



Energy
Transitions
Commission

Barriers to climate action: transitional costs, distributional issues and politics

Adair Turner

Chair, Energy Transitions Commission

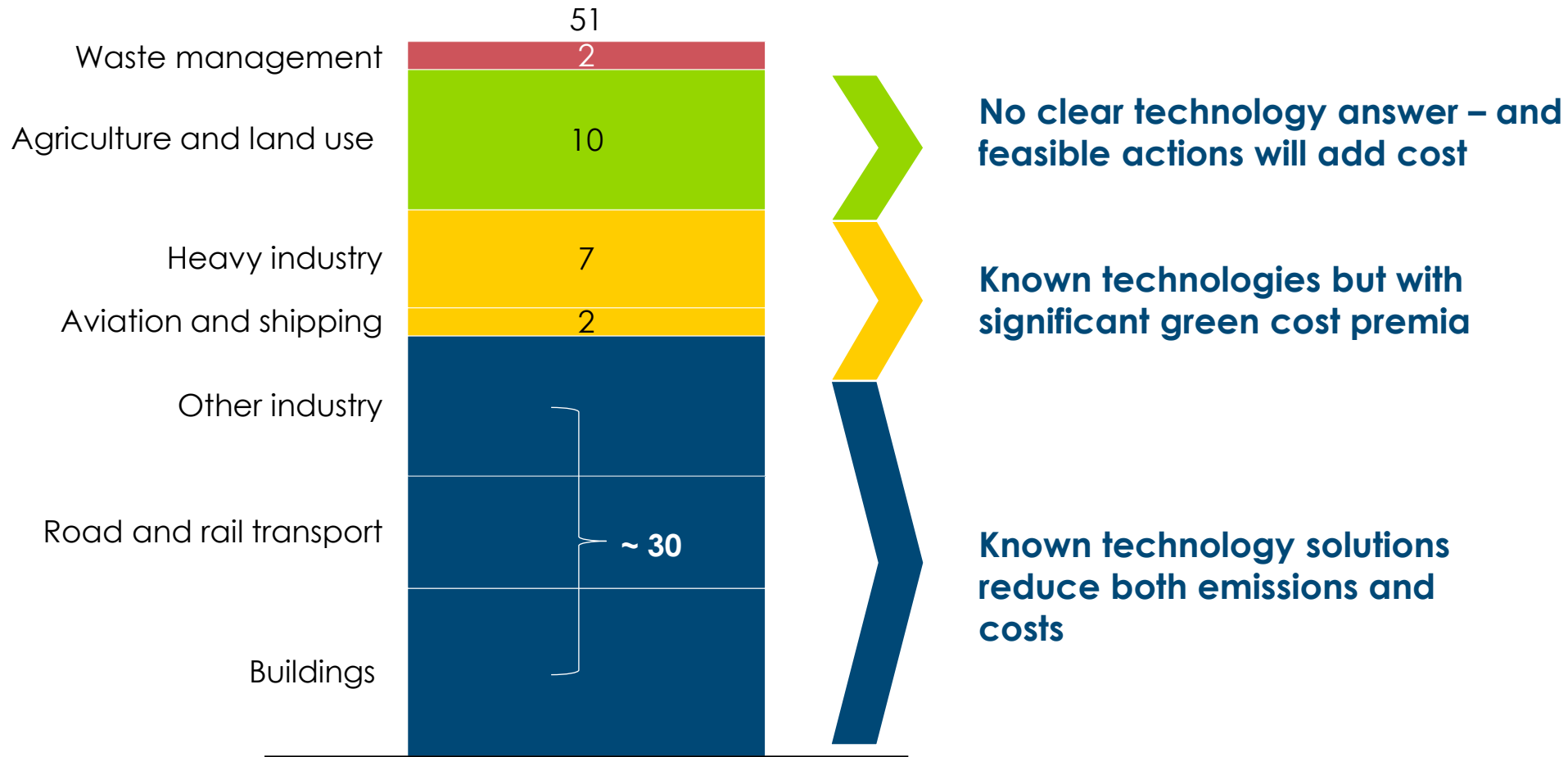
The Global School of Sustainability at LSE

3rd of February 2026



GHG emission by broad sector

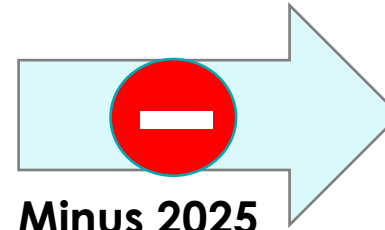
Gt CO_{2eq}



Estimates of remaining carbon budget

Gt CO₂

Temperature (°C)	Estimated remaining carbon budgets from the beginning of 2025 (Gt CO ₂)				
Avoidance probability:	17%	33%	50%	67%	83%
1.5	320	200	130	80	30
1.6	620	420	310	240	160
1.7	910	640	490	390	290
2	1790	1310	1050	870	690



Minus 2025 emissions:

- Energy ~39
- Land use ~4

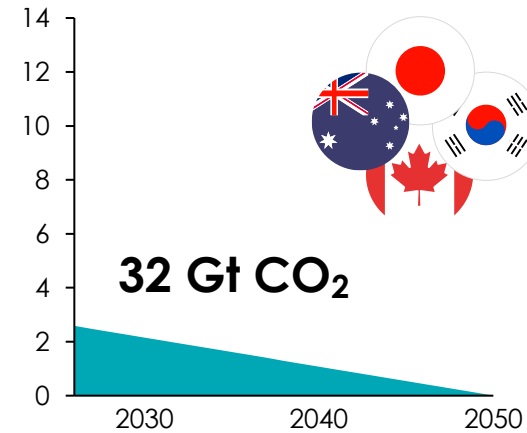
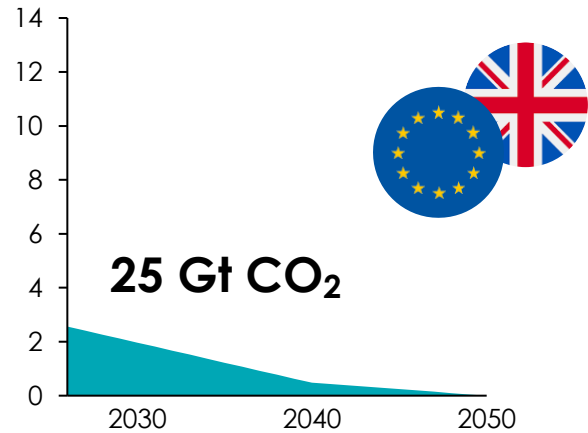
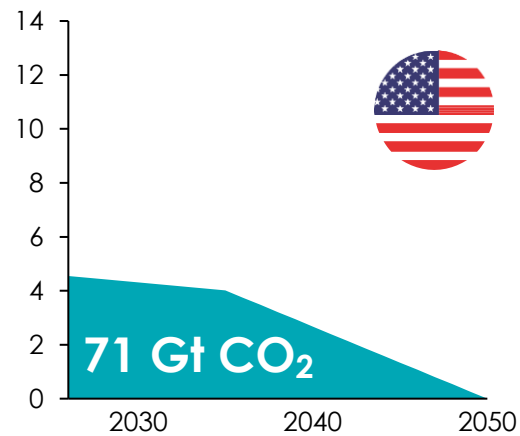
Remaining at January 2026		
	50%	67%
1.5C	87	37
2C	1007	827



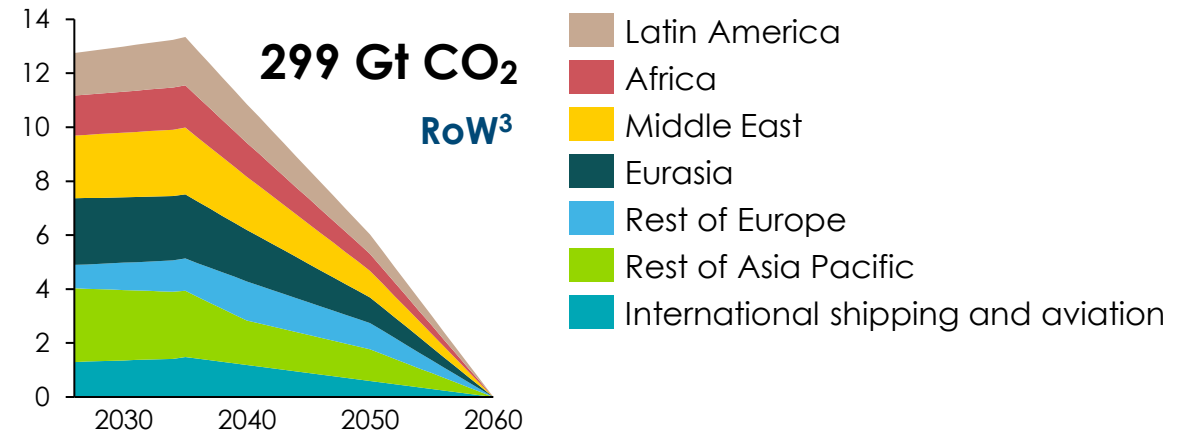
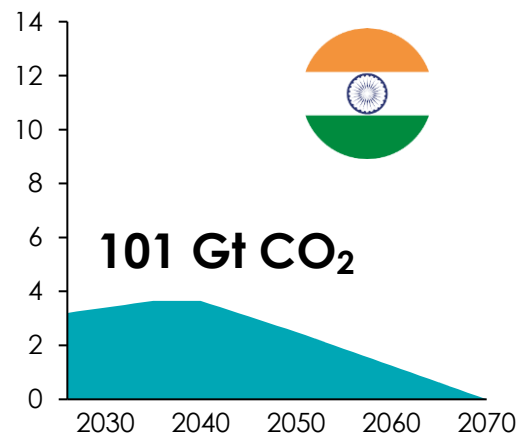
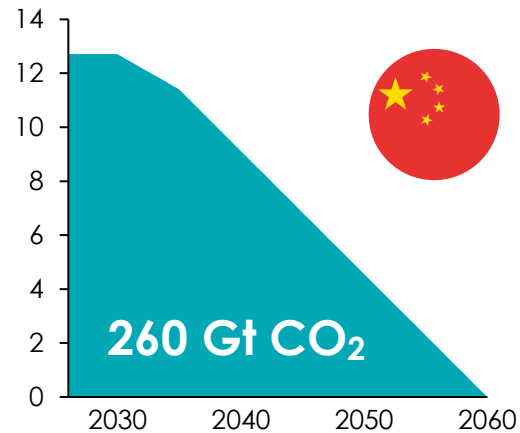
Source: www.essd.copernicus.org/articles/17/2641/2025/essd-17-2641-2025.pdf

Cumulative future energy related emissions implied by current NDCs and pledges

Gt CO₂



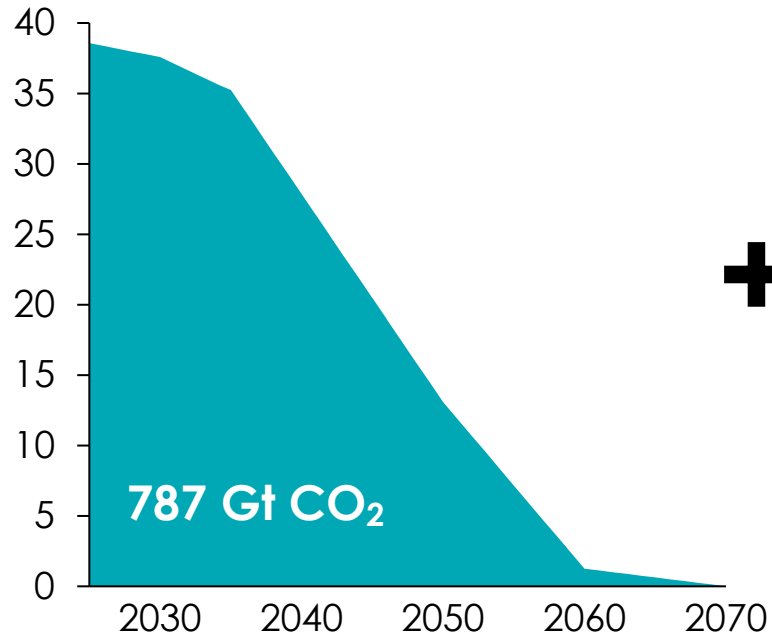
**Total =
787 Gt CO₂**



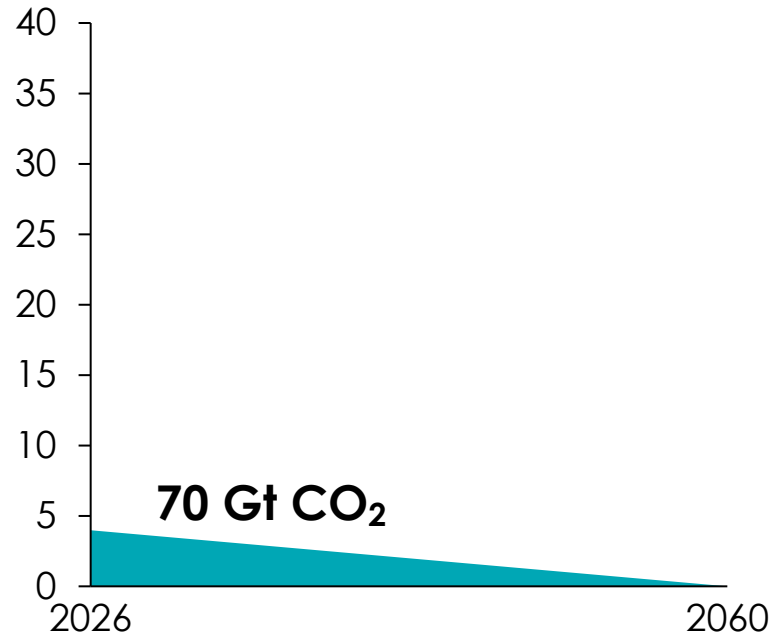
Cumulative CO₂ emissions versus remaining budget

Gt CO₂

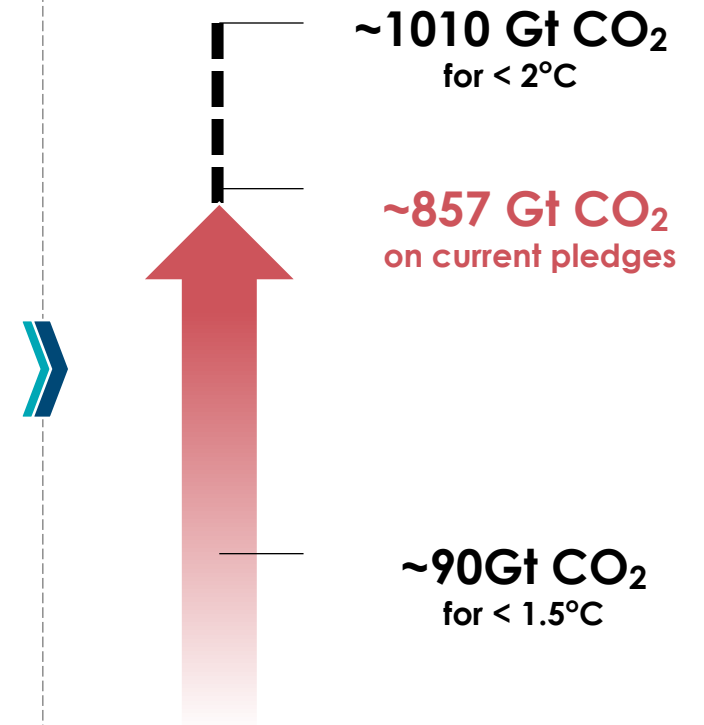
Energy and industry related



Land-use change

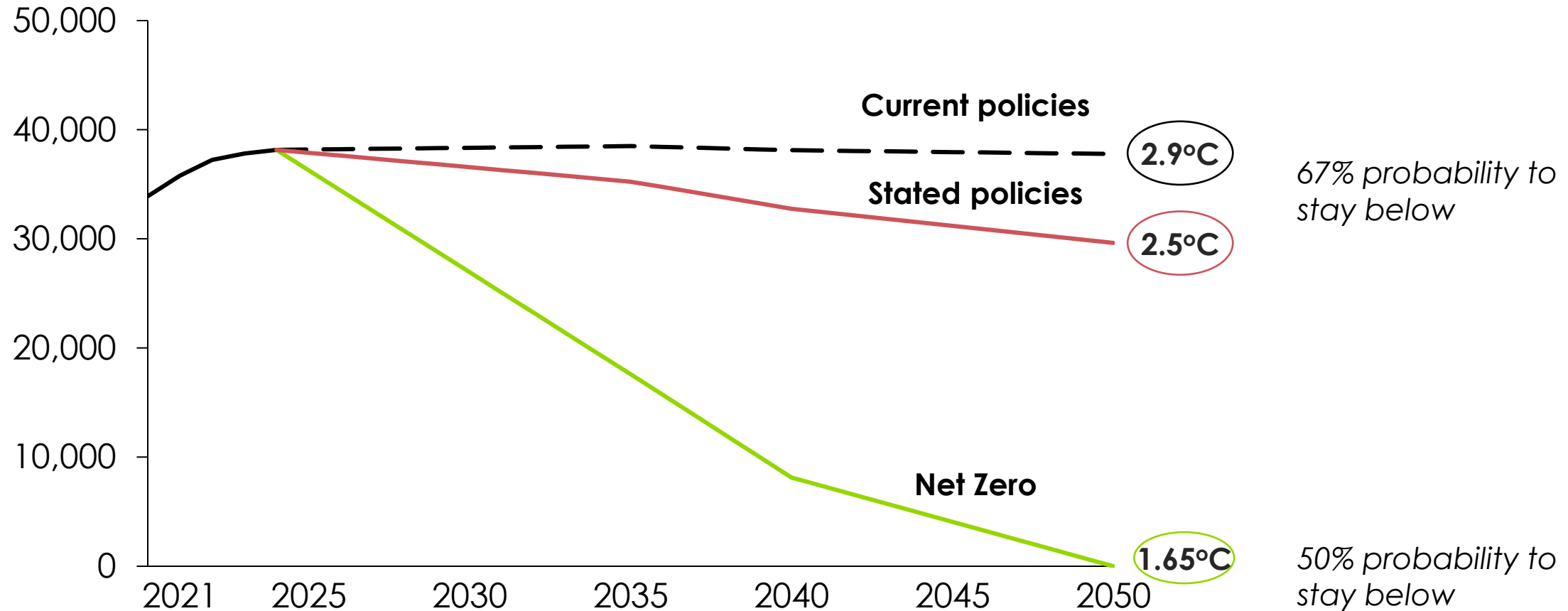


Remaining carbon budget 50% likelihood



IEA emission scenarios 2024 and implied peak temperature

Energy-related Mt CO₂



Source: IEA (2021) Net Zero by 2050;
Note: IEA Scenarios have emissions interpolated between 5-10 years;



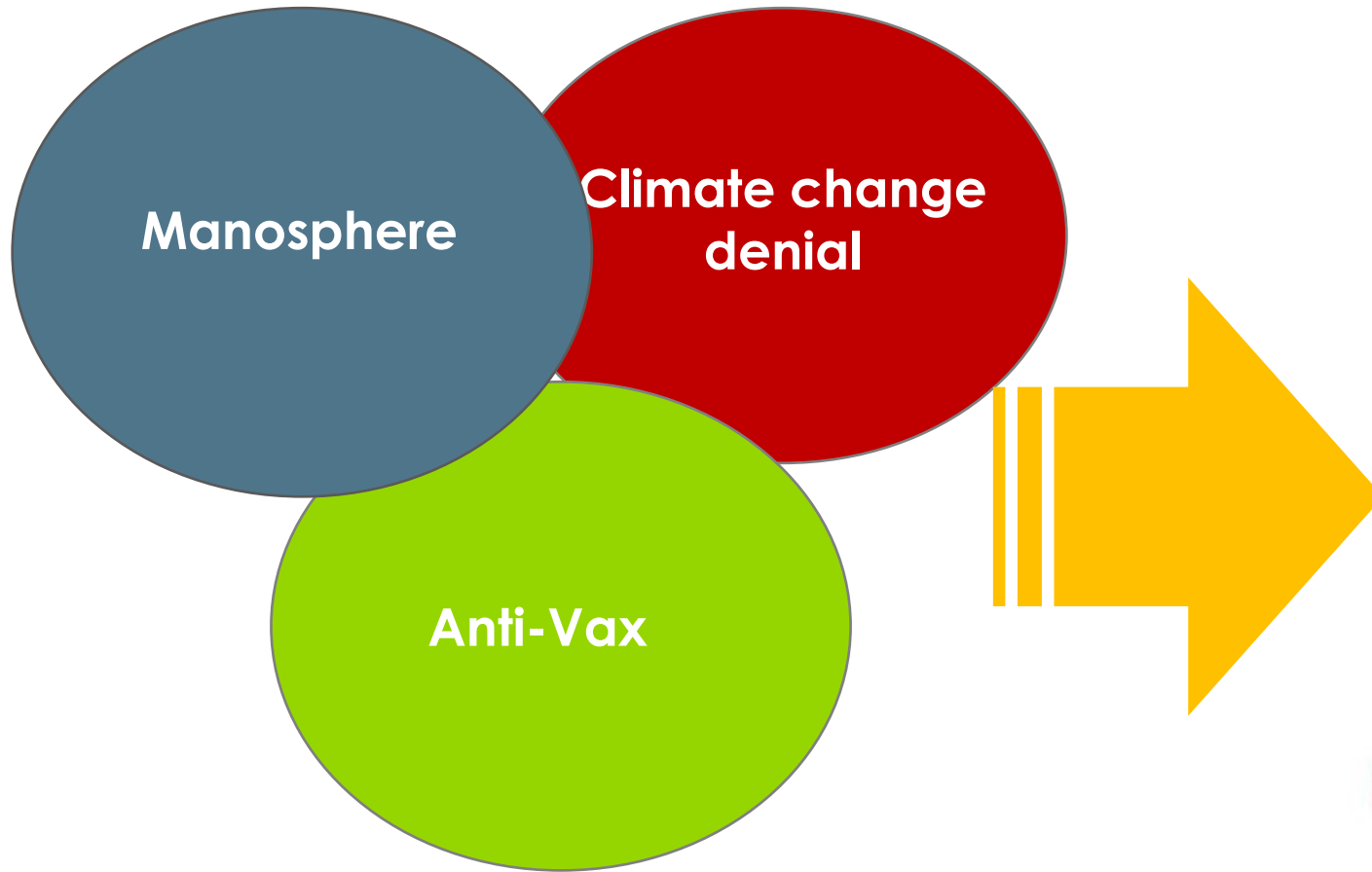


- ❖ IRA not continued/reversed – US will not achieve committed target of 48-52% reduction (from 2005 level) by 2030
- ❖ US will not become major driver of clean tech development and cost reduction alongside China
- ❖ US will not provide significant support to capital flows to developing countries
- ❖ US exit from Paris process and UNFCCC may encourage other countries to do same and/or dilute emission reduction targets



+0.2°C to reasonable estimate of global warming by 2100?





**Oxfordshire County Council pass
Climate Lockdown 'trial' to begin in
2024**



Residents will be confined to their local
neighbourhood and have to ask permission to
leave it, all to *'save the planet'*





Scrapping net zero deadline could save Britain £14bn a year

Projected cost of 2050 plan is equivalent to 0.4% of GDP or £500 a year per household

<https://www.thetimes.com/uk/politics/article/britain-net-zero-target>



UK energy costs likely to halve by 2050, says system operator

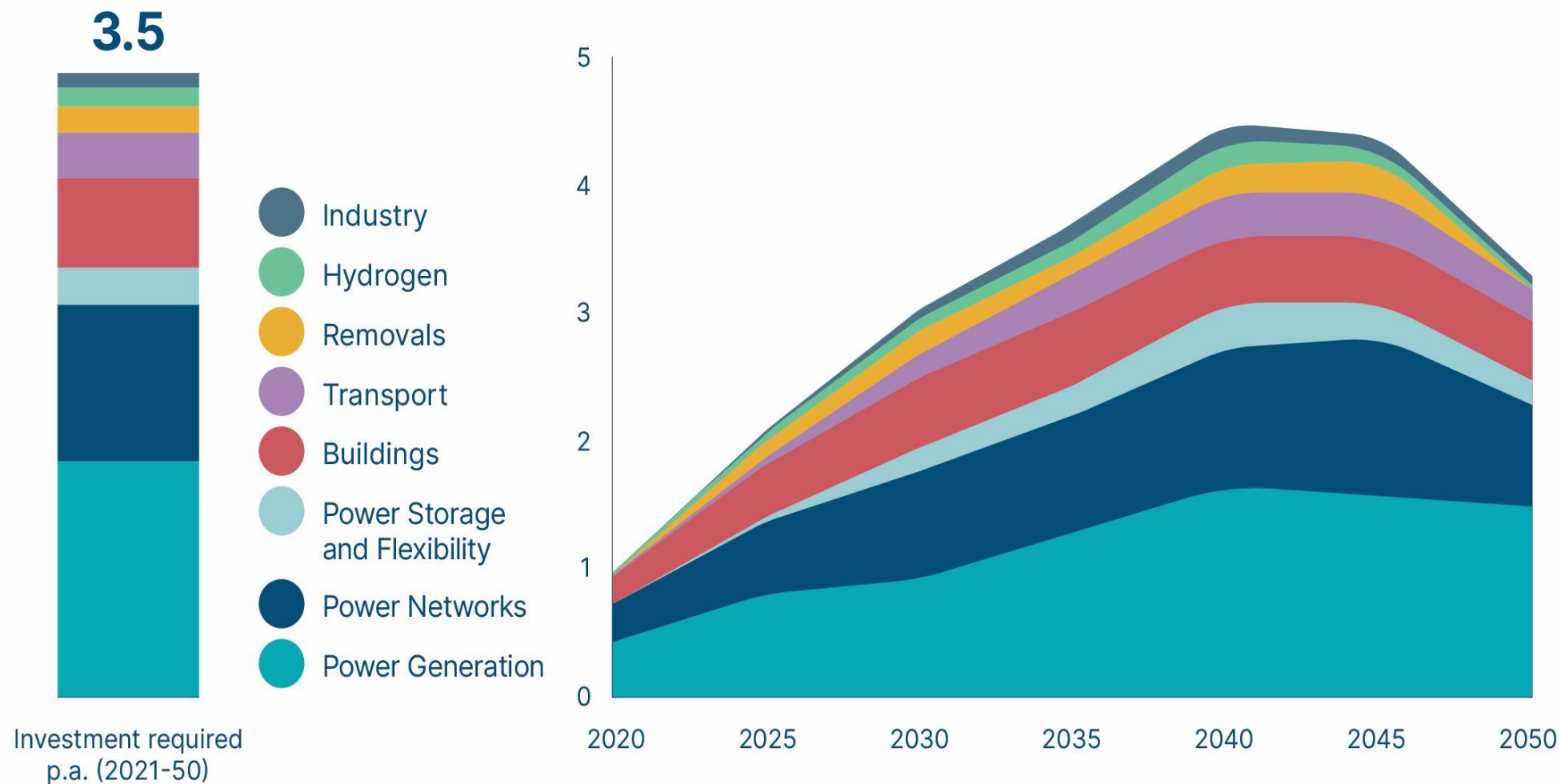
Modelling by independent body Neso forecasts sharp fall in expenditure from 10% of GDP as shift to renewables continues

<https://www.ft.com/content/25ad418f-6961-417b-825e-2071c1e693f2>



Annual capital expenditure in the energy system

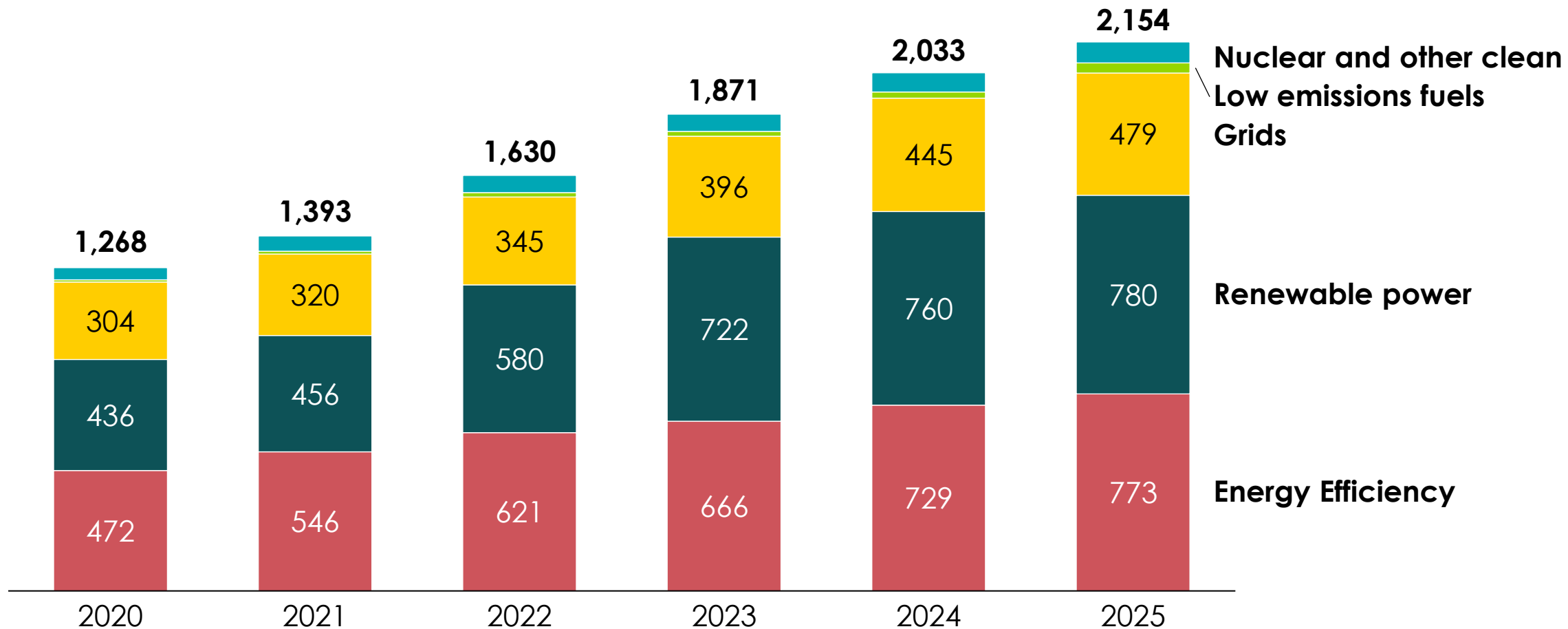
Trillion \$



Source: ETC (2023), *Financing the Transition*.

Clean energy investment 2020-2025

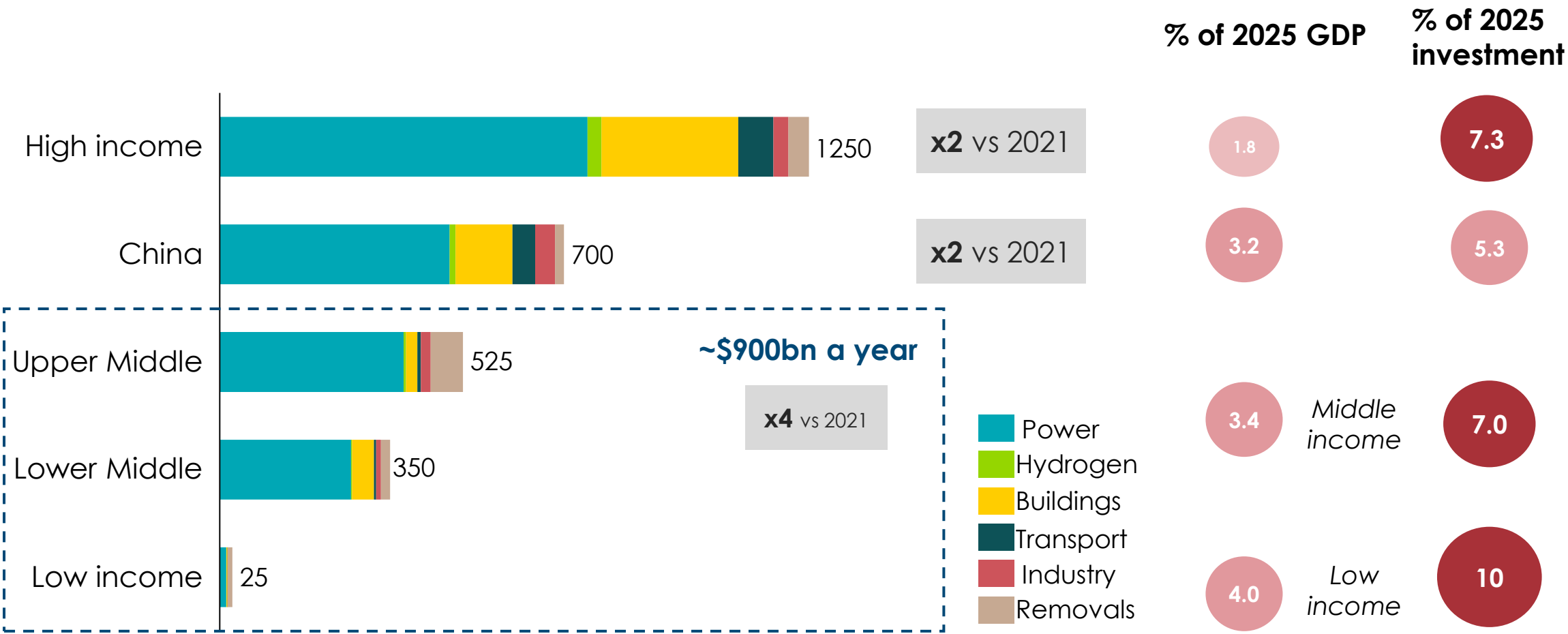
\$bn



Source: IEA Investment report <https://www.iea.org/reports/world-energy-investment-2025/executive-summary>

Required investment by country type 2026-2030

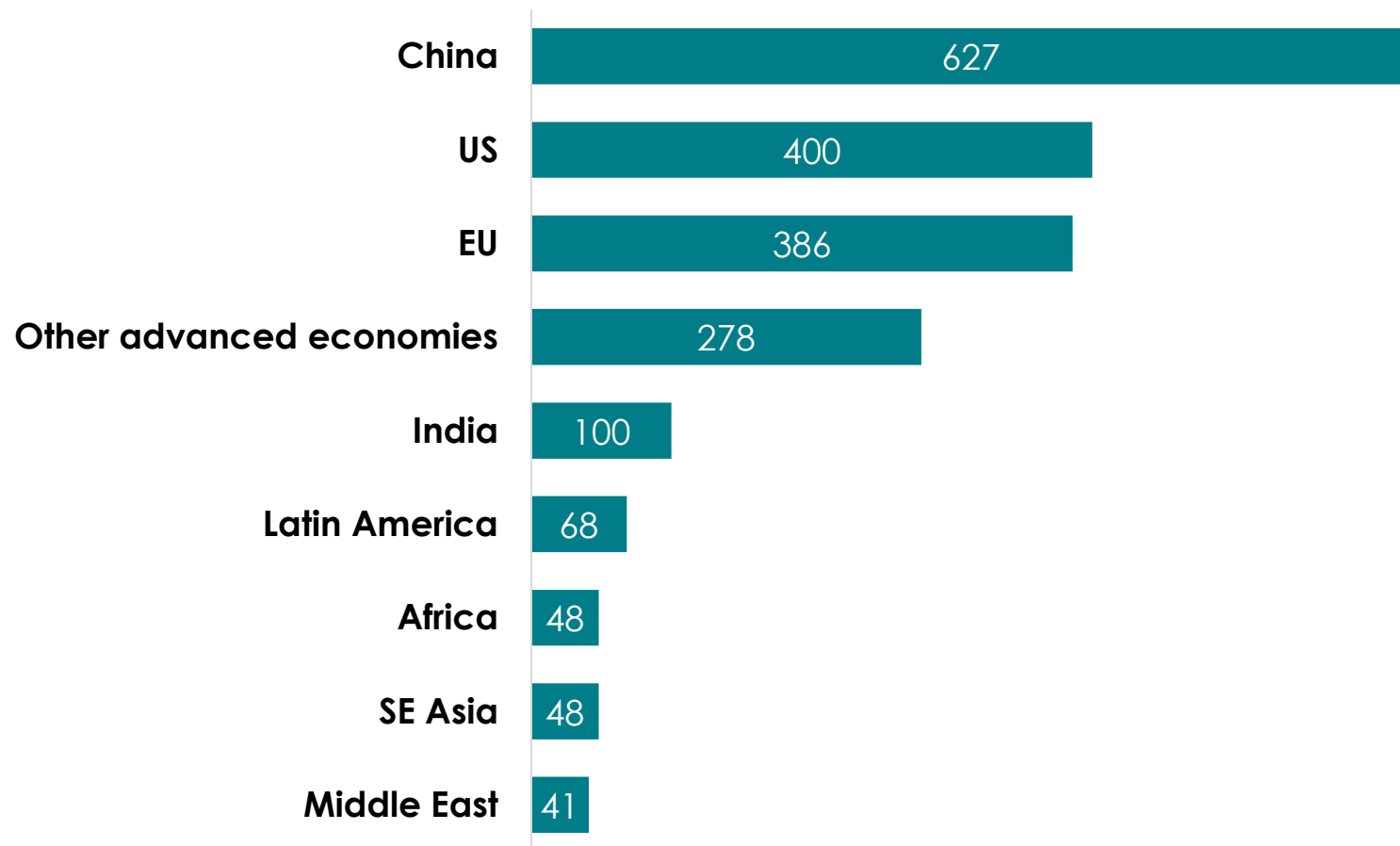
USD billion per annum



Sources: SYSTEMIQ analysis for the ETC (2022); SYSTEMIQ (2021), *Investments for green recovery and transformational growth 2020–30: Technical Note*; IMF (2022), *World Economic Outlook October 2022*.
Note: 2025 GDP projections based on GDP in market exchange rate terms. Total investment is assumed to grow in line with GDP.

Clean energy investment 2025

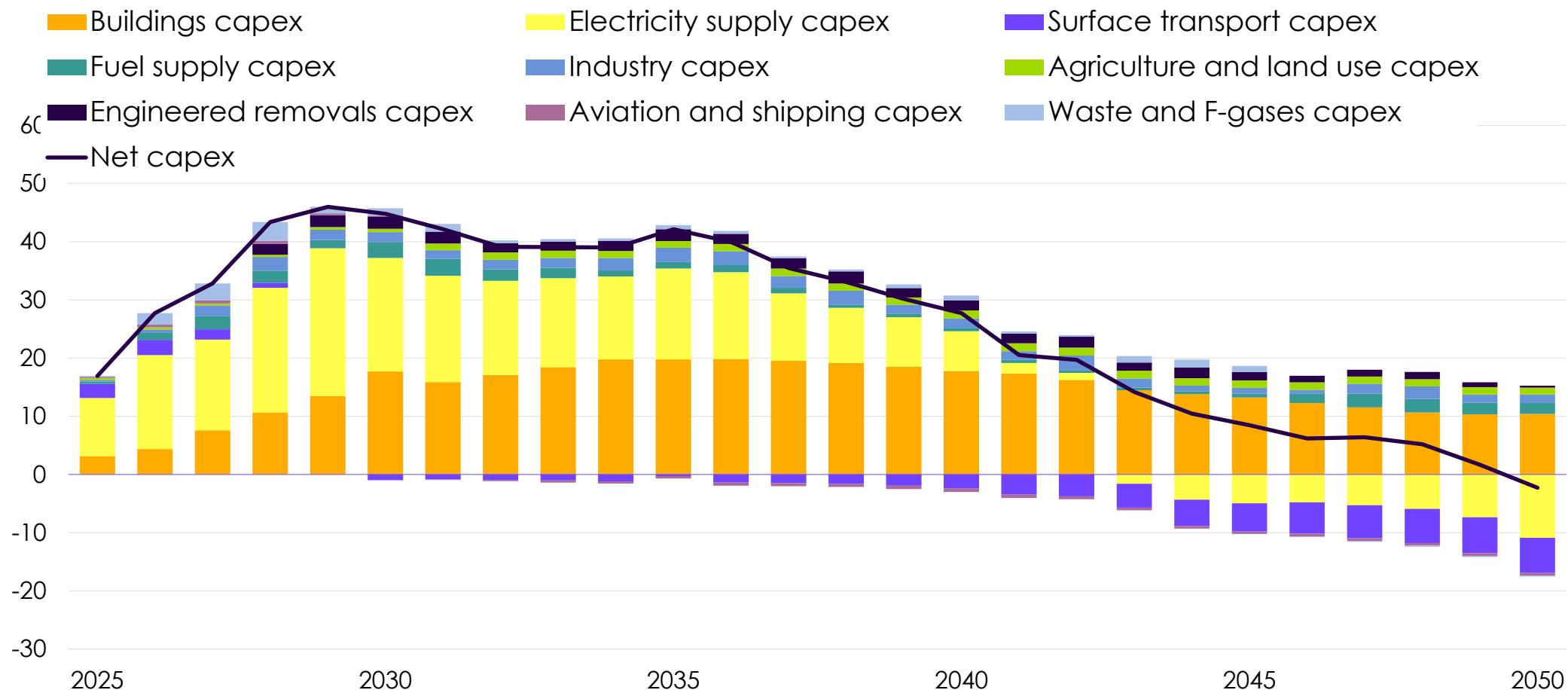
\$bn



Source: IEA, World Energy Investment, 2025, Executive Summary

Additional investment to deliver UK net zero by 2050 commitment

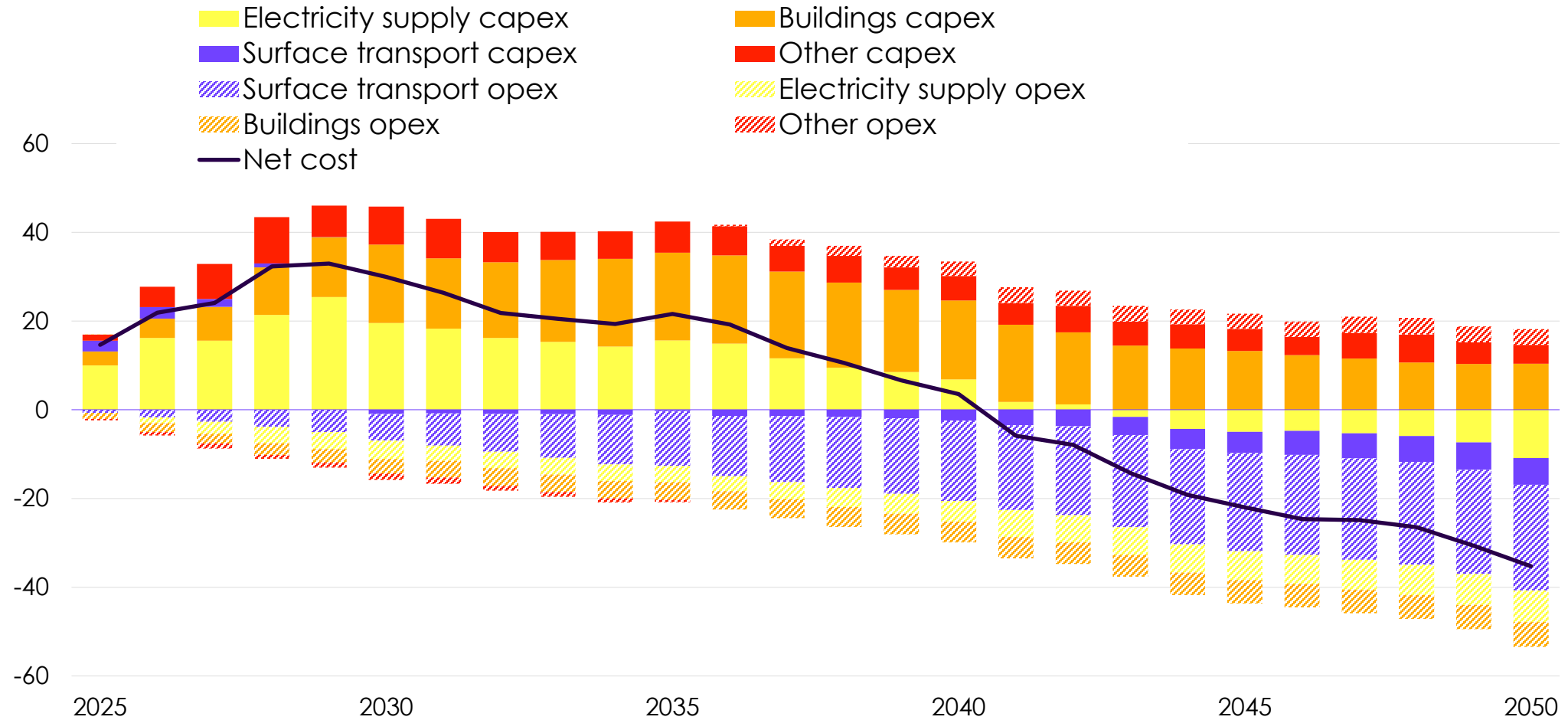
£bn/yr



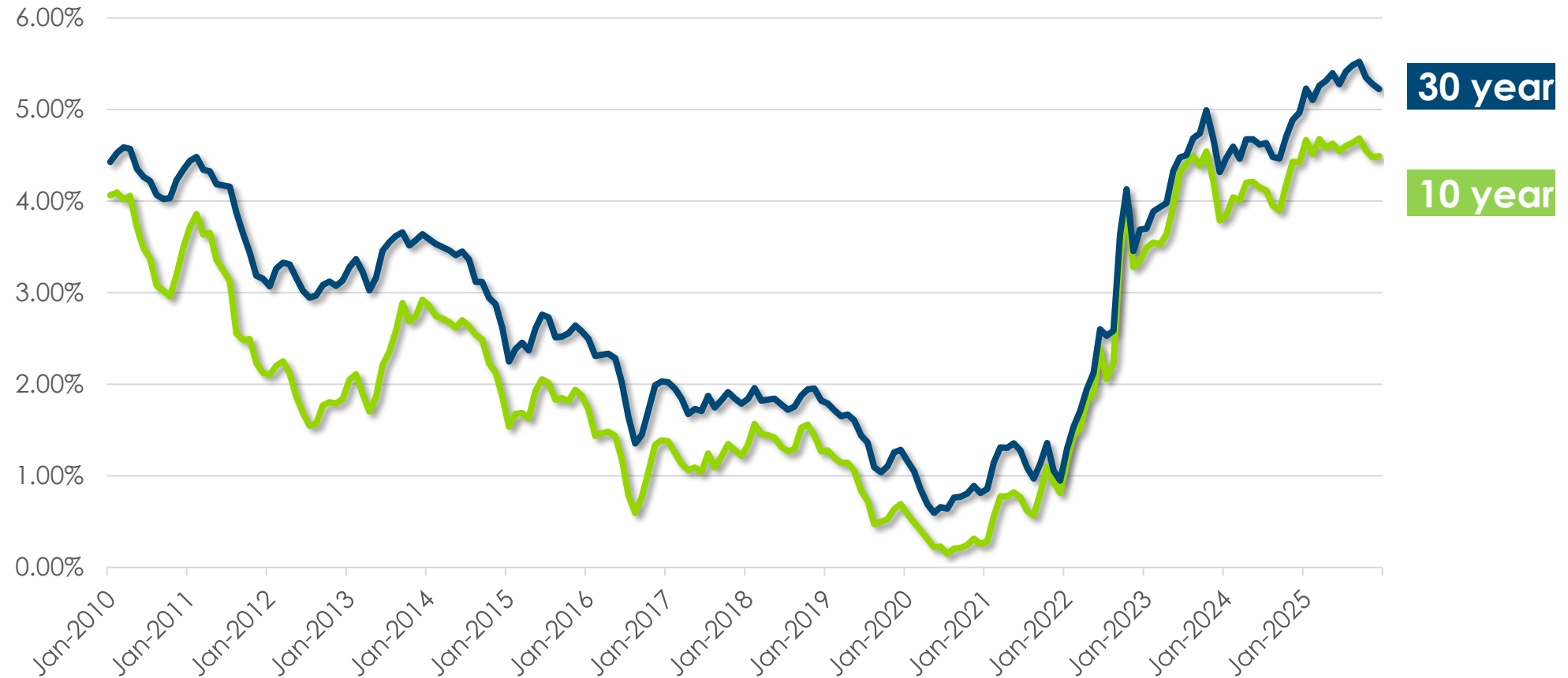
Source: www.theccc.org.uk/wp-content/uploads/2025/02/The-Seventh-Carbon-Budget.pdf

Increased investment vs operating cost savings in UK path to net zero emissions

£bn/yr



UK 30 and 10 years gilt yields 2010 – 2026



Source: <https://www.dmo.gov.uk/data>

Rising prices at UK offshore auctions

£ per MWH, 2024 prices

**AR 4
2022**

**11 GW awarded
@ £37.5 per MWH
(2012 prices)**

52

**AR 7
2026**

**8.4 GW awarded
@91.2 per MWH**

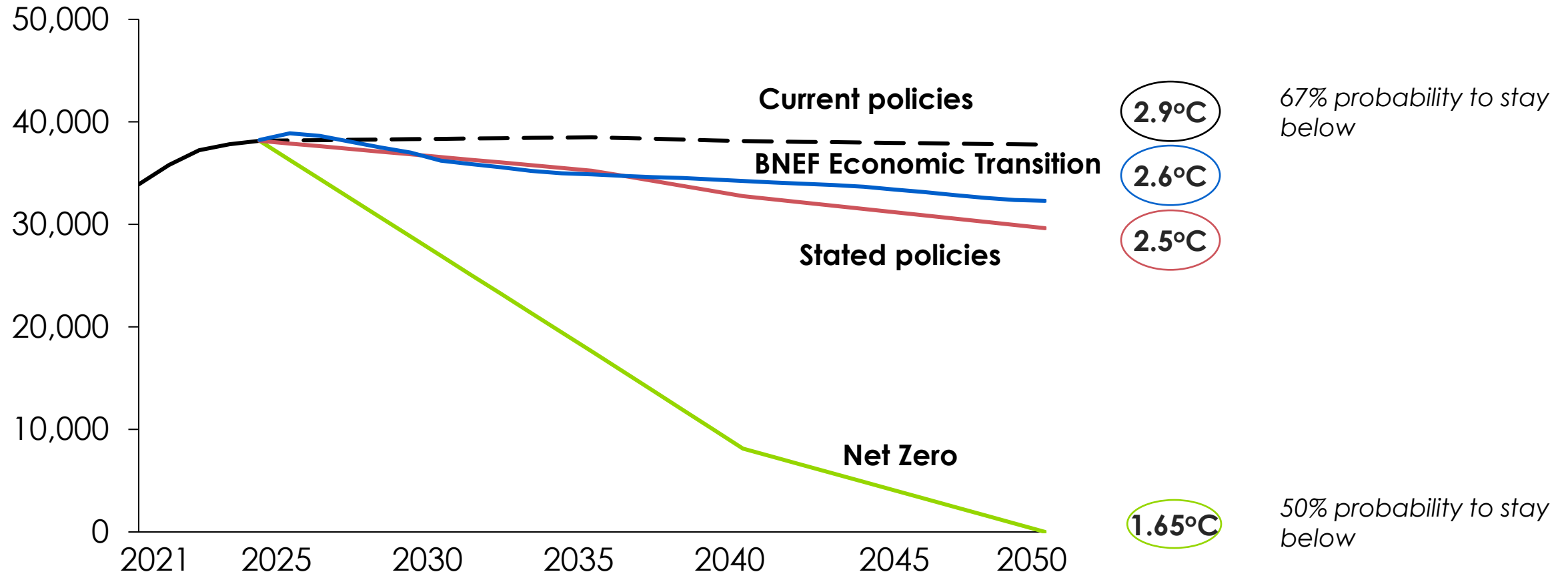
91.2



Source: UK Government (Department for Energy Security & Net Zero, <https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation>)

IEA and BNEF emission scenarios 2024 and implied peak temperature

Energy-related Mt CO₂

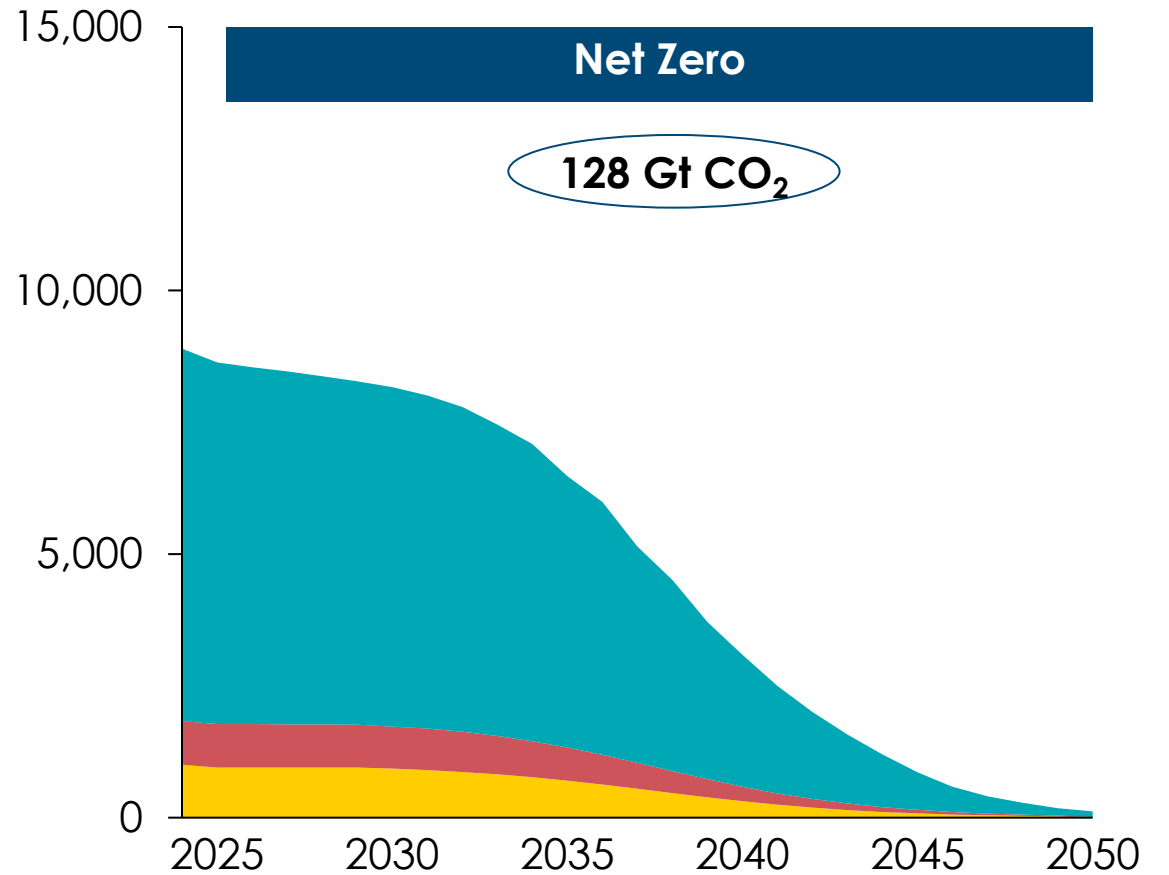
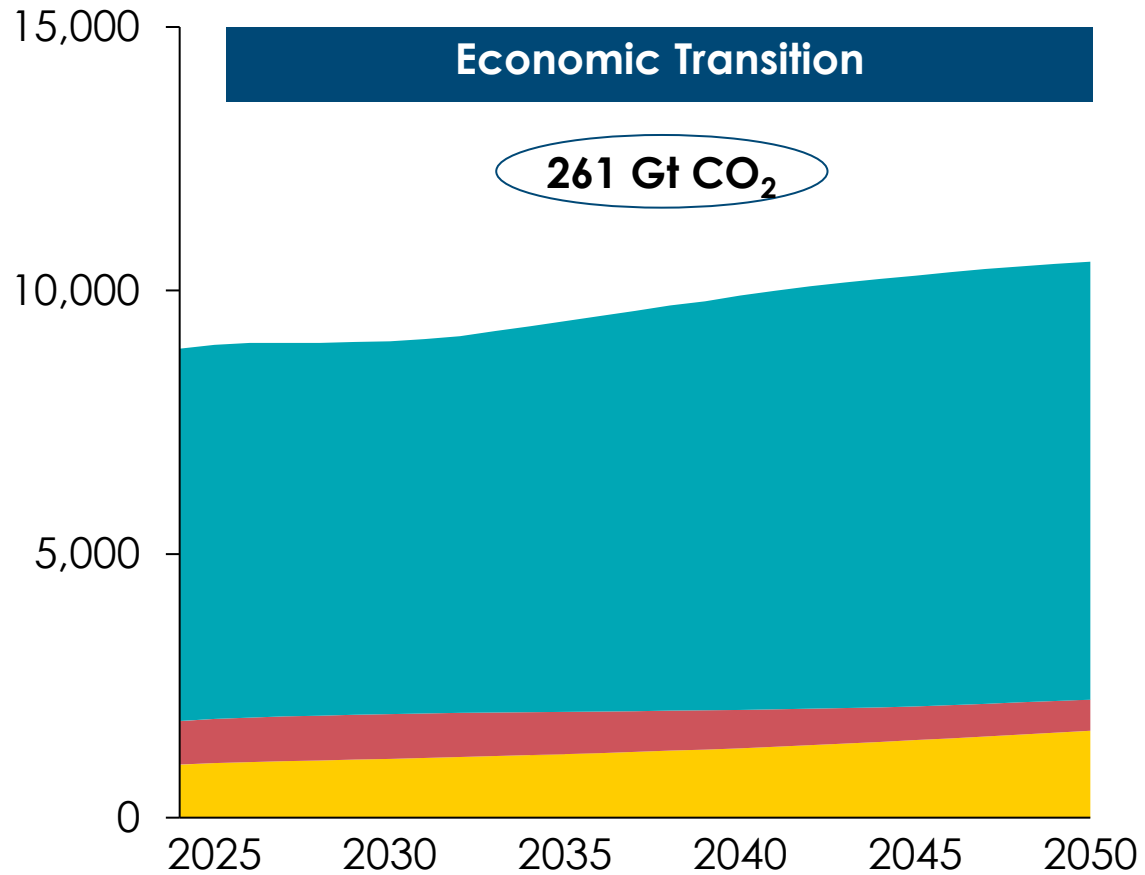


Source: IEA (2021) Net Zero by 2050; BNEF New Energy Outlook 2025
Note: IEA Scenarios have emissions interpolated between 5-10 years;

Emissions from energy-intensive industries, BNEF Scenarios

Mt CO₂

Heavy-industry Shipping Aviation

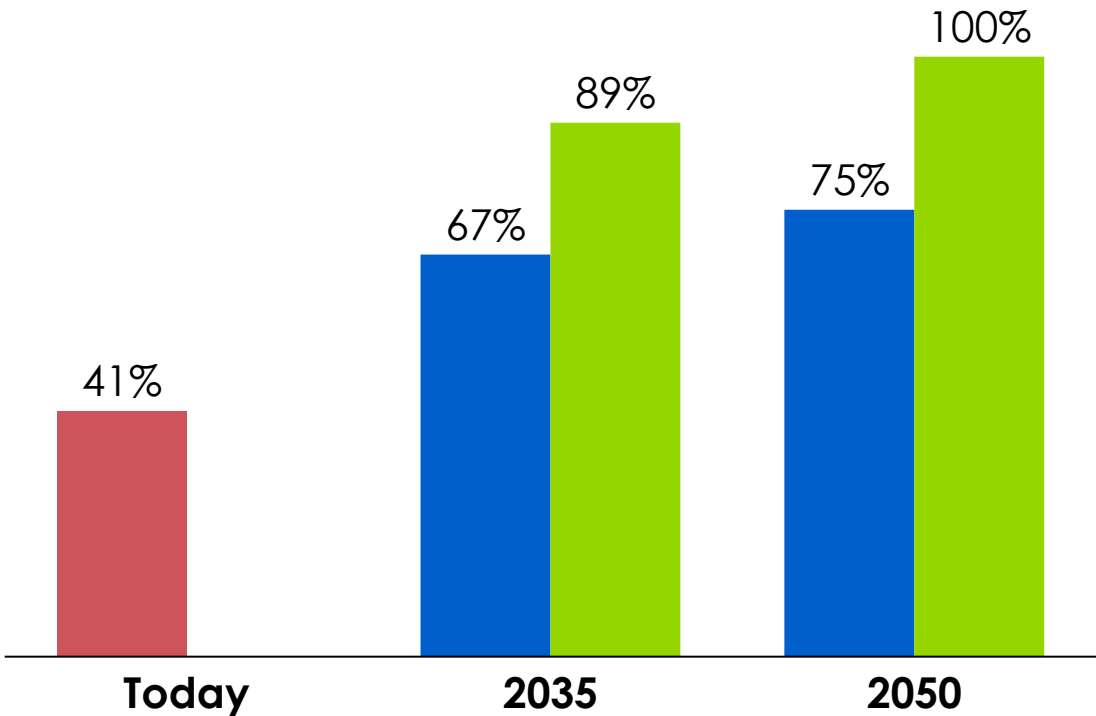


Source: BNEF New Energy Outlook 2025 – ETS Scenario

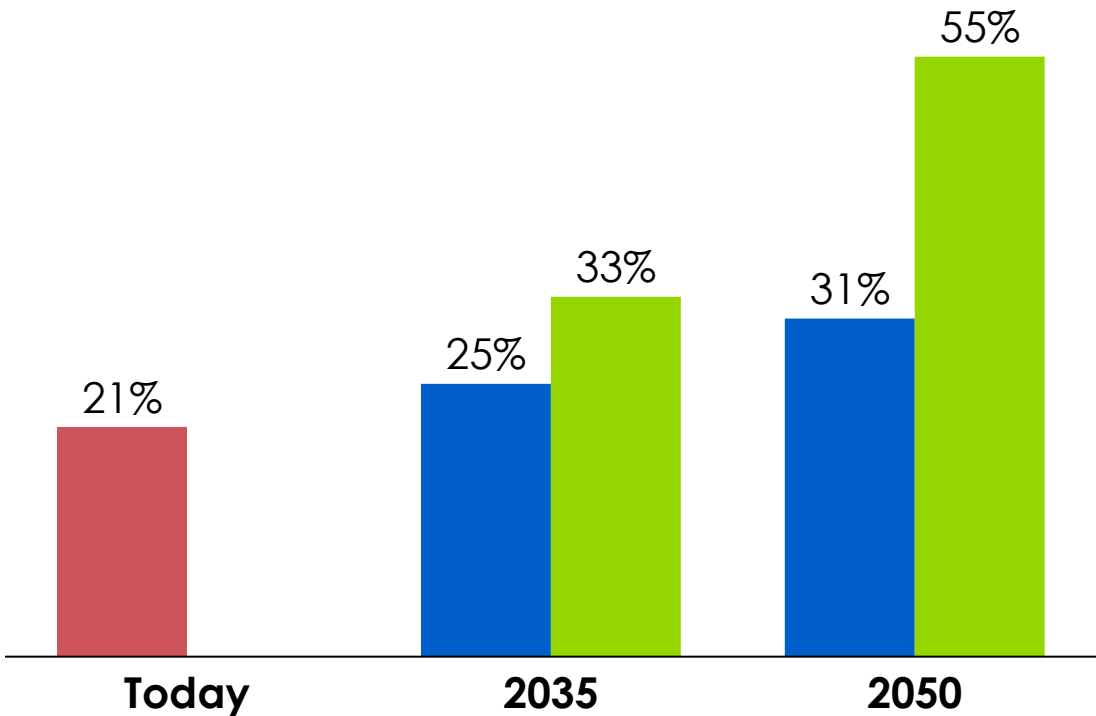
Electrification and clean generation

■ BNEF Economic Transition ■ IEA Net Zero

Clean Generation as share of Electricity Supply



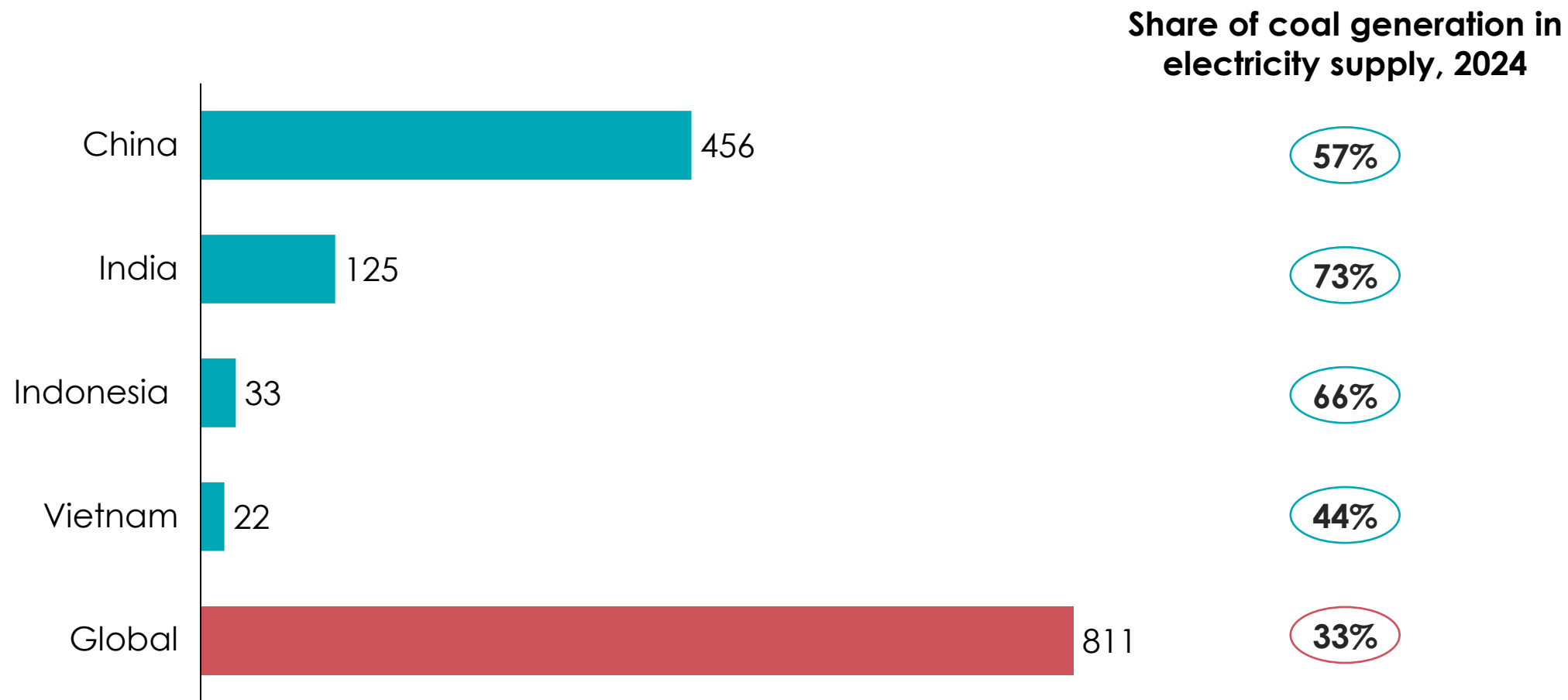
Electricity as share of Energy Demand



Note: Clean generation includes nuclear and abated fossil fuel
Source: BNEF New Energy Outlook 2025 – ETS Scenario

Added coal capacity 2014-2024

GW

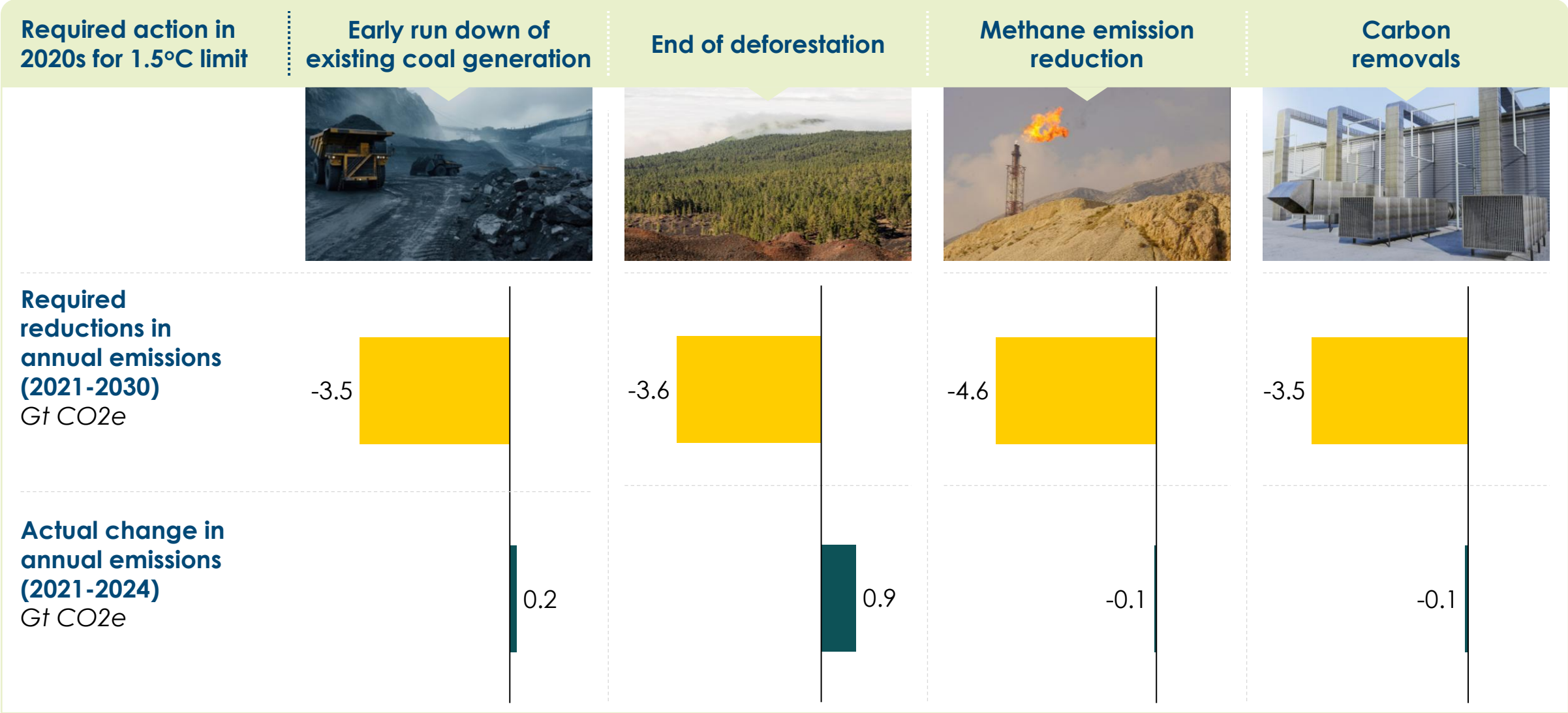


Source: BNEF New Energy Outlook 2025 – ETS Scenario

Cost of early coal phase out: illustration

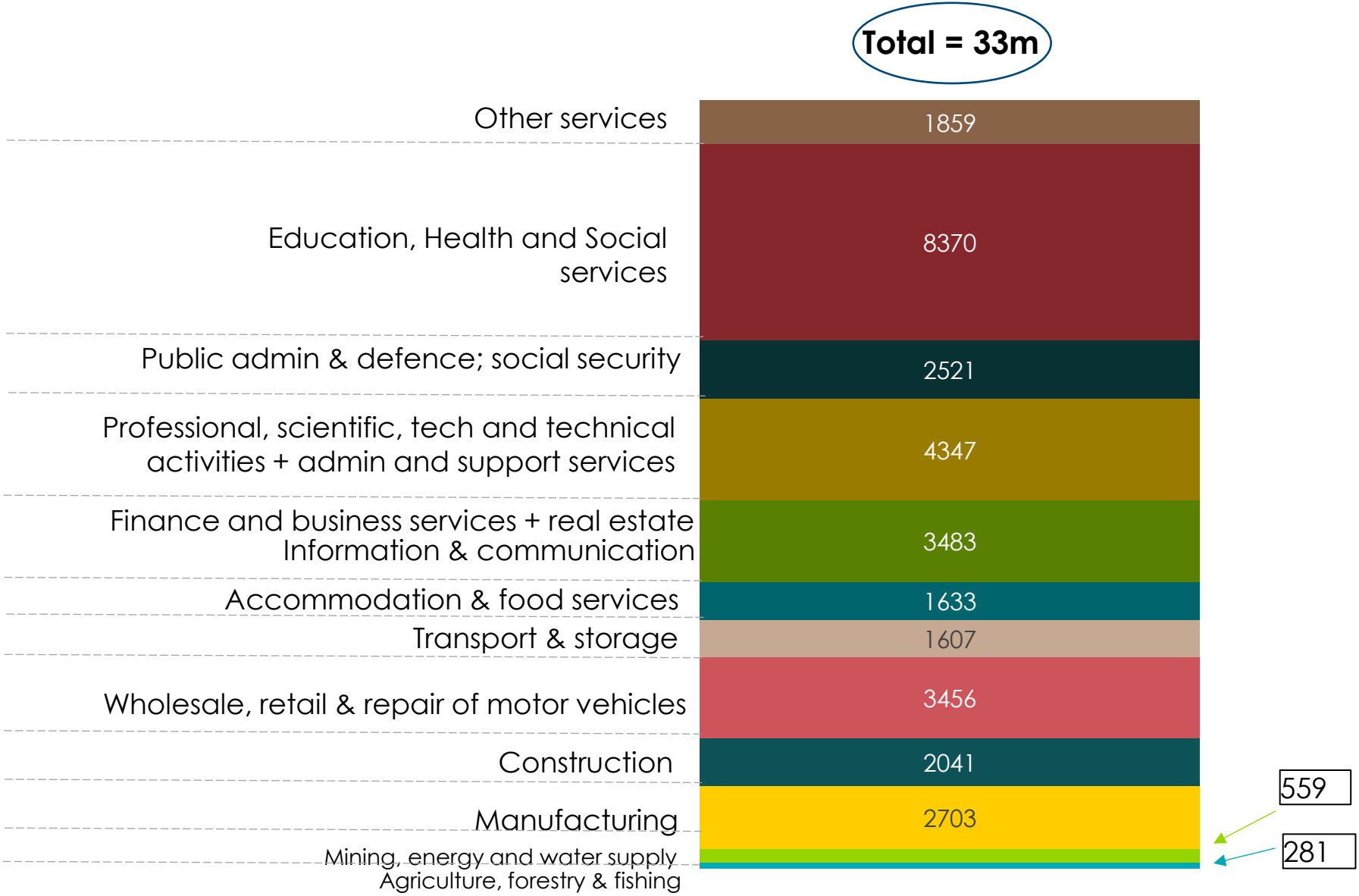


4 big misses in the 2020s



Notes: Methane emissions expectations only account for NDCs and Global Methane Pledges commitments; MSCI CDR credit volume calculated by multiplying projected market size (\$) by ETC average cost of carbon removal in each year (\$/tCO₂). Source: ETC (2021) Assessing the commitments from COP26; ETC(2021) Keeping 1.5oC Alive; WRI (2025) Deforestation and Restoration Targets Tracker (Beta); IEA (2025) world Energy Outlook; MSCI Carbon Markets (2025), [Frozen Carbon Credit Market May Thaw as 2030 Gets Closer](#); Crippa M., Guizzardi D., Pagani F., Banja M., Muntean M. et al., GHG emissions of all world countries - 2025 Report, Publications Office of the European Union, Luxembourg, 2025, doi:10.2760/9816914, JRC143227; Global Forest Watch [Accessed Nov 2025].

UK employment by industry, April – June 2024

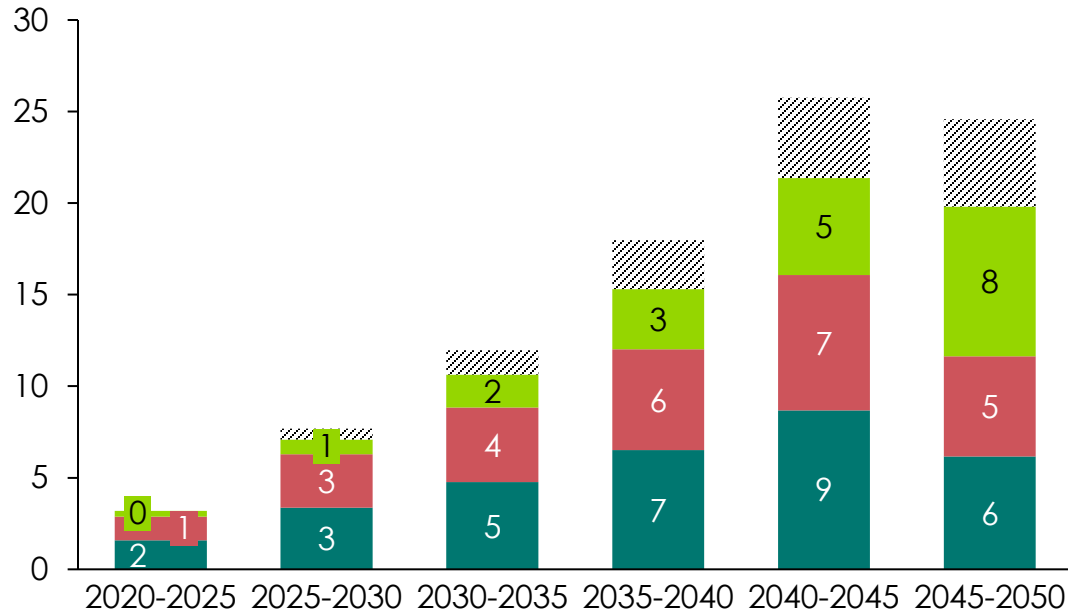


Making solar panels



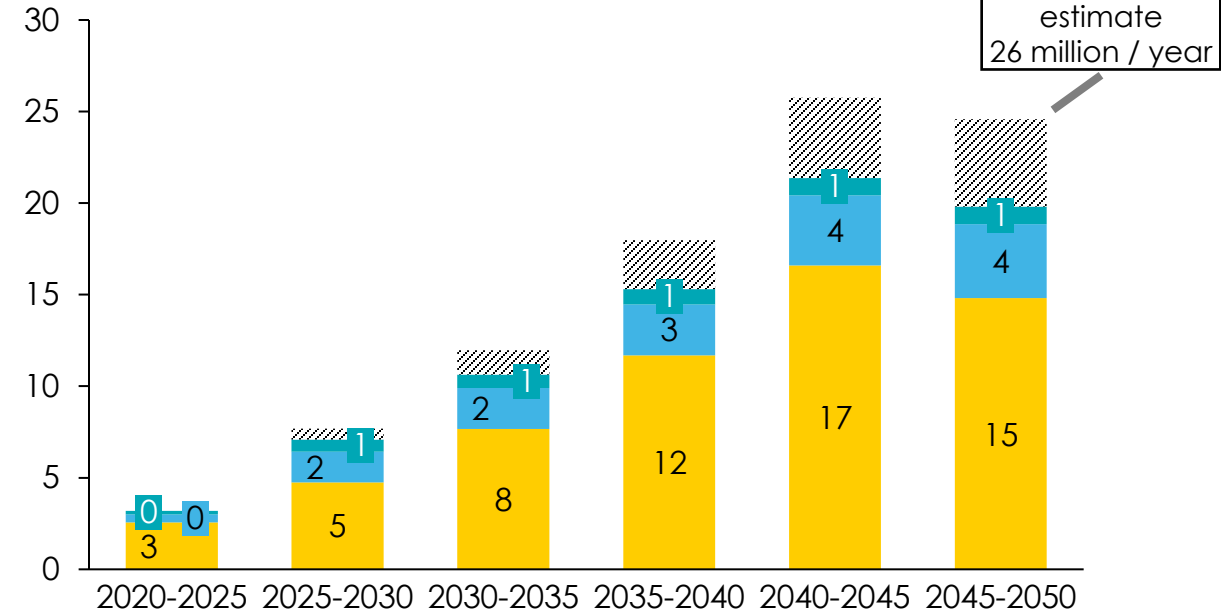
Employment creation in renewable power

Jobs by type Millions



- Total before productivity improvement
- Operations & Maintenance
- Installation
- Manufacturing

Jobs by technology Millions



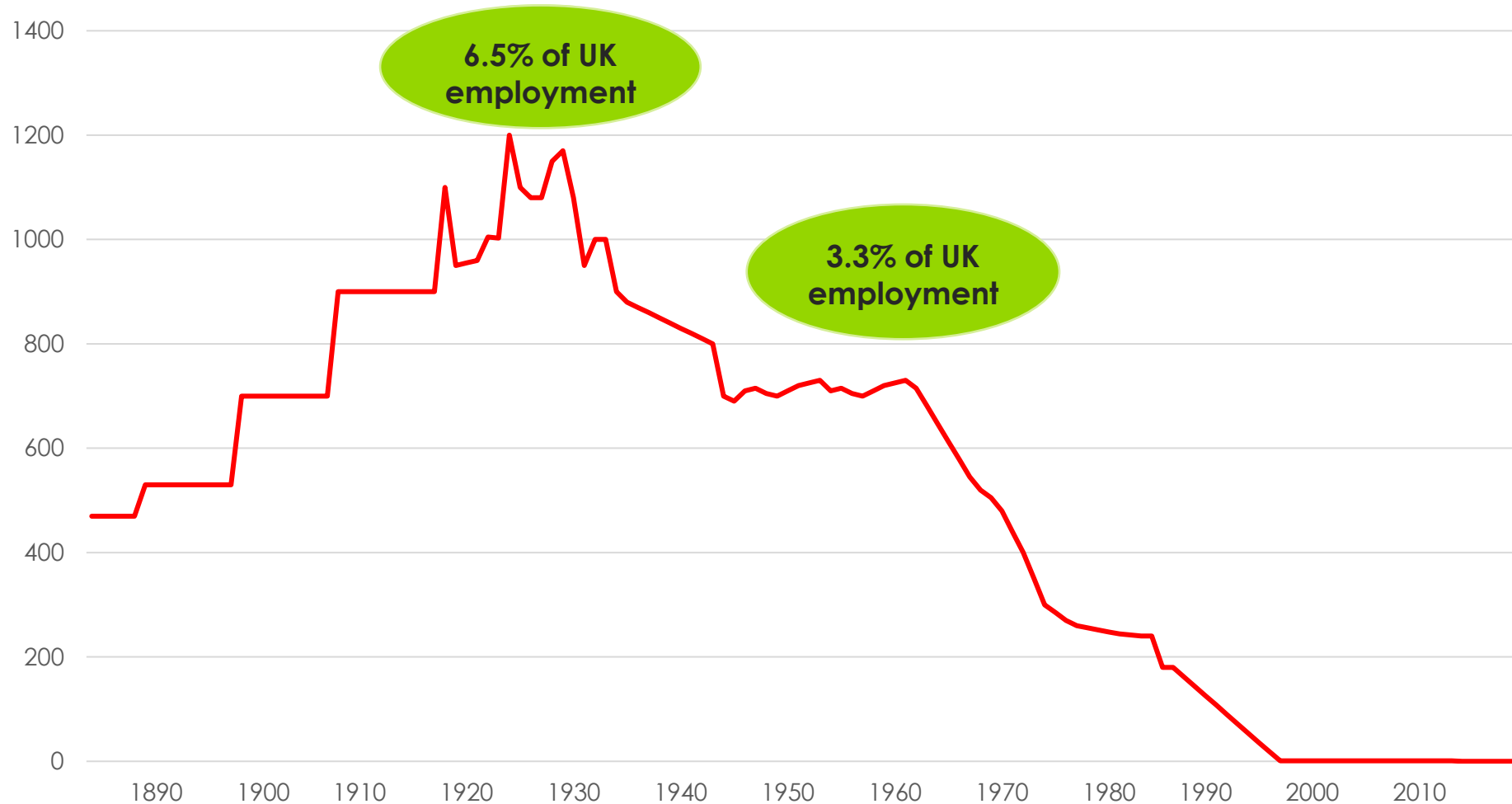
- Total before productivity improvement
- Offshore wind
- Onshore wind
- Solar



Source: ETC (2021), *Making Clean Electrification Possible*.

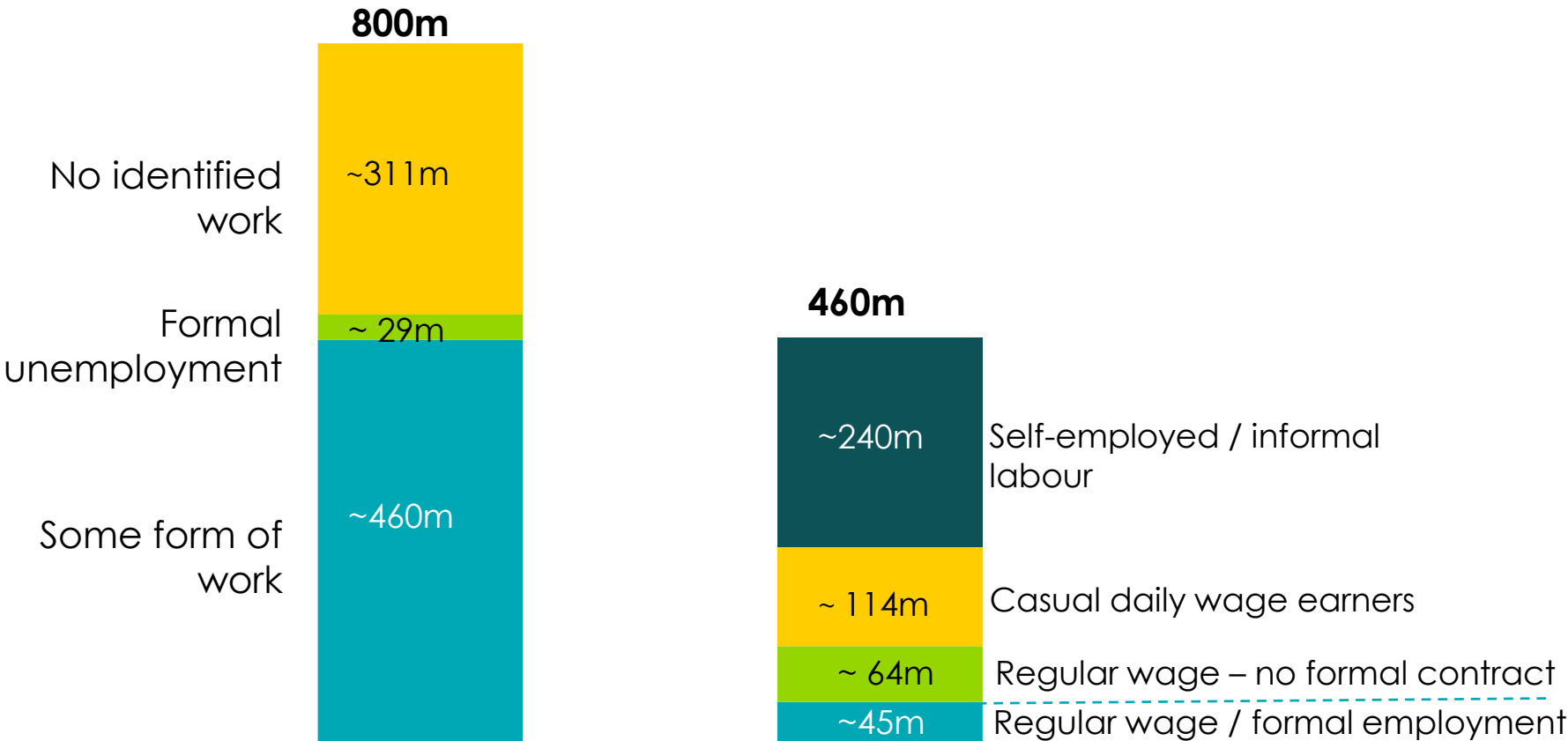
UK employment in coal mining 1880-2010

Thousands of jobs



India's job creation challenge

Working age population (2019)

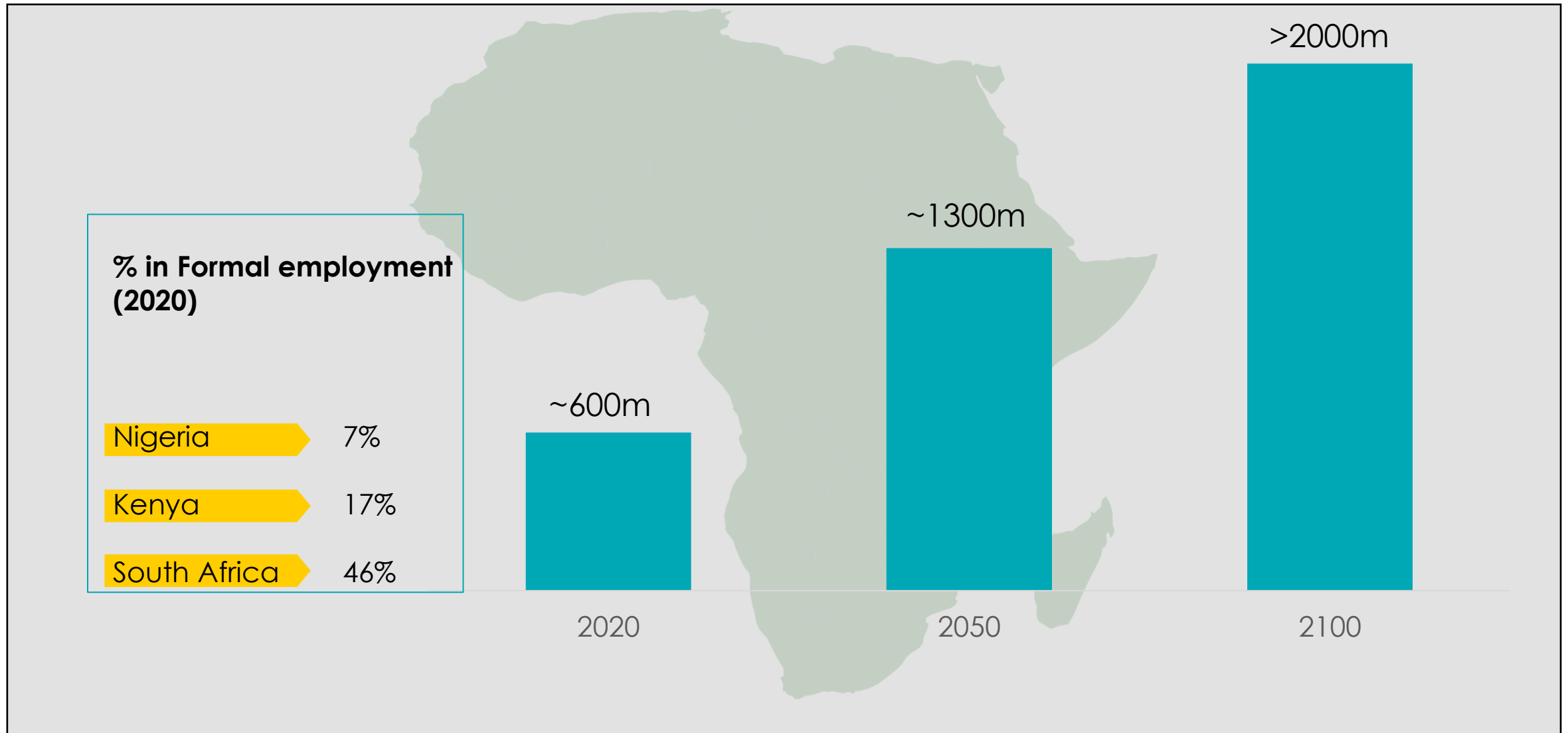


Change from 2012-2019
• GDP + 58% (6.7% per annum)
• Working age population + 130m
• Identifiable employment + 2m

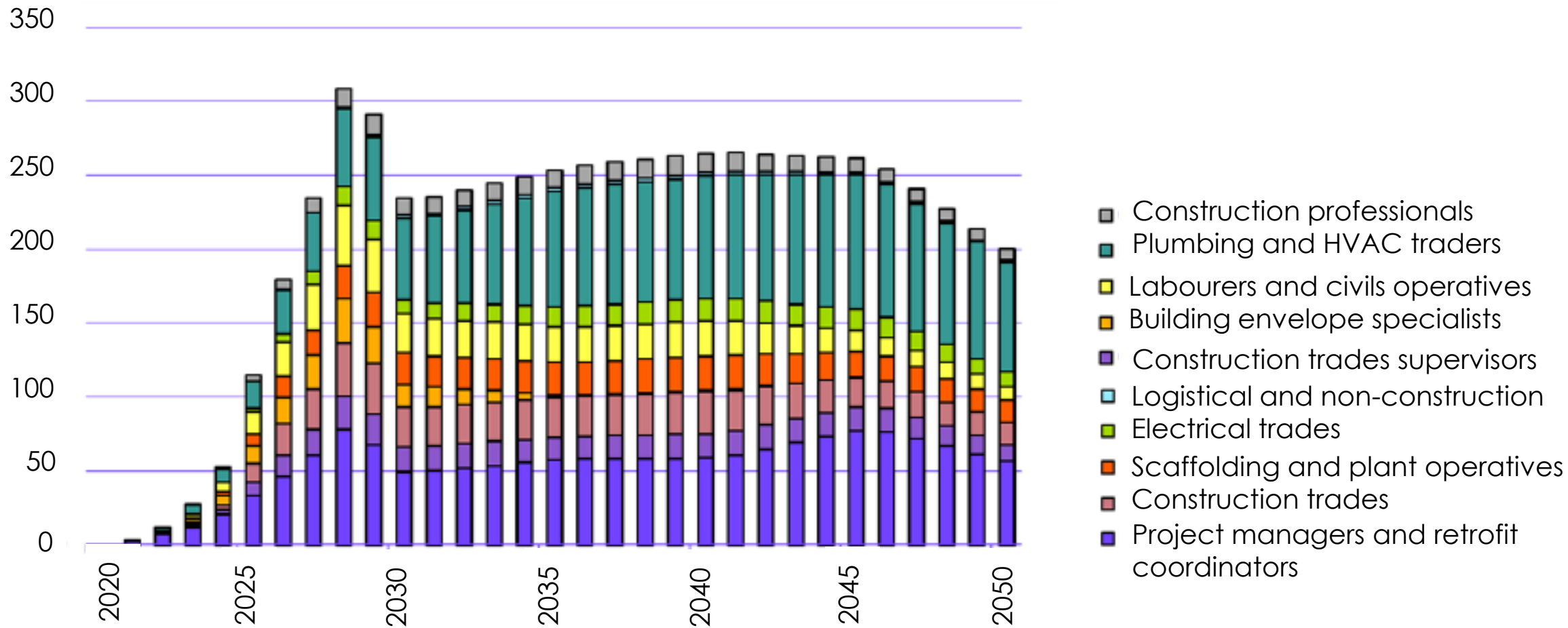


Source: The State of Working India, Centre for Sustainable Employment, Azim Premji University

Africa working age population



Additional full-time equivalent jobs above 2019 levels



Source: UK's Climate Change Committee – The Sixth Carbon Budget, December 2020



Total system costs (generation, balancing, and grids), recent vs post-2050

\$/MWh (real 2024\$)

■ Average wholesale power prices ■ Balancing costs ■ Wind/solar ■ T&D costs



India



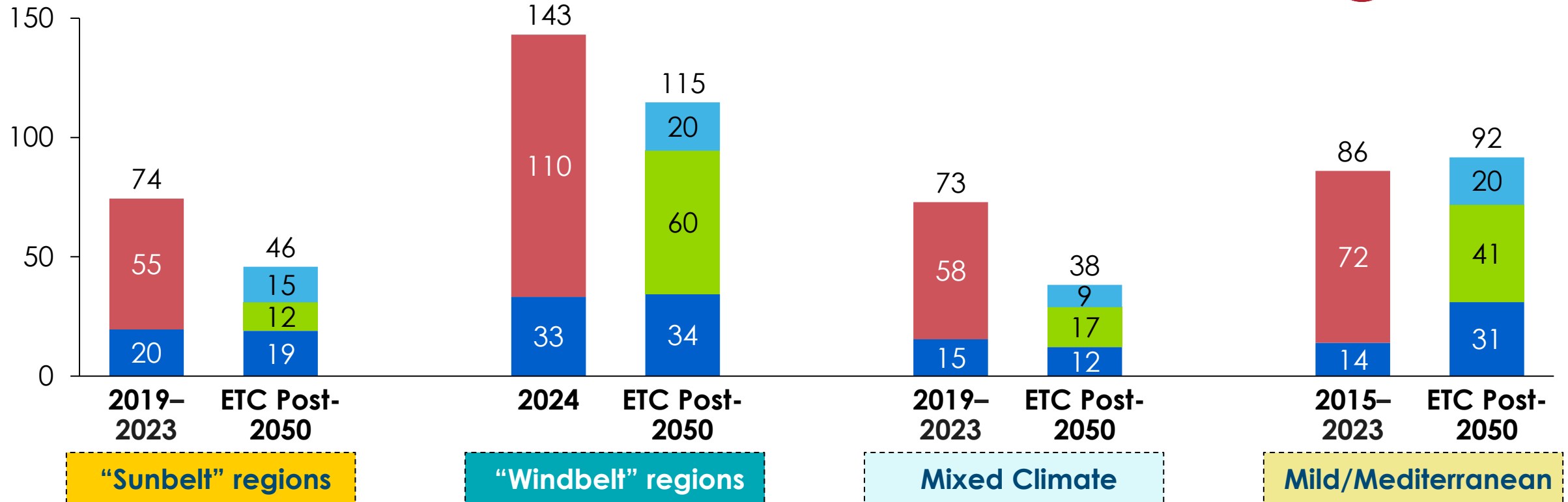
UK



China



Spain

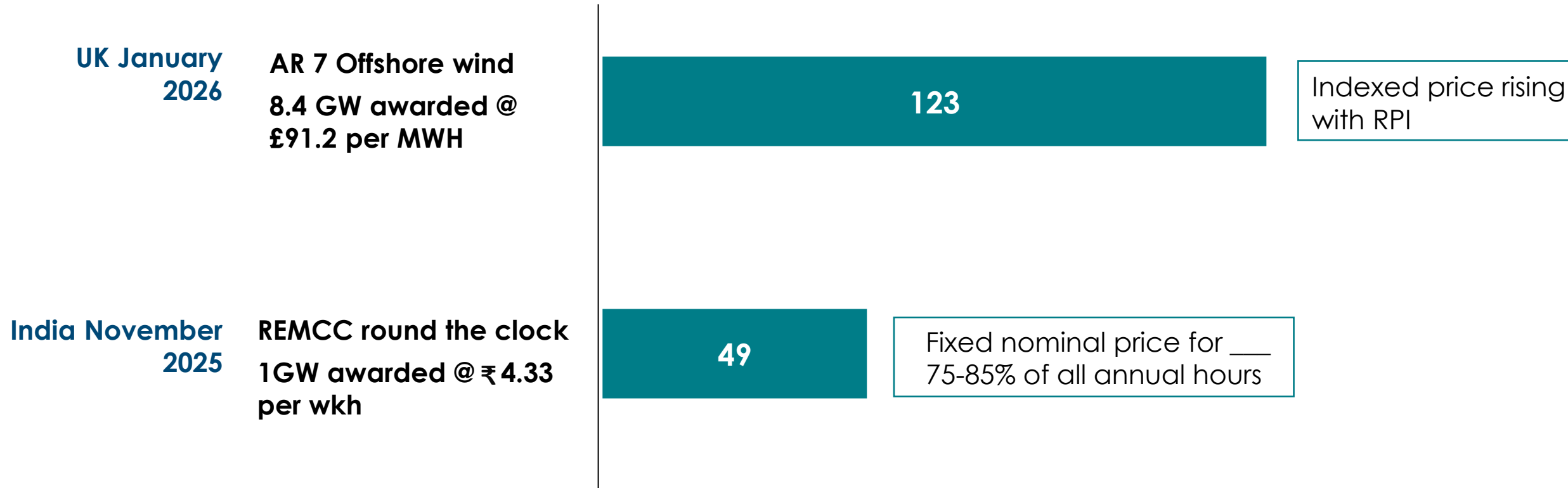


Note: T&D = Transmission and distribution.

Source: ETC (2025) Power Systems Transformation: Delivering Competitive, Resilient Electricity in High-Renewable Systems

Clean power auctions in UK and India

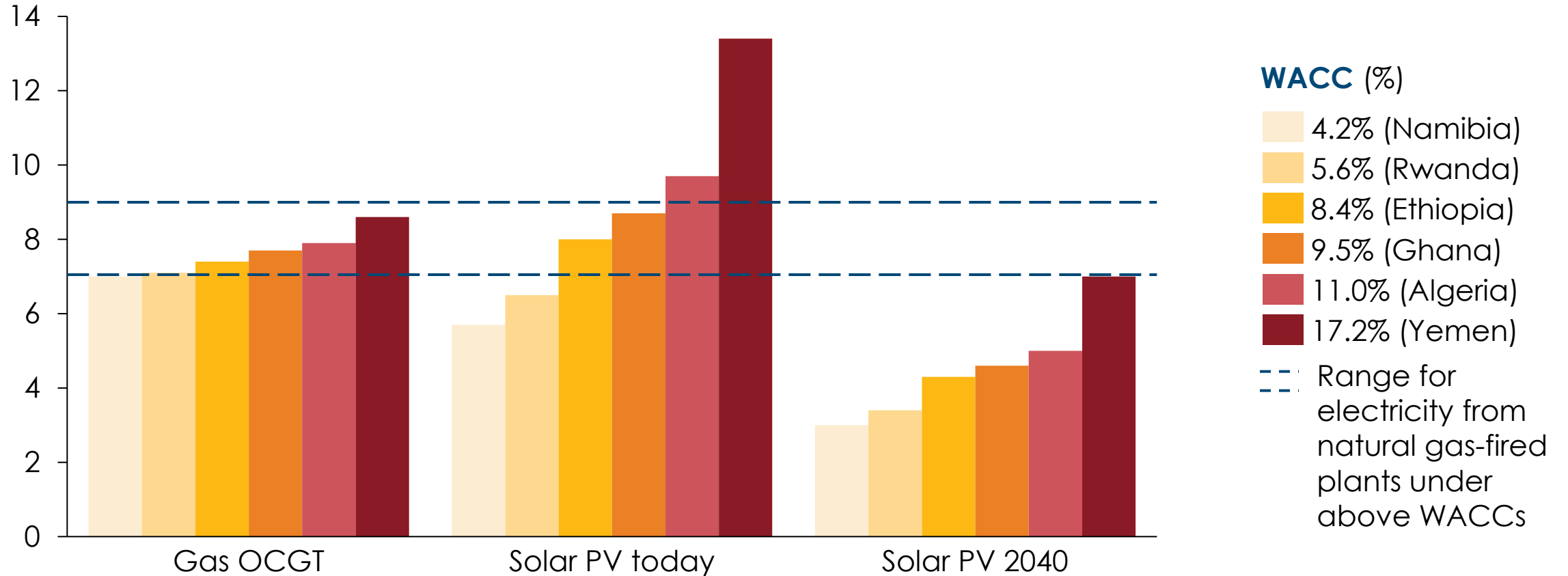
\$ per MWH price



Source <https://www.mercomindia.com/ayana-renew-acme-among-winners-of-remcls-1-gw-rtc-renewable-power-auction> <https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-7-results>

Levelized cost of energy

USD ct/KWh

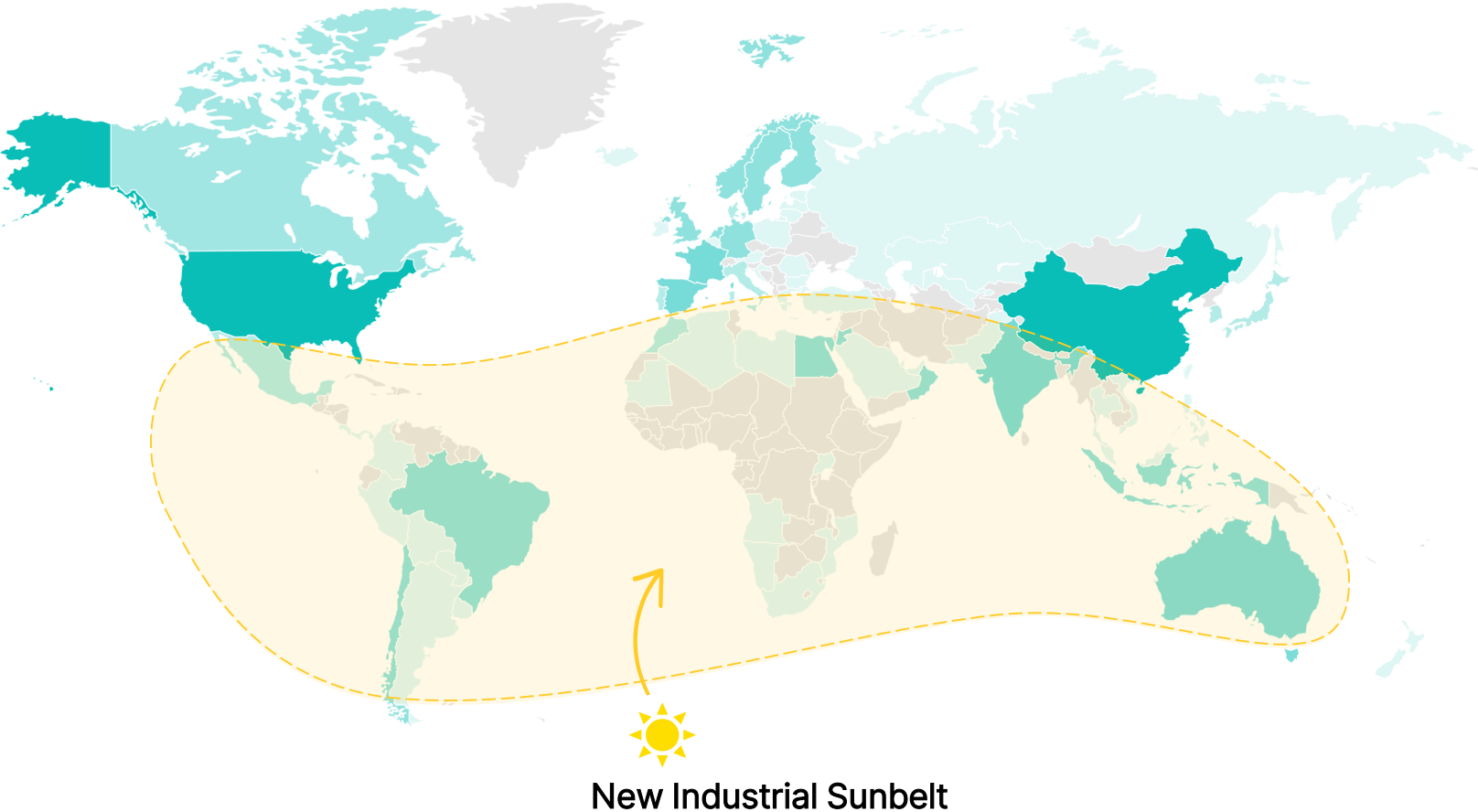


Sources: All values on CAPEX, OPEX, and fuel costs are taken from IRENA (2021b) and expressed in 2015 U.S. dollars; we used the 2015 fuel costs for natural gas from the same source. Other assumptions included a 35-year lifetime for OCGT plants and a 30-year lifetime for solar PV (Oyewo et al. 2022), a 40% efficiency and 50% average capacity factor for OCGT plants, and a 19% average capacity factor for solar PV plants. (The CF of solar PV differs from country to country, although typically by a few percentage points at most [Sterl et al. 2022]). The WACC values represent the real (inflation-adjusted) 2021 numbers for solar PV on a country-by-country level, and are taken from IRENA (2023b).













Clean industrial projects by location

<10  >90 Announced projects per country, 30th April 2025



Total and announced projects Top 20 countries, by total project count

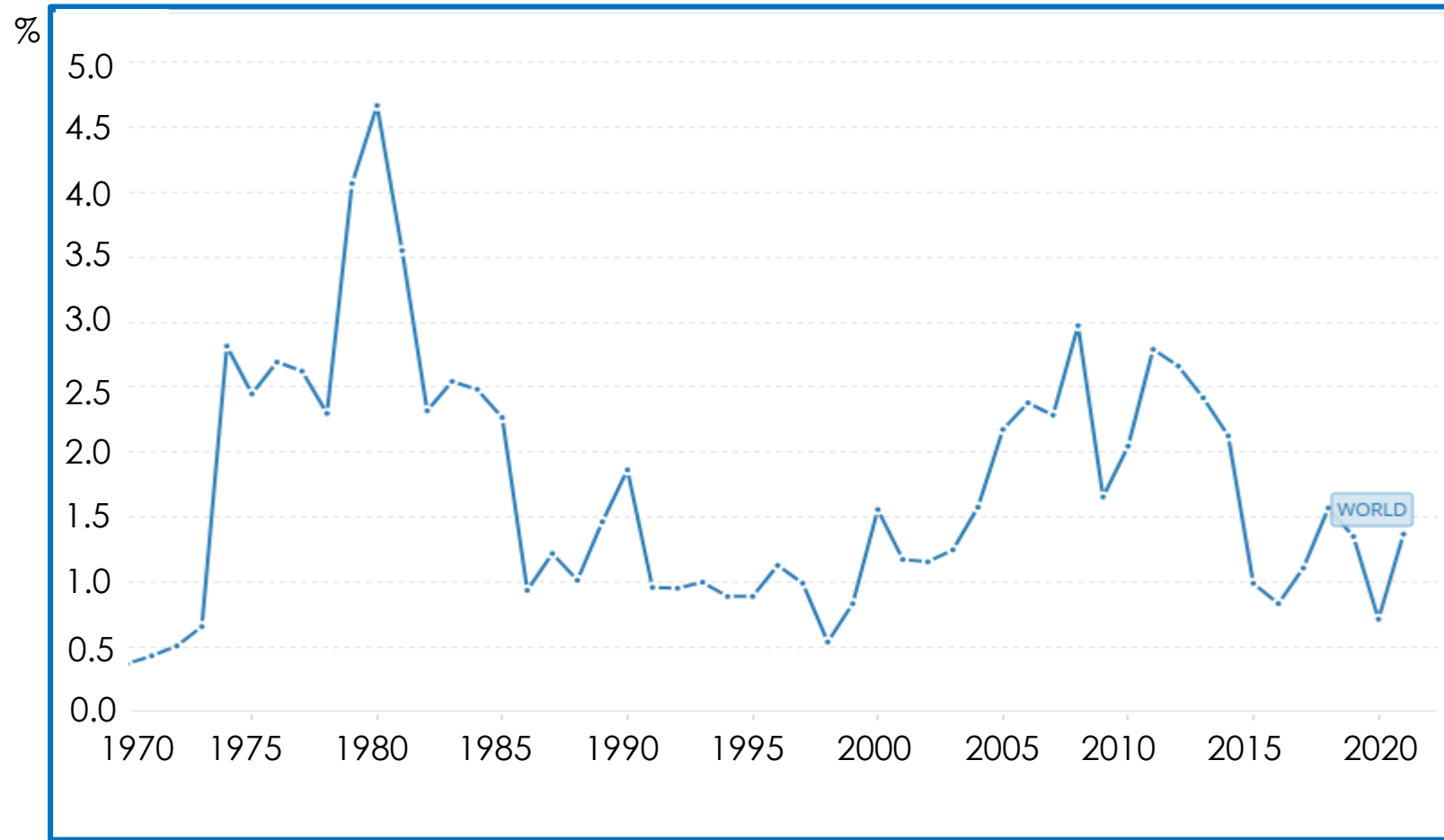
-  EMDE country in the new industrial sunbelt
-  Non-EMDE country in the new industrial sunbelt

Country	Announced	Total*
China	96	142
United States	92	108
 Australia	46	48
 India	36	41
Canada	25	39
France	34	36
Spain	28	32
Norway	19	27
 Egypt	25	25
 Brazil	19	23
Sweden	19	22
Germany	18	21
 Chile	21	21
 Oman	15	17
 Jordan	14	14
Netherlands	11	13
Finland	11	13
United Kingdom	13	13
 Indonesia	11	12
Mexico	9	9

Includes projects that are at the announced, reached final investment decision (FID) and operational

Source: <https://www.missionpossiblepartnership.org/tracker-insights/jun-25/>

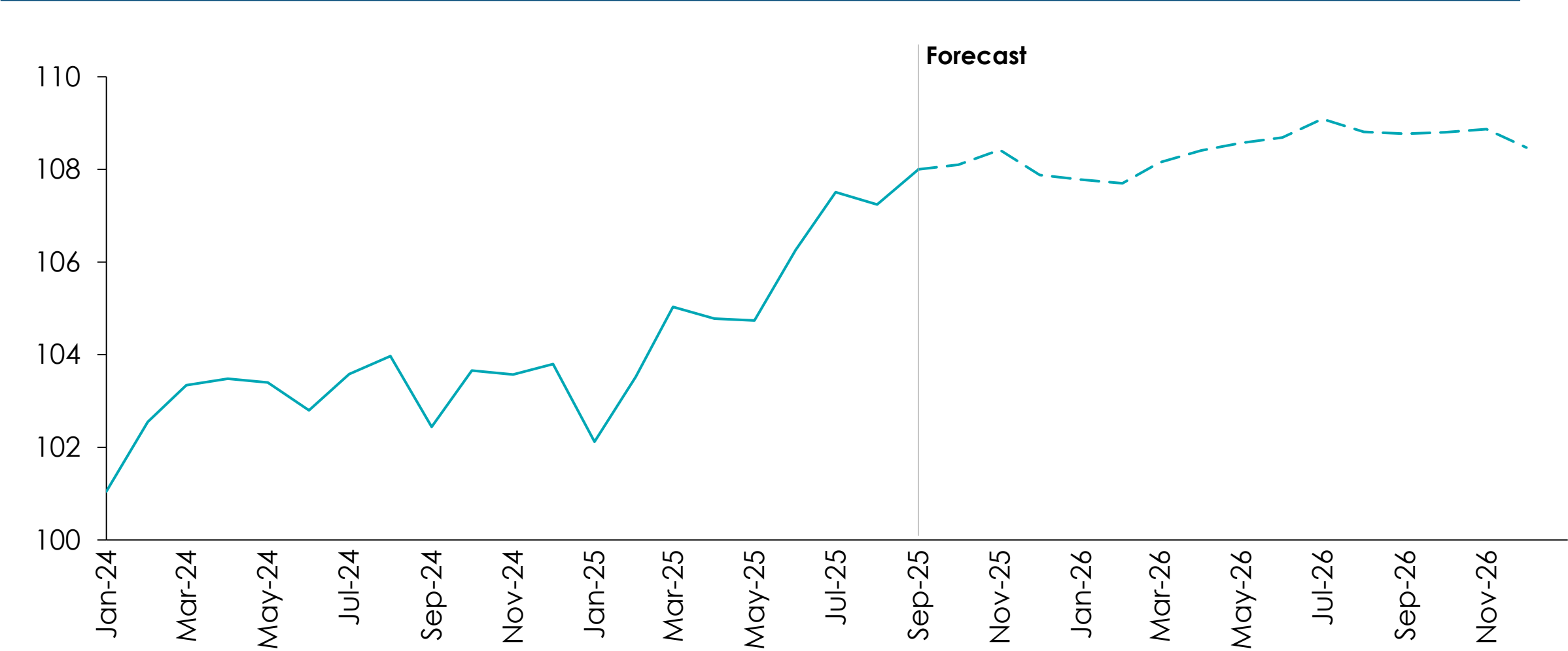
Oil supply economic rents as % of global GDP



Source: <https://data.worldbank.org/indicator/NY.GDP.PETR.RT.ZS>

Global oil supply, 2024-2026

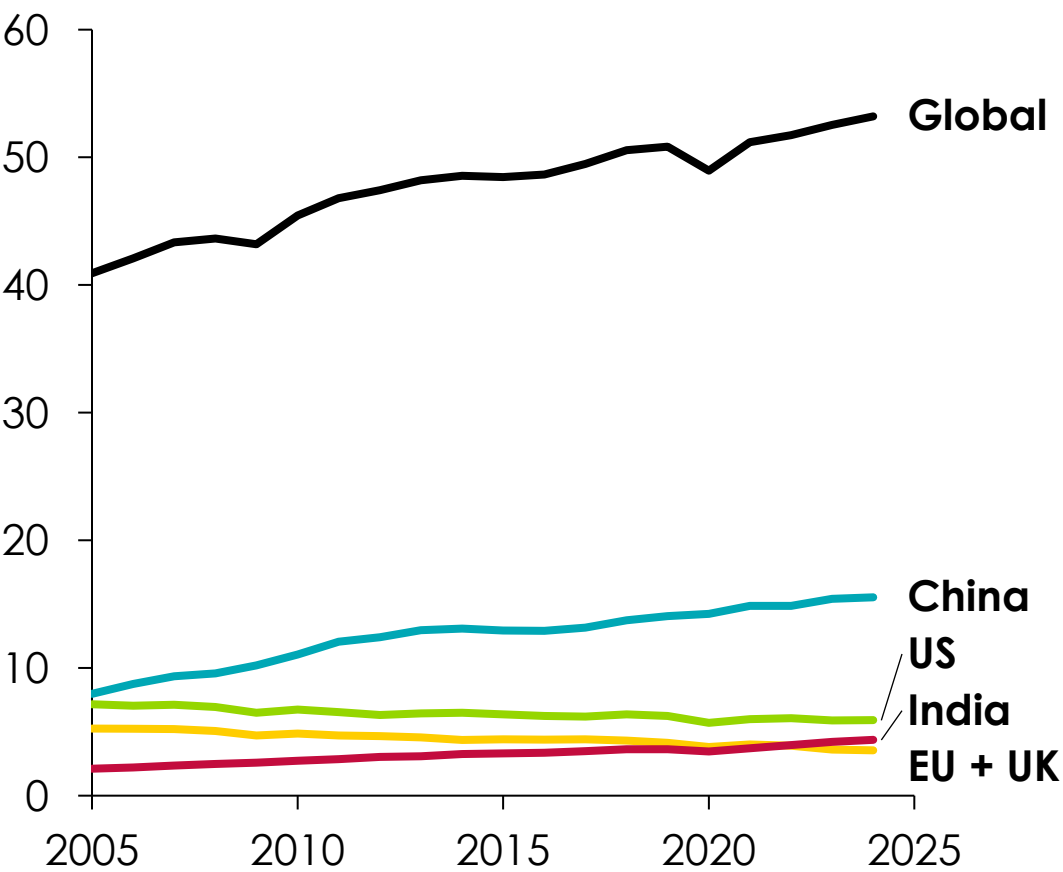
mb/d



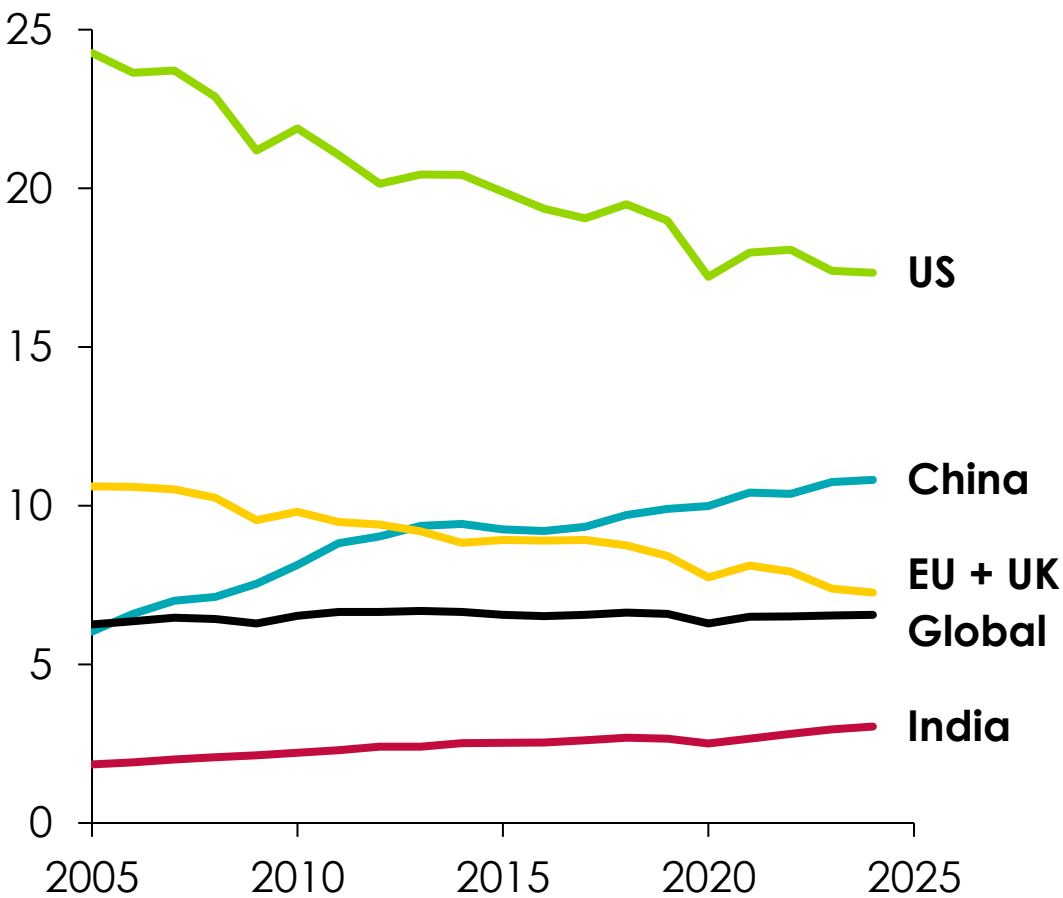
Source: IEA (2025) As oil market surplus keeps rising, something's got to give

Greenhouse gas (GHG) emissions by country

GHG Emissions Gt CO_{2eq}



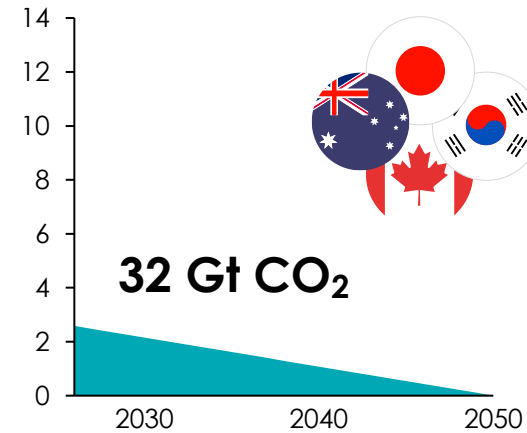
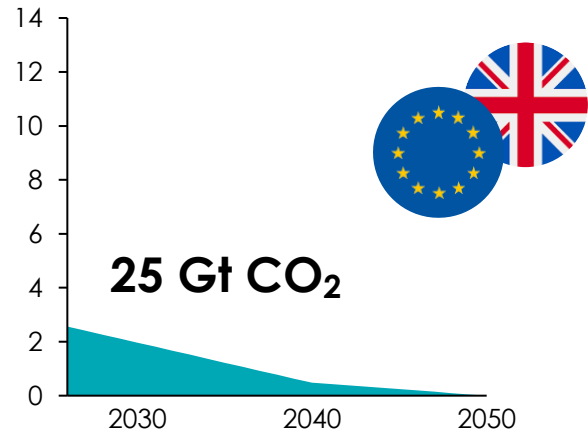
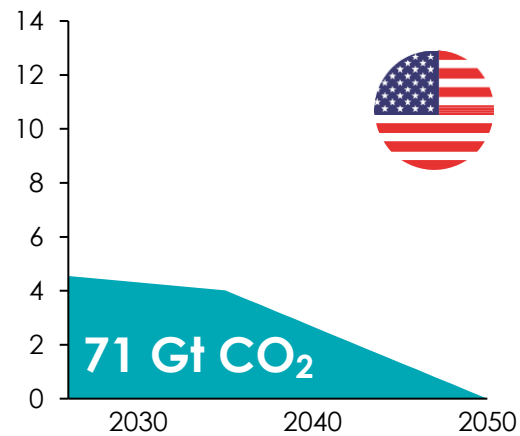
Emissions per capita (tCO_{2eq}/cap/y)



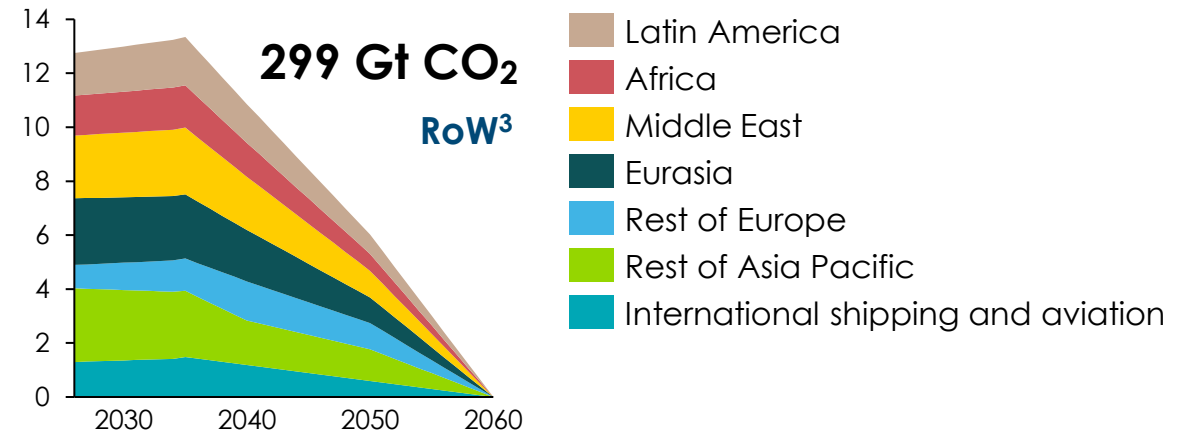
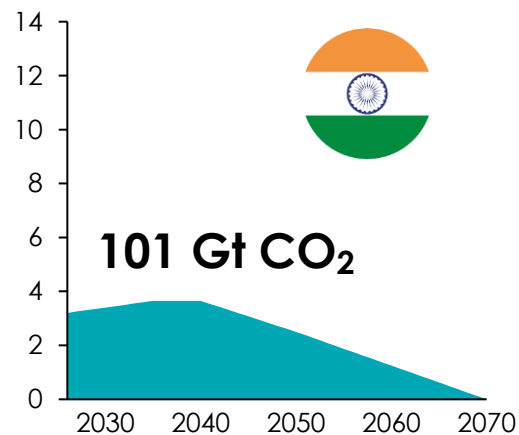
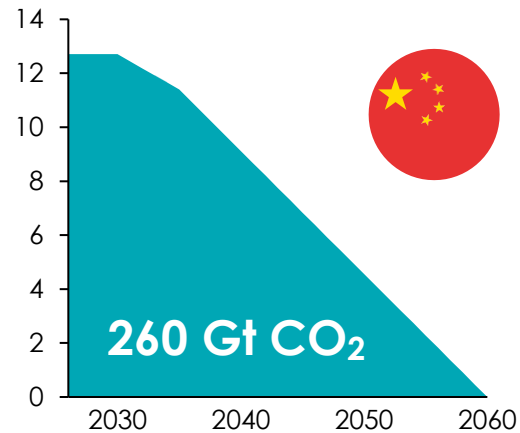
Source: EDGAR

Cumulative future energy related emissions implied by current NDCs and pledges

Gt CO₂

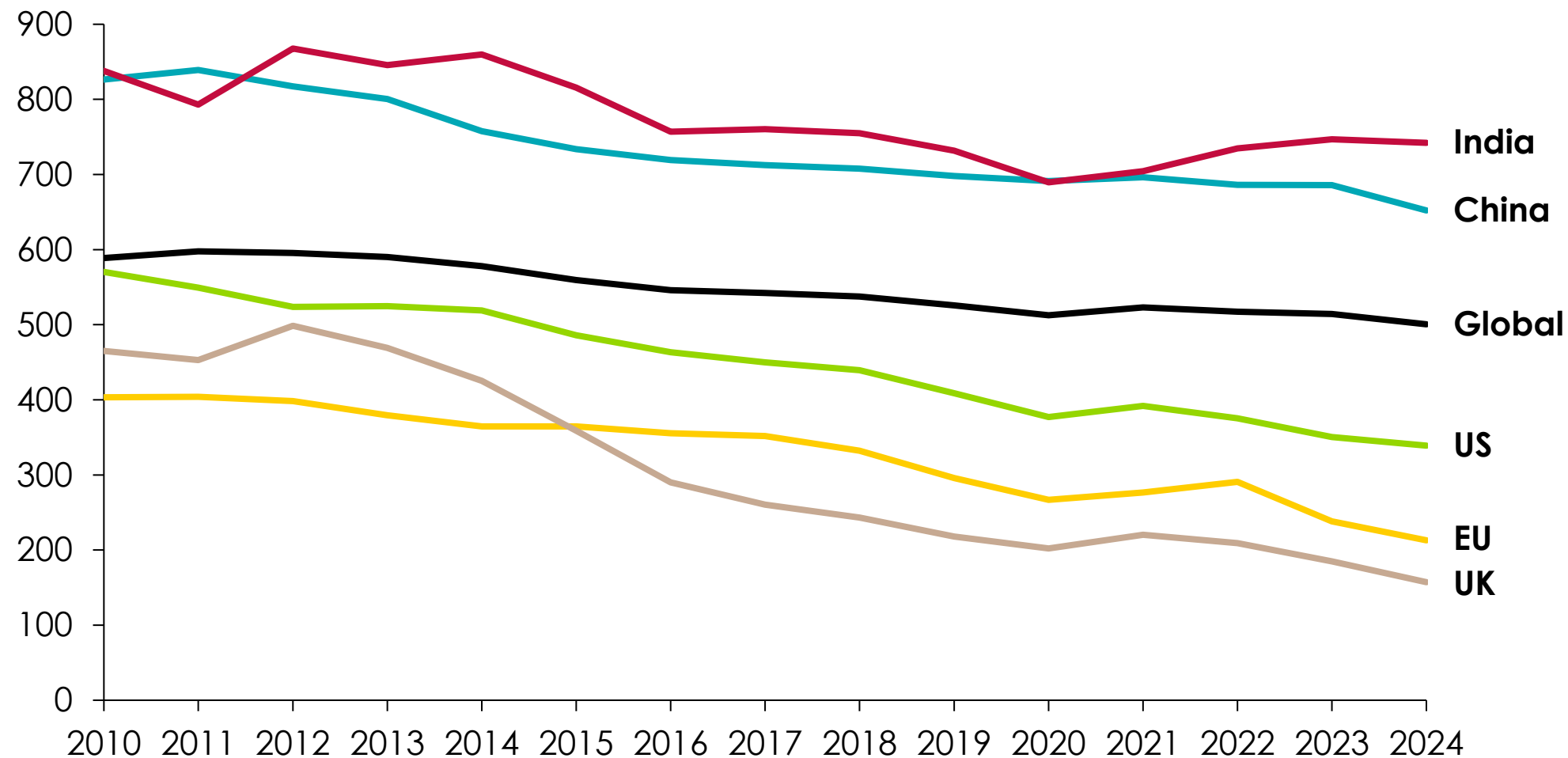


**Total =
787 Gt CO₂**



Carbon intensity of electricity generation

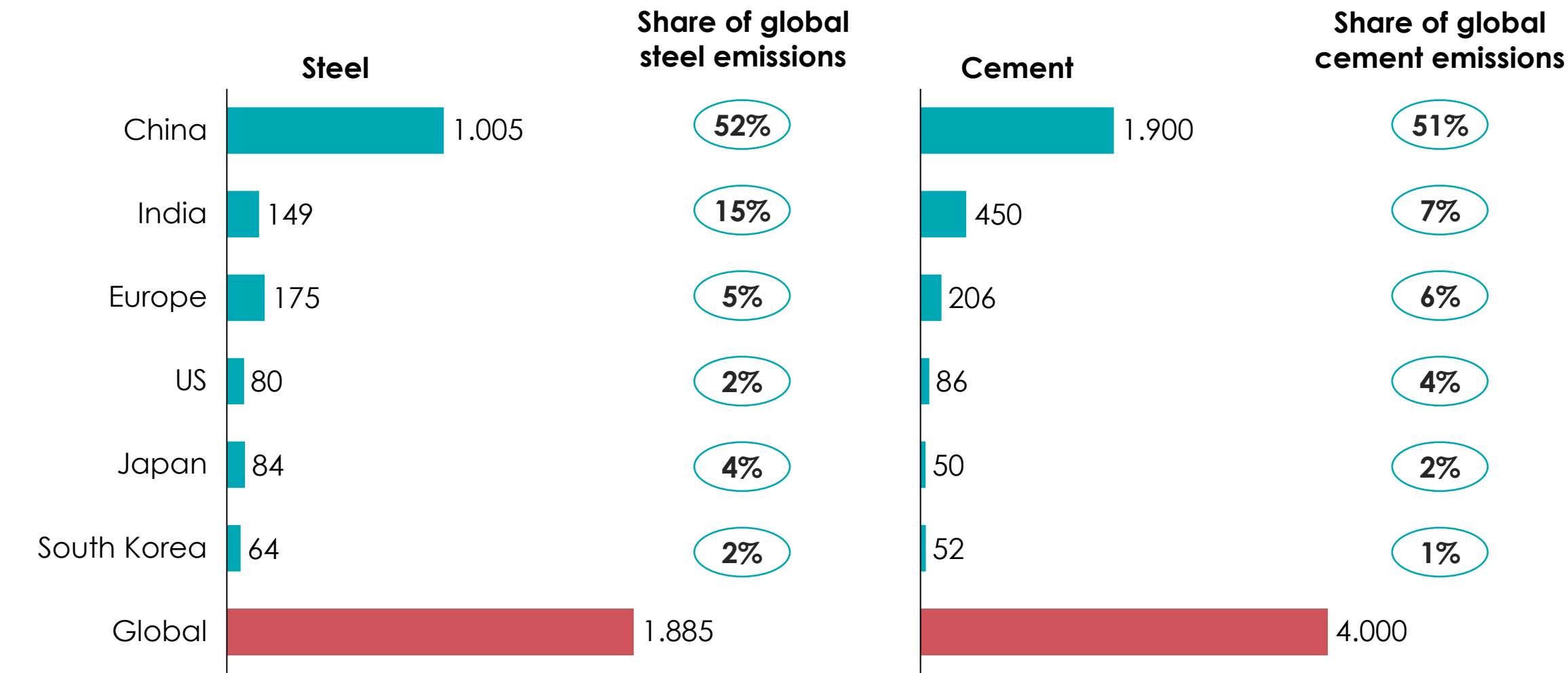
g CO_{2eq} / kWh



Source: EDGAR, Ember

Crude Steel & Cement production and emissions, 2024

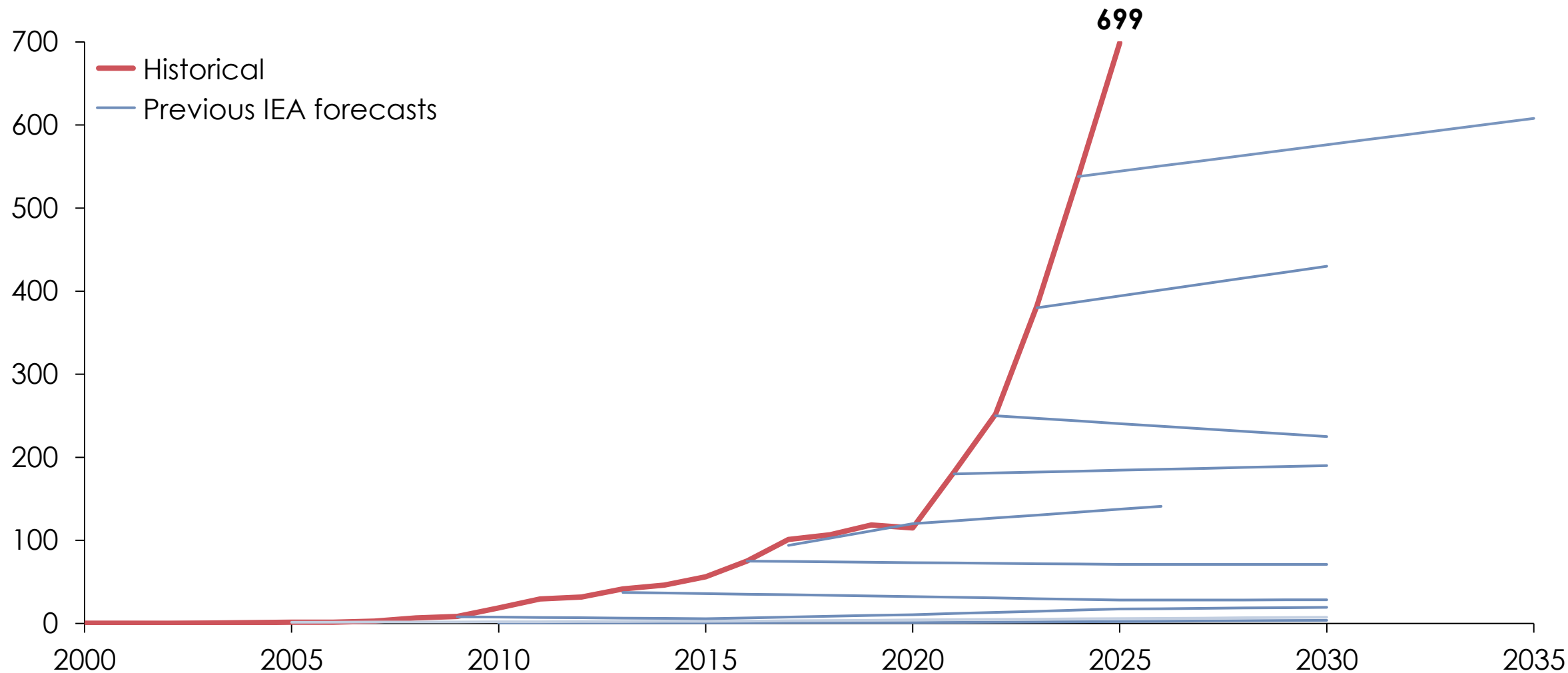
Million tonnes



Source: World Steel Association; Global Cement (2025) Global Cement Top 100 2026 [Assesed January 2026]; BNEF New Energy Outlook 2025

Annual solar PV installations compared to IEA forecasts

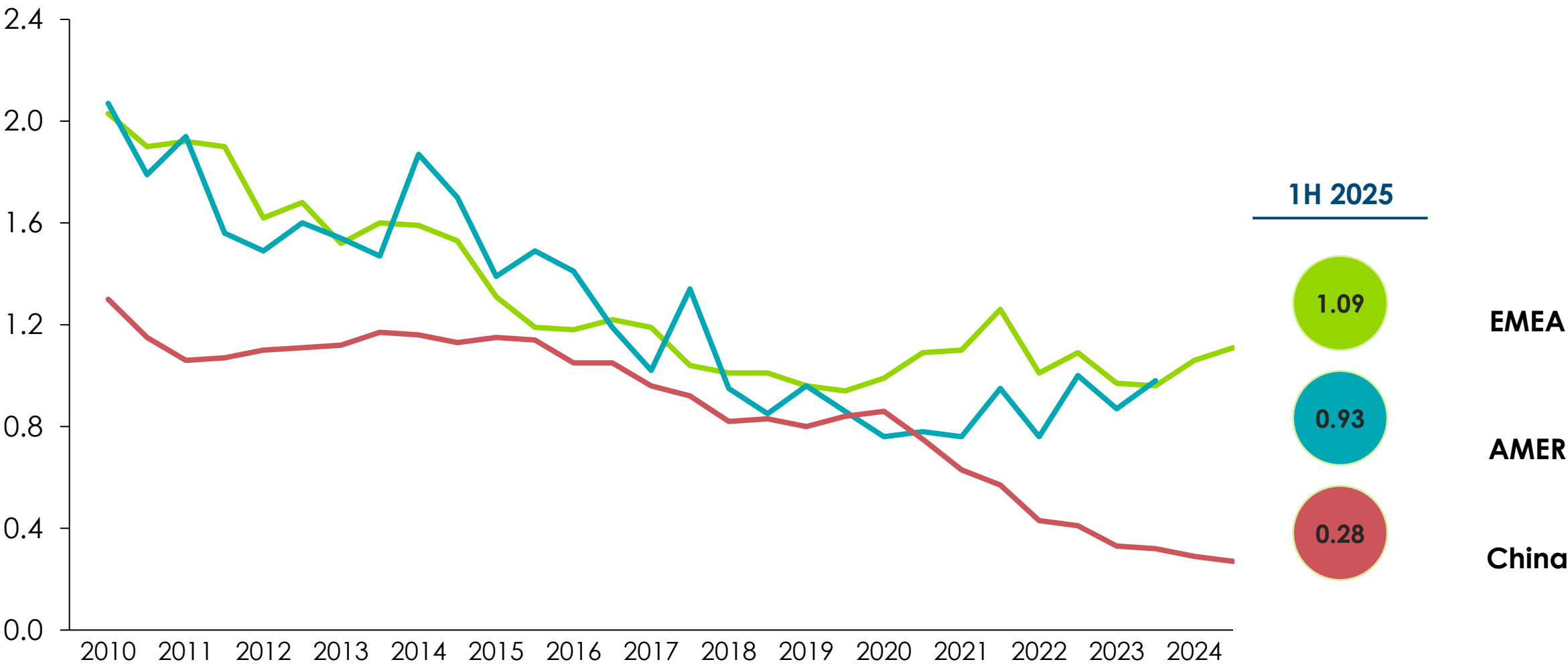
GW



Source: IEA; BNEF

Wind turbine prices by region, 2010-2025

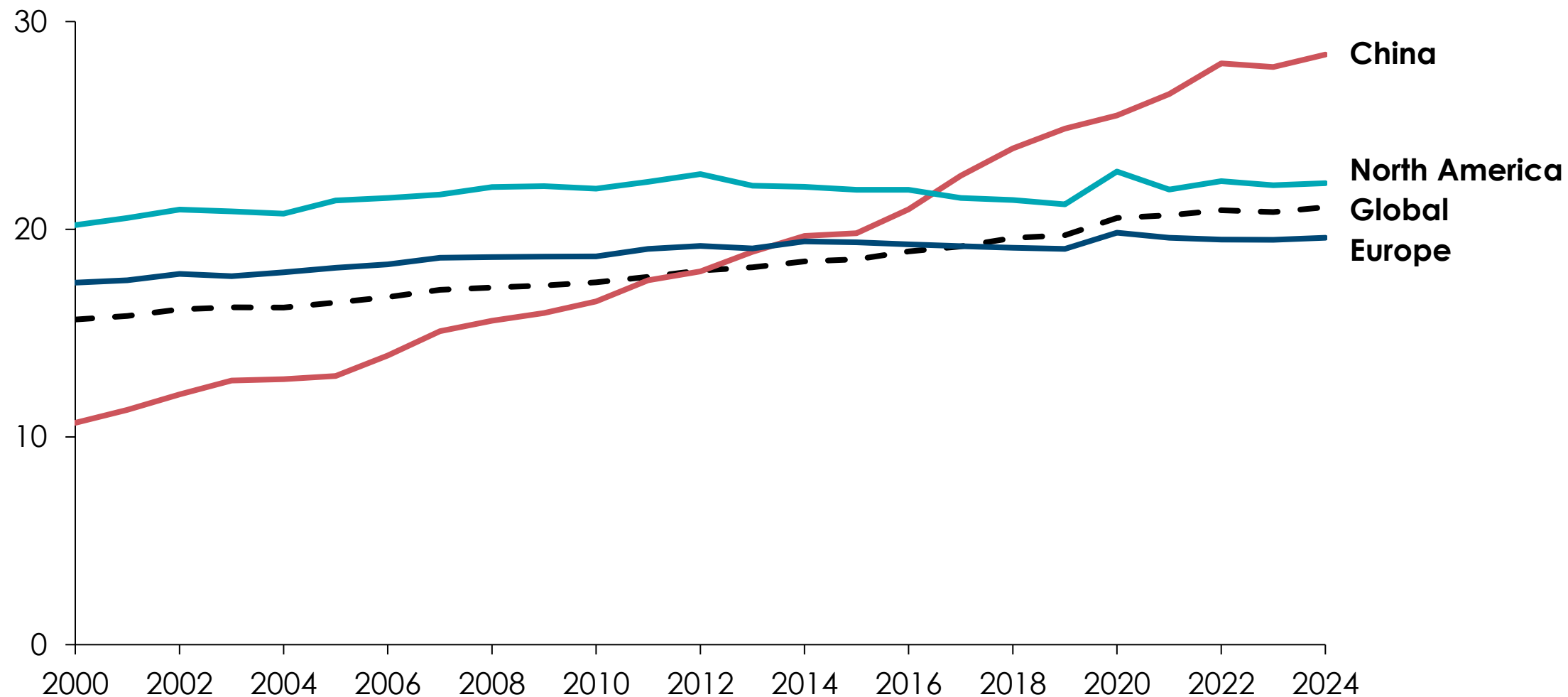
\$ million/MW, 2025 real



Source: BNEF (2025) Wind Turbine Price Index 1H 2025: Still on the Rise; U.S. Bureau of Labor Statistics (2025), Consumer Price Index for All Urban Consumers (CPI-U), All Items, U.S. City Average, Not Seasonally Adjusted.

Electricity share of final energy demand

%



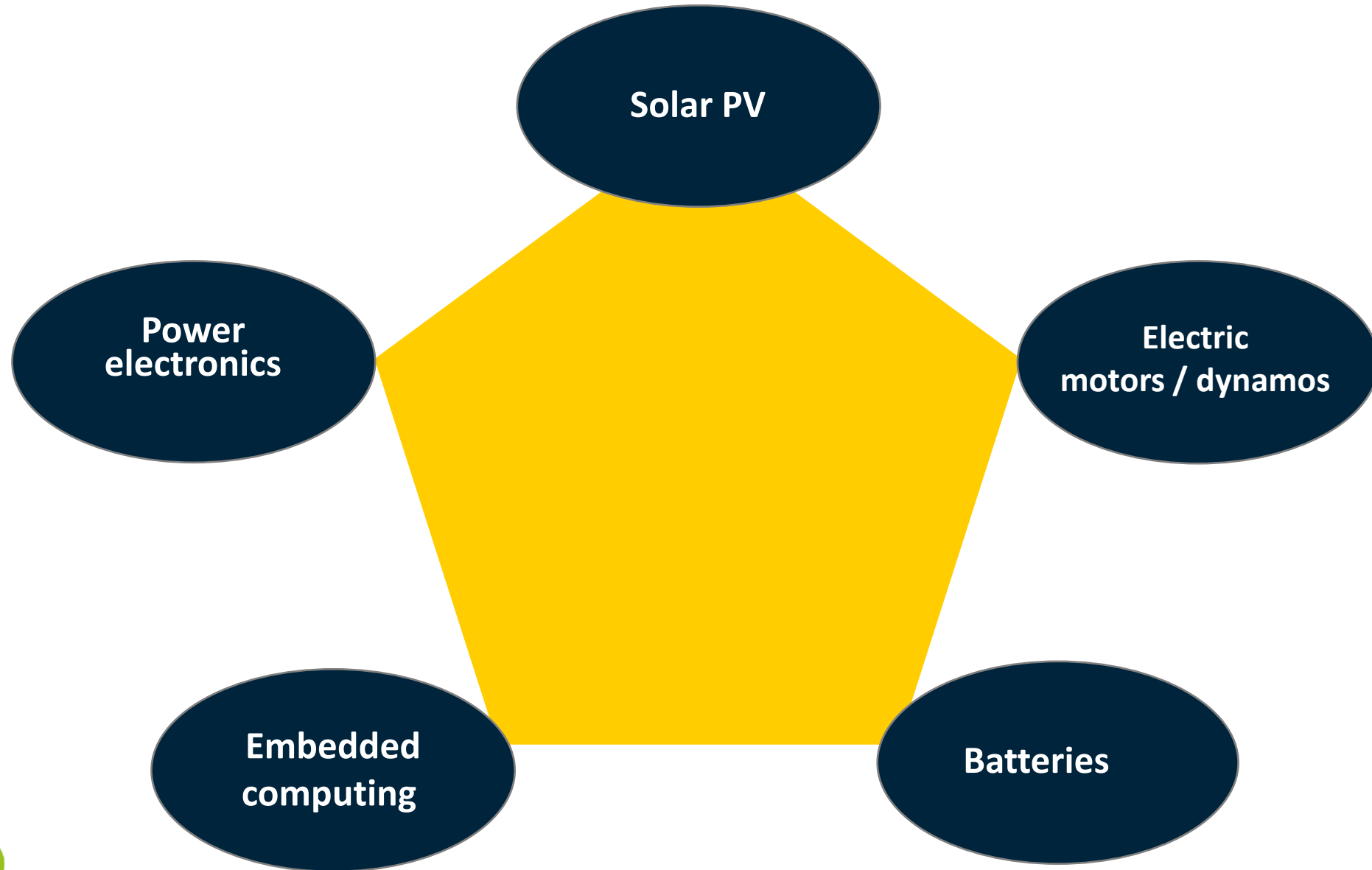
Source: BNEF (2025) *New Energy Outlook*

Installed global manufacturing capacity by country/region 2023

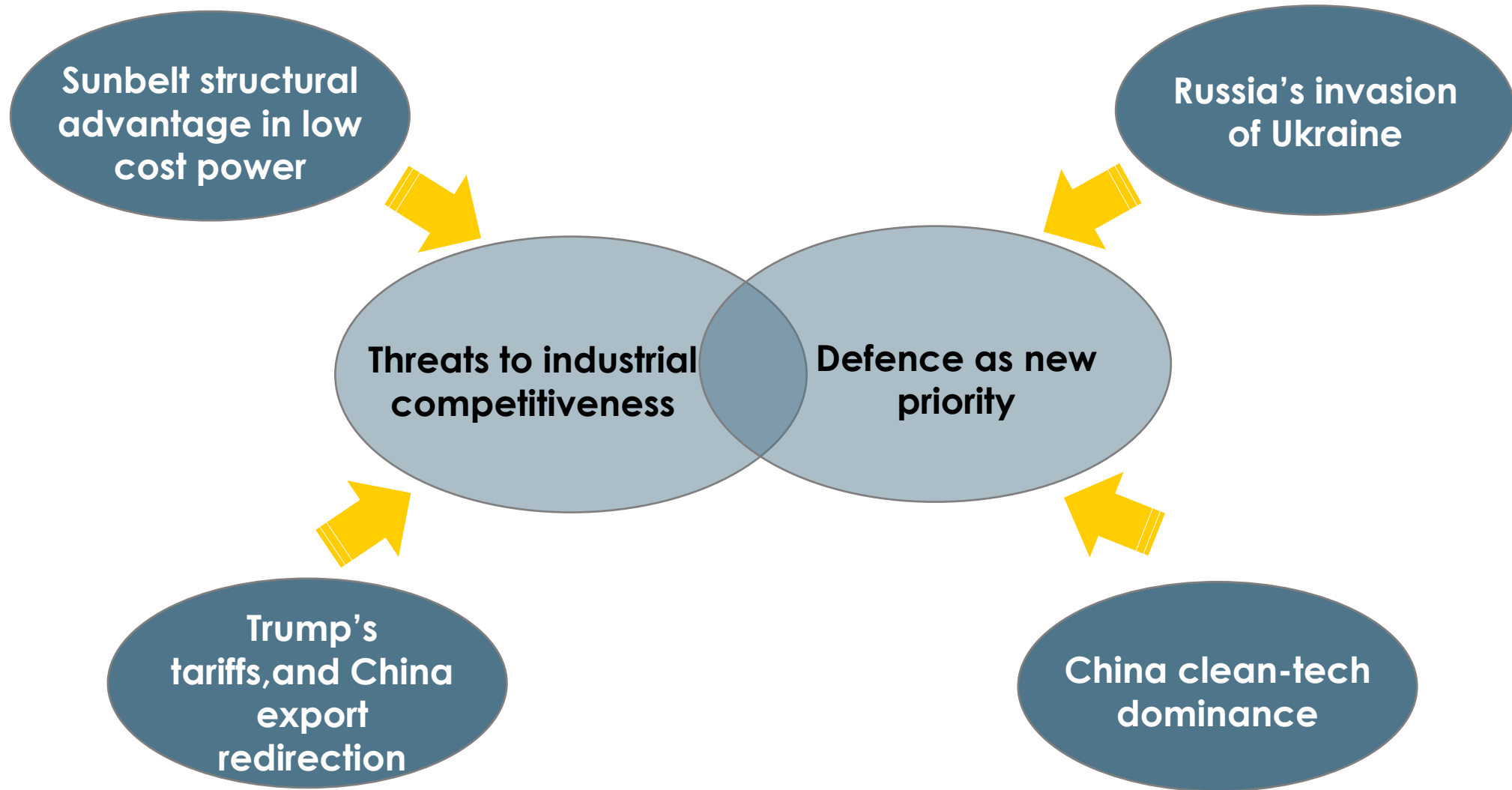


Source: IEA (2024) *Clean Technology Perspectives*

The electro tech stack

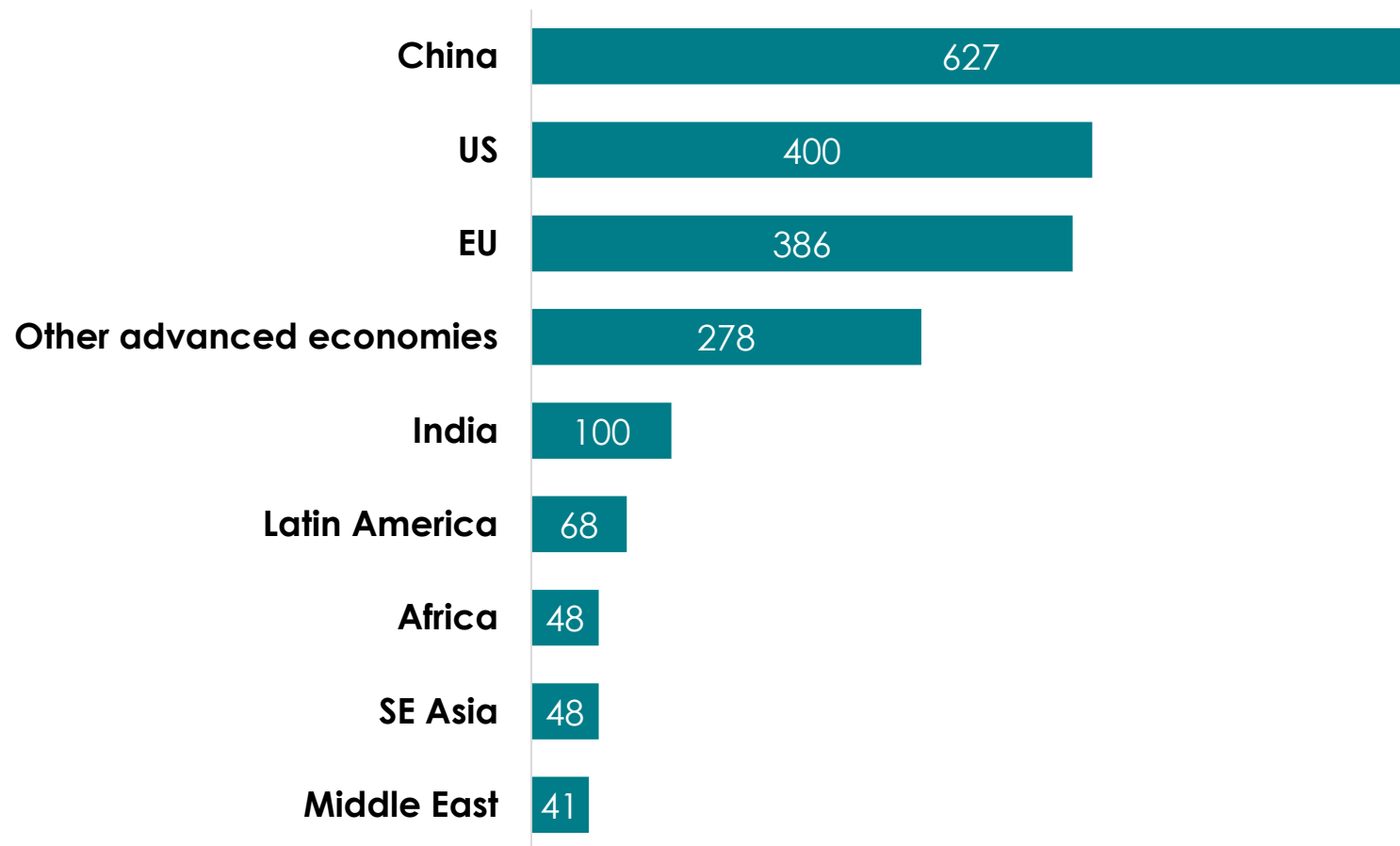


Europe's perfect storm



Clean energy investment 2025

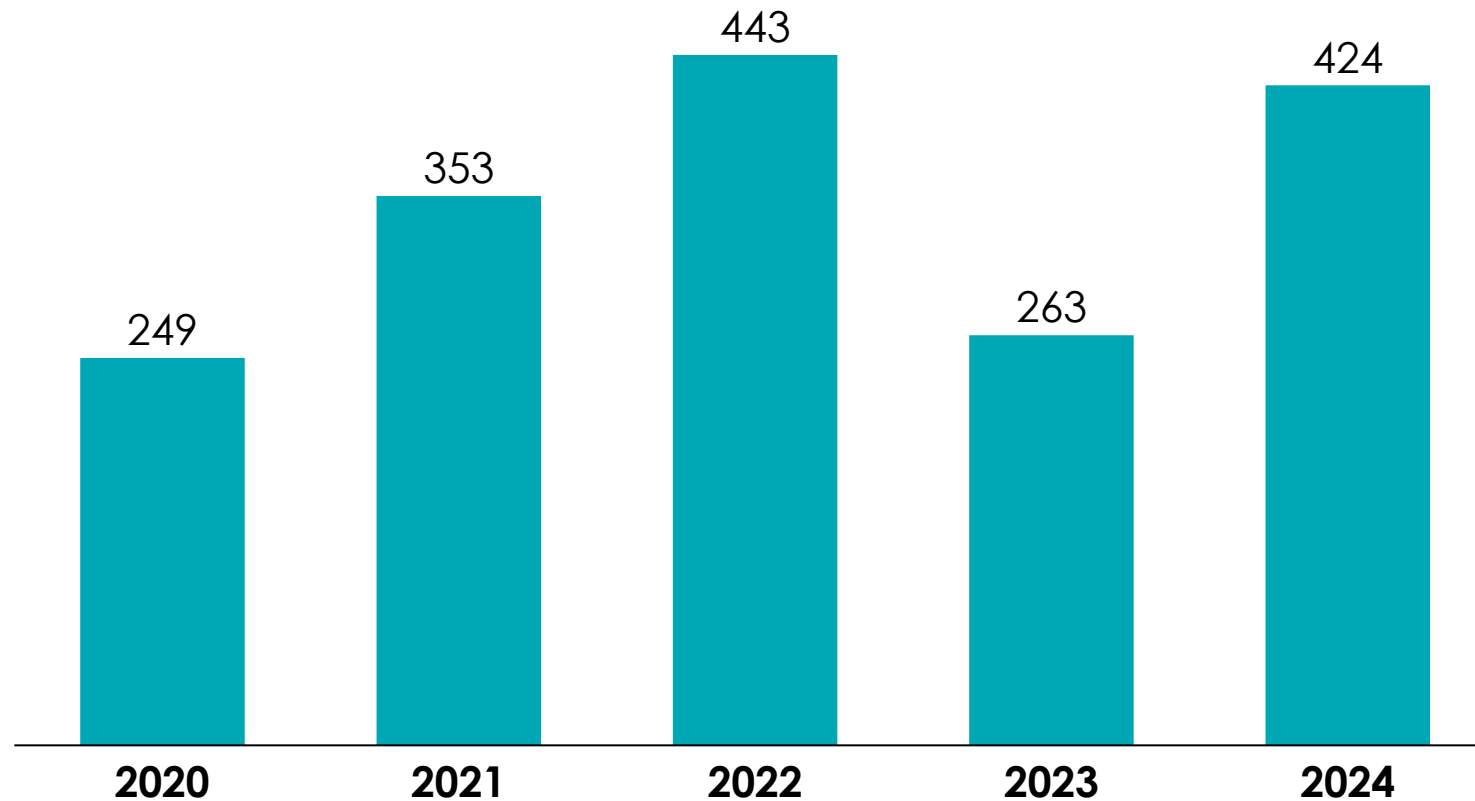
\$bn



Source: IEA, World Energy Investment, 2025, Executive Summary

China current account surplus 2020-2025

\$Bn



Trade surplus: **\$1200bn**

Current account
surplus for first 3
quarters: **~\$500bn**

2025 latest estimates



Source: https://www.theglobaleconomy.com/china/current_account_dollars

The economics of the energy transition – challenges and opportunities

Investments

- ❖ Cost to some category of consumer
- ❖ Cost of capital crucial issue

Costs of going fast enough

- ❖ Subsidies for early tech deployment
- ❖ Double running gas grid and expanded electricity system
- ❖ Retiring existing coal plants before end of life

Distributional issues

- ❖ Jobs: both opportunity and threat more limited than often suggested
- ❖ Within countries: residential heat harder than shipping
- ❖ Between countries: global sunbelt cost advantage
- ❖ Economic rents: demand reduction vital to transition beyond fossil fuels

China opportunity and challenge

- ❖ Faster emissions reductions essential – including hard to electrify sectors
- ❖ Clean-tech dominance: global low-cost opportunity but local industry threat
- ❖ Climate finance: the most important provider?

