Energy
Transitions
Commission

ETC Asia Australia Chapter Engagement meeting

July 21, 2025

Agenda

ETC Asia engagement

State of the global energy transition and implications for the ETC

- *Guest Speaker: Amir Hon - Petronas*

Emerging Insights: Asia Energy Demand Trends

- *Guest Speaker: Rajiv Mangal – Tata Steel*

Emerging Insights: Nuclear

ETC 2026 strategy: Looking ahead and feedback

ETC's impact highlights from 2025 so far

As a trusted source of facts, ETC was mentioned in 1200 recent news stories

How the world has responded to Trump's Paris climate agreement withdrawal — The Guardian

China, Europe and UK should form climate coalition apart from US, energy expert says — FINANCIAL TIMES

"As fast as we possibly can": Energy expert on transitioning to renewables — cna

EU climate targets: "China is providing the technologies that can solve the problem" — CGTN

AI will not supercharge GDP growth — The Korea Times

How Xi sparked China's electricity revolution — FINANCIAL TIMES

Zero Carbon Cooling in a Warming World — TerraGreen

Our direct reach expands

ETC now reaches 30,000+ newsletter subscribers

We are engaging new audiences through new channels

Recorded 8 podcast episodes

- The Infrastructure Podcast
- IEMA Sustainable Matters
- FT The Economics Show
- BBC Talking Business
- S&P Global All Things Sustainable
- Shaken Not Burned
- Battery: Advancing Renewable Integration with Innovative Battery Technologies
- The Urban Report.

Leveraging social media to reach new networks

17,000+ followers (up 14%)
150,000+ impressions (up 44%)

Launched BlueSky Account

There is strong interest for our evidence-base

5,000+ file downloads on the ETC website

We regularly speak to a global audience

ETC has attended over 50 events around the world:

Global Trade in the Energy Transition

June

ETC discusses the role of trade in accelerating the energy transition and highlights two key areas: principles for nearshoring supply chains and carbon pricing.

At launch, Adair presented key insights to the OECD

ETC members helped disseminate the report and findings on social media

Faustine Delasalle · 1st
Chief Executive Officer, Mission Possible Partnership
22h

New briefing note from the Energy Transitions Commission on "Global trade in the energy transition: principles for clean energy supply chains and carbon pricing".

Clean trade can be a powerful accelerator of the global energy transition, enabling clean energy supply chains to scale up faster. However, growing concerns over concentrated supply chains and perceptions that carbon border adjustments are protectionist could significantly delay global progress.

Jean-Pascal Tricoire · 3rd+ ✓ Following
Chairman at Schneider Electric
20h

As the global energy landscape evolves, policy must keep pace. The Energy Transitions Commission's latest briefing offers timely insights on aligning technological progress and carbon pricing with effective global trade.

The ETC outlines a pragmatic and principled approach to two critical challenges:

- Building resilient domestic supply chains – Six policy principles to guide national strategies.
- Carbon pricing and CBAMs – A call for globally coherent policies to decarbonize hard-to-abate sectors.

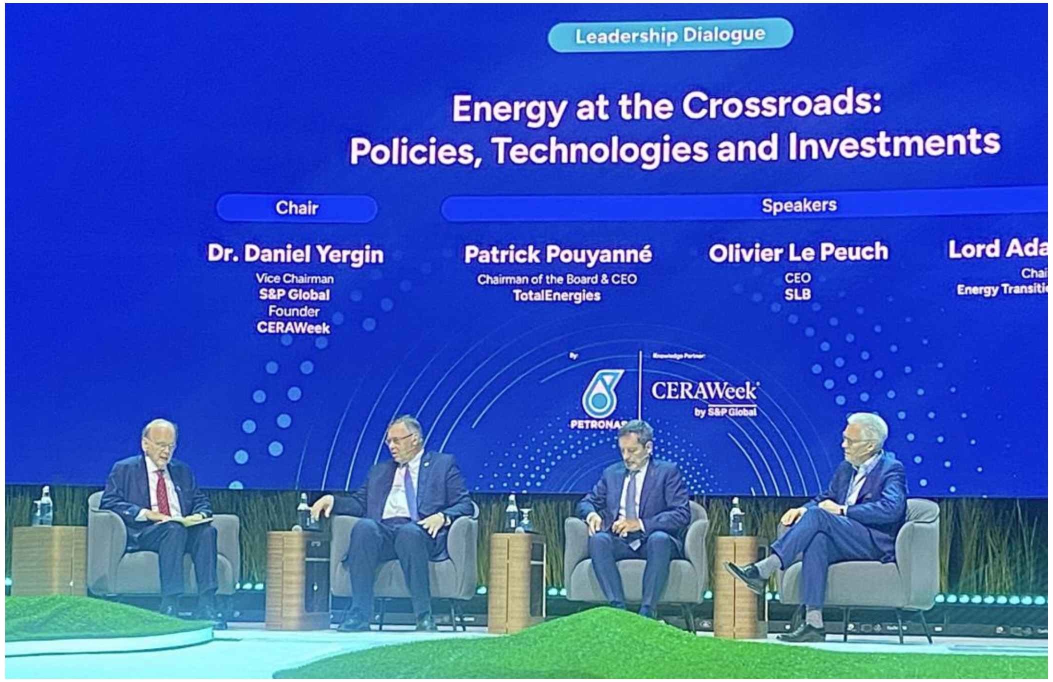
Alan Thomson · 2nd ✓ Following
Director, Global Energy Business Leader at Arup
23h

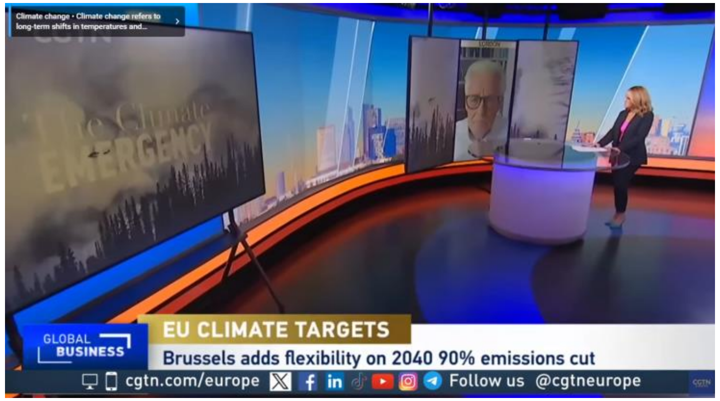
If you would like to know more about CBAM, carbon pricing, clean supply chains and other global net-zero mechanisms it is worth a read of this recent report from the Energy Transition Commission, one of Arup's Strategic Global Partners. A really concise, well written and informative overview of this rather dry, but important subject. #Arup #CBAM

Targeted international media, Tier 1 and trade outside of UK and US. Our press release newswire distribution to over 30 countries and briefings with journalists led to coverage in over 200 news stories around launch.

BusinessGreen	Report: Carbon levies and diverse supply chains 'essential' for energy transition
Energy Monitor	ETC briefing highlights global energy trade challenges
CarbonCopy – Making Climate Sense	Carbon Pricing Key to Drive Decarbonisation in Internationally Traded Sectors
Borderlex	Interview: Europe 'can win argument' over carbon border adjustment

ENERGY ASIA





Recent ETC engagement at Asia-focused events:

Energy Asia. June 15-17, Kuala Lumpur

- Sunday closed door session - Inaugural Energy Asia Global Leadership Executive Forum
- Monday plenary session
- Tuesday engagement with the young entrepreneurs
- Tuesday CNBC panel "Powering the Energy Transition: Innovation as a Catalyst for a Smarter, Greener Future"

June 18, Singapore

- Meeting with President Tharman Shanmugaratnam & climate experts

June 19-20

- Rose to Jakarta

July 17

- China Executive Leadership Programme in Cambridge

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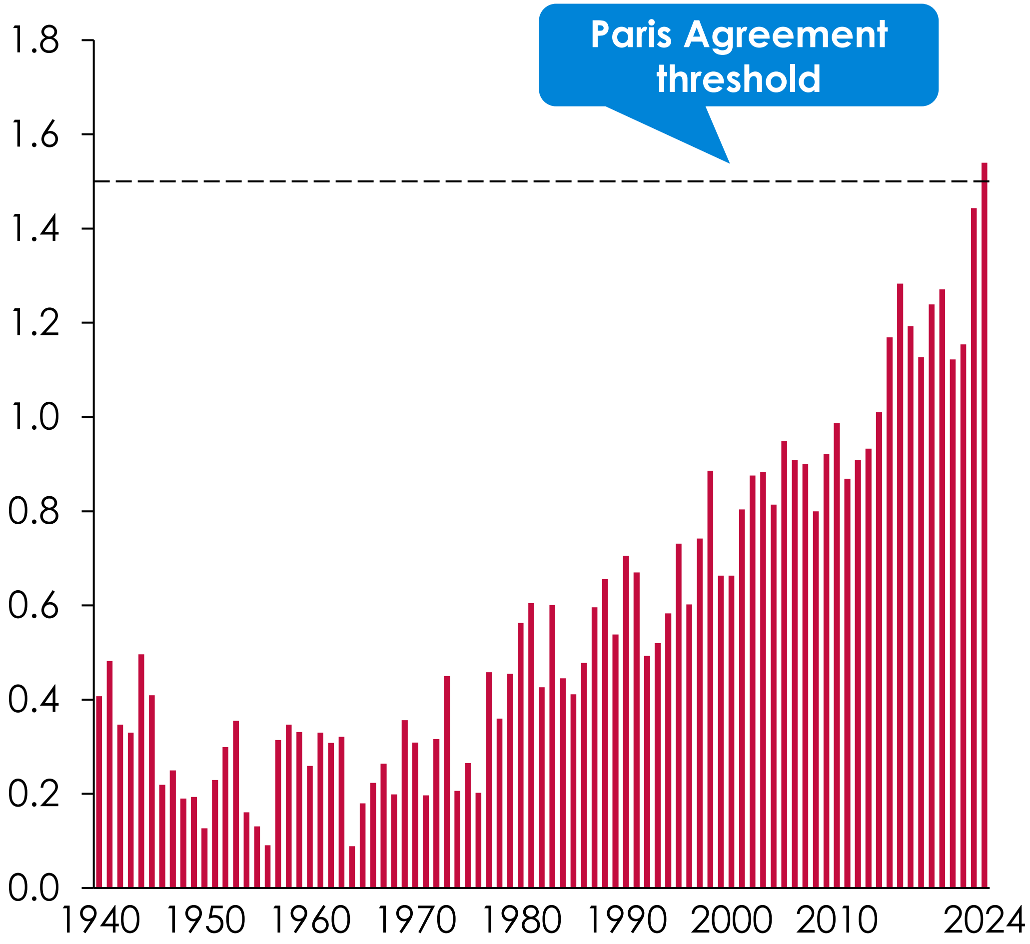
ETC 2026 strategy: Looking ahead and feedback

2024 saw the Paris agreement threshold breached for the first time and impacts for human systems can be even more catastrophic if we reach 2°C

Global surface air temperature anomalies with reference to pre-industrial period (1850-1900)

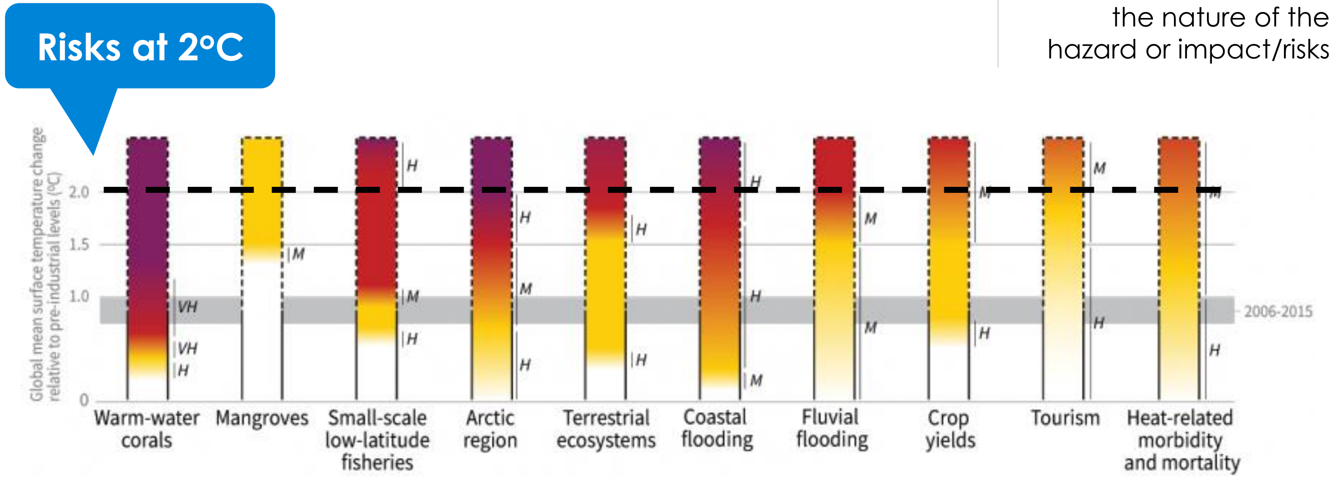
°C above pre-industrial levels



Impacts and risks for selected natural, managed and human systems

Leve of additional impact/risk due to climate change

Undetectable	Moderate	High	Very High
White indicates that no impacts are detectable and attributable to climate change	**Yellow** indicates that impacts/risks are detectable and attributable to climate change with at least medium confidence	**Red** indicates severe and wide-spread impacts/risks	**Purple** indicates very high risks of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impact/risks

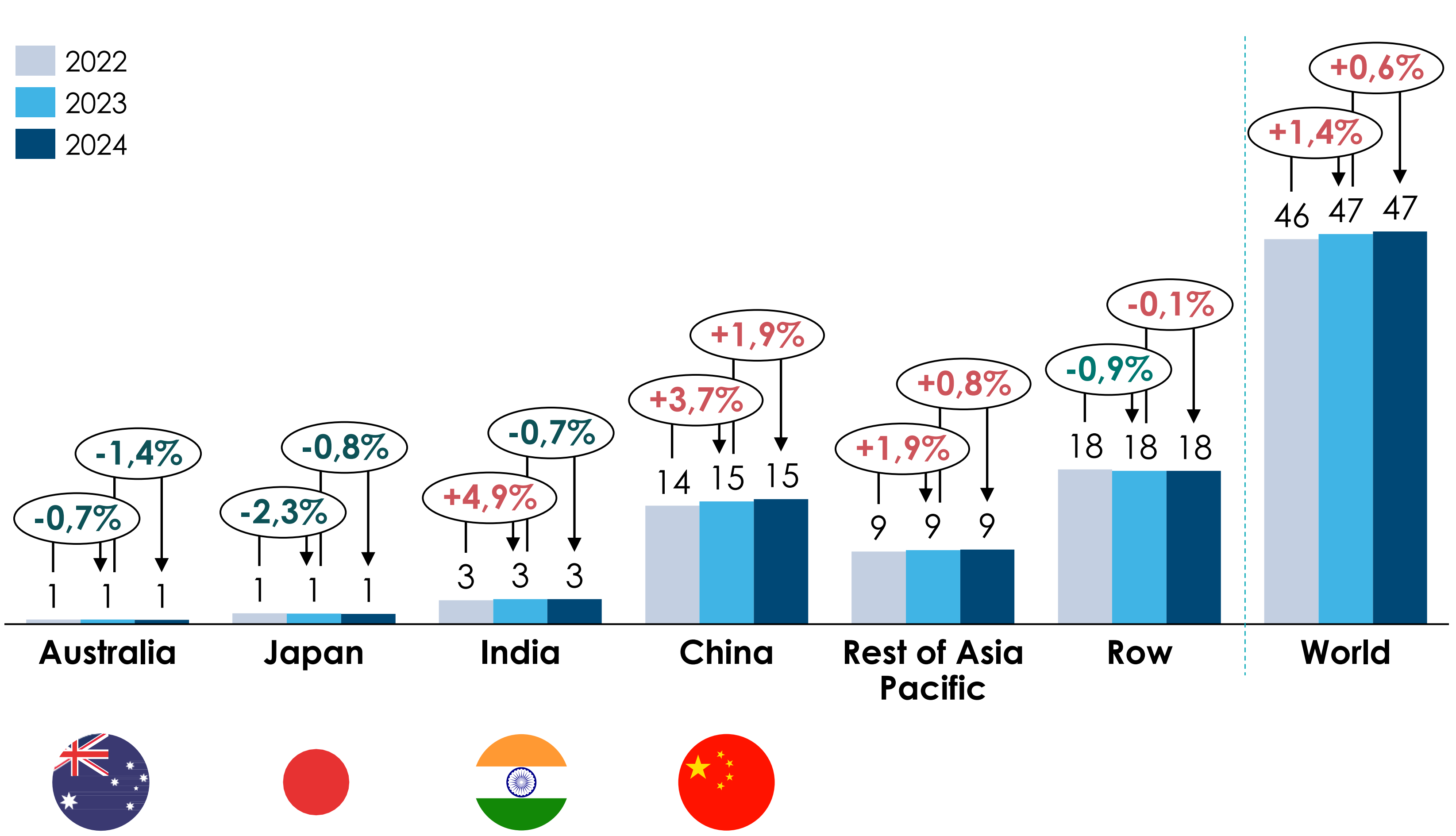


Note: Paris Agreement threshold is officially based on 20 year average temperature increase.
Source: Copernicus (Accessed Jan 2025), Global climate highlights 2024, NOAA global temperature; IPCC (2018) Global Warming of 1.5 °C

Rate of CO_2 growth slowing, but not yet falling; Chinese energy sector emissions likely at peak

Global Energy CO2 emissions*, 2022-2024

GtCO2/year



- New high in global energy emissions: **0.6% growth – growth in global south, aviation and shipping outweigh emissions reductions in developed economies**
- Slower growth in China's emissions partially due to the **growth in wind and solar** capacities but also restoration of **hydropower generation (+11% compared to 2023)**
- **India** emissions slightly decreased due to **power emissions intensity coming down** compensating an increase in electricity use in buildings driven by AC usage in during heat waves

*Include industrial process emissions

Source: Climate Trace available at: https://climatetrace.org/inventory?country=CHN&year_from=2022&year_to=2022&gas=co2 accessed on July, 2025

Political support for decarbonisation in Asia continues to be mixed

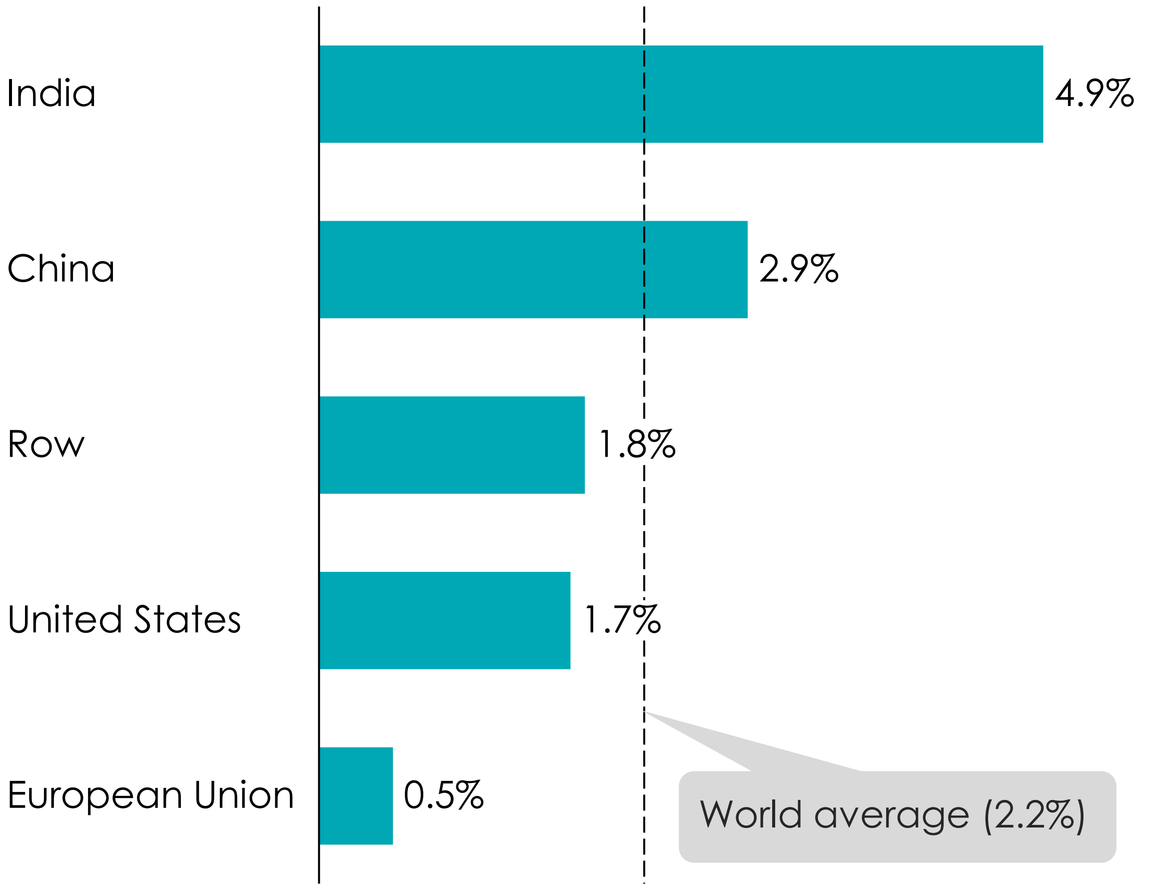
Key energy transition indicators across selected countries

	Australia	South Korea	China	India	Indonesia	Bangladesh
2023 emissions per capita (tCO_2/person/y)	14	11	8	2	3	1
Wind and solar share of electricity generation in 2024 (%)	29	6	18	11	0	1
Net zero target year	2050	2050	2060	2070	2060	*No target set*
Key takeaways	Strong incentives for storage and renewable generation, and momentum in green industrialisation	Leading in nuclear development but targets still have insufficient coverage	Although ranked strongly on renewables expansion, continues with fossil projects	Slow progress but possible potential to advance Net Zero ahead of 2070?	Slow progress, new power plan is not ambitious despite strong solar fundamentals	High potential for rooftop solar and wind but lacking incentives

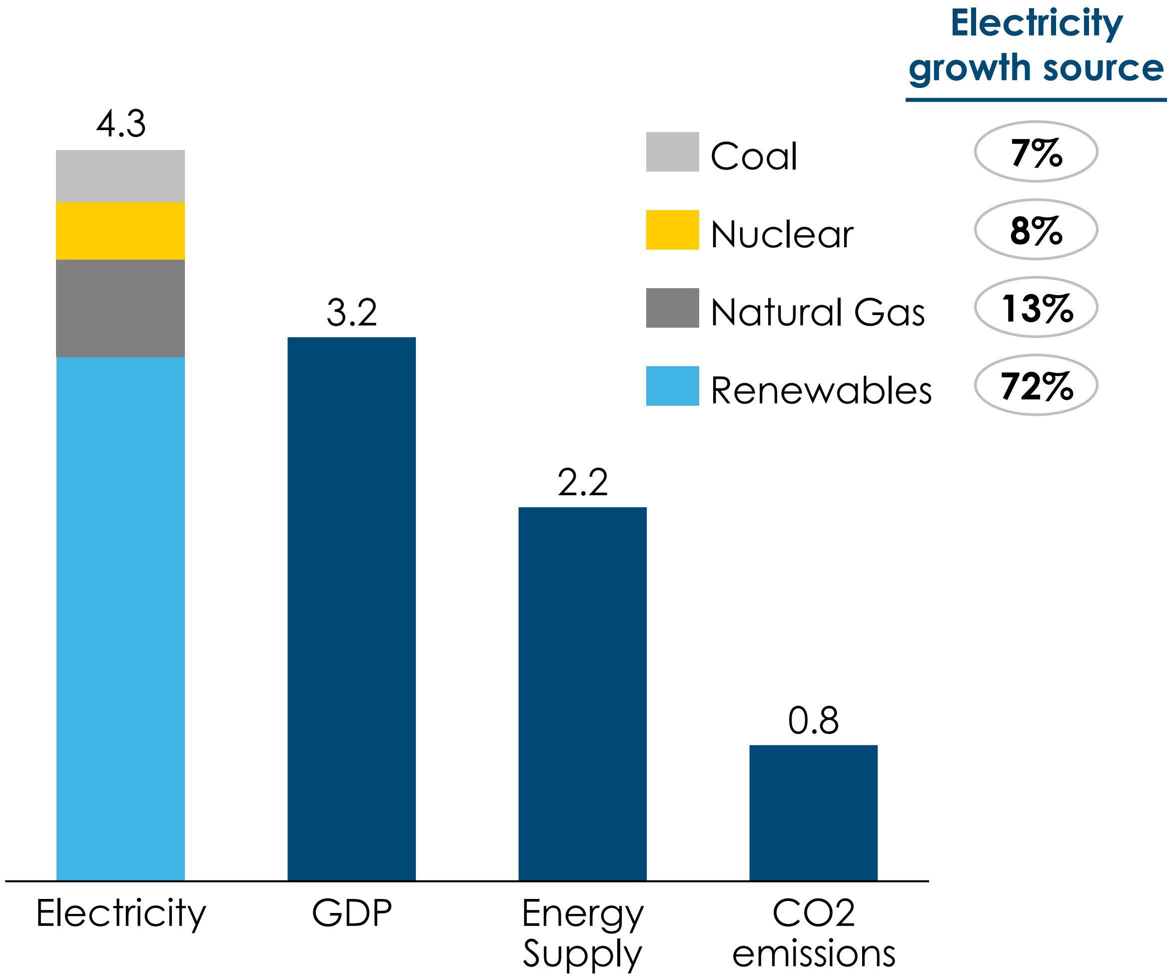
Source: Our World in Data (2025), *Per capita CO_2 emissions*; Ember (2025), *Electricity Data Explorer;* Climate Action Tracker (2025), *Net zero targets*

Energy demand is growing fast, outside of Europe. Most growth is now electricity. Most electricity growth now met through clean sources.

Energy supply growth rates 2023-2024
%



Key global growth rates 2024
%

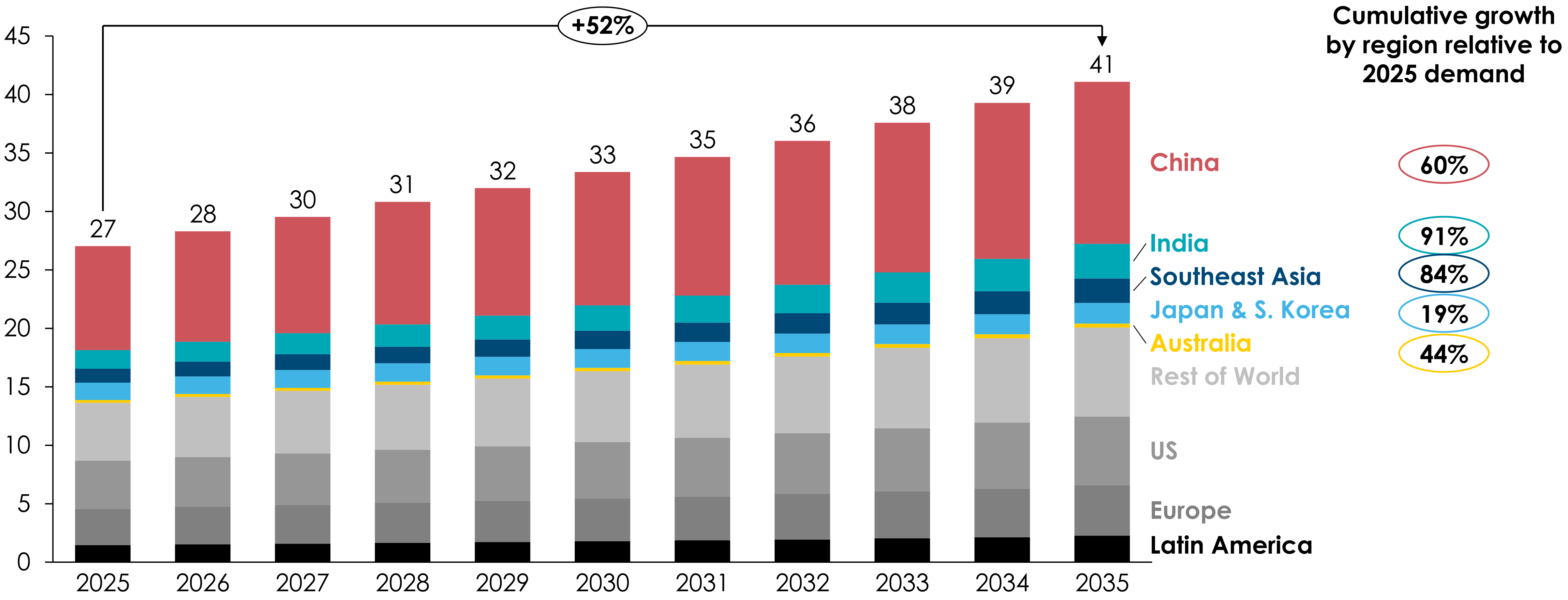


Source: IEA (2025) World Energy Review 2025

Asia will account for half of electricity demand growth in next 10 years

Annual electricity demand by country/region over the coming decade under BNEF's NZS

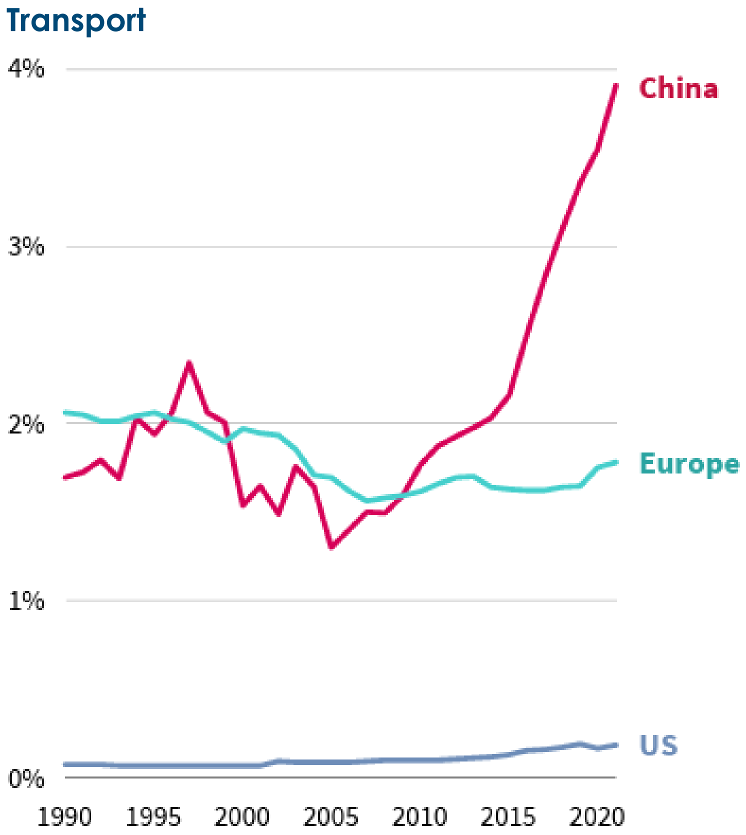
'000 TWh/year



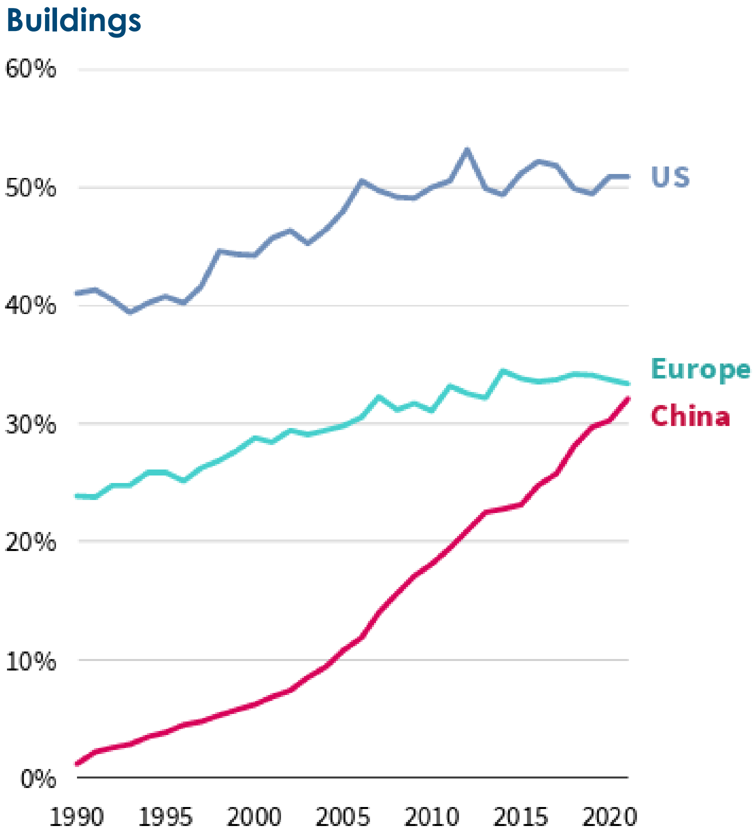
Notes: NZS = Net Zero Scenario, in which the energy transition is purely driven by technology cost-competitiveness, rather than climate concerns. Some non-EU European countries are included in Rest of World rather than Europe.
Sources: BNEF (2025), *New Energy Outlook*

China is the world's first electrostate: clean electrification is increasing in sectors across transport, buildings, and industry

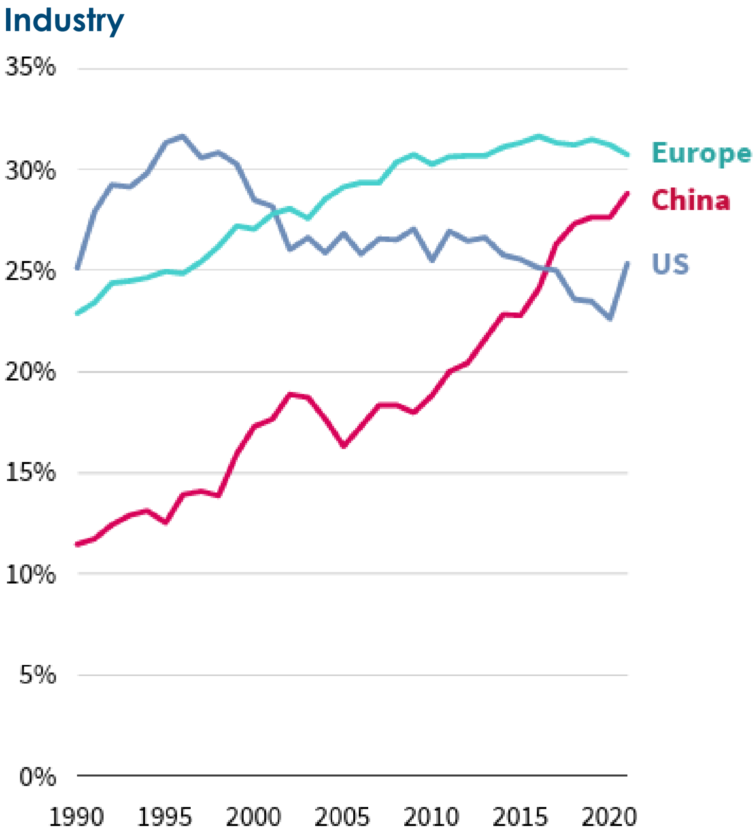
Electricity share of final energy by sector, %



Rapid electrification of transport across cars, trucks, buses and high-speed rail



Rising air conditioner use related to increasing extreme temperatures

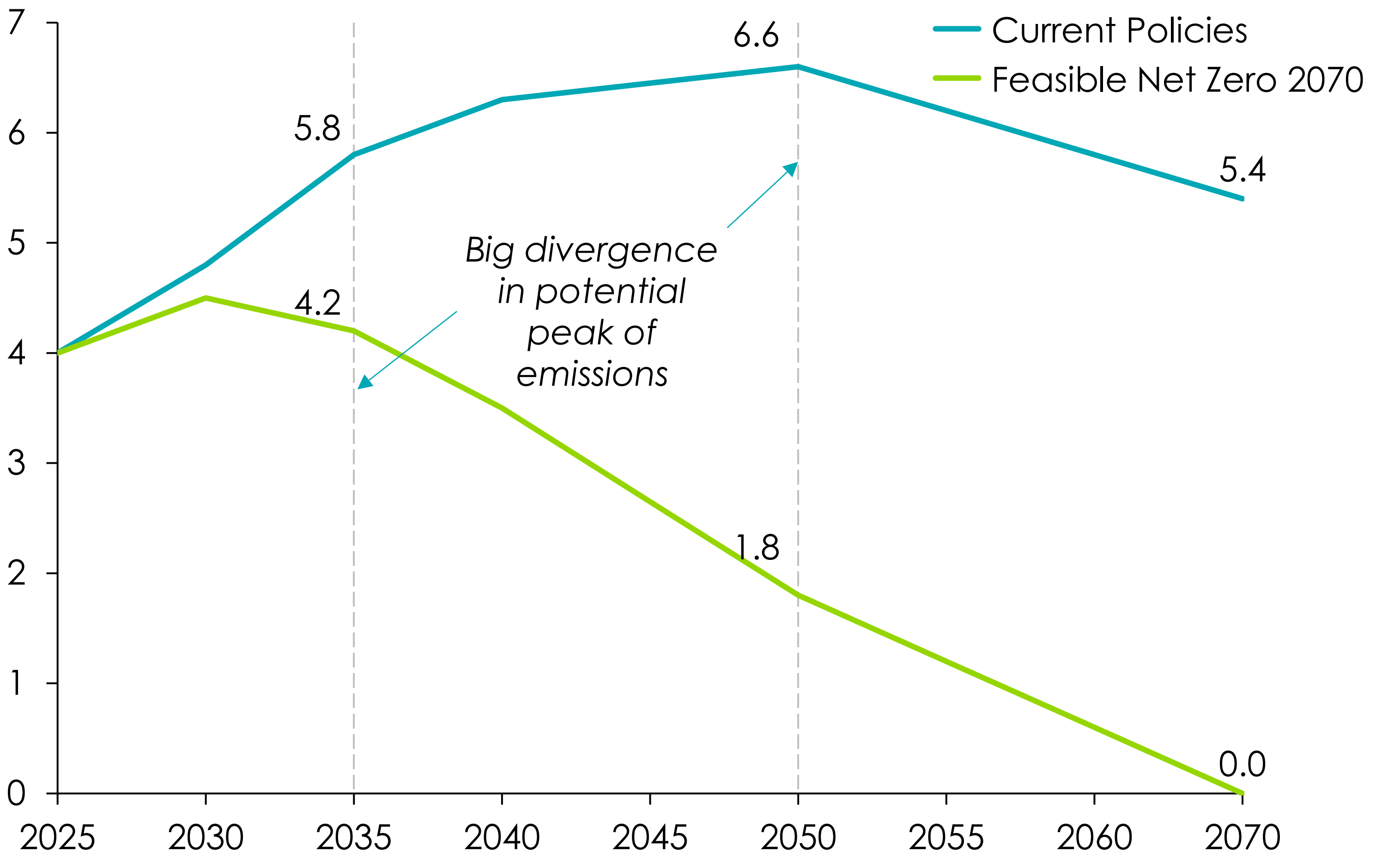


Greater power intensity across industrial uses including chemicals & clean tech manufacturing

Source: RMI (2024), X-Change: The Race to the Top Cleantech competition between China, Europe, and the United States https://rmi.org/wp-content/uploads/dlm_uploads/2024/03/X_change_the_race_to_the_top.pdf

India's Net Zero target still 2070: despite renewables growth, most electricity demand growth still being met with coal

Emissions | CO_2 (Gt CO_2/yr, net)



- **High growth:** India's expected real GDP growth rate: 6.2% p.a. 2025-50
- **Large ambitions** (500 GW renewables by 2030; 100 GW nuclear) **but current deployment not in line** (~137 GW wind and solar capacity and 7.5 GW nuclear today)
- **Coal generation grew by 4.3% in 2024** (vs 8.8% average in the prior 3 years). Coal generation **met 64% of India's 2024 electricity demand growth, declining from 91% in 2023.**

Source: Montek Ahluwalia, BNEF (2025), 1H 2025 India Market Outlook: Clean Power, Transport Shine, Ember (2025) Global Electricity Review 2025
Note: Scenarios are illustrative.

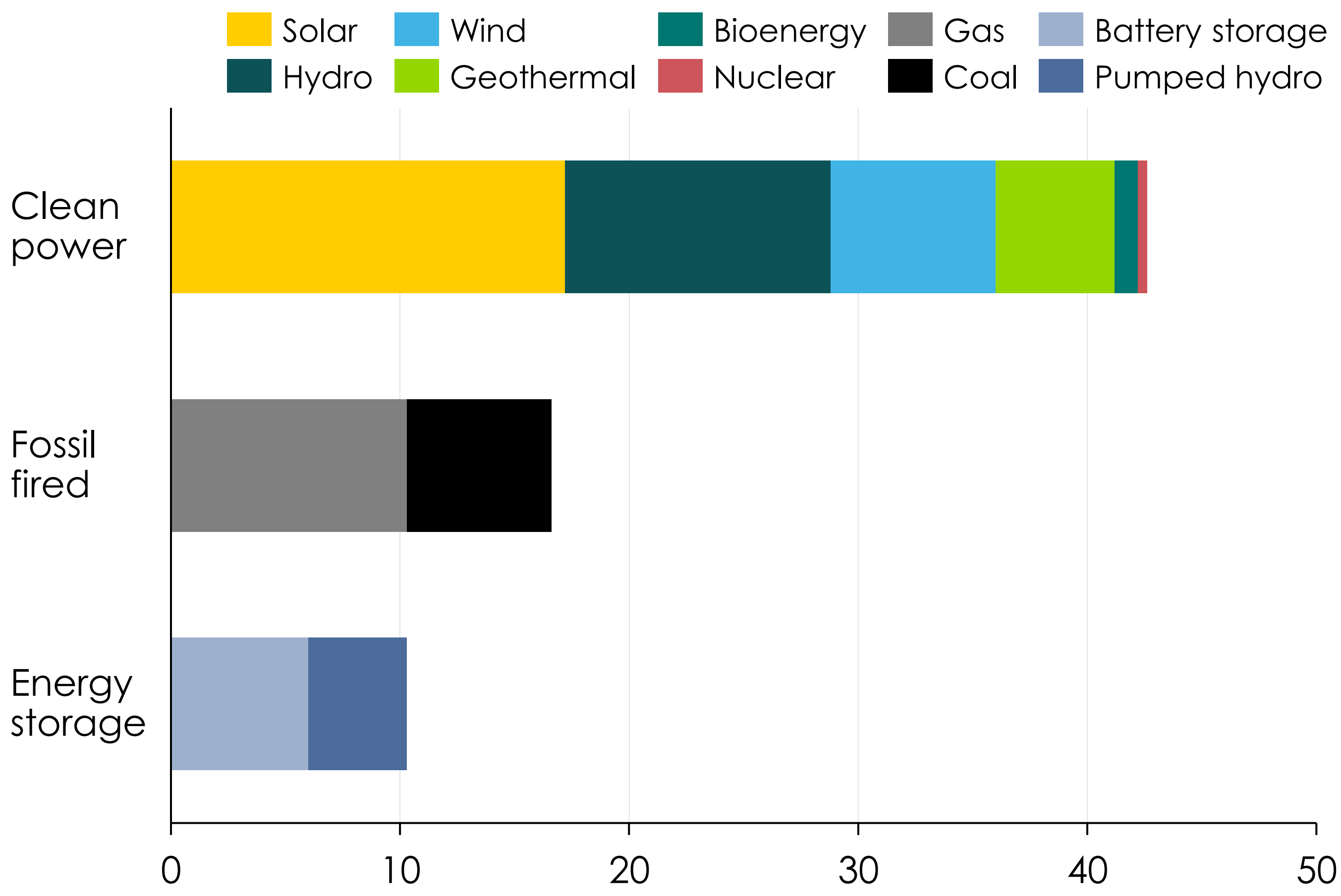
Indonesia's latest power plan to expand both renewables and fossil

RUPTL 2025-2034

- Indonesia announced its **latest 10-year power plan in May 2025.** It sets out:
  - A **quadrupling of renewable power generation** capacity to 57 GW by 2034, but a downgrade of new renewable capacity by 2030 vs RUTL 2021-2030 (17 GW vs 21 GW)
  - A **significant role for coal and gas expansion,** particularly in the next five years –**40%** expansion in from 2024 **to 2034**, higher than previous target
- **Plan will depend on private financing**, as majority of expansion expected to be developed by IPPs
- State utility PLN has previously **struggled to deliver renewable expansion**

BNEF planned additional capacity in Indonesia's 2025-2034 power plan

GW



ETC's upcoming work with IESR to show how clean power can help meet the goal of 8% GDP growth

BNEF (2025) *Indonesia $185 Billion Power Plan Hinges On Private Funds: React*

Malaysia Net Zero 2050 is heavily dependent on LULUCF and Bio

National Energy Transition Roadmap to 2050

2050 Installed RE capacity target of 70%

- **Low capacity-factor of solar means that RE contribution to total generation will be much lower**
- No new coal power + phase out of existing plants by 2044, but expansion of gas power plants
- Looking to extend fossil fuel plants through retrofits and co-firing with biomass/ammonia (coal) or hydrogen (gas), though cost to do this quite high

2050 80% new sales EV penetration goal

- While blanket diesel subsidies for road transport ended June 2024, targeted diesel subsidies and blanket petrol subsidies remain in place

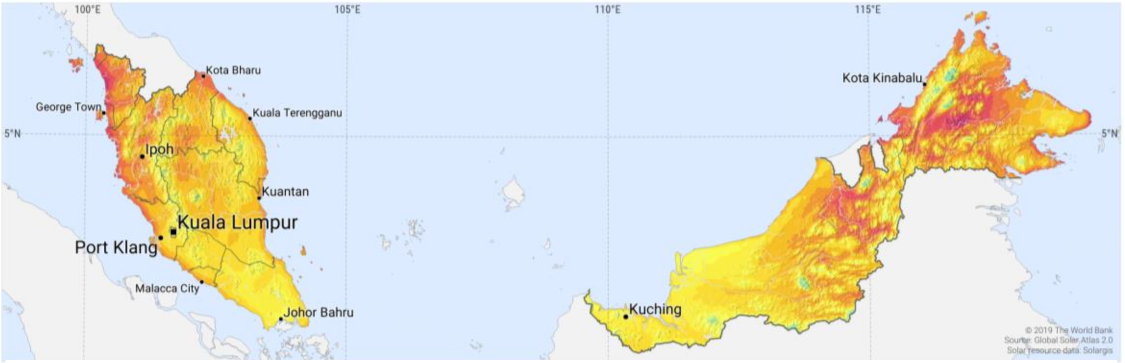
215 MtCO2e annual removals from LULUCF required

Potential for greater ambition at faster pace

Massive solar potential, despite cloud coverage

- Utility-scale solar already cheapest bulk generation

Photovoltaic Power Potential



Long term average of PVOUT, period from 1999 (2007 in the East) to 2018

Daily totals: 3.2 3.4 3.6 3.8 4.0 4.2 kWh/kWp

Yearly totals: 1168 1241 1314 1387 1461 1534

100% electrification of road transport

- Removal of fossil fuel subsidies for road transport

Note: Renewables predominantly driven by solar but also includes hydro and a very small amount of bio

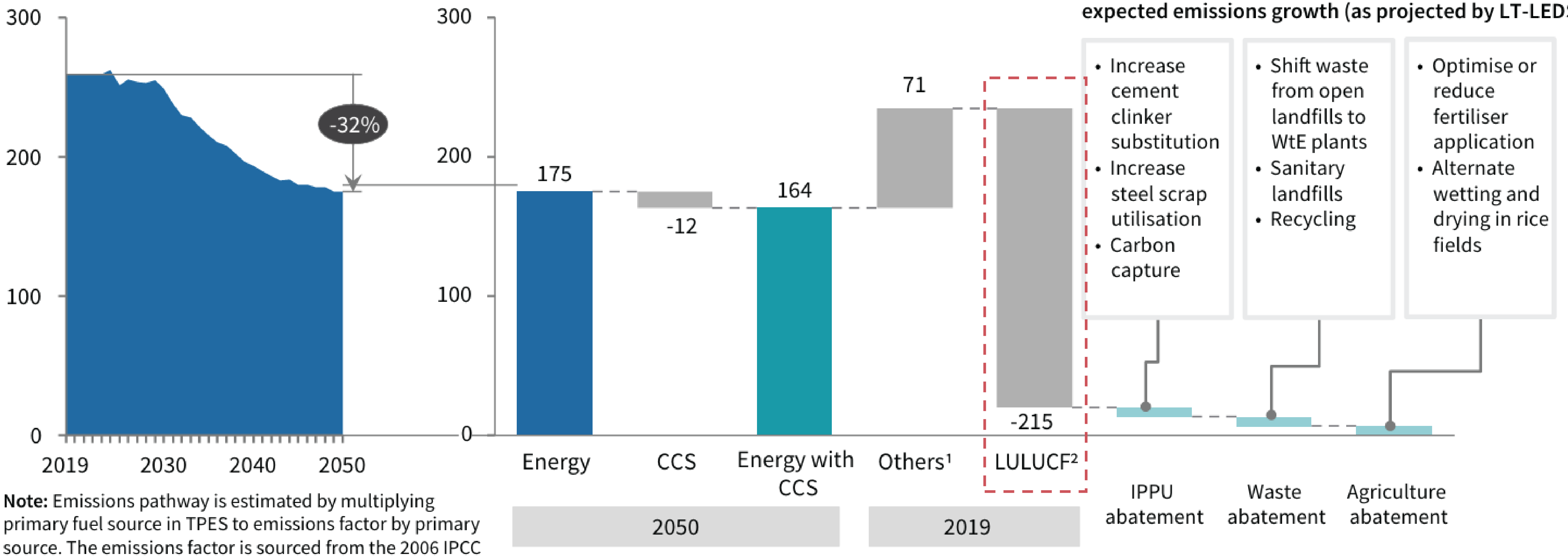
Source: Malaysia Ministry of Economy (2023) *National Energy Transition Roadmap*; BNEF (2025) *Malaysia: A Techno-Economic Analysis of Power Generation;* Global Solar Atlas

Malaysia: Projected GHG emissions reductions primarily reliant on LULUCF

Projected GHG Emissions, 2023 - 2050 ($MtCO_2eq$)

Projected GHG Emissions, 2050 ($MtCO_2eq$)

Critical to scale up non-energy abatement to address expected emissions growth (as projected by LT-LEDS)

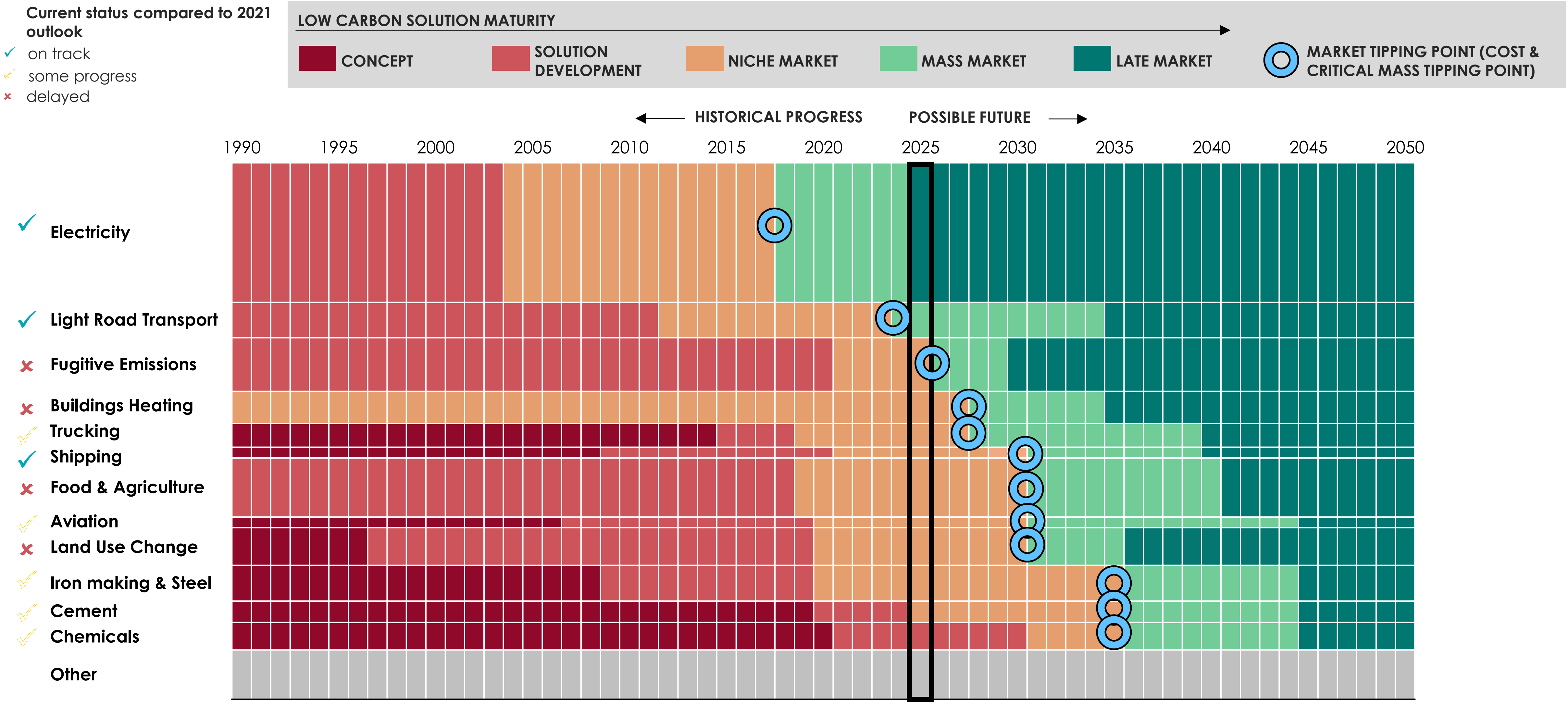


Note: Emissions pathway is estimated by multiplying primary fuel source in TPES to emissions factor by primary source. The emissions factor is sourced from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The objective of this method is to provide directional guidance on policy decisions and is not intended as a submission to UNFCCC nor any other international bodies.

1. Includes IPPU (industrial processes and product use), waste and agriculture
2. LULUCF = land use, land-use change and forestry

Source: Malaysia Ministry of Economy (2023) *National Energy Transition Roadmap*;

Assessing low-carbon solutions: low-carbon electric technologies largely 'on track', other sectors show delayed progress towards tipping points



Note: Section sized according to 2023 emission impact (CO2e); Other include cooking; rail transport; light industry and other minor sources of emissions
Source: UN (2024) Emission Gap Report 2024, CCPI Index, MPP tracker

Global policies will impact sectors' 2030/35 transition pathways

	Carbon pricing	Maritime sector policy	Aviation sector policy
	EU CBAM	**IMO Carbon Levy (2027+)**	**ICAO CORSIA & SAF Mandates**
Key policies	• EU launching full implementation of CBAM in 2026 and phasing out free ETS allowances	• Levy (~$100-380/t) to start in 2028	• Regions adopting regulation to drive SAF uptake, e.g. mandates in EU and UK
Current situation	• Increased policy stringency should strengthen incentives for heavy industry decarbonisation	• Levies send signal to accelerate ammonia/methanol adoption and bunker readiness	• SAF share of global jet fuel in 2024 was 0.3%, expected to double to 0.6% in 2025
implications	• New cost pressures from domestic carbon pricing and border adjustments may lead to shifts in supply chains	• However, BNEF estimate that a carbon price of > €400/t would be required to incentivize a significant shift, so uncertainty remains	• Currently, production overcapacity as stronger demand guarantees needed to scale to 2030 targets

Industry diversification:

Over half of new projects now in EMDEs, driven by cheap renewables and national incentives.

Industrial players likely to diversify, including pivoting to emerging markets (e.g. India, Brazil, Namibia) and adapt to a more distributed deployment landscape.

Source: MPP November 2024 Update; Carbon Border Adjustment Mechanism (March 2025); Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA); Elisabetta Cornago et al. (2024) Learning from CBAM's transitional phase; BCG (September 2023) The Start of CBAM: A Major Landmark for Global Trade and Carbon Accounting, BNEF (2025), 2025 Sustainable Aviation Fuel Outlook: Reaching New Highs

Local Asia Pacific policies are being implemented

Carbon pricing

- Prices increasing in **China**'s ETS - currently at $14/tCO_2$
- **Vietnam** launched ETS until 2029 covering 50% of total emissions
- **India** has adopted regulations for an intensity-based 'baseline-and-credit' scheme, with mandatory GHG emissions intensity targets
- **Australia's** safeguard mechanism mandates industry emissions reductions to meet 2030 and 2050 goals with tradeable credits
- **Japan**'s emissions trading scheme is set to transition to a mandatory compliance scheme in 2026

Maritime sector policy

- **Singapore** to electrify port operations by 2030.
- **Japan** promotes zero-emissions ship project with 1st ship by 2028

Aviation sector policy

- **Singapore, Indonesia, India, Malaysia** all have SAF blend target: 1% by 2026-27, rising up to 5% by 2030
- **Japan**: finalizing 10% SAF blend by 2030
- **China**: 5% SAF mandate by 2030 is expected by industry leaders

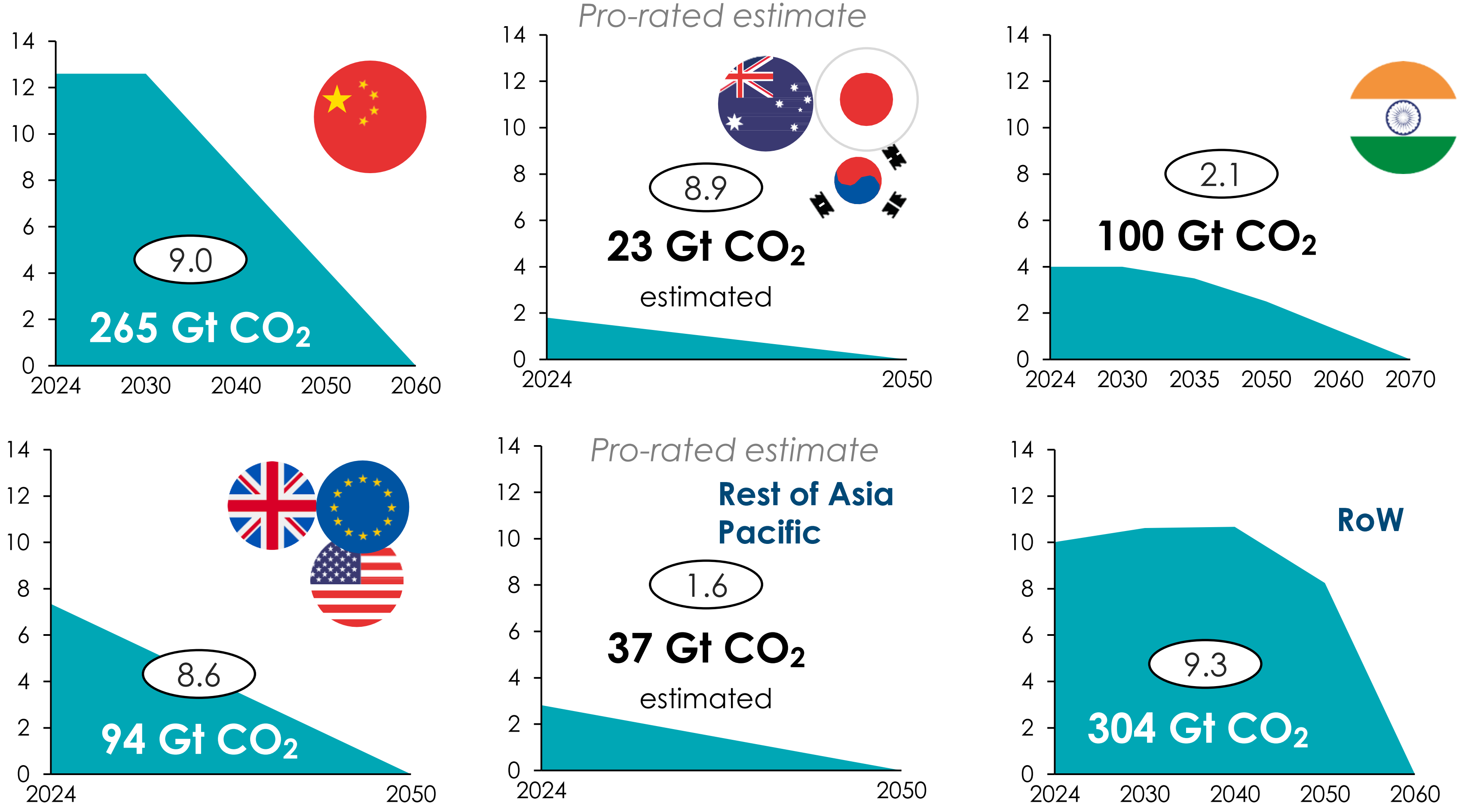
Source: MPP November 2024 Update; Reuters 2025 Vietnam launches first phase of emissions trading scheme; The Independent 2025 Singapore makes waves in maritime sustainability with electric Harbour Craft; Carbon Border Adjustment Mechanism (March 2025); Carbon Direct 2025 Beyond the transatlantic core: Emerging SAF mandates in global markets; Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA); Elisabetta Cornago et al. (2024) Learning from CBAM's transitional phase; BCG (September 2023) The Start of CBAM: A Major Landmark for Global Trade and Carbon Accounting, BNEF (2025), 2025 Sustainable Aviation Fuel Outlook: Reaching New Highs

Even if most countries reach net-zero by 2050, the world is more than halfway between 1.5-2.0°C

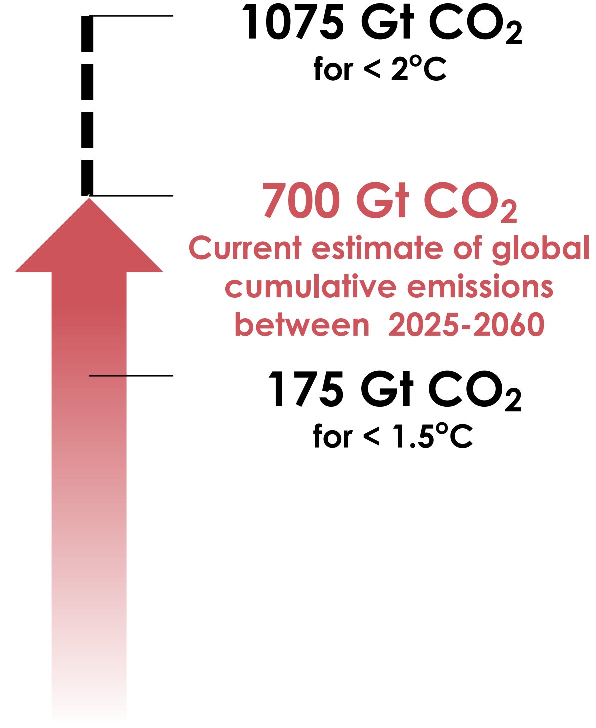
Cumulative CO_2 emissions, 2024-2070

$GtCO_2$

X.X Estimated 2024 tons CO_2 per capita



Remaining carbon budget at the start of 2025 for a 50% likelihood



Note: Estimates based on 2023 GHG EDGAR emissions ratio

Source: IEA (2025) World Energy Review; IEA (2024) World Energy Outlook; ETC (2023) Fossil Fuel in Transition; EDGAR (2024) GHG Booklet Fossil CO_2 only

What should Asia's priorities be for COP30?

Coal phase down

- Recommit to **fossil fuel phase down**, particularly in China, India, and Indonesia
- Ensure **access to climate finance** to support phase out of coal plants where required

Financing for grids and renewables

- Dedicated **climate finance for grid expansion and modernisation**, to offset offtake risk in EMDEs, and to support regional grid interconnections (E.g. ASEAN Power Grid)

Industrial decarbonisation – *Build Clean Now*

- Set out **sectoral decarbonisation roadmaps** aligned with net-zero targets, with **clear 2030 targets**
- **Support to ensure FIDs** after project announcements
- Focus on the **Industrial Sunbelt** opportunity

Updates of NDCs

- **NDCs – opportunity for new NDCs** to reflect existing commitments, **tripling overall ambition**
- **NDCs – consistent and comprehensive format, as well as clear sectoral roadmaps & policies** to ensure they are 'investable'

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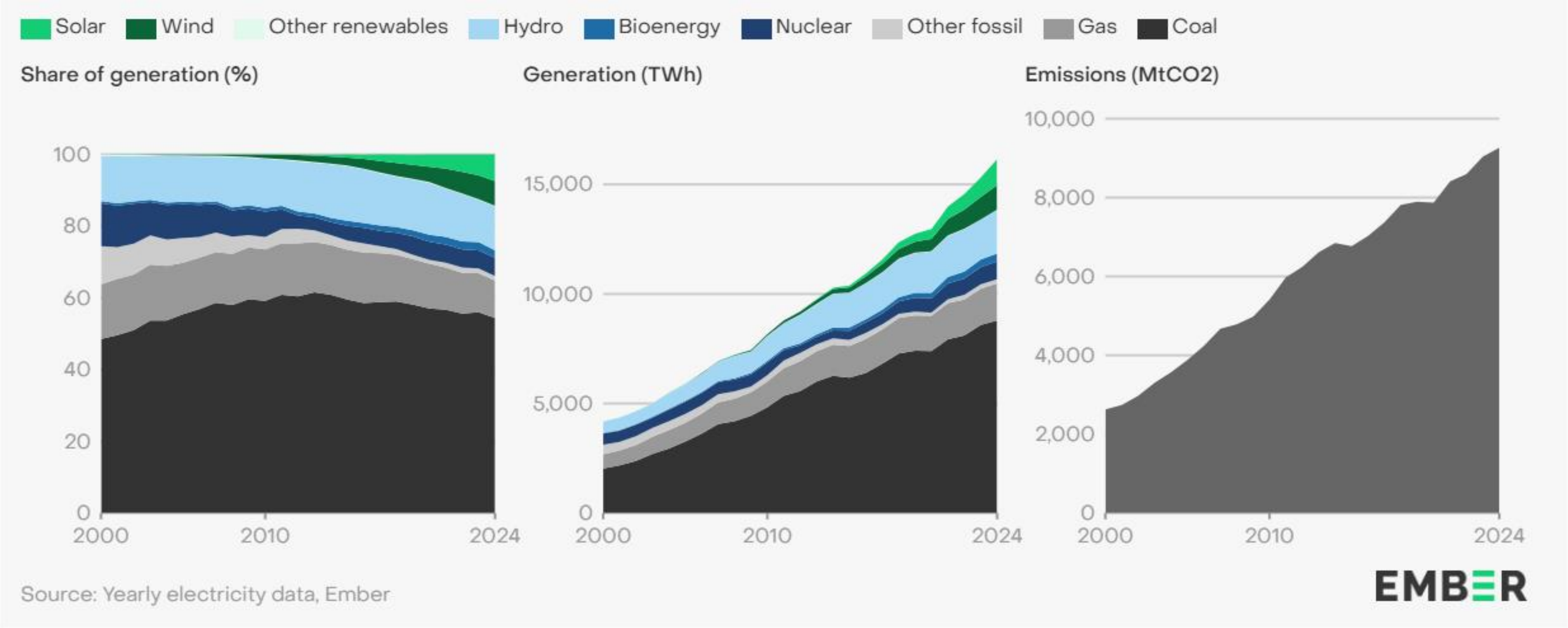
ETC 2026 strategy: Looking ahead and feedback

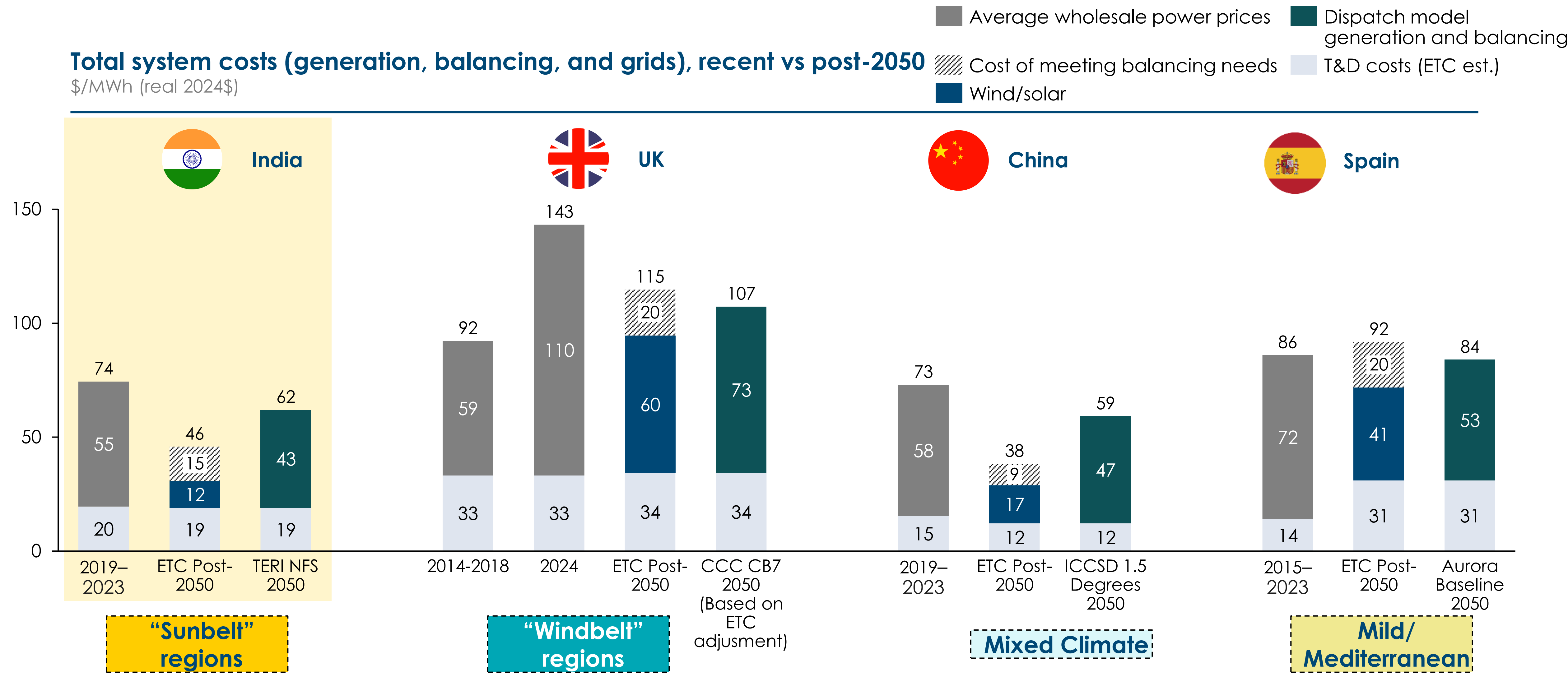
Asia-Pacific still has significant amounts of fossil power generation, although this is declining



Source :Ember

“Sunbelt” opportunity for cost effective power decarbonisation

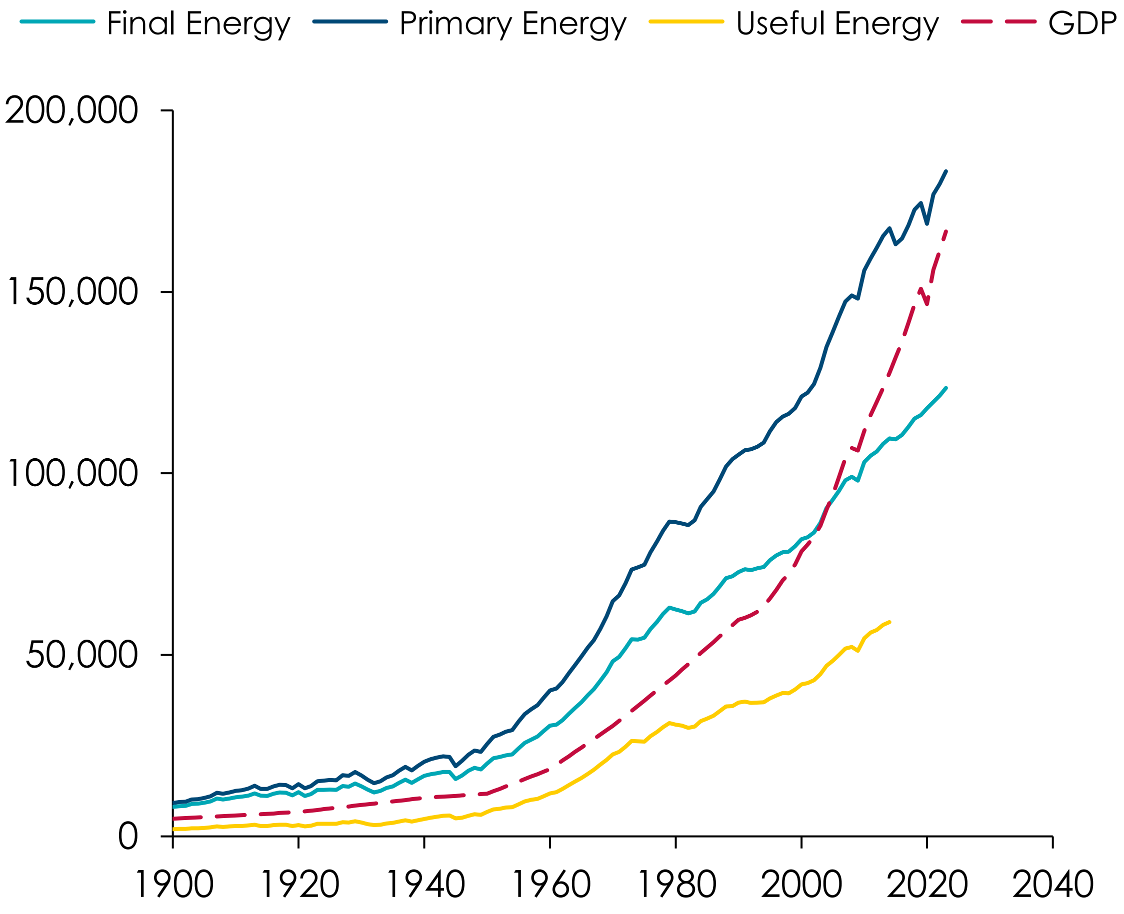
Total system costs (generation, balancing, and grids), recent vs post-2050
$/MWh (real 2024$)



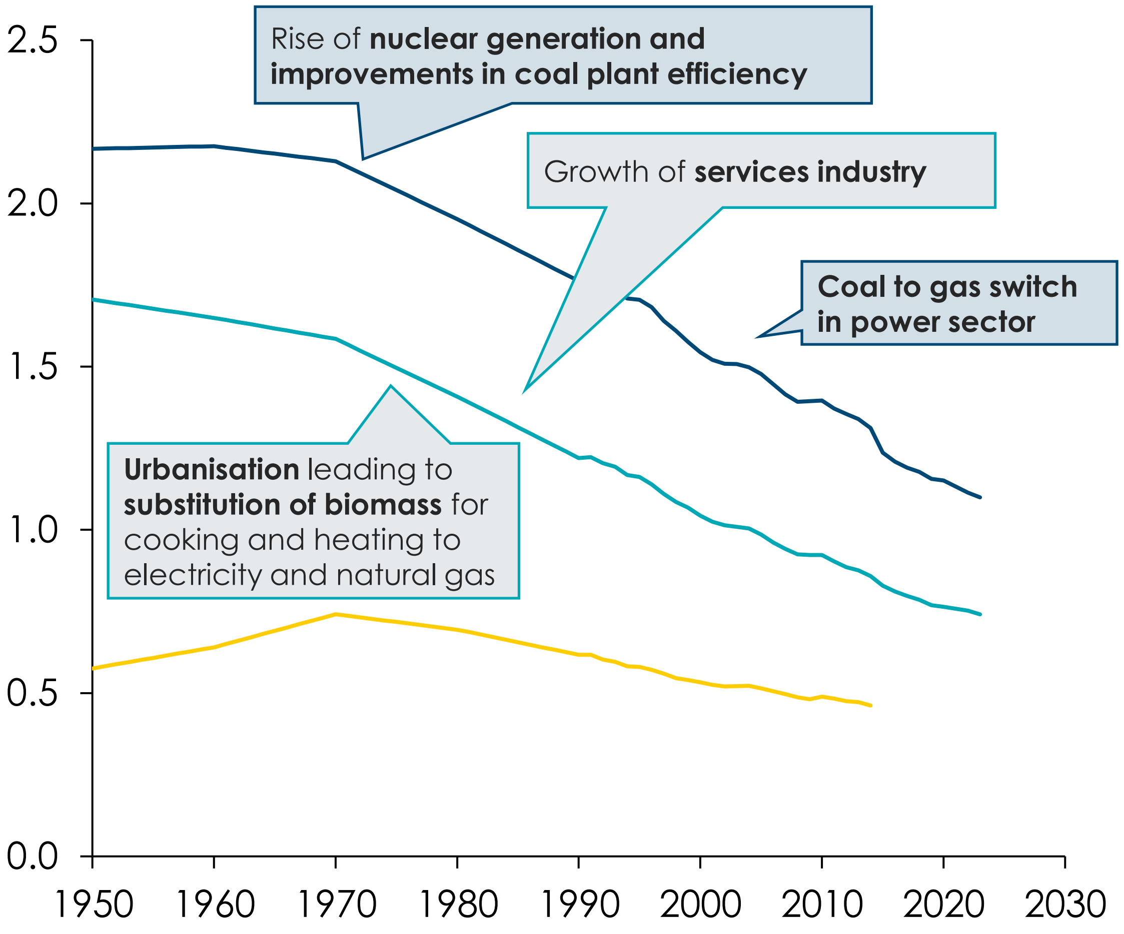
Note: T&D = Transmission and distribution. T&D costs per MWh have been assumed based on ETC modelling outlined in Chapter 2 across all presented here for consistency.
Source: Systemiq analysis for the ETC; BNEF (2025), *LCOE: Data Viewer*; Ofgem (2025), *Wholesale market indicators – Electricity Prices: Forward Delivery Contracts – Weekly Average (GB)*; IEA (2023), *Electricity Market Report – Update 2023*; Statista (2024), *Average electricity prices for enterprises in China from September 2019 to September 2024*; Ember (2025), *Wholesale electricity prices in Europe*; CCC (2025), *The Seventh Carbon Budget*; TERI (2024), *India's Electricity Transition Pathways to 2050: Scenarios and Insights*; ICCSD (2022), *China's Long-Term Low-Carbon Development Strategies and Pathways*; Aurora (2023), *Long Duration Energy Storage in Spain*.

The world has made progress on increasing energy intensity over time

Total GDP vs. Energy Demand, 1900 - 2023
GDP in constant 2021 Bn.US$, Energy Demand in TWh



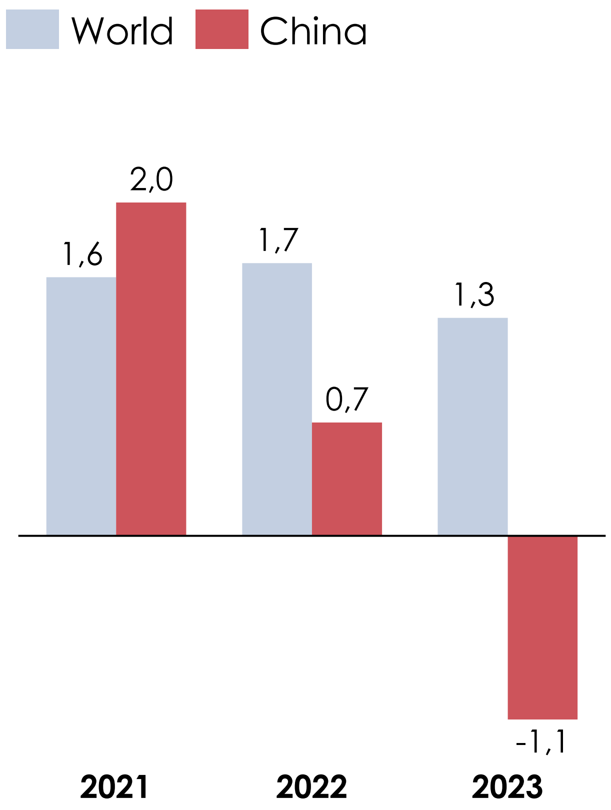
Energy Productivity, 1950 - 2023
kWh/$ 2021 PPP



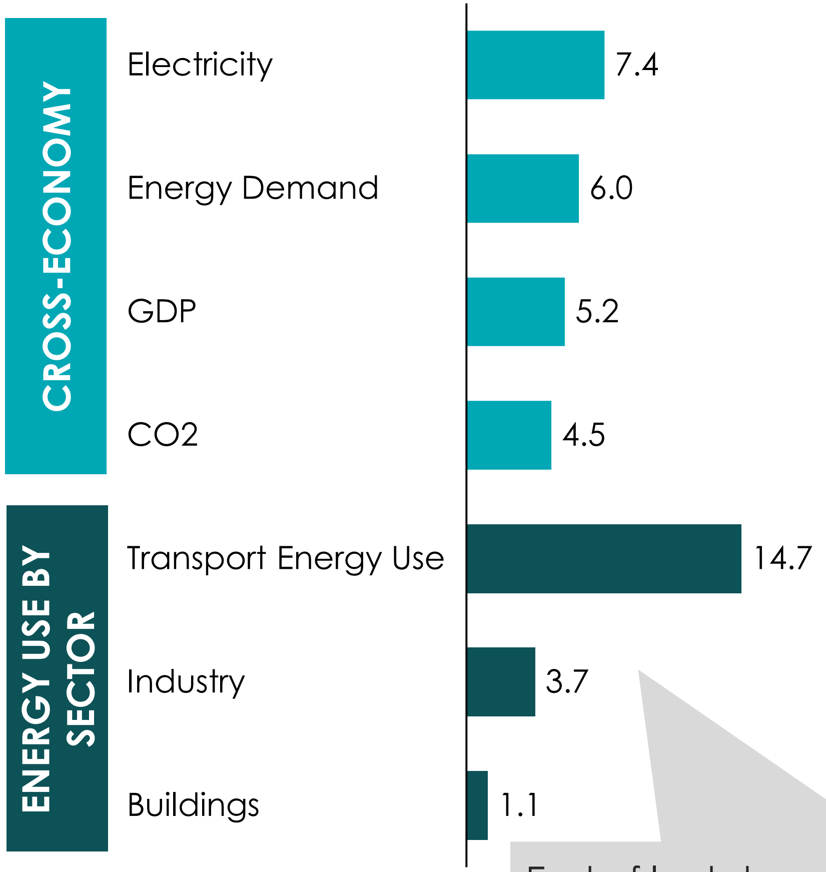
Source: Systemiq analysis for the ETC; World Bank Group; Our World in Data; IEA (2024), *World Energy Outlook 2024; IIASA PFU Dataset*

Since 2021, China primary intensity gains declined due to fossil fuel still meeting the bulk of new energy demand

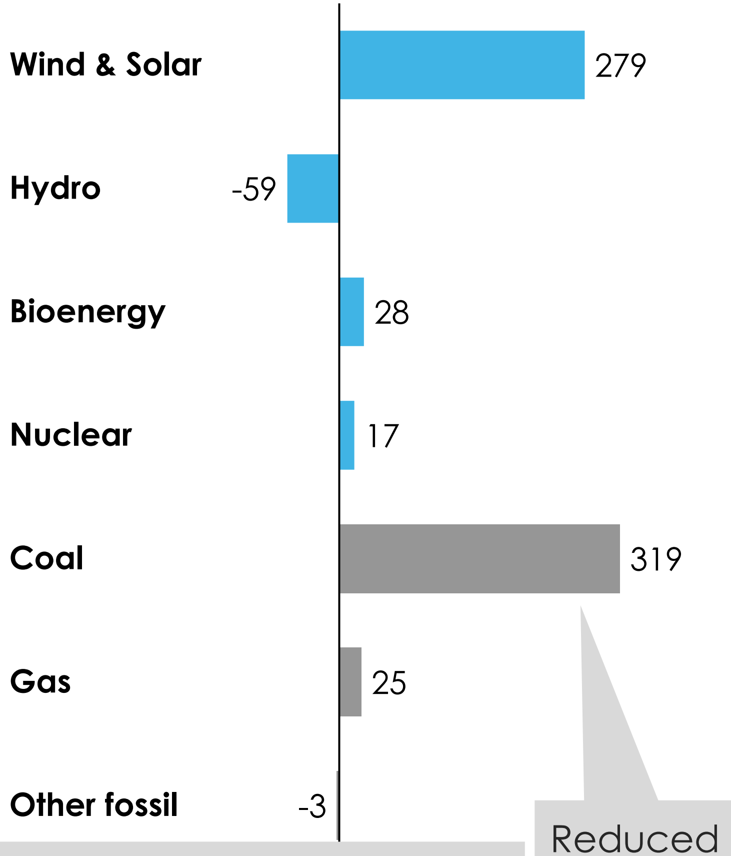
Primary Energy Productivity improvements
%



China growth rates, 2023
%



China changes in electricity generation, 2023
TWh



End of lockdown restrictions in Dec. 2022 could have contributed to increase energy demand

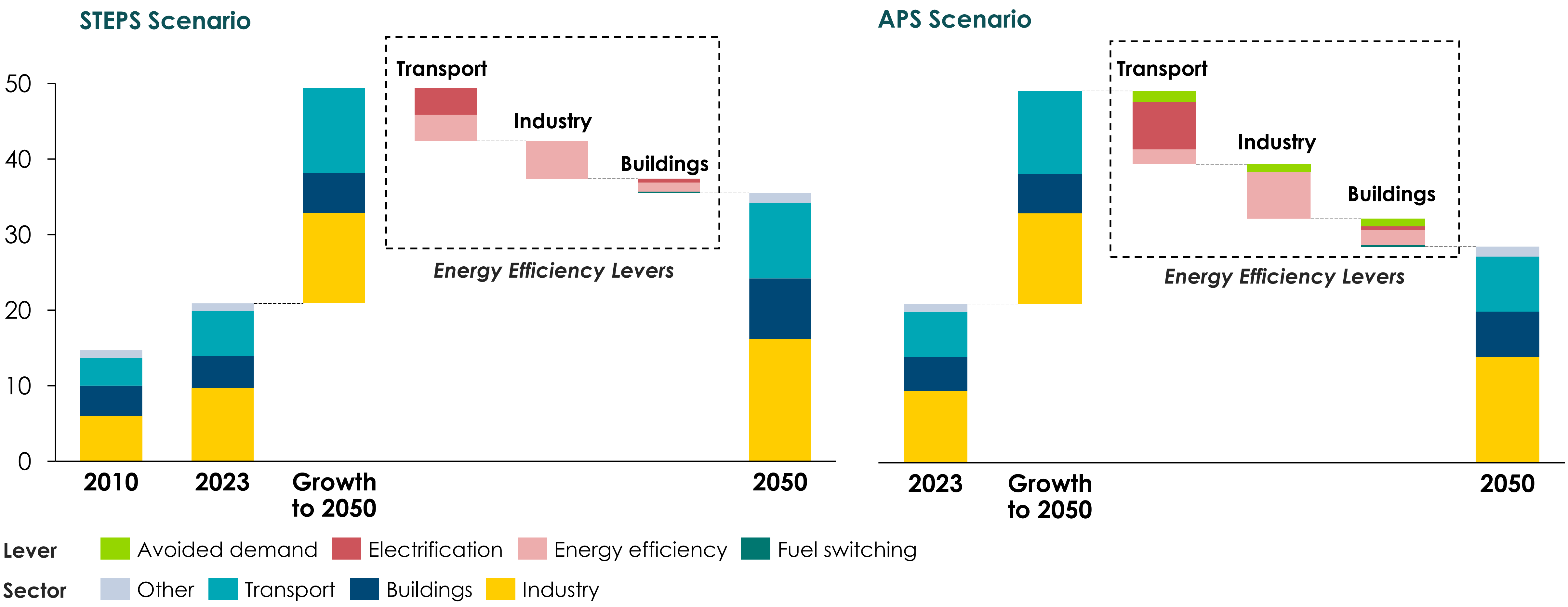
Reduced coal growth in 2024 (111 TWh)

Source: IEA (2024) World Energy Outlook; IEA, China Efficiency & Demand tracker; World Bank GDP Data; Ember (2023) Electricity Report

IEA projects Efficiency and Electrification can significantly moderate the increase in energy usage in SE Asia

Changes in final energy consumption by lever, sector and scenario, IEA 2010-2050

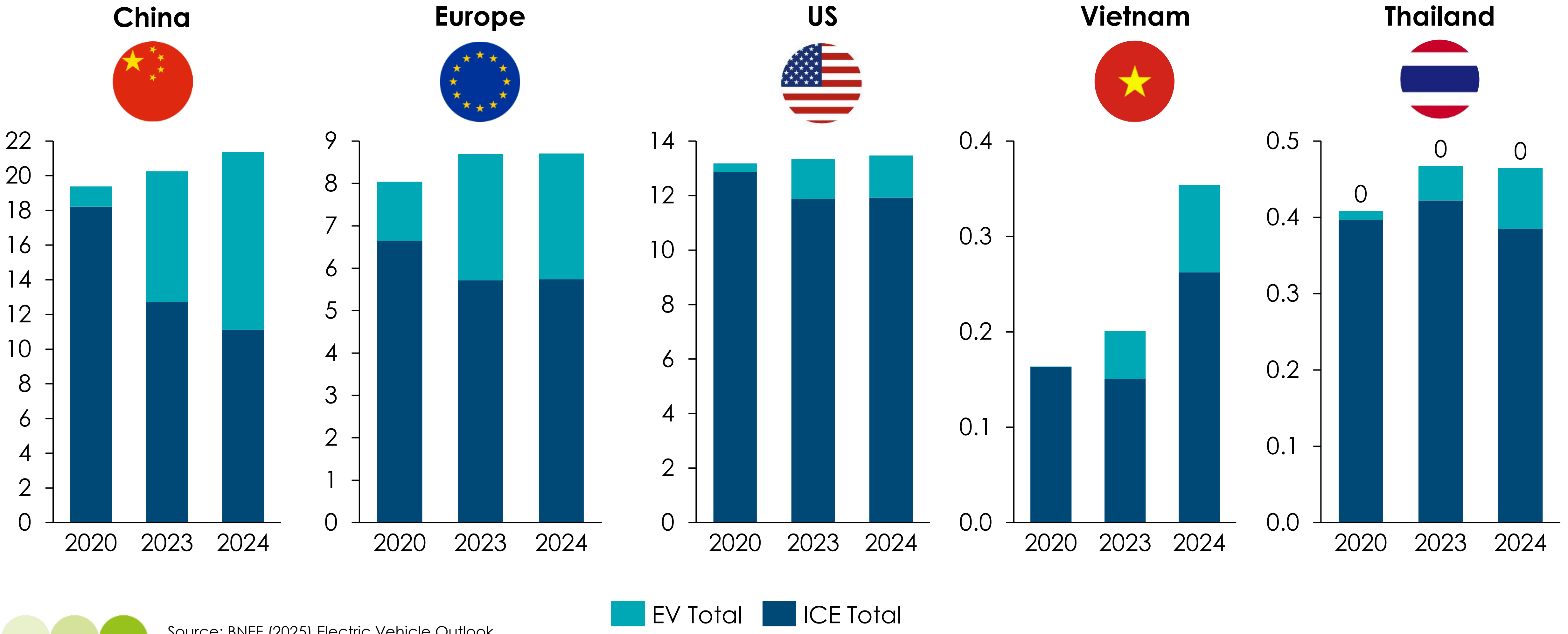
EJ



Source: IEA

Transport: Rate of EV adoption across selected countries and key policies

Total vehicle sales in selected markets, (2020, 2023, 2024)
million units

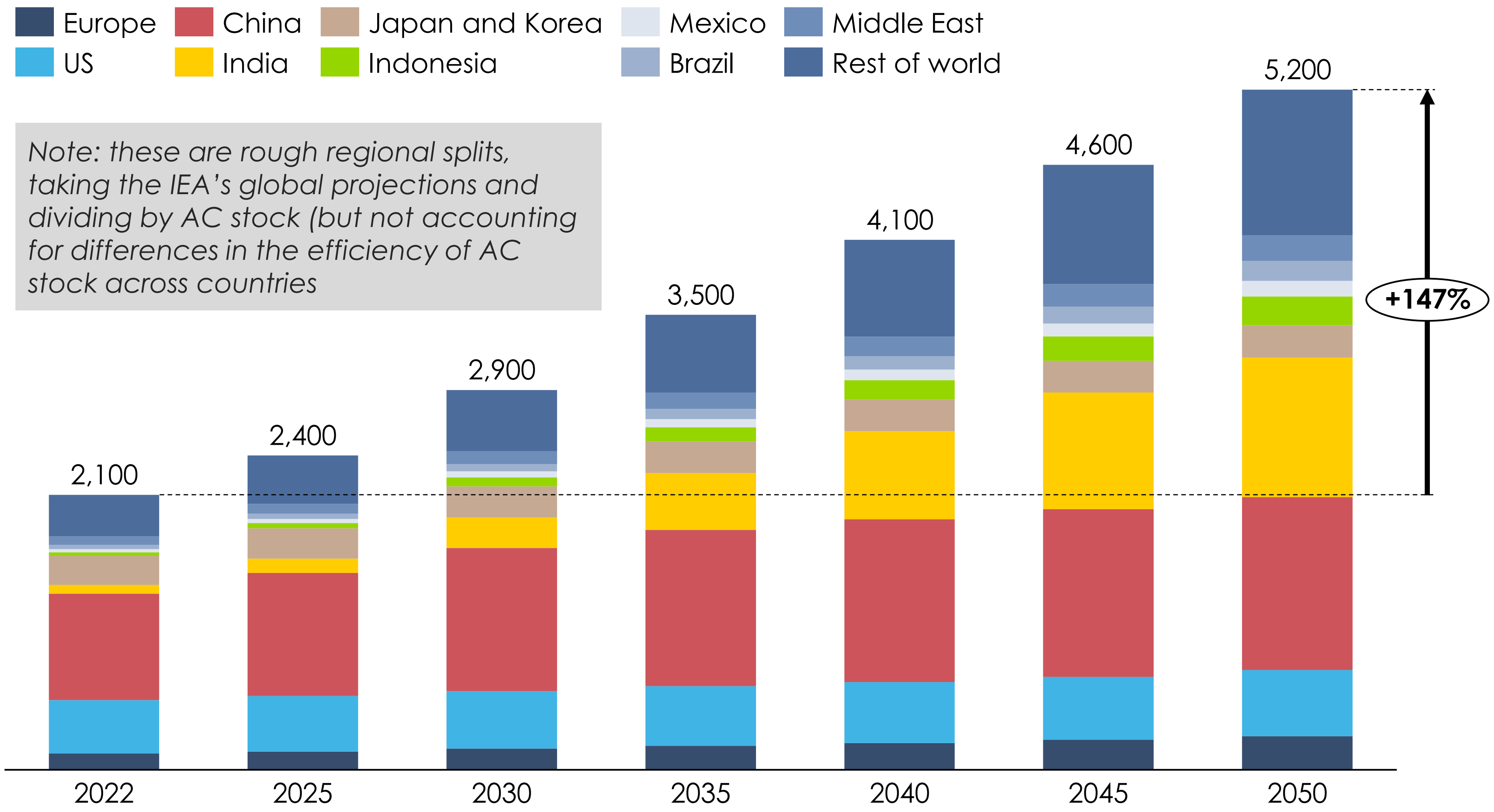


Source: BNEF (2025) Electric Vehicle Outlook

Buildings: global distribution of cooling energy consumption will continue to shift, with Asia accounting for over 50% by 2050

Space cooling energy consumption by region, IEA baseline scenario, 2022-50

TWh



India's energy consumption for cooling is set to increase 16x by 2050, taking its global share from 3% to 21%

China share 39% of cooling energy consumption today, growing at 2% per year, peaking around 2025 and drops to 25% by 2050

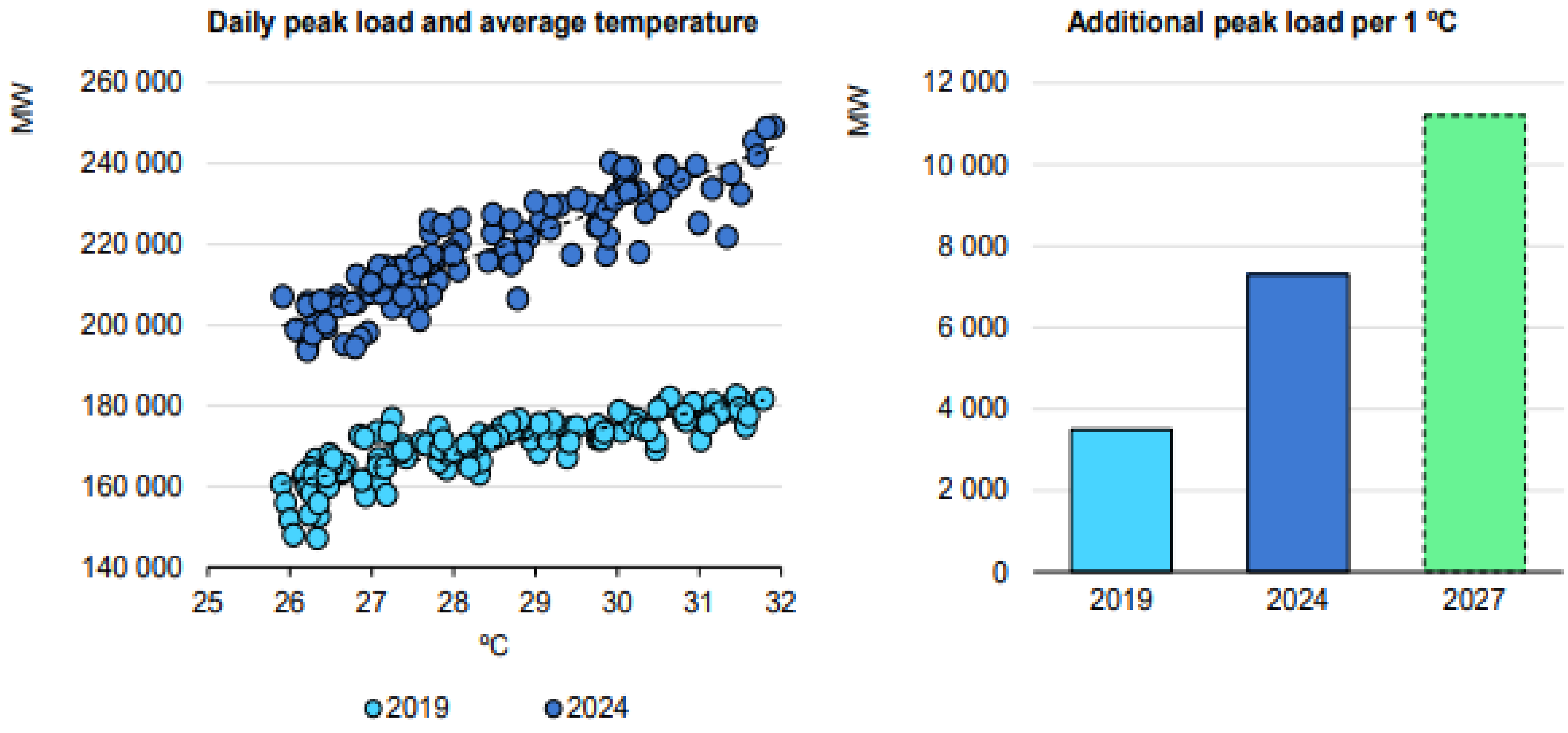
Europe's and US' shares set to fall from 6% and 19% to 5% and 10% respectively

Source: IEA (2023), *World Energy Outlook 2023*

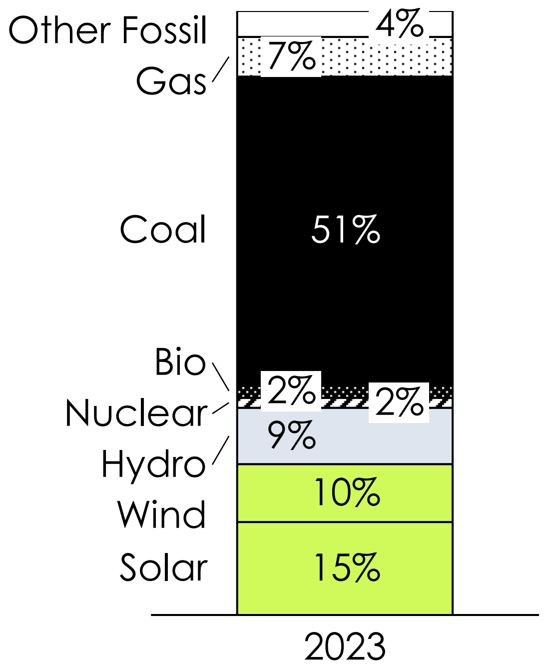
Note: We use IEA numbers on year 2020 and 2022 and linear interpreted the forecasted figures based on IEA graphs and models, using IEA AC stock projections to derive regional split. The IEA AC stock data originally classify regions as United States, China, Japan and Korea, European Union, India, Indonesia, Mexico, Brazil, Middle East and Rest of world

Buildings: Rapid growth of peak power demand driven by heat waves is leading to growing coal use

Daily Peak load in cooling season compared to average temperature in India, 2019-2027



India 2023 installed power generation capacity, % of total

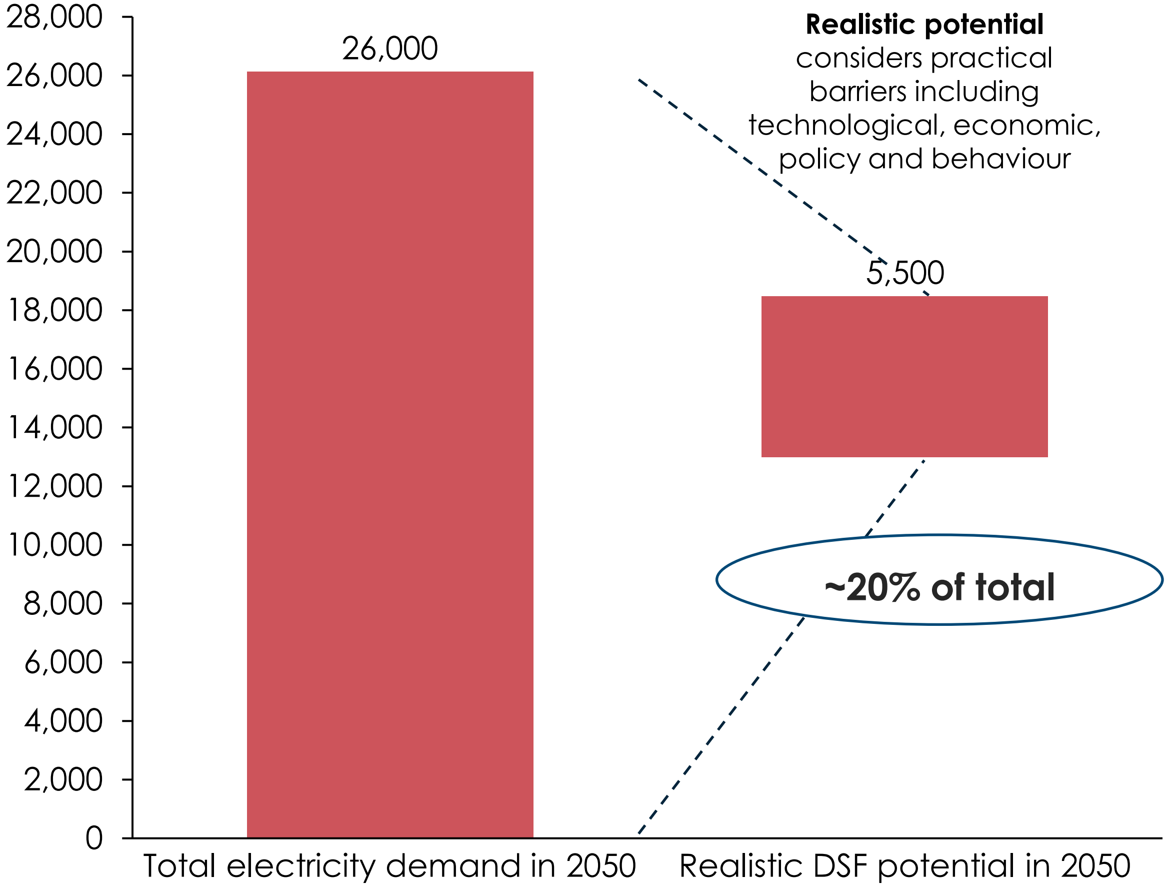


Source: IEA. CC BY 4.0, Ember

Buildings: ~20% of building demand in 2050 could be flexible

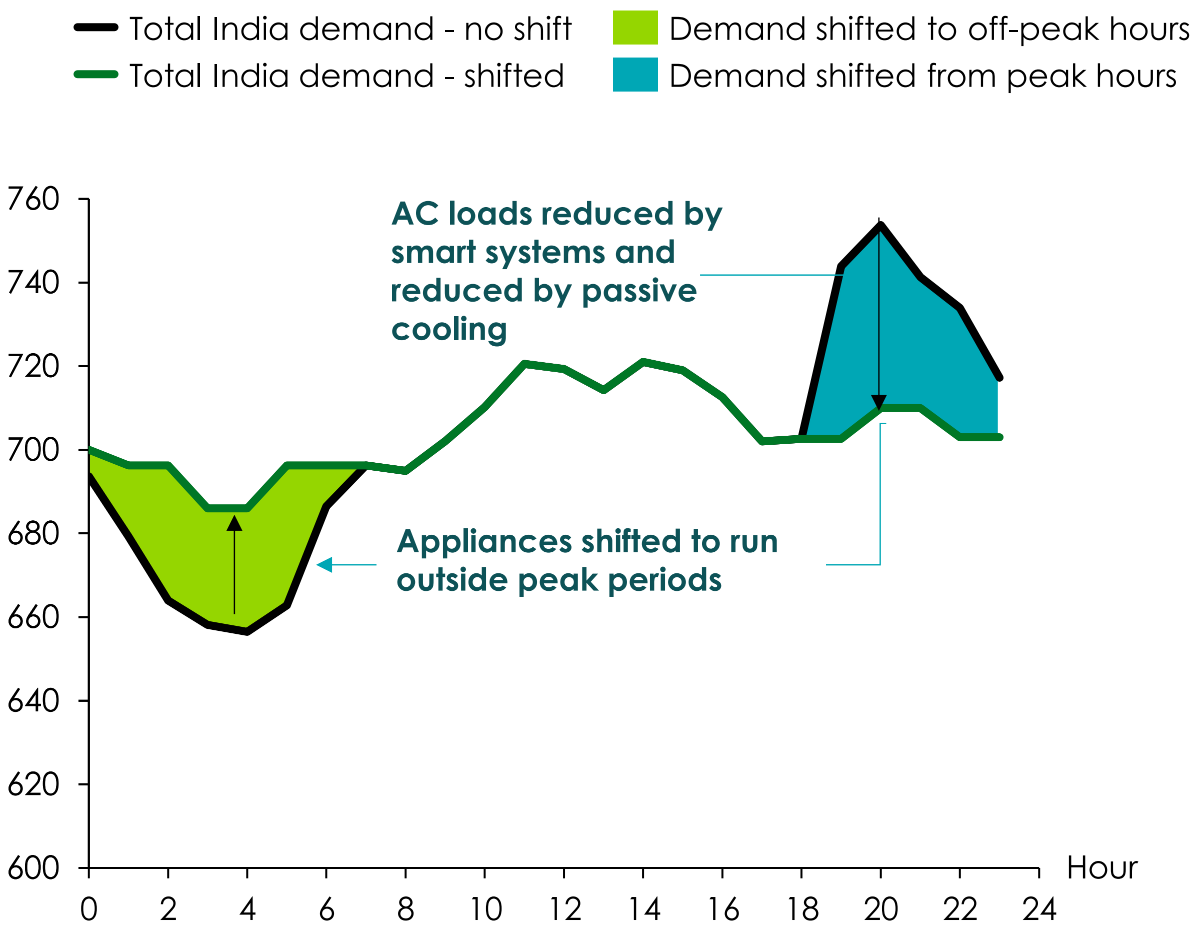
Global electricity demand and DSF potential in buildings, 2050

TWh



India potential demand shift impacts

2050 demand (GW)

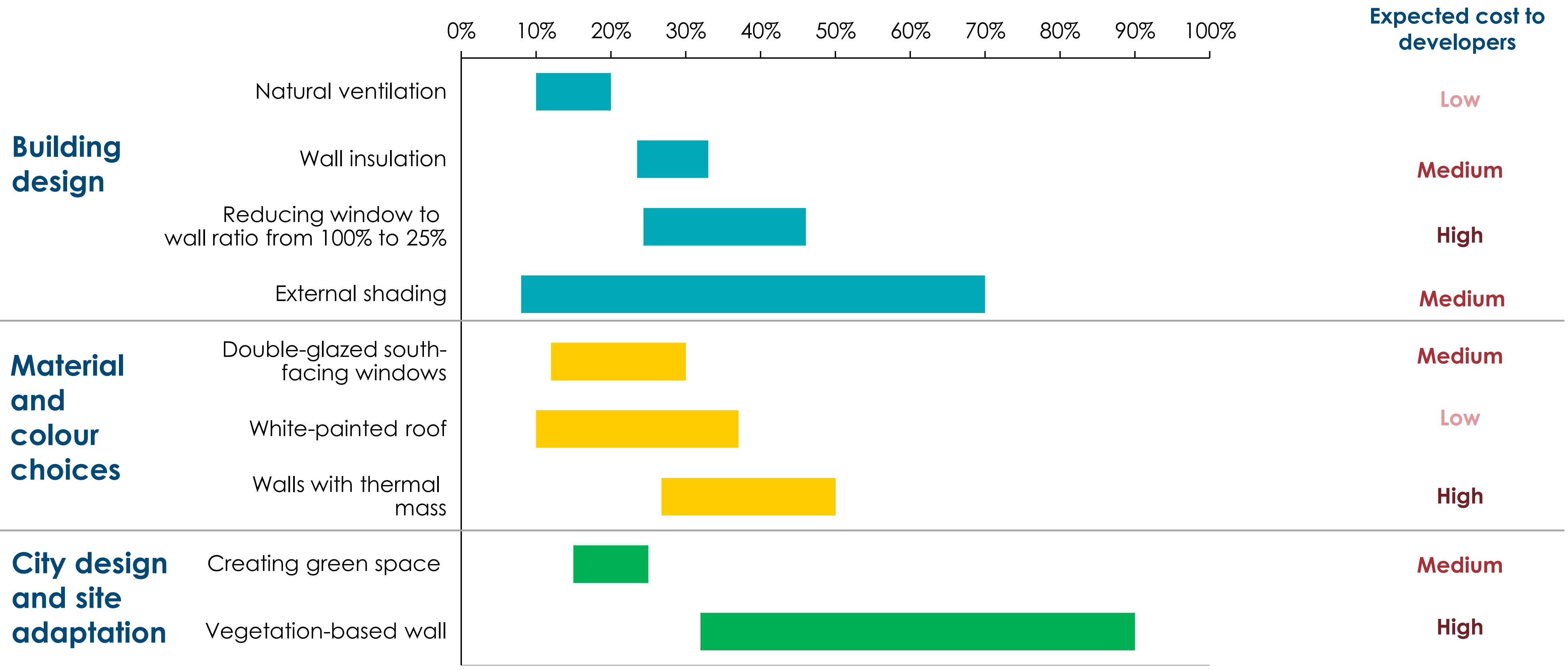


Note: In our DSF Briefing Note, we look at two scenarios "realistic" and "theoretical" to consider the ideal possibilities and what can be realistically achievable. In this analysis, we focus on the realistic potential of DSF, as it provides a more grounded and actionable view of what can be delivered given today's technological, policy, economic and behavioural constraints — and therefore offers a more reliable basis for system planning. The India potential demand shift impacts on the RHS are based on the peak demand day (17th Aug) from the ETC's recent power system balancing modelling.

Source: Systemiq analysis for the ETC; IEA (2024), *World Energy Outlook 2024;* RMI (2023), *Unlocking demand-side flexibility in China*; Macquarie (2020), *Flexibility of Hydrogen Electrolysers;* IEA (2024), *Global EV Outlook 2024;* World Electric Vehicle Journal (2019), *Flexibility of EV demand.*

Buildings: Passive cooling features are critical to reduce cooling demand

Impact on annual cooling energy consumption of passive cooling techniques, %



Note: IRR analysis assumes a discount rate of 5% over 50 years. Based on an average single-family flat/house of 60–80 m^2.

Source: Systemiq analysis for the ETC; Ahmed et al. (2023), *The impact of window orientation, glazing, and window-to-wall ratio on the heating and cooling energy of an office building: The case of hot and semi-arid climate*; Song et al. (2021), *A review on conventional passive cooling methods applicable to arid and warm climates considering economic cost and efficiency analysis in resource-based cities.*

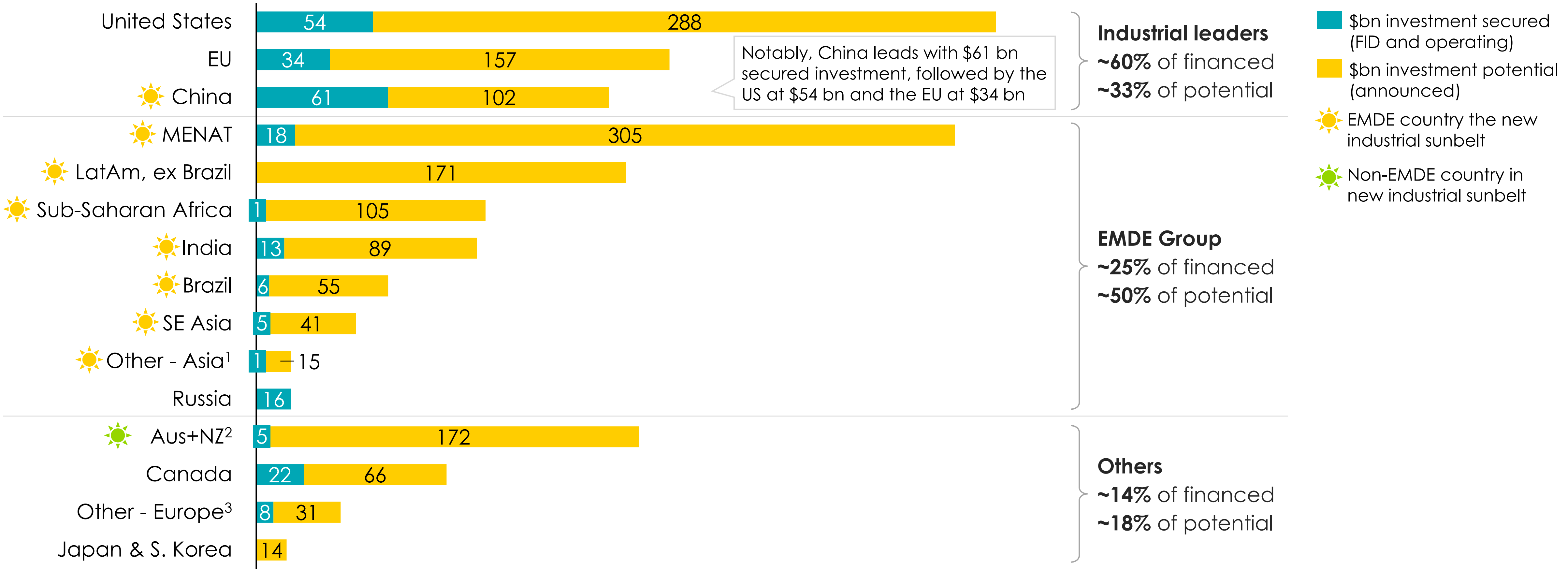
Heavy Industry: Opportunity to grow investment in Asia-Pacific region

Investment in Clean Industry from the Mission Possible Partnership (MPP) Global Project Tracker

(Chemicals, Aviation, Aluminium, Cement, Steel)

Share of investments by major countries/regions

$bn, 30th April 2025



1 Other – Asia consists of Malaysia (sunbelt), Pakistan (sunbelt), Uzbekistan (non-sunbelt), and Kazakhstan (non-sunbelt)

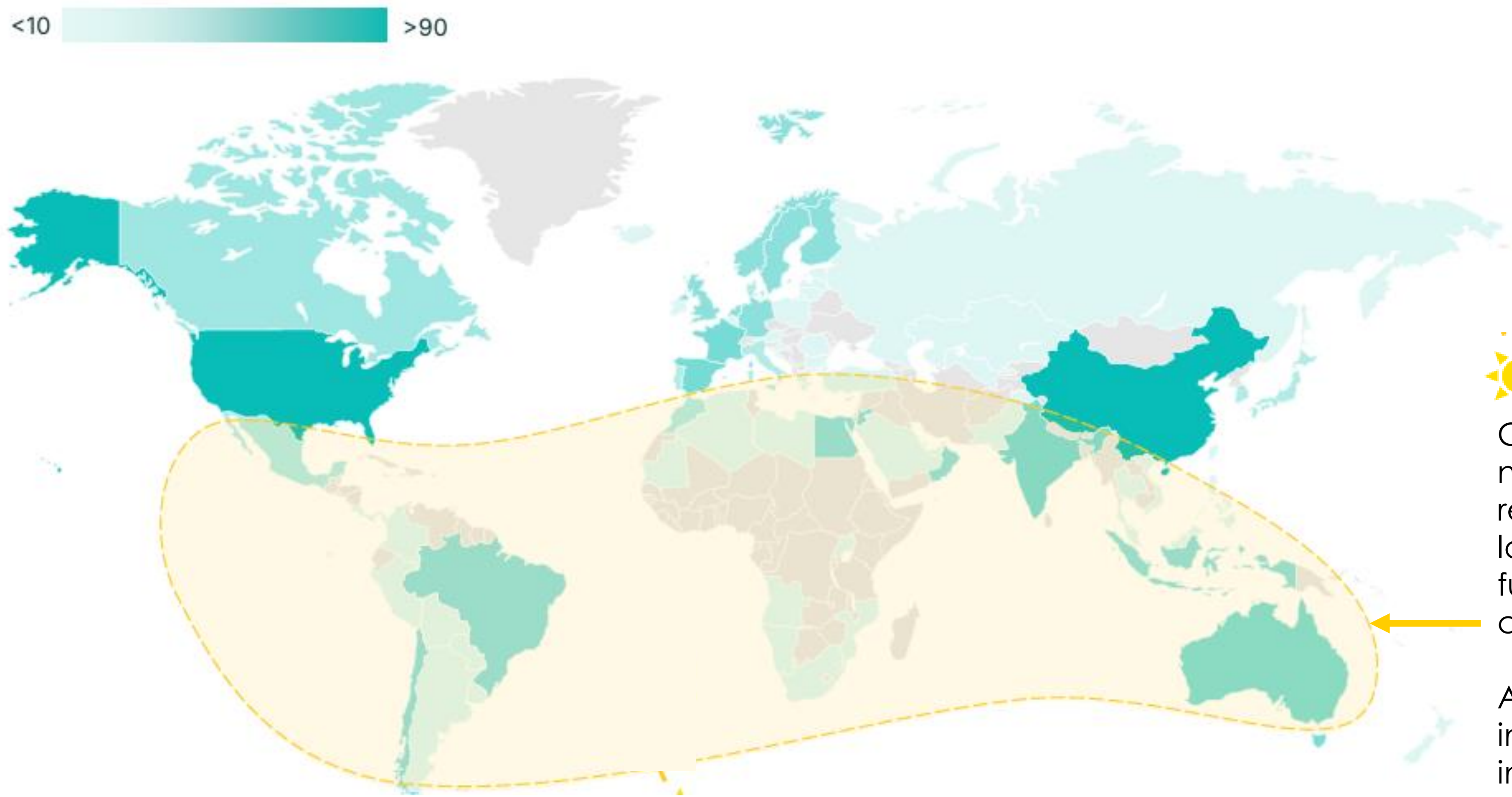
2 Oceania consists of 48 projects in Australia (sunbelt) and 1 project in New Zealand (non-sunbelt)

3 Other – Europe consists of Iceland, Norway and United Kingdom (all non-sunbelt)

Source Mission Possible Partnership Global Project Tracker

Heavy Industry: Industrial Sunbelt opportunity for Asia

Announced projects per country, 30 April 2025



New Industrial Sunbelt

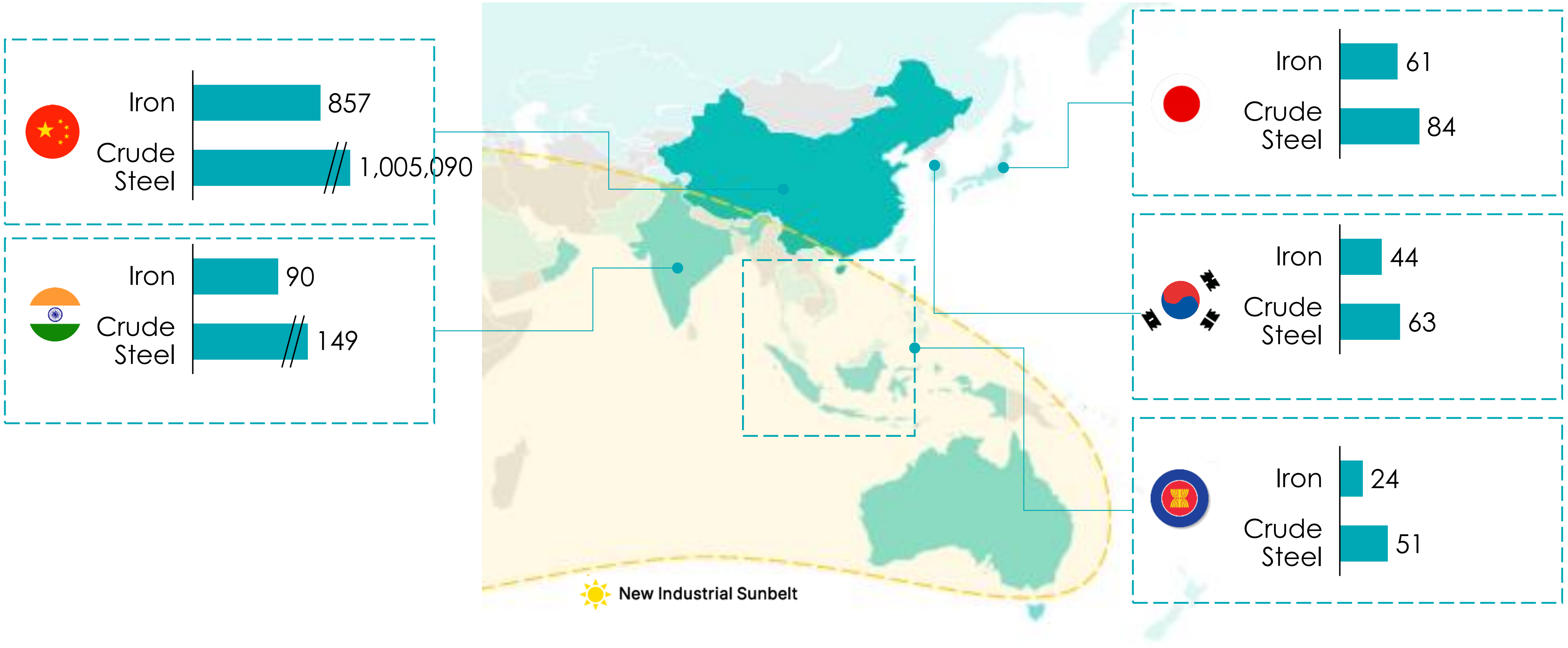
Countries with an abundance of natural resource to produce renewable energy, competitive labour markets and good fundamentals to deliver plentiful clean hydrogen at lower costs.

A fifth of all clean industry investments to date have flowed into new industrial sunbelt countries.

Source: Mission Possible Partnership

Heavy industry: Will green ironmaking centres in Asia shift?

Top Asia-Pacific Iron and Steel production volumes, millions of tonnes 2024



Source: Mission Possible Partnership, World Steel Association

Key takeaways for Asia

- Asia power generation continues to heavily depend upon coal, but has an opportunity **to develop a competitive solar-dominated power system at half the cost of today**
- Although China has seen a steady growth in electrification, its **energy productivity has decreased** due to growth in coal usage for power generation
- **Energy efficiency measures are critical in SE Asia** to maximise energy productivity in 2050 by up to ~50%
  - Electrification of transport is the largest lever, with significant growth potential outside of China
  - Buildings cooling demand will grow significantly, it is critical to ensure flexible and efficient air conditioning systems
- With the rampdown of US in climate leadership, there is an **opportunity for Asia to capture more clean industry investment**

Agenda

ETC Asia engagement

State of the global energy transition and implications for the ETC

- *Guest Speaker: Amir Hon - Petronas*

Emerging Insights: Asia Energy Demand Trends

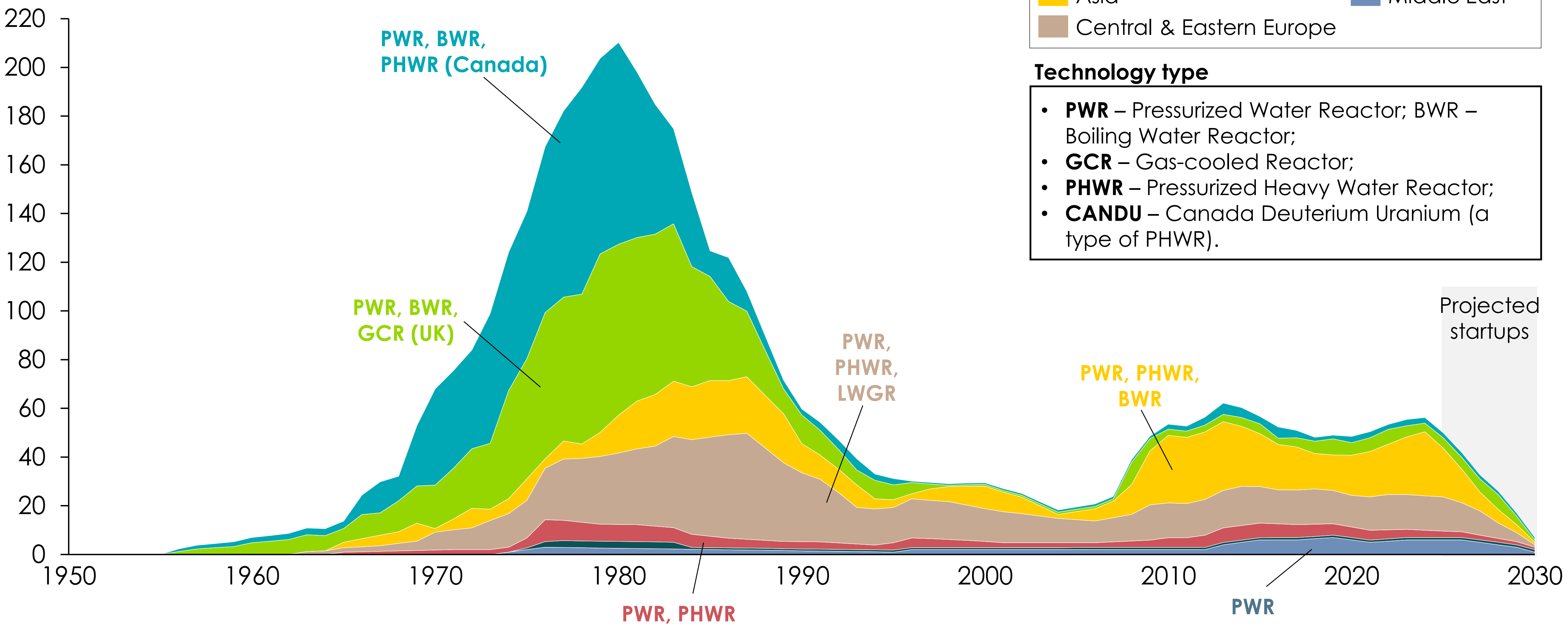
- *Guest Speaker: Rajiv Mangal – Tata Steel*

Emerging Insights: Nuclear

ETC 2026 strategy: Looking ahead and feedback

Nuclear power deployment peaked in the 1980s in the West, with a recent peak in Asia

Reactors under construction by year by region
GW (dominant reactor types annotated)



Region

- North America
- Western Europe
- Asia
- Central & Eastern Europe
- Latin America
- Africa
- Middle East

Technology type

- **PWR** – Pressurized Water Reactor; BWR – Boiling Water Reactor;
- **GCR** – Gas-cooled Reactor;
- **PHWR** – Pressurized Heavy Water Reactor;
- **CANDU** – Canada Deuterium Uranium (a type of PHWR).

Source: adapted from Mycle Schneider Consulting (2024), *The World Nuclear Industry Status Report 2024*; World Nuclear Association (2025), *Reactor Database*

Advanced nuclear reactors and SMRs are starting to be operated and constructed across Asia

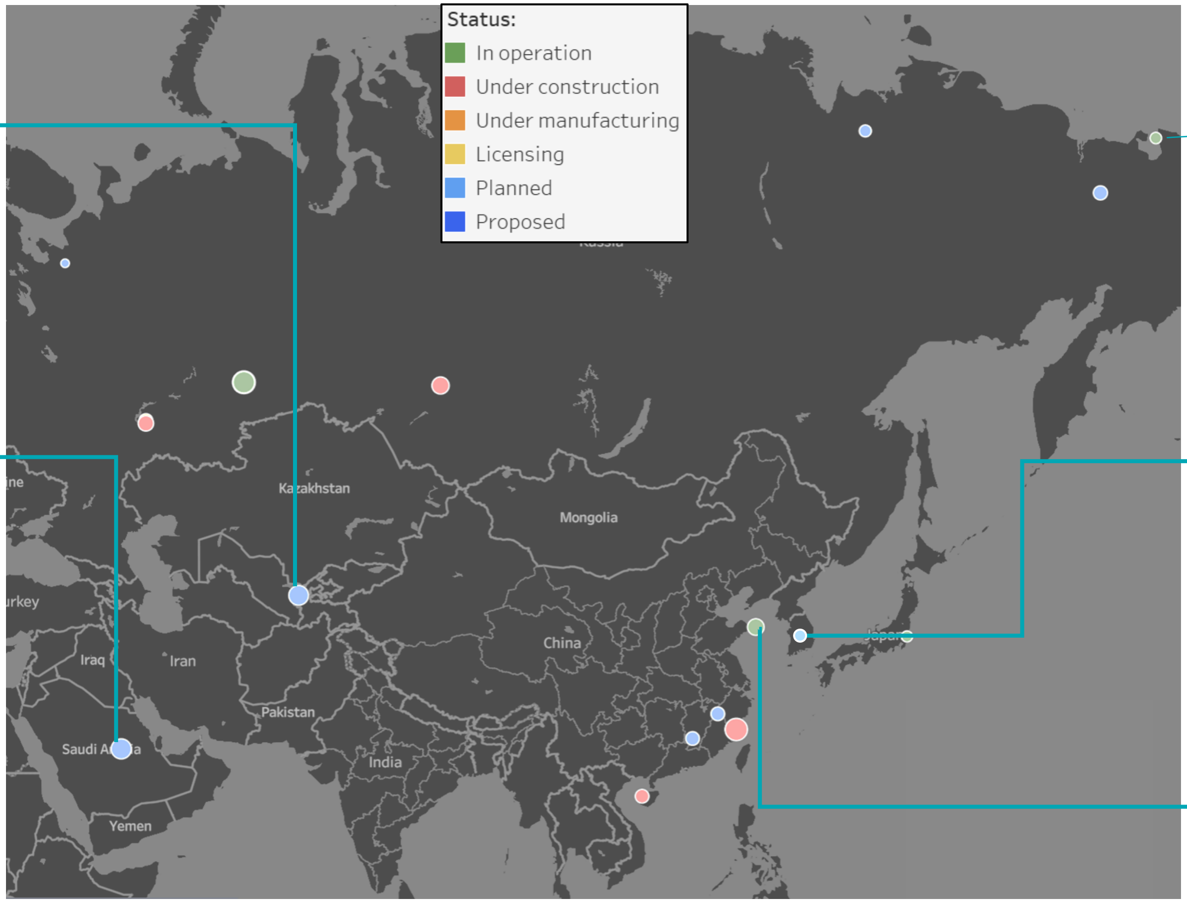
Global advanced nuclear reactor demonstration deployment map

Circle colour denotes status and size denotes capacity

Uzbekistan
Project name: UzAtom
Size: 6x 50MWe
Status: Under Construction
Reactor Type: RITM-200N
Reactor Source: Russia
Commissioning date: 2029

Saudi Arabia
Project name: KEPCO/KHNP
Size: 330 MWth (~100 MWe)
Status: Planning
Reactor Type: SMART SMR
Reactor Source: South Korea
Commissioning date: TBC

Various
Other Asian countries exploring SMRs, though at earlier stages of development, include **India, Kazakhstan, Pakistan, Vietnam, Bangladesh, Indonesia, Philippines, Thailand, Myanmar, Mongolia**



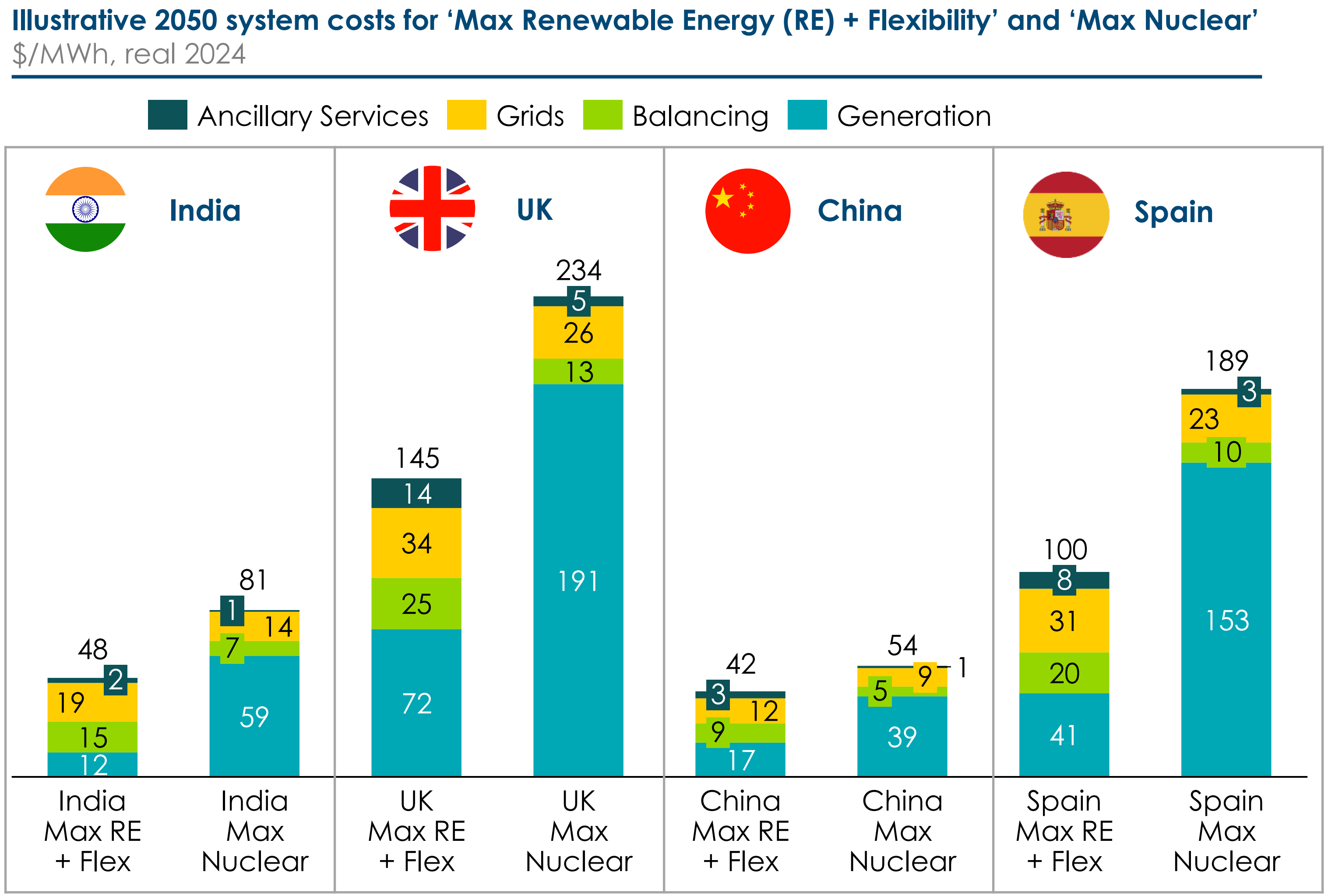
Russia
Project name: Rosatom
Size: 2 x 32 MWe
Status: Operating
Reactor Type: KLT-40S
Reactor Source: Russia
Commissioning date: 2020
Load Factor: ~30%

South Korea
Project name: KHNP/KAERI
Size: 170 MWe
Status: Planning
Reactor Type: i-SMR
Reactor Source: South Korea
Commissioning date: 2031

China
Project name: Huaneng Group
Size: 2 x 100 MWe (de-rated to 150 MWe)
Status: Operating
Reactor Type: HTR-PM
Reactor Source: China
Commissioning date: 2023
Load Factor: ~9%

Notes: HTR-PM = High-Temperature Reactor.
Sources: US DoE (2024), *Pathways to Commercial Liftoff: Advanced Nuclear*; Mycle Schneider Consulting (2024), *The World Nuclear Industry Status Report 2024*; Third Way (2024), *The Global Race for Advanced Nuclear Is On*; Nuclear Innovation Alliance (2025), *Advanced Reactor Deployment Map*

Given current projections of future cost, a nuclear dominated system would likely be more expensive than a wind and solar dominated system



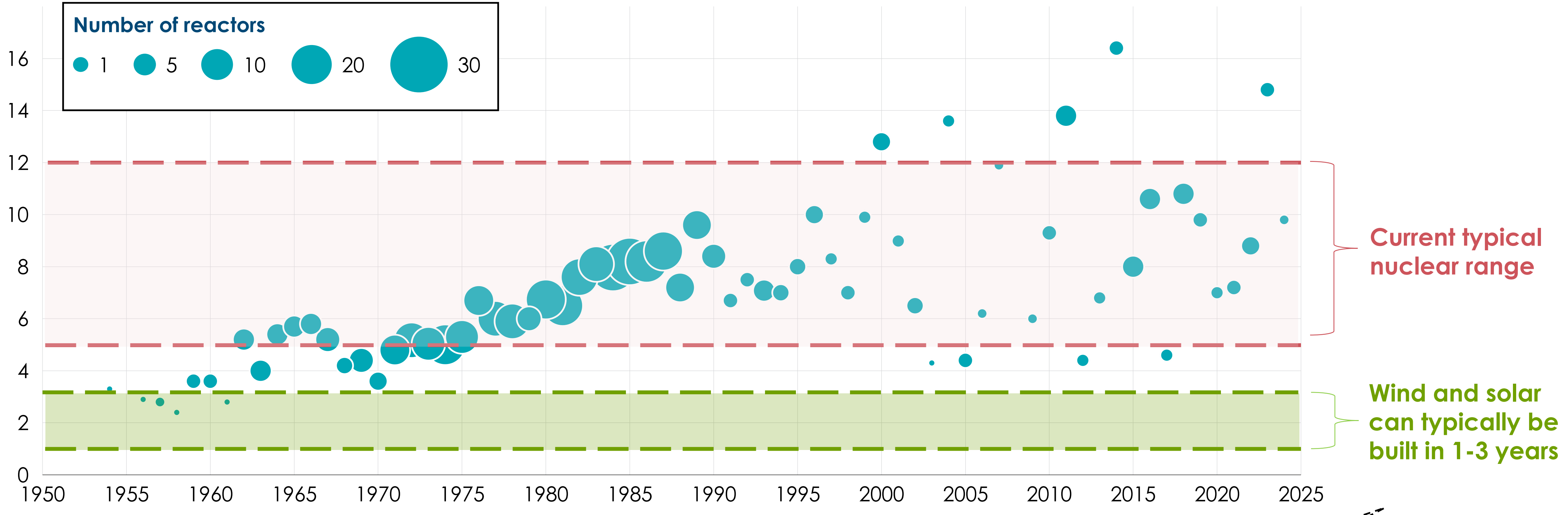
Key questions for our work:

a. What are the **features of a region which would benefit from nuclear** (e.g. land use, speed of deployment)?
b. What is the **flexibility potential** of nuclear and consequent balancing needs?
c. What are the **deployment principles** for nuclear? E.g. should we oversize renewables/storage or rely on nuclear?
d. What is the **opportunity cost** of nuclear investments?
e. What is the **impacts of DSF** in Max VRE vs Max Nuclear scenarios

Notes: Preliminary assumptions (based on available BNEF data): generation cost equates to nuclear 2024 LCOEs for Max Nuclear scenario (due to lack of data on future projections, however significant cost declines outside of China are unlikely based on current deployment trends), balancing cost reduction of 50% for Max Nuclear vs Max Wind & Solar, grid cost reduction of 25% for Max Nuclear vs Max Wind & Solar, Ancillary Services costs of 20% of generation, balancing and grid costs for Max Wind & Solar and 1/3 of Max Wind and Solar's Ancillary Services cost for Max Nuclear, respectively. India nuclear LCOE assumed to be 1.5x China's and Spain nuclear LCOE assumed to be 0.8x the UK's.

Average nuclear construction times have trended upwards, in contrast to renewables that can be built in under three years

Average annual durations from construction start to grid connection over time
Years



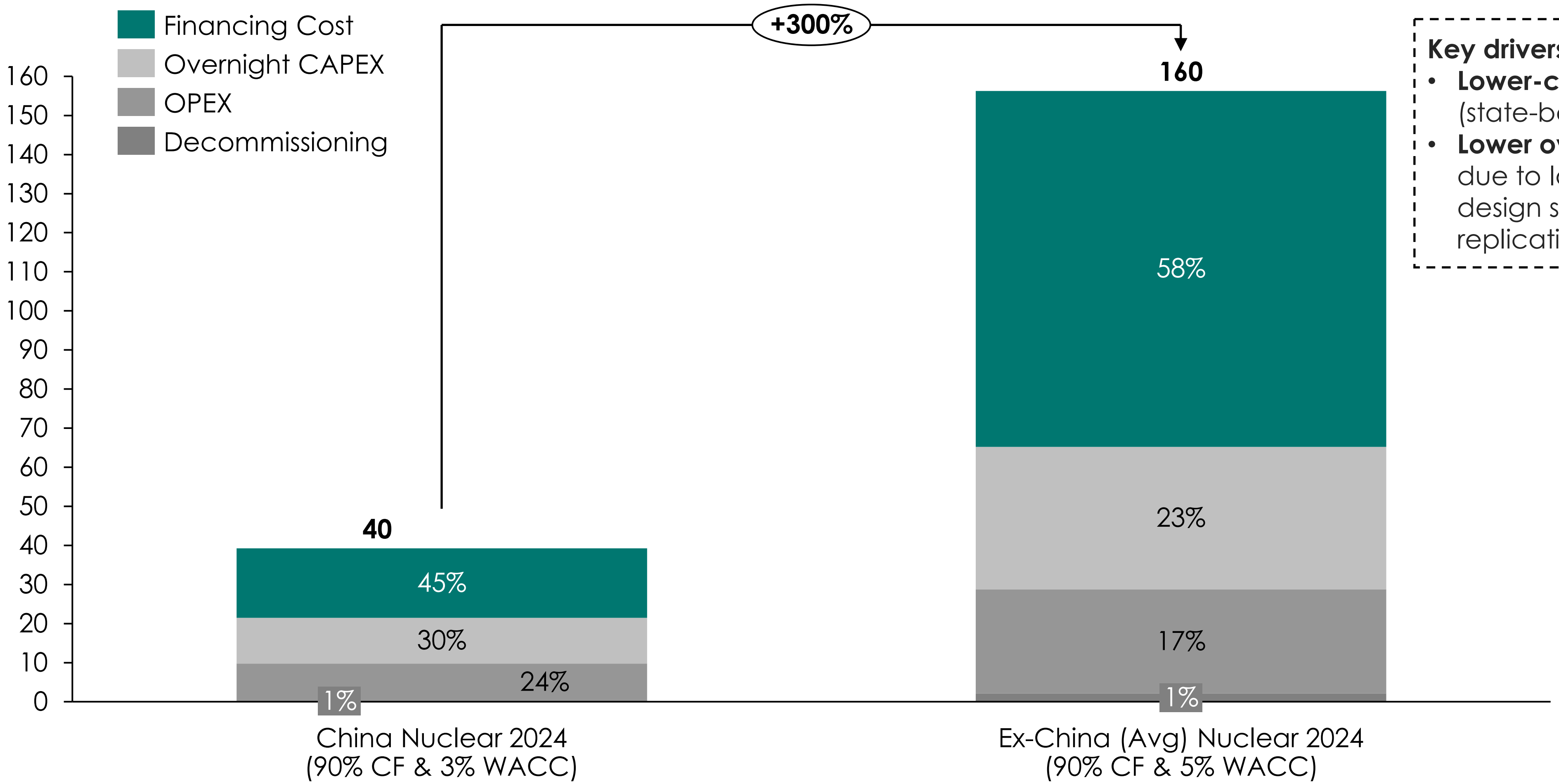
Average construction times have increased significantly, particularly in the West

New nuclear will add 1,000 TWh in the next 10 years while solar will add 10,000 TWh

Sources: Adapted from Mycle Schneider Consulting (2024), *The World Nuclear Industry Status Report 2024*; Financial Times (2025), Can the nuclear industry find a better way to build?; A. Gumber (2024), *A global analysis of renewable energy project commissioning timelines*

Levelised cost of energy (LCOE) is diverging across regions and alternative technologies

NUCLEAR: China and Ex-China indicative LCOE breakdown
$/MWh, real 2024



Key drivers:
- **Lower-cost capital in China** (state-backed, low risk)
- **Lower overnight CAPEX** in China due to lower labour costs, more design standardization and replication

Notes: CF = Capacity Factor, WACC = weighted average cost of capital (real), CAPEX = Capital Expenditure, OPEX = Operating Expenditure (incl. fueling), DECEX = Decommissioning Expenditure. Overnight CAPEX is the total CAPEX excluding financing costs.
Source: BNEF LCOE Data Viewer, Nuclear Energy Cost Estimates for Net Zero World Initiative, ORE Catapult (2021), *End-of-life planning in offshore wind*

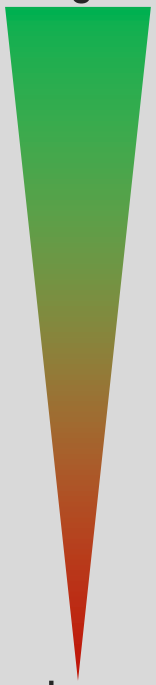
Nuclear is likely to play a key role in geographies with renewable resource constraints and sufficient institutional capacity

FOR DISCUSSION

Archetype description	Nuclear's role		Structural enablers		Key countries (Asia focus)
	VRE resource constraints	Large existing nuclear fleet	Regulatory capacity	Financing availability	
1a **Clear role for nuclear: VRE-constrained**	✓	N/A	✓	✓	Japan, Singapore, South Korea, Bangladesh
1b **Clear role for nuclear: Scaling legacy**	X	✓	✓	✓	China
2 **Nuclear is optional**	X	X	✓	?	India, Indonesia, Philippines, Thailand, Kazakhstan, Iran, Australia
3 **Low nuclear potential / need**	X	X	X	X	Myanmar, Cambodia, Sri Lanka, Afghanistan

Initial ETC view on the need for nuclear in 2050 power systems:

High



Low

Key barriers to nuclear deployment are safety, development risk, environmental impacts, and resource use

Issue	Summary of Debate
Cost	• Nuclear is capital-intensive, with high upfront costs and long payback periods. • High risk of cost overruns and schedule delays • Financing costs are a major LCOE driver.
Workforce	• Long-term nuclear buildout programmes are required to sufficiently train sufficient workforce • Intermittent build programmes contribute to skill attrition and re-training needs, further increasing labour costs and reducing productivity.
Construction times	• Long timelines (often 8–15 years) undermine competitiveness and increase financing risk. • SMRs claim faster build times but lack commercial proof.
Safety (incl. lifetime extensions)	• Public concern persists over core meltdowns, aging reactor components, and disaster history • Lifetime extensions raise questions about material degradation and safety margins.
Security of uranium supply	• Uranium is globally available, but conversion/enrichment is geographically concentrated. • Dependence on Russia for enrichment is a rising concern.
Environmental impact	• High-level waste remains a politically and technically unresolved issue in most countries • Nuclear plants are water-intensive, particularly those using once-through or wet cooling. • Local environmental impacts (e.g. thermal pollution) are a concern.

To discuss: what are the principles of nuclear deployment?

FOR DISCUSSION

Issue	Preliminary Guidelines
Cost	• **Holistic system planning** in line with project lifetimes • **Implement low-cost financing** including via government-backed loans). • **Ensure balancing of risk on the developer and taxpayes** • **Use standardised designs** to reduce risks of cost and schedule overruns.
Workforce	• **Prioritise nuclear projects with high gross value add impact** • **Plan long-term strategic nuclear buildout programmes** in line with project pipelines.
Construction times	• **Ensure aligned with the required pace of decarbonisation**.
Safety (incl. lifetime extensions)	• **Standardise regulations globally** to balance of safety modular cost benefits • **Lifetime extensions should be prioritised over new builds** when safe, to maximise kWh per $ spent
Security of uranium supply	• **Uranium conversion/enrichment capacities must be assessed** in line with any proposed buildout
Environmental impact	• **Establish waste disposal programmes** in line with global best practices • **Thermal pollution** (e.g., in local waterways) must be thoroughly assessed • **Water usage** should be assessed in line with local and global planetary boundaries.

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ETC 2026 strategy: Looking ahead and feedback

Proposal for evolution: more agile analysis & increased engagement

ETC in 2025 – 15 analytical outputs:	ETC in 2026 ~ 6-11 analytical outputs?
3 major reports (100 page +): Buildings, power, molecules	**1 major report:** State of the global energy transition
4 insights briefings (c. 50 pages): Nuclear/geothermal, long distance transmission, energy productivity, road transport	**~5 insights briefings (c. 50 pages):** e.g. economics of the transition x3, hydrogen, power
5 briefing notes/blogs (5-20 pages): Trade, carbon credits, power demand growth, demand-side flex, bio	**~5 briefing notes/blogs (5-20 pages):** *to be agreed*
2x regional insights: India (AgriPV), Indonesia (energy system)	**Space for increased regional work and engagement?**

CONTINUING TO EVOLVE AND REFINE OUR THREE PILLAR COMMUNICATIONS STRATEGY

Disseminating ETC insights & recommendations

Leveraging existing knowledge

Informing the influencers

Hypothesis for discussion – more agile analysis & increased engagement

Robust analysis across ETC strengths in 3 core focus areas

FOCUS AREAS:	General / emissions / economics / priority areas	Clean electrification	Molecules
THE FACTS	▪ The economics of transition ▪ Jobs, growth, competitiveness	▪ Role of low-carbon baseload ▪ Consumer bill impacts/market design	▪ Hydrogen: re-assessing the fundamentals, 4 years on. Lessons learned etc.
THE 'UNBLOCKERS'	▪ Policy recommendations for low cost consumer electricity in Europe	▪ *Example: Priorities for power markets in South East Asia* ▪ *Example: Removing red tape to accelerate behind-the-meter energy*	▪ *Example: Accelerating carbon capture in Europe*

+

THE NARRATIVE

A comprehensive state of the transition campaign

Using the ETC's existing global & regional connections and iniatitives to target policymakers and business in all key regions

To be further defined this year

Disseminating ETC insights & recommendations | **Leveraging existing knowledge** | **Informing the influencers**

Feeding into our overall communications strategy

Is there a role for ETC Ambassadors to increase regional engagement?

What we are looking for

Strong local network to help:

- Spread ETC messages
- Recruit members/allies
- Get ETC materials to key decision-makers

Responsibilities

Regular alignment with ETC to:

- Feed local developments and insights into global analysis
- Tailor messages for local nuance
- Act as local spokesperson

Considerations

For discussion today:

- **Value-add / additionality**
- **Effort required from ambassador**
- **Effort required from ETC team**
- **Budget**