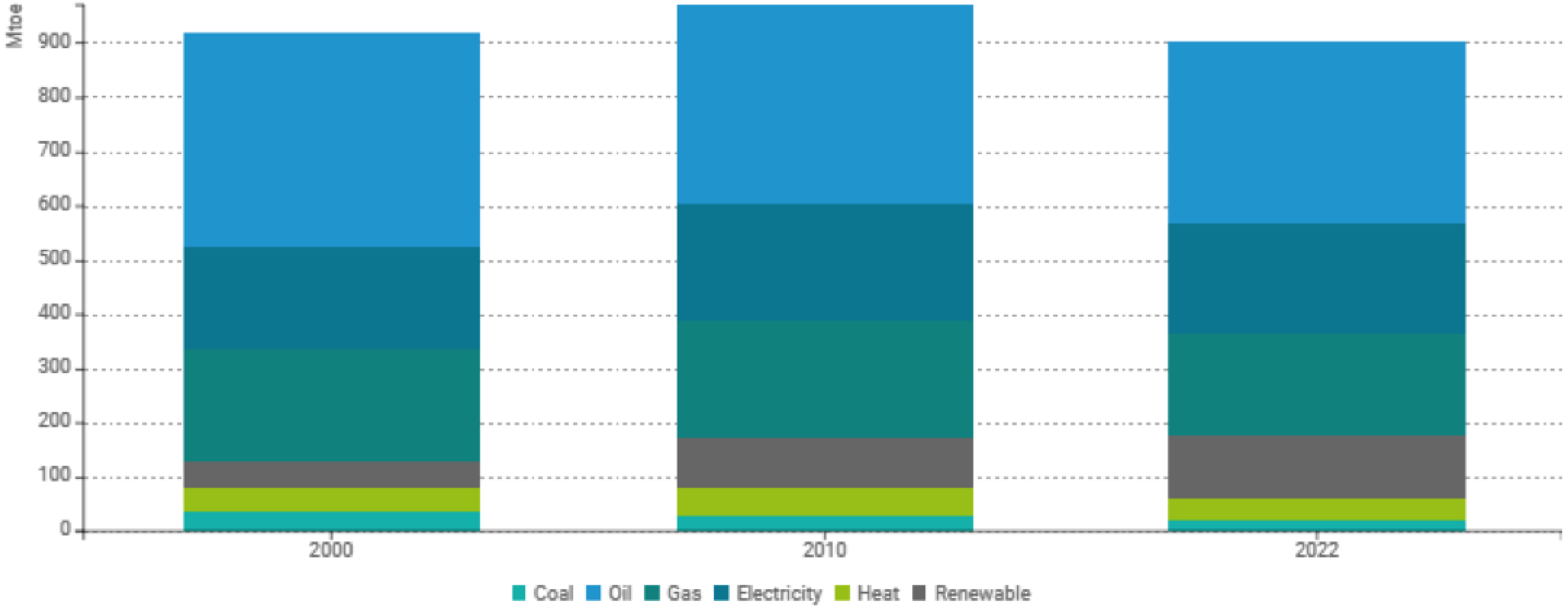
Member States (at least) with support schemes for non-fossil flexible resources.

Moderating whole-system costs, including for capacity and other security of supply support schemes, will be key for affordable electricity prices in the EU

Source: ACER

Electrification

Fuel mix in the EU

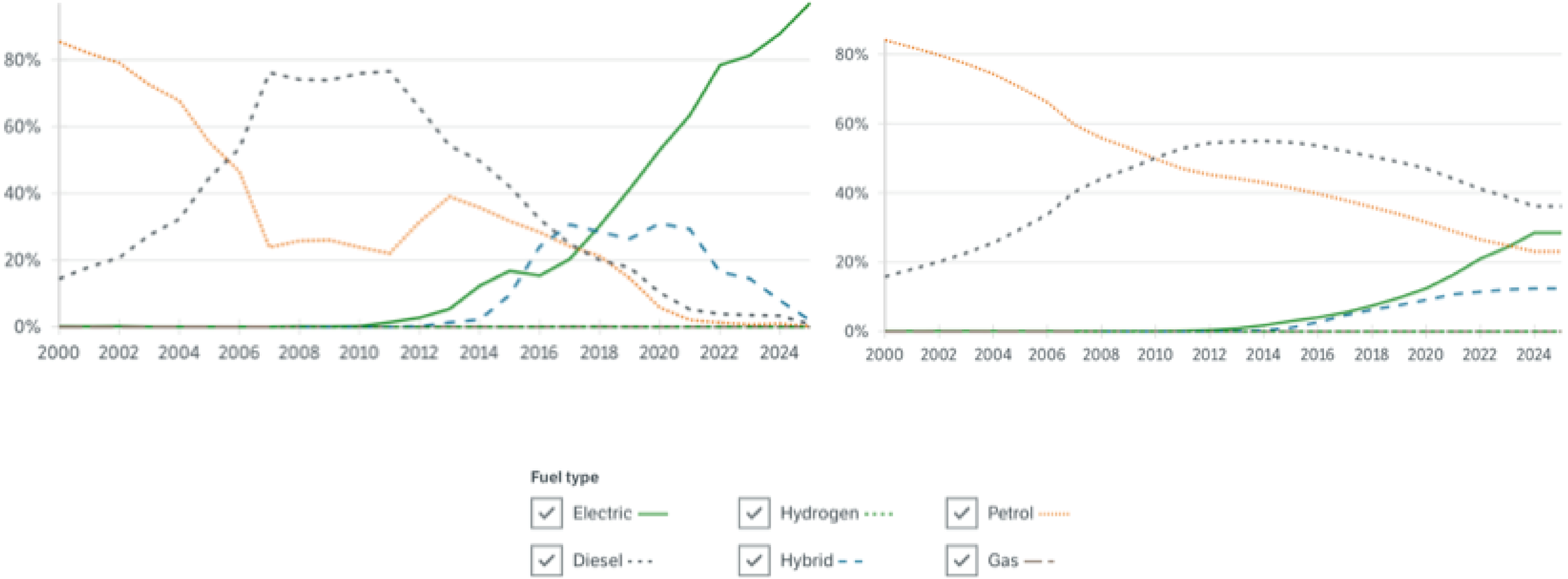


Source: EEA

Electrification - the low hanging fruit to decarbonisation, 2024

- Emissions cut by 59% (1990) - cleanest power generation mix ever
- Average wholesale day-ahead prices EUR82 per MWh (97 in 2023)
- Renewables 48%, Nuclear 24%, Fossil fuels 28%
- Power demand lower than pre-crisis levels (+2% compared to 2023)
- Negative prices 1480 times

Passenger cars by fuel type in Norway



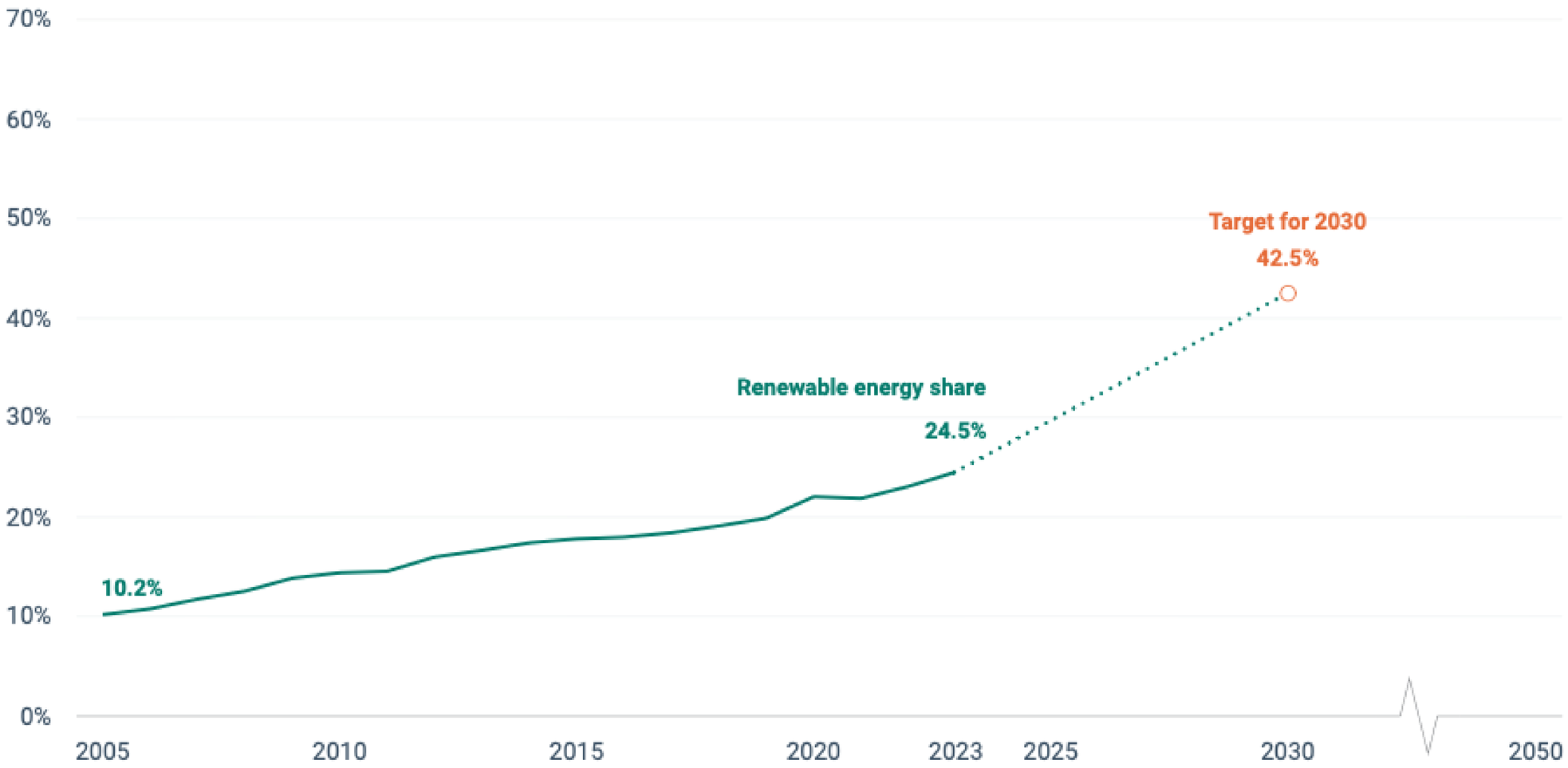
Source: government.no

55 billion euro less revenues from car related taxes and VAT, 2007-2025

- No tax and no VAT on electric cars (ceiling NOK500000)
- Lower toll on all toll roads (at least 30%)
- Reduced prices for parking and ferries
- Lower road fee
- All city taxis must be electric
- Access to bus/taxi lanes
- National charging strategy

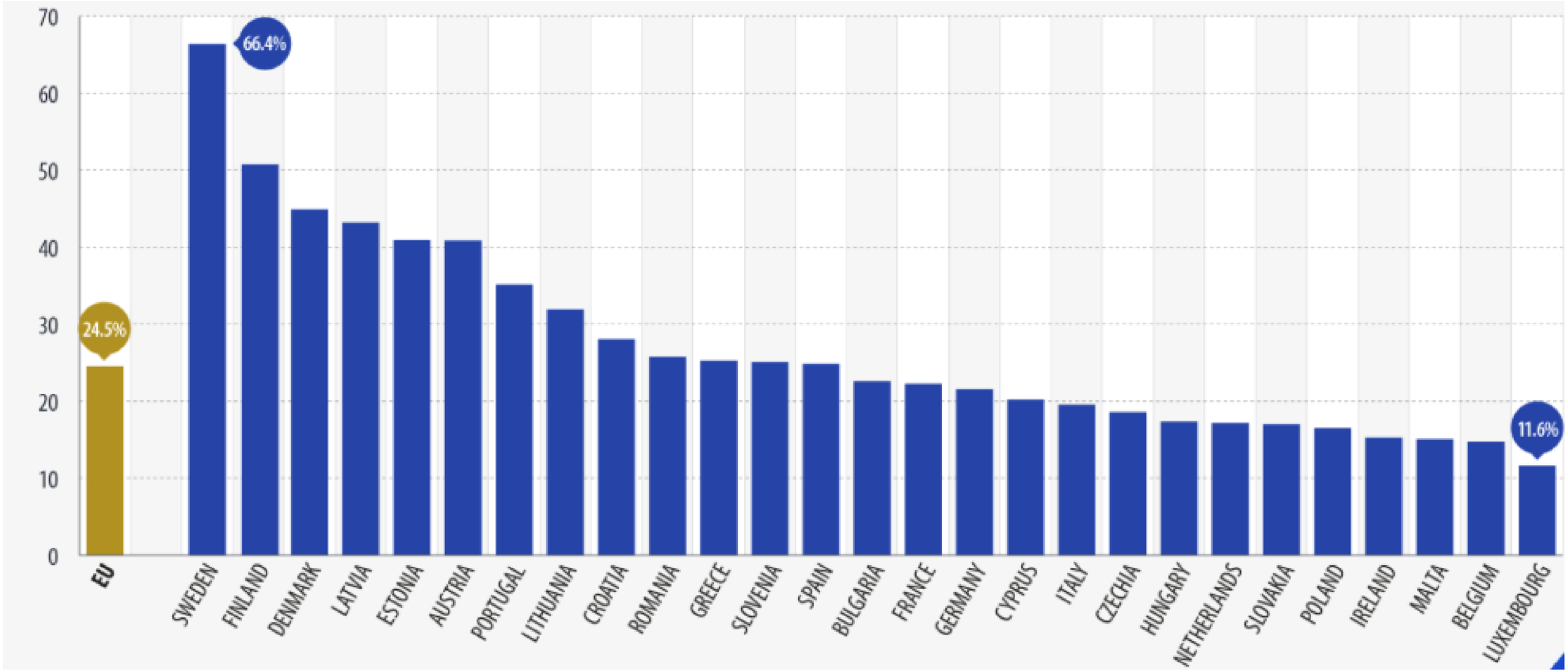
Renewable Energy

Toward renewable energy source targets



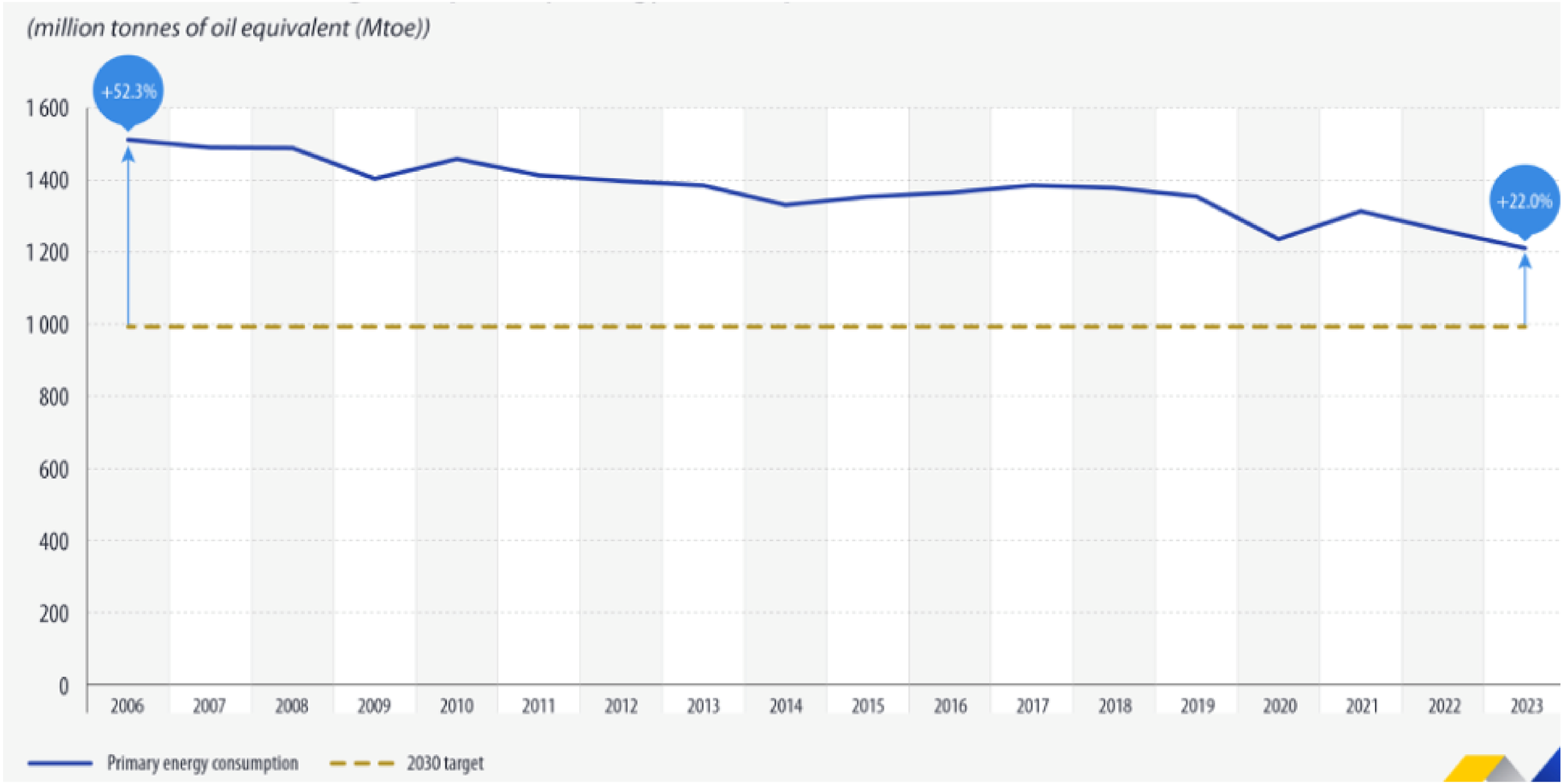
Source: EEA

Share of energy from renewable sources in 2023



Source: EC

4% decrease of primary energy consumption in 2023 compared with 2022



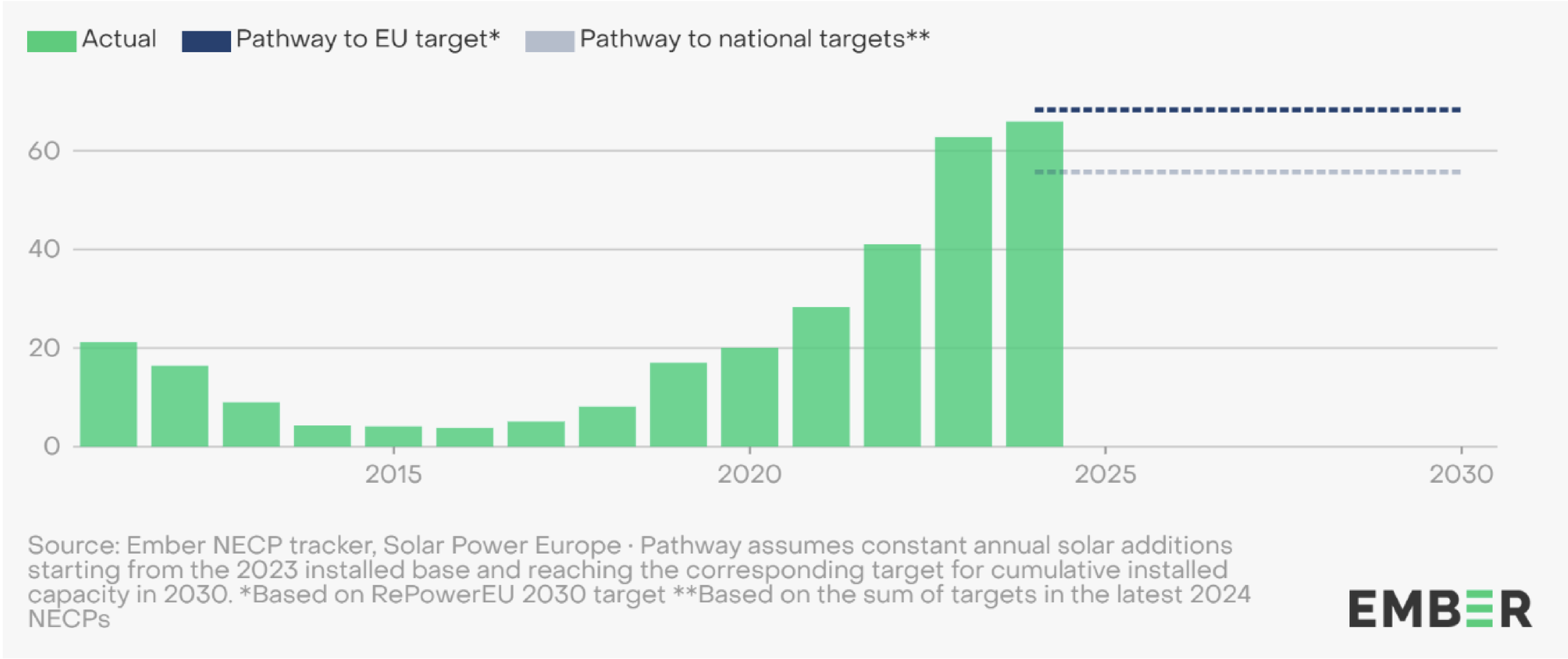
Source: EC

	2023 Electricity generation (TWh) Share of generation (%)	2024 Electricity generation (TWh) Share of generation (%)	Change 2023-2024 Generation (TWh) Percentage change (%)
Total renewables	1208 TWh **44.8%**	1300 TWh **47.4%**	92 TWh **7.6%** ▲
- Solar	250 TWh **9.3%**	304 TWh **11.1%**	54 TWh **21.7%** ▲
- Wind	470 TWh **17.4%**	477 TWh **17.4%**	7 TWh **1.5%** ▲
- Hydro	330 TWh **12.2%**	362 TWh **13.2%**	32 TWh **9.8%** ▲
- Bioenergy	152 TWh **5.6%**	150 TWh **5.5%**	-2 TWh **-1.3%** ▼
- Other renewables*	7 TWh **0.3%**	7 TWh **0.3%**	0 TWh **4%** ▲
Nuclear	620 TWh **23%**	649 TWh **23.7%**	29 TWh **4.7%** ▲
Total fossil	868 TWh **32.2%**	793 TWh **28.9%**	-75 TWh **-8.7%** ▼
- Coal	319 TWh **11.8%**	269 TWh **9.8%**	-50 TWh **-15.7%** ▼
- Gas	456 TWh **16.9%**	430 TWh **15.7%**	-26 TWh **-5.6%** ▼
- Other fossil**	93 TWh **3.5%**	94 TWh **3.4%**	0 TWh **0.3%** ▲
Net imports	-2 TWh	-17 TWh	-15 TWh
Electricity demand	2694 TWh	2725 TWh	31 TWh **1.2%** ▲

Source: Yearly electricity data, Ember
*'Other renewables' generation includes geothermal, tidal and wave generation. **'Other fossil' generation includes generation from oil and petroleum products, as well as manufactured gases and waste.

EMBER

Annual solar capacity additions (GW)



Source: Ember NECP tracker, Solar Power Europe · Pathway assumes constant annual solar additions starting from the 2023 installed base and reaching the corresponding target for cumulative installed capacity in 2030. *Based on RePowerEU 2030 target **Based on the sum of targets in the latest 2024 NECPs

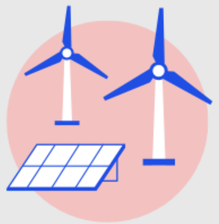
EMBER

Too slow with new renewable installations- example of wind

- Wind generated 17% of all electricity in 2024 (2030 should 34%)
- **13 GW** new capacity in 2024: 11,4 GW onshore and 1,4 GW offshore
- To reach 2030 target **30 GW a year** should be built
- Main bottlenecks - not sufficient application of EU permitting rules; new grid connections delayed; electrification not quick enough

EU Electricity Wholesale Market Integration

+ 10%	7,000 h	EUR 4 bn	27%
Hours when generation was mostly non-responsive	Prices below 5 EUR/MWh (1,400 hours in 2019)	Cost of managing EU power grid congestion in 2023	Methodologies face implementation delays in 2024



Limited system flexibility led to high day-ahead prices and instances of low or negative prices, creating challenges for market operations and investment.

Relative shares of traded volume per year in the future for delivery in Germany, 2023

To support investment and maintain competitive electricity prices, ACER calls for the full implementation of market design changes to unlock flexibility.

Europe's balancing energy platforms can only reach their full potential with the participation of more transmission system operators.

Source: ACER

Electricity Infrastructure Development

Electricity grids are essential to connect clean energy and transport it to consumers

2.5 more renewables and exponential growth in electrification expected in Europe by 2030.

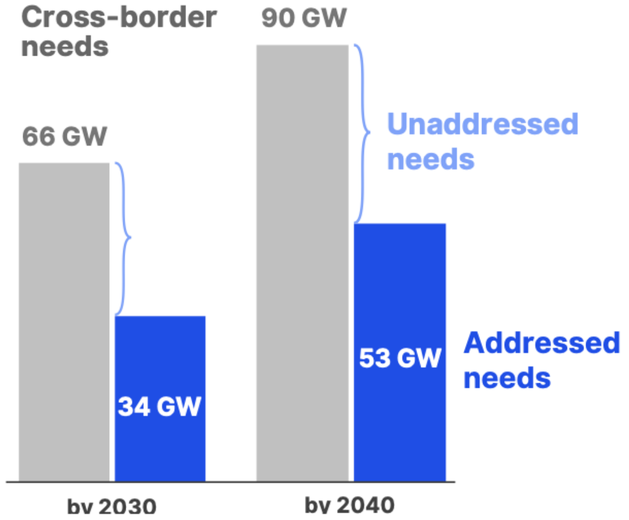
High stakes of persistent delays in increasing power grid capacity

EU risks missing out on benefits of an integrated power market, such as security of supply, resilience to price shocks, flexibility.

Containing rising system costs is key for EU competitiveness

Power system costs will be a main driver of electricity costs. Consider 'efficiency first', as grid investments need to double by 2050.

Massive investment in local, national and cross-border electricity grids needed to keep pace with the growth in renewables and power consumption



Better planning

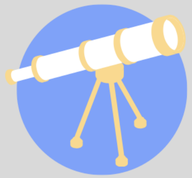
Power grid operators must plan local, national and cross-border grids based on market needs and benefits. Consistent and methodical planning assures regulators while they consider anticipatory investment.

Efficiency first

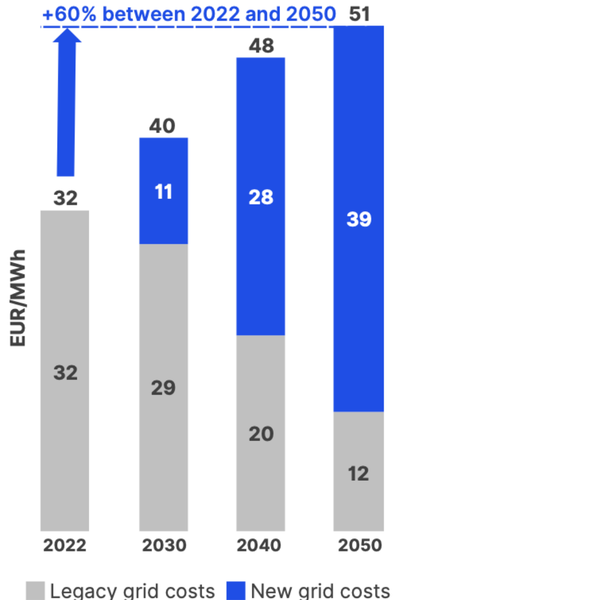
Power grid companies should make better use of existing grids before investing in new ones. So 'more grids' calls for more targeted grid development and innovative grid technologies.

Careful monitoring

Regulators need to monitor investments across all grid levels for efficient grid developments that keep pace with the energy transition.

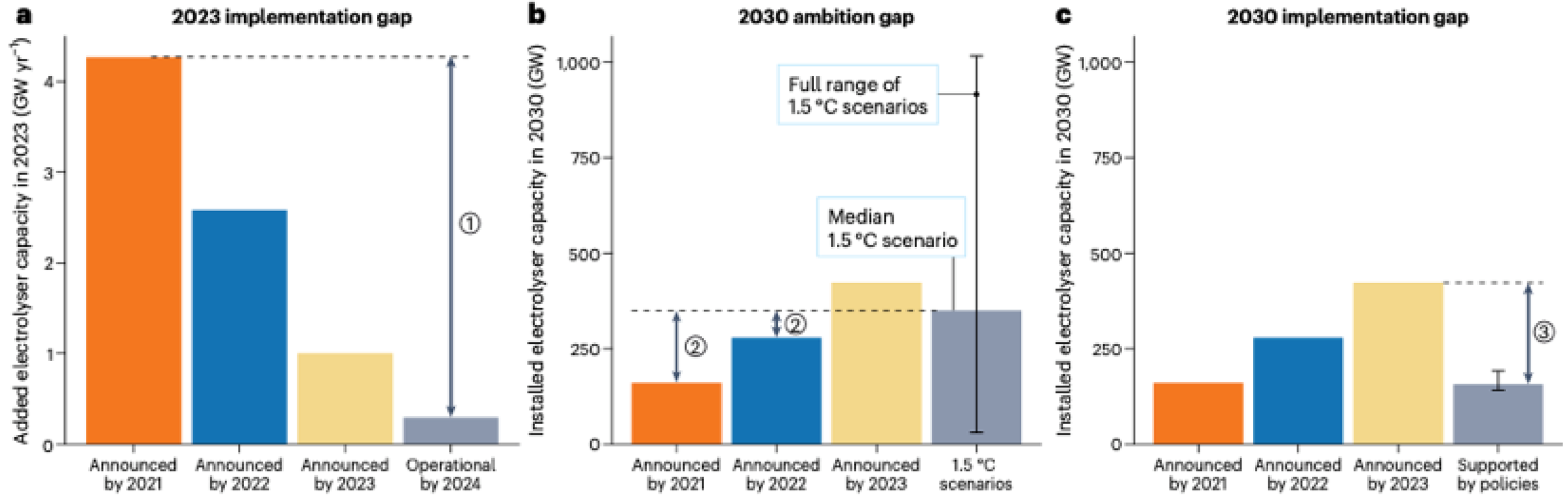


As grid costs become a main driver of electricity costs, containing their rise is key for competitiveness.



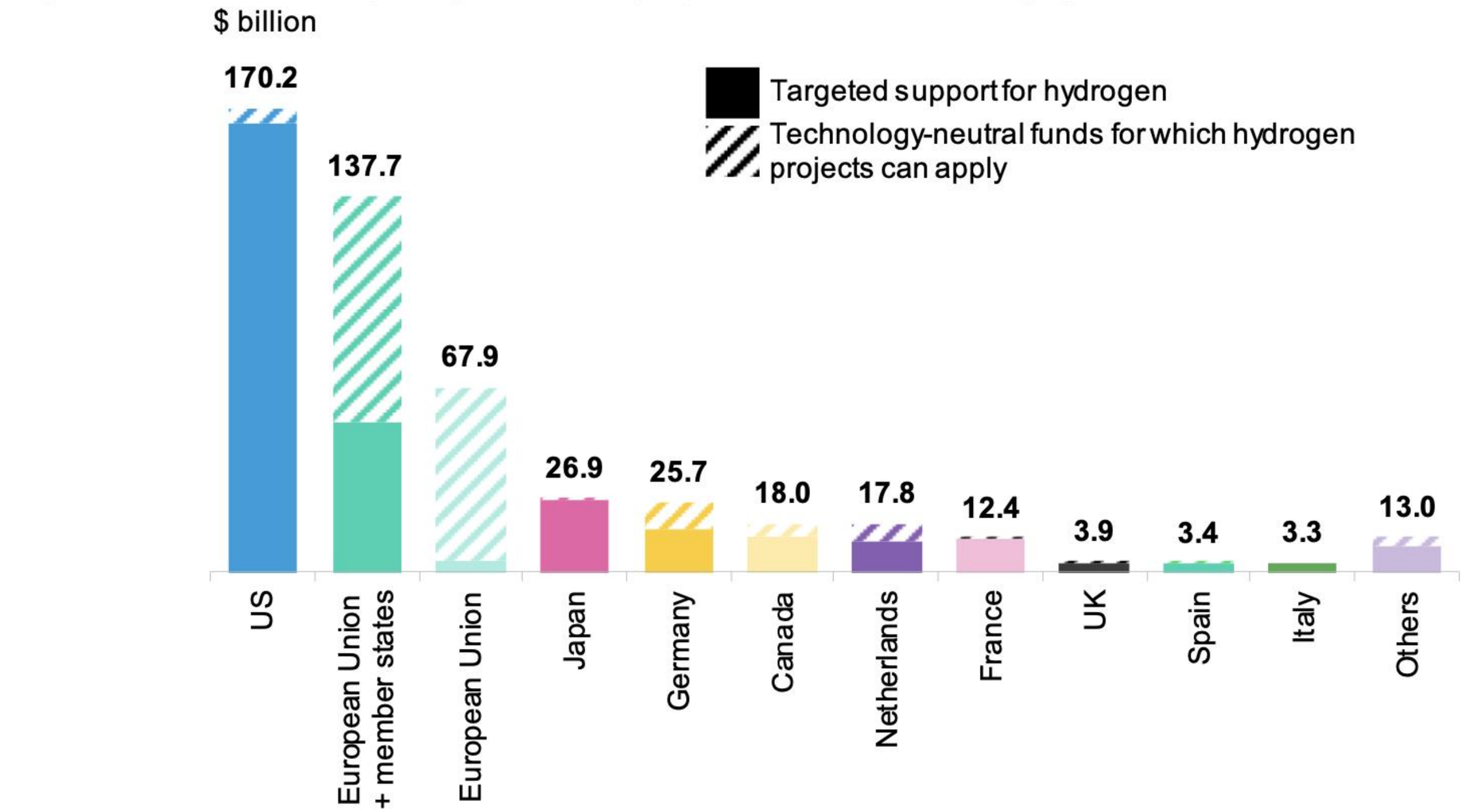
Source: ACER

The three gaps of global green hydrogen deployment



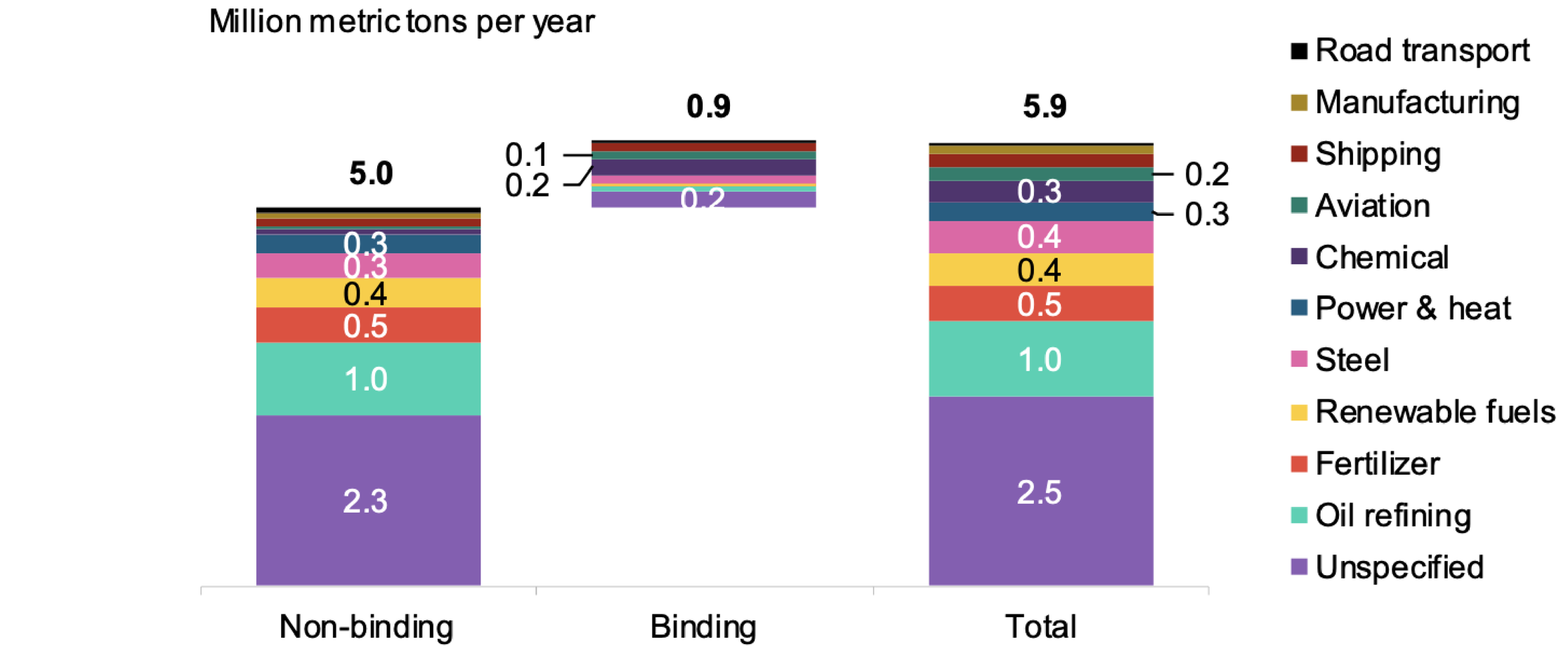
Source: Odenweller, A. & Ueckerdt, F. *Nat. Energy* https://doi.org/ 10.1038/s41560-024-01684-7 (2025)

Estimated Hydrogen Funding (as of April 30, 2024)



Source: BloombergNEF.

Annual Supply of Hydrogen in Offtake Agreements



Source: BloombergNEF.

Energy policy development and outlook for 2025

Critical tasks for an accelerated transition in challenging environment (Tariffs; Interest rates; Uncertainty)

- Electrification (Electric vehicles, heat pumps, industry)
- Low carbon electricity mix (wind, solar, nuclear, battery)
- Hard-to-abate sectors (CCUS, Hydrogen, biofuels)
- Clarity, predictability, and confidence in Europe and its industrial policy