UNIVERSITY OF CAMBRIDGE | CISL Cambridge Institute for Sustainability Leadership

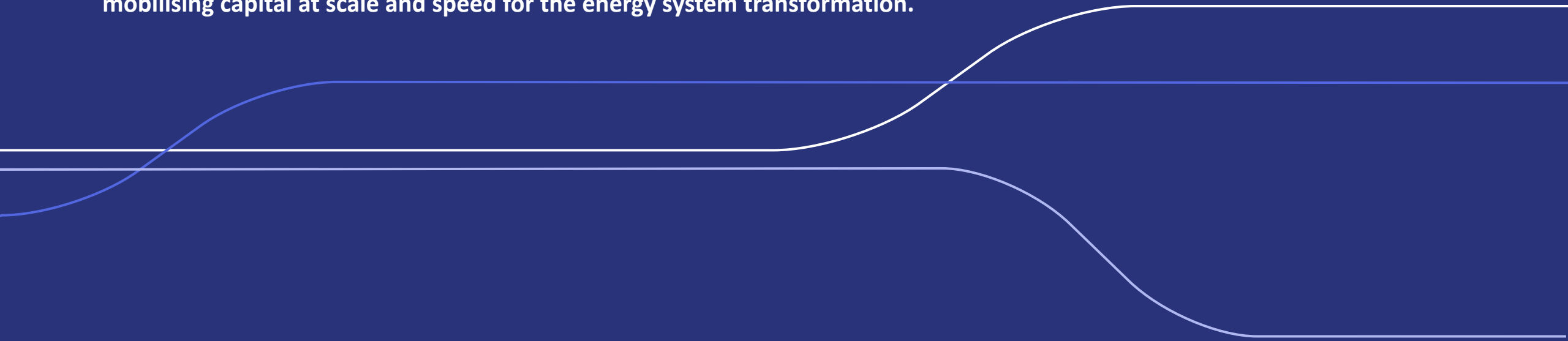
The future is now, new pathways for change: For Australia, the opportunities, and risks, are huge

Tim Buckley, Founder Climate Energy Finance,
tim@climateenergyfinance.org 2/3 March 2025

UNIVERSITY OF CAMBRIDGE | CISL Cambridge Institute for Sustainability Leadership

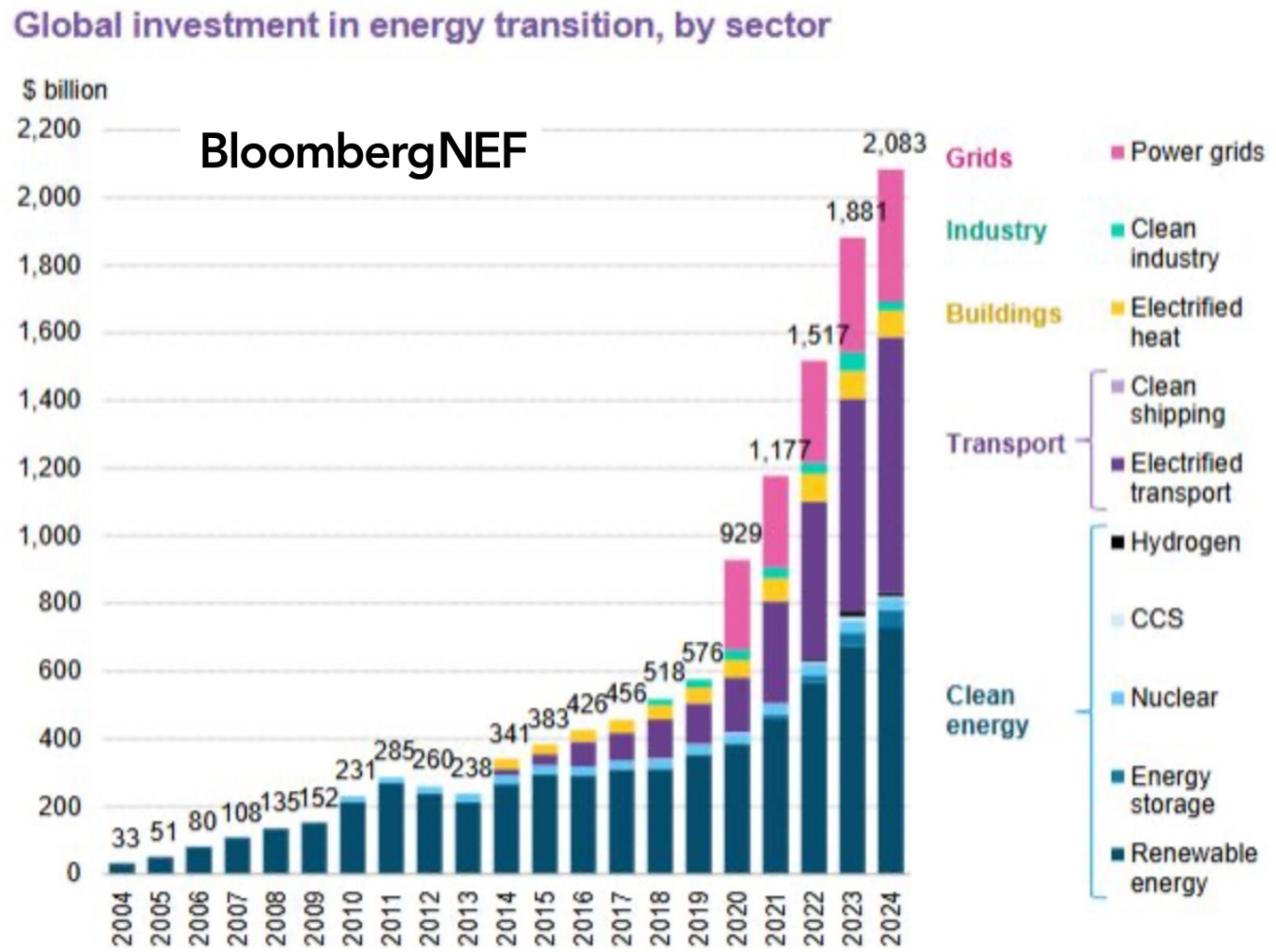
To highlight the critical dependencies between resource use and industry, focusing on the opportunities for change

Tim Buckley, Founder of CEF, a not-for-profit public interest thinktank focused on mobilising capital at scale and speed for the energy system transformation.



Global capital is moving, at scale

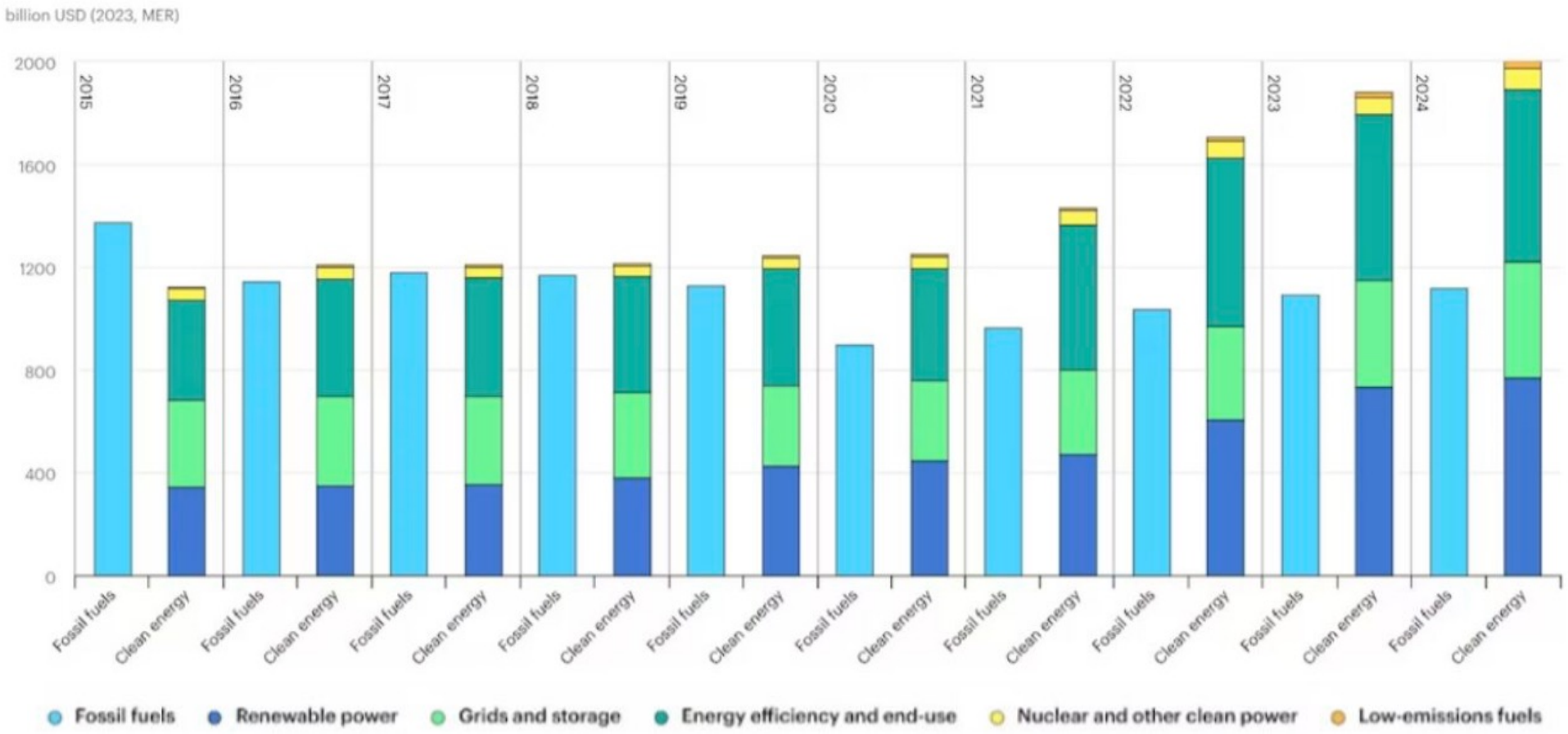
The world invested US$2.1 trillion in cleantech in 2024, +11% yoy



Source: BNEF https://assets.bbhub.io/professional/sites/24/951623_BNEF-Energy-Transition-Trends-2025-Abridged.pdf

Global capital is moving, at scale

The world invested US$2.1 trillion in cleantech in 2024, double the global investment in fossil fuels



Source: IEA World Energy Investments 2024

Global capital is moving, at scale

The European Commission announced another €100+ billion for clean industrial investments

Europe's clean industrial future

27 February 2025

Yesterday, one of the year's most awaited legislative pronouncements was unveiled, as European Commission President Ursula von der Leyen presented the EU Clean Industrial Deal — a roadmap to strengthen Europe's industrial competitiveness & accelerate decarbonisation.

Bringing together energy-intensive industries & clean-tech innovation, the **Clean Industrial Deal** sets the course for a climate-neutral and resilient European economy. Landing as a response to geopolitical tensions, economic slowdowns, and increasing global competition, the deal has been labelled a big win for clean-tech manufacturers and industrial decarbonisation aiming to ensure that Europe's industries remain at the forefront of the green transition. Key initiatives are:

- €100+ billion mobilised for clean industrial investments, including a new Industrial Decarbonisation Bank.
- Made in Europe" incentives to ensure EU procurement prioritises sustainable, locally produced clean tech.
- Support for energy-intensive sectors (steel, cement, chemicals) to cut emissions while maintaining competitiveness.
- An Affordable Energy Action Plan to lower energy bills for industries, businesses and households and speed up the roll-out of clean energy and accelerate electrification and interconnectivity, making the link between security of supply and competitiveness abundantly clear.
- Looser state aid rules to help industries transition to low-carbon production and green manufacturing.
- New Circular Economy & Raw Materials Plan in 2026 to reduce waste and secure key industrial materials.
- Skills & workforce development to create new green jobs in industrial regions.
- Carbon Border Tax (CBAM) adjustments to protect EU industries from carbon-intensive imports.

Source: EU Clean Industrial Deal; https://commission.europa.eu/topics/eu-competitiveness/clean-industrial-deal_en

Global capital is moving, at scale

Strategic public capital is a key facilitator, in the absence of a CO_2 price

Singapore adds S$5bn clean energy funds, mulls nuclear

19/02/25 Argus By Prethika Nair

Singapore will add a further S$5bn (US$3.7bn) to its clean energy fund, and is also studying the potential for nuclear deployment, said the country's prime minister Lawrence Wong on 18 February.

Singapore's Future Energy Fund was set up in 2024 with an initial injection of S$5bn to develop clean energy options.

Expanding access to clean energy is a major national imperative as "the industries of the future," such as artificial intelligence and semiconductors, are highly energy intensive, said Wong at the unveiling of the country's budget for 2025. "Be it electricity imports, hydrogen or nuclear, we need to make major investments in new infrastructure," said Wong.

A short-term solution is to import low-carbon electricity from the region. Singapore expects about a third of its projected electricity demand in 2035 to be met through electricity imports, according to Wong. The country aims to import 6GW of low-carbon electricity by 2035, and has signed supply agreements with Malaysia, as well as granted conditional approvals to projects in Indonesia.

But Singapore needs to have its own domestic sources of clean power, said Wong.

Singapore has been evaluating the use of low-carbon hydrogen for power, "but there are inherent challenges in the production, storage and transportation of hydrogen, which make it hard to scale up in a commercially viable manner," Wong added.

Singapore submitted its new emissions reduction target 10 February 2025, aiming to reduce emissions to 45-50mn of CO_2 in 2035 as part of its nationally determined contribution.

Argus media: https://www.argusmedia.com/en/news-and-insights/latest-market-news/2659343-singapore-adds-3.7bn-clean-energy-funds-mulls-nuclear

Global capital is moving, at scale

Strategic public capital is a key facilitator, in the absence of a CO_2 price signal

FMIA, CIS, RTN, NRF, Future Fund, CEFC, ARENA, EFA, NAIF

Capacity Investment Scheme

The Capacity Investment Scheme (CIS) is an Australian Government revenue underwriting scheme to accelerate investment in:

- 23 GW of renewable capacity representing $52 billion in investment
- 9 GW of clean dispatchable capacity representing $15 billion in investment.

South Australia

Australian Associated Press

20 Feb 2025

Troubled Whyalla steelworks gets $2.4bn government bailout as hunt for new owner begins

"Crucial support:" Federal Labor launches $2bn green aluminium production credit scheme

RENEW ECONOMY Andrew Brown Jan 20, 2025

Rewiring the Nation Fund

The $19 billion Rewiring the Nation (RTN) Fund is a significant expansion of CEFC investment capacity, with a particular focus on facilitating the timely delivery of grid and transmission projects, using CEFC capital to accelerate the benefits of grid transformation to consumers, including helping to lower consumer energy costs.

Rio Tinto says aluminium could run on renewables and batteries

FINANCIAL REVIEW Feb 6, 2025

$200 million investment in critical minerals to build Australia's future

The Hon Ed Husic MP

Minister for Industry and Science

15 January 2025

The Albanese Government's National Reconstruction Fund Corporation (NRFC) will invest $200 million in Arafura Rare Earths to help build Australia's Future.

Global capital is moving, at scale

Even with subsidies, gas peakers are no longer competitive vs BESS

Engie's pulled project highlights the worsening economics of gas

Due to "equipment procurement constraints," the Perseus gas peaker plant is no longer in the running for a slice of the $5 billion Texas Energy Fund.

LISA MARTINE JENKINS | FEBRUARY 25, 2025 LATITUDE MEDIA

Engie is withdrawing a major gas project from consideration for a Texas program that provides low-interest loans for new or expanded dispatchable energy generation, citing equipment procurement delays.

Texas has soaring load forecasts; since 2021, power demand in the state has climbed by 17%, totalling 86 gigawatts in 2024. And the vast majority of the load deployed to meet that demand has been renewable. New gas deployment has made up a shrinking sliver — much to the chagrin of lawmakers and state leadership in the home to the fracking boom that began to reshape the U.S. energy system two decades ago.

So lawmakers created the Texas Energy Fund to support the industry and ostensibly provide grid reliability — though batteries are already serving much the same purpose. In 2023, voters approved the program, which is now working with $5 billion in appropriated funds from the Texas legislature.

Initially, interest was robust. Last summer, the program saw a "flood" of developer applications representing 72 projects, the *Houston Chronicle* wrote at the time. The applications requested more than $24 billion for more than 38 GW of projects — far more than the $5 billion available.

Engie joined the fray and submitted applications to finance two projects: Perseus and Spenser. TEF chose Perseus, a 930-MW peaker plant, among its 17 finalists in August.

However, Eric De Caluwé, who leads flexible generation in North America for Engie, wrote in a letter to Texas PUC director Tracie Tolle that the company recently "met with PUC staff to inform them that it has become evident that equipment procurement constraints, among other factors, will delay the project schedule such that we would be unable to make the statutorily mandated initial loan disbursements by December 2025."

Source: https://www.latitudemedia.com/news/engies-pulled-project-highlights-the-worsening-economics-of-gas/

China's Electrification and Decarbonisation is Accelerating

China's electricity grid capacity grew +15% yoy in CY2024, by 429GW; 87% of being zero emissions capacity

Australia installs as much renewable energy capacity in a year as China does every week

New Capacity Installed in China in Jan-Dec 2024

		Jan-Dec 2024	Share of new adds (%)	Change (yoy %)	Dec-24	Share of new adds (%)
Thermal Power	GW	54.1	13%	4%	6.7	6%
Hydropower	GW	14.4	3%	3%	4.4	4%
Nuclear Power	GW	3.9	1%	7%	2.7	2%
Wind Power	GW	79.3	18%	18%	27.6	25%
Solar Power	GW	277.2	65%	45%	70.9	64%
Total capacity added	**GW**	**429.0**	**100%**	**15%**	**112.3**	**100%**
Renewable Energy adds	GW	370.9	86%	25%	102.9	92%
Zero Emissions Capacity Adds	GW	374.8	87%	25%	105.6	94%
Investment in Completed Power Grid Project	1 billion yuan	608.3		15%	79.3	

Source: NBS, CEF Estimates

China’s Electrification and Decarbonisation is Accelerating

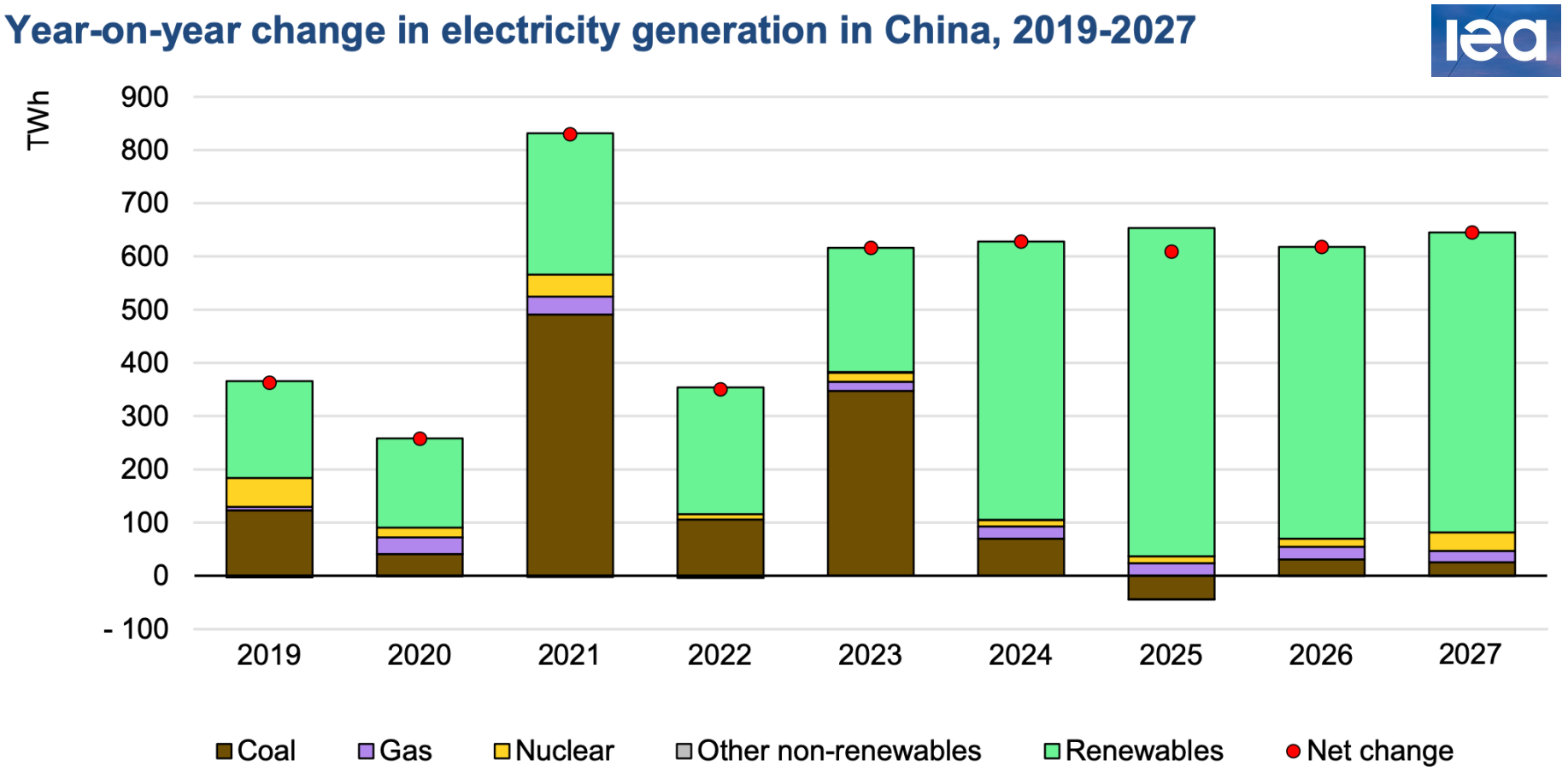
China’s electricity demand grew +5.7% yoy, faster than GDP growth of +5.0% yoy, as China continued to improve its energy security by reducing reliance on imported oil

China's Electricity Generation Mix in Jan-Dec 2024						
		Jan-Dec 2024	% Share of Jan-Dec generation	% Change yoy	Dec-24	% Change yoy
Thermal Power	TWh	6,171	62%	1.7%	583	-2.0%
Coal	*TWh*	*5,871*	*59%*	*2.0%*	*555*	*-2.0%*
Gas	TWh	*283*	*3%*	*-4.8%*	*27*	*-2.0%*
Other Thermal	TWh	*17*	*0%*	*2.0%*	*2*	*-1.9%*
Bioenergy	TWh	193	2%	-2.5%	*18*	-2.0%
Hydropower	TWh	1,285	13%	4.8%	*84*	6.5%
Nuclear Power	TWh	444	4%	2.2%	*42*	11.4%
Wind Power	TWh	989	10%	11.6%	*100*	11.3%
Solar Power	TWh	853	9%	46.1%	*72*	58.6%
TOTAL POWER GENERATION	**TWh**	**9,936**	**100%**	**5.7%**	*899*	**3.9%**
Variable Renewable Generation	TWh	1,842	19%	25.3%	172	27.2%
Zero Emissions Power Generation	TWh	3,764	38%	13.1%	316	17.0%

Source: China NBS, Ember, CEF Estimates

China's Electrification and Decarbonisation is Accelerating

The IEA models peak coal in China in 2024, and ~95% of electricity generation growing being zero emissions

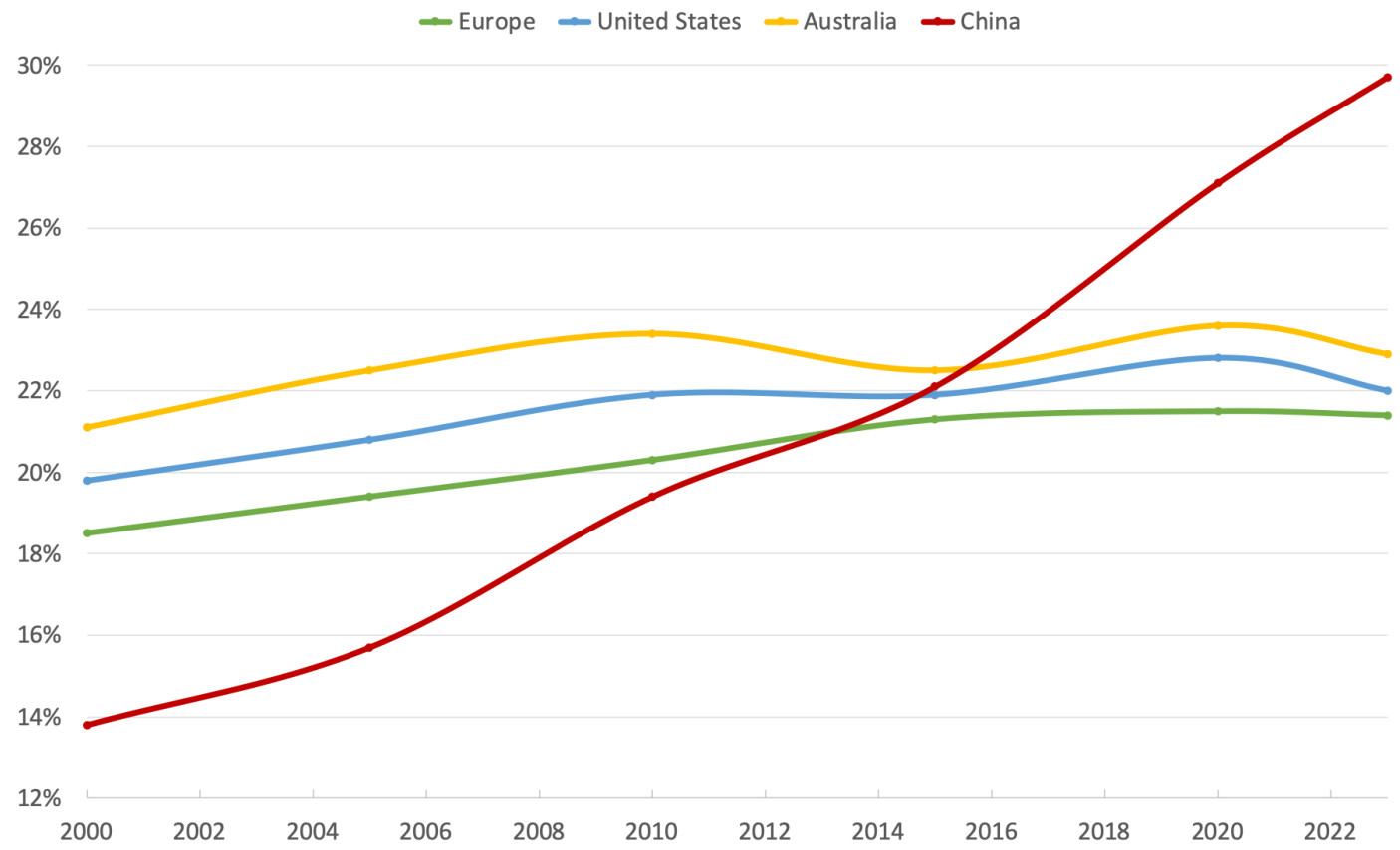


Source: Source: IEA Electricity 2025
https://iea.blob.core.windows.net/assets/77522eb7-49c8-4611-851e-59bd5b93454c/Electricity2025.pdf

China's Electrification and Decarbonisation is Accelerating

China leads the world in its three decade long program of progressive electrification of everything

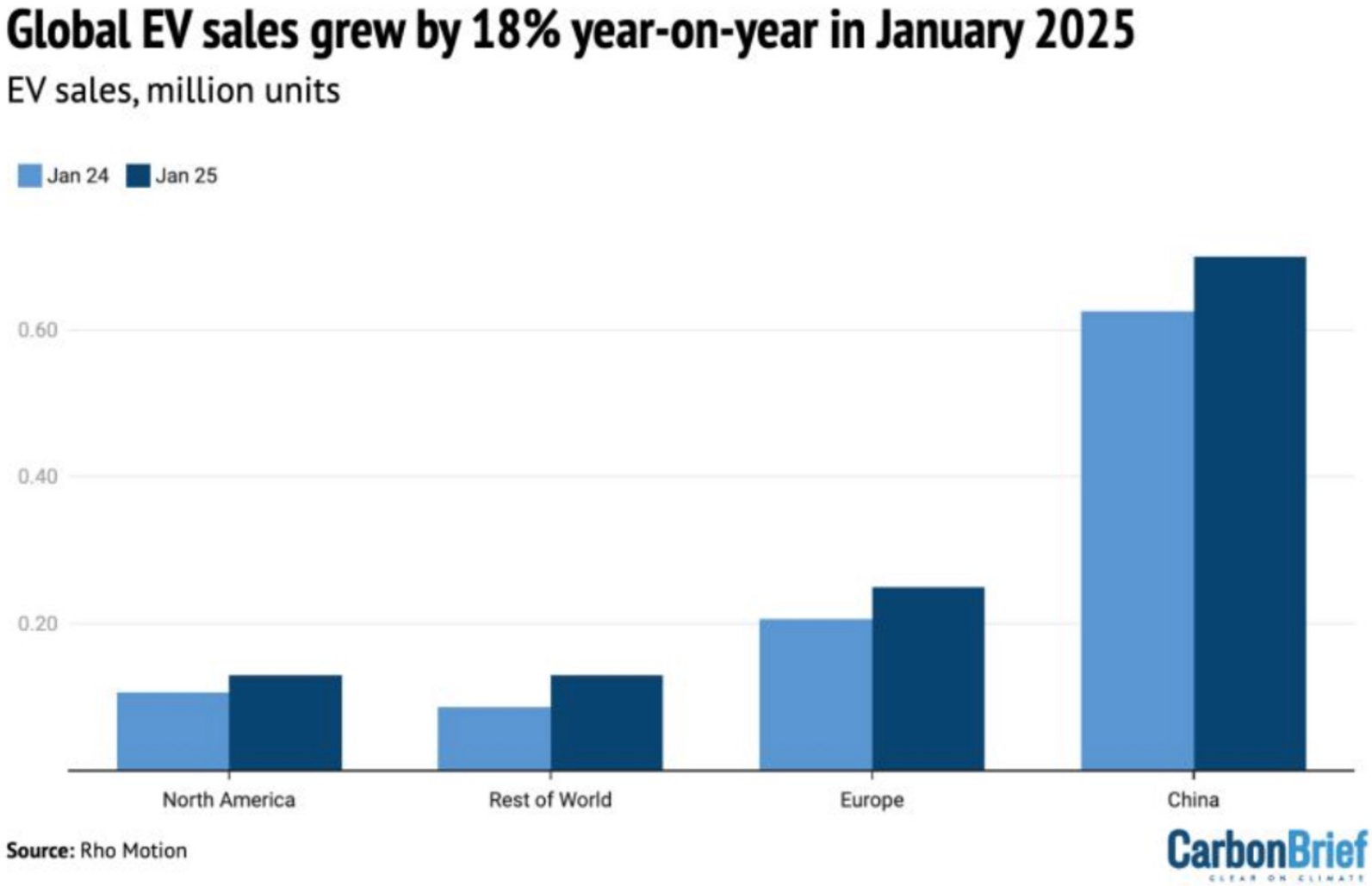
Figure 4: Share of electricity in final energy consumption



Source: Enerdata, CEF calculations

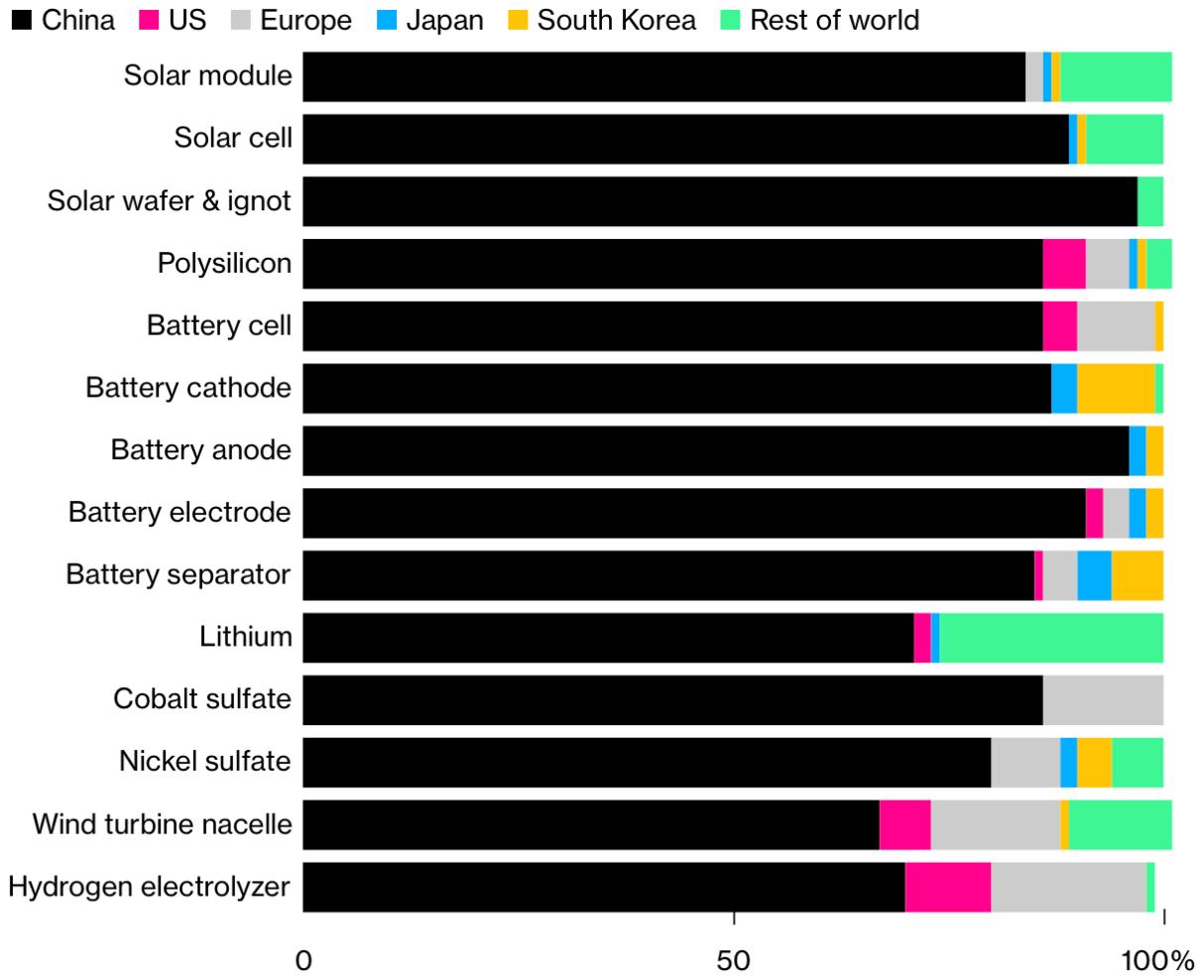
China’s Electrification and Decarbonisation is Accelerating

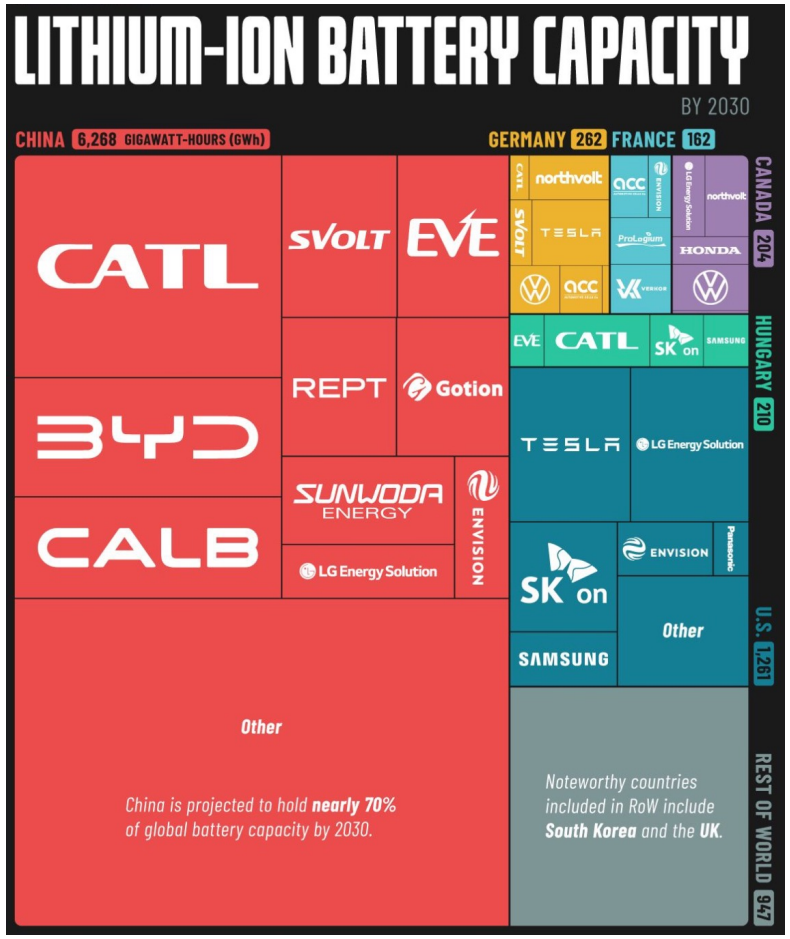
China leads the world in new energy vehicle adoption; we need to avoid taking a western centric perspective



China's Electrification and Decarbonisation is Accelerating

China now dominates global cleantech manufacturing, RD&D, domestic installs, exports and OFDI





EXCLUSIVE DATA PARTNER BENCHMARK benchmarkminerals.com

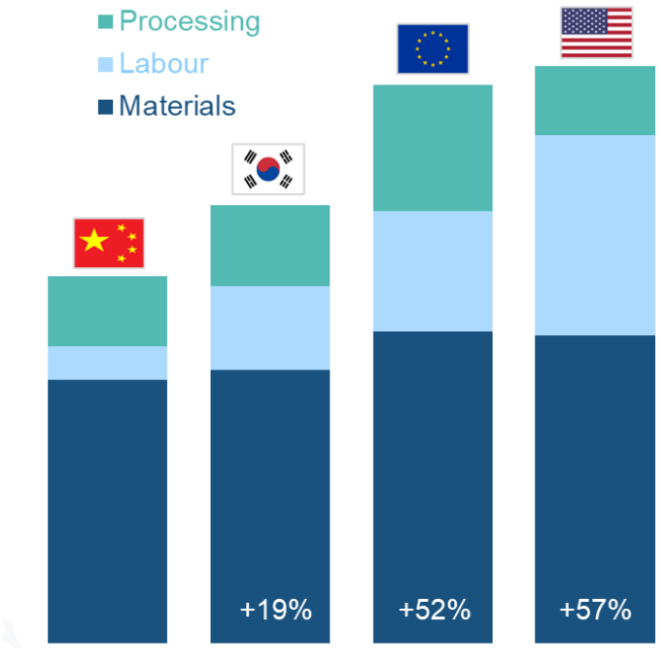
Source: BloombergNEF, https://www.bloomberg.com/news/newsletters/2024-04-16/china-extends-clean-tech-dominance-over-us-despite-biden-s-ira-blueprint

China’s Electrification and Decarbonisation is Accelerating

China has a R&D, scale and precinct advantage over its competitors

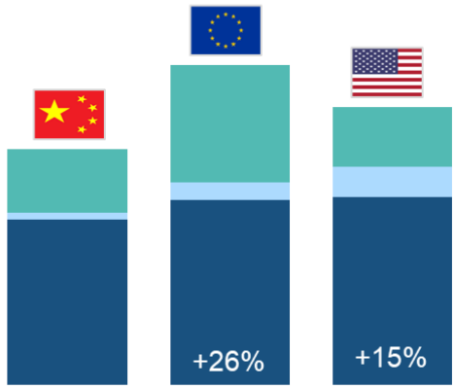
YIELDS AND AUTOMATION ARE INITIALLY LOWER FOR NEW GIGAFACTORIES

Average battery cell production costs, NMC 811, 2024 $/kWh



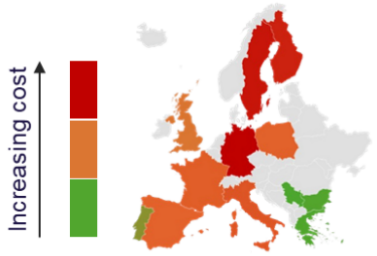
EVEN IF A STATE-OF-THE-ART CHINESE FACTORY WAS TRANSPLANTED INTO EU/US, ENERGY AND LABOR COSTS WILL IMPACT ECONOMICS

Modelled battery cell production costs for BYD, LFP, 2024 average $/kWh



Model parameters:

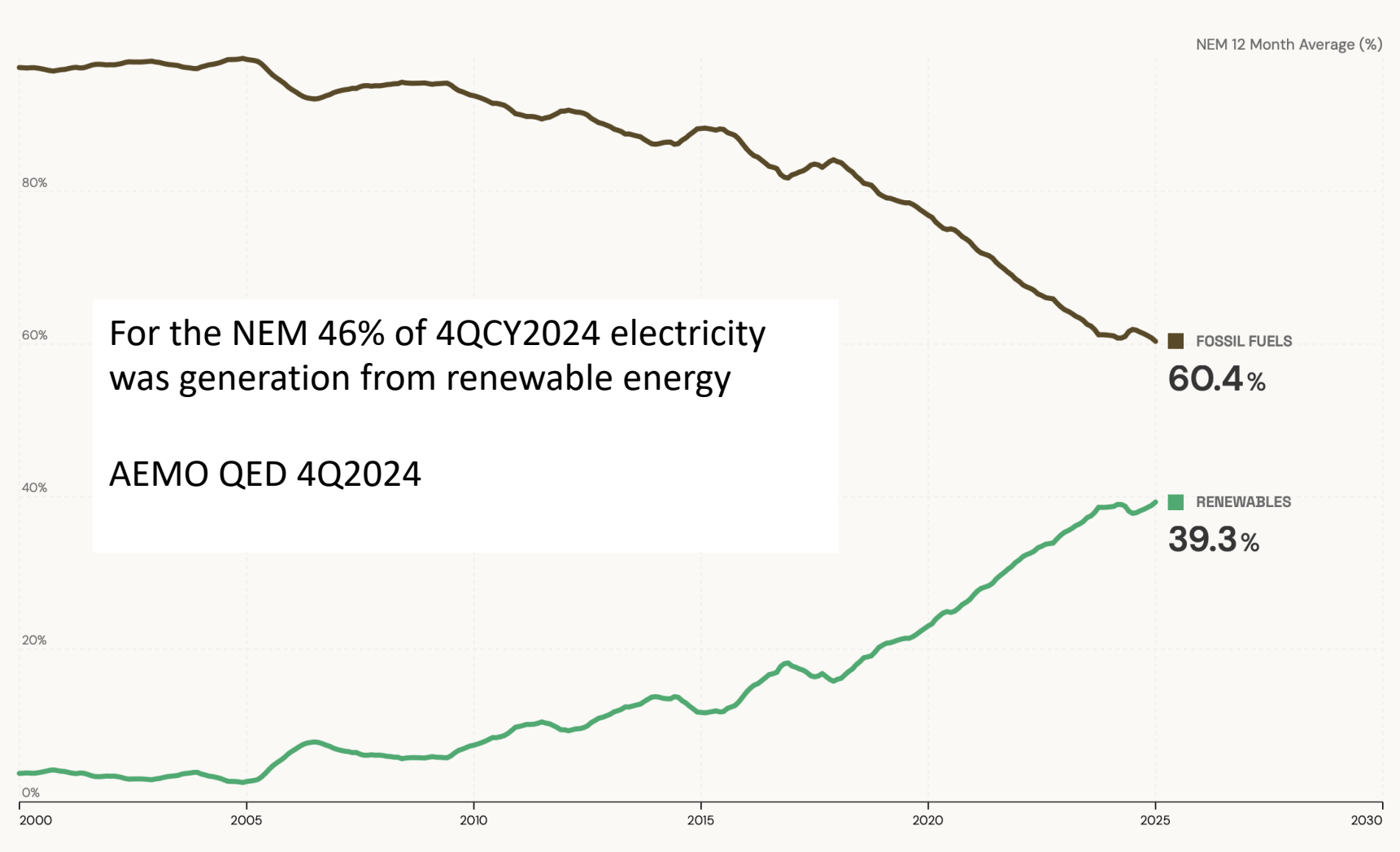
- Same yields, factory automation, material margins
- No import tariffs or local premiums on materials
- Region-average energy prices
- CAM and AAM made locally



Source: CRU Group, Volta Foundation 2024 Battery Report
https://volta.foundation/battery-report-2024

Australian Decarbonisation is Accelerating

Electrification & Decarbonisation – National Electricity Market (NEM) now at 39.3% renewables



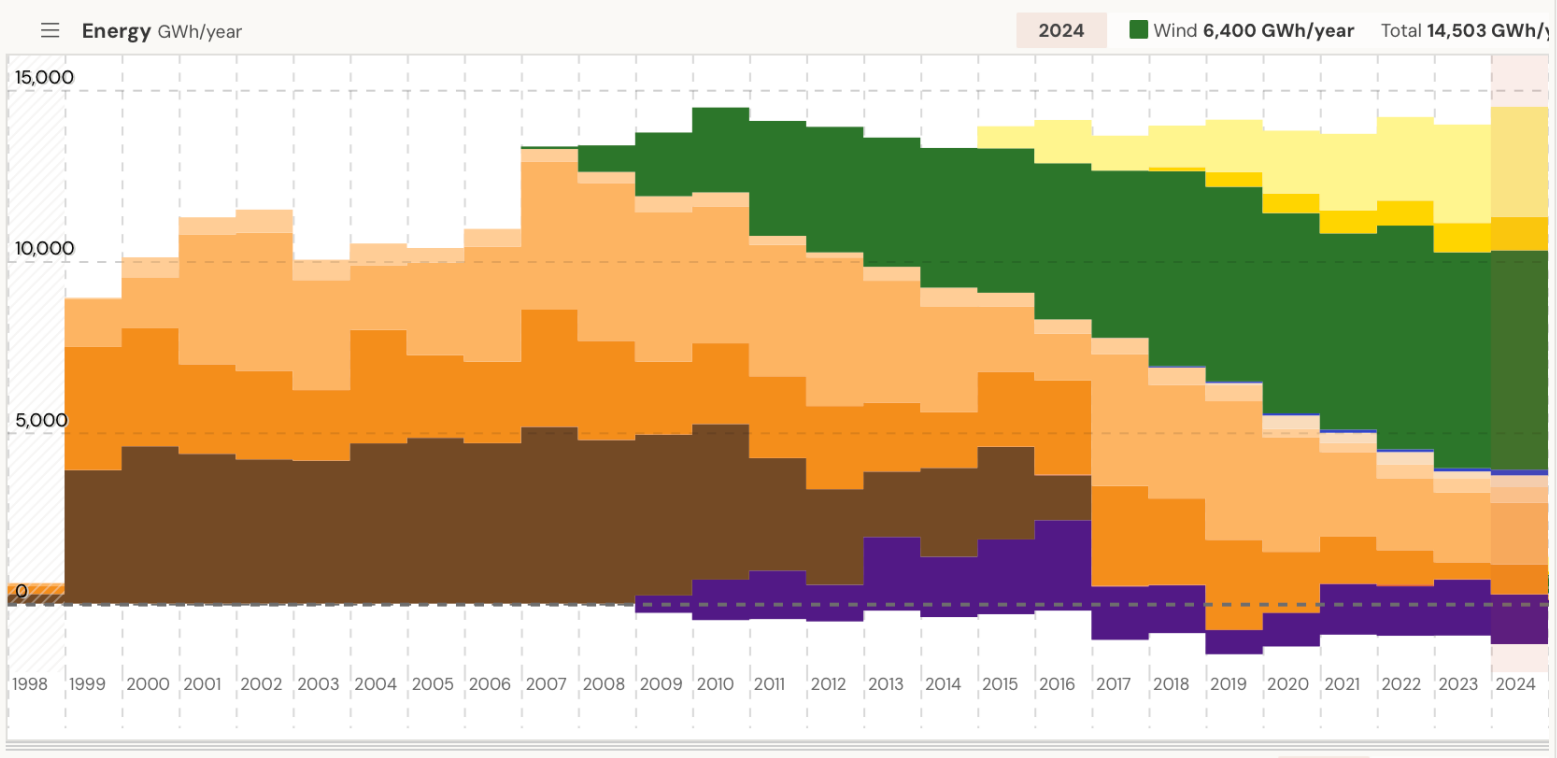
Source: Open Electricity, https://openelectricity.org.au AEMO QED 4QCY2024 https://aemo.com.au/energy-systems/major-publications/quarterly-energy-dynamics-qed

Australian Decarbonisation is Accelerating

Electrification & Decarbonisation – South Australia CY2024 averaged 71.9% variable renewable energy (75.6% Jan'25)

Open Electricity

Energy | South Australia | 1D | 3D | 7D | 30D | 1Y | ALL | Year



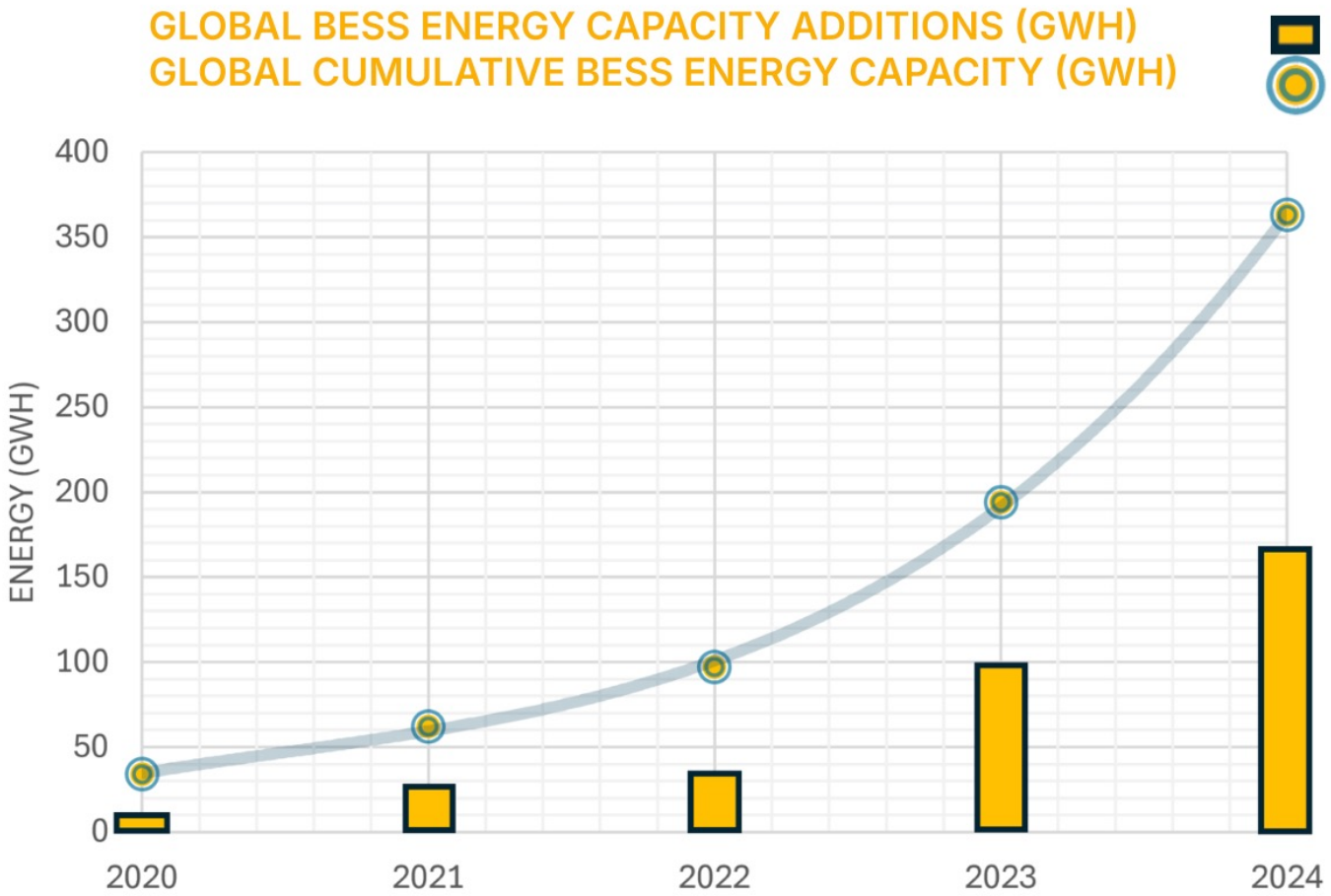
2024

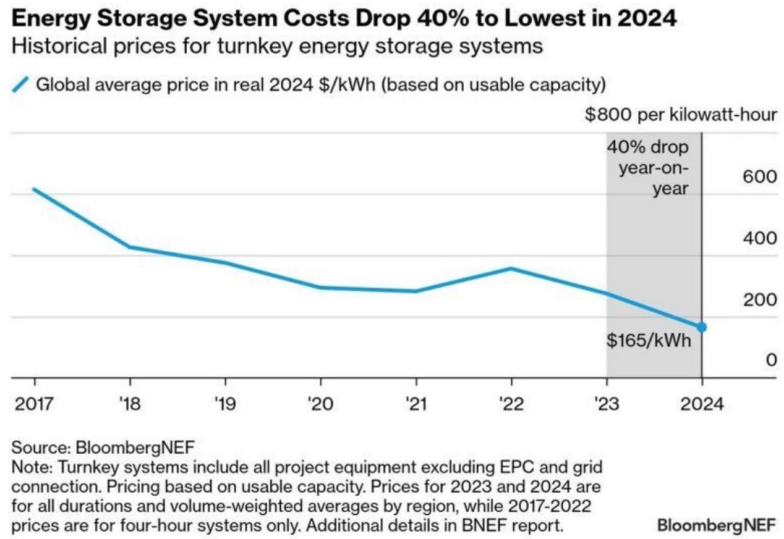
Detailed	Energy GWh	Contribution to demand	Av.Value $/MWh
Sources			
Solar (Rooftop)	3,214	21.8%	$27.20
Solar (Utility)	976	6.6%	$44.06
Wind	6,400	43.5%	$64.59
Battery (Discharging)	167	1.1%	$263.83
Gas (Reciprocating)	344	2.3%	$230.06
Gas (OCGT)	459	3.1%	$445.34
Gas (CCGT)	1,794	12.2%	$211.81
Gas (Steam)	874	5.9%	$172.97
Distillate	9.7	0.07%	$1,581.53
Coal (Brown)	0	0.0%	–
Imports	1,444	9.8%	$0.00
Loads	**-1,180**		
Exports	-957	-6.5%	$0.00
Battery (Charging)	-223	-1.5%	$26.61
Net	**14,503**		
Renewables	**10,591**	71.9%	

Source: Open Electricity, https://explore.openelectricity.org.au/energy/sa1/?range=all&interval=1y&view=discrete-time&group=De
AEMO QED 4QCY2024 https://aemo.com.au/energy-systems/major-publications/quarterly-energy-dynamics-qed

Australian Decarbonisation is Accelerating

BESS + Solar + V2G / EV => Accelerating Energy System Disruption



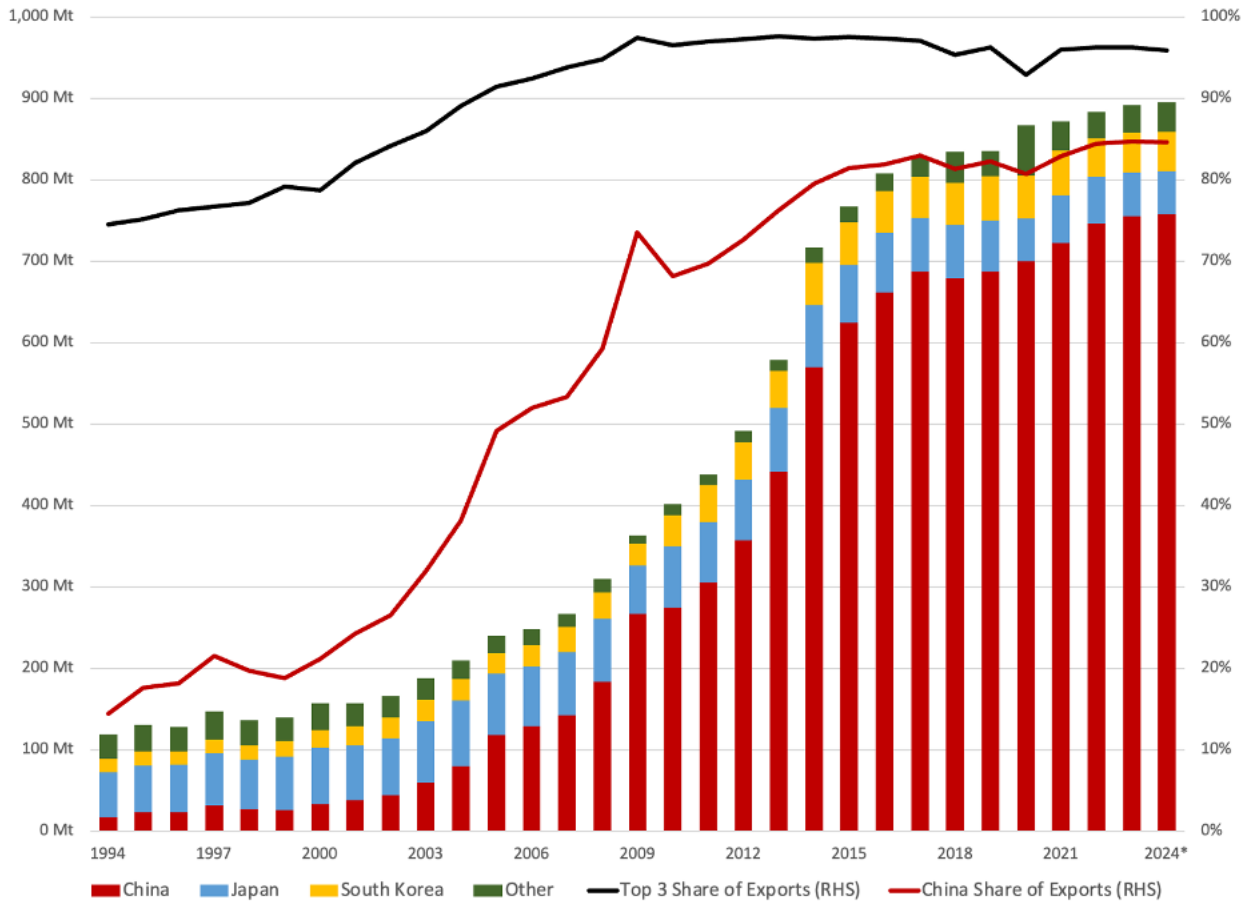


Source: PowerSwitch, Volta Foundation 2024 Battery Report
https://volta.foundation/battery-report-2024

Australian Decarbonisation is Accelerating

Australia exports half the world's iron ore – a massive economic threat, and massive strategic opportunity

Australia's Iron Ore Export Markets

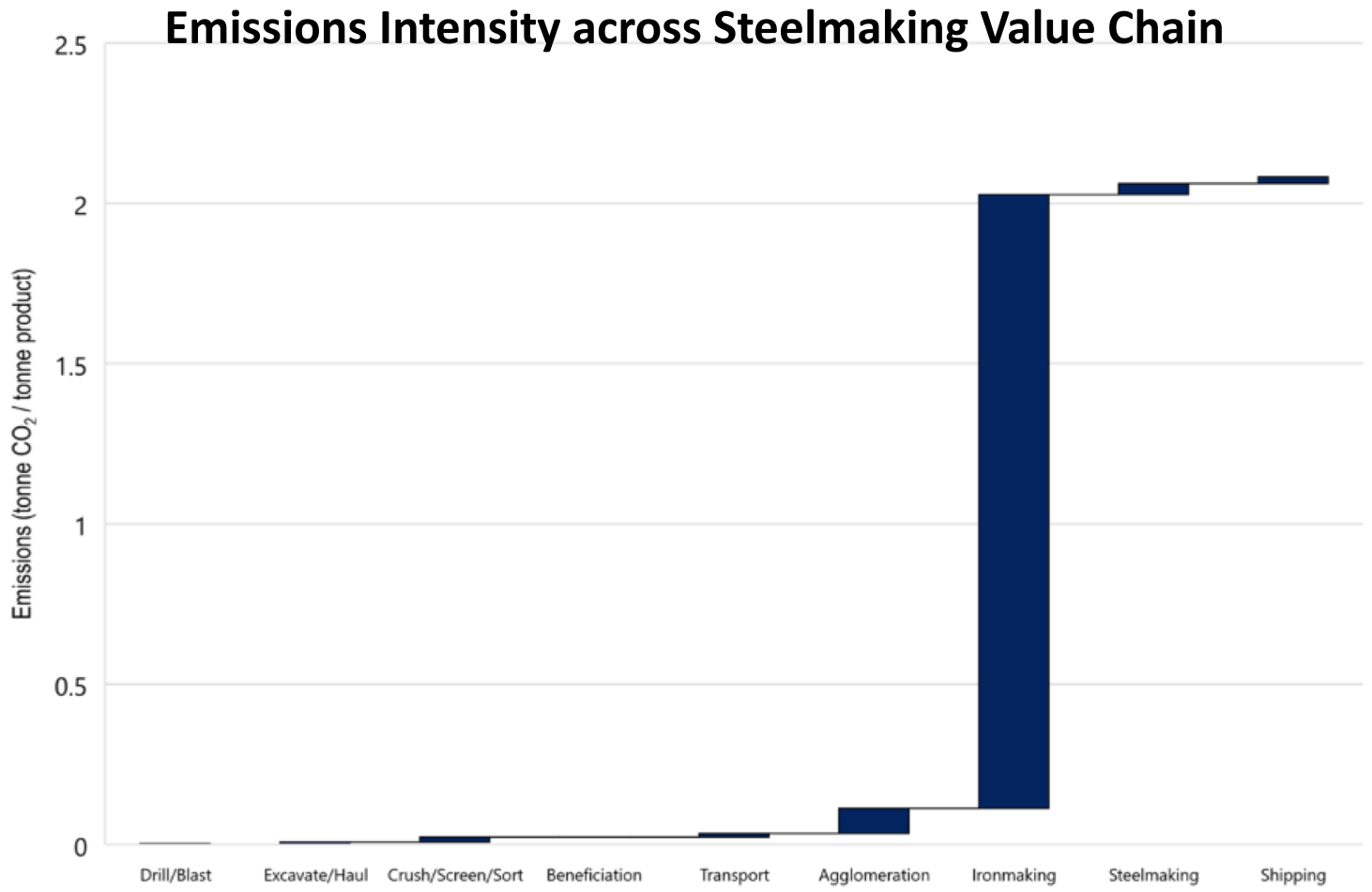


China accounted for 85% of Australia's A$138bn pa of iron ore exports, having delivered +6% CAGR in volume over the last decade. This has been a key partnership of profound strategic value for Australia. But Chinese steel production likely peaked in 2020 (China's steel output was -3% yoy in 2024), scrap use is rising, and China is diversifying into Simandou, Guinea (120Mtpa).

Source: Climate Energy Finance Report: "Green Metal Statecraft"
https://climateenergyfinance.org/wp-content/uploads/2024/11/CEF_Green-Metal-Statecraft_FINAL.pdf

Australian Decarbonisation is Accelerating

Australia exports half the world's iron ore – a massive economic threat, and massive strategic opportunity



Relative cost of energy is the defining driver of where DRI & green iron and green aluminium will be produced, as and when CBAM takes off in international trade.

Very hard for finance to move absent a CO_2 price signal. China doesn't have that problem.

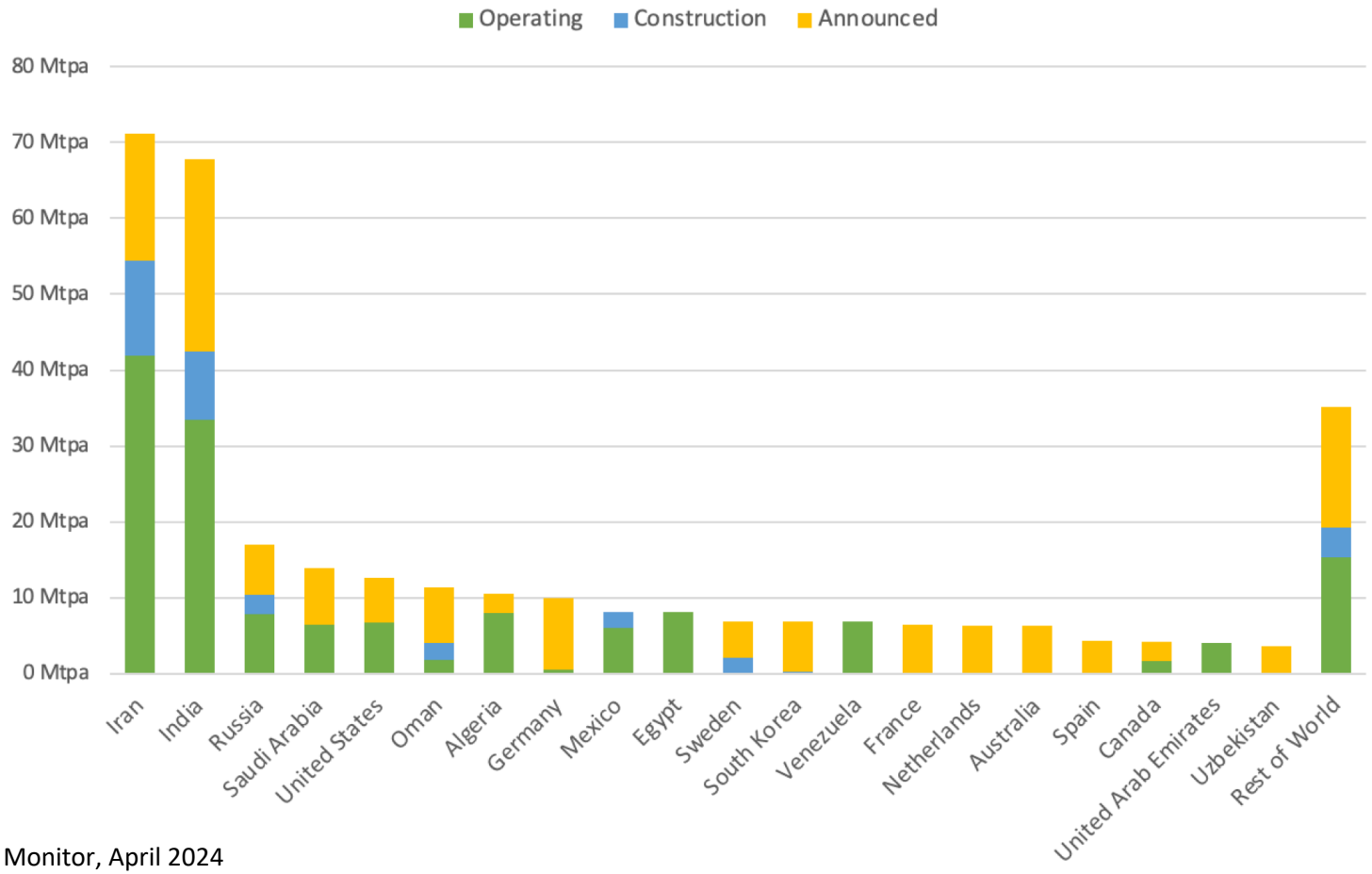
Australian domestic methane gas is 3x that of the US and 6x the middle east, cost prohibitive.

Source: MRIWA, WA Green Steel Opportunity

Australian Decarbonisation is Accelerating

Australia exports half the world's iron ore – a massive economic threat, and massive strategic opportunity

Global Direct Reduced Iron (DRI) Capacity Additions



GEM reports 149Mtpa of DRI capacity globally – with a further 35Mtpa currently under construction, plus 138Mtpa capacity announced. In 2023, global DRI production reached 136Mtpa. Australia currently produces zero DRI and has no plants under construction.

Source: Global Energy Monitor, April 2024
https://globalenergymonitor.org/projects/global-steel-plant-tracker/

UNIVERSITY OF CAMBRIDGE | CISL Cambridge Institute for Sustainability Leadership

Thank you

Please contact us for further information

Tim Buckley, Climate Energy Finance, tim@climateenergyfinance.org