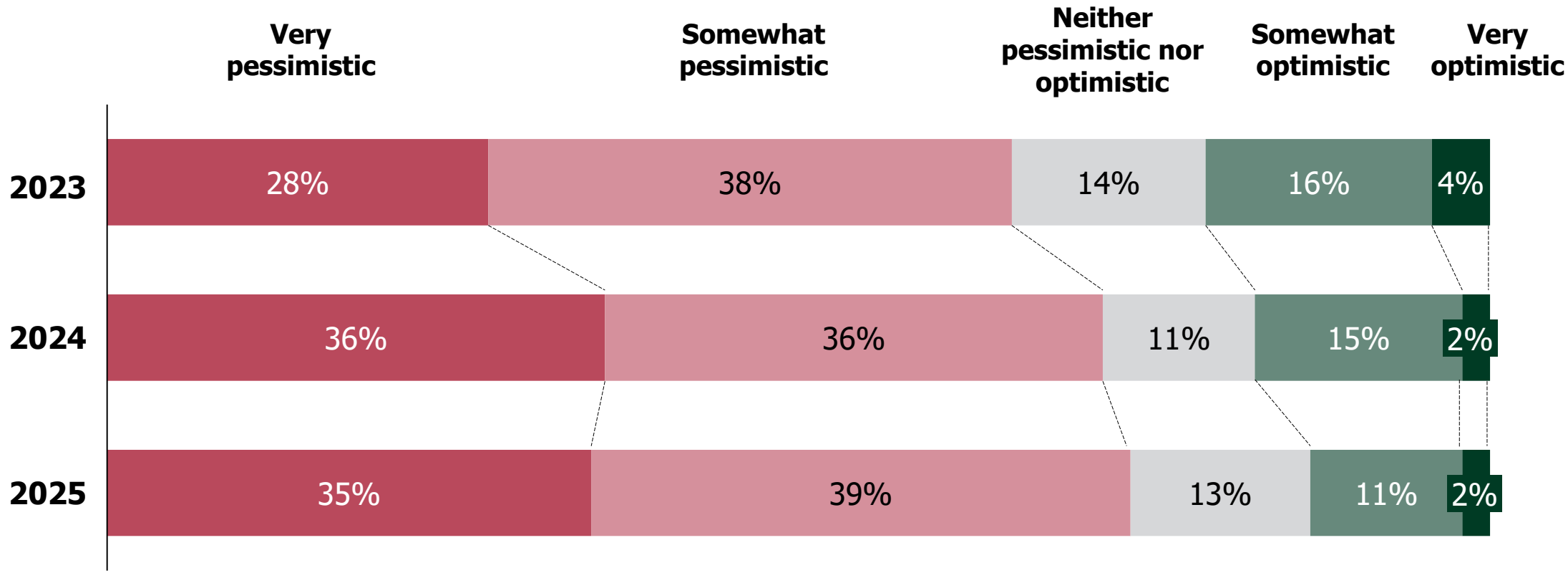
NET ZERO
2026 Perspective

Keeping global warming below 2°C: technologies, economics and politics

eden mccallum

How pessimistic or optimistic are you about your country achieving the target of net zero greenhouse gas emissions by 2050?

BUSINESS LEADER SURVEYS



Source: Eden McCallum Business Outlook Surveys

Lord Adair Turner

Currently
- **Chair, The Energy Transitions Commission**
- Chair, Chubb Europe
- Board Member, Envision AESC (Japan)
- Adviser, Watershed Technology Inc

Previous public policy roles
- Chair, Financial Services Authority
- Chair, Climate Change Committee
- Chair, Pensions Commission
- Chair, UK Low Pay Commission

Previous business roles
- Vice-Chair, Merrill Lynch Europe
- NED, Standard Chartered plc
- Director-General, CBI
- Director, McKinsey

Energy Transitions Commission

eden mccallum

Energy
Transitions
Commission

Keeping global warming below 2°C: technologies, economics and politics

Adair Turner

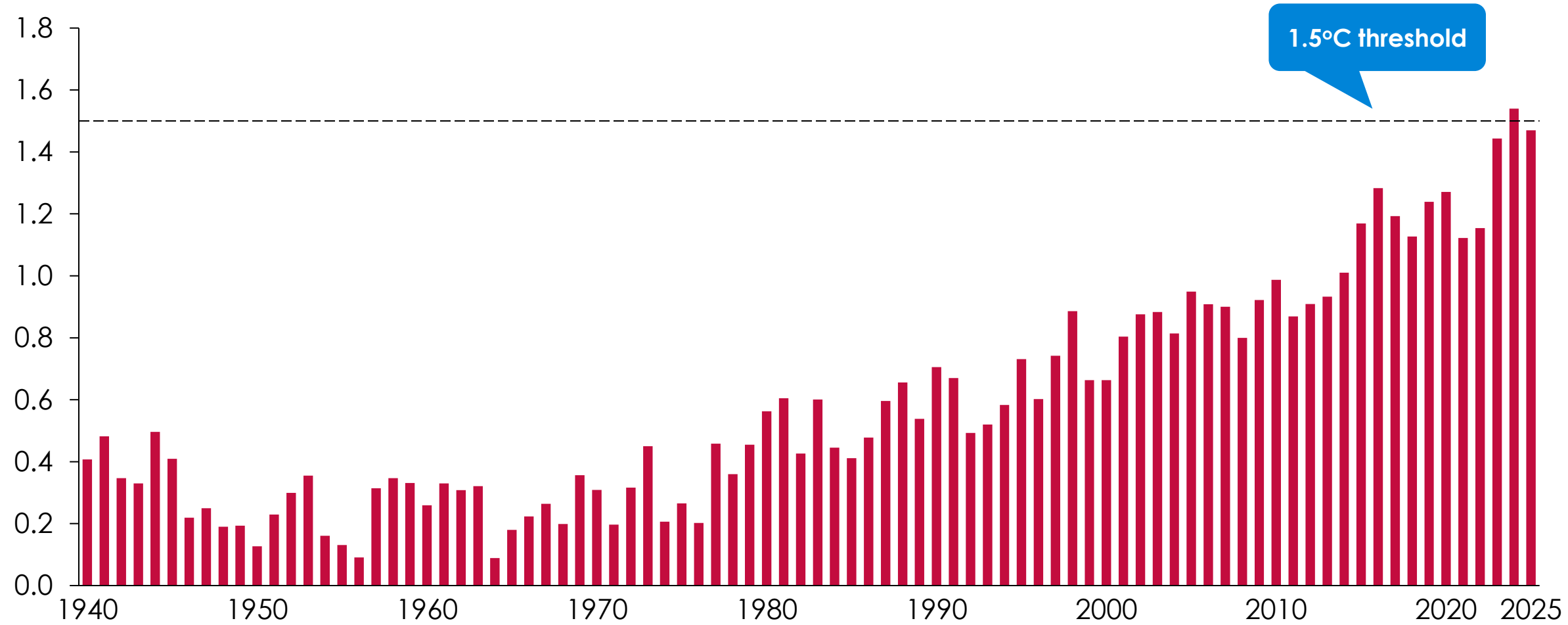
Chair, Energy Transitions Commission

Eden McCallum Net Zero Talk

13th February 2026

Global surface temperature increase above pre-industrial level

°C above pre-industrial levels; Reference period: pre-industrial (1850-1900)



Source: Copernicus (Accessed Jan 2026), Global climate highlights 2024, NOAA global temperature

Extreme weather in the past 18 months

Jan 2025

Los Angeles, USA

Sep 2025

Valencia, Spain

Nov 2025

Pakistan

Jan 2026

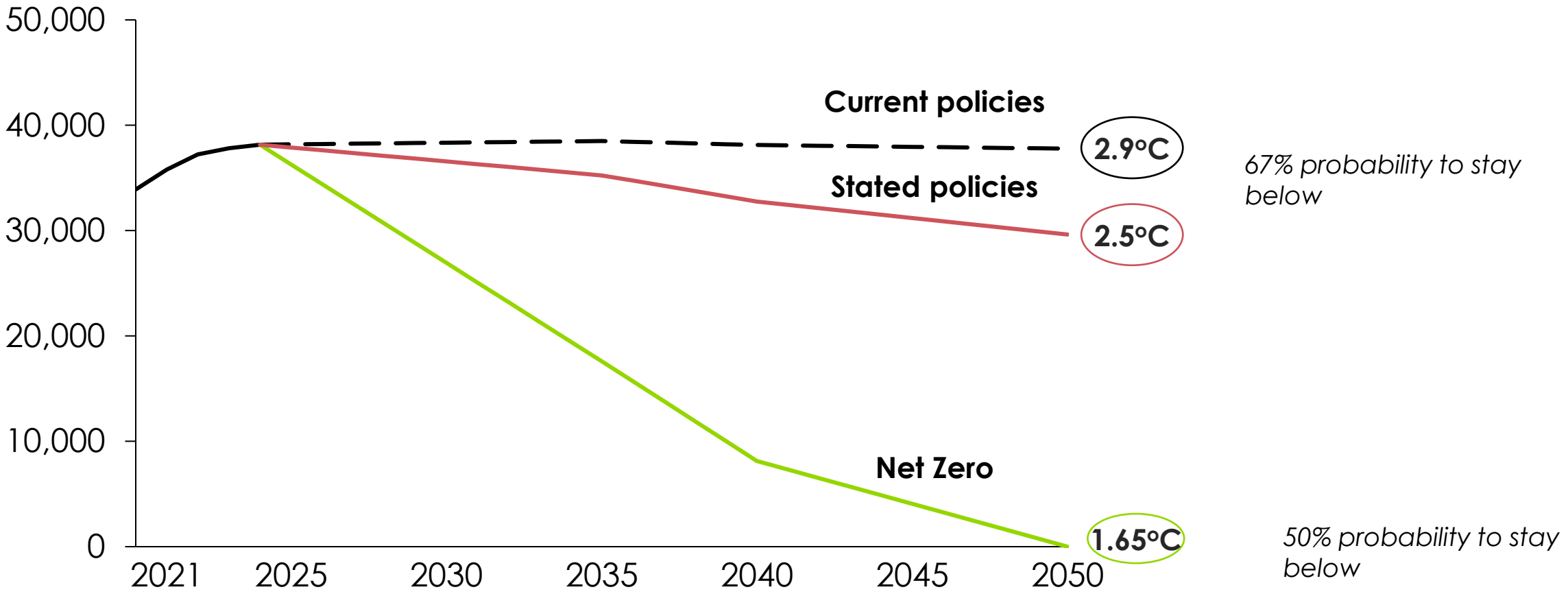
Australia

Jan 2026

Mozambique

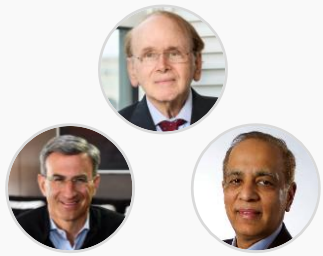
IEA emission scenarios 2024 and implied peak temperature

Energy-related Mt CO_2

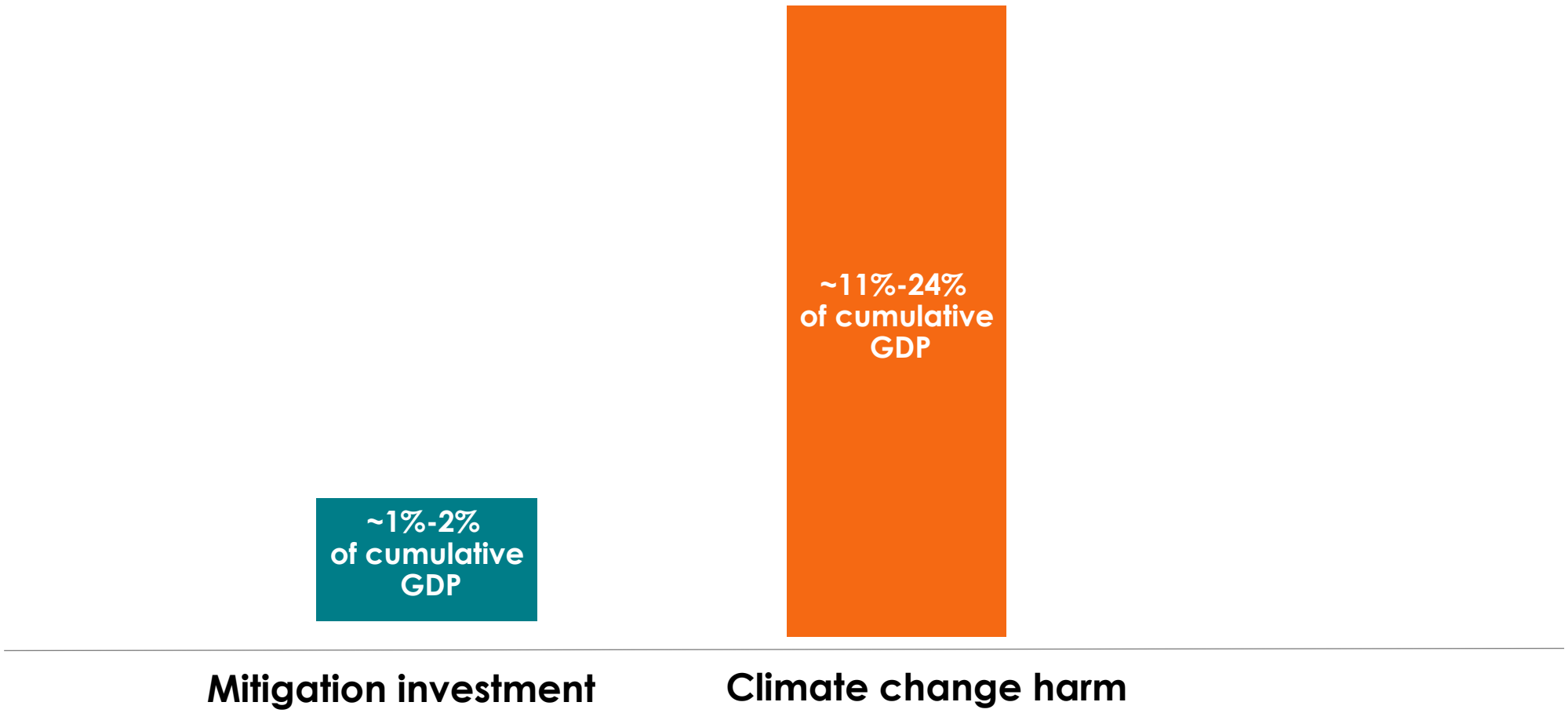


Source: IEA (2021) Net Zero by 2050;
Note: IEA Scenarios have emissions interpolated between 5-10 years;

Calls for a "pragmatic" reset of climate ambition

		Key points	Temperature assumption
Dan Yergin, Atul Arya and Peter Orszag *The Troubled Energy Transition – how to find a pragmatic way forward*		Growing energy demand, energy security concerns and very large transition costs make rapid transition impossible; fossil fuels still essential to prosperity and will take long time to replace	**~2.4°C**
Bill Gates *Three tough truths about climate*		*"We should measure success by our impact on human welfare more than our impact on the global temperature"*	**No chance of <2°C, can deal with consequences of 3°C**
Michael Liebreich *The pragmatic climate reset*		1.5°C was always impossibly costly objective – adopted without analysis *"It's time to switch back to the hard 2°C target which was at the heart of the Paris Agreement "*	**1.8°C-3.5°C** **But ideally <2°C**

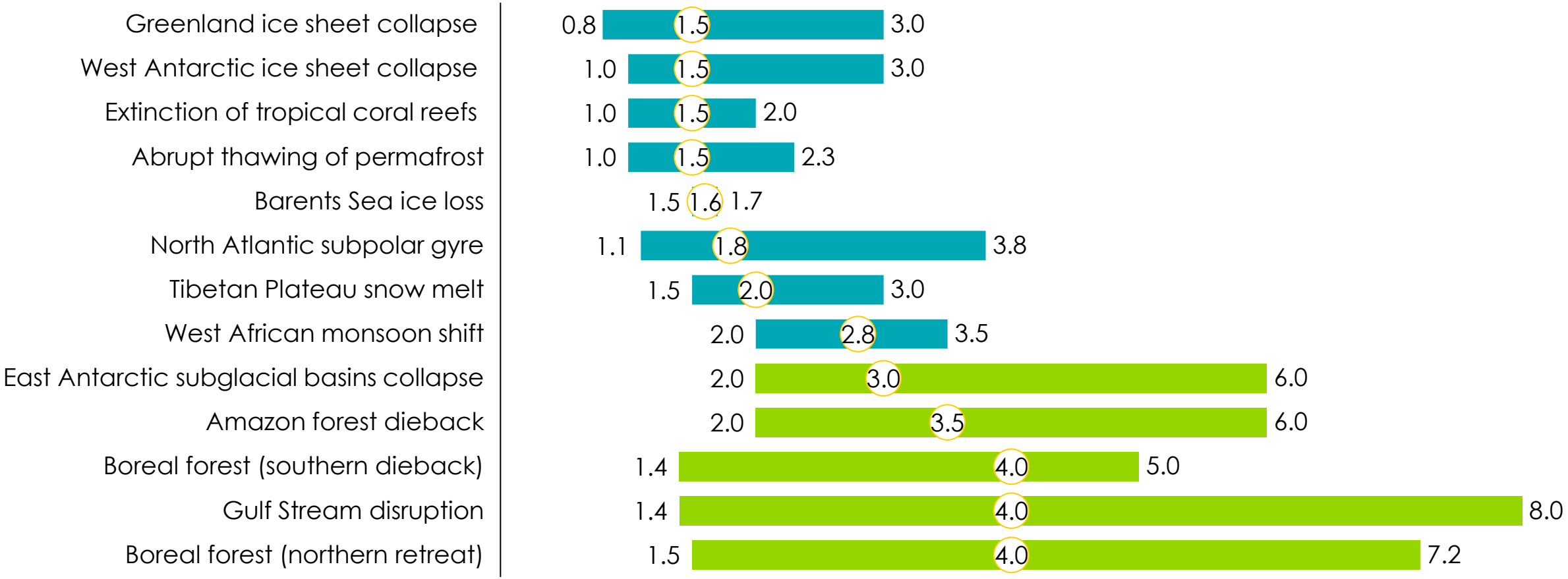
Mitigation costs vs climate change harm 2025-2100: comparing 2^{0}C vs 3^{0}C world



Source: BCG and Cambridge University *Too hot to think straight , too cold to panic*. 2025 https://www.cam.ac.uk/research/news/too-hot-to-think-straight-too-cold-to-panic

Temperature ranges at which tipping points may occur

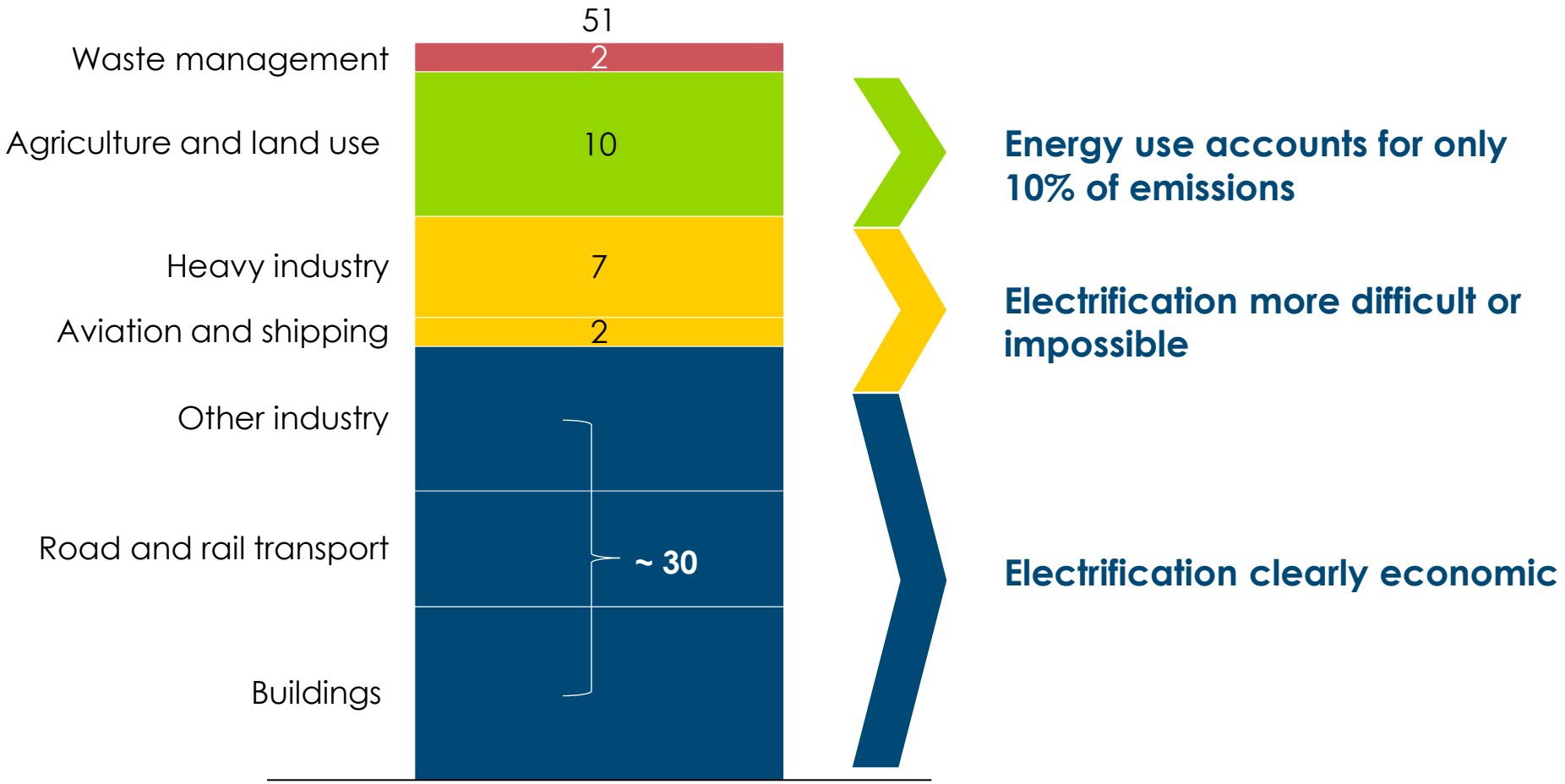
°C increase relative to pre industrial era



Source: "Exceeding 1.5°C global warming could trigger multiple climate tipping points," Science, 2022; BCG analysis.

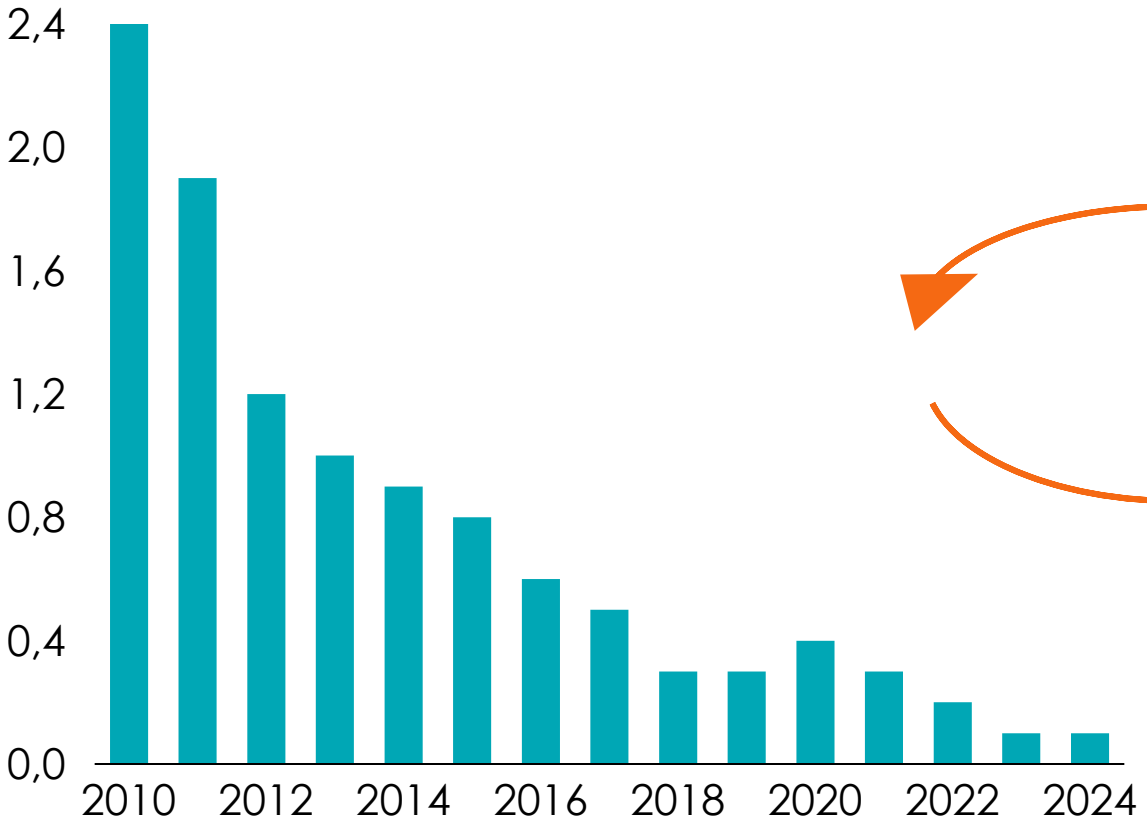
GHG emission by broad sector

Gt CO_{2eq}



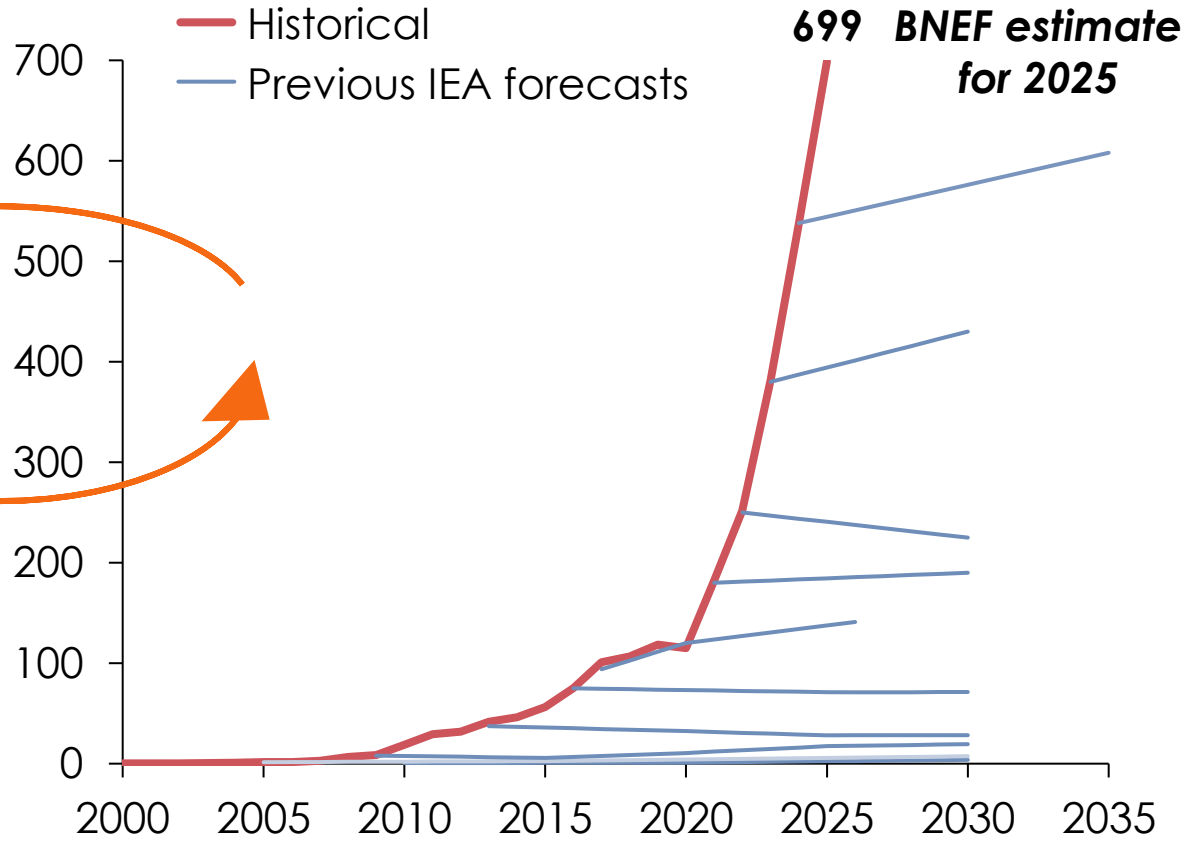
Benchmark capex for a typical module fixed-axis utility-scale photovoltaic power project

$ per Watt



Annual solar PV installations compared to IEA forecasts

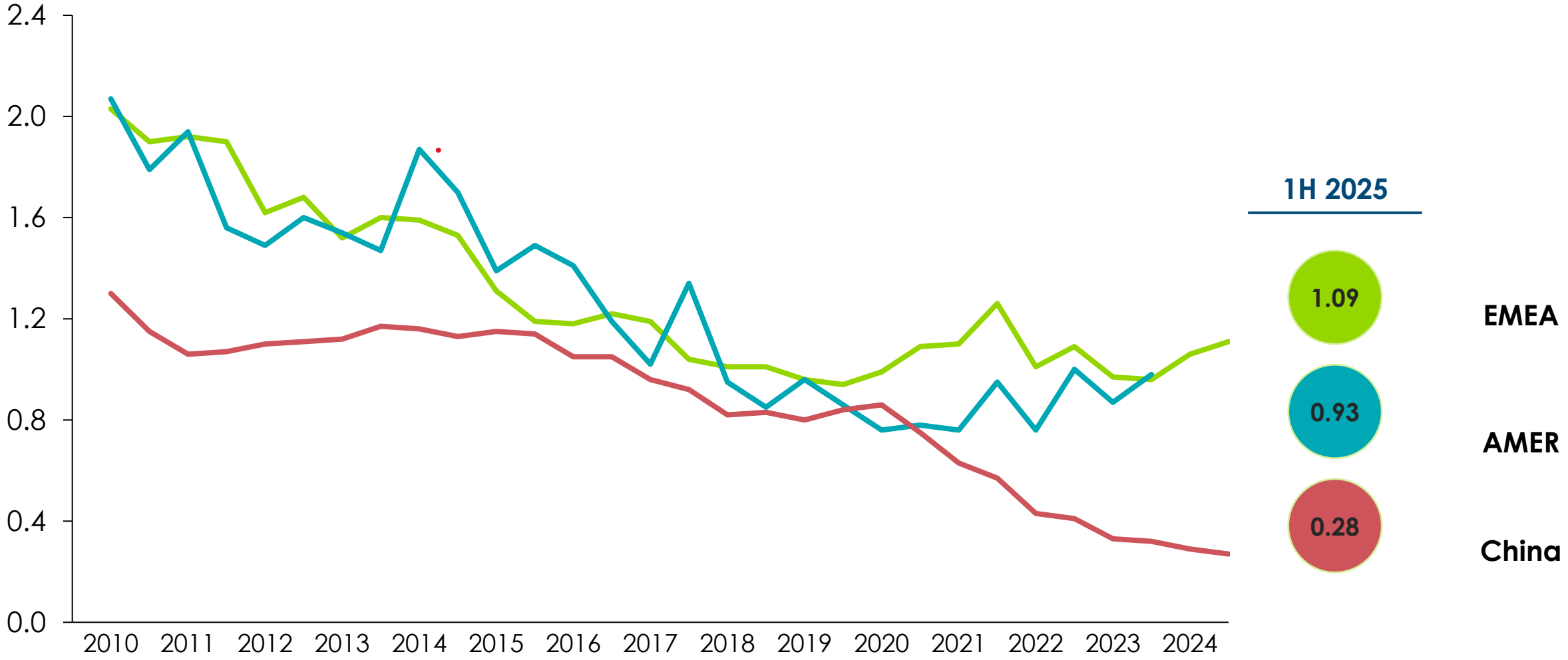
GW



Source: BNEF, Solar Modules Are Cheap and Will Become Even Cheaper. March 2025 https://www.bnef.com/shorts/ssej7bt1um0w00; IEA World Energy Outlook, multiple years of publication

Wind turbine prices by region, 2010-2025

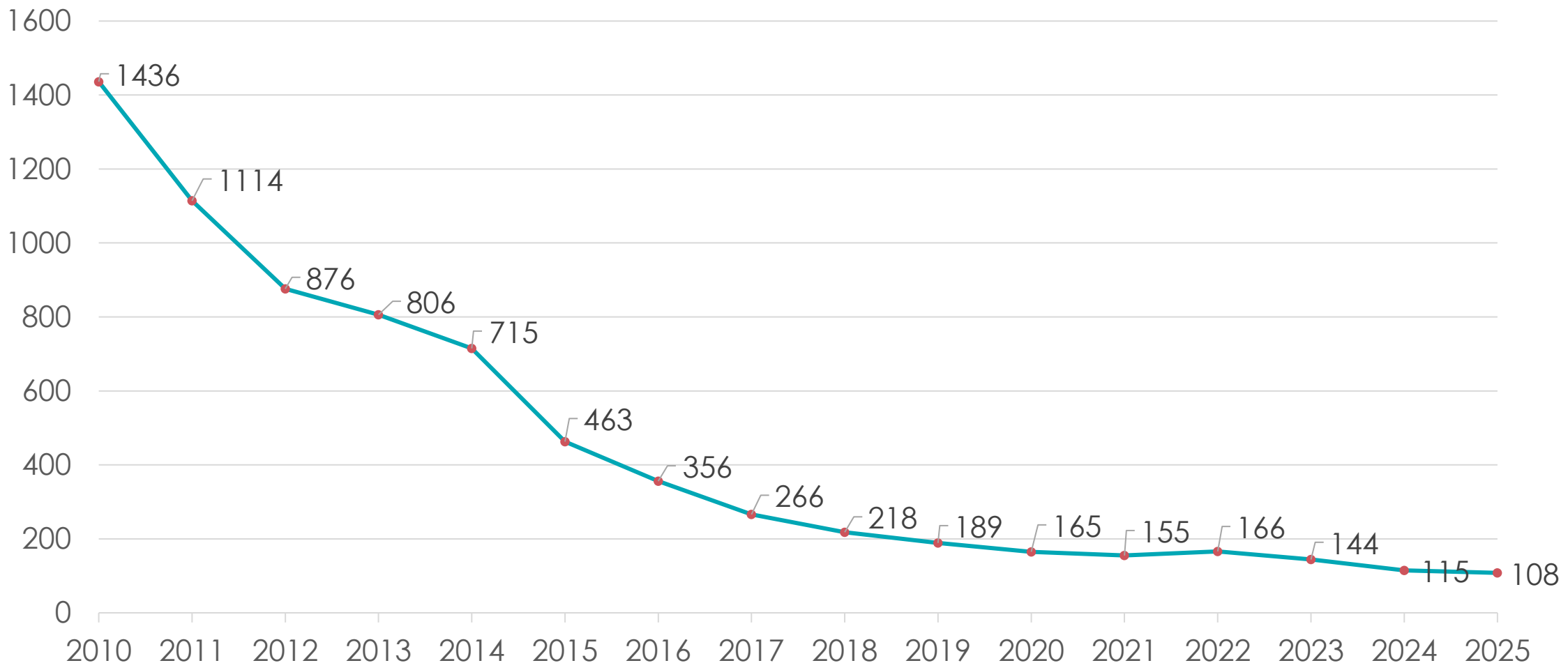
$ million/MW, 2025 real



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.*

Lithium-ion battery price survey results: global average pack price

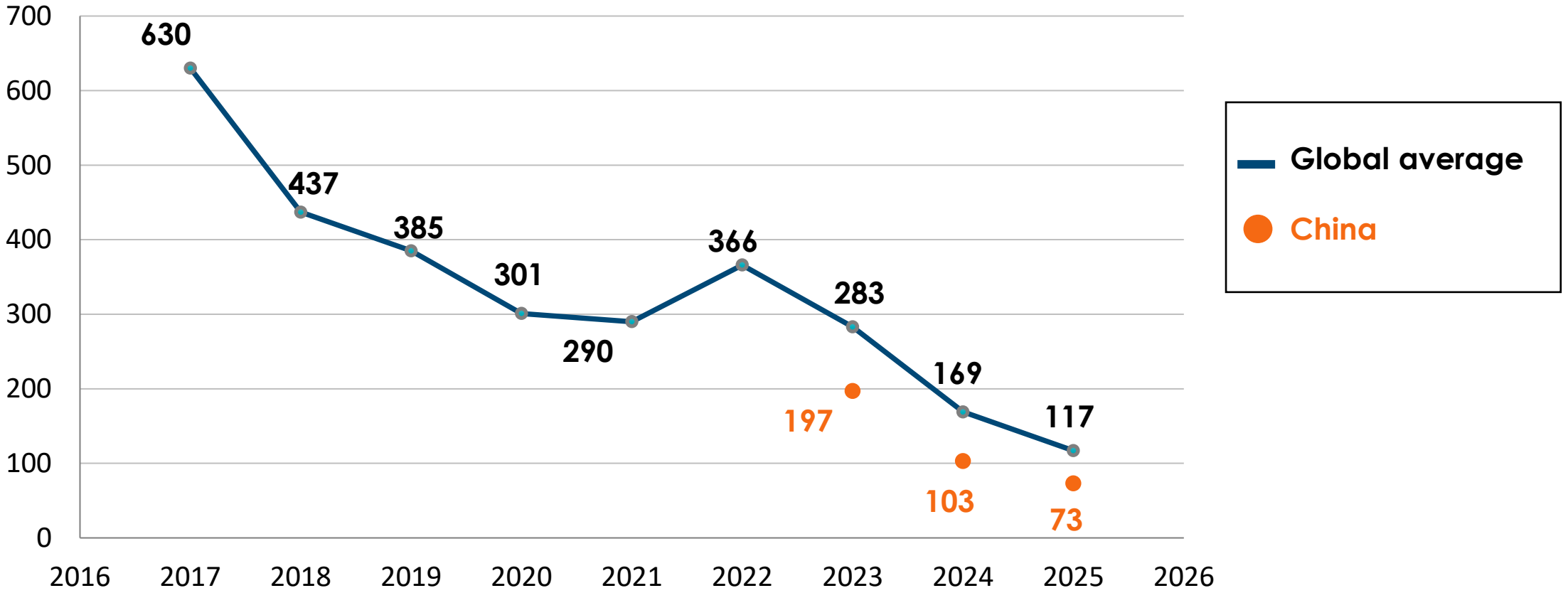
$/kWh, real 2024



Source: *BNEF Lithium-ion battery price survey* December 2025

Prices for turnkey energy storage systems 2016 –25

$ per kilowatt-hour, usable (real 2025)

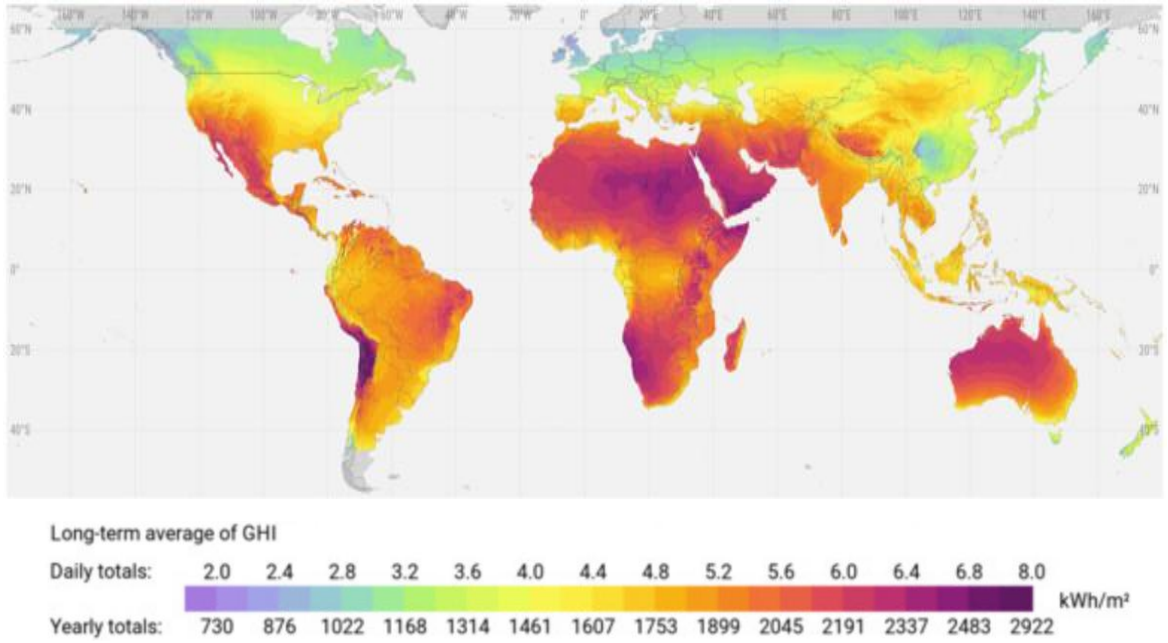


Source: BNEF EnergyStorageSystems CostSurvey 2025, https://www.bnef.com/insights/38229/view

The global sunbelt and the high latitude wind belt

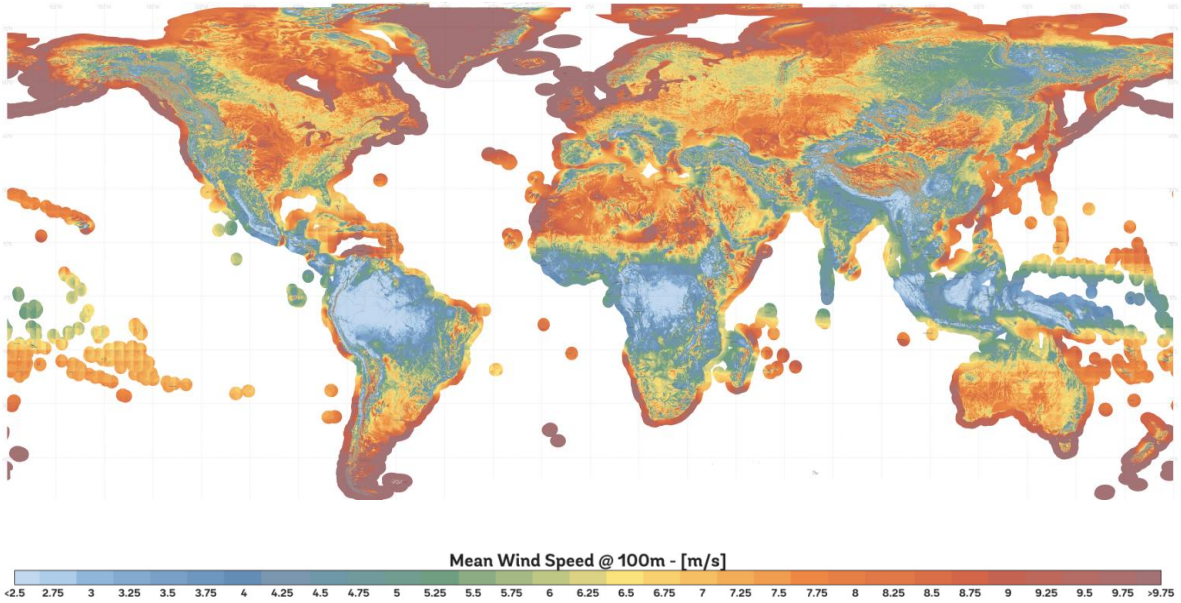
Solar irradiation intensity

Long-term yearly average of daily and yearly GHI totals



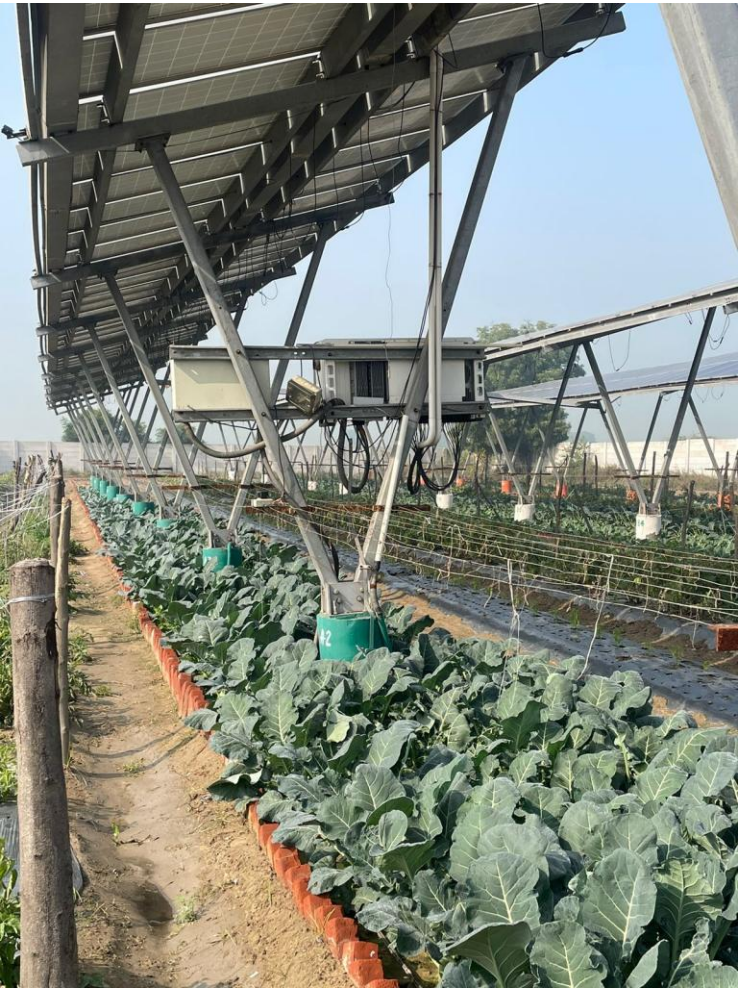
Wind power density

Mean wind power density at 100 m above surface level



Note: GHI refers to Global Horizontal Irradiance - the total amount of solar radiation received on a horizontal surface.
Source: World Bank (2023), *Global Solar Atlas*, available at https://globalsolaratlas.info/map?c=11.609193,8.4375,3. [Accessed 10/01/2025]; World Bank (2023), *Global Wind Atlas*, available at https://globalwindatlas.info/en/. [Accessed 10/01/2025].

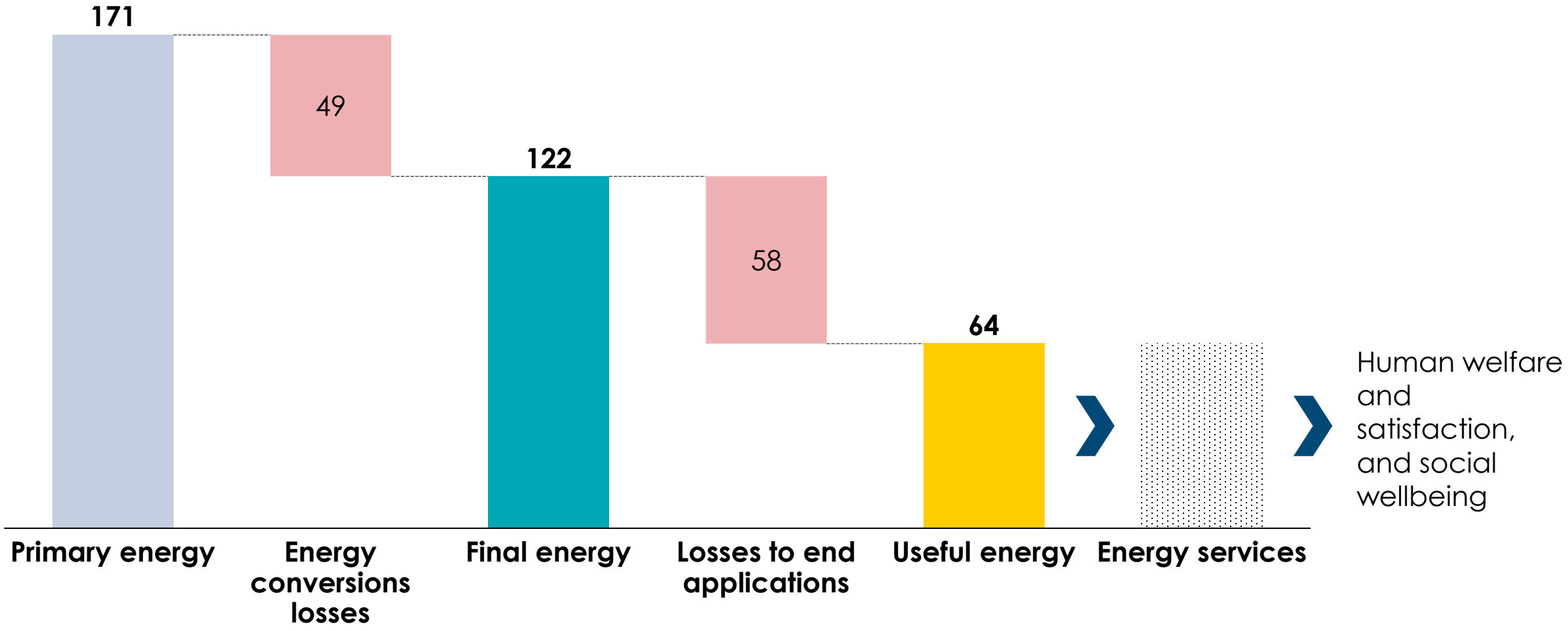
Agri PV



Source: TERI

Global energy flows

000 TWh, 2023

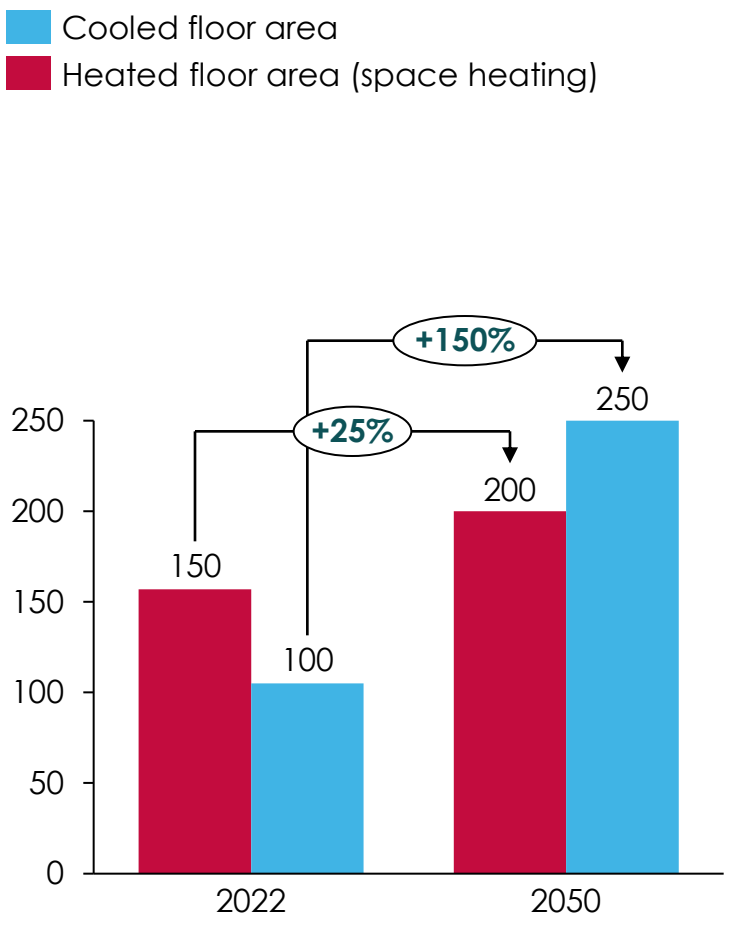


Source: ETC (2025) Energy productivity: Increasing efficiency in an expanded, electrified energy system

Likely growth in energy services

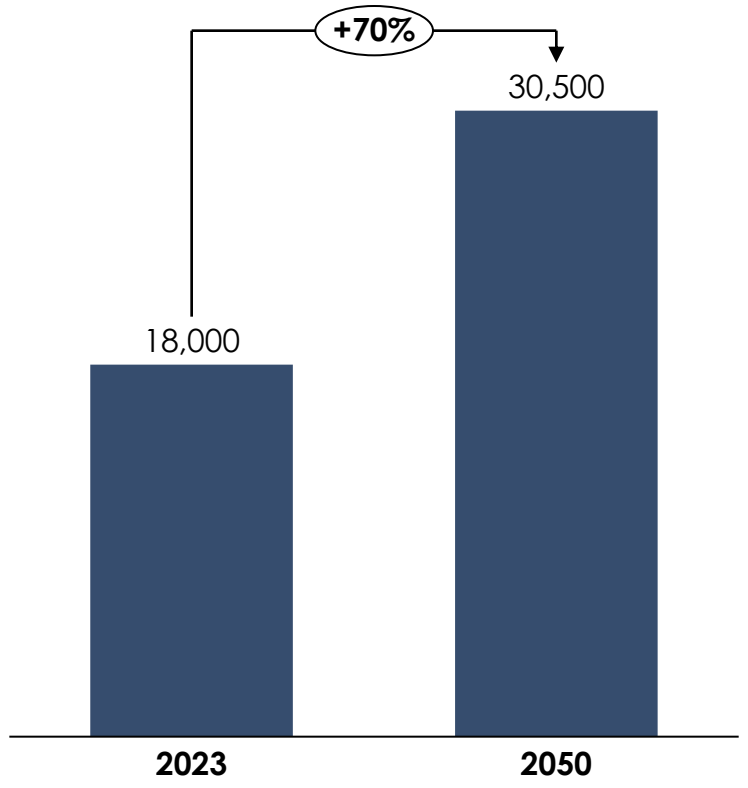
Heated and cooled floor area demand

Billion m2;



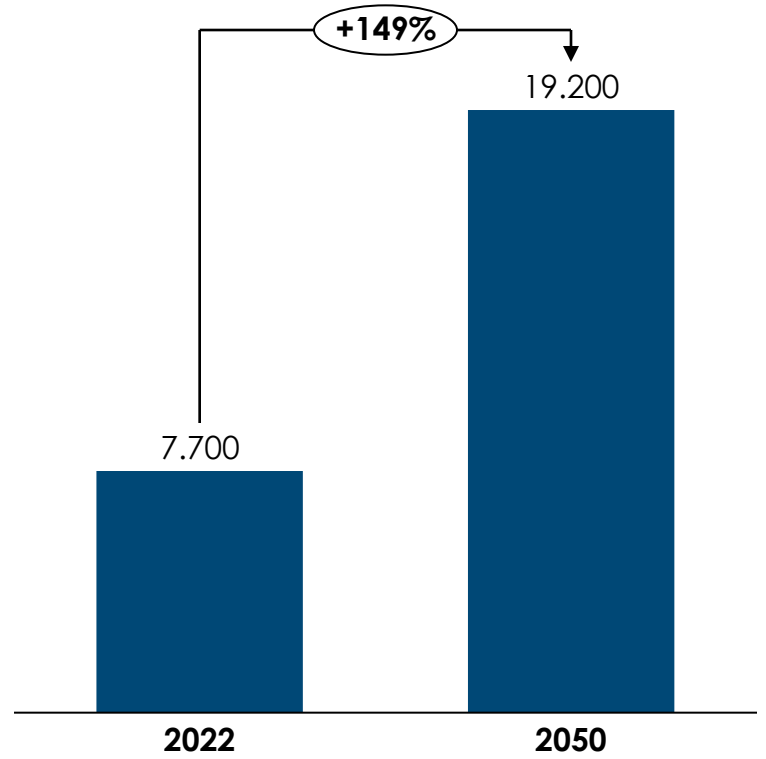
Passenger road transport demand

Billion km;



Aviation demand

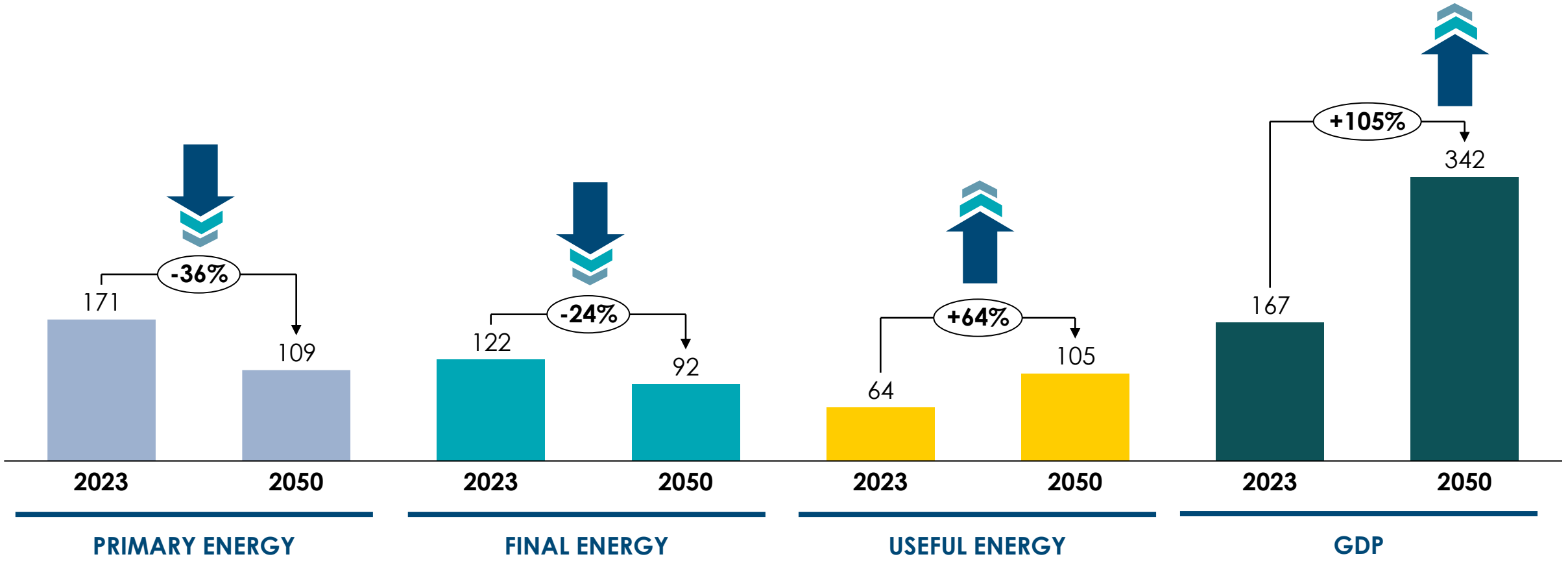
Billions revenue passenger km (RPK)



Note: Revenue passenger km represents the number of paying passengers carried on scheduled flights multiplied by the number of km those seats were flown.
Source: ETC (2025) Energy productivity: Increasing efficiency in an expanded, electrified energy system

Rising energy services with falling inputs – the electrification effect

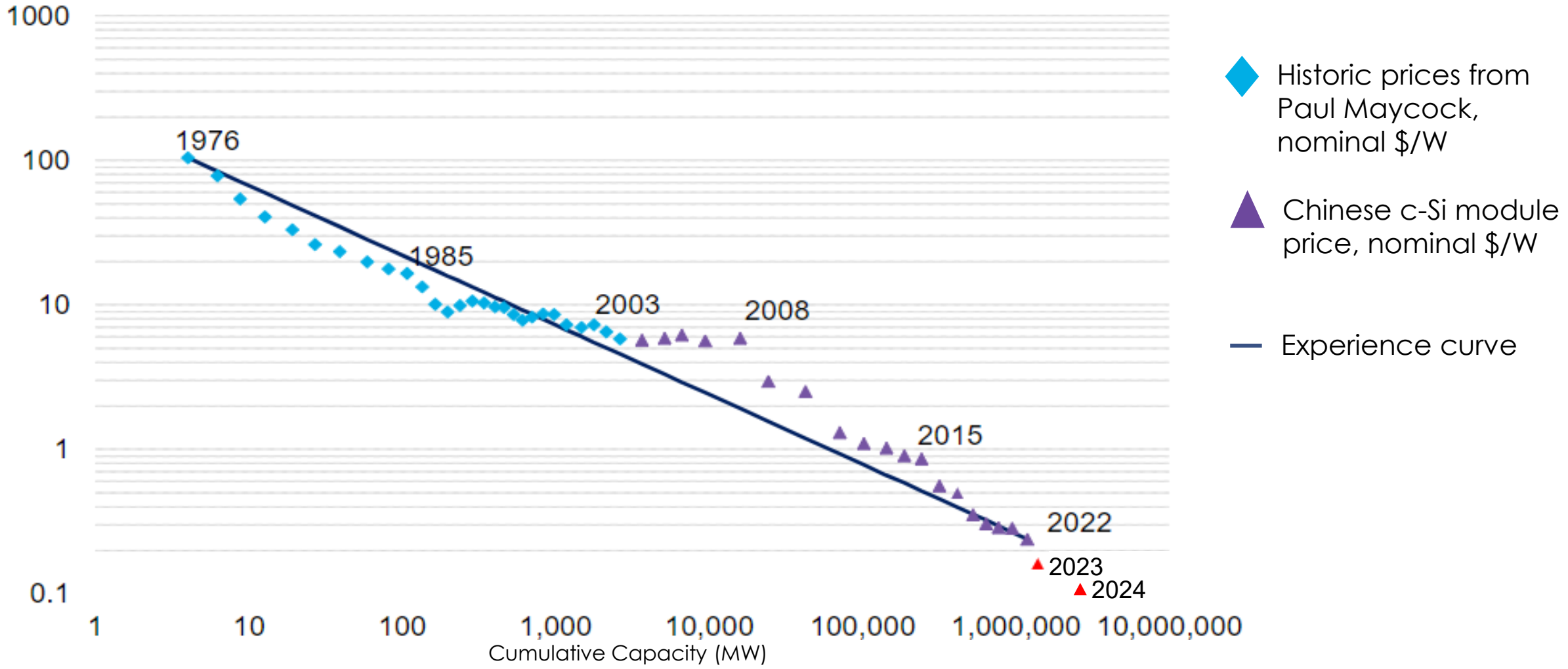
Energy in 000 TWh; GDP in constant 2021 Tn.US$



Source: Systemiq analysis for the ETC; IEA (2025), *World Energy Outlook*; MPP (2023), *Hard-to-Abate Sector Transition Strategies*; ETC (2025), *Achieving Zero-Carbon Buildings*; ETC (2023), *Fossil Fuels in Transition*; BNEF (2023), *Electric Vehicle Outlook*; Systemiq (2022), *Planet Positive Chemicals*

Price of solar PV panels

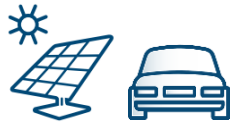
$ per peak watt; real 2023 $



Source: BNEF

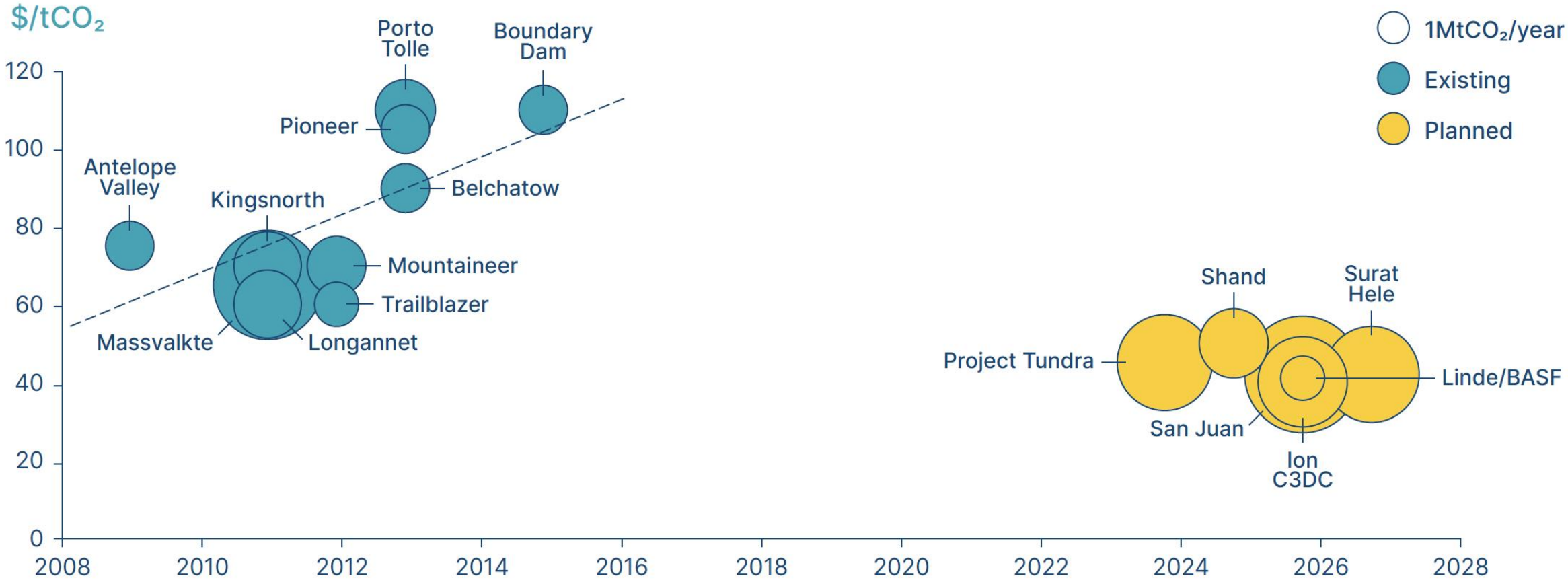
Fastest cost reduction

Slower/nil cost reduction

Solar PV, EVs and batteries		▪ Mass produced in large-scale, replicable factories ▪ Easily transported ▪ Easily deployed / installed
Heat pumps		▪ Mass produced in large factories ▪ Easily transported ▪ Complex installation
Wind		▪ Turbines supply chains very complex, scale of production is orders of magnitude smaller than PV/batteries ▪ Higher degree of customisation for projects ▪ Transport and installation more complex
Electrolyser and green H_2		▪ Can be mass produced, but balance of system costs and specific project complexities important
CCUS		▪ Customised engineering design and deployment
Large-scale nuclear		▪ Hugely complex large-scale systems

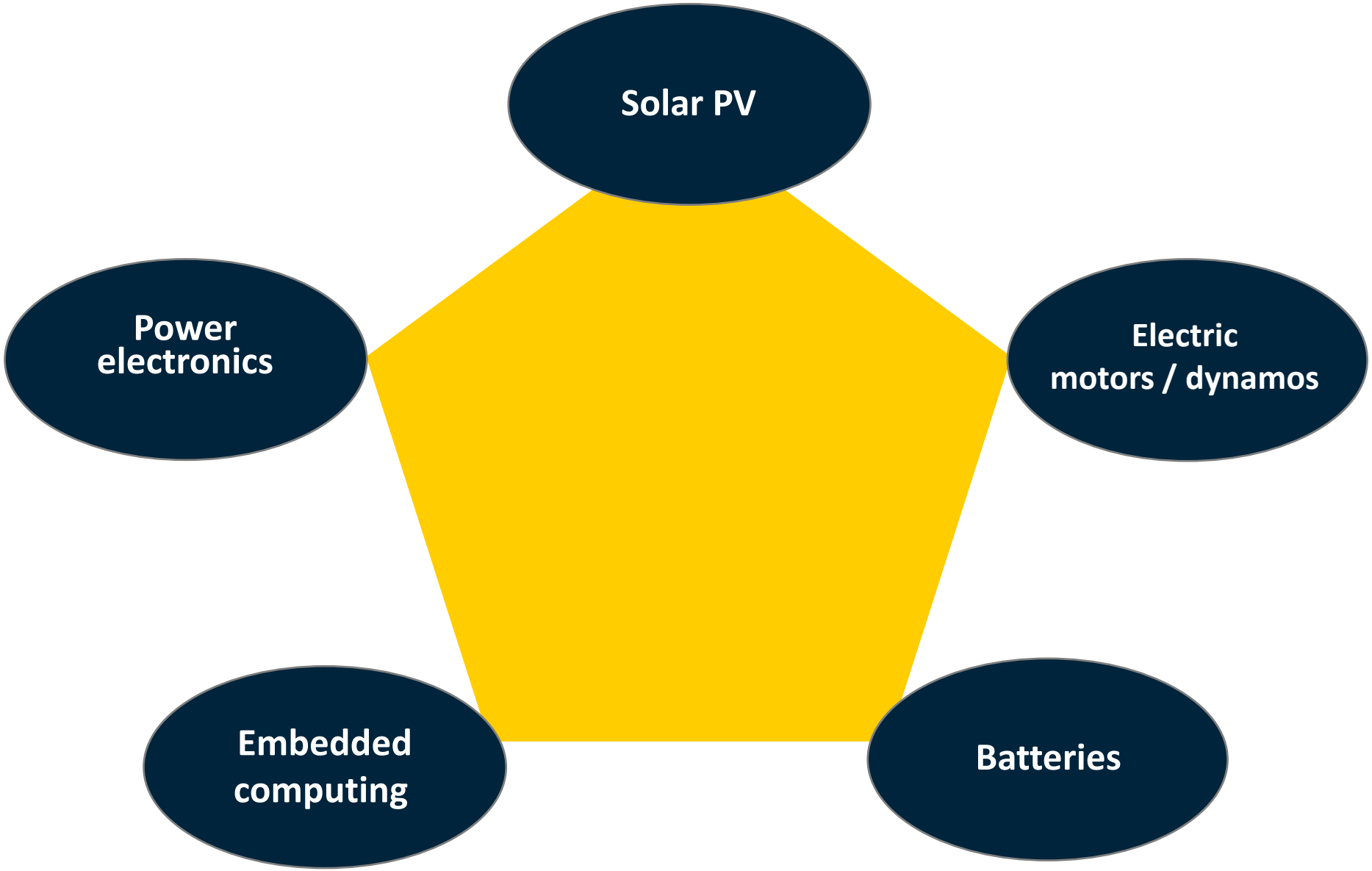
CCUS project costs: 2008-25

$/tCO$_2$



Source: ETC (2022) Carbon Capture, Utilisation and Storage in the Energy Transition: Vital but Limited

The electro tech stack



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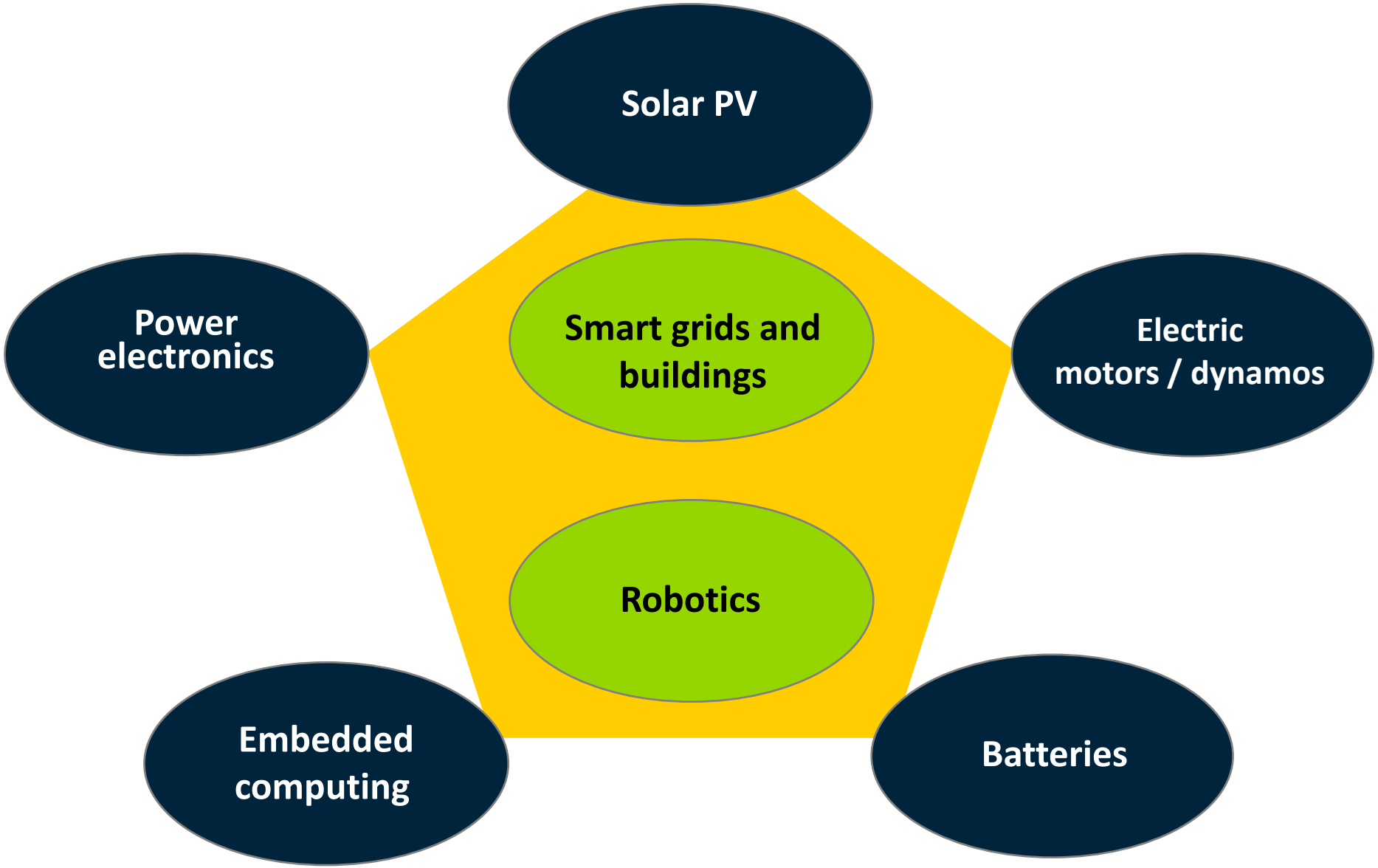
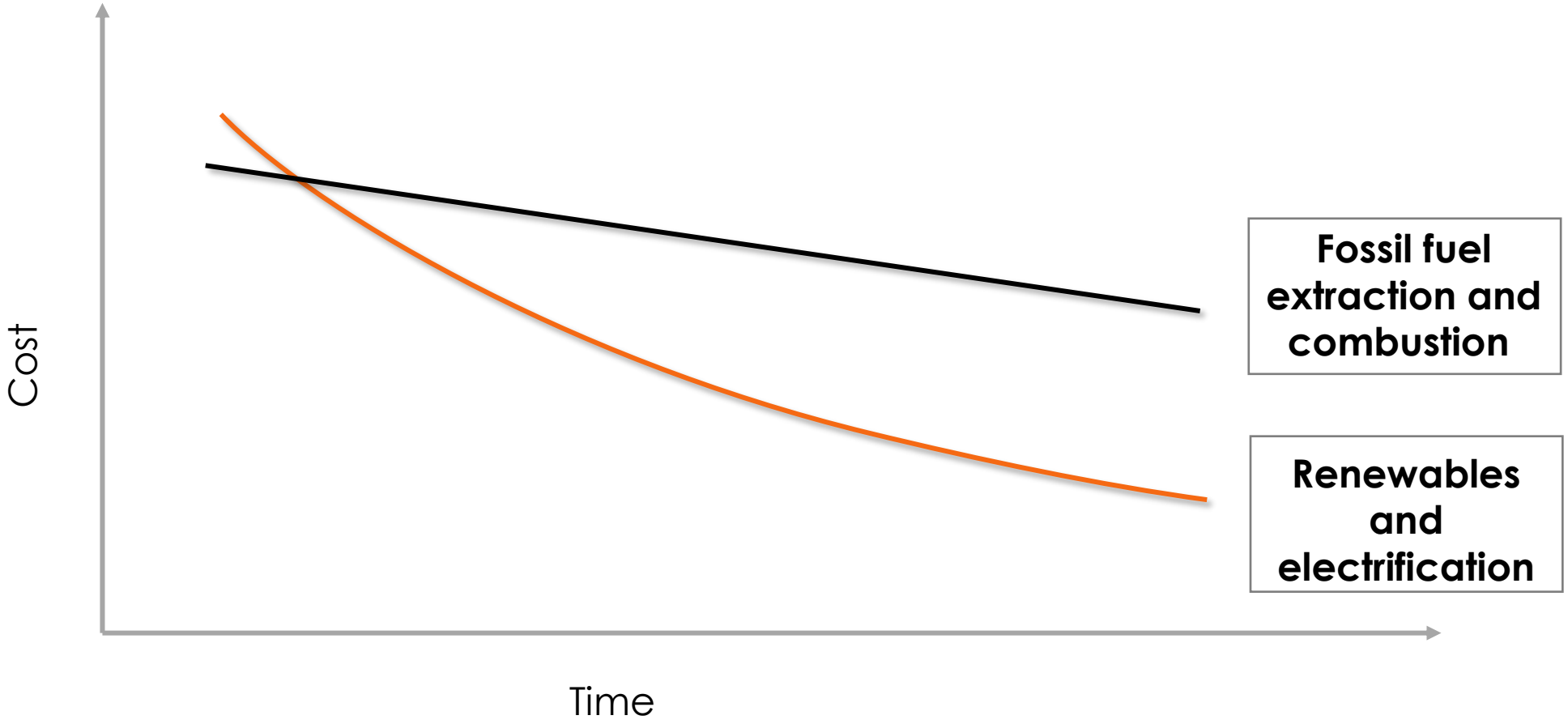
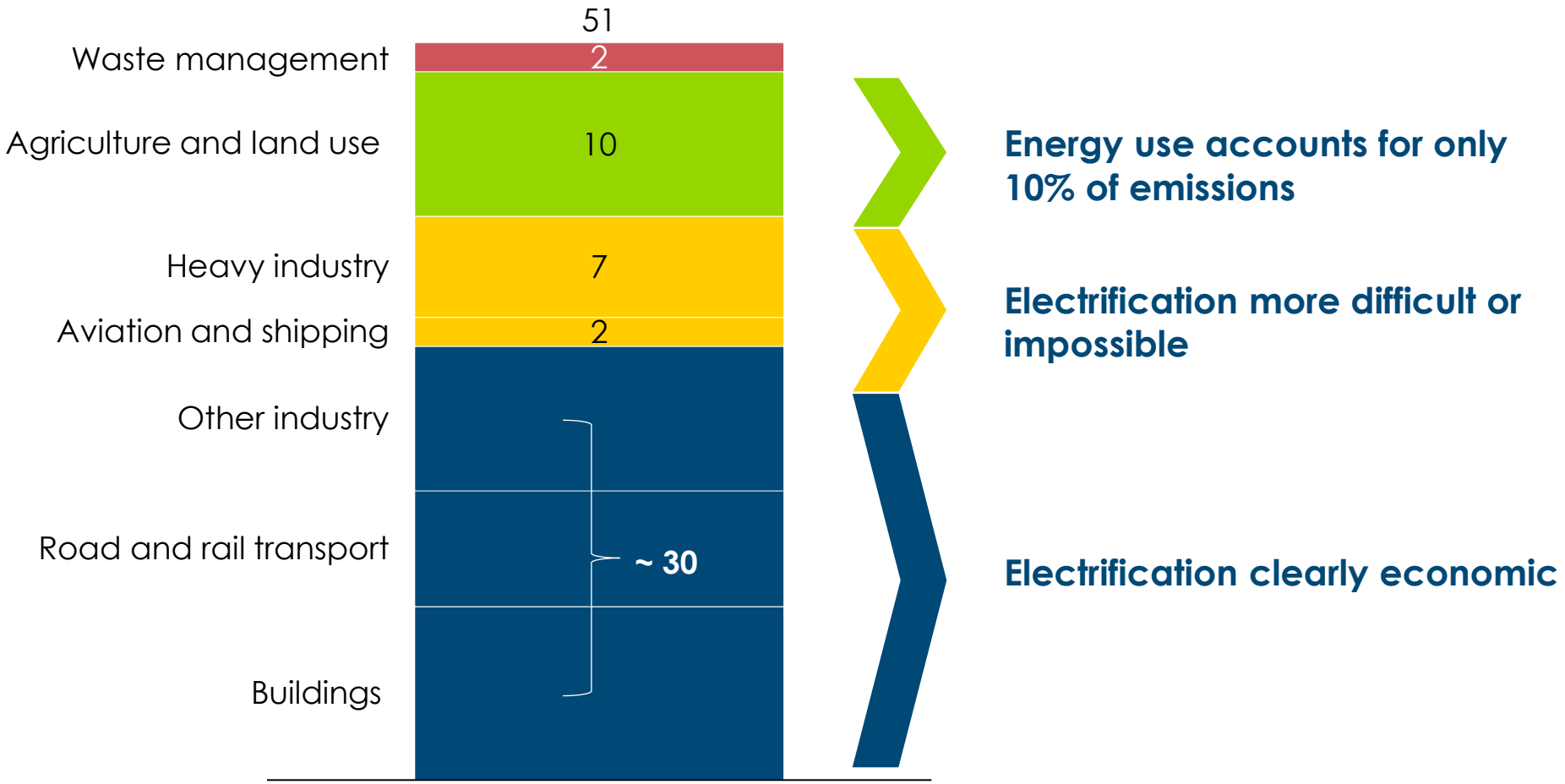


Electro tech vs fossil fuels



GHG emission by broad sector

Gt CO_{2eq}



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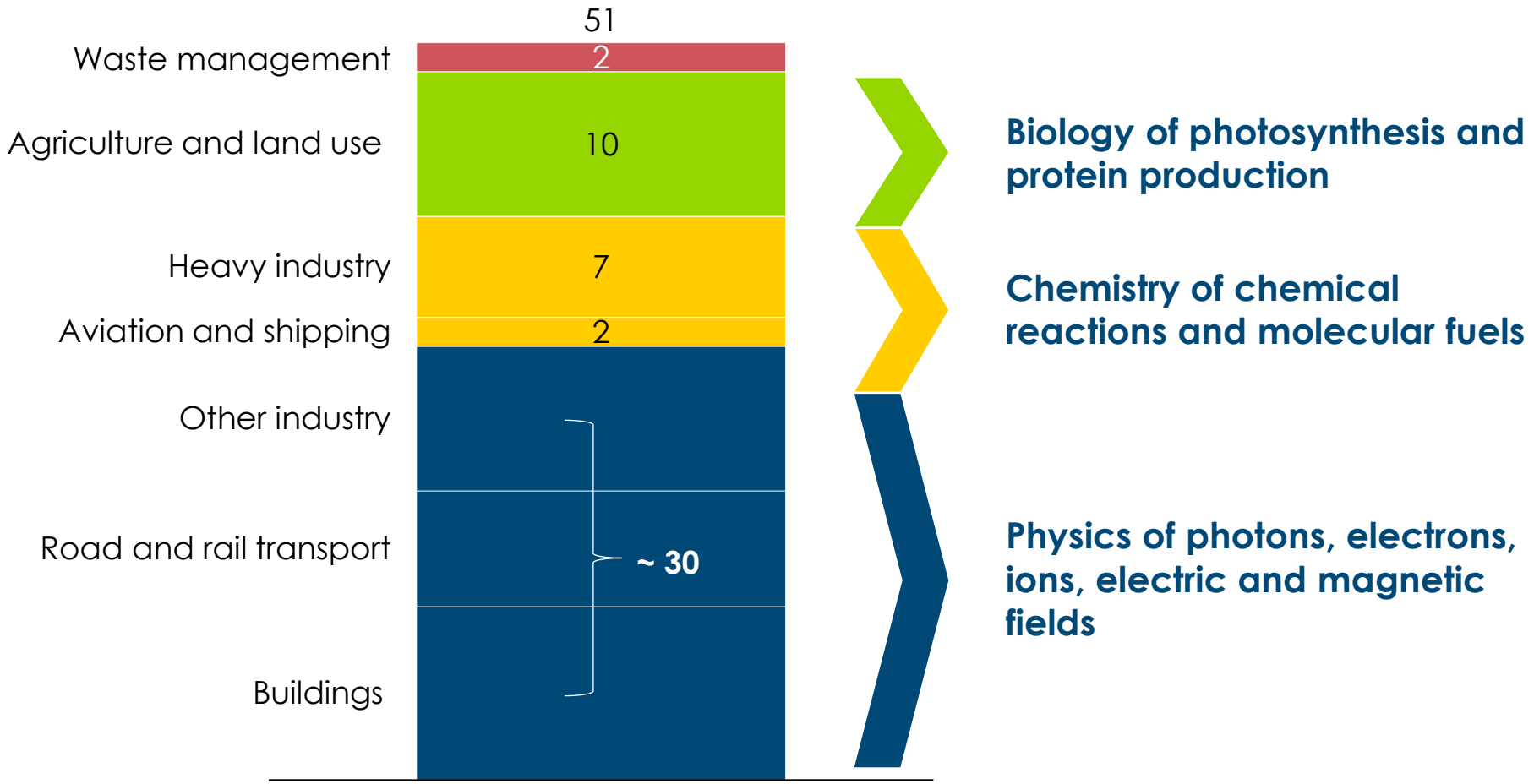


Cement

$$CaCO_3 + heat \rightarrow CaO + CO_2$$

Iron

$$2C + O_2 \rightarrow 2CO$$

$$4CO + Fe_3O_4 \rightarrow 3Fe + 4CO_2$$

Heavy industry decarbonisation technologies

Iron and steel

- Hydrogen as reduction agent
- CCS
- Electrolysis/electrowinning

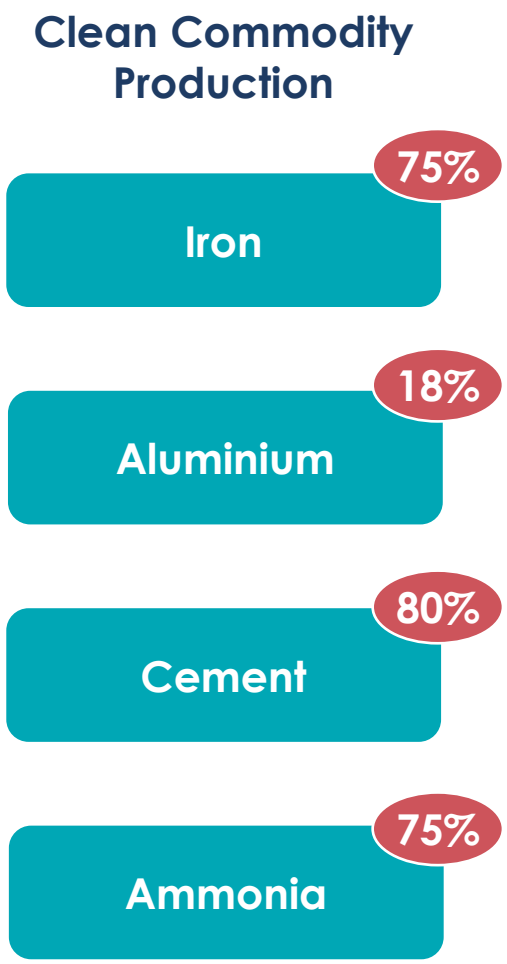
Cement

- CCS
- New cementitious materials

Plastics

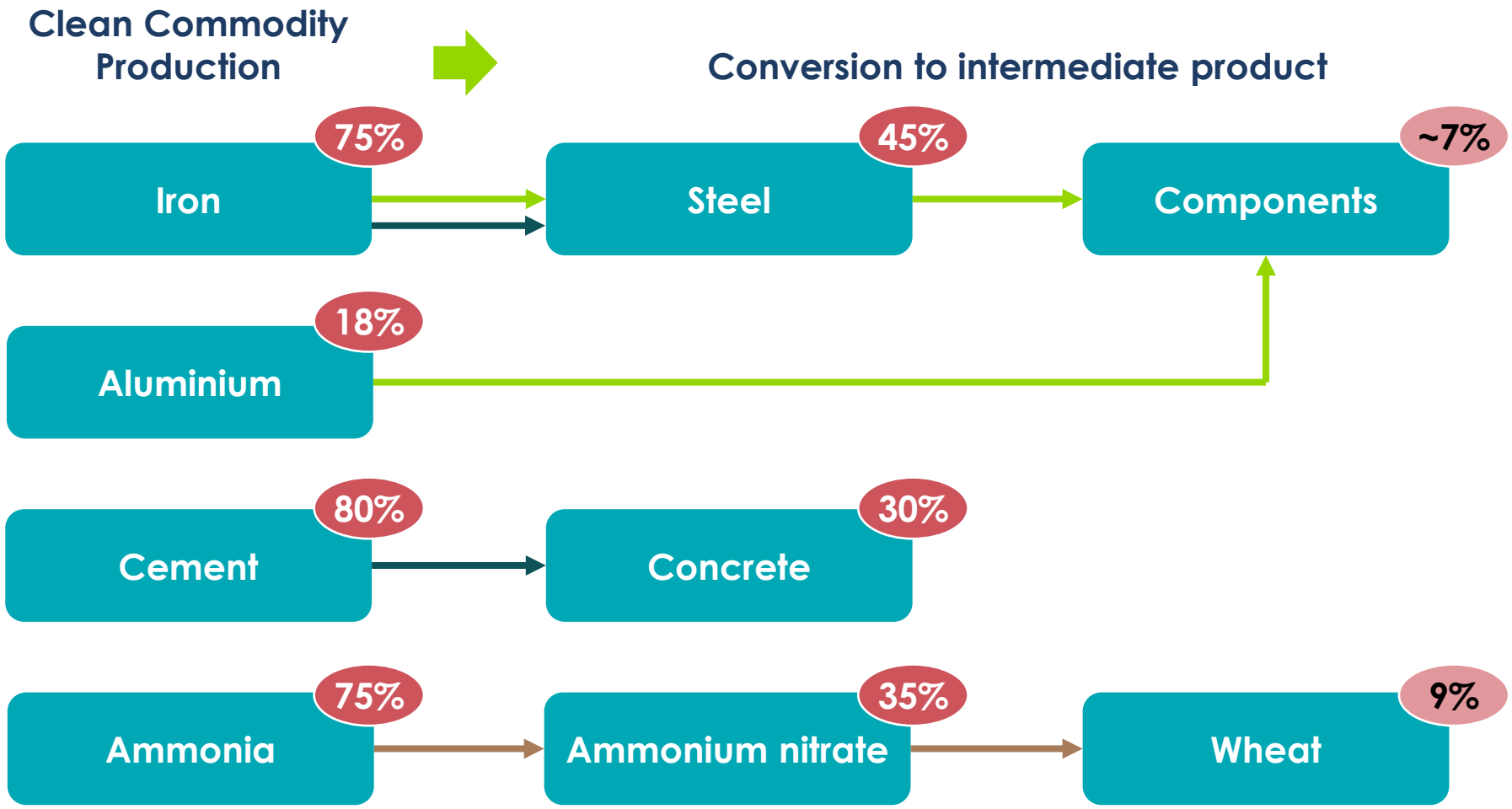
- New carbon atom sources – bio or direct air capture
- CCS
- Mechanical or chemical recycling
- Sustainable end of life storage

The green premium in heavy industry decarbonisation



Assumes 100% cost pass through, costs are based on productions in low-cost regions of Europe. Upstream costs are based on MPP analysis of data produced by Bloomberg NEF, MPP and Energy Transitions Commission – full assumptions can be found in the technical annex.

The green premium in heavy industry decarbonisation



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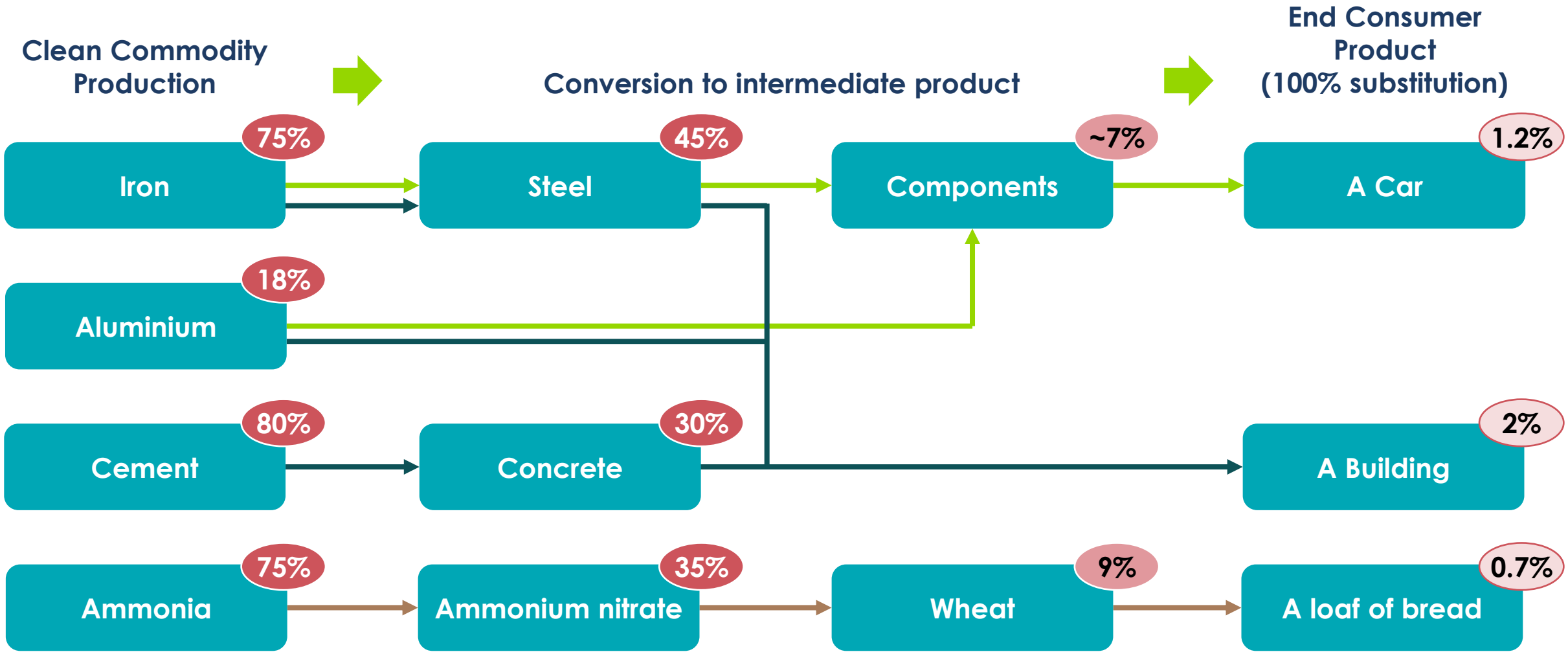

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GHG emission by broad sector

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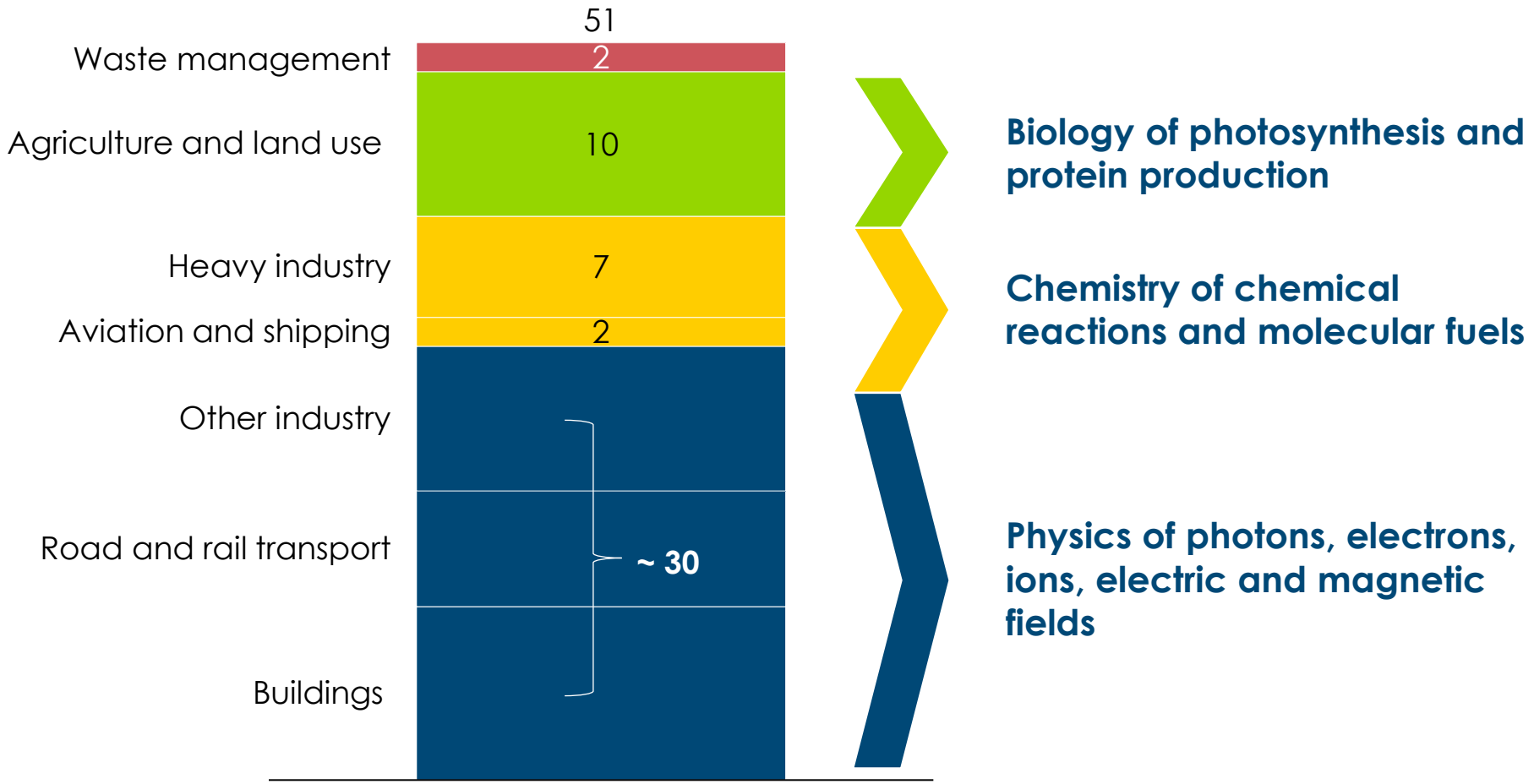
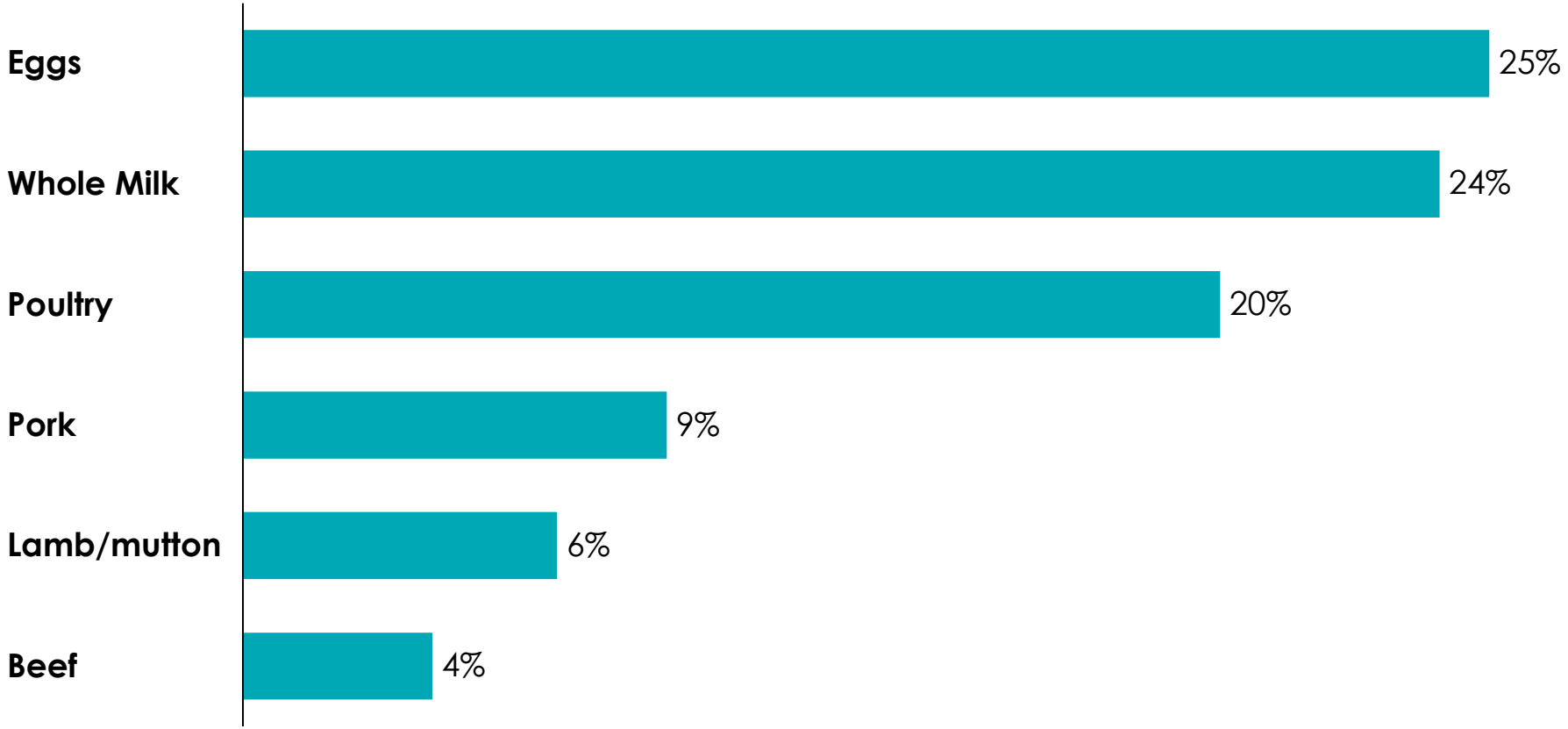


Protein efficiency of meat and dairy production

% of protein inputs as feed effectively converted to animal product



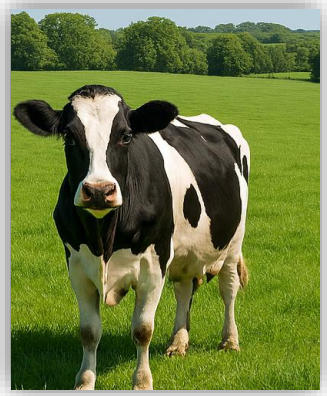
Source: Alexander et al. (2016). *Human appropriation of land for food: the role of diet,* Global Environmental Change , Volume 41

Relative efficiency: road transport vs meat

Solar to motion

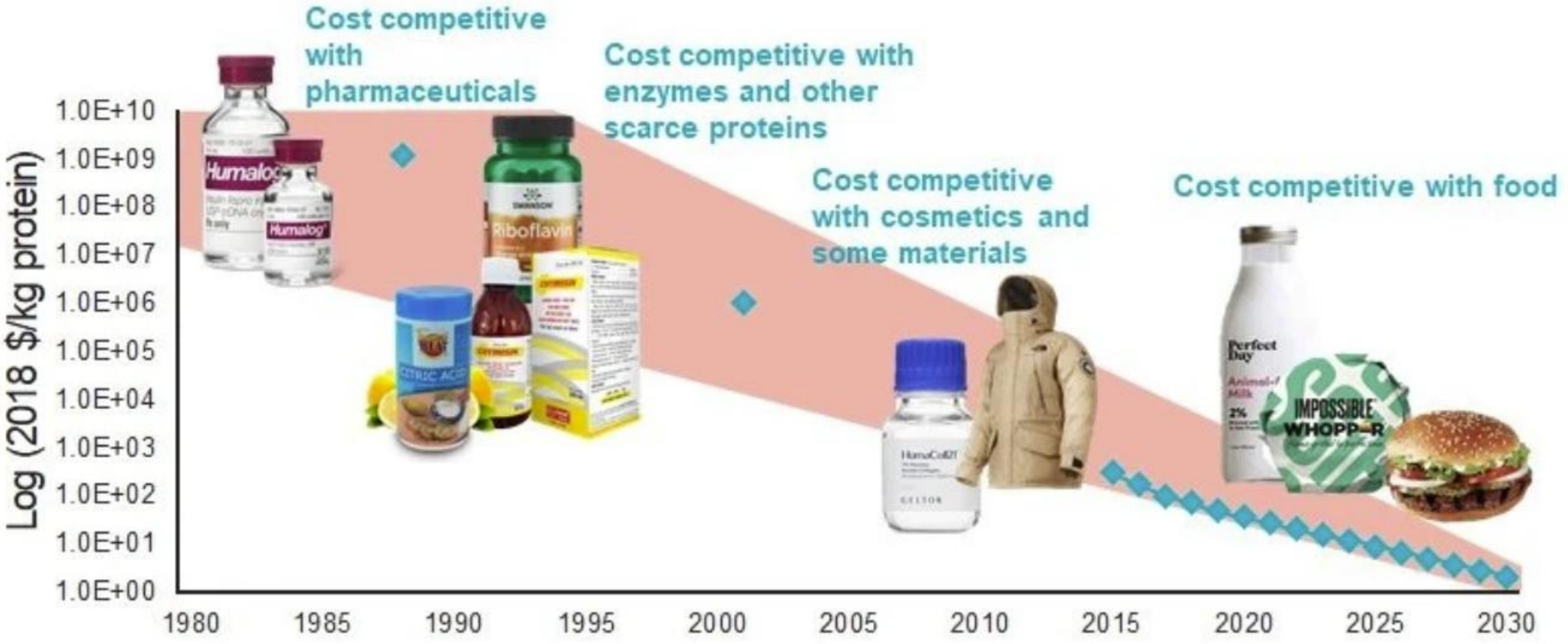
15% x 90% = 13.5%

Solar to animal protein



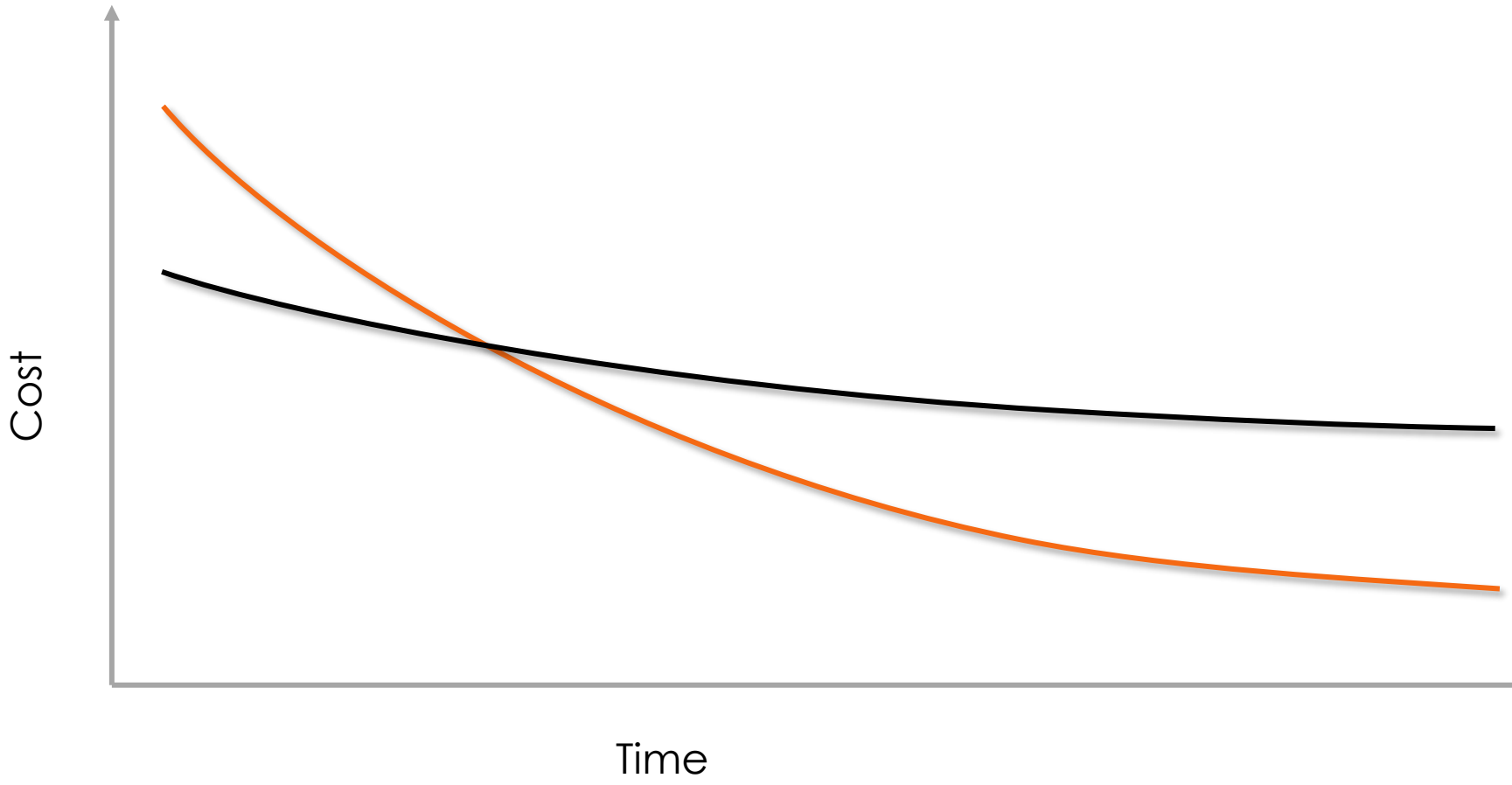
1% x 4% = 0.04%

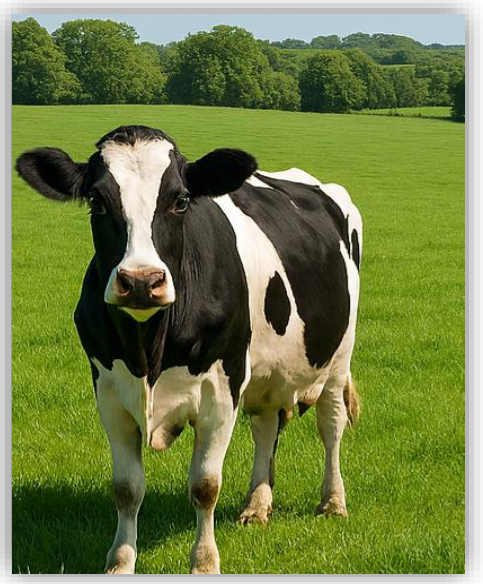
Precision fermentation proteins



Source: Rethink X , Rethinking Food and Agriculture, 2019 , www.rethinkx.com/publications/rethinkingfoodandagriculture2019.en

Synthetic protein versus the cow





GHG emissions by broad sector

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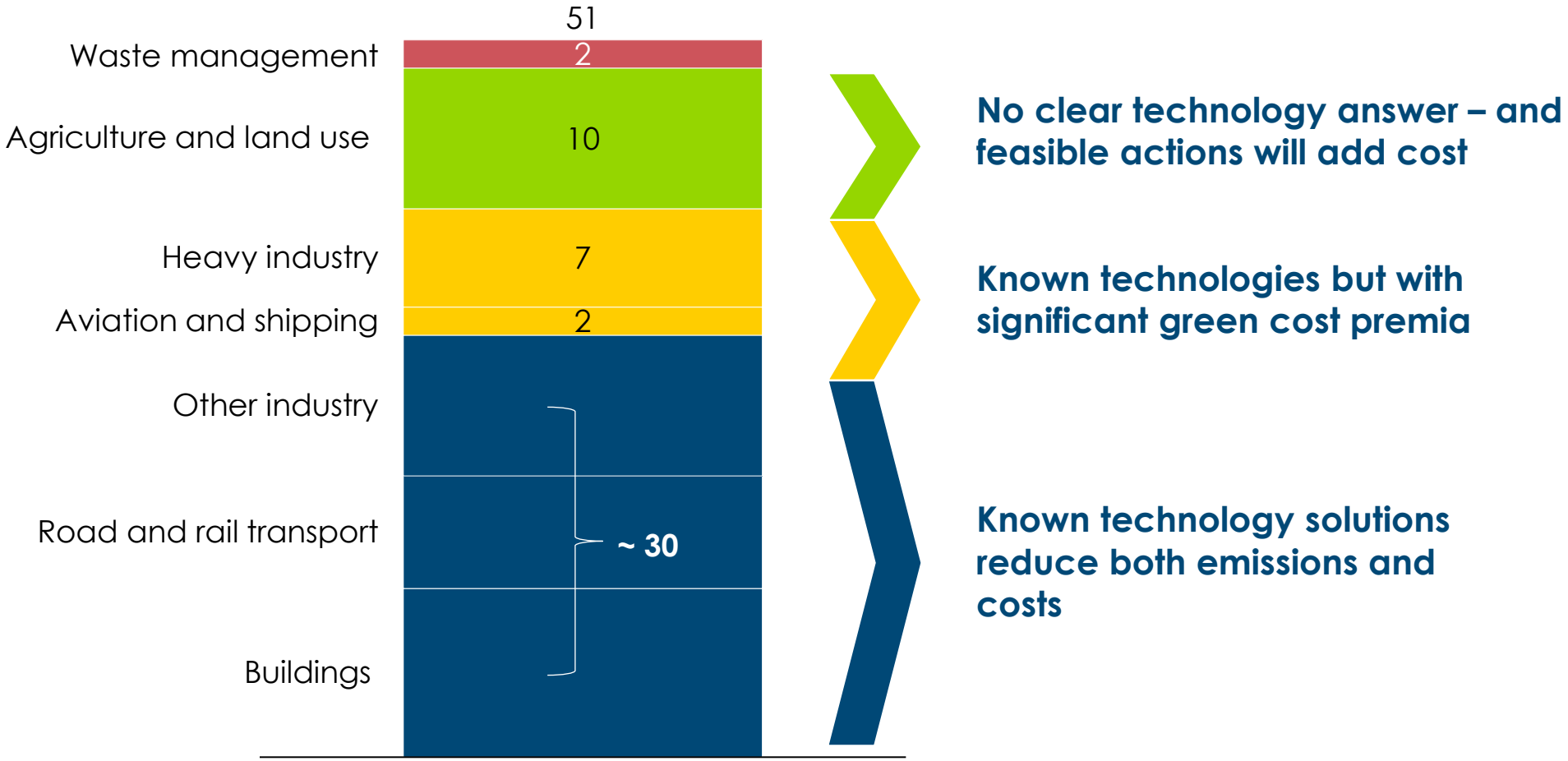
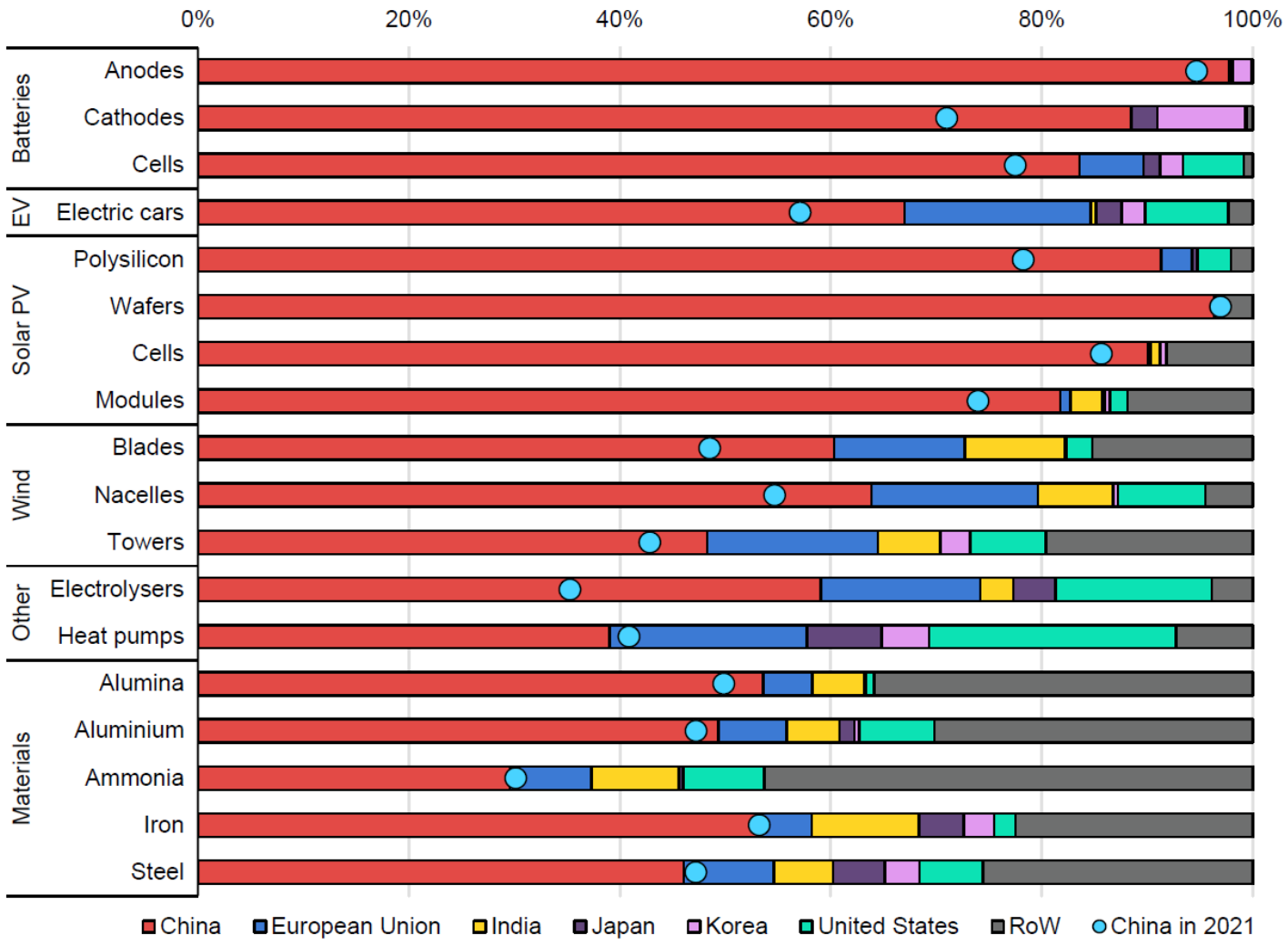


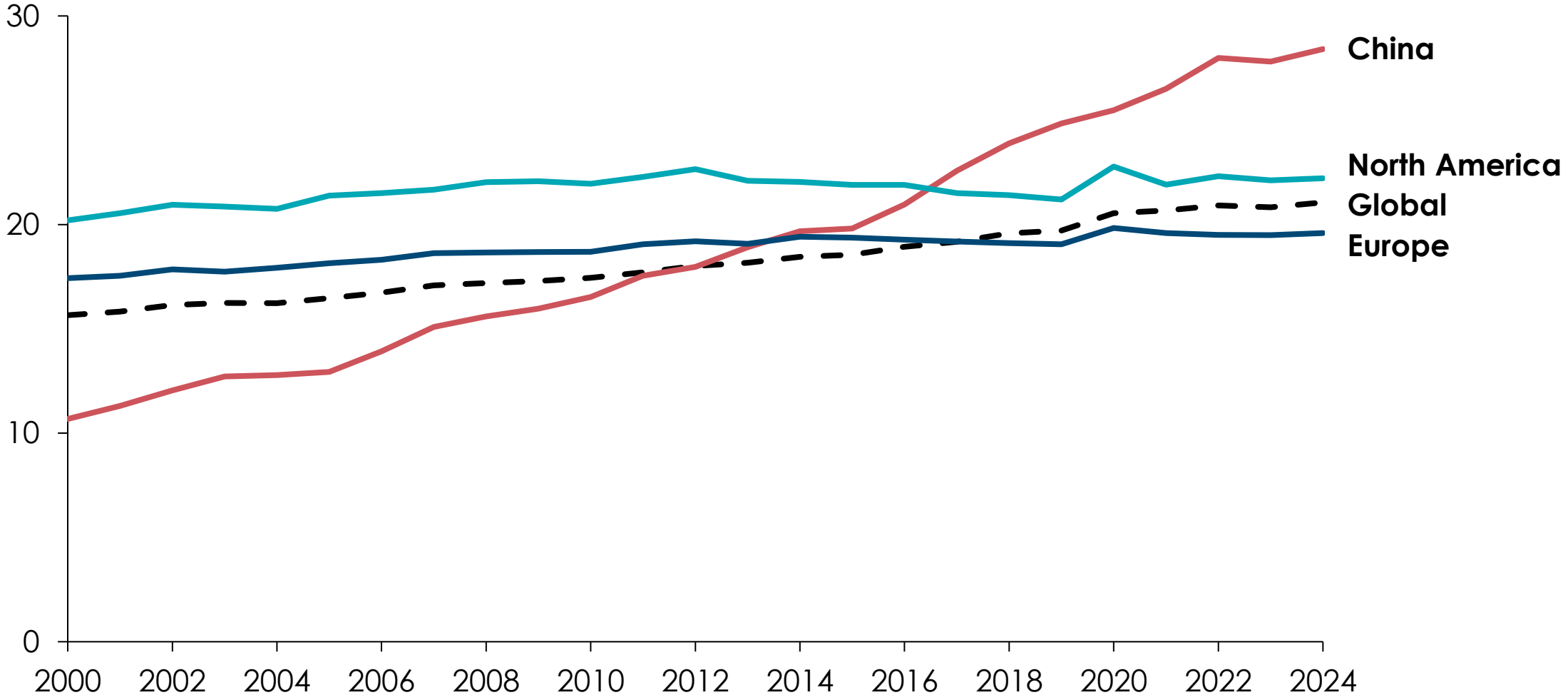
Installed global manufacturing capacity by country/region 2023



Source: IEA (2024) *Clean Technology Perspectives*

Electricity share of final energy demand

%

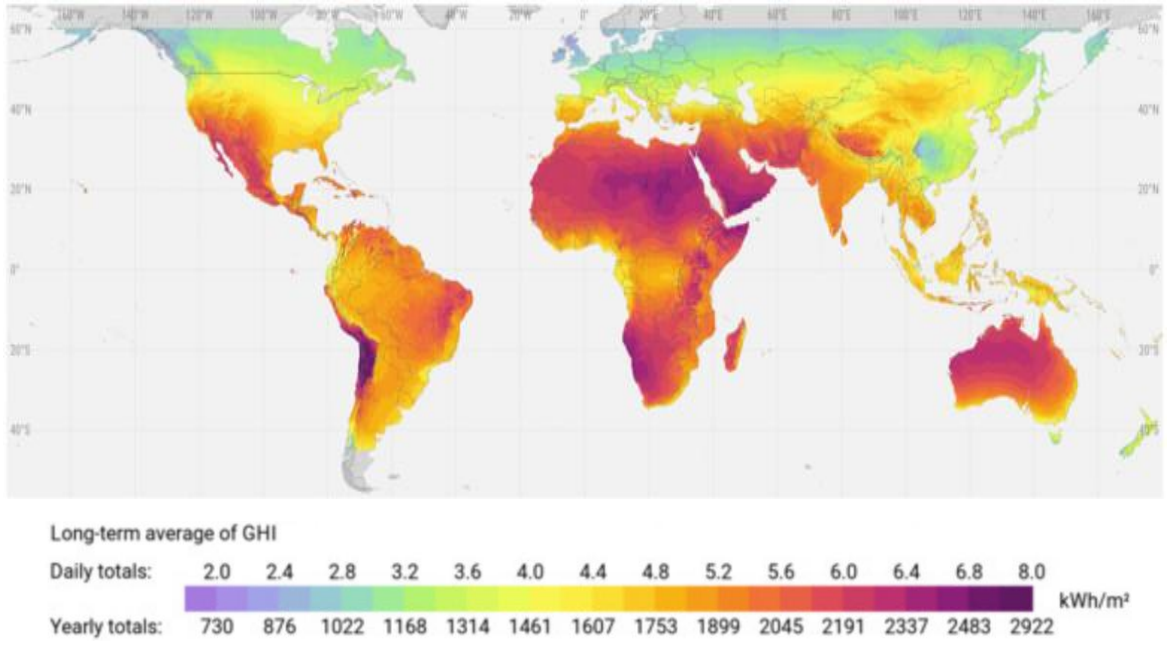


Source: BNEF (2025) *New Energy Outlook*

The global sunbelt and the high latitude wind belt

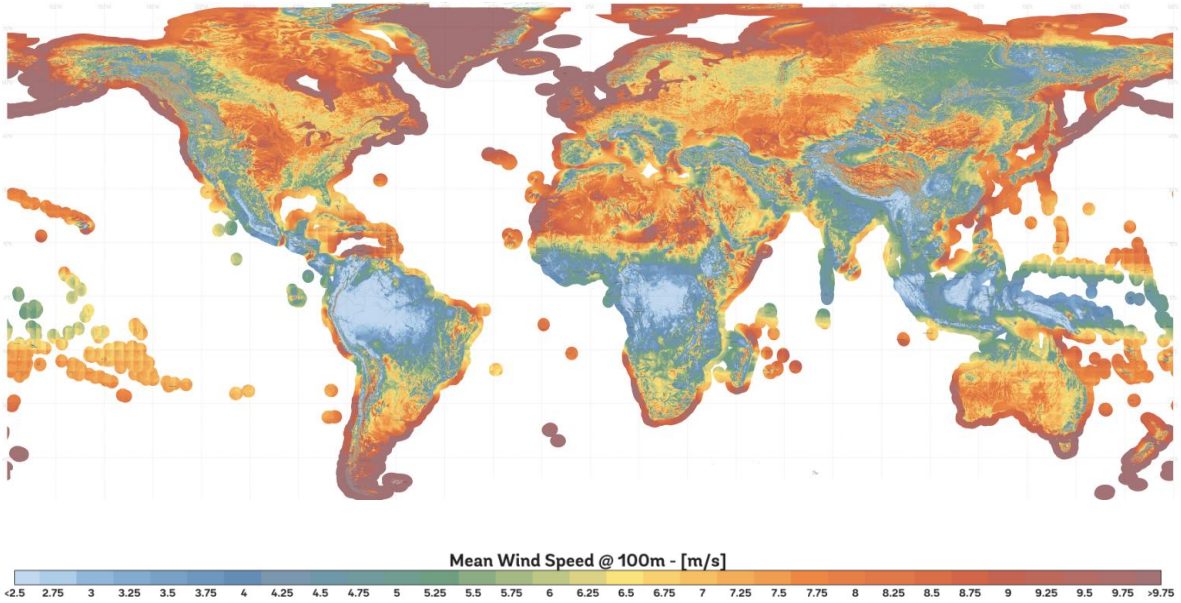
Solar irradiation intensity

Long-term yearly average of daily and yearly GHI totals



Wind power density

Mean wind power density at 100 m above surface level



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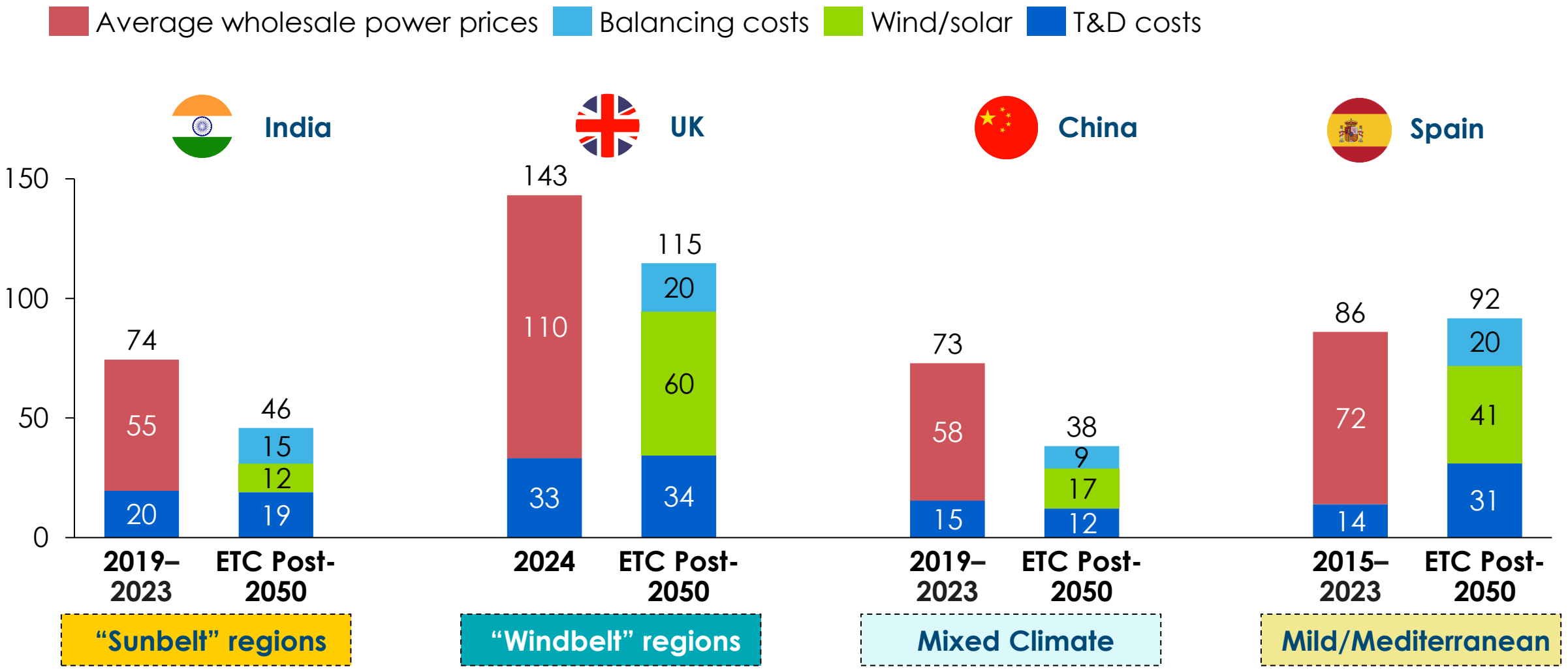
Total system costs (generation, balancing, and grids), recent vs post-2050

$/MWh (real 2024$)



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

UK January 2026

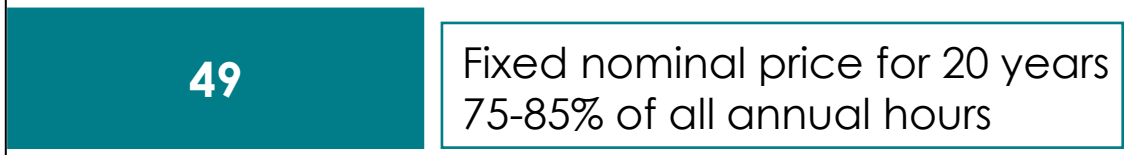
AR 7 Offshore wind

8.4 GW awarded @ £91.2 per MWH

India November 2025

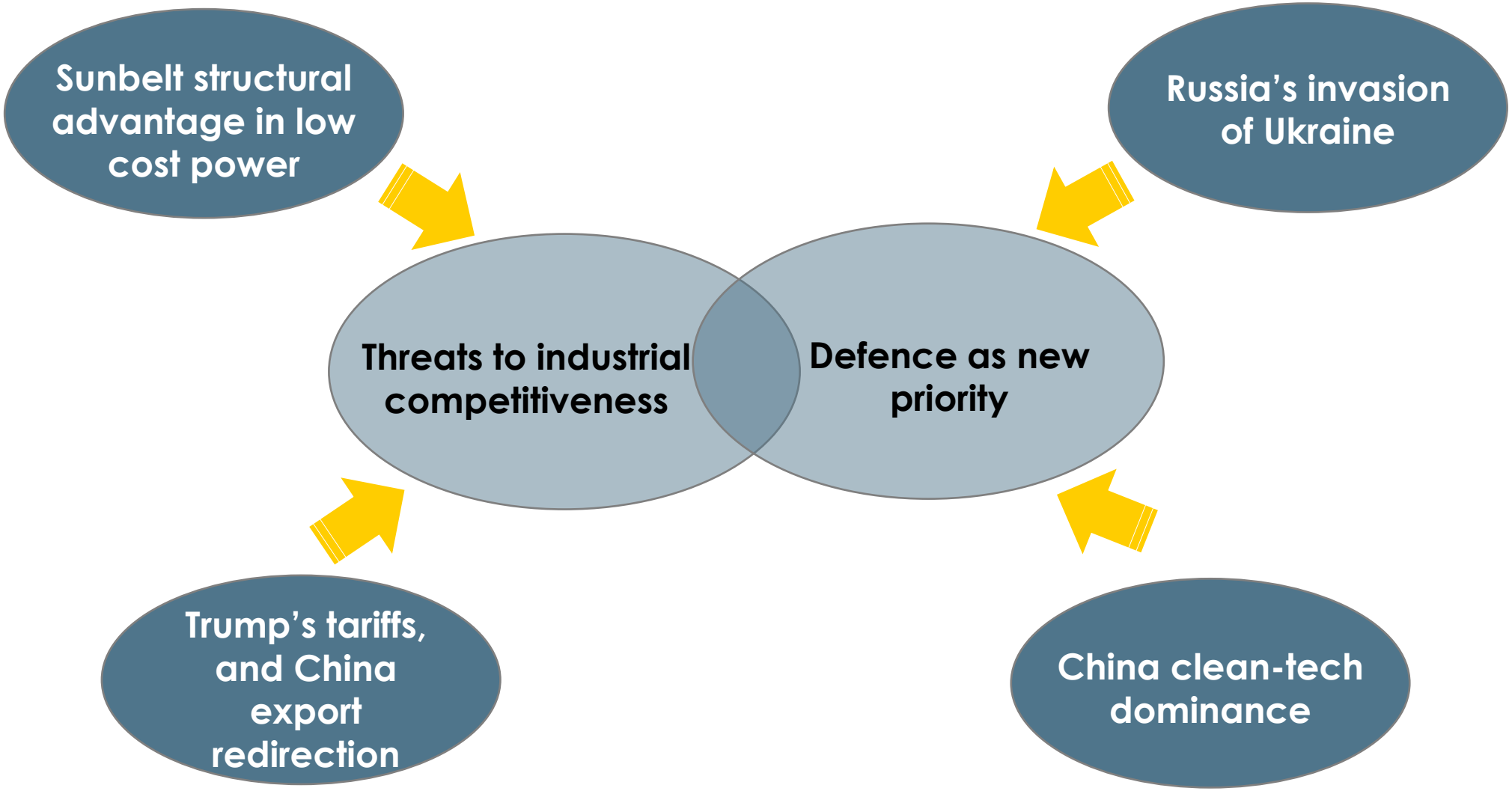
REMCC round the clock

1GW awarded @ ₹4.33 per wkh



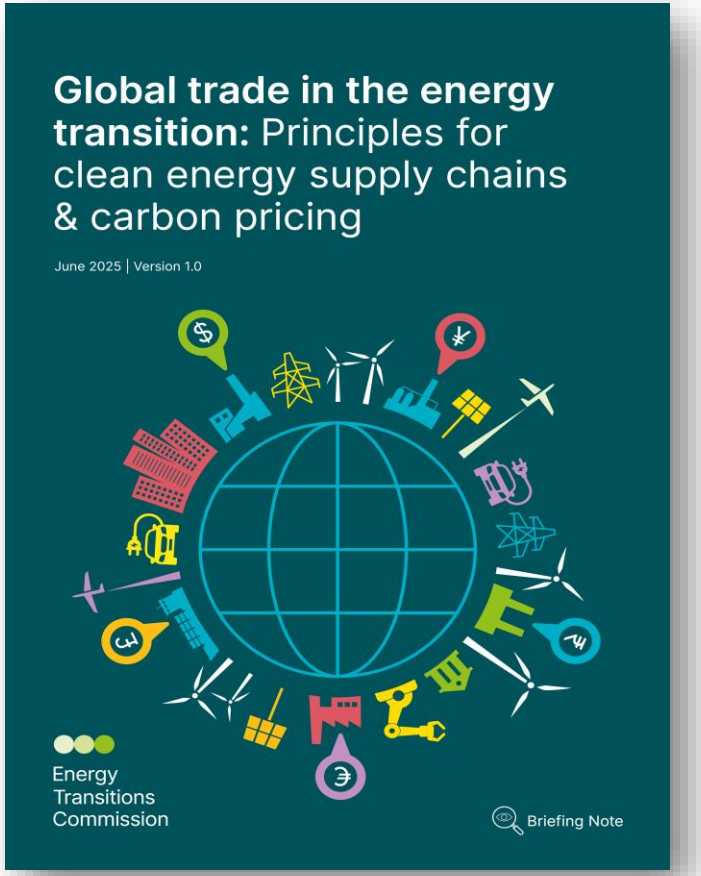
Source https://www.mercomindia.com/ayana-renew-acme-among-winners-of-remcls-1-gw-rtc-renewable-power-auction https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-7-results

Europe's perfect storm



Developing domestic supply chains: five principles

1. Aim for diversified supply chains but **not complete autarky**
2. **Vary policy by sector** to reflect different starting points and inherent characteristics
3. Use **tariffs in a fact-based and WTO compliant** fashion
4. Focus primarily on the **location of employment and value added**, rather than ownership
5. Think straight about **different dimensions of "security"**



Q&A

Energy Transitions Commission

eden mccallum