Data, Insight, Strategy & Communities

# Renewable Energy and the Call for Critical Minerals – A Global Perspective

Resources, Energy & Innovation Forum, Dubbo

CRU. Independent *expert* intelligence

6th August 2024

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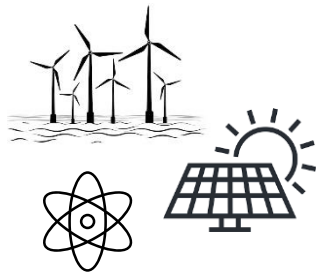
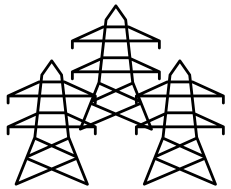
# The Global Energy Transition – NSW and the Central-West are well positioned

## How we generate energy



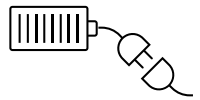
U
Cu
Rare Earths
ASM
Zn
Al
Zr
Ag
Si
Steel
Hf
Ag
SILVER MINES LIMITED

## How we transport energy



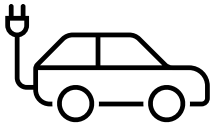
Cu
Steel
Al

## How we store energy



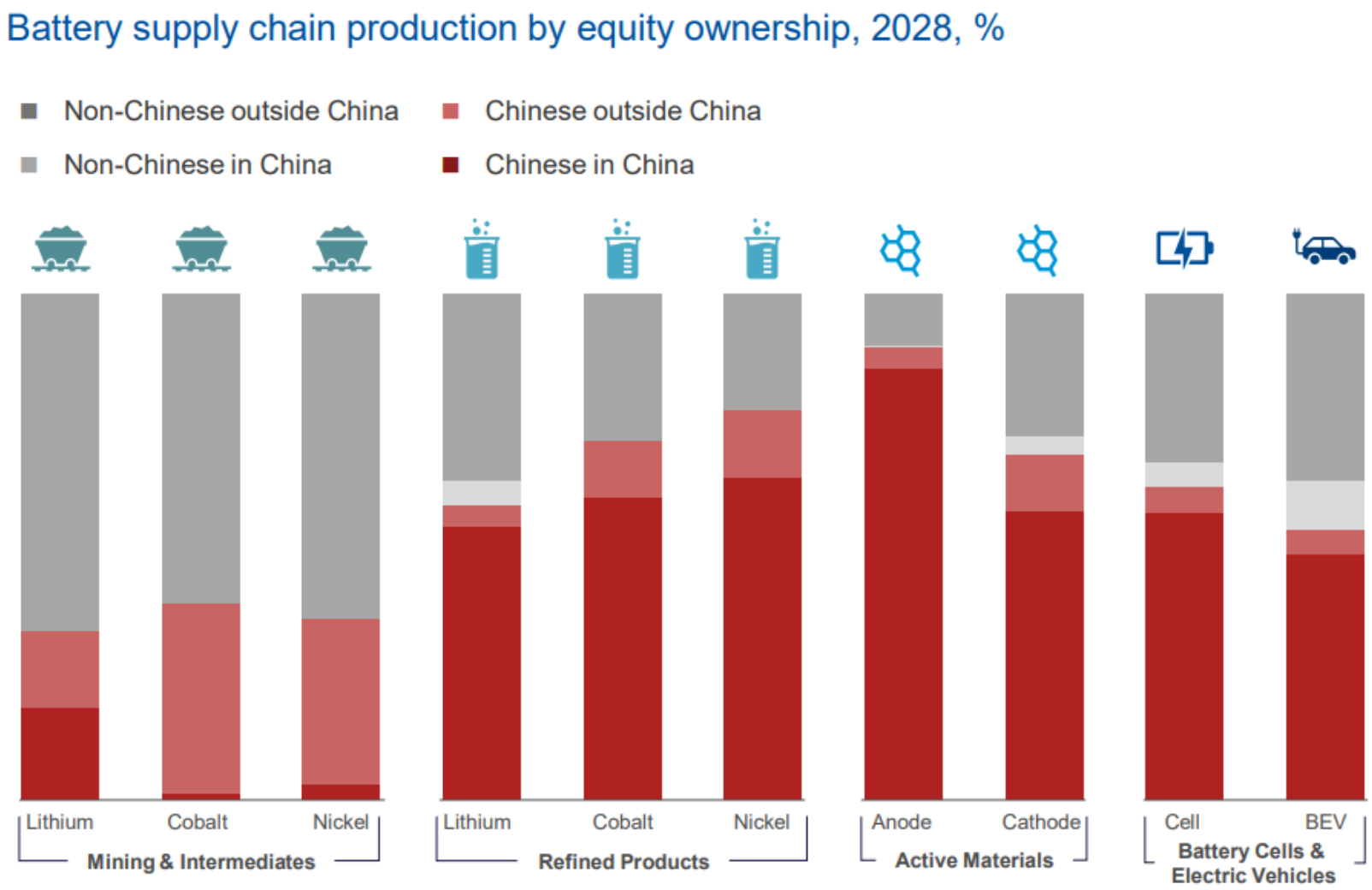
Al
Cu
Co
Li
Mn
Ni
P
Mn

## How we use energy



Rare Earths
Al
Co
Li
Mn
Ni
Cu
P

# Current supply chains are sub-optimal, especially from an ESG standpoint …



# … while strategic competition is intensifying

Global Energy Transition Metals: Criticality Assessment

| Metal | | | | |
|---|---|---|---|---|
| Nickel | ✓ | ✓ | ✓ | ✓ |
| Copper | *DOE only* | ✓ | ✓ | ✓ |
| Cobalt | ✓ | ✓ | ✓ | ✓ |
| Lithium | ✓ | ✓ | ✓ | ✓ |
| Rare Earths | ✓ | ✓ | ✓ | ✓ |
| Manganese | ✓ | ✓ | ✓ | |
| Zinc | ✓ | | ✓ | |
| Aluminum | ✓ | ✓ | ✓ | ✓ |

- Major economies continue to add metals to the critical list
- Critical minerals legislation is increasingly supportive (2024 US National Defense Authorisation Act, EU Critical Raw Materials)
- Restrictions in trade of critical metals in effect (i.e China: gallium and germanium), creating tensions on the global stage
- With the emergence of strategic and economic schisms in geopolitics, protectionism and frictions are likely to increase

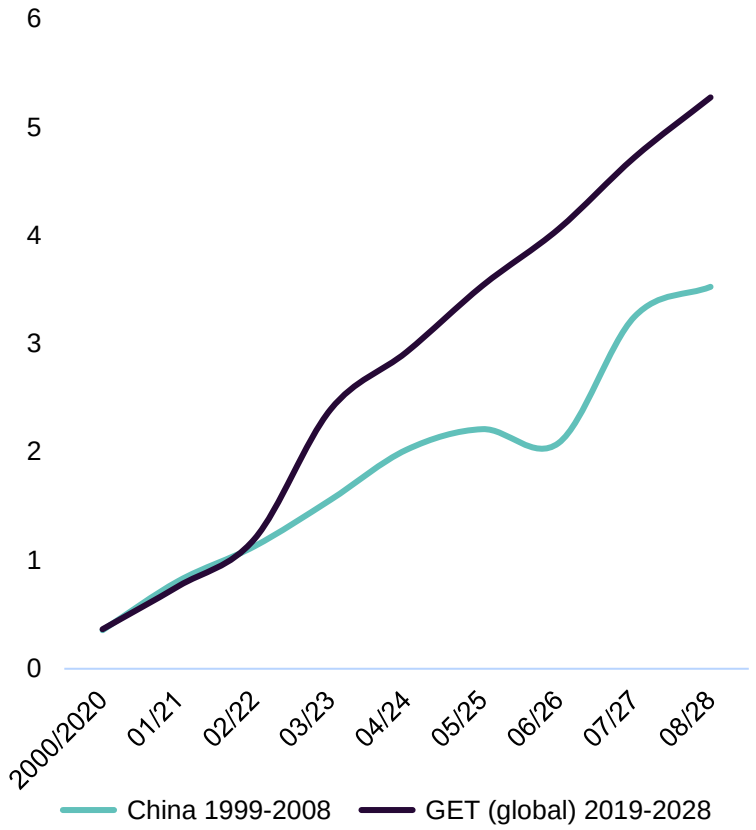
***"…export restrictions may be playing a non-trivial role in international markets for critical raw materials", OECD Trade Policy Paper April 2023***

***"Export restrictions on critical raw materials have seen a five-fold increase since the OECD began collecting data in 2009", OECD April 2023***

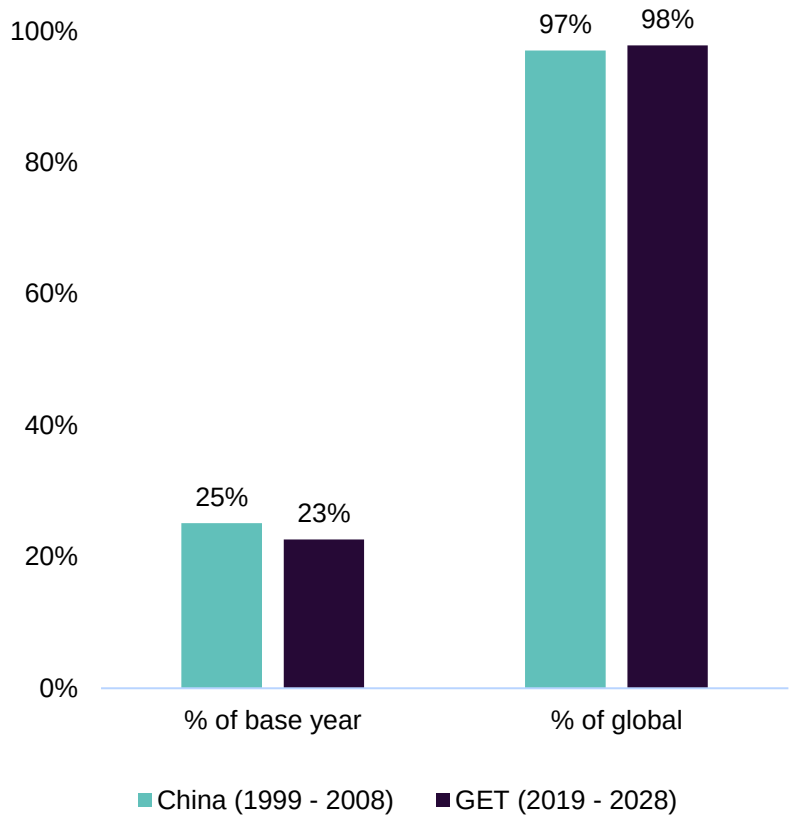
Sources: USGS, US DOE, NRCAN, China Geological Survey, OECD

# The greatest secular demand driver since China's urbanisation take-off …

Cumulative Cu consumption growth, Mt



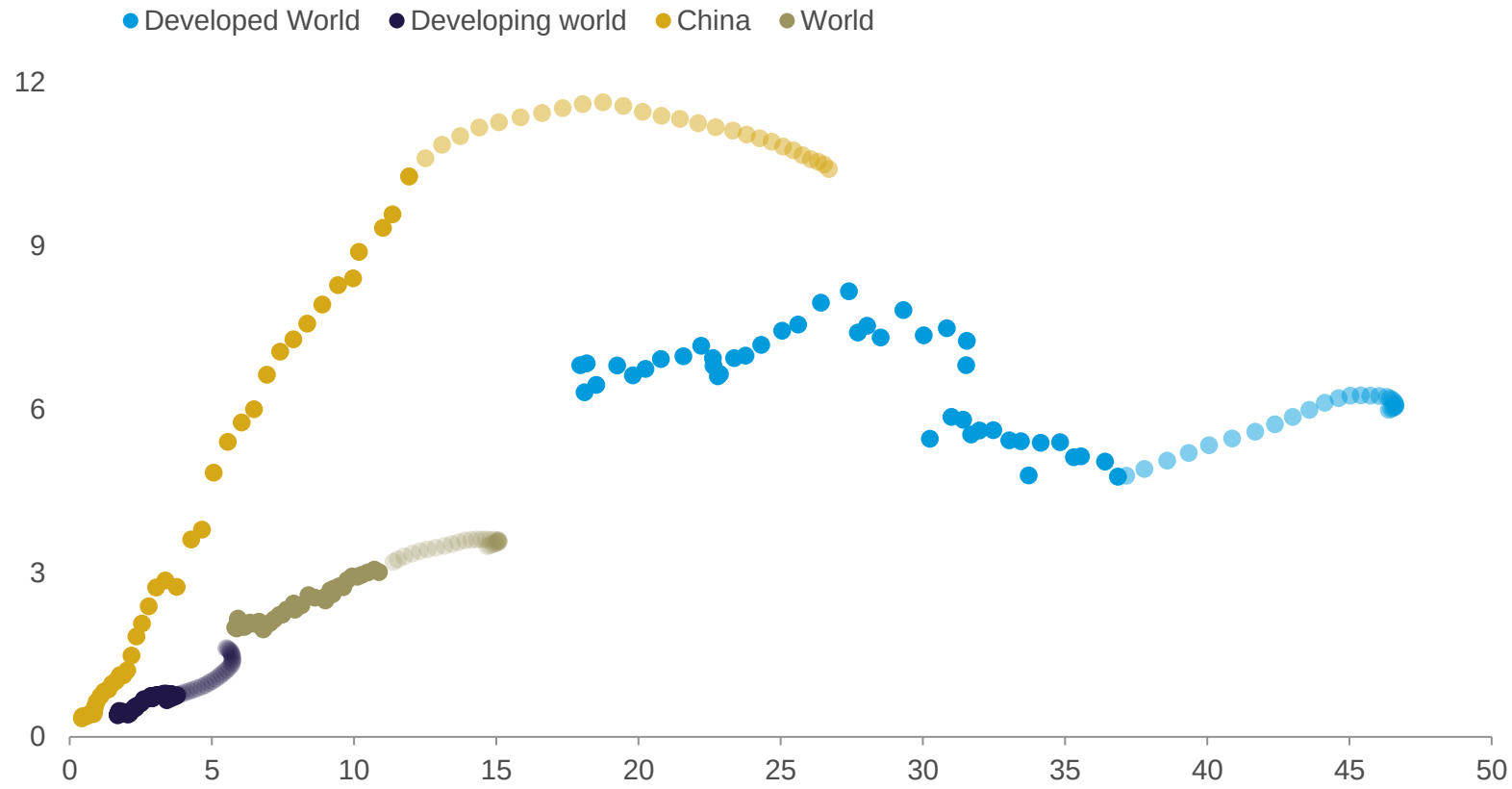

Cumulative Cu consumption growth, %




DATA: CRU GET = green energy transition uses including electric vehicles, renewable energy and related grid infrastructure

# … will reverse multi-decade trends in the developed world

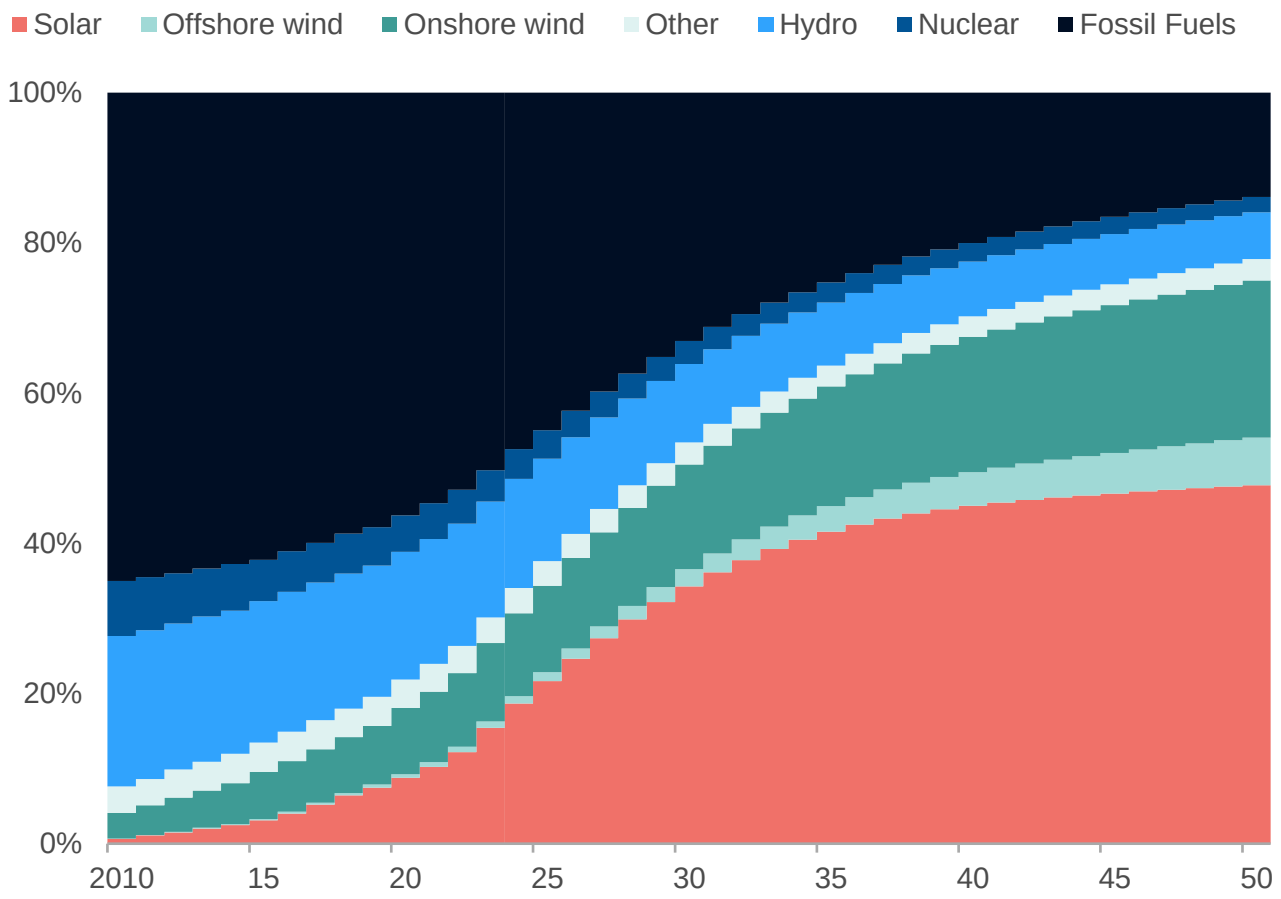
Refined copper per capita (kg) [y-axis] vs GDP per capita (real 2015$, '000) [x-axis], 1980-2050




DATA: CRU

# Annual renewables capacity installations to reach >1,000 GW

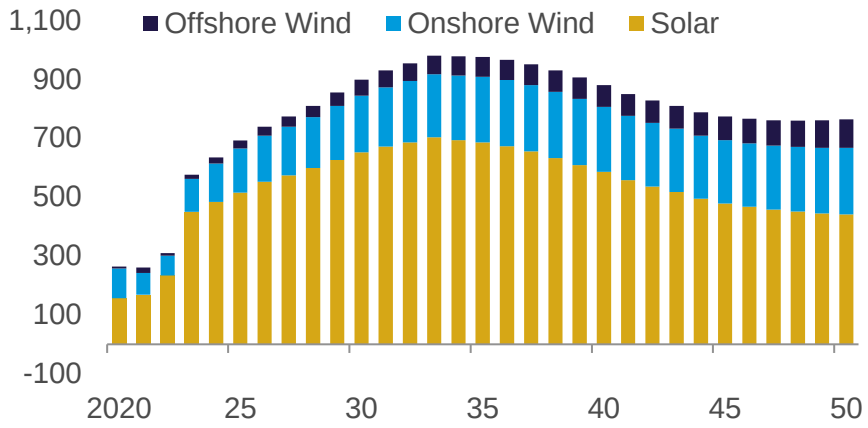
World electricity generating capacity, % share



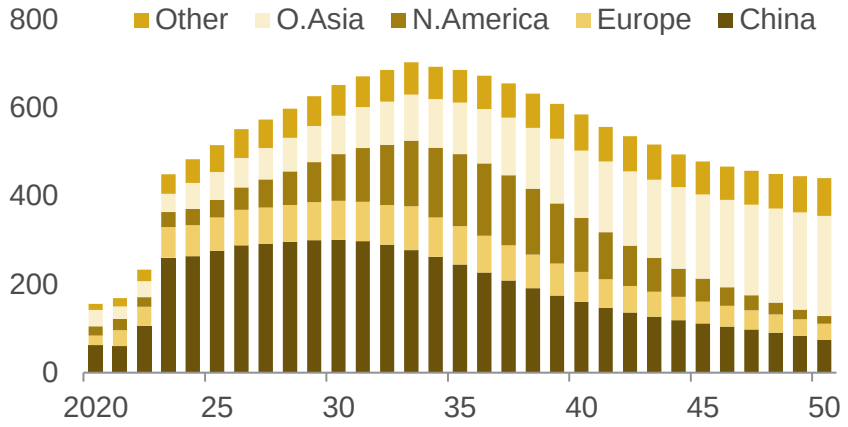

DATA: CRU. Note: *includes replacement capacity

# Renewables will shift away from solar and China towards wind and RoW

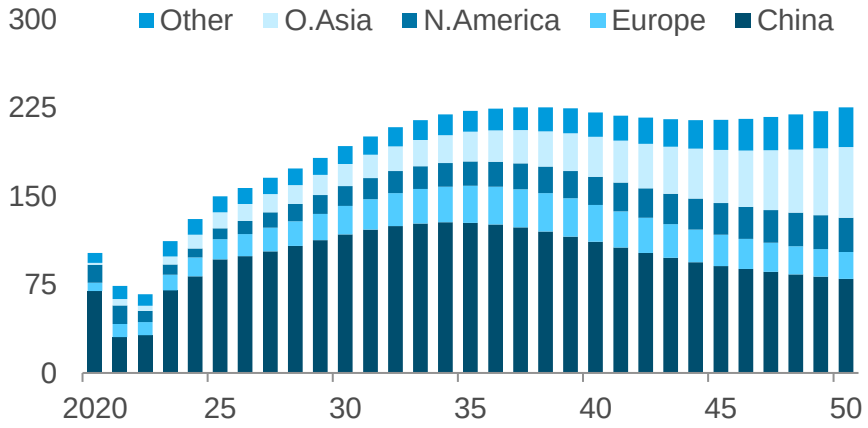
Capacity installations, GW



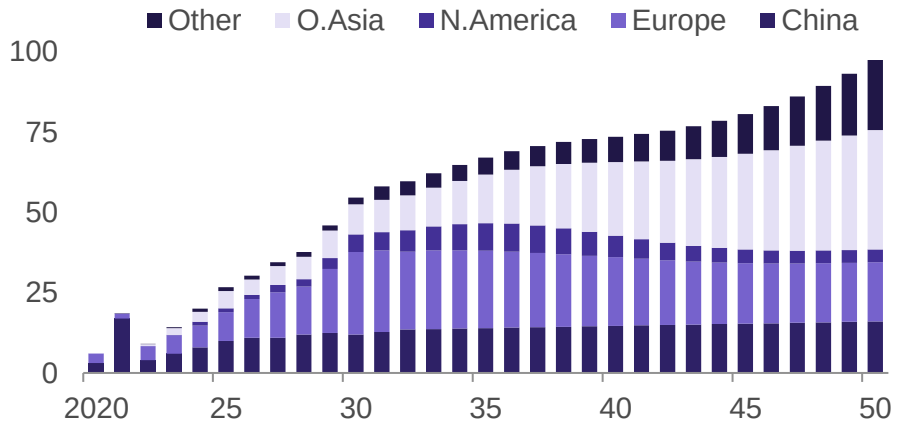

Solar capacity installations, GW




Onshore wind capacity installations, GW

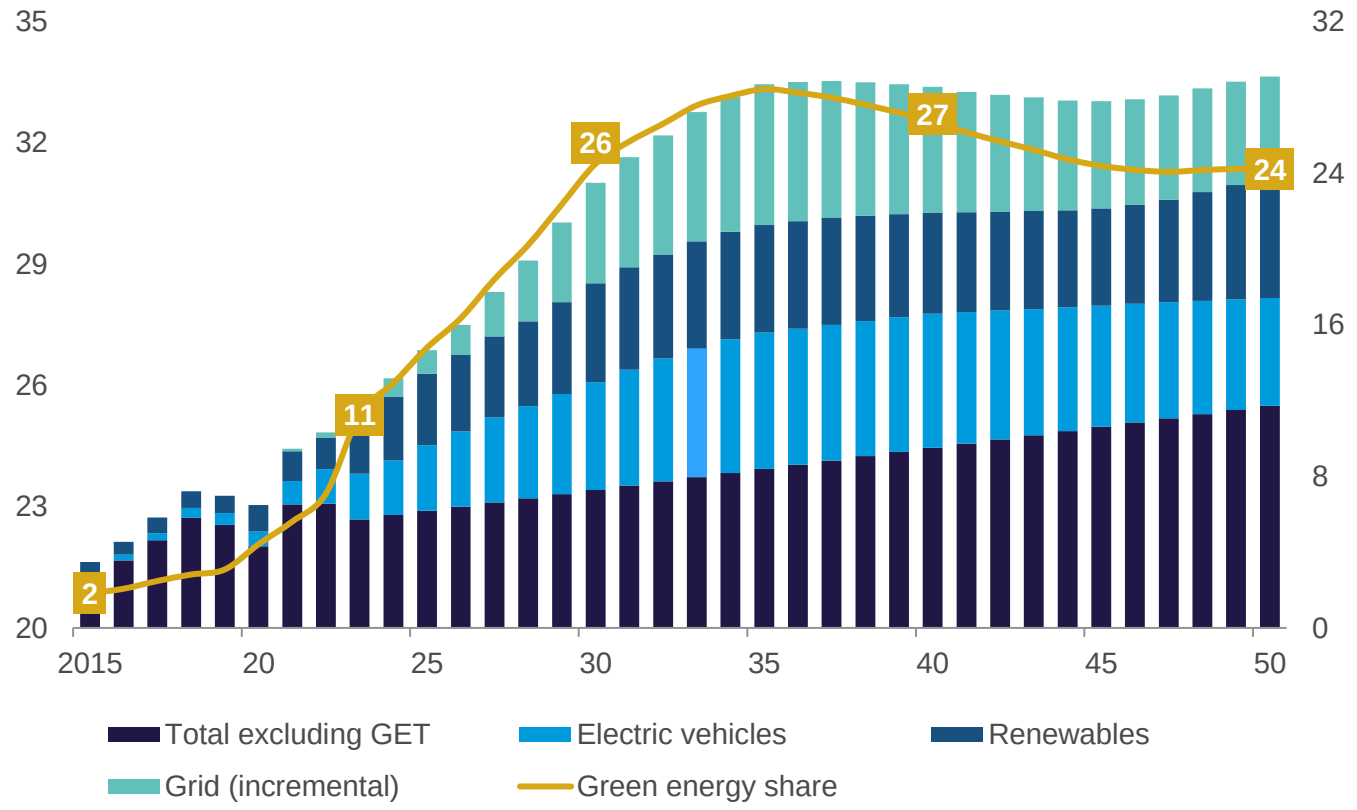



Offshore wind capacity installations, GW



# GET will be the key driver of demand growth well into the next decade

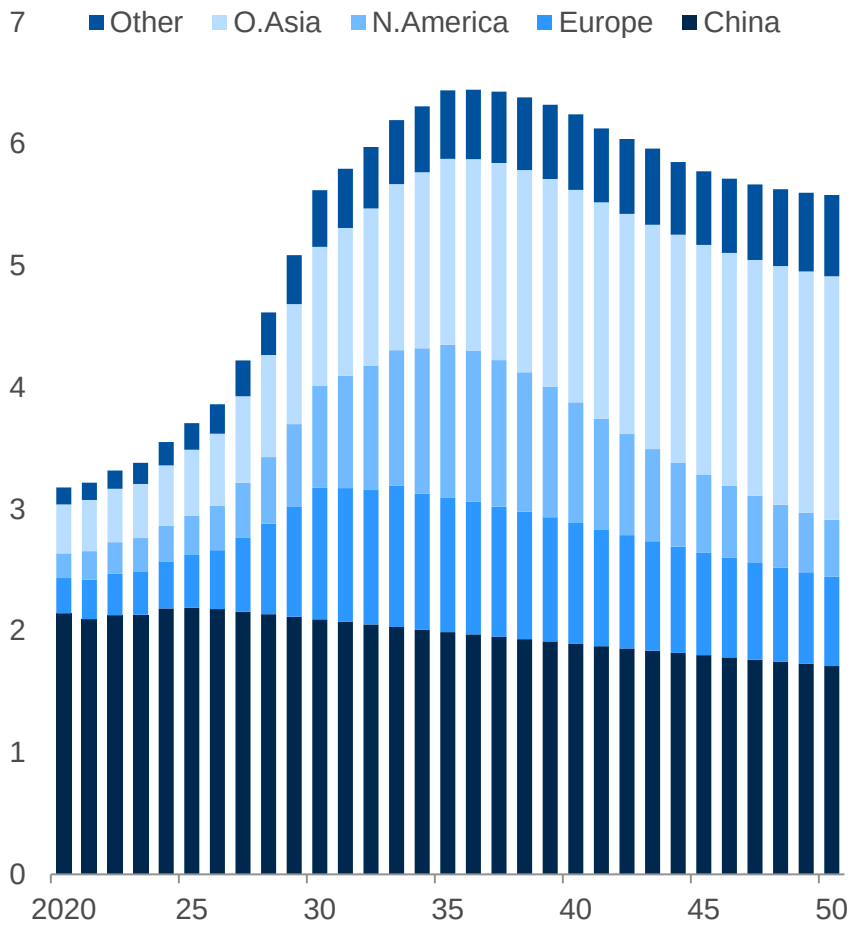
Global refined copper consumption, Mt



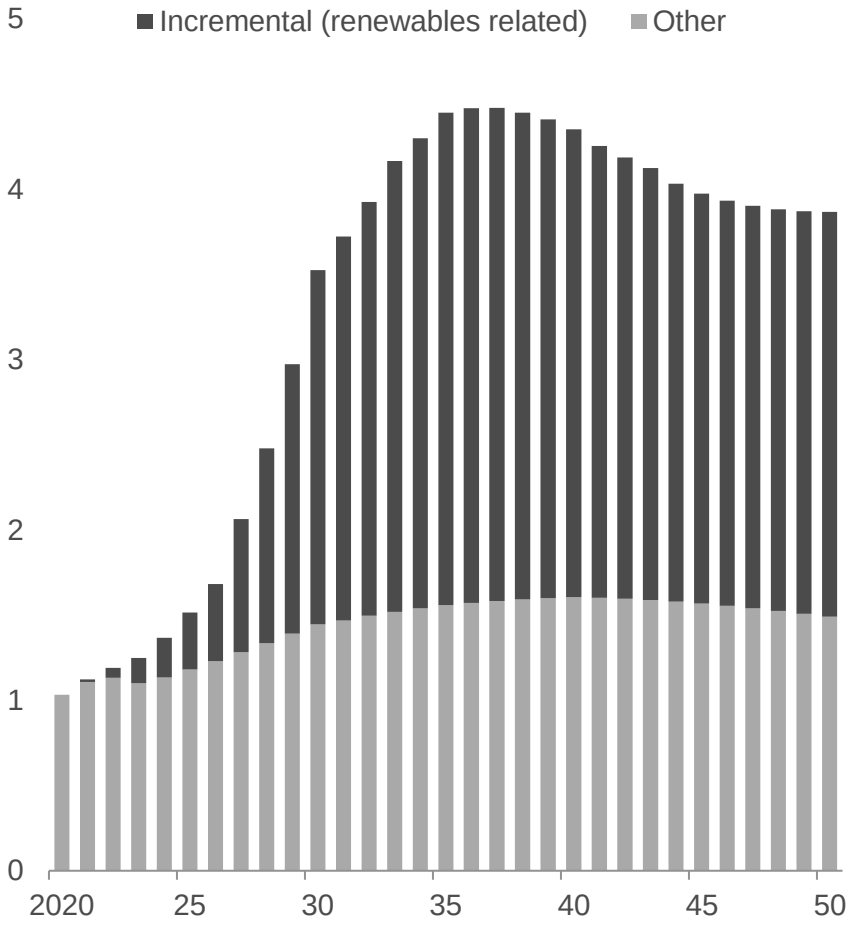

DATA: CRU. Note: *demand from EVs, renewables and associated electricity grid infrastructure.

# The electricity grid is THE great unknown

World Cu demand in EG, Mt



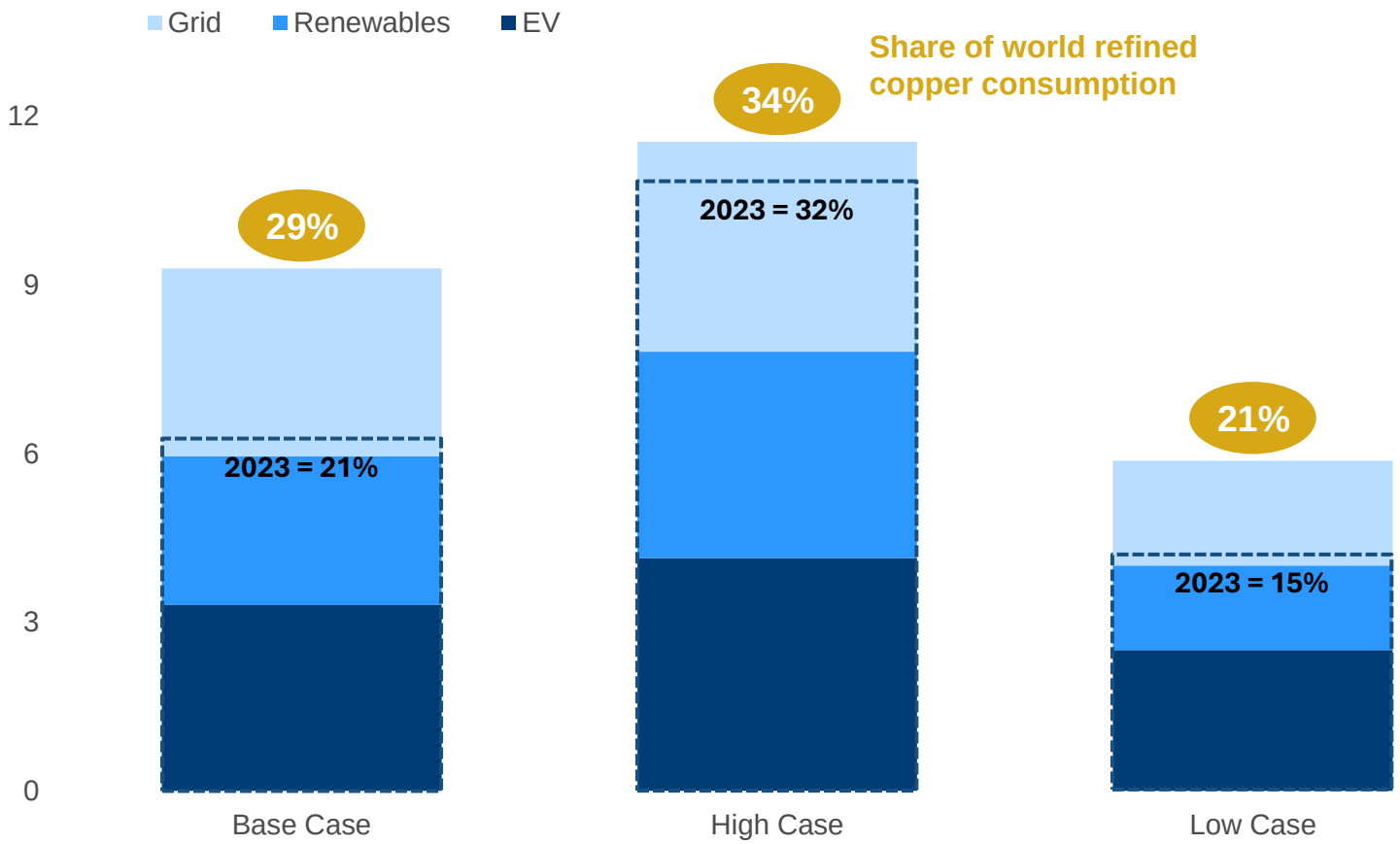

World ex. China Cu demand in EG, Mt




DATA: CRU

# High and low cases highlight the range of possibilities for GET copper demand

World green energy-related refined copper consumption, 2034, MT




DATA: CRU

## High Case

**Renewables:** generating capacity installations exceed 1,000 GW p.a., in line with Net Zero by 2050 aims.

**EVs:** Zero Tailpipe Emissions production scenario; high case copper intensities.

**Grid:** more rapid growth in renewables and EVs spurs additional grid investment to cope with increased loading and intermittency.

**Scrap:** technical / environmental challenges limit growth in use in semi-fabricated products and / or smelting-refining.

## Low Case

**Renewables:** generating capacity installations stay at 2023 levels of ~575 GW p.a. Higher rates of substitution / thrifting.

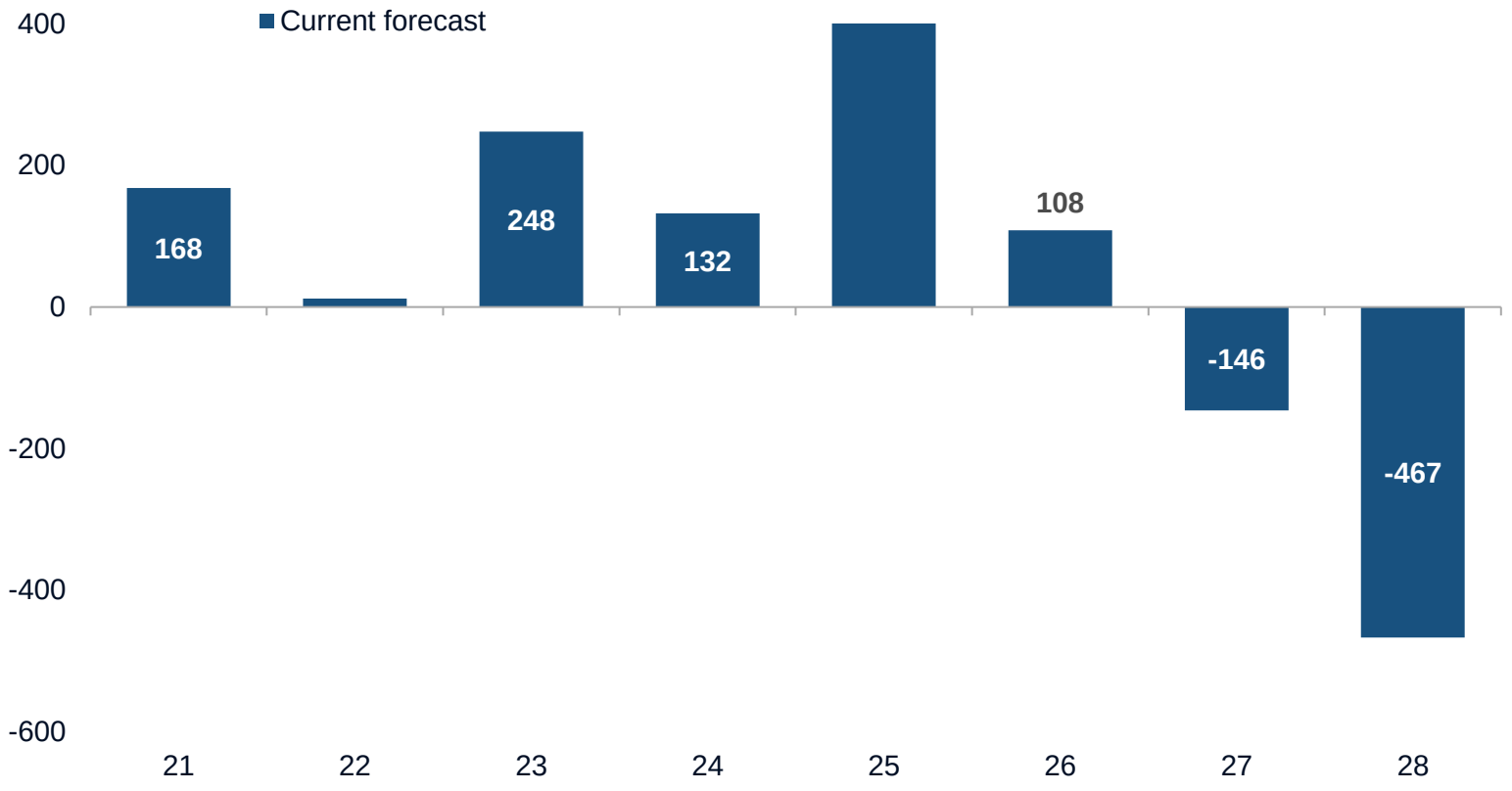
**EVs:** base case production; low case copper intensities.

**Grid:** lack of growth in renewables reduces need for grid upgrades in developed world.

**Scrap:** scrap-based wirerod and secondary smelting sectors develop more quickly than expected, especially in China.

# We need to put $$$ behind our projects today

Refined copper market balance, ‘000 t




DATA: CRU

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# Thank you

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