



**CLIMATE ENERGY FINANCE**

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**The promise and reality of  
renewable energy laws  
and policy symposium**

**Sydney Uni**

**28 March 2023**

# **Agenda: Global Energy Transition, and the need for a strong public-private Australian response to the US IRA and EU Net Zero Industry Act**

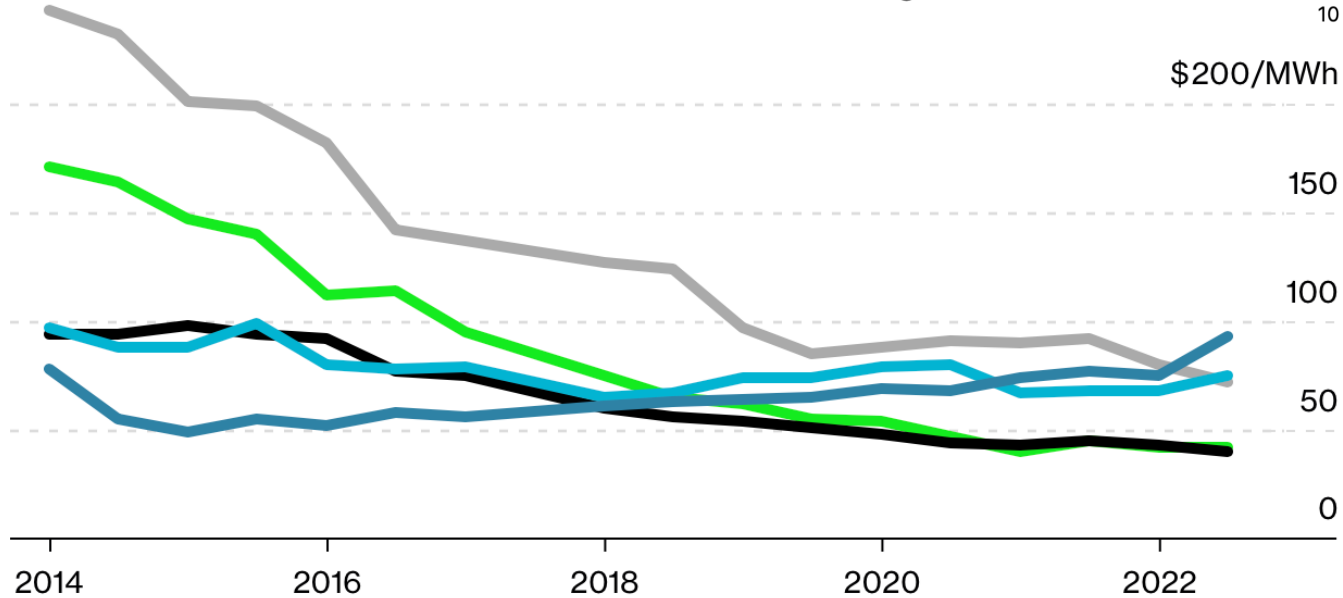
1. Key global themes: deflation, pricing emissions, market returns
2. Energy Technologies: China leads the world
3. The US IRA and EU NZIA (Net Zero Industry Act), India's PLI, South Korea and Japan's GX Roadmap
4. Australian electricity: the rooftop solar and EV disruption; the safeguard mechanism and Origin Energy as a case study
5. Value-adding Critical Minerals pre-export: Australia as a Renewable Energy & Critical Minerals Superpower

# 1. Key themes – Ongoing Deflation

## Rising Fossil Fuel Prices Have Made Renewables More Attractive

Even with rising costs, wind and solar are more competitive than ever

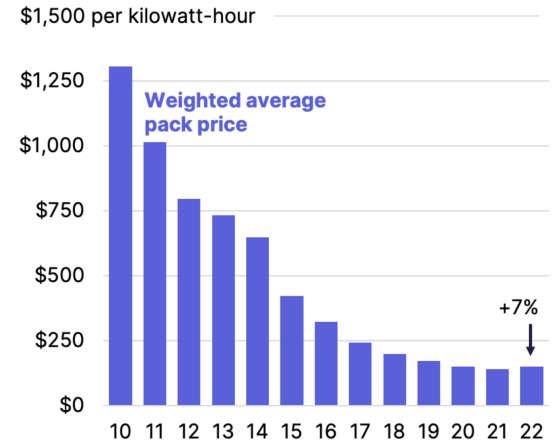
█ Solar   
 █ Onshore wind   
 █ Offshore wind   
 █ Natural gas   
 █ Coal



Source: BloombergNEF

Note: Figure shows the levelized cost of energy. Solar is with fixed-axis.

Battery system costs and energy storage system costs



# 1. Key themes – Pricing in CO<sub>2</sub> emissions

## The Five-Year EU ETS Pricing (€/t)

EU Carbon Permits (EUR) 96.58 +2.75 (+2.93%)

Since July 2021 China has operated the world's largest ETS.

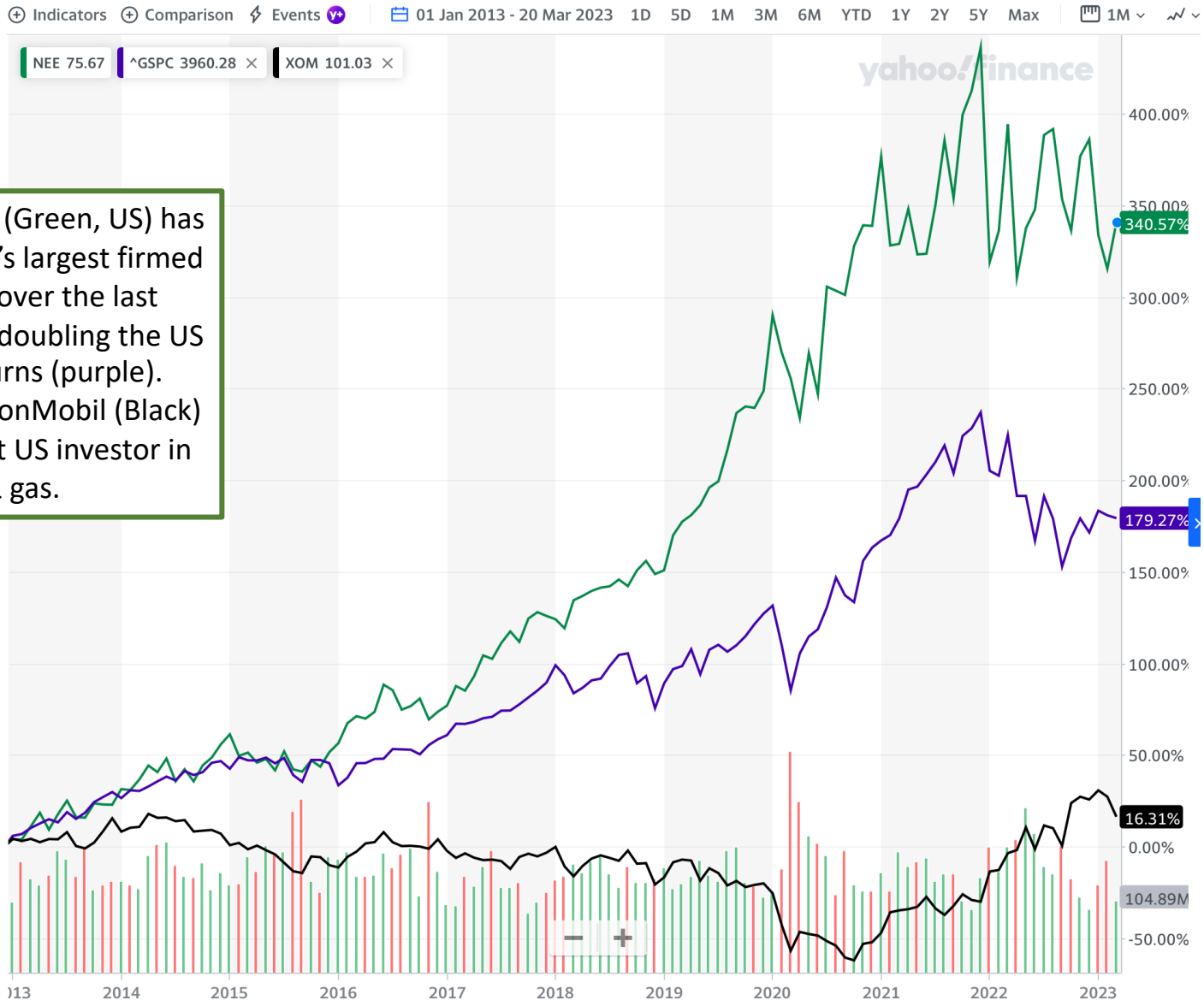
December 2022 saw Japan's GX Roadmap propose a staged ETS from 2026.

The US IRA in 2022 put a US\$1,500/t cost on methane emissions.

Safeguard mechanism = Oz price on carbon



# 1. Nextera Energy vs ExxonMobil

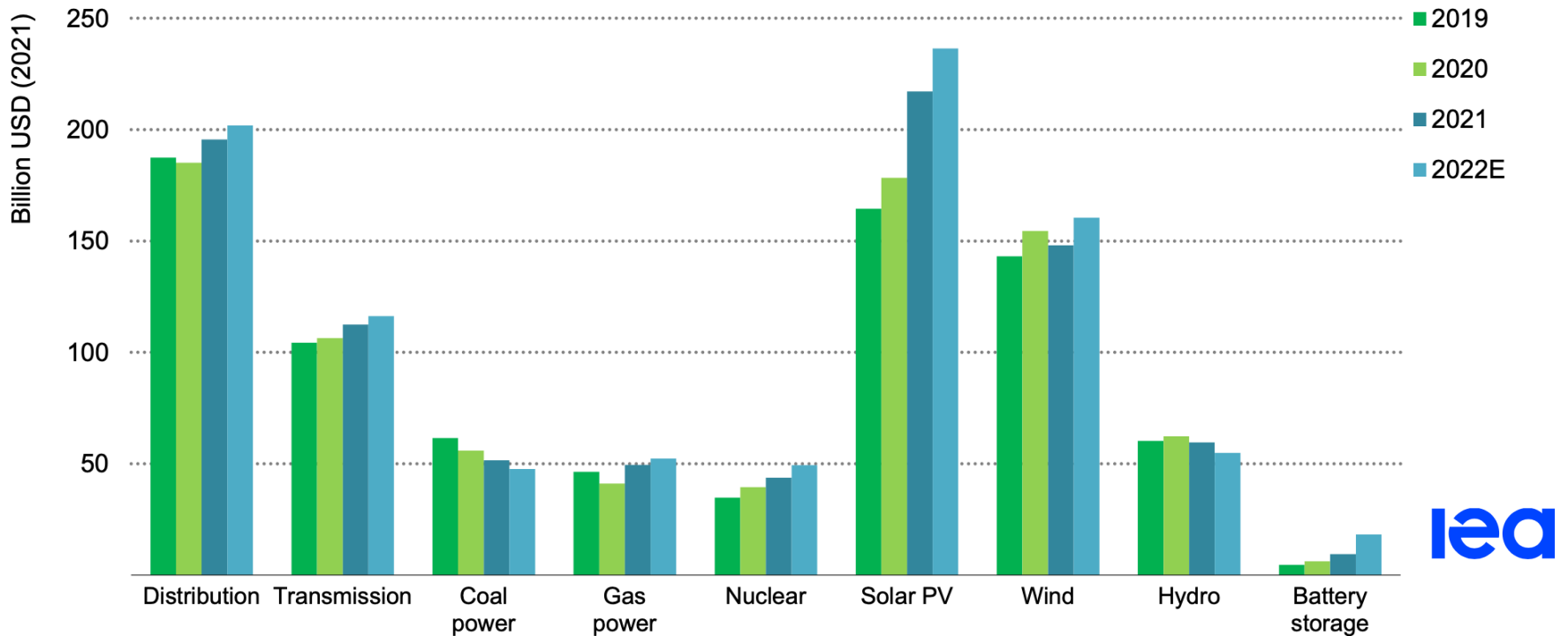


NextEra Energy (Green, US) has been the world's largest firm RE investor over the last decade, nearly doubling the US S&P500 returns (purple). In contrast, ExxonMobil (Black) was the largest US investor in oil & gas.

# 2. Global Energy Investment Trends

The world will see a cumulative US\$100 trillion ‘invested’ in energy by 2050

Global annual investment in the power sector by technology, 2019-2022E



IEA. All rights reserved.

Notes: Gas-fired generation investment includes both large-scale plants and small-scale generating sets and engines; hydropower includes pumped-hydro storage.

As emerging markets grow, and annual fossil fuel spend is capitalised into upfront RE infrastructure capex, energy investments will rise to ~\$4 trillion pa - >US\$100 trillion by 2050

Source: IEA World Energy Investment 2022

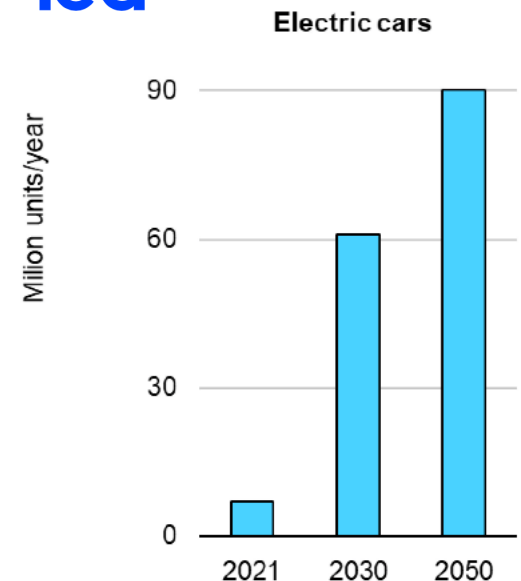
## 2. China Leads the World in Electric Vehicles

China has produced and sold 6.5 million EV/PHEV in 2022; growth of 94% yoy.  
 China sold ~60% of the world's EVs in 2022.  
 27.8% of all China car sales in 2022 were EVs

	2022 Production	YoY Growth	Market Share	2022 Sales	YoY Growth	Market Share
Total Domestic Vehicles	27,021,000	3.4%		26,864,000	2.1%	
Passenger Vehicles	23,836,000	11.2%	88.2%	23,563,000	9.5%	87.7%
of which New Energy Vehicles	6,716,000	97.8%	28.2%	6,548,000	94.3%	27.8%
BEV	5,132,000	83.4%	76.4%	5,033,000	81.7%	76.9%
PHEV	1,584,000	165.0%	23.6%	1,515,000		
Commercial Vehicles	3,185,000	-31.9%	11.8%	3,300,000		
of which New Energy Vehicles	342,000	81.5%	10.7%	338,000		
BEV	335,000	82.7%	98.0%	331,000		
PHEV*	4,000	10.5%	1.2%	4,000		
Total Vehicle Exports	3,111,000	54.4%				
of which New Energy Vehicles	679,000	120.2%	21.8%			

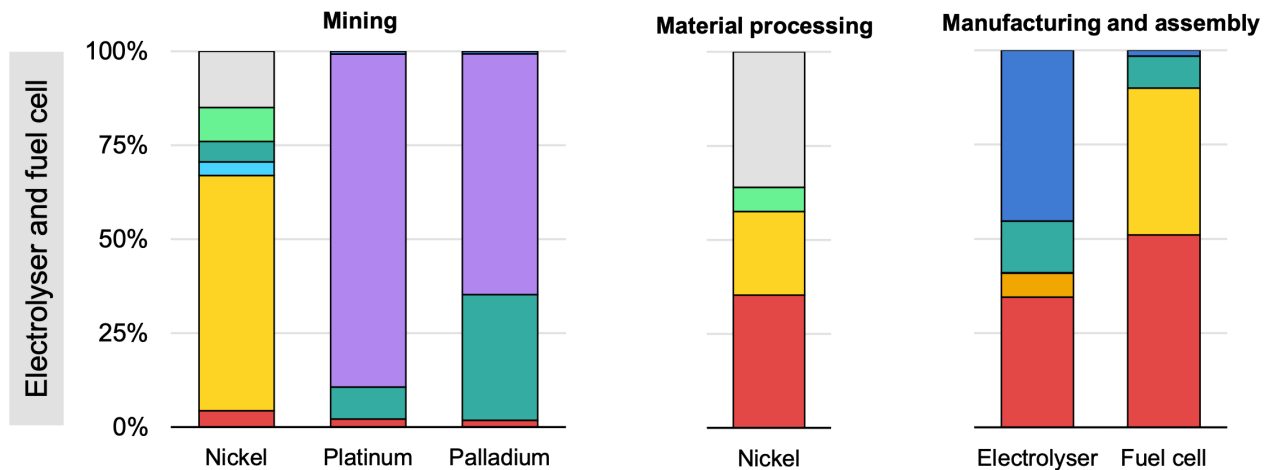
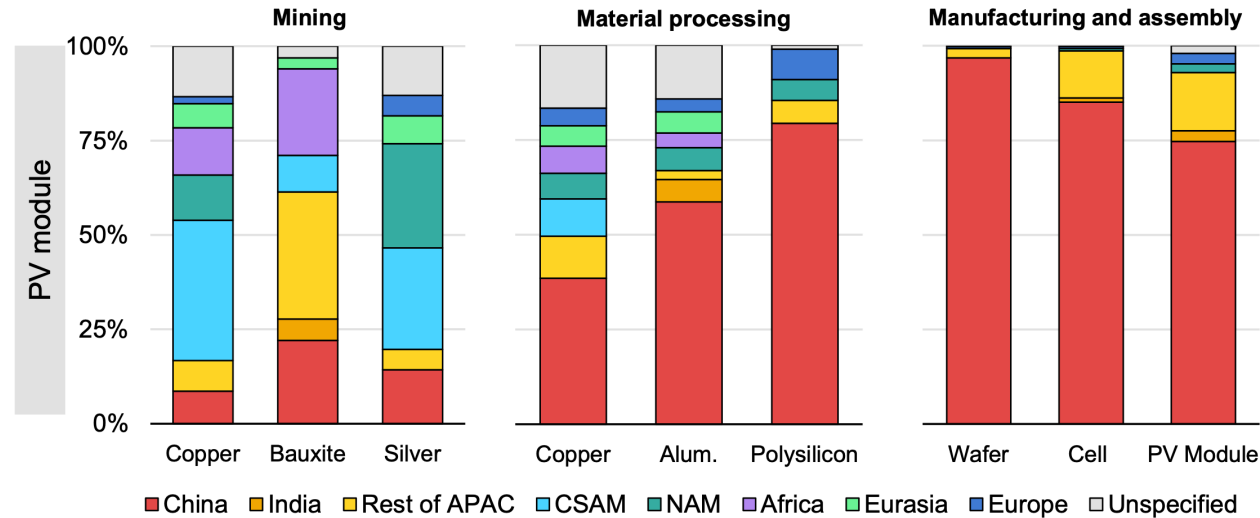
\* BEV + PHEV does not account for full NEV Production and Sales in Commercial New Energy Vehicles

Figure 1.6 Global deployment Scenario



## 2. China Leads the World on Mineral Processing

Supply chain security, cheap RE and resource ownership means Australia should be leveraging our new competitive advantages to lead the global energy transition



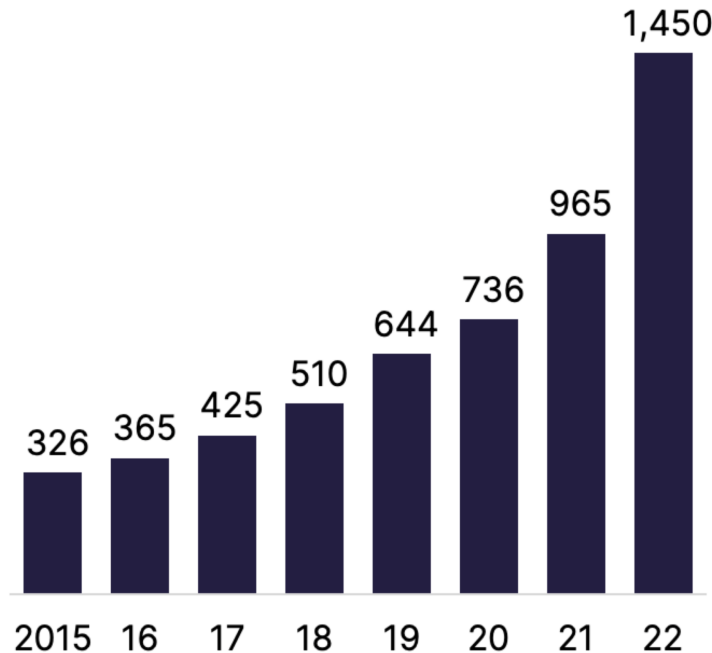


# 3. US Inflation Reduction Act 2022

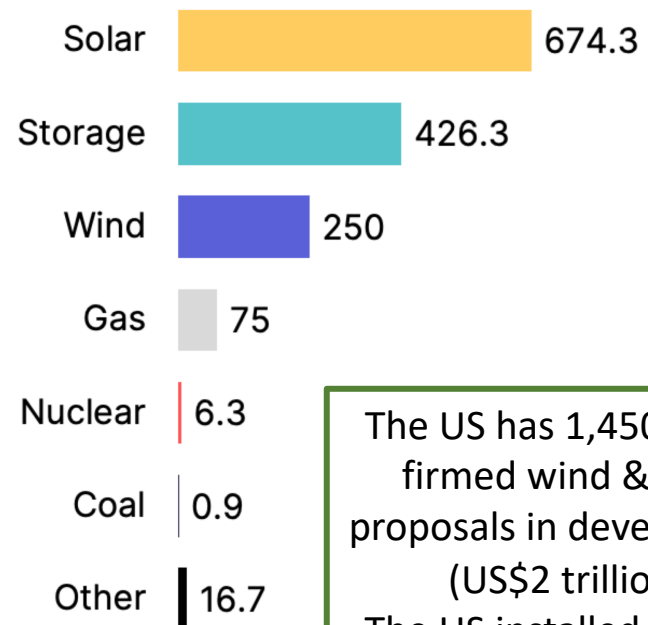
The US under President Biden has talked the talk, the IRA 2022 delivers serious firepower – US\$369bn + US\$400bn DoE Loan Program

The US power interconnection queue has more generation capacity than is currently online

US interconnection queue, gigawatts



Interconnection queue, by resource



The US has 1,450 GW of firmed wind & solar proposals in development (US\$2 trillion).  
The US installed 5GW of batteries in 2022.

## DOE launches \$6B program to slash emissions from heavy industry

The Biden administration announced it will help fund projects to clean up the production of steel, cement, aluminum and other hard-to-decarbonize sectors.

# 3. EU Net Zero Industry Act 2023



Press release | 16 March 2023 | Brussels

## Net-Zero Industry Act: Making the EU the home of clean technologies manufacturing and green jobs

The aim that the EU's overall domestic share of strategic net-zero technologies manufacturing capacity is >40% of EU deployment needs by 2030.

Today, the Commission proposed the [Net-Zero Industry Act](#) to scale up manufacturing of clean technologies in the EU and make sure the Union is well-equipped for the clean-energy transition. This initiative was announced by President **von der Leyen** as a part of the [Green Deal Industrial Plan](#).

The Act will strengthen the resilience and competitiveness of net-zero technologies manufacturing in the EU, and make our energy system more secure and sustainable. It will create better conditions to set up net-zero projects in Europe and attract investments, with the aim that the Union's overall strategic net-zero technologies manufacturing capacity approaches or reaches at least 40% of the Union's deployment needs by 2030. This will accelerate the progress towards the EU's 2030 climate and energy targets and the transition to climate neutrality, while boosting the competitiveness of EU industry, creating quality jobs, and supporting the EU's efforts to become energy independent.

# 3. India's Solar Manufacturing PLI

## India launches second phase of solar production incentive scheme

Solar Energy Corp. of India (SECI) has started accepting applications from solar manufacturers under the second phase of the production-linked incentive (PLI) scheme, with an outlay of about \$2.4 billion.

NOVEMBER 22, 2022 **UMA GUPTA**

BALANCE OF SYSTEMS

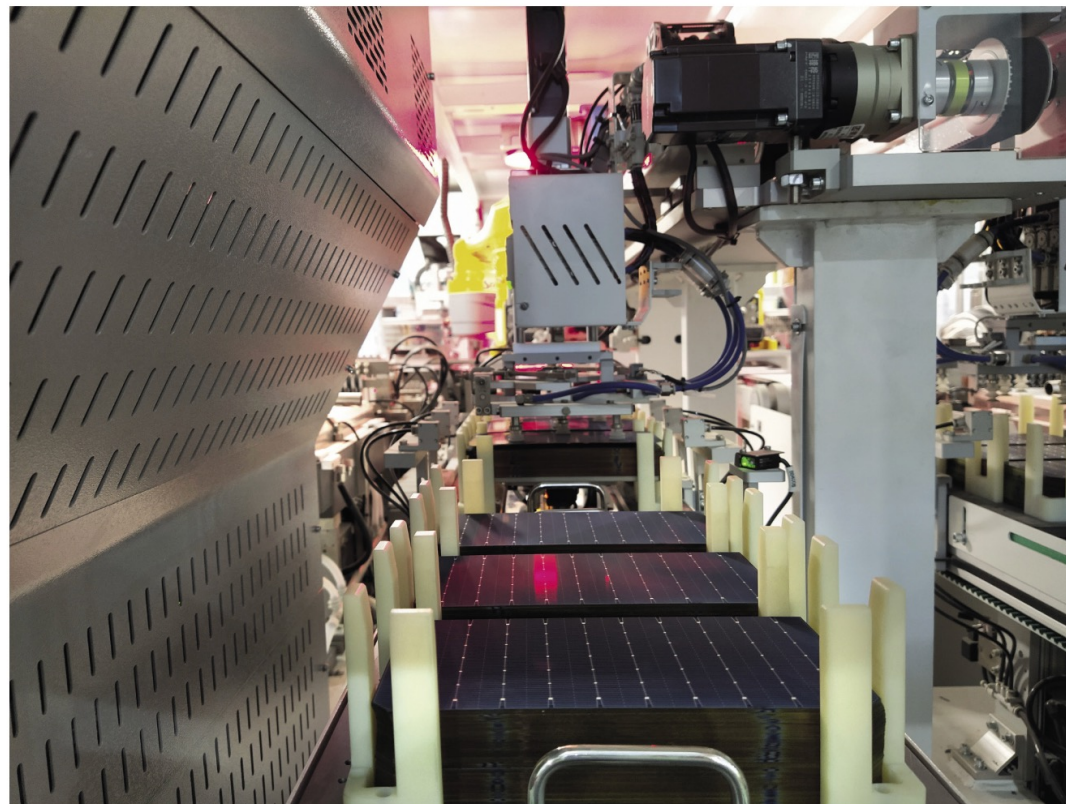
INVERTERS

MARKETS

MODULES & UPSTREAM MANUFACTURING

INDIA

MNRE secretary Indu Shekhar Chaturvedi said 21 Sept'2022 that the PLI would add 74 GW of solar module manufacturing capacity, an investment of Rs 94,000 crore.



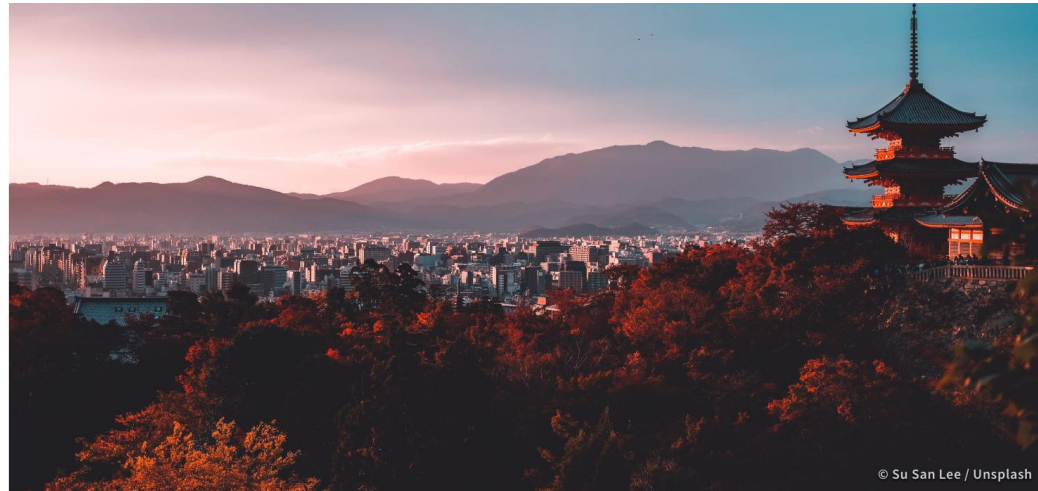
Source: PV Magazine's Uma Gupta 22 November 2022  
<https://www.pv-magazine.com/2022/11/22/india-launches-second-phase-of-incentive-scheme-for-solar-manufacturing/>

Image: Adani Solar

# 3. Japan's GX Roadmap

## Japan's Cabinet approves policy roadmap including plans for national ETS

METI's "Green Transformation" (GX) ten-year roadmap with ¥20 trillion in government support includes a 46% reduction in carbon emissions by 2030, a national ETS phased in from 2026, and "zero-emission thermal power" to decarbonise electricity by 2035.



On 10 February 2023, Japan's Cabinet approved the [Basic Plan](#) for the "GX: Green Transformation Policy", designed to help Japan reach its climate targets. Earlier in 2022, the Ministry of Environment, Trade, and Industry (METI) released the draft Basic Plan for public consultation, before compiling the final version towards the end of the year. The proposal comes at a time when Japan is facing an energy crisis, with energy in short supply and sharp increases in prices. To address these energy security challenges, Japan aims to continue moving towards "growth-oriented" carbon pricing.

The newly approved Basic Plan is a ten-year roadmap of Japan's decarbonization strategy. It outlines several carbon pricing instruments that will work in tandem to help Japan reach its NDC targets of a 46% reduction in greenhouse gases by 2030 and climate neutrality by 2050. These include the Green Transformation (GX) League (a voluntary baseline-and-credit system), a more traditional emissions trading system (ETS) later down the line, and a carbon levy.

Source: International Carbon Action Partnership 22 Feb 2023

<https://icapcarbonaction.com/en/news/japan-s-cabinet-approves-policy-roadmap-including-plans-national-ets> & J-REI 28 Feb 2023

<https://www.renewable-ei.org/en/activities/reports/20230228.php>

### 3. Korea's Refocus on the US IRA

#### Battery Makers Plow \$31 Billion Into Remaking Korean Steel Hub

*The city of Pohang built up a world class steel industry over decades. Now it's turning to EV batteries.*



The sun sets over the Posco steel mill in Pohang, South Korea, on July 17, 2018. The city is increasingly seen as the country's new capital for the electric vehicle battery industry.

A South Korean city home to one of the world's biggest steelmakers is betting its manufacturing expertise, billions of dollars in investments and government incentives can help it dominate a 21st century industry: electric vehicle batteries.

Companies in the south-eastern hub of Pohang — famous for **Posco Holdings Inc.** steel mills and one of the country's elite universities — are aggressively building out EV battery campuses as automakers hurry to find reliable suppliers outside China. Three South Korean giants in the global battery market — LG Energy Solution Ltd., Samsung SDI Co. and SK On Co. — have promised 40 trillion won (\$31 billion) in domestic investments with their local suppliers.

President Yoon Suk Yeol said 'the government and companies including Samsung Electronics Co. will pour US\$422bin into areas such as chips and EV in the nation's most aggressive effort yet to win a heated global race for tech supremacy'

Source: Bloomberg's Heejin Kim 16 March 2023

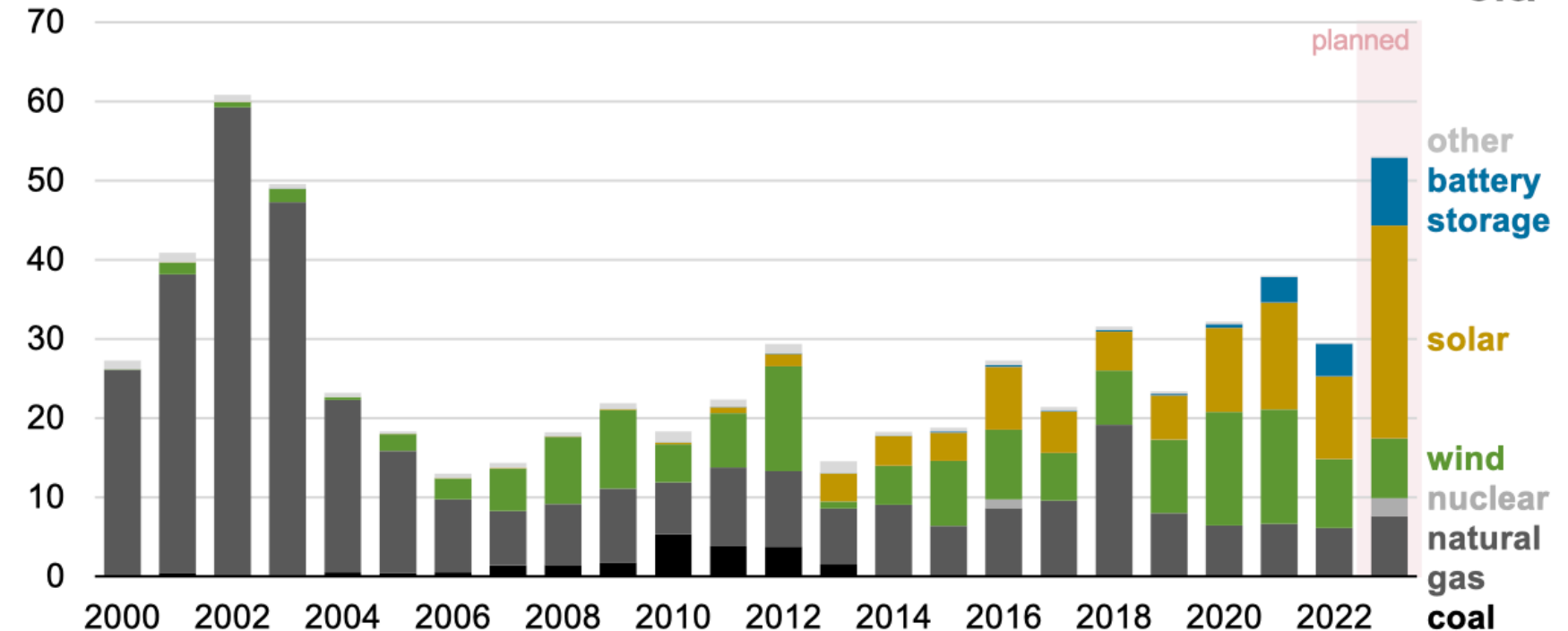
<https://www.bloomberg.com/news/articles/2023-03-15/battery-makers-plow-31-billion-into-remaking-korean-steel-hub>

# 4. Electricity – US Capacity Adds

Wind, solar, and batteries increasingly account for more new U.S. power capacity additions

Annual U.S. electric-generating capacity additions (2000–2023)

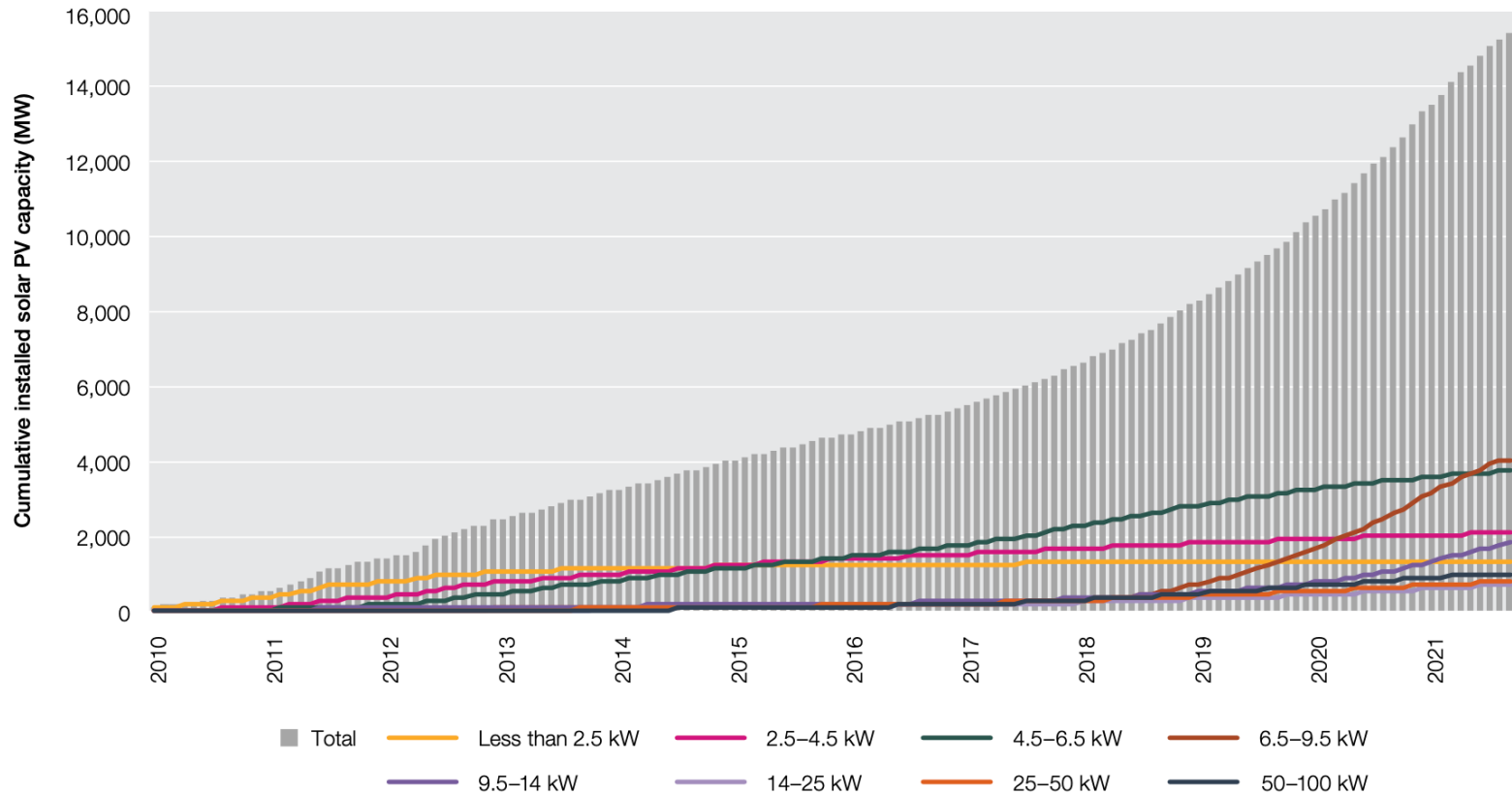
gigawatts



Data source: U.S. Energy Information Administration, *Preliminary Monthly Electric Generator Inventory*, January 2023

# 4. Rooftop Solar + EV + Storage => Disruption

Australia: 2022: 15GW of Rooftop Solar, 3GW pa adds



AEMO's Integrated System Plan:  
2022: 15GW rooftop solar  
2050: 68GW rooftop solar

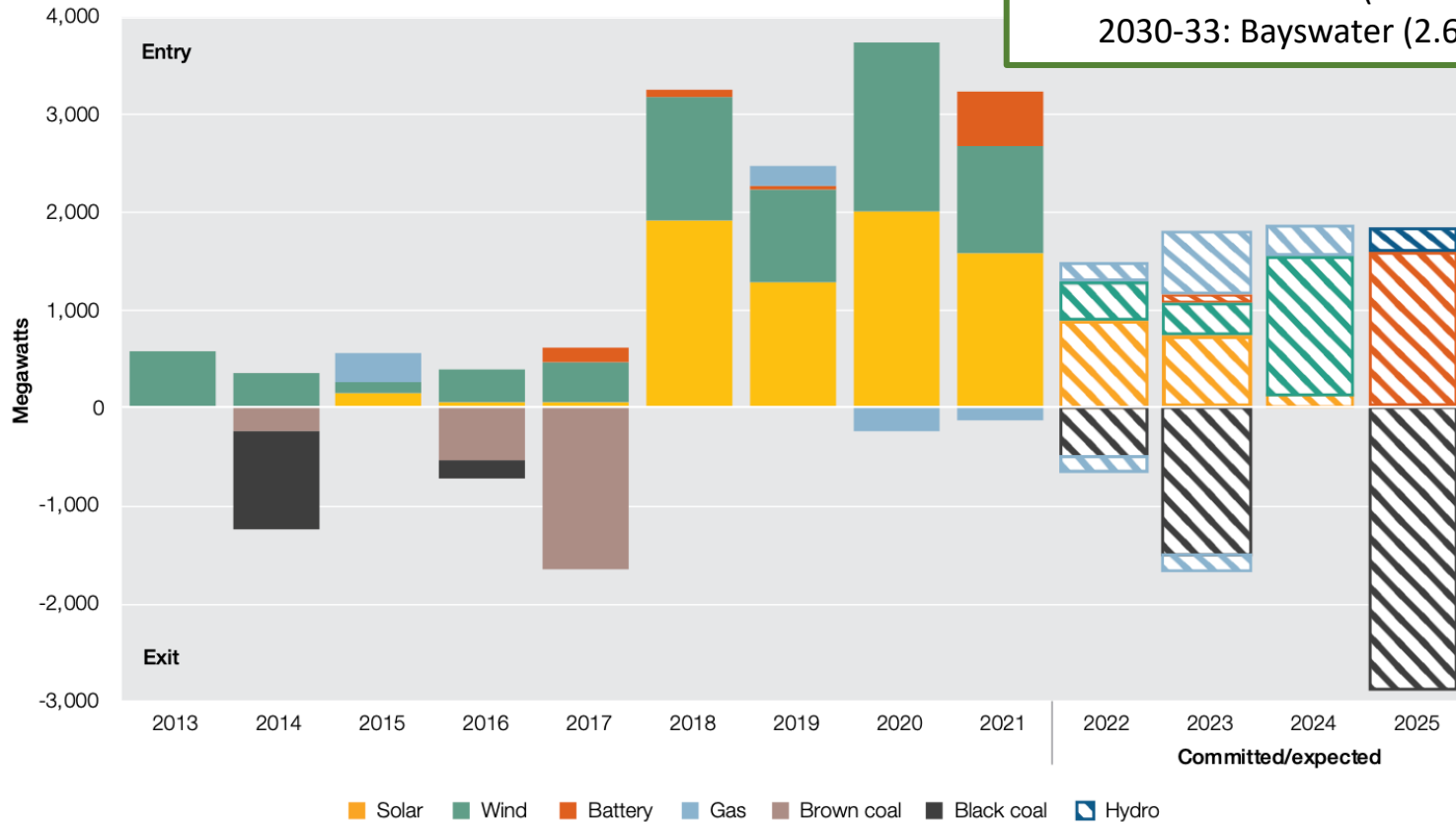
# 4. Australian Electricity Generation

Coal closures are accelerating, private investors are only backing firming VRE

AEMO ESOO 22 Feb'2023 reports investor firming RE pipeline across Australia now stands at 209 GW.

Renewable Share of NEM:  
 2017: 16%  
 2022 : 34%  
 2030 (f): 82%

NEM coal closures pending:  
 2023: Liddell (2.05GW)  
 2025: Eraring (2.88GW)  
 2022-29: Collie & Muja WA (1.43GW)  
 2028: Yallourn (1.48GW)  
 2030-33: Bayswater (2.64GW)





# 4. Australian Electricity Generation

Global Capital is Moving towards Decarbonisation

## Brookfield to pour billions into energy transition via Origin takeover

Angela Macdonald-Smith AFR Mar 28, 2023

Canadian giant Brookfield has pledged to invest billions of dollars to accelerate the decarbonisation of Origin Energy after sealing a \$18.7 billion deal to buy out the Australian electricity and gas supplier together with US partner EIG.

The deal, [announced late Monday](#), has been fully endorsed by the board of the target, with Origin chief executive Frank Calabria describing it as a “great outcome” for shareholders, customers, employees and partners.



Brookfield Asia Pacific CEO Stewart Upson says Brookfield will invest at least \$20 billion to build out renewables and storage.

Under the terms of the deal, Brookfield, which is partnered by Singapore’s Temasek and GIC, will take Origin’s energy markets business.

The deal will also bring a new player into Australia’s clean energy sector, with Brookfield revealing it will work with Indian giant Reliance Industries as a strategic partner in renewables in connection with the transaction. [Reliance revealed last year](#) it was eyeing potential green hydrogen opportunities in Australia, further expanding its multi-billion-dollar push into cleaner energy around the world.

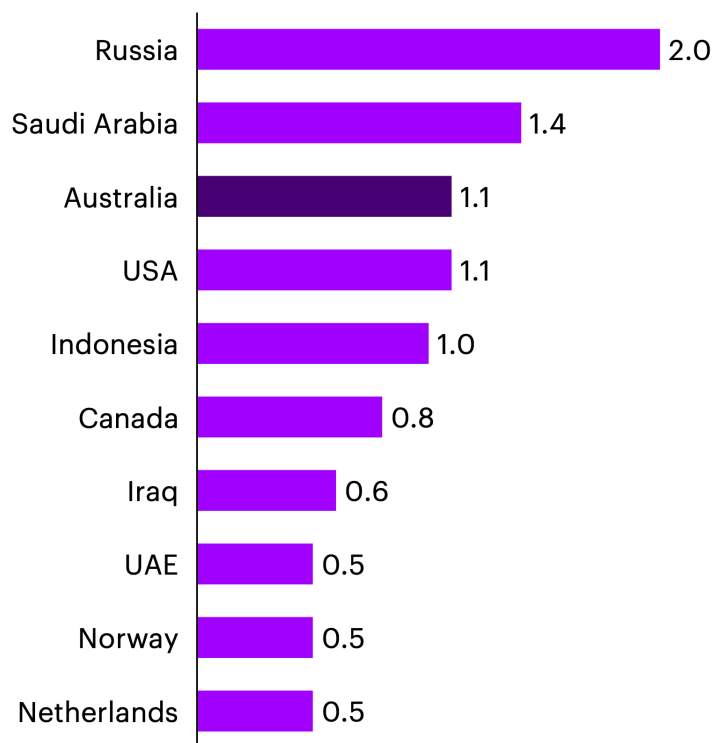
Christopher Case this morning said we are seeing a shift in the energy market from a commodity basis (oil, coal, gas) to a finance / it system.

# 4. Australia Will be a Critical Minerals Superpower

Supply chain security, cheap RE and resource ownership means Australia should be leveraging our new competitive advantages to lead the global energy transition

**Figure 4: Global ranking of CO<sub>2</sub> emissions due to fossil fuel exports<sup>4</sup>**

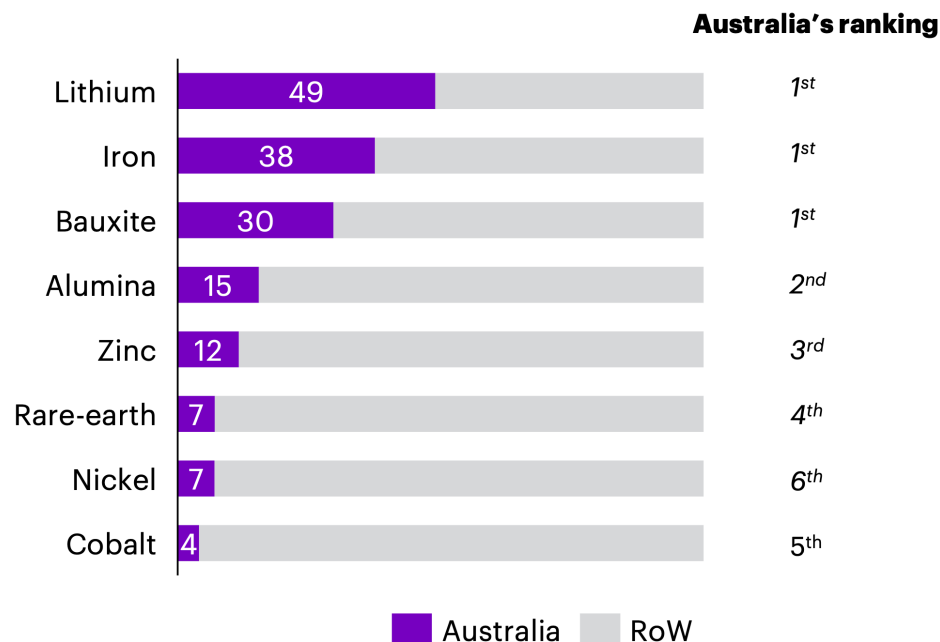
billion tonnes



**Figure 8: Australia's production of select metals and minerals essential for the energy transition<sup>3</sup>**

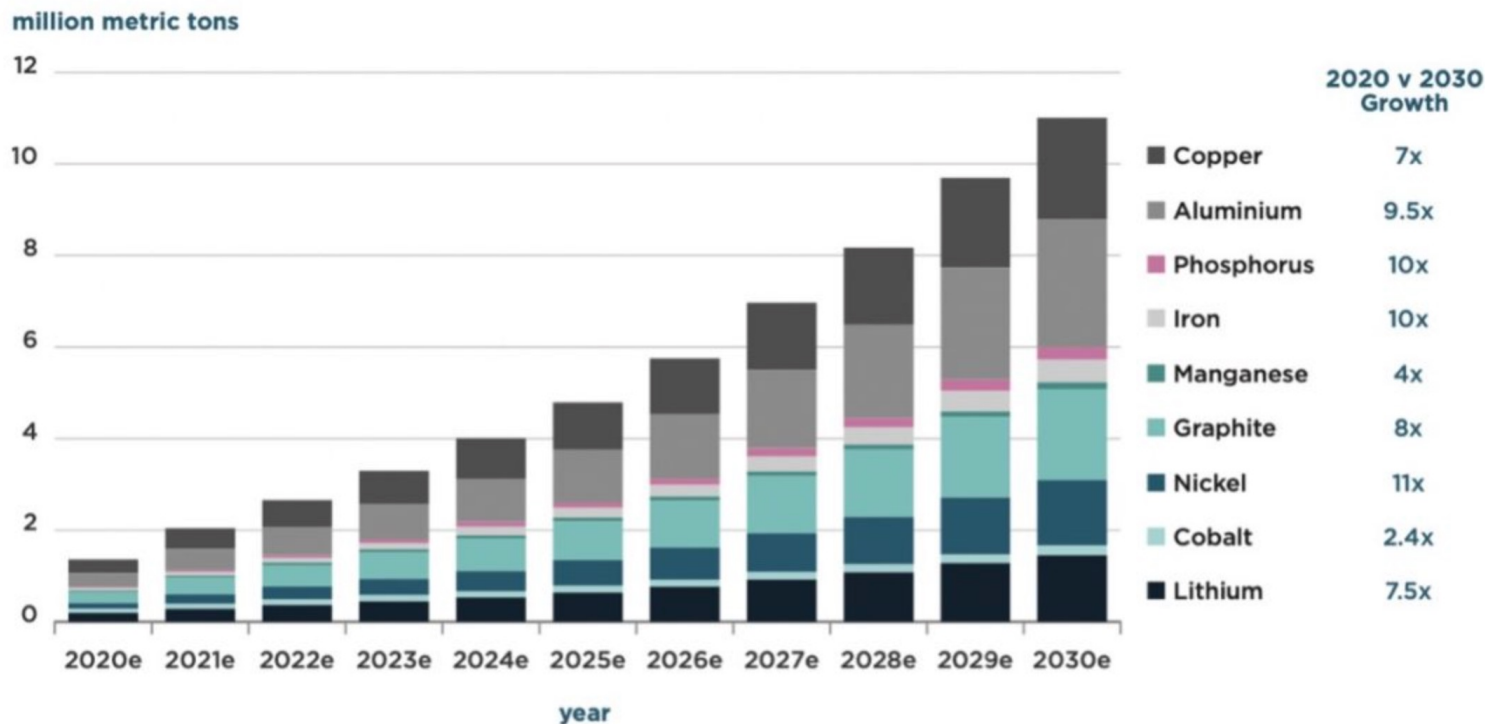
% of global production

2021



# 4. Australia Will be a Critical Minerals Superpower

Supply chain security, cheap RE and resource ownership means Australia should be leveraging our new competitive advantages to lead the global energy transition



Source: BloombergNEF

Note: Metals demand is assumed to occur approximately one year before battery demand, i.e. metals demand in 2030 is metal content of batteries deployed in 2031 (with allowances for material waste fabrication). Lithium includes material used in cathodes and electrolytes. It is expressed as Lithium Carbonate Equivalent (LCE). To convert to contained metal, multiply by 19%. Copper includes copper current collectors and pack wiring. Aluminium includes aluminium current collectors, cell and pack materials and aluminium in cathode active materials.

# 4. Australia Will be a Critical Minerals Superpower

Supply chain security, cheap RE and resource ownership means Australia should be leveraging our new competitive advantages to lead the global energy transition



Director of Communications at  
CEF: Annemarie Jonson

## A Critical Minerals Value-Adding Superpower

**Mapping Australia's 'once in a century' opportunity to lead the world in new economy minerals mining and renewables-powered onshore refining and manufacturing pre-export**

**1 MARCH 2023**

Shifting the narrative from one of fear of the cost, to excitement of the massive opportunity ahead!

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**Tim Buckley, Founder and Director, CEF**  
**Matt Pollard, EV Supply Chain Analyst, CEF**

*with a Foreword by Dr Alan Finkel*

# 4. Australia Will be a Critical Minerals Superpower

## The Australian Government is starting to respond to the US IRA

Figure A2: Announced funding commitments across the six key export opportunities (non-exhaustive)

Opportunity	Government	Description	Source
Critical minerals	Federal	\$1 billion allocated from the National Reconstruction Fund for value-adding in resources.	Parliament of Australia (2022)
		\$50 million Critical Minerals Development Program, which involves competitive grants to support early and mid-stage critical minerals projects.	Department of Industry, Science, Energy and Resources (2022)
		\$50.5 million Critical Minerals R&D Hub.	Department of Industry, Science, Energy and Resources (2022)
		\$2 billion Critical Minerals Facility administered by Export Finance Australia.	Export Finance Australia (2022)
Green metals	Federal	Up to \$3 billion of the National Reconstruction Fund will be allocated to investments in green metals (steel, alumina and aluminium), clean energy component manufacturing, hydrogen electrolyzers and fuel switching, agricultural methane reduction, and waste reduction.	ALP (2022)
Batteries	Federal	\$100 million pledged for a battery manufacturing precinct in Queensland.	Australian Financial Review (2022)
	Victoria	\$119 million in funding for a 125MW big battery and grid forming inverter.	Premier of Victoria (2022)
	Queensland	\$500 million for Queensland publicly owned energy businesses to invest in battery projects.	Queensland Government (2023)
Renewable hydrogen and ammonia	Federal	\$525 million in investments for in hydrogen hubs overall, including the \$454 million Regional Hydrogen Hubs program which covers projects in Gladstone, the Hunter Valley, the Pilbara, Port Bonython, and Bell Bay.	Department of Prime Minister and Cabinet (2022)
		\$70 million in investment to support the development of a hydrogen hub in Townsville.	Department of Prime Minister and Cabinet (2023)
		\$13.7 million grant for Fortescue Future Industries and Incitec Pivot to develop hydrogen facility through ARENA.	Department of Climate Change, Energy, Environment and Water (2022)
		\$50 million committed to the HyGATE initiative, a joint hydrogen innovation project with Germany.	Australian Renewable Energy Agency (2023)
	New South Wales	\$1.05 billion to build NSW's clean manufacturing base into new renewable technologies, including green hydrogen and green metals. This investment is in addition to \$3 billion in Government incentives in the NSW Hydrogen Strategy.	NSW Department of Planning and Environment (2022)
	Queensland	\$70 million to support the development of a hydrogen hub in Townsville (matching Federal funding).	Department of Prime Minister and Cabinet (2023)
	Western Australia	\$3.8 billion investment in renewable energy and energy storage, which includes funding for battery projects.	

**Federal Budget May 2023 – CCS? Powering the Regions?**