

CLIMATE ENERGY FINANCE

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## **Australian Hydrogen Council Discussion**

**26 November 2024**

# **Australian Hydrogen Council Forum**

## **Agenda – Reconstructing global iron and steel supply chains**

**China is leading the world's installs of renewable energy (Oz is a laggard).**

**China is leading a global step change in cleantech manufacturing capacity**

**China cleantech is going global: ODFI + exports + offshoring manufacturing**

**Australia's Green Iron Challenge – China is 86% of our iron ore exports**

**Global Steel Sector Decarbonisation**

**State of Play: Green Hydrogen**

**Direct Reduced Iron and Low-Emission Steelmaking**

**Time for Australia to act: This is a 1Bn tpa emissions reduction opportunity!**

# China is installing 22GW per month of RE

RE Momentum in 9MCY2024 has Slowed, it is 'only' +22% yoy

The month of September 2024 saw 27.8GW of RE commissioned

## New Capacity Installed in China in Jan-Sep 2024

		Jan-Sep 2024	Share of new adds (%)	Change (yoy %)	Sep-24	Share of new adds (%)
Thermal Power	GW	33.4	14%	-15%	4.8	15%
Hydropower	GW	8.0	3%	1%	1.4	4%
Nuclear Power	GW	1.2	0%	0%	0.0	0%
Wind Power	GW	39.1	16%	17%	5.5	17%
Solar Power	GW	160.9	66%	25%	20.9	64%
<b>Total capacity added</b>	<b>GW</b>	<b>242.6</b>	<b>100%</b>	<b>15%</b>	<b>32.6</b>	<b>100%</b>
Renewable Energy adds	GW	208.0	86%	22%	27.8	85%
Zero Emissions Capacity Adds	GW	209.2	86%	22%	27.8	85%
Investment in Completed Power Grid Project	1 billion yuan	398.2		21%	144.2	

Source: NBS, CEF Estimates

## Xi Jinping's Great Economic Rewiring Is Cushioning China's Slowdown

*Advances in EV, solar and semiconductors are helping the nation navigate its property slump*

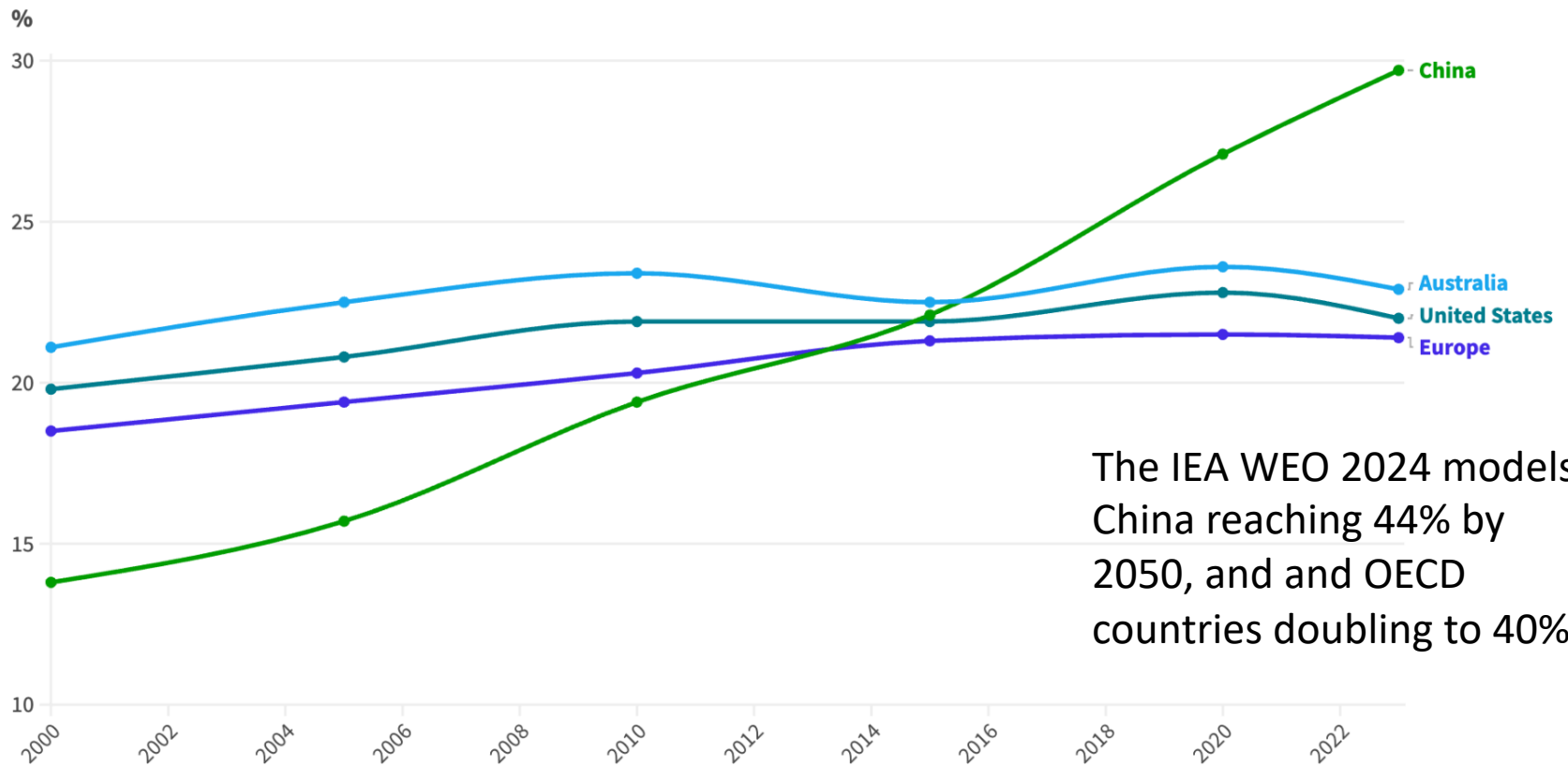
By Bloomberg News 16 July 2024

# China's Electrification of Everything

## China Leads the world on Progressive Electrification of Everything

### Share of final energy from electricity

China has leapfrogged United States, Europe and Australia in electrification

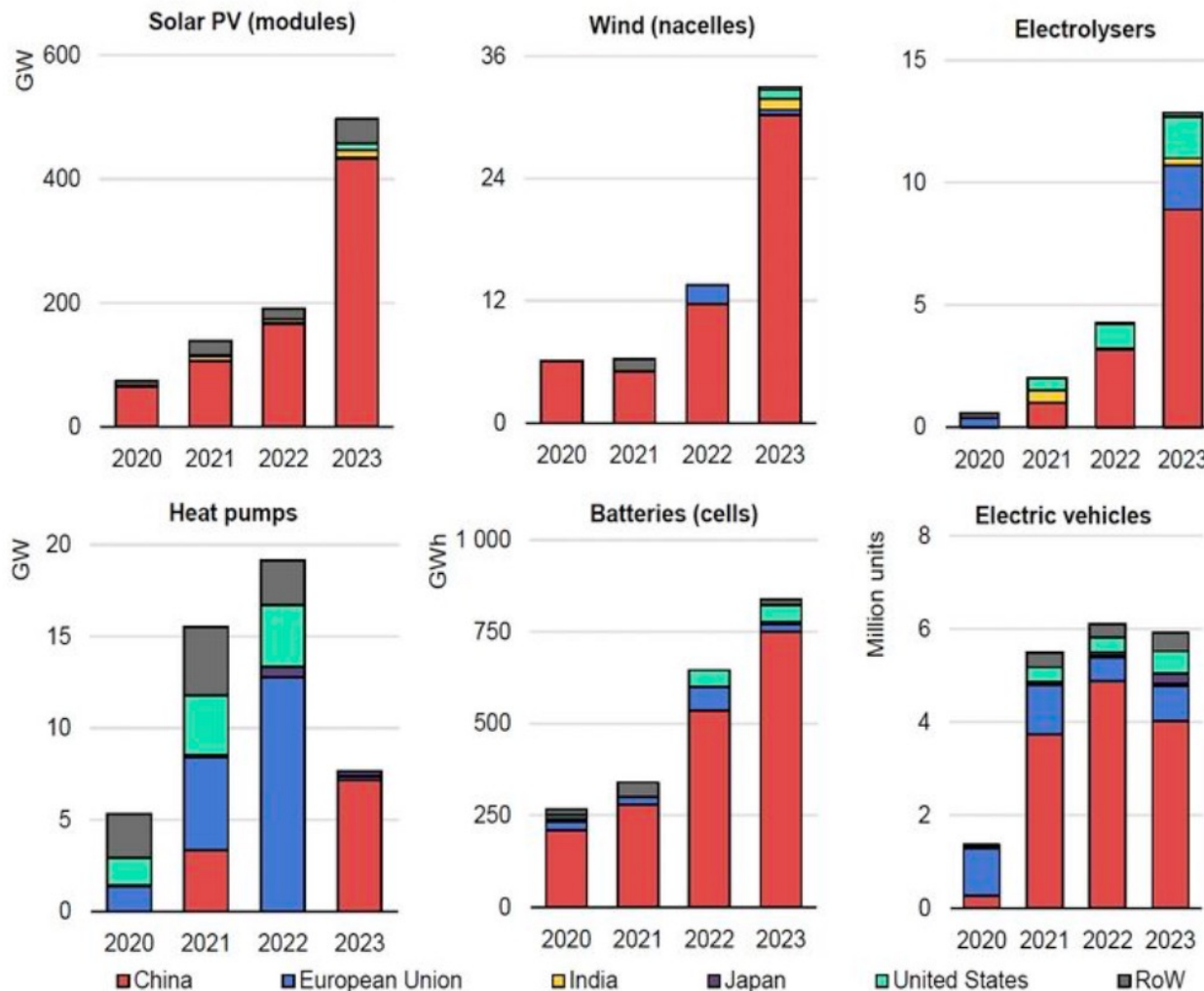


The IEA WEO 2024 models China reaching 44% by 2050, and and OECD countries doubling to 40%.

# China's Cleantech Manufacturing Dominance

## Global Cleantech Manufacturing Capacity Expansions by Year

Figure 1.6 Net manufacturing capacity additions for selected clean energy technologies by country/region, 2020-2023



# China's US\$115bn Cleantech ODFI since 2023

## China's response to the growing US and EU anti-China trade barriers

Investment						Date of	Expected	
US\$m	Technology	Company	Investment Partner	Location	news	Product	start of production	Confirmed / FID
8,100	Battery	CATL	n.a.	Debrecen, Hungary	May'2024	Battery Mfg, 100GWh	2025	Yes
5,600	NEV	Human Horizons	Ministry of Investment	Saudi Arabia	Jun'2023	NEV Mfg - MoU	n.a.	No
4,200	Hydro	Power China	n.a.	Tanzania	Feb'2024	Hydro-electricity - 2,115MW	2024	Yes
3,300	Grid T&D	China State Grid	n.a.	Brazil	Apr'2024	2*1,500km grid transmission lines	n.a.	Yes
2,600	Solar Farms	CEEC	ACWA & Aramco	Saudi Arabia	Feb'2024	2,600MW of solar farm	2024	Yes
2,450	Wind Farm & BESS	Goldwind	Omni Energy	NSW, Australia	Aug'2024	1.4GW wind, 200MW-2hr BESS	2028	No
2,360	Battery	Gotion	n.a.	Michigan, US	Aug'2024	Battery Mfg	n.a.	No
2,200	Battery	CALB	n.a.	Portugal	Jan'2024	Battery Mfg, 15GWh	2026	No
2,100	Solar Mfg	TCL Zhonghuan	RELC & Vision	Saudi Arabia	Jul'2024	20GW solar wafers pa	n.a.	No
2,000	Wind Farms	CEEC	ACWA Power	Uzbekistan	Aug'2024	to construct a 1GW wind farm	2026	Yes
2,000	Solar Farms	CGN	n.a.	Laos	Aug'2024	2,000MW of solar across 3 farms	2026	Yes
2,000	Hydro	CEEC	China Energy	Pakistan	Aug'2024	Hydro-electricity - 884MW	2025	Yes
2,000	BESS	Sungrow	Algihaz	Saudi Arabia	Jul'2024	BESS - 7,800MWh	2025	No
1,575	Battery	EVE Energy	n.a.	Coventry, UK	Mar'2024	Battery Mfg	n.a.	No
1,550	Battery Materials	Huayou Cobalt	n.a.	Acs, Hungary	Jul'2024	Cathodes, 100,000tpa	2026	Yes
1,500	Solar Farms	Jinko Solar	EDF & TAQA	Dhafrah UAE	Aug'2024	1,500MW solar farm	2024	Yes
1,500	Grid T&D	Southern Power Grid	Chilean partners	Chile	Apr'2024	1,342km grid transmission line	n.a.	No
1,500	Battery Materials	Shanghai Putailai	n.a.	Sundsvall, Sweden	May'2023	Graphite anodes, 100,000tpa	n.a.	No
1,500	BESS	BYD	Grenergy	Atacama, Chile	Sept'2024	BESS - 3,000MWh	2025	Yes
1,450	Battery	Envision AESC	n.a.	Kentucky, US	Sep'2023	Battery Mfg, 30GWh	2024	Yes
1,450	Battery	Envision AESC	n.a.	Douai, France	Nov'2023	Battery Mfg, 9GWh	n.a.	Yes
1,400	Battery	EVE Energy	n.a.	Debrecen, Hungary	Nov'2023	Battery Mfg, 28GWh	2025	Yes
1,400	Battery Materials	CATL	YLB Mining	Bolivia	Jan'2024	Lithium hydroxide, 50,000tpa	n.a.	Yes
1,350	Battery Materials	Shanghai Shanshan	n.a.	Finland	Oct'2023	Graphite anodes, 100,000tpa	n.a.	No
1,332	NEV	Geely's Volvo	n.a.	Košice, Slovakia	Jul'2022	NEV Mfg - 250,000 units pa	2026	No

Source: CEF Report: [Green capital tsunami](#)

<https://climateenergyfinance.org/wp-content/uploads/2024/10/final--CEF-Report-China-Outbound-FDI-2-October-2024-2.pdf>

# Solar Step Change

## How China Came to Control 90% of the Global Solar Market



Australian Government  
Australian Trade and Investment Commission

21 October 2024

### SunDrive Solar and Trinasolar to manufacture solar panels in Australia

The joint venture will combine SunDrive's innovative technology with Trinasolar's manufacturing expertise.

China's Trinasolar is teaming up with Australia's SunDrive Solar to manufacture solar panels in Australia.

The 2 companies have signed a memorandum of understanding to form a joint venture (JV). The majority Australian-owned JV will aim to establish solar manufacturing capabilities in Australia.

SunDrive will lead an application for funding under the Australian Government's Solar Sunshot program to help advance the JV's solar module production. The funding will also support feasibility studies for further extending the solar manufacturing value chain at the AGL Hunter Energy Hub site.

The proposed manufacturing facility is expected to create 400 highly skilled jobs.

### Bringing world-class solar manufacturing to the region

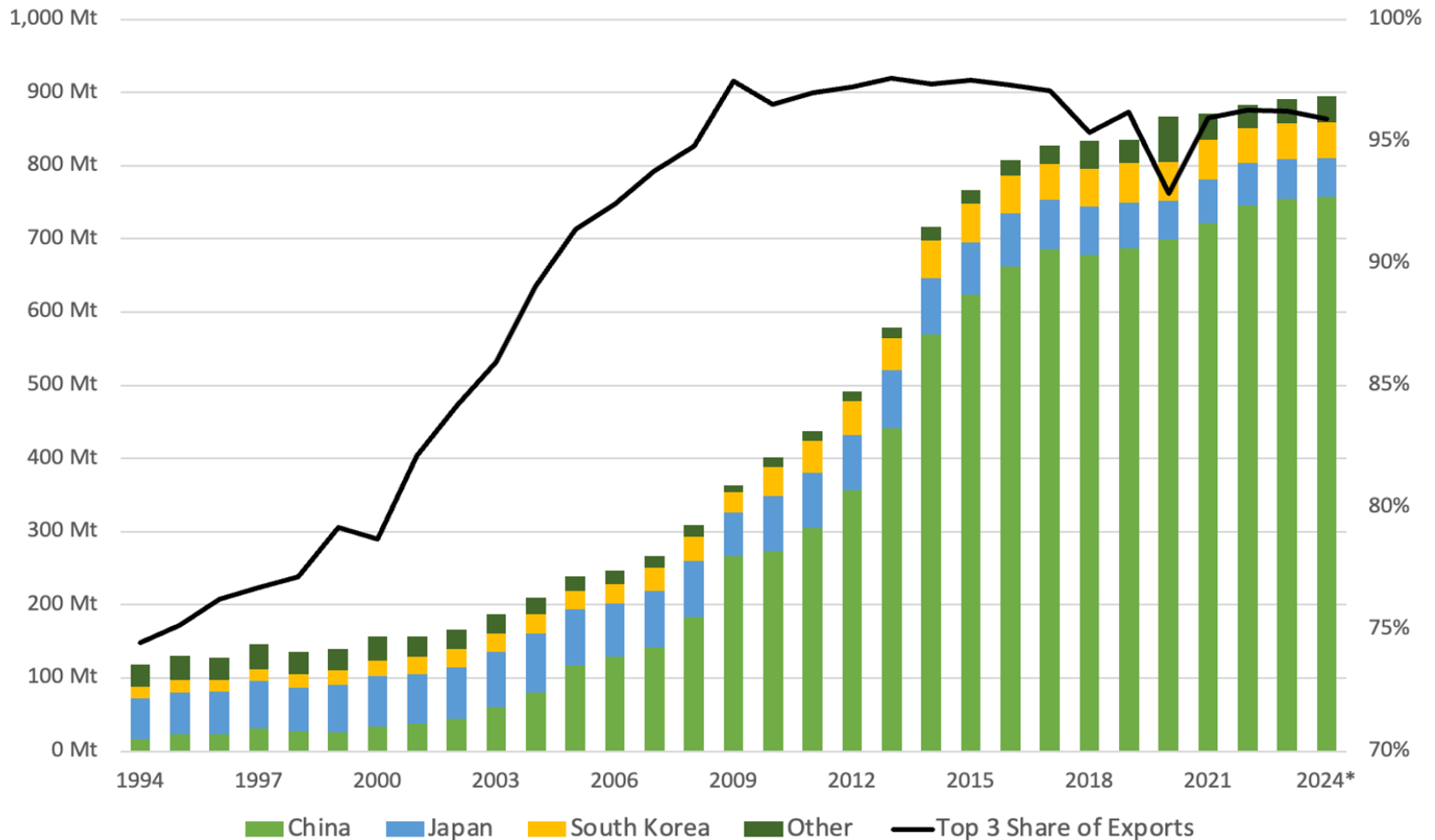
SunDrive Solar is an Australian solar technology company. Its copper metallisation technology has the potential to revolutionise solar manufacturing by replacing silver with copper, a more abundant and cost-effective material.

Trinasolar is a global provider of photovoltaic (PV) module and smart energy solutions. To date, the company has delivered more than 225 GW of solar modules worldwide. It has been serving the Australian market since 2009.

# Australia's Green Iron Challenge

China is the destination for 86% of Australian iron ore

**Figure 1.1: Australian Iron Ore Export Markets**



Source: Office of the Chief Economist; Note: 2024 is annualised 1H2024



# Australia's Green Iron Challenge

## The Implications of Global Steel Sector Decarbonisation

- Australia supplies 55% of the world's iron ore exports, and 55% of coking coal exports, two of our top 3 exports, and a major source of corporate profits, corporate tax and royalties.
- Australia has the world's highest iron ore resource (30%), of which magnetite is 38%. However, over 95% of Australia's iron ore exports are hematite, primarily fines. Australia's fines are typically low- to mid-grade iron ore, with high levels of impurities.
- Sintering (agglomeration of fines into lumps) and blast furnaces are the largest emissions sources in the traditional BF-BOF steelmaking value chain, together accounting for up to 91% of emissions across the entire steel value chain.
- This is a massive risk for Australia, as the vast majority of Australia's current iron ore production is not suitable for the commercially-demonstrated iron processing technologies which directly reduce iron (DRI) using a combination of methane gas and H<sub>2</sub>.
- DRI plants require high-grade, low-impurity iron ores. High-quality magnetite is used in DRI facilities, as their properties allow for the lowest-cost, and highest-yield beneficiation.
- Other technologies are being researched globally to reduce emissions eg direct electrolytic iron reduction (DEIR), however only methane gas based DRI has been proven at scale.

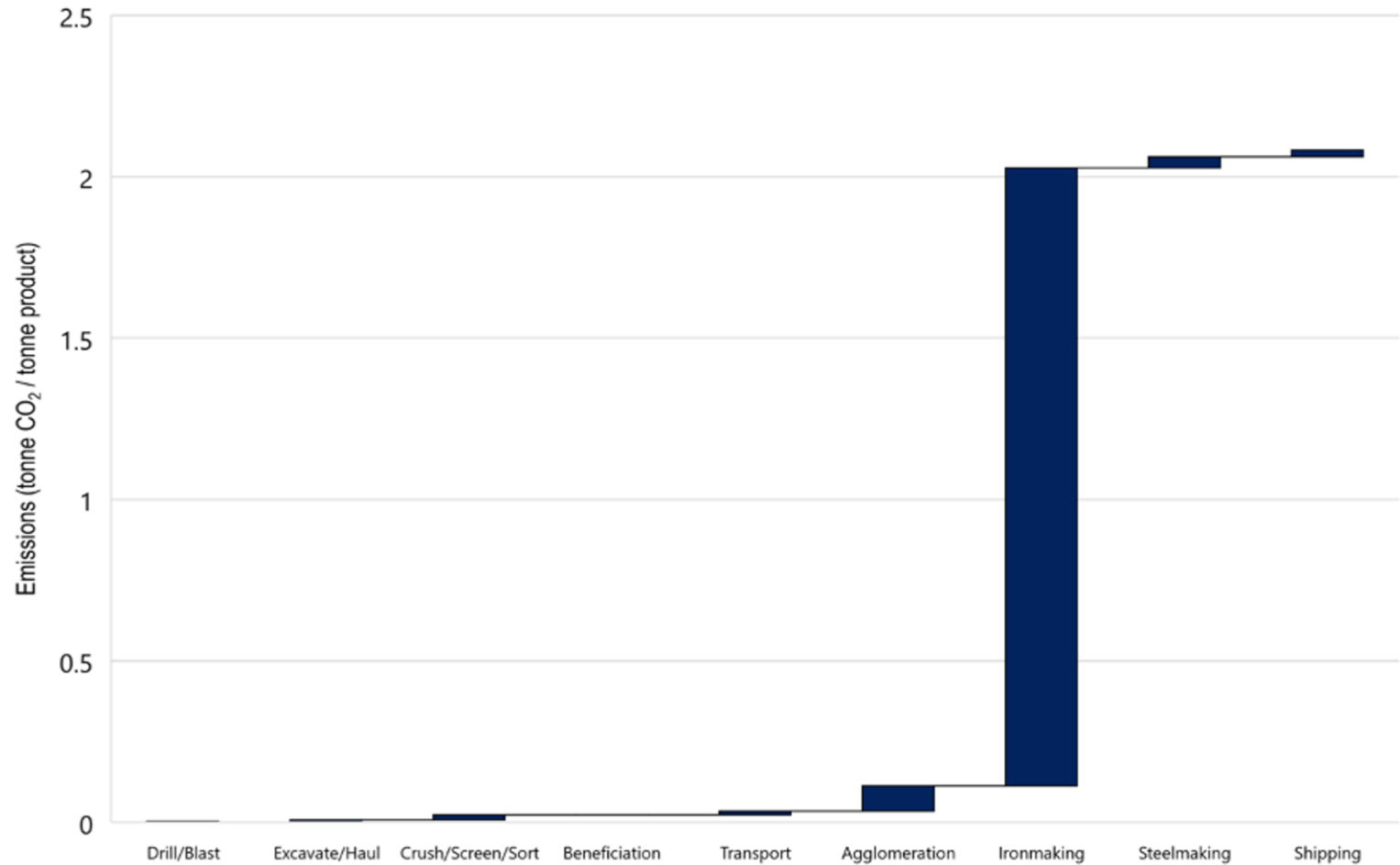
# Australia's Green Iron Challenge

## Implications for Australia

- The decarbonisation of ironmaking is the largest emissions reduction opportunity for the steelmaking value chain. This requires a global decoupling of ironmaking from steelmaking.
- The common factor amongst all pathways to decarbonisation is the need for significant amounts of electricity.
- The decarbonisation of the steel industry will likely catalyse a global restructuring of supply chains and global re-industrialisation on a massive scale. This presents a massive risk, but also opportunity for Australia to onshore value-added iron processing.
- The decoupling of ironmaking and steelmaking requires increased global collaboration, supporting the deployment of renewable energy in large mining jurisdictions with superior land availability, wind resources and solar irradiation, like Australia, and the Middle East.
- Despite our comparative advantages, this is a global race. Australia needs to overcome significant technology, grade and capital cost barriers. Yet with the right **green metal statecraft**, Australia is well-positioned to emerge as a major decarbonised iron producer. This could potentially double the value of our current iron ore exports.
- To overcome the technical barriers to commerciality, CEF recommends an **additional \$500m over 10-years to the CSIRO** of strategic support for RD&D into the commercialisation of technologies to unlock Australia's green iron industry.

# Australia's Green Iron Challenge

**Figure 2.2: Emissions Intensity across Steelmaking Value Chain**



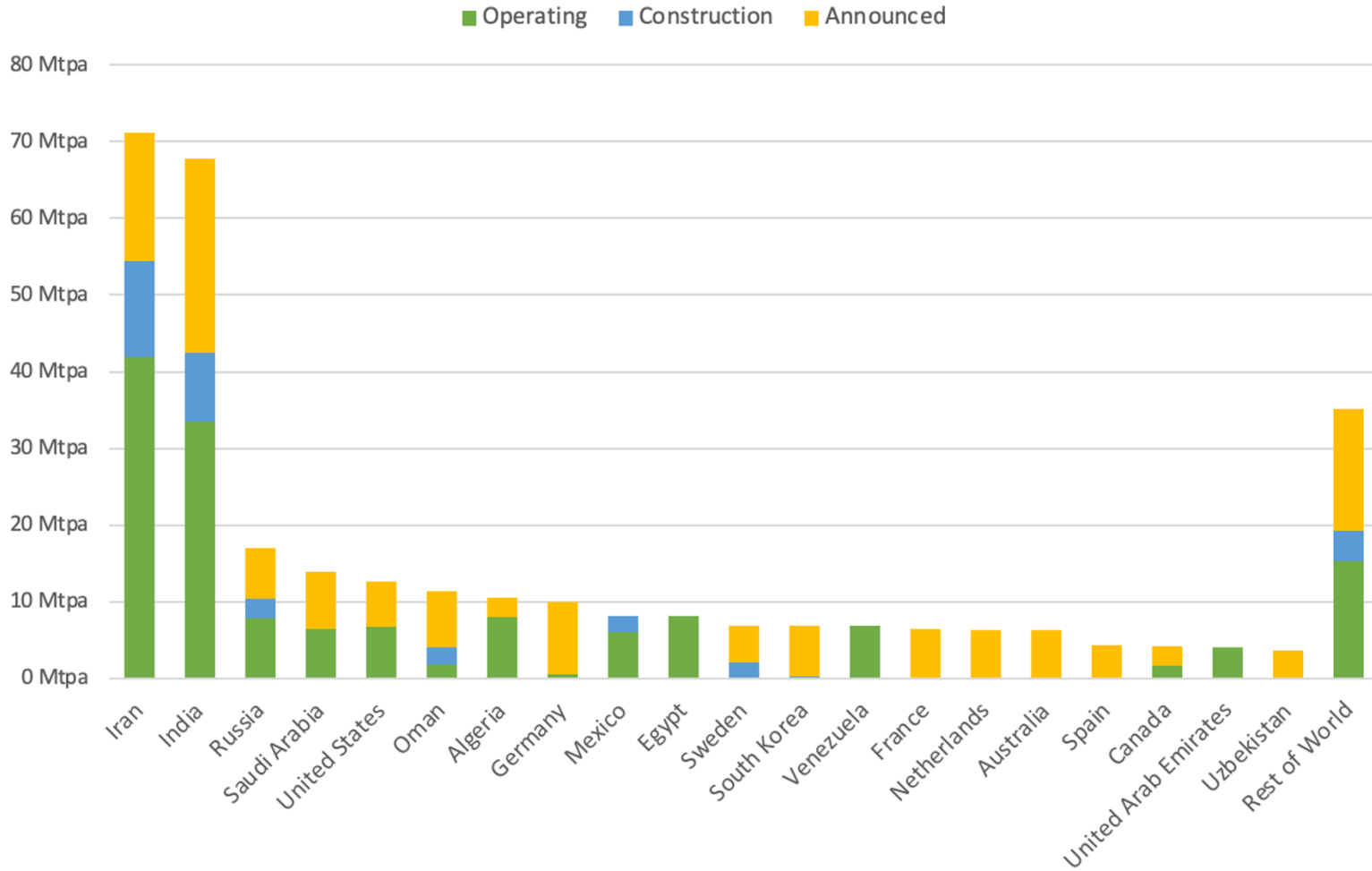
Source: MRIWA

Source: CEF Report: [Green capital tsunami](#)

<https://climateenergyfinance.org/wp-content/uploads/2024/10/final--CEF-Report-China-Outbound-FDI-2-October-2024-2.pdf>

# Australia's Green Iron Challenge

**Figure 3.2: Global DRI Capacity Investments as of April 2024**



Source: Global Energy Monitor <sup>23</sup>

Source: CEF Report: [Green capital tsunami](#)

<https://climateenergyfinance.org/wp-content/uploads/2024/10/final--CEF-Report-China-Outbound-FDI-2-October-2024-2.pdf>

# Australia's Green Iron Challenge

## State of Play: Green Hydrogen

- As of May 2024, only 1.75GW of electrolyser capacity has been deployed globally, producing just 185ktpa, or 0.2% of total hydrogen production.
- Despite massive manufacturing overcapacity, electrolyser capex still remains too high for projects without long-term offtake agreements to be bankable.
- In 2023, manufacturing overcapacity reached almost 30GW compared to stacks shipped.
- BloombergNEF forecasts 50GW of overcapacity in 2024 vs stack shipments reaching a new all-time annual deployment record of 4.3GW, less than a tenth of manufacturing capacity.
- In 2023, around 68% of global electrolyser manufacturing is in China. Of the total installed production capacity globally, China has over 65%.

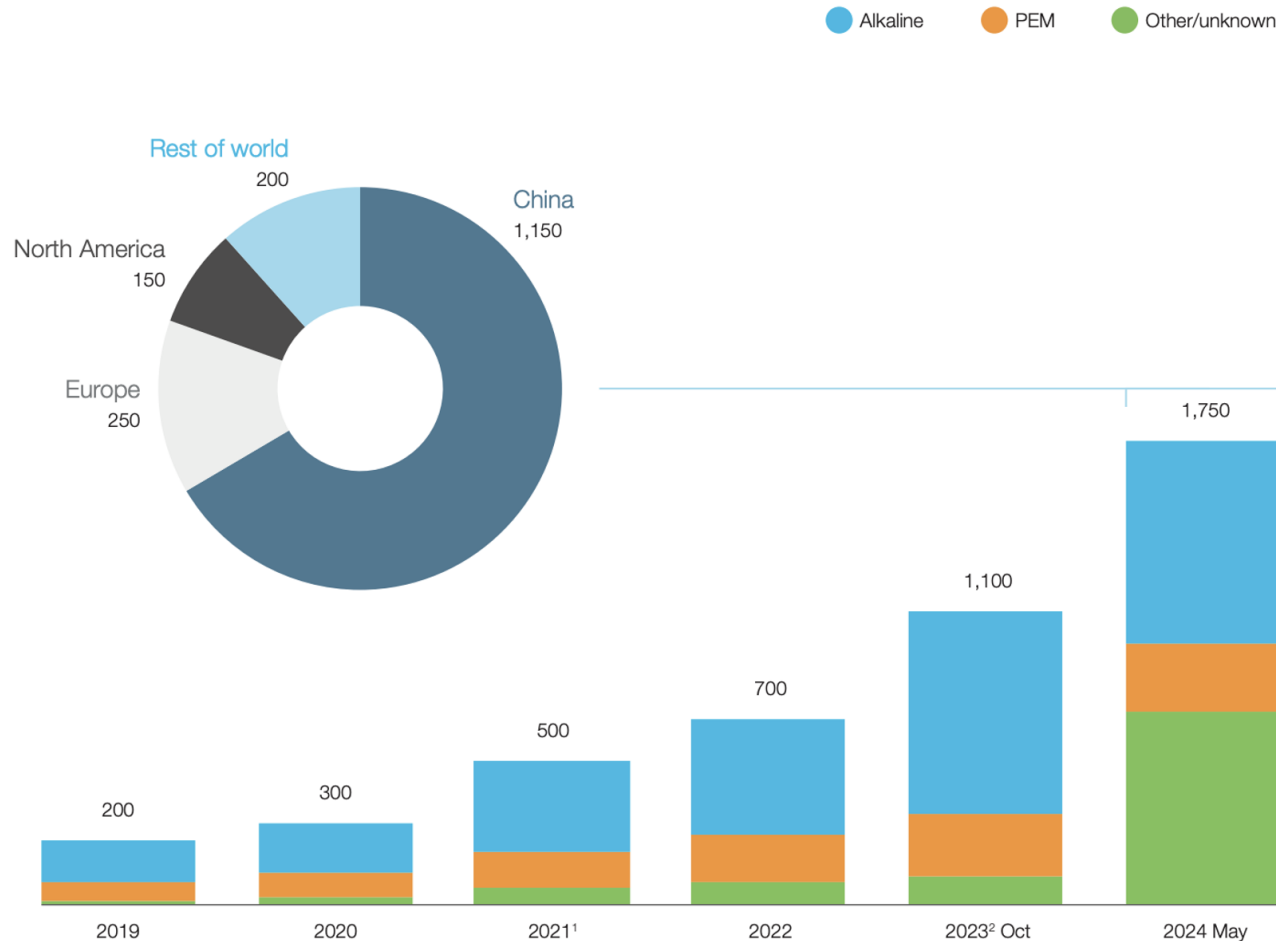
### Implications for Australia:

- Like almost all cleantech industries, China dominates electrolyser manufacturing. Australia must work collaboratively with China to ensure we utilise its world-leading manufacturing base to lower the capital intensity of H2 production facilities to power our green iron.
- Australia needs a trilateral with Japan + Korea, & a bilateral JV with China for demand pull.
- CEF recommends Australian policy support & financing mechanisms for GH2 projects be primarily dedicated to powering green metal facilities. With the GH2 hype in recent years deflating globally, the investment pipeline approaching FID is likewise deflating.

# Australia's Green Iron Challenge

## State of Play: Green Hydrogen – Oz not even on the Map

**Figure 4.1: Cumulative Global Installed Electrolysis Capacity**



Source: Hydrogen Council, McKinsey <sup>39</sup>

# Australia's Green Iron Challenge

## Direct Reduced Iron and Low-Emission Steelmaking

- Global DRI production in 2023 was 136Mtpa, +6.5% yoy.
- 100% of gas-based DRI produced in 2023 was from fossil gas, not GH<sub>2</sub>. The current DRI landscape highlights the competitive nature of producing DRI from methane gas in regions with large low cost methane gas resources as opposed to coal-based pig iron.
- As a result, the Middle East is rapidly emerging as a global hub for DRI production.
- DRI is forecast to grow 30% globally to 2030, but could go dramatically faster. There is a lack of a clear CO<sub>2</sub> market price signal in international trade to value lower emissions solutions.
- The world has 675Mtpa of EAF capacity operating (70% is BF/BOF). The largest opportunity to cut emissions is increasing circularity in the steel value chain via the scrap-EAF pathway.
- There are still technical challenges to global adoption of commercial DRI technologies, namely the high quality iron ore requirements.
- Economic challenges to GH<sub>2</sub>, high electrolyser & renewable costs, and lack of a CO<sub>2</sub> price.

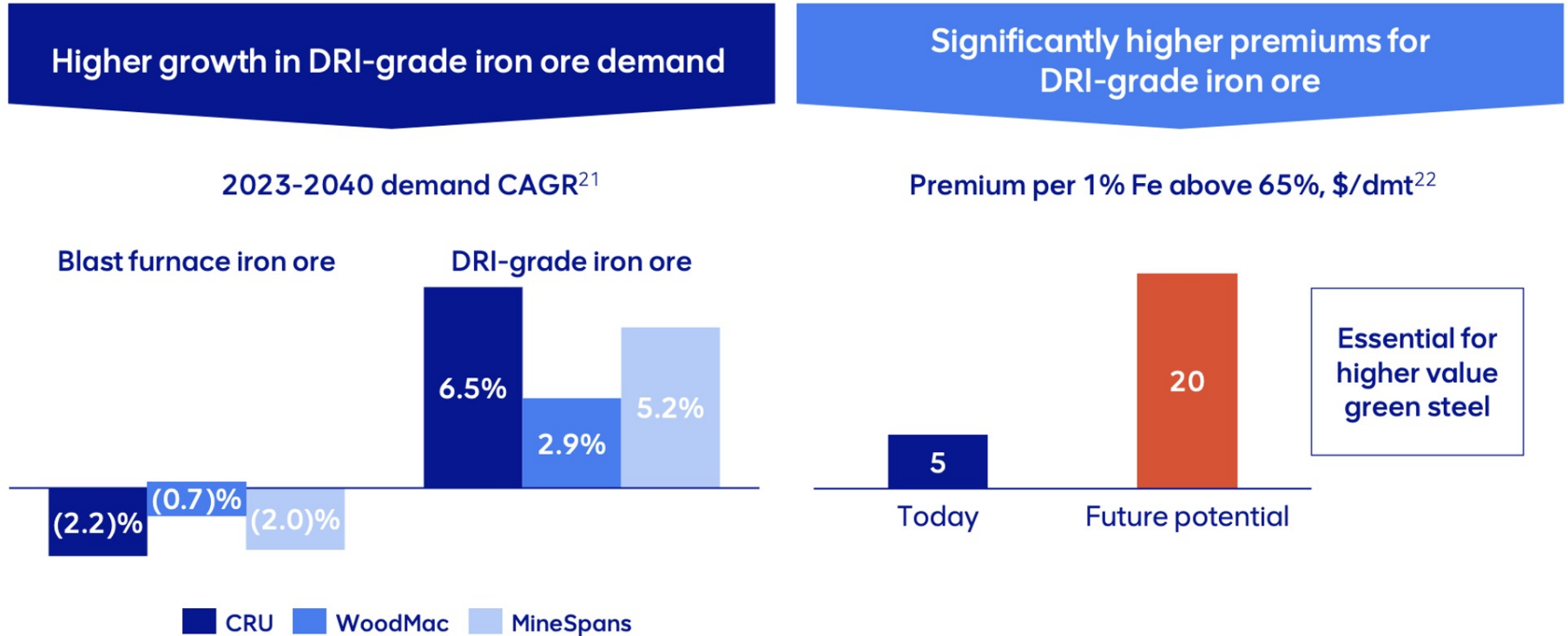
### Implications for Australia:

- **Australia cannot compete** on a cost-competitive basis **if we prioritise methane gas**. We have domestic methane gas prices multiples the price prevailing in the Middle East & US.
- We must address technical challenges to iron quality in decarbonised iron technologies.
- For Australia to be competitive, we need an Asian CBAM and scaled, low cost firm RE.

# Australia's Green Iron Challenge

## Direct Reduced Iron and Low-Emission Steelmaking

**Figure 8.2: Iron Ore Market Fundamentals**



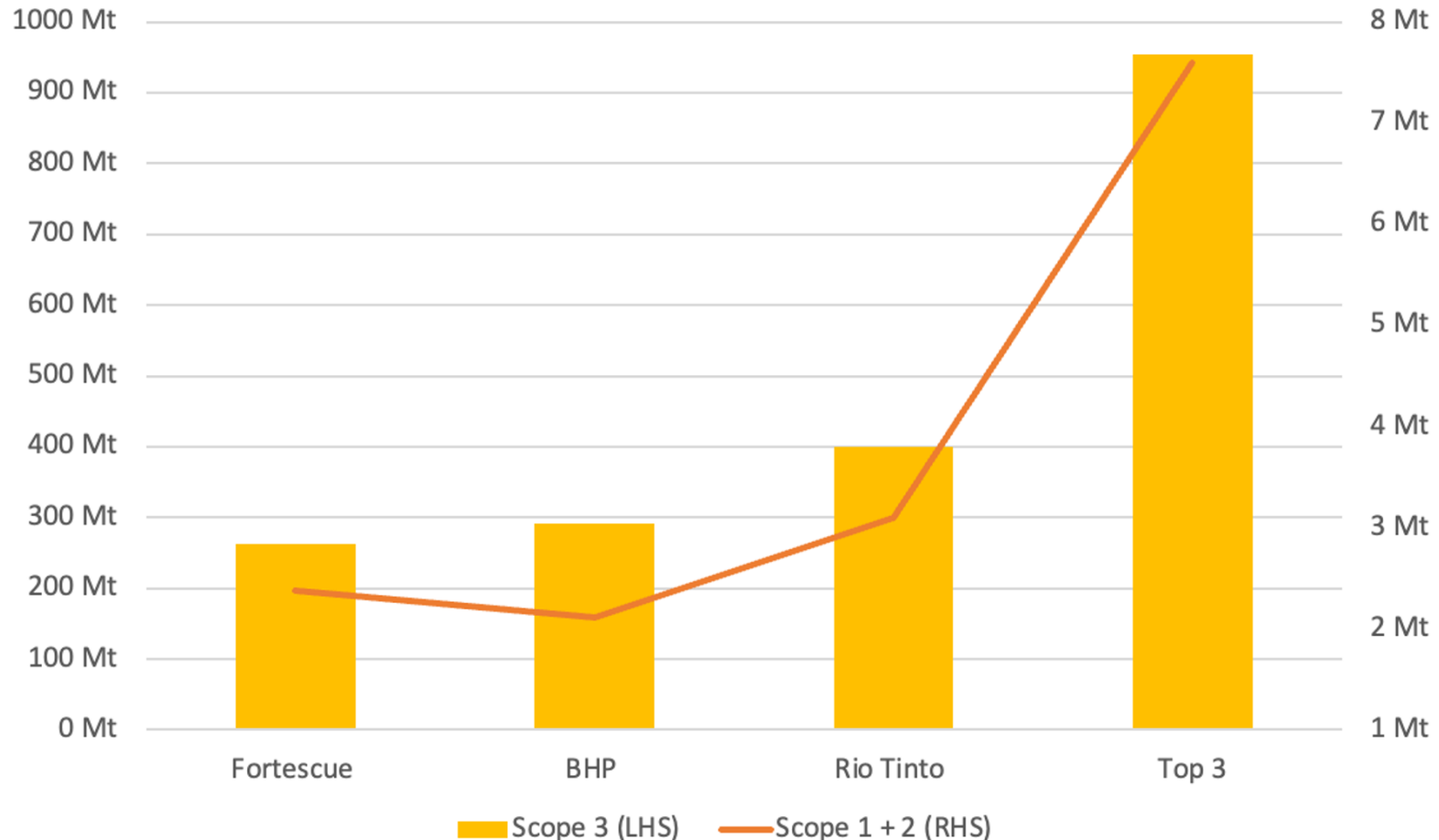
Source: Anglo American, May 2024



# Australia's Green Iron Challenge

## Low-Emission iron making – a 1Bn tpa opportunity for Oz

**Figure 8.4: Domestic Emissions Compared to Exported Emissions in Australian Iron Ore**



Source: CEF Report: [Green capital tsunami](#)

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