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Beyond 2030: Transforming to Lead

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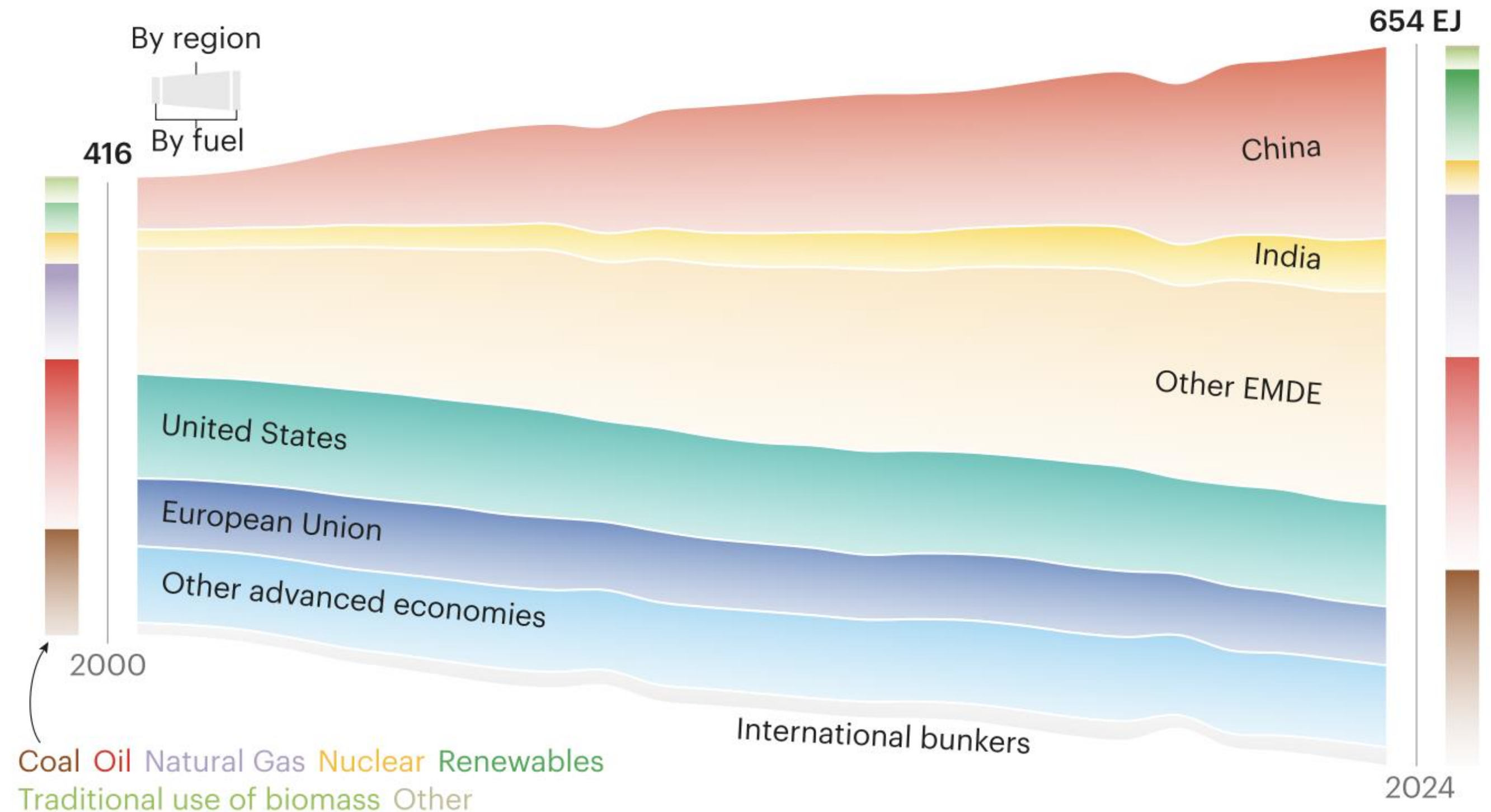
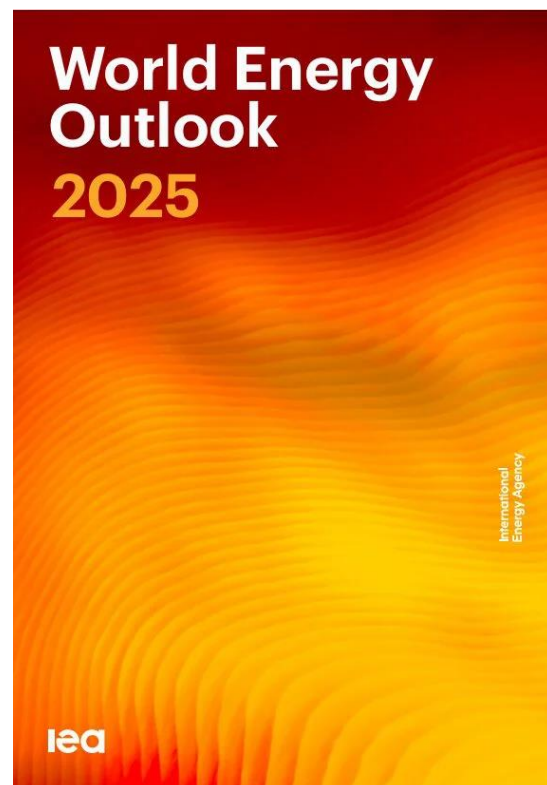
Time of uncertainty

- Geopolitical tensions and wars
- Technological (paradigm) change
- Trade wars (impact on prices)
- Supply chains disruptions (and reconfigurations)
- Multilateral architecture (crisis)



Energy demand
growth since 2020

+ 60%





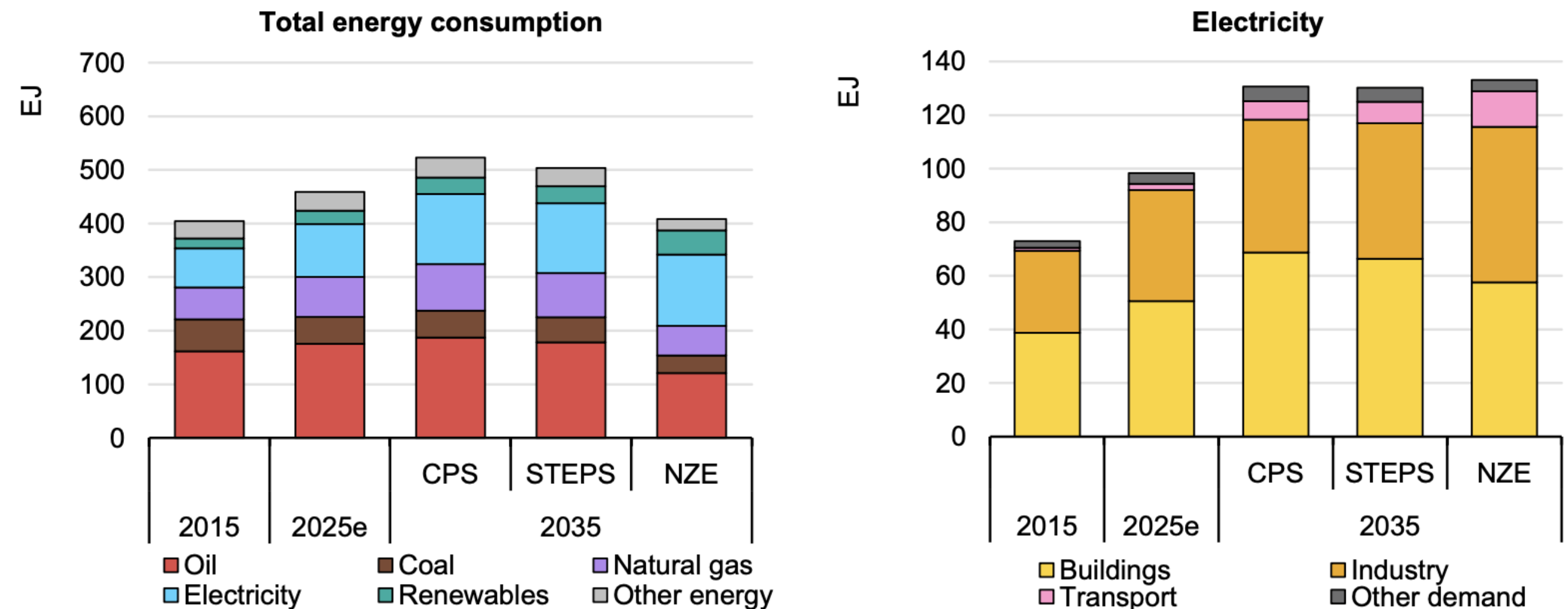
Energy demand
expected growth
to 2035 (Stated
Policy Scenario)

+ 30%

Renewable energy
supply expected
growth to 2035
(Stated Policy
Scenario)

+ 70%

Figure 2.7 Total energy consumption per fuel and electricity demand per end-use sector and by scenario, 2015-2035



IEA. CC BY 4.0.

Notes: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario; NZE = Net Zero Emissions by 2050 Scenario. Renewables include modern bioenergy and renewable waste.



Energy new centrality

- as source of economic power (cost competitiveness)
 - as key driver of social stability (cost of living crisis)
 - as the frontier of technological/industrial innovation
 - as driver of industrial investment and their location
 - as coercion mechanism (energy weaponisation)
 - as key to address climate change
- ...conflicting claims and multiple risks



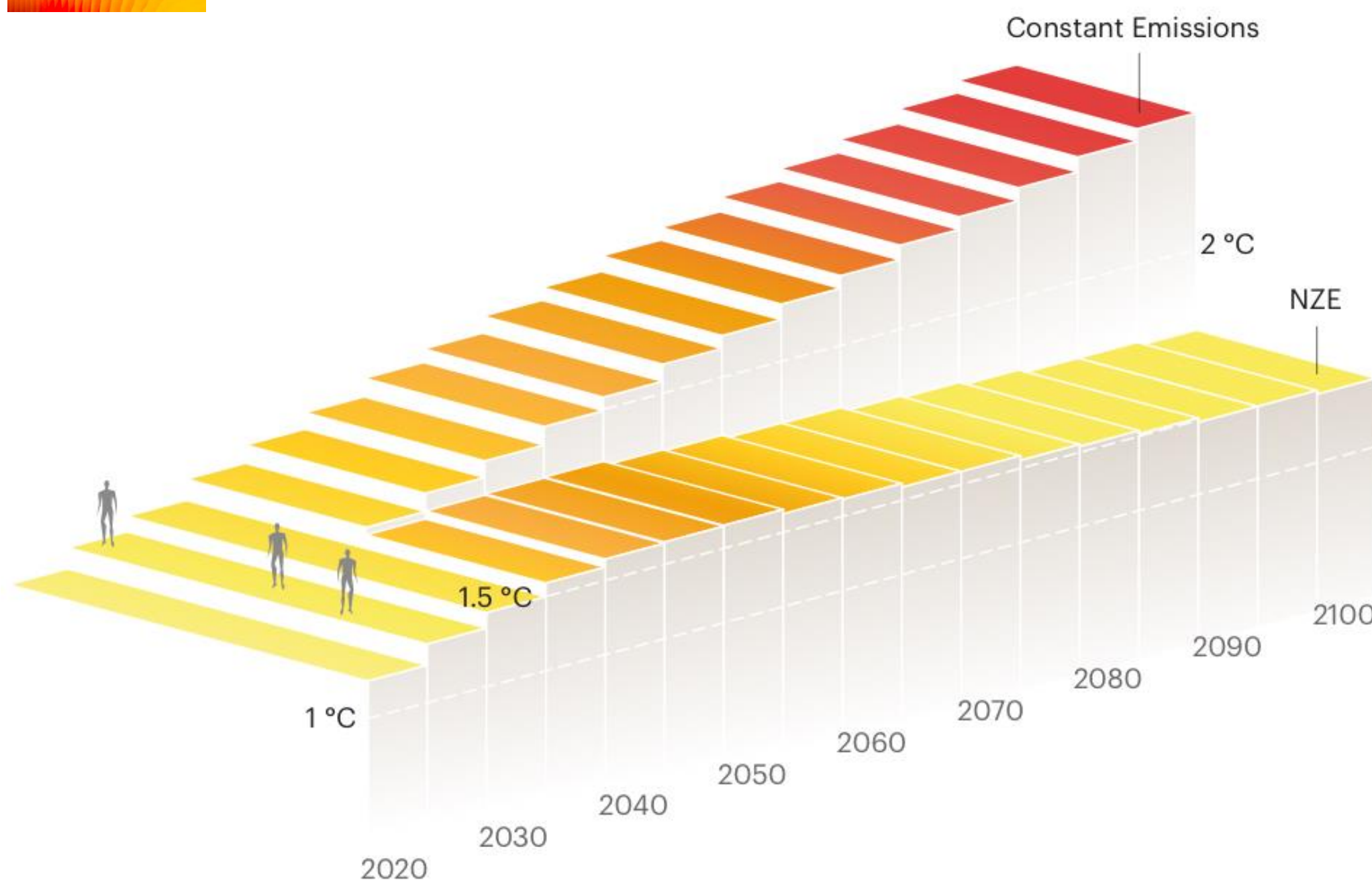
The risks (and costs) of inaction

- Political backtracking and postponements
- Policy incoherence and regulatory uncertainty
- Insufficient/delayed investments (further lock-in)
- Leaving it to the market alone...
- Climate tipping points (and unsustainable costs)
- Finding ourselves on the 'wrong cost curves'...



Call for acting now to limit overshoot

Energy investment in the NZE Scenario increases to around USD 4.8 trillion per year over the next decade, from USD 3.3 trillion today.



+ 4 times by 2035



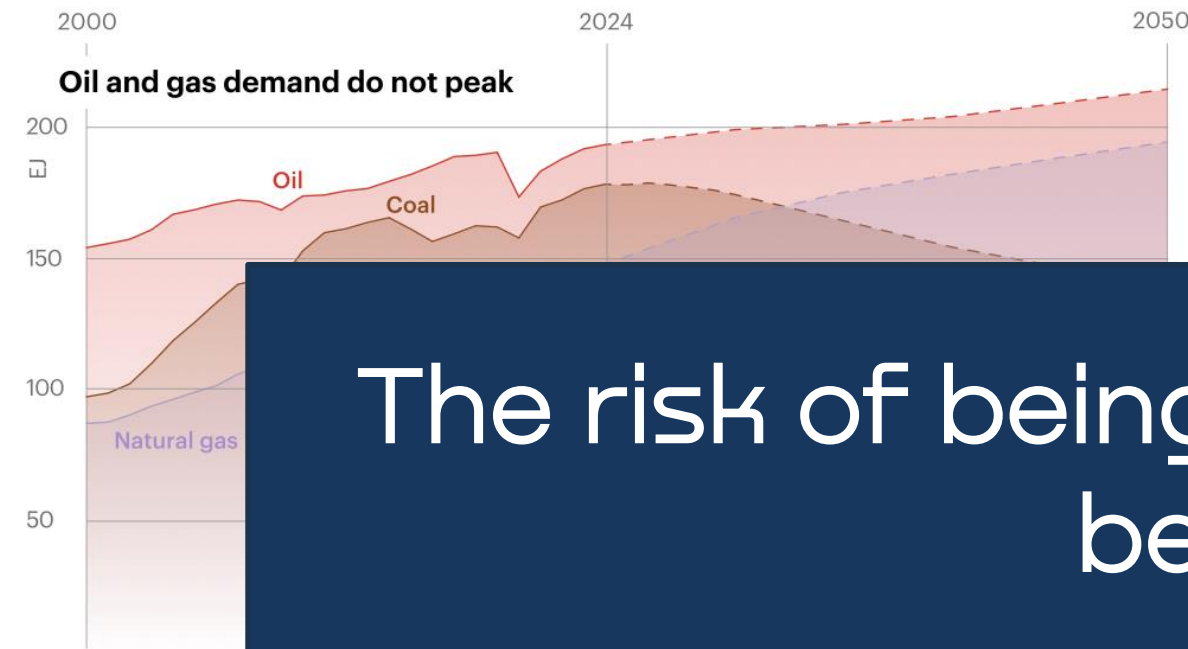
> 4 times deployment



+ 4% per year by 2035

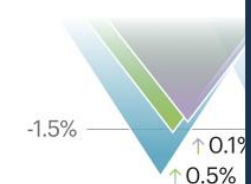


The Current Policies Scenario



Several regions reductions are

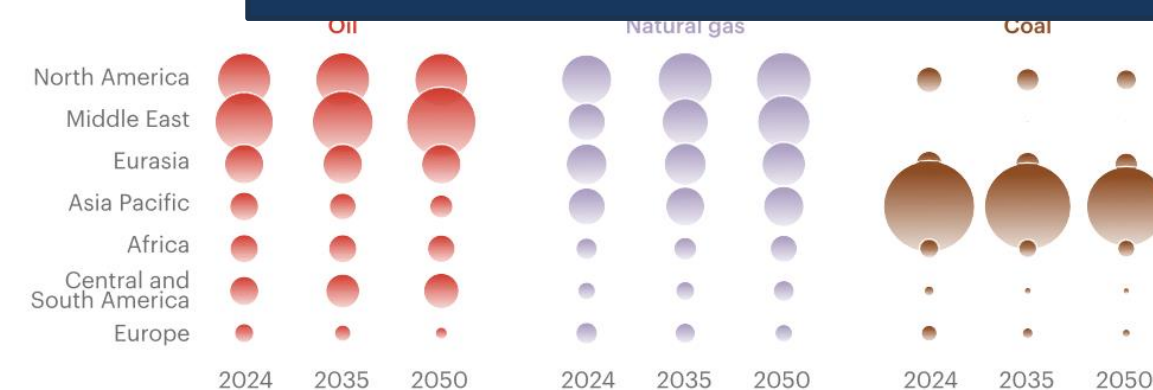
Reductions in total consumption per



2015-2024
2024-2035
2035-2050
Advanced economies

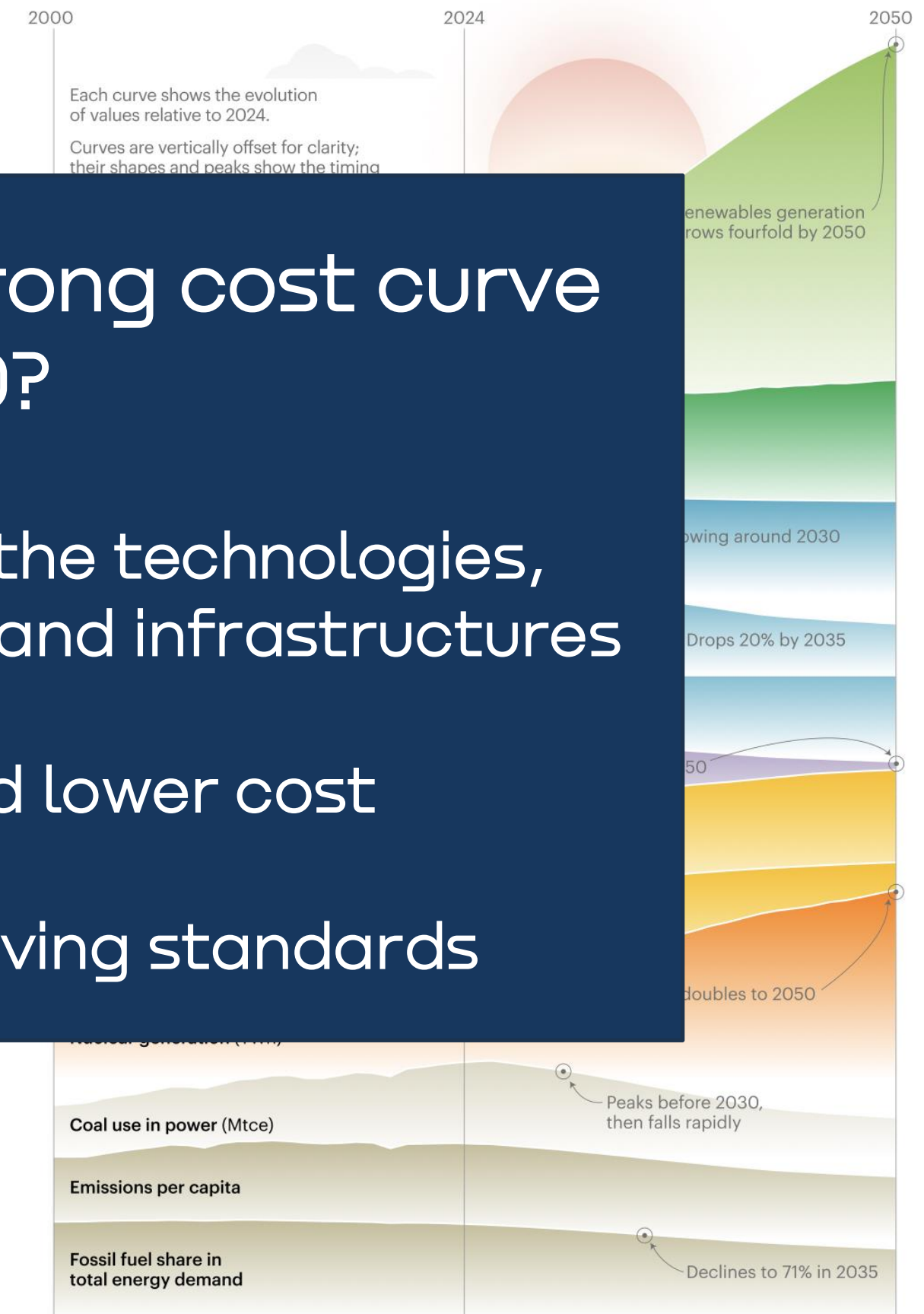
Established fuel supply th

The United States to 2050, but prod



Peaks and valleys of the Stated Policies Scenario

Where the energy system reaches new highs and where it falls away



The risk of being on the wrong cost curve beyond 2030?

Not having built (and diffused) the technologies, productive capabilities (at scale) and infrastructures

to produce at greener and lower cost

to sustain our societies and living standards

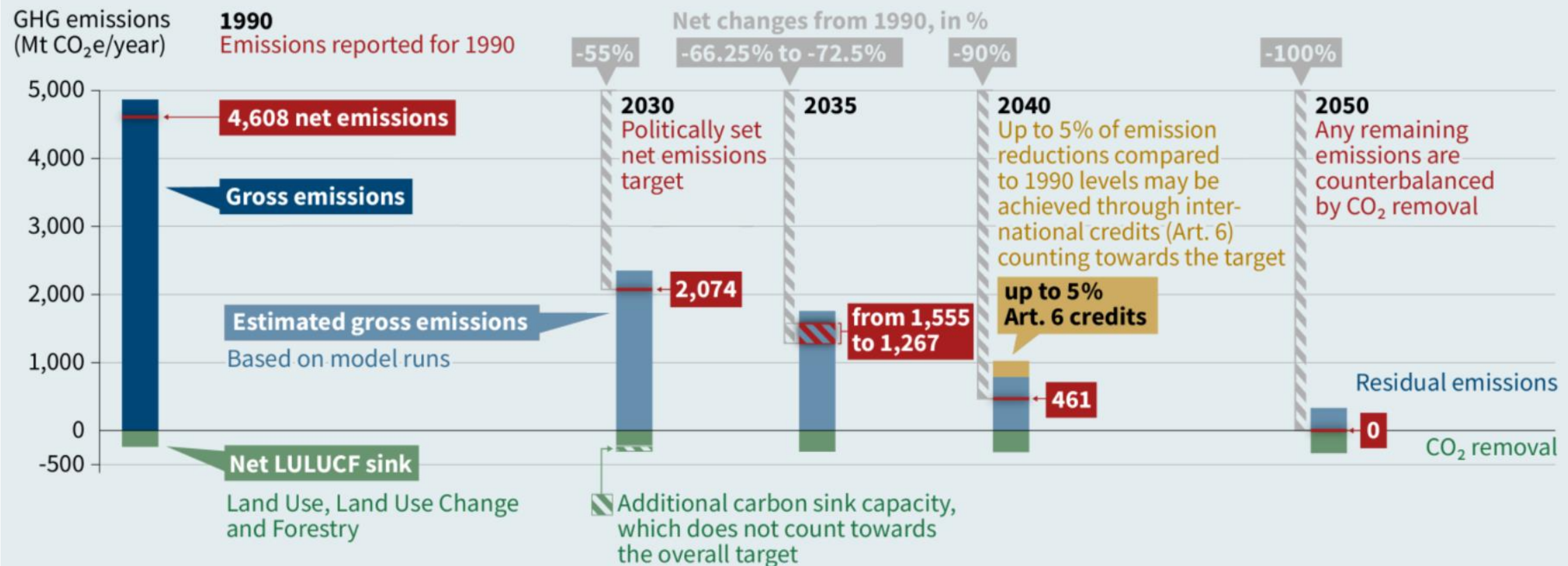




Green ambitions ... without sufficient investments

EU emissions pathway to 2050 and its components

Net targets, projected gross emissions, removals and international credits permitted to offset domestic emissions



Sources: LULUCF Regulation and European Climate Law; European Commission, Impact Assessment on the 2040 climate target; European Environment Agency for historical data: www.eea.europa.eu

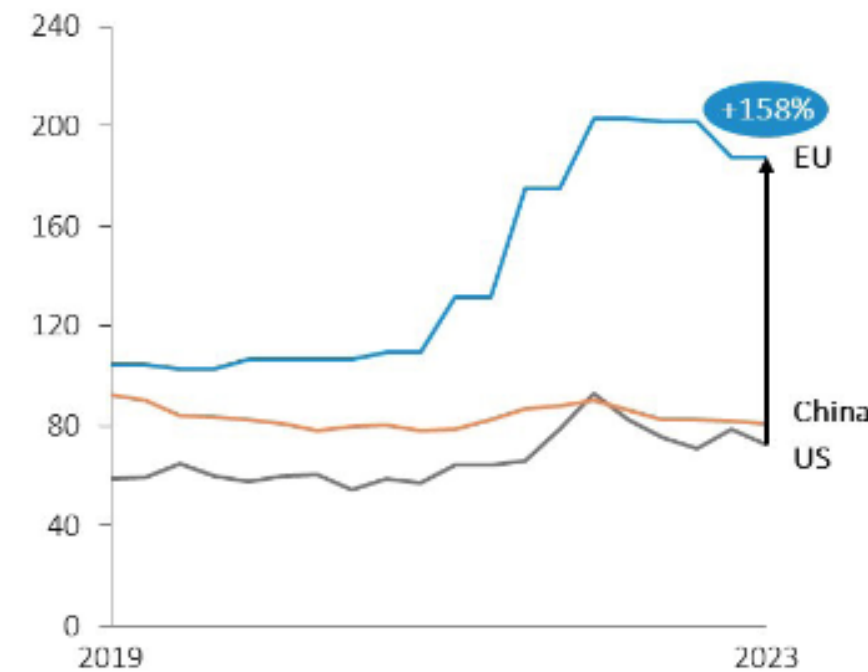


EU Low Investment regime

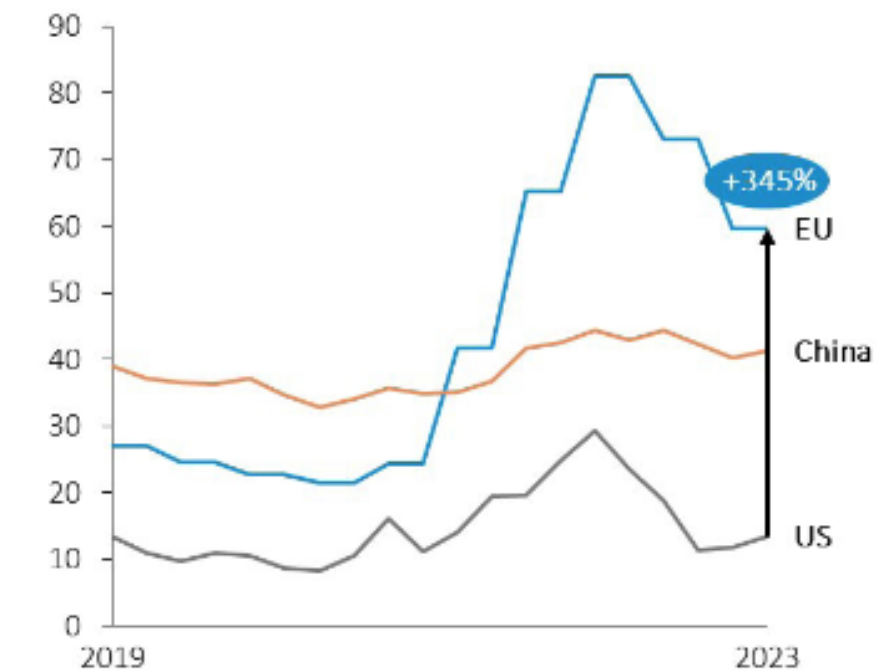
- R&D Intensity growing but not enough to reach 3% of GDP target by 2030
- Low GFCF at 21.40% of GDP in 2025

Gas and retail price gap for industry

Industrial retail power prices
EUR/MWh

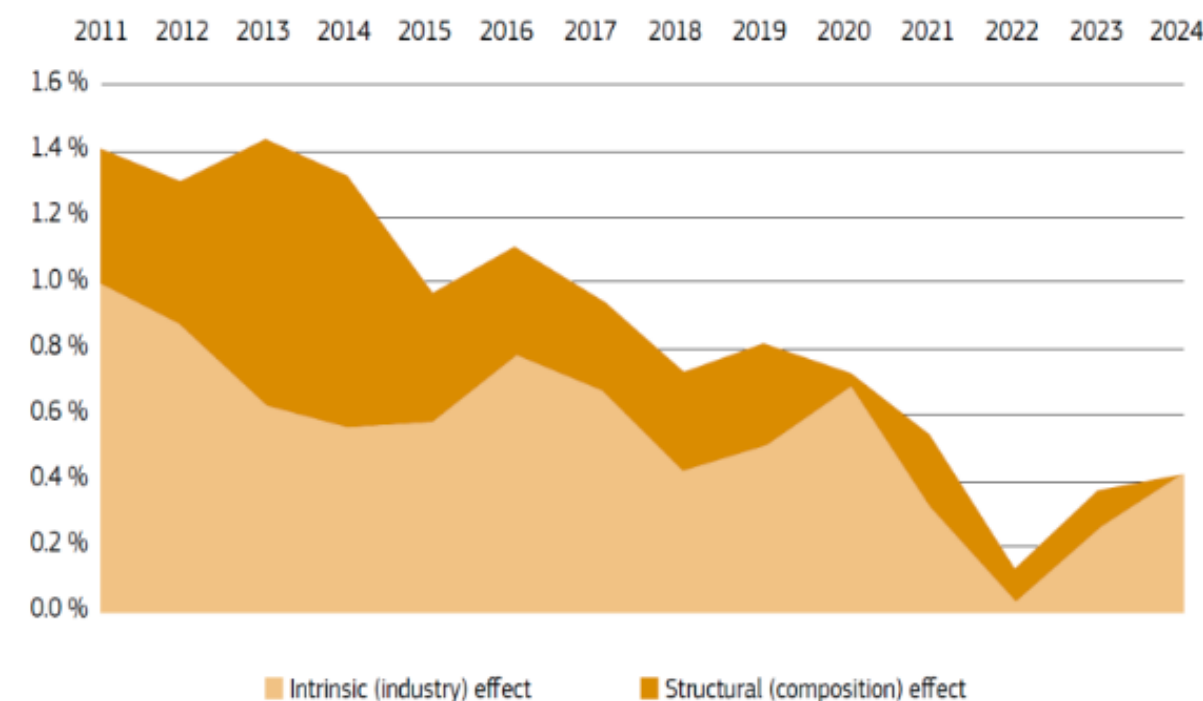


Industrial gas prices
EUR/MWh

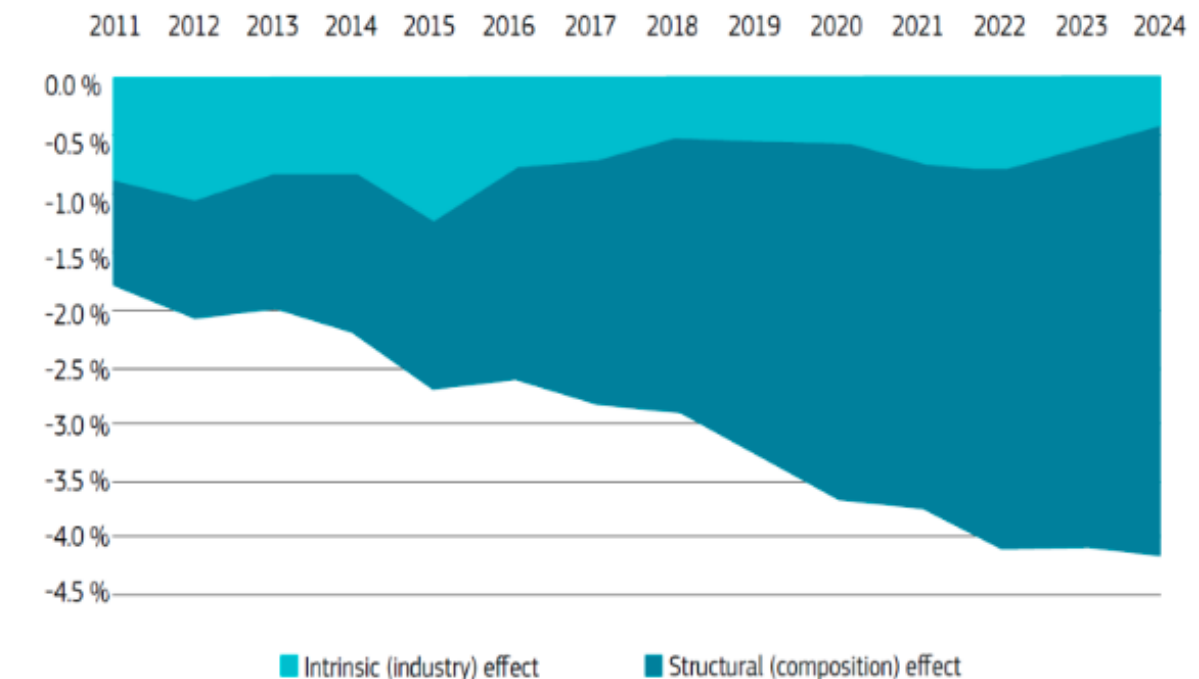


Source: European Commission, 2024. Based on Eurostat (EU), EIA (US) and CEIC (China), 2024.

EU-China Private R&D Intensity Gap



EU-US Private R&D Intensity Gap

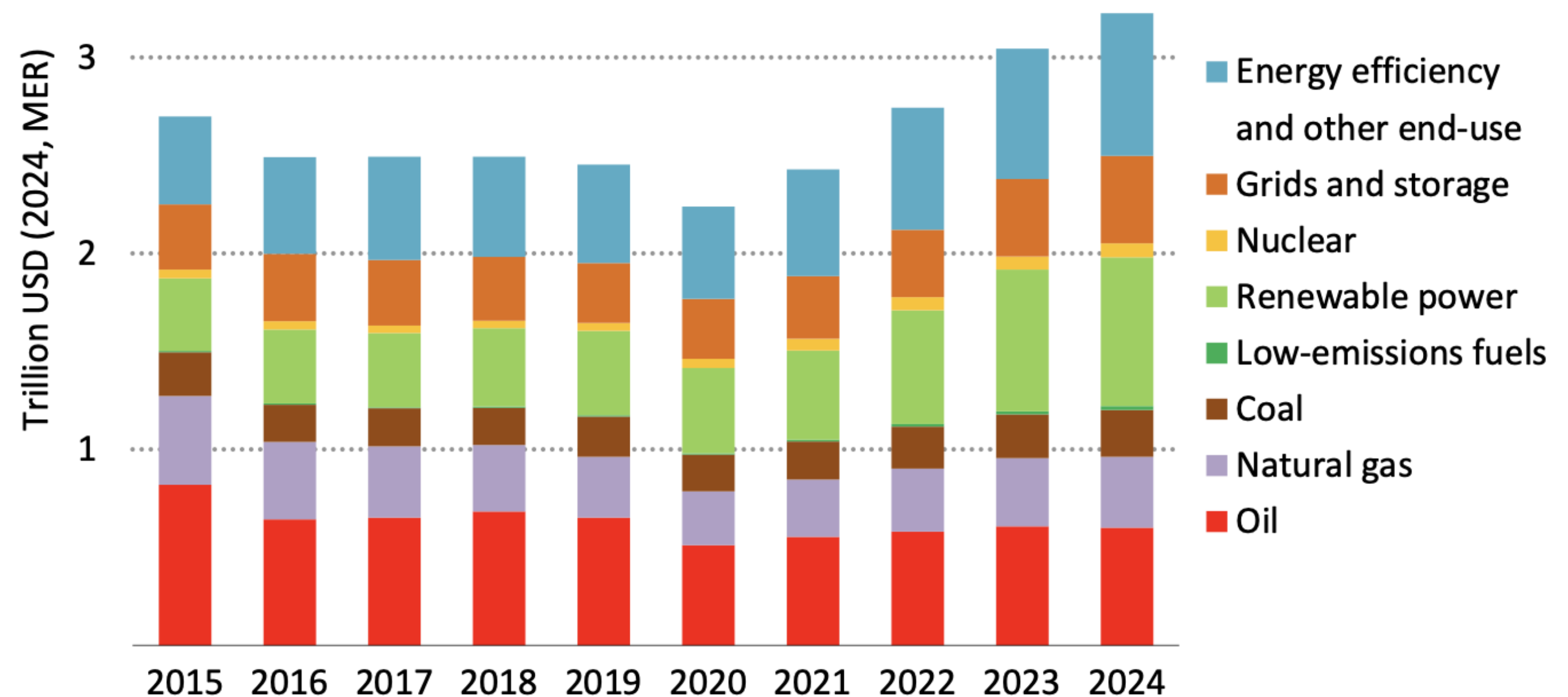




China has driven growth in investment (from 25% in 2015 to almost 30% in 2025)

Can Europe compete and leverage?

Figure 2.4 ▶ Global energy-related investment, 2015-2024





Shifting from crisis management to sustained investments

- Technological and industrial innovation
- Industrial Ecosystem Transformation
- Policy orchestration (and experimentation)

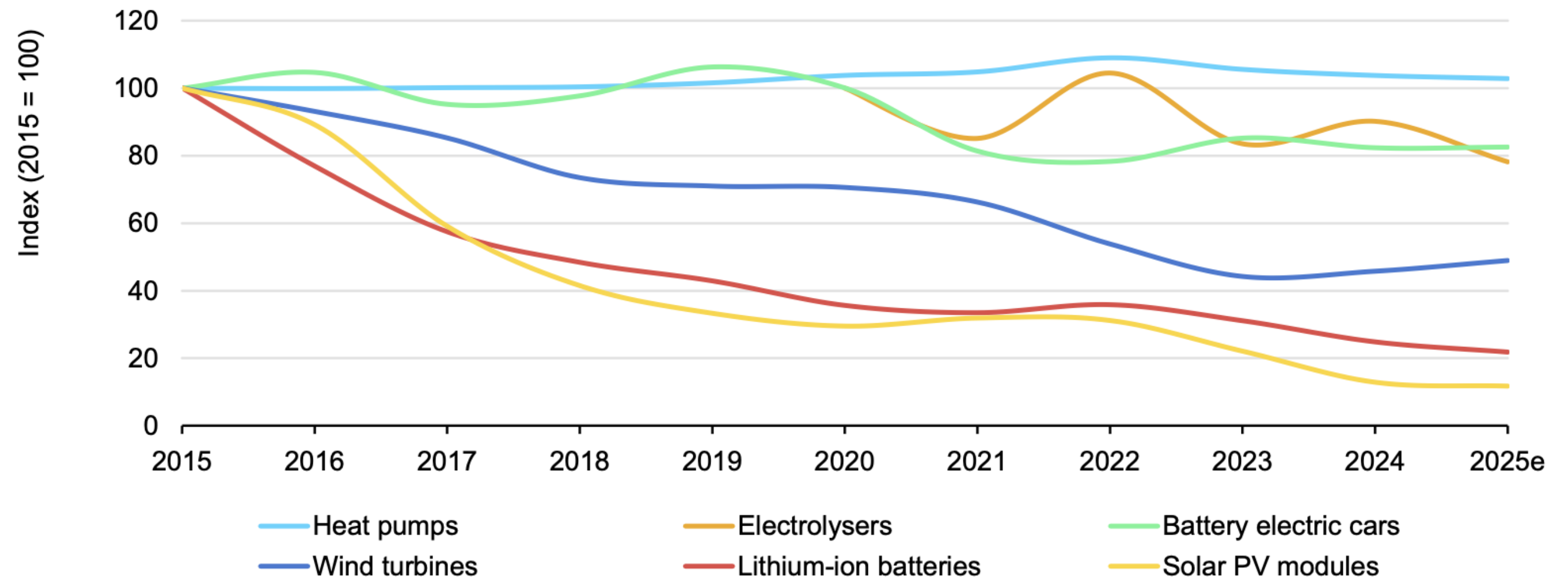


Shifting from crisis management to sustained investments

- Technological and industrial innovation



Figure 2.2 Global average clean energy technology price trends, 2015-2025e



IEA. CC BY 4.0.

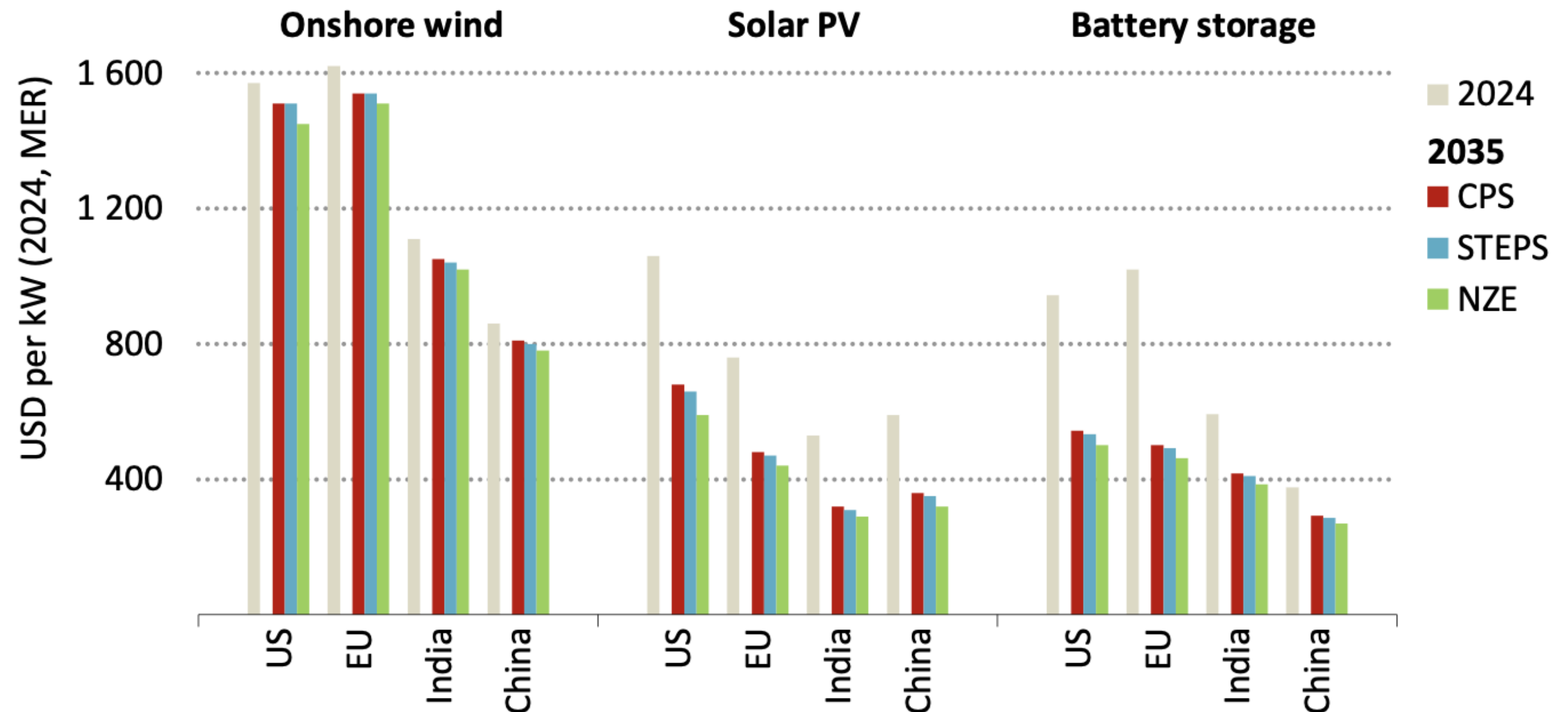
Note: Heat pumps are residential only.

Sources: IEA analysis based on BNEF (2025); InfoLink (2025); and S&P Global Mobility (2025).

The prices of most clean energy technologies have fallen sharply since 2015, especially solar PV modules, lithium-ion batteries and wind turbines.



Figure 2.14 ▸ Installed costs of onshore wind, solar PV and battery storage by scenario and region/country, 2024 and 2035



Installed cost
expected decline to
2035

Onshore wind

Solar PV

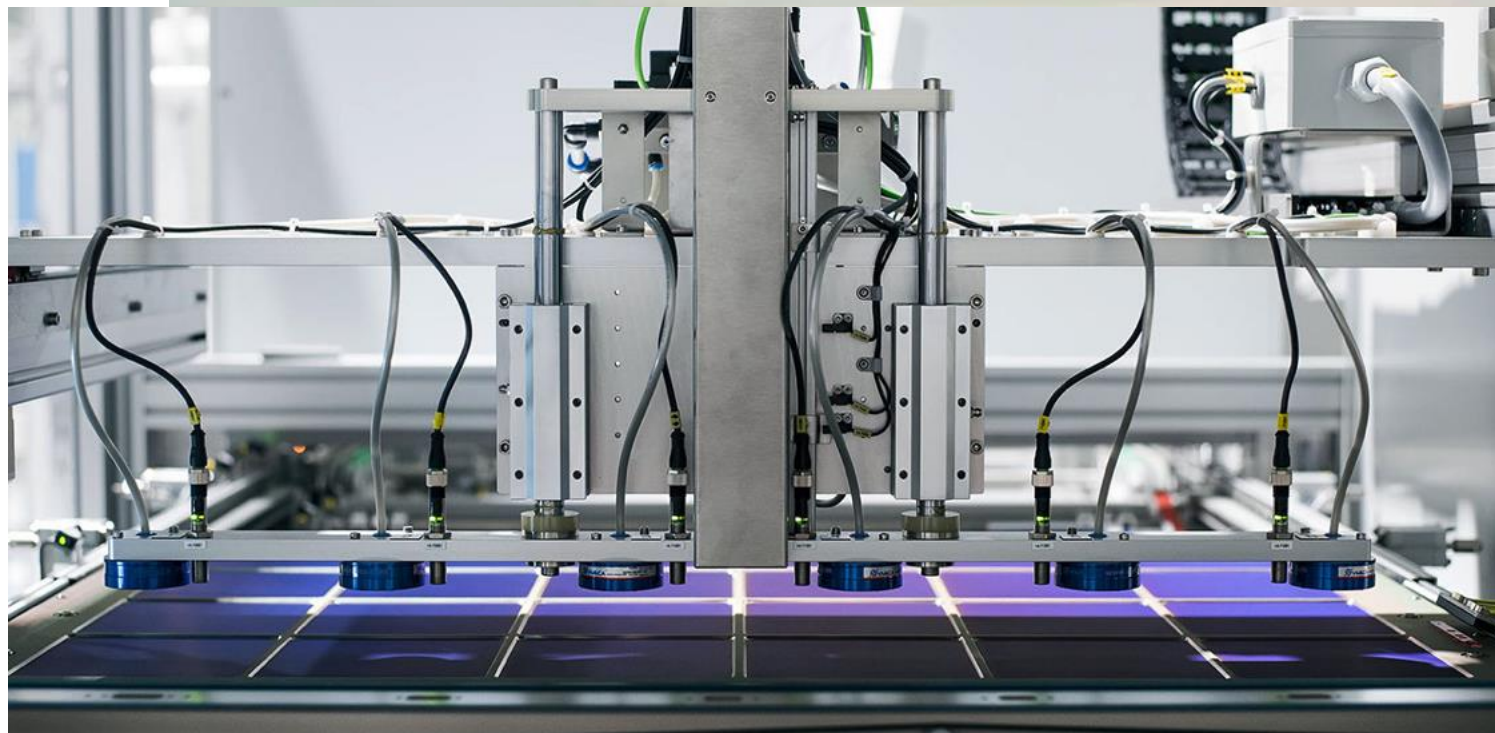
Utility-scale
battery storage



Regaining a competitive edge in technological and industrial innovation for PV deployment in Europe

3SUN Gigafactory

Catania's "Sun Factory," where high-efficiency solar cells and modules are made, is **Europe's largest center** for the production of next-generation photovoltaic modules.



3 GW

annual production capacity target of about 15,000 PV modules per day.



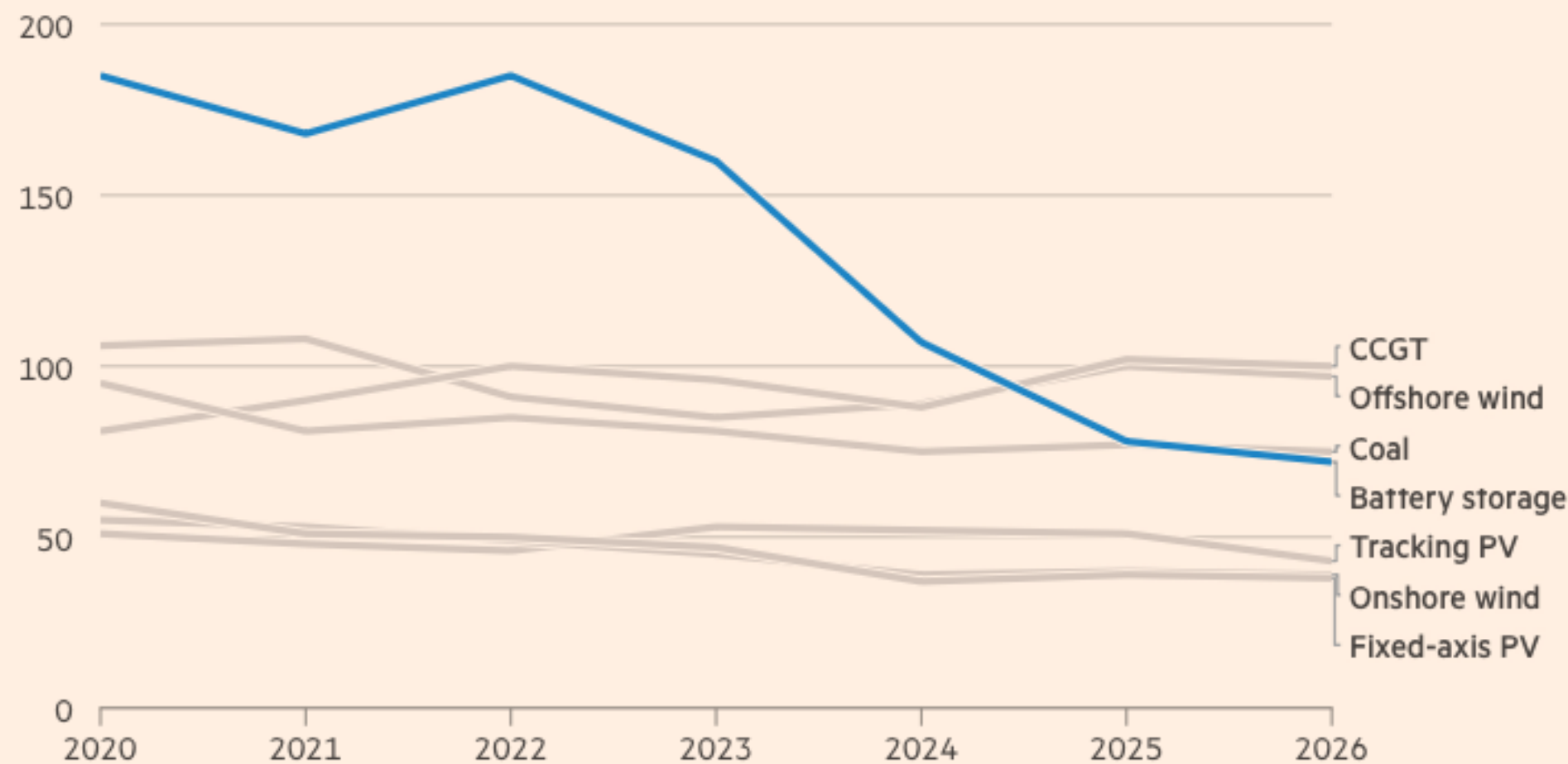
€1 billion

total investment (Capex, Opex + €190 million from the European Innovation Fund and the national 'Development Contract' scheme).



The frontier of learning gains: Battery techs for mobility and energy storage (baseload)

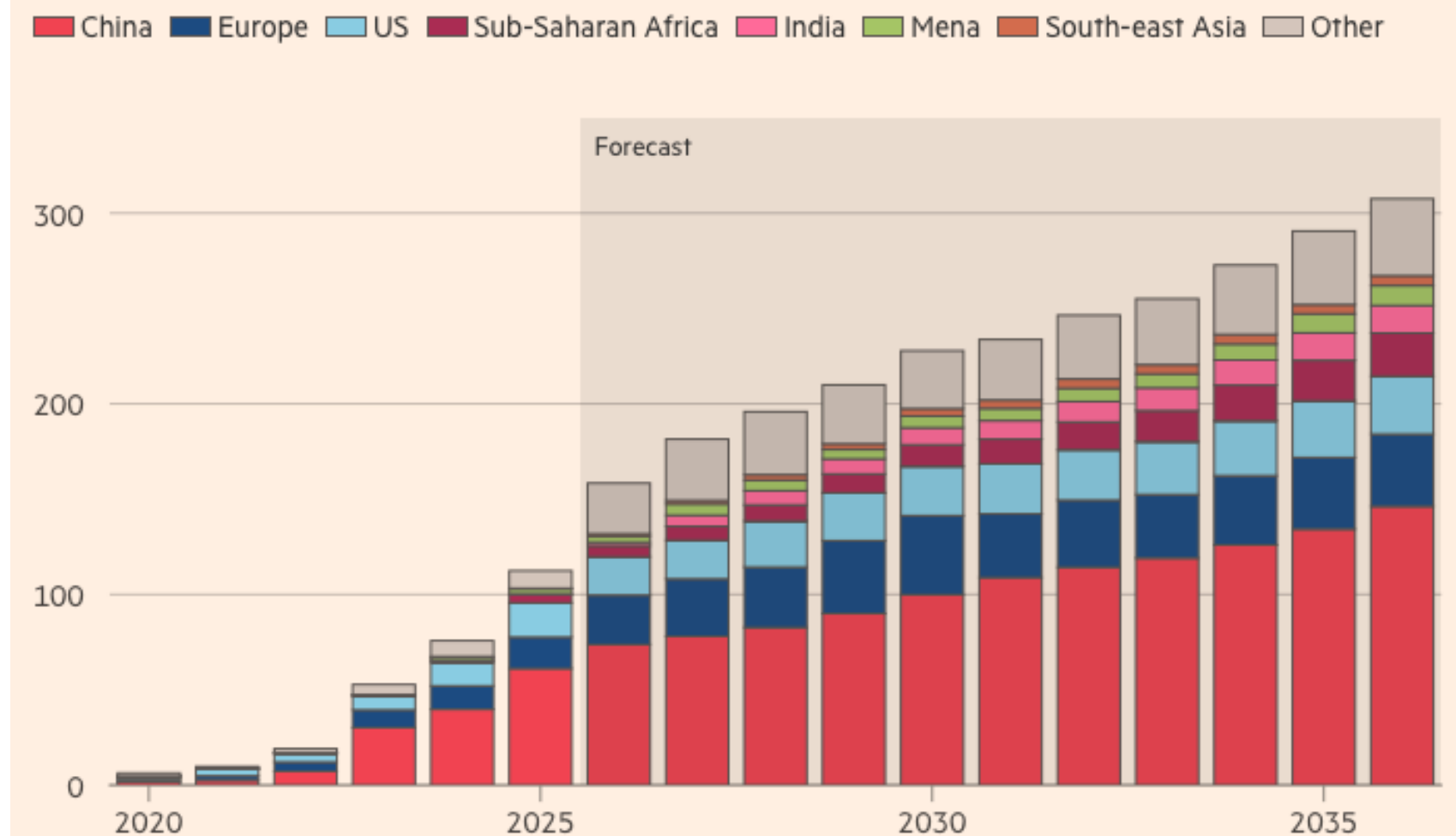
Global benchmark levelised cost of electricity (Constant 2025 \$ per MWh)



FINANCIAL TIMES

Source: BloombergNEF • 2026=estimate; CCGT=combined-cycle gas turbine

Global energy storage additions by market (GW)



FINANCIAL TIMES

Source: BloombergNEF • excludes pumped hydro plants

CATL's fastest-growing business line today is the production of cells for large-scale energy storage systems

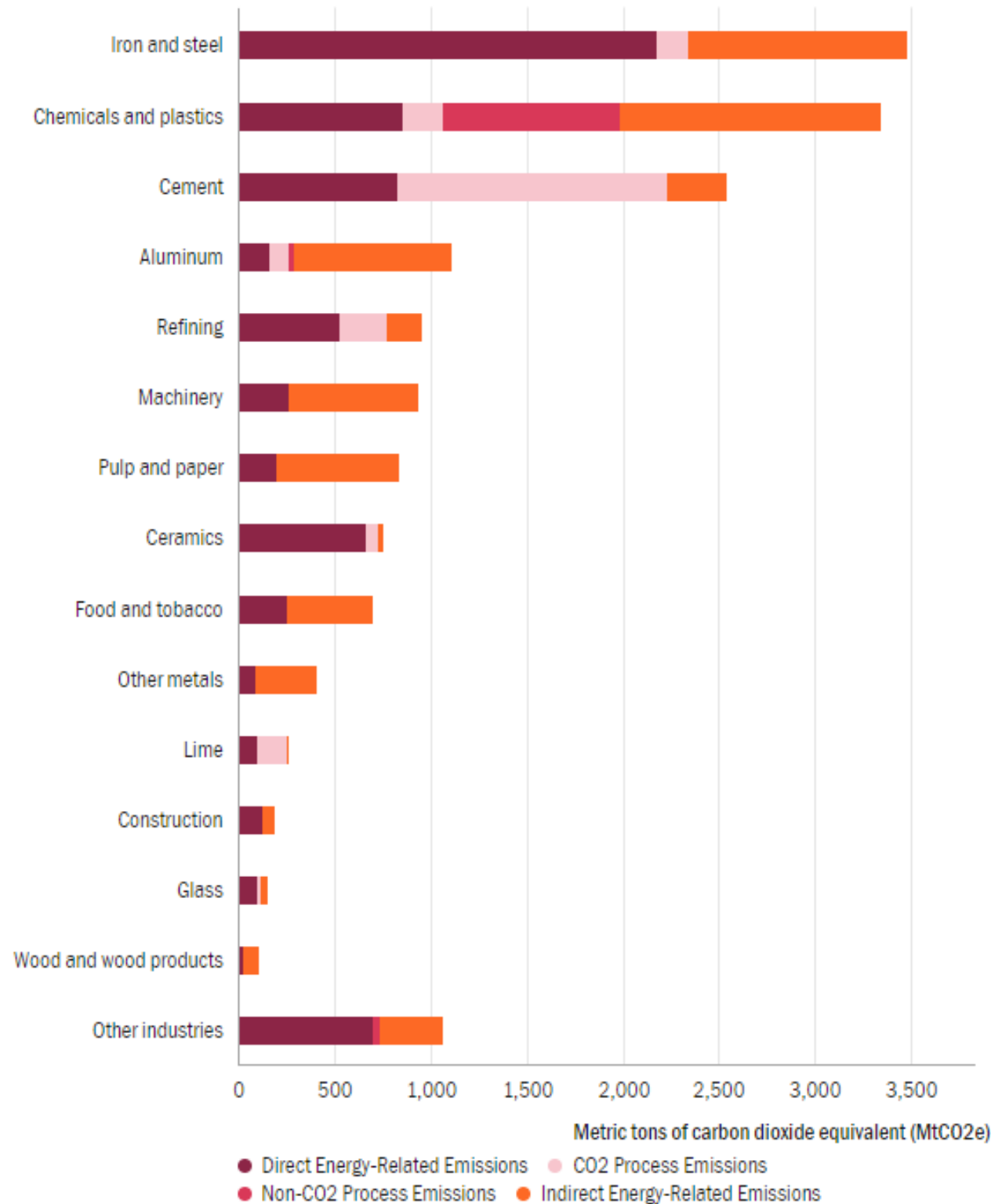


Shifting from crisis management to sustained investments

- Industrial Ecosystem Transformation



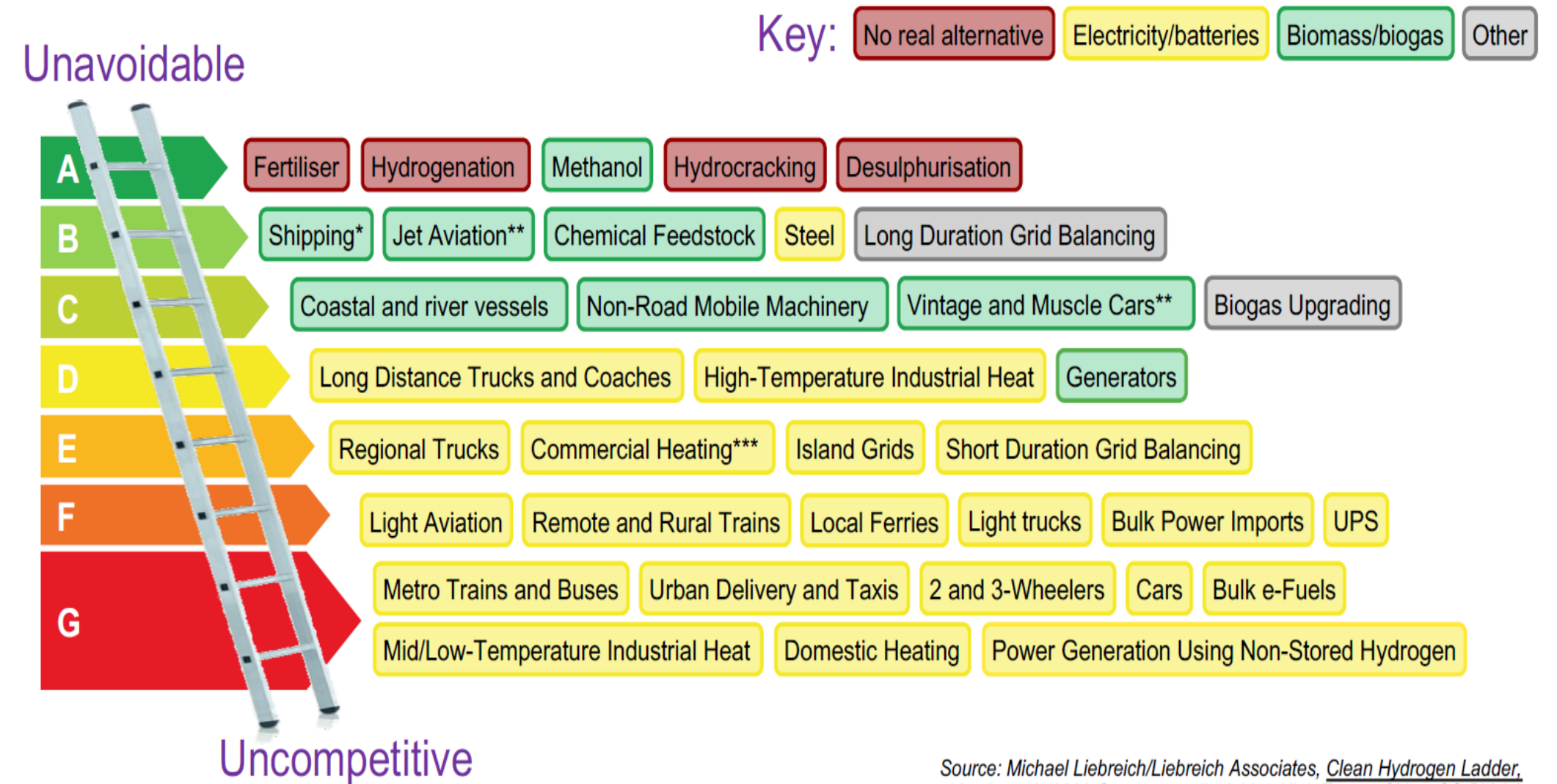
EMI Industries



The Hydrogen Ladder

Hydrogen Ladder 5.0

Liebreich Associates



*As ammonia or methanol **As e-fuel or PBTl ***As hybrid system

Source: Michael Liebreich/Liebreich Associates, Clean Hydrogen Ladder, Version 5.0, 2023. Concept credit: Adrian Hiel, Energy Cities. CC-BY 4.0



Industrial decarbonisation and green hydrogen: No viable investments without offtakes

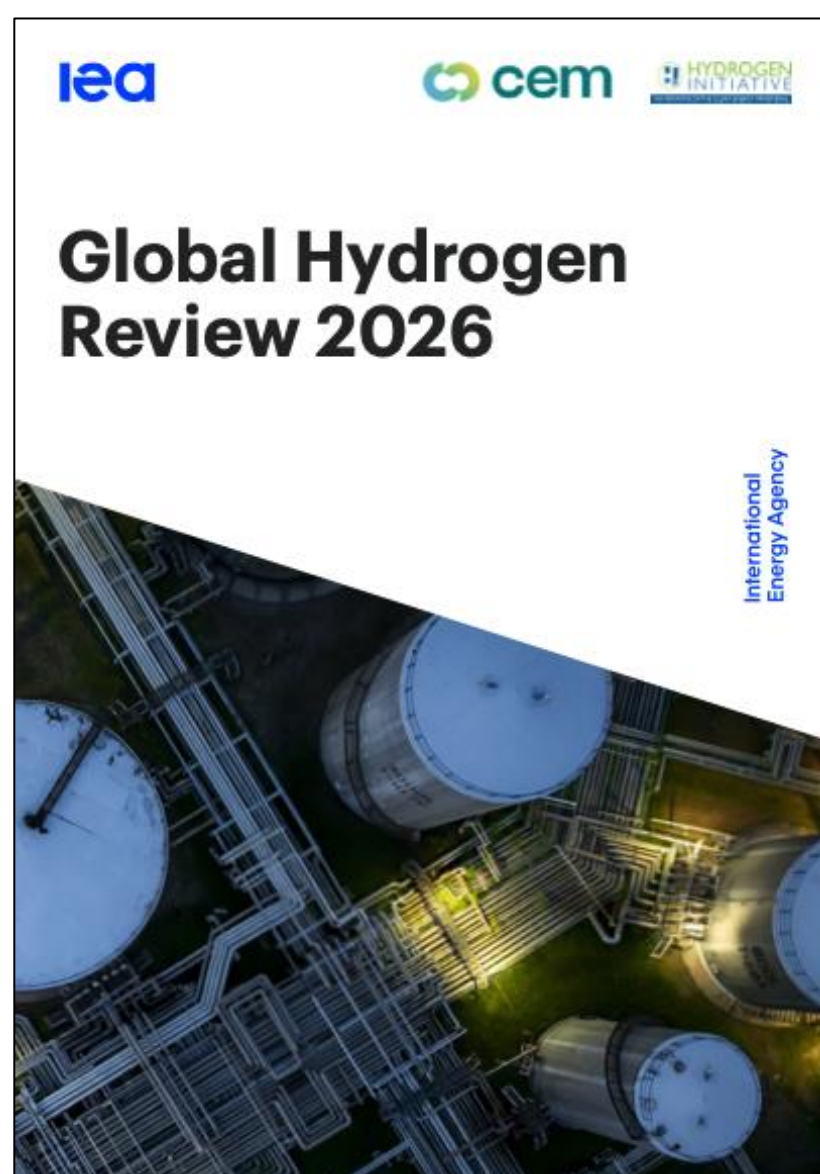
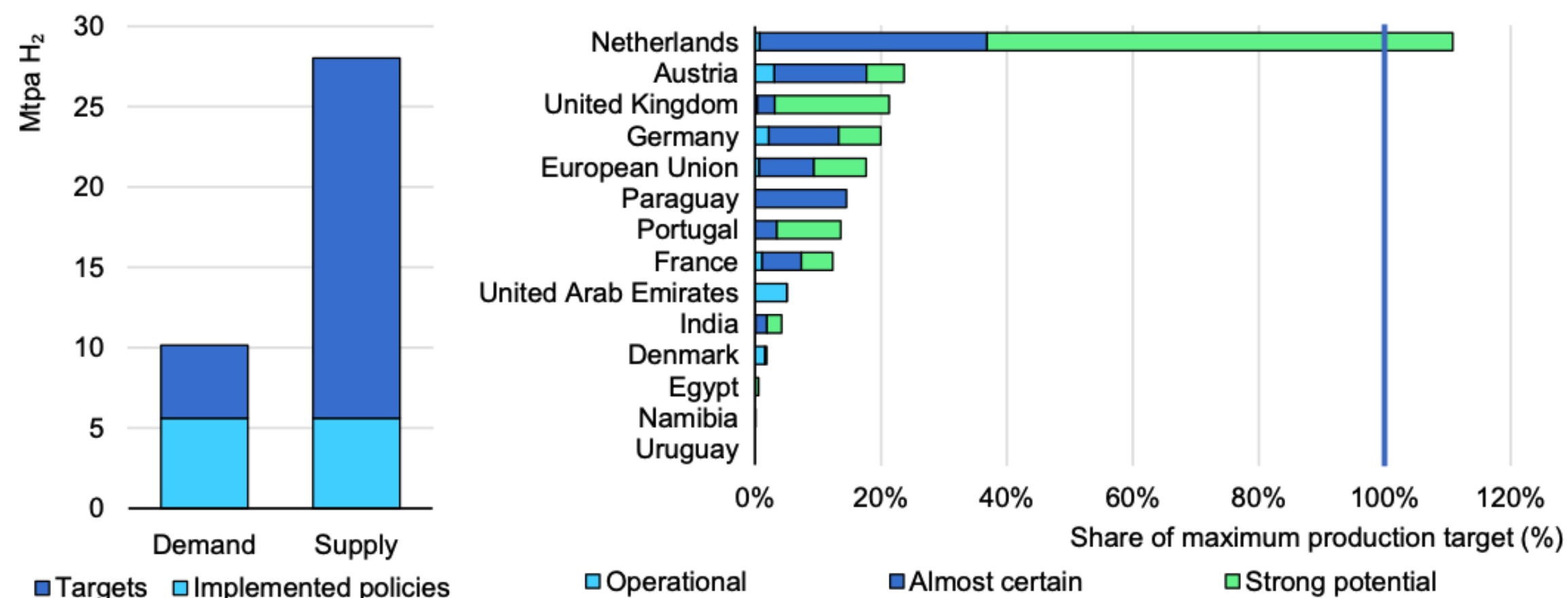


Figure 1.7 Government targets for low-emissions hydrogen production and demand globally and selected individual targets for production, 2030



IEA. CC BY 4.0.

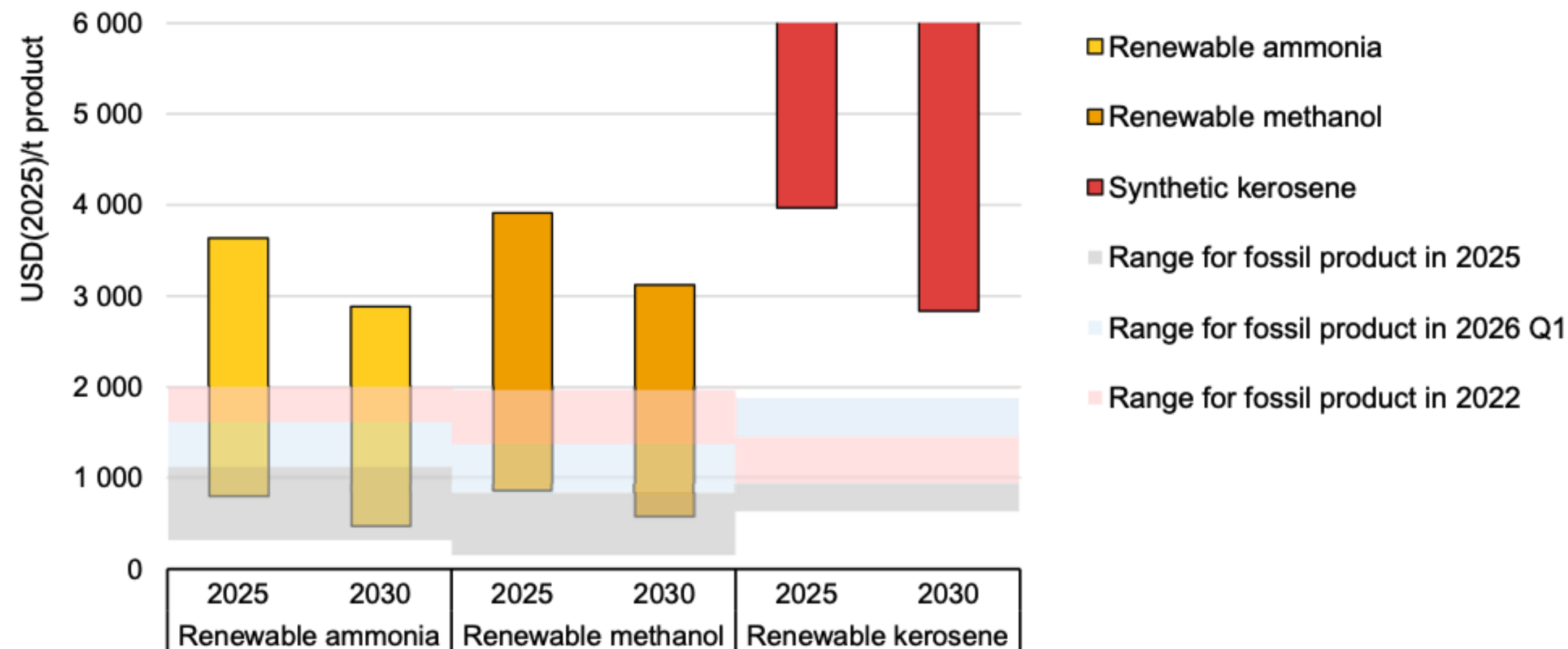
Note: China is excluded from the chart to avoid distorting the scale and because its 2030 target is 300 ktpa while its project pipeline with all projects up to strong potential equals more than six times this target.

Only China and the Netherlands are on track to meet their announced targets for production of low-emissions hydrogen by 2030.



Conflict in the Middle-East and 'Green Premium': Impact on urea, ammonia and methanol made from hydrogen

Figure 3.22 Production cost of renewable ammonia, methanol and synthetic kerosene in the Stated Policies Scenario, 2025 and 2030, compared with cost ranges of fossil-based equivalents in 2022, 2025 and Q1 2026



High energy prices can reduce the cost gap for renewable hydrogen and hydrogen-based products

Some low-emissions hydrogen-based products could become cost-competitive in the near term

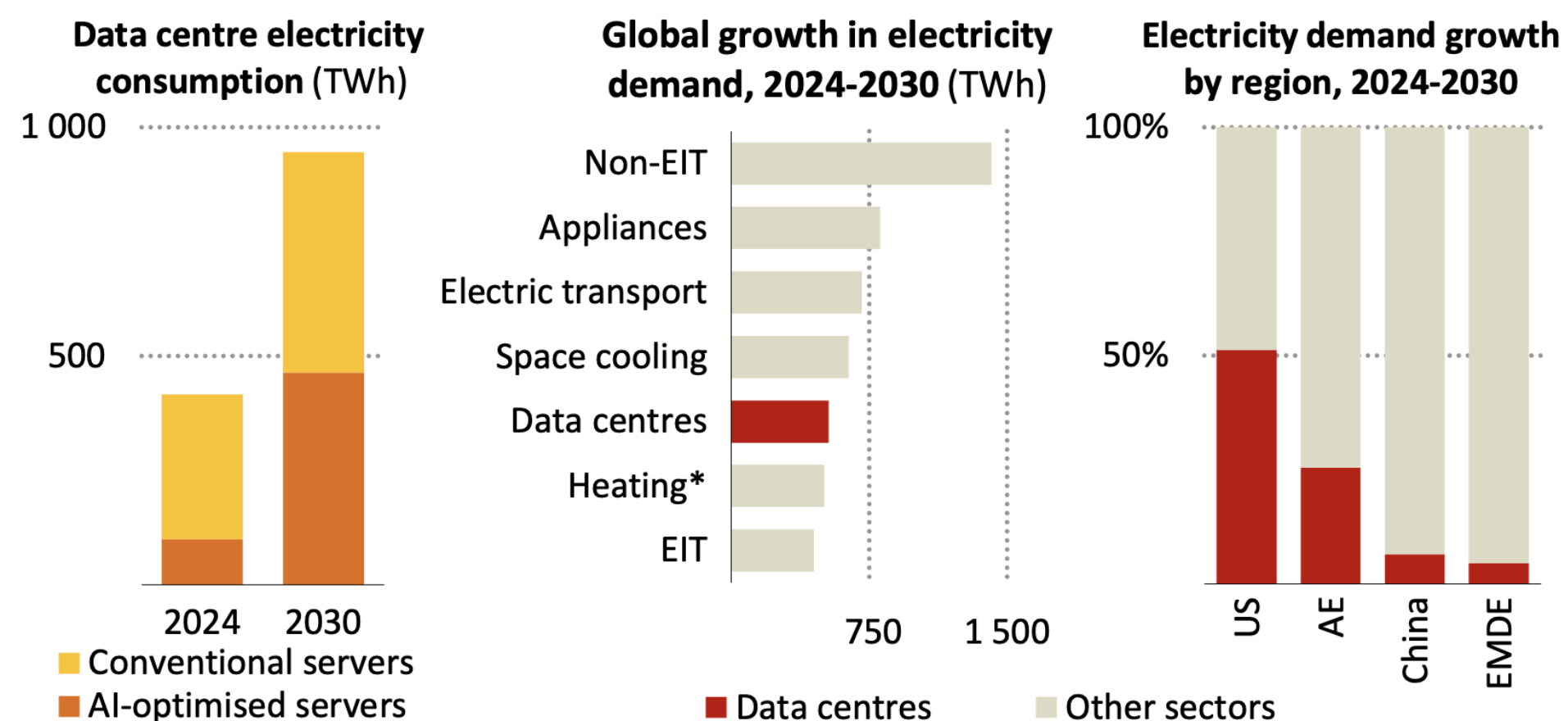
- Reducing fossil fuel dependency
- Hedge against price shocks



New sources of demand: Data Centres

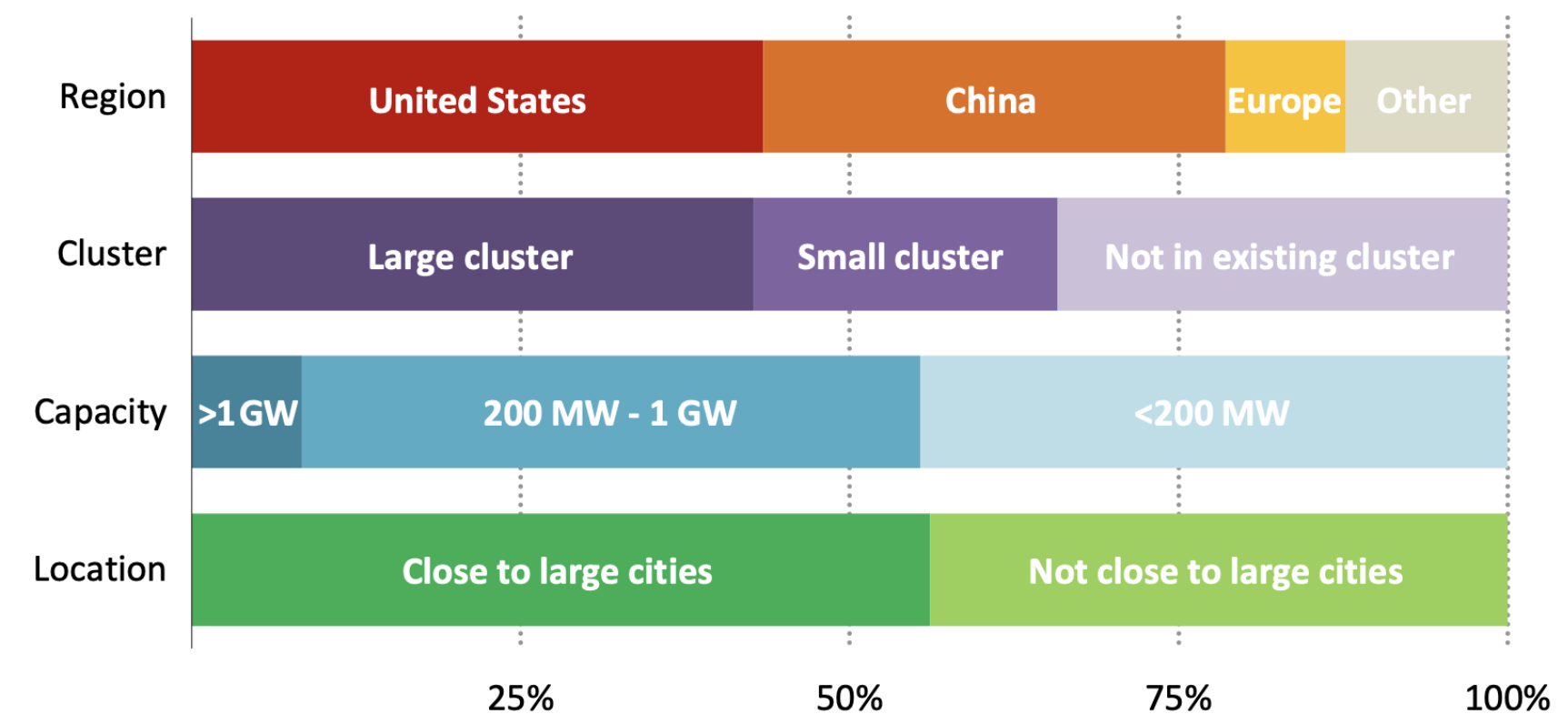
Across all countries, majority large scale (>200 MW)

Figure 1.16 ▶ Electricity consumption in data centres by server type, and global and regional electricity demand in the STEPS, 2024-2030



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Figure 1.17 ▶ Characteristics of data centre capacity in the pipeline



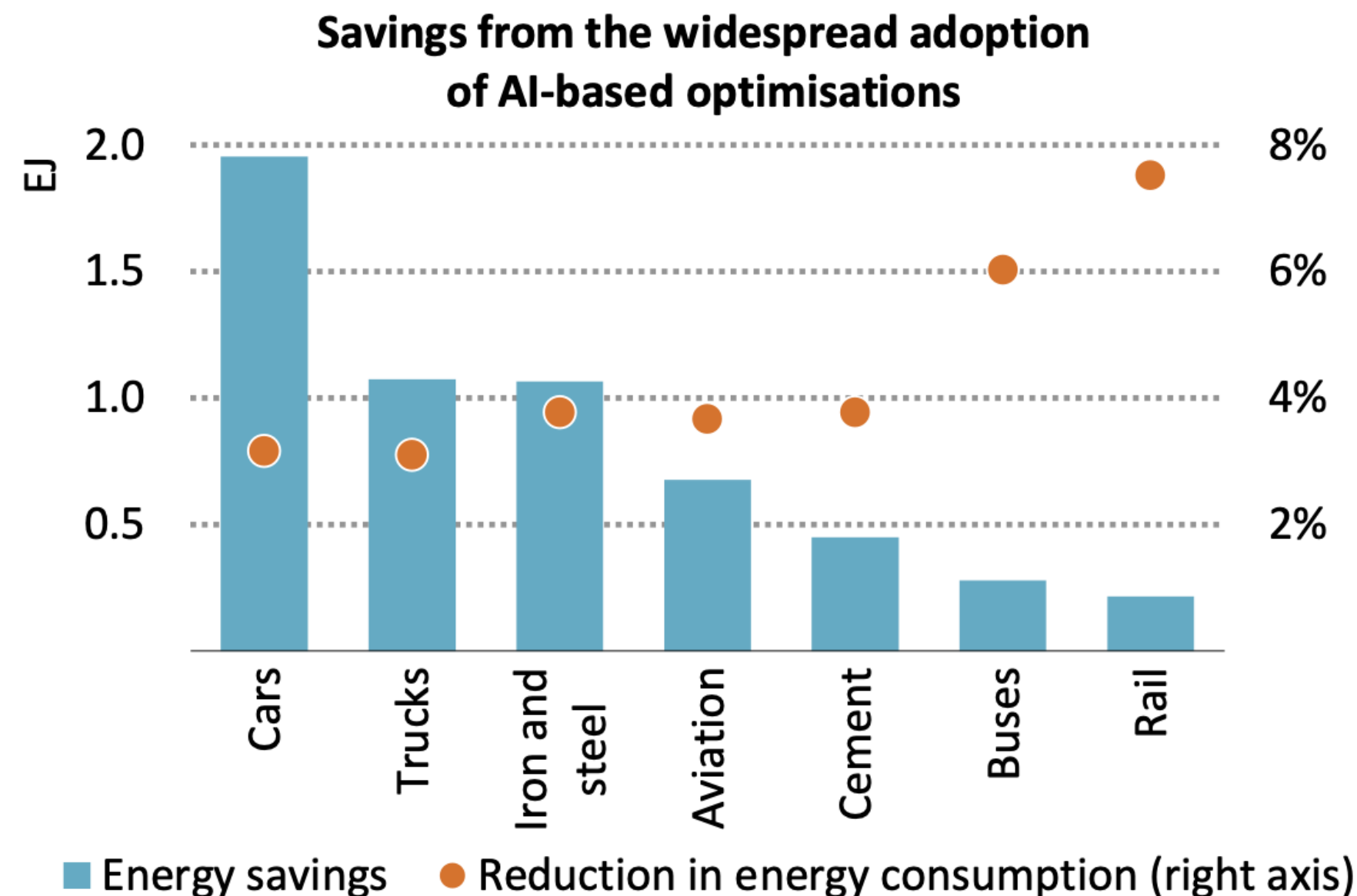
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Global energy savings potential from AI



Widespread adoption of known AI applications has the potential to save 13.5 EJ in 2035

Figure 1.18 ▶ Global energy savings potential from AI in selected end-uses in 2035, and historical analysis of battery materials by AI



Analysis of battery materials

Candidates analysed by AI



Candidates analysed by conventional methods
~200 000



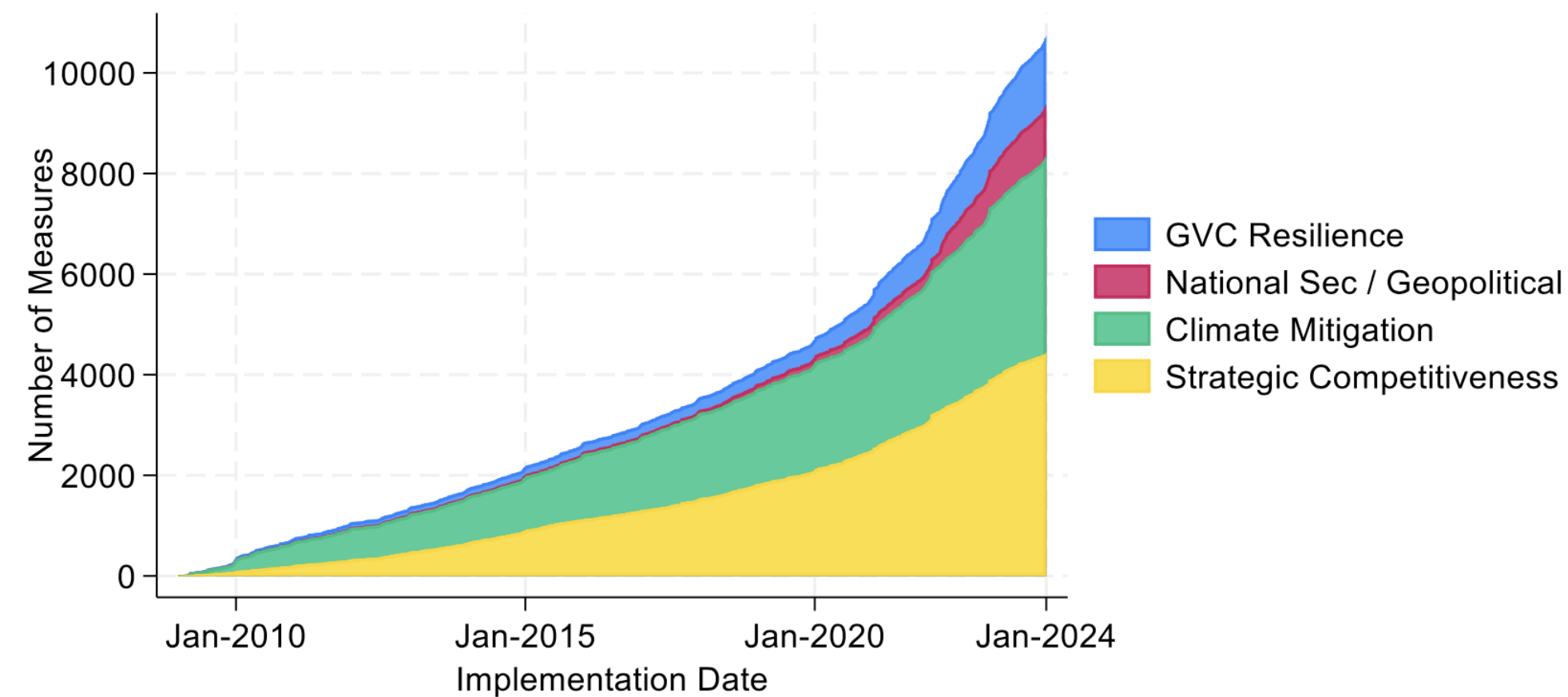
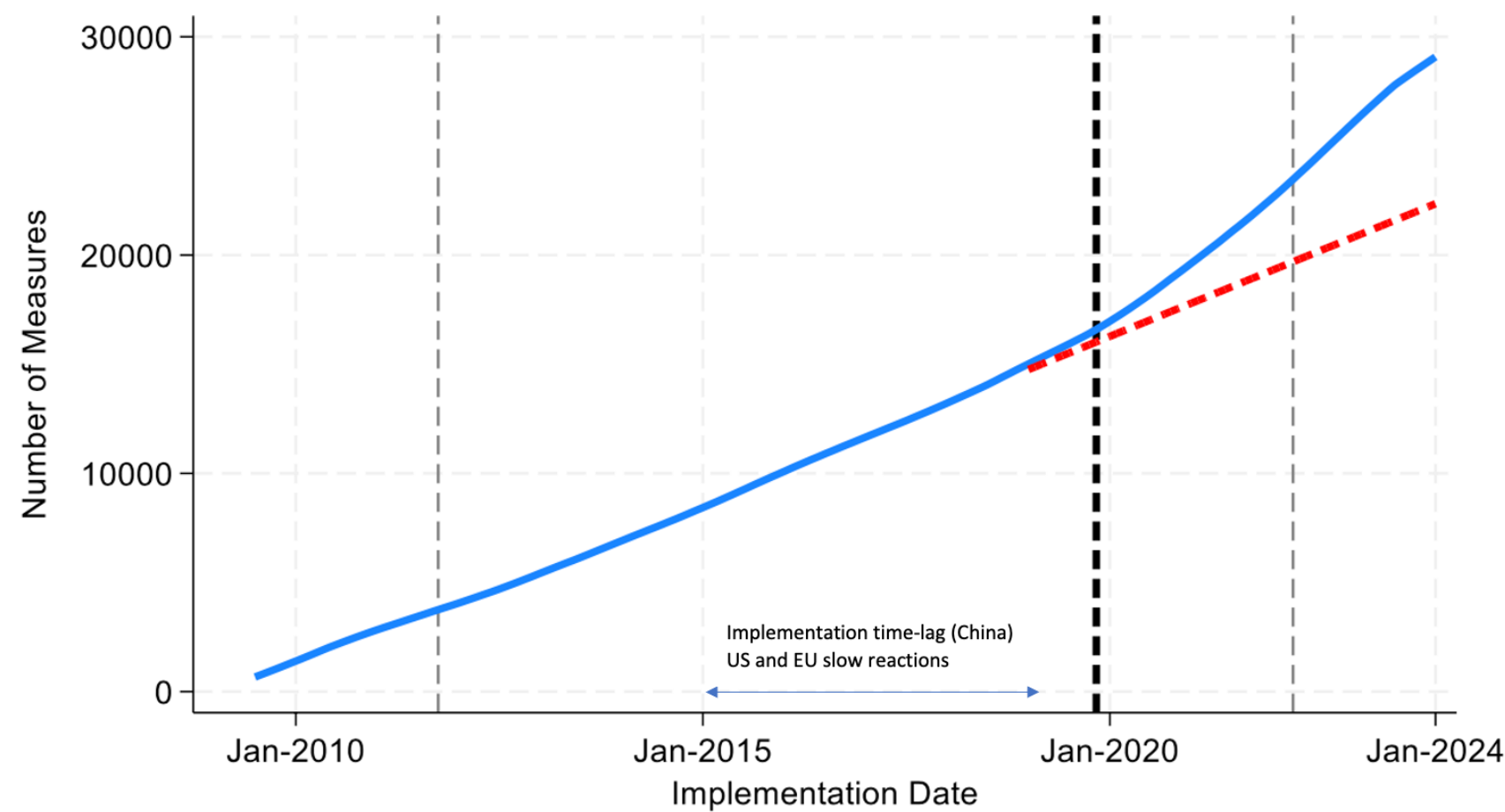
Shifting from crisis management to sustained investments

- Policy orchestration (and experimentation)
 - Industrial policy
 - Energy/Infrastructure Policy
 - Energy Markets Regulation and Competition Policy



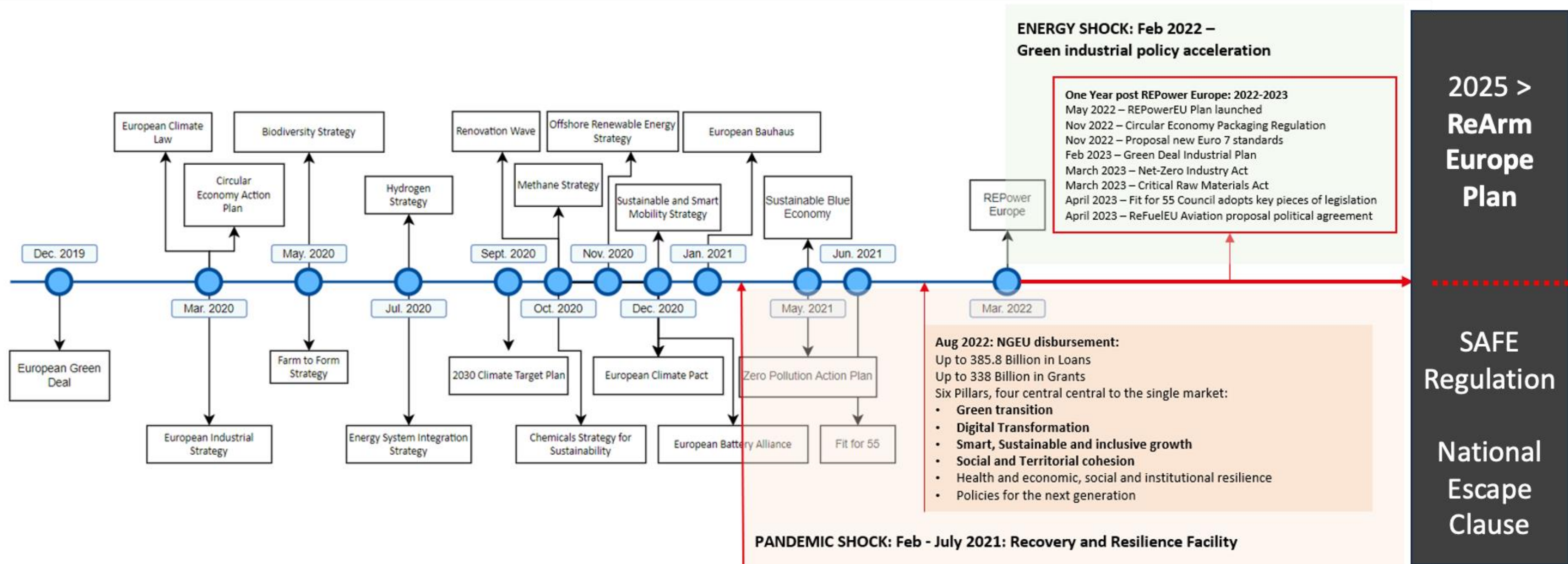
The return of industrial policy?

Many measures, more need for orchestration





EU: green as normative, regulatory fragmentation and reactive policy mode





Energy investments is a 'better deal' than re-armament but it needs multi-level policy orchestration

At the national level

- ☐ Most countries deploy IP instruments without strategies
- ☐ Most countries face an energy infrastructure gap (HV Grid)
- ☐ Most governments give away carrots without sticks

At the EU level

- ☐ Reloading the Green Deal towards green competitive advantage and economic resilience (Industrial Accelerator Act)
- ☐ Energy market integration fit for a new energy technology mix
- ☐ Energy infrastructure integration to support green tech diffusion



At the Global level

- Ongoing ETS reforms (greater flexibilities) and better integration with industrial policy
- Waking-up to China and its sources of competitive advantage: EU catching up / learning from global leader in renewable energy technologies, business models and public finance
- Forging equal partnerships: EU Global gateway for mutually beneficial industrial partnerships in energy and critical minerals

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