CLIMATE ENERGY FINANCE

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How we look at the energy transition as a huge opportunity for Australia

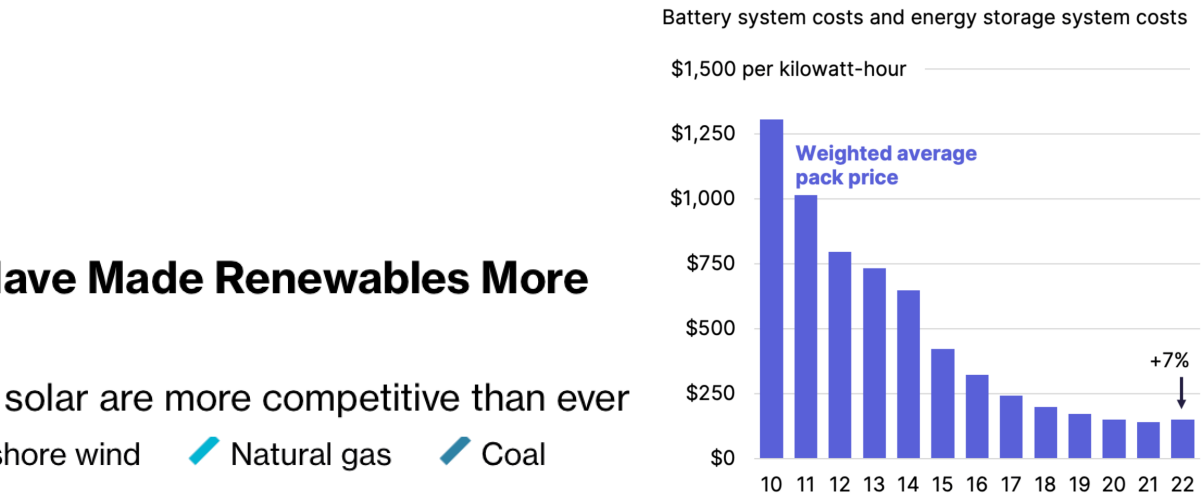
Moir Group Environment Group Monthly Meeting

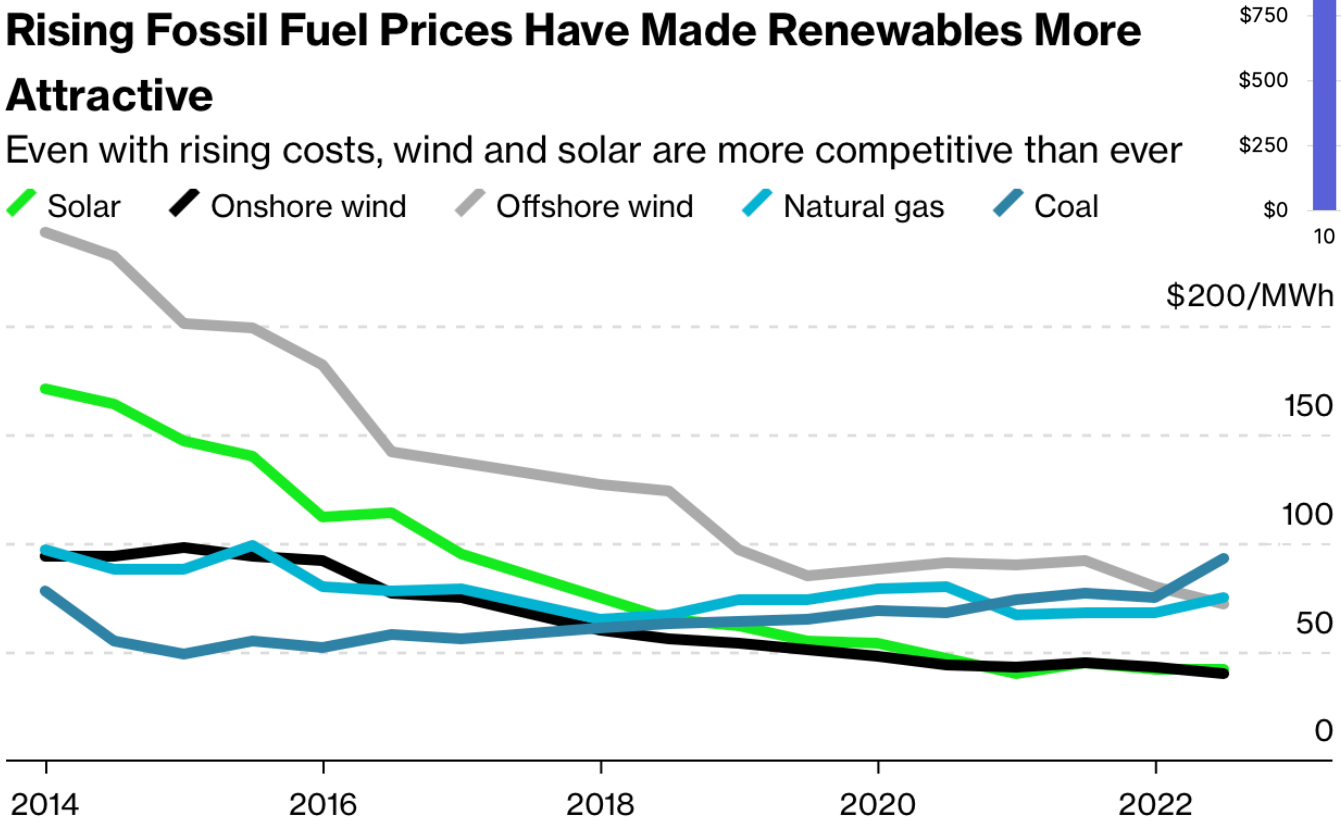
20 March 2023

Agenda: How we look at the energy transition as a huge opportunity for Australia

1. Key global themes: deflation, pricing emissions, market returns
2. Global Energy Sector Investment Trends: China leads the world
3. The US IRA and EU NZIA (Net Zero Industry Act)
4. Australian Electricity
5. Value-adding Critical Minerals pre-export: Australia as a Renewable Energy & Critical Minerals Superpower

1. Key themes – Ongoing Deflation





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

Source: BNEF Feb 2023

1. Key themes – Pricing in CO_2 emissions

The Five-Year EU ETS Pricing (€/t)

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

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

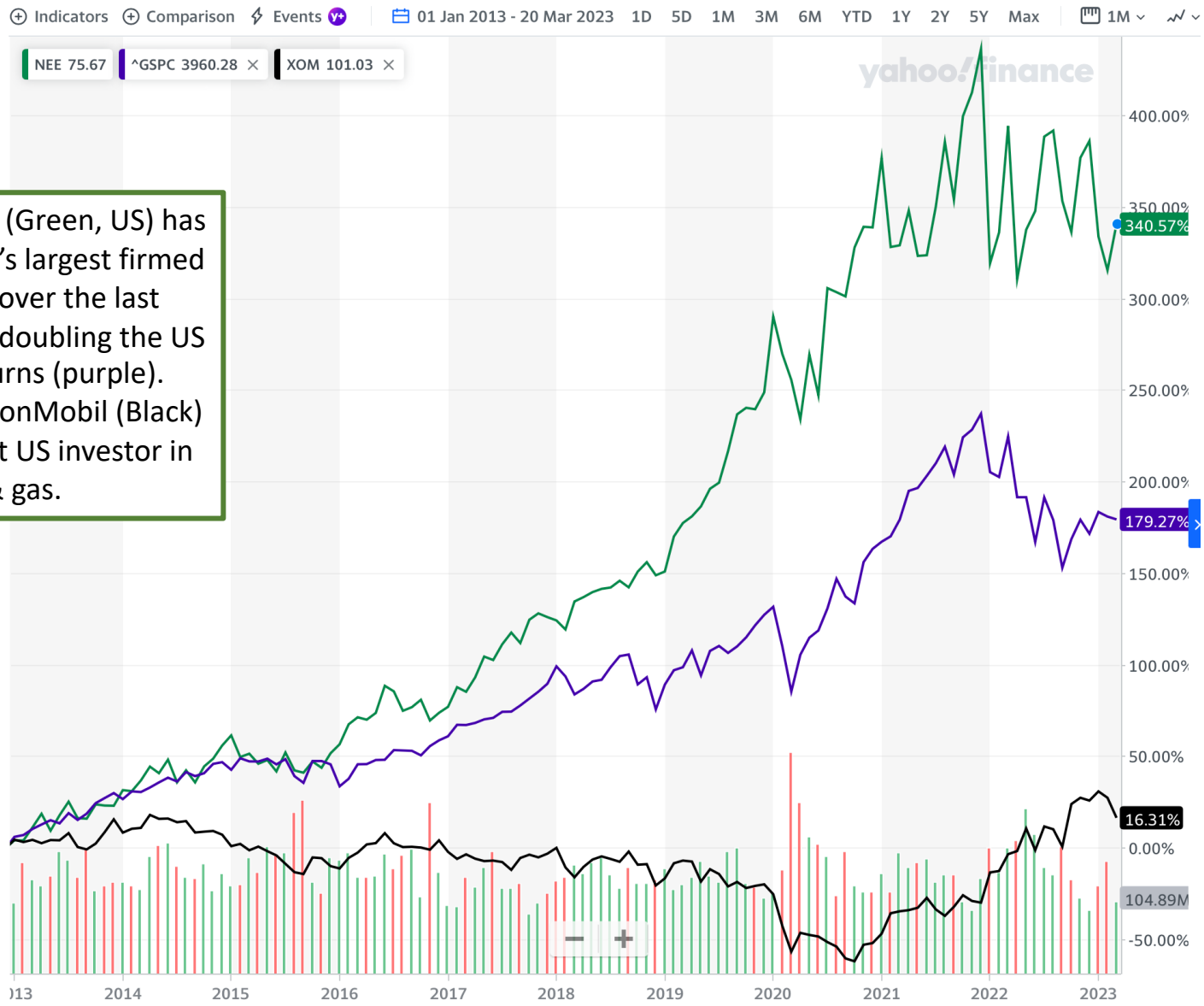
The US IRA in 2022 put a US$1,500/t cost on methane emissions.

Safeguard mechanism / ACCU = Oz carbon price

Source: Trading Economics, Accessed 20 March 2023

1. Nextera Energy vs ExxonMobil

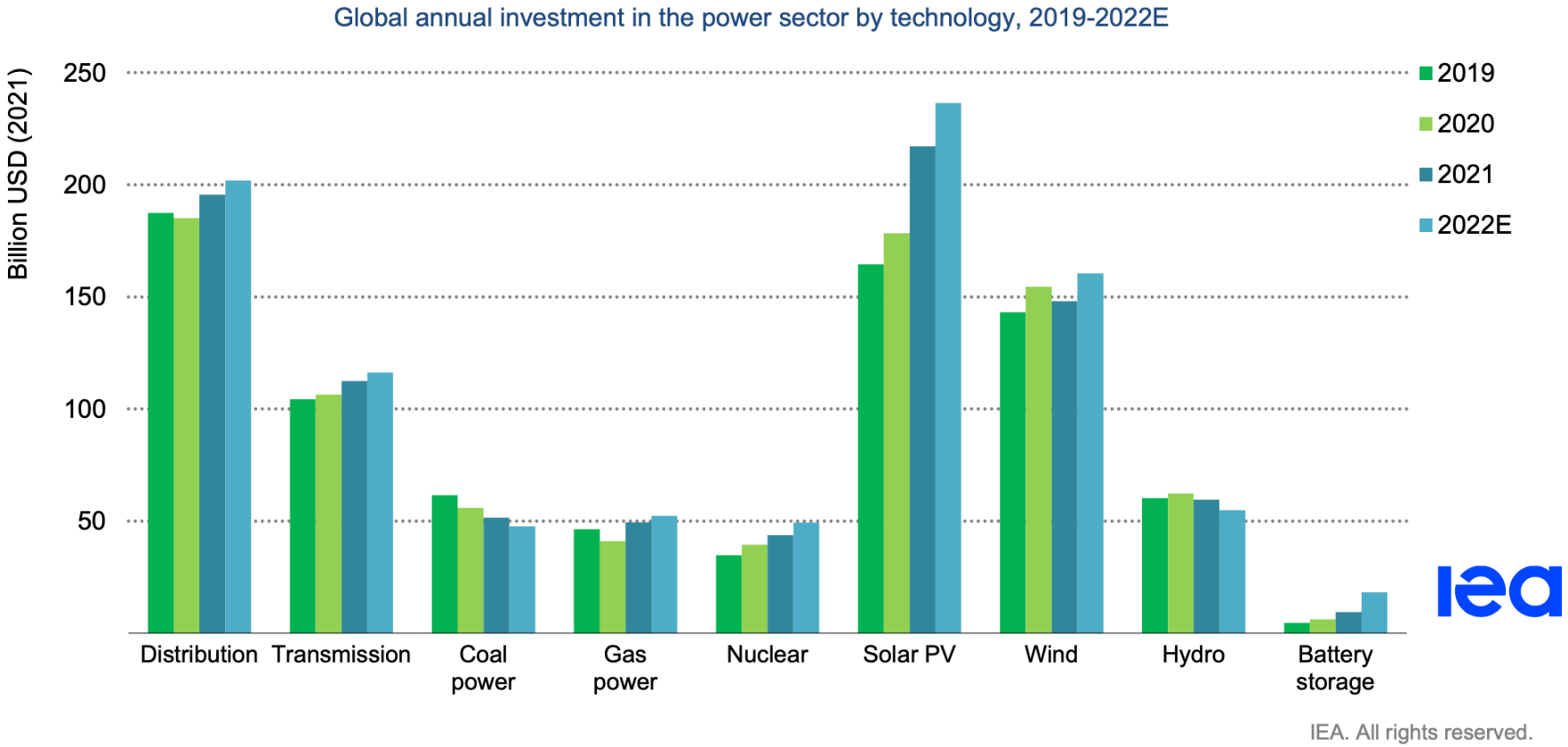
NextEra Energy (Green, US) has been the world's largest firmed RE investor over the last decade, nearly doubling the US S&P500 returns (purple).
In contrast, ExxonMobil (Black) was the largest US investor in oil & gas.



Source: Yahoo Finance 20 Mar'2023

3. Global Energy Investment Trends

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



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

Source: IEA World Energy Investment 2022

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

China Leads the World in Electric Vehicles

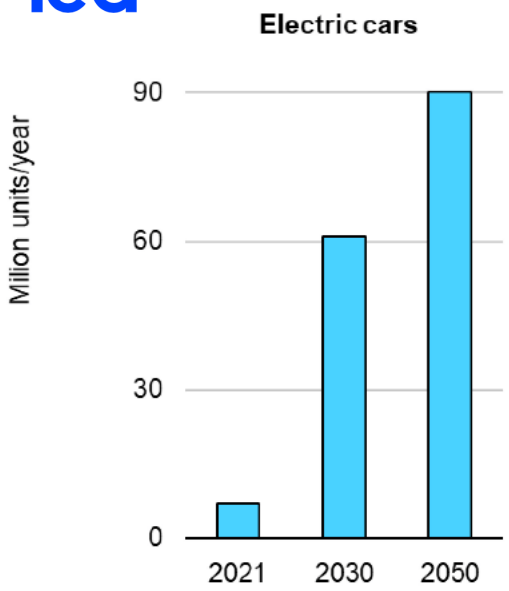
China has produced and sold 6.5 million EV/PHEV in 2022; growth of 94% yoy.
China sold ~60% of the world's EVs in 2022.
27.8% of all China car sales in 2022 were EVs

	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*

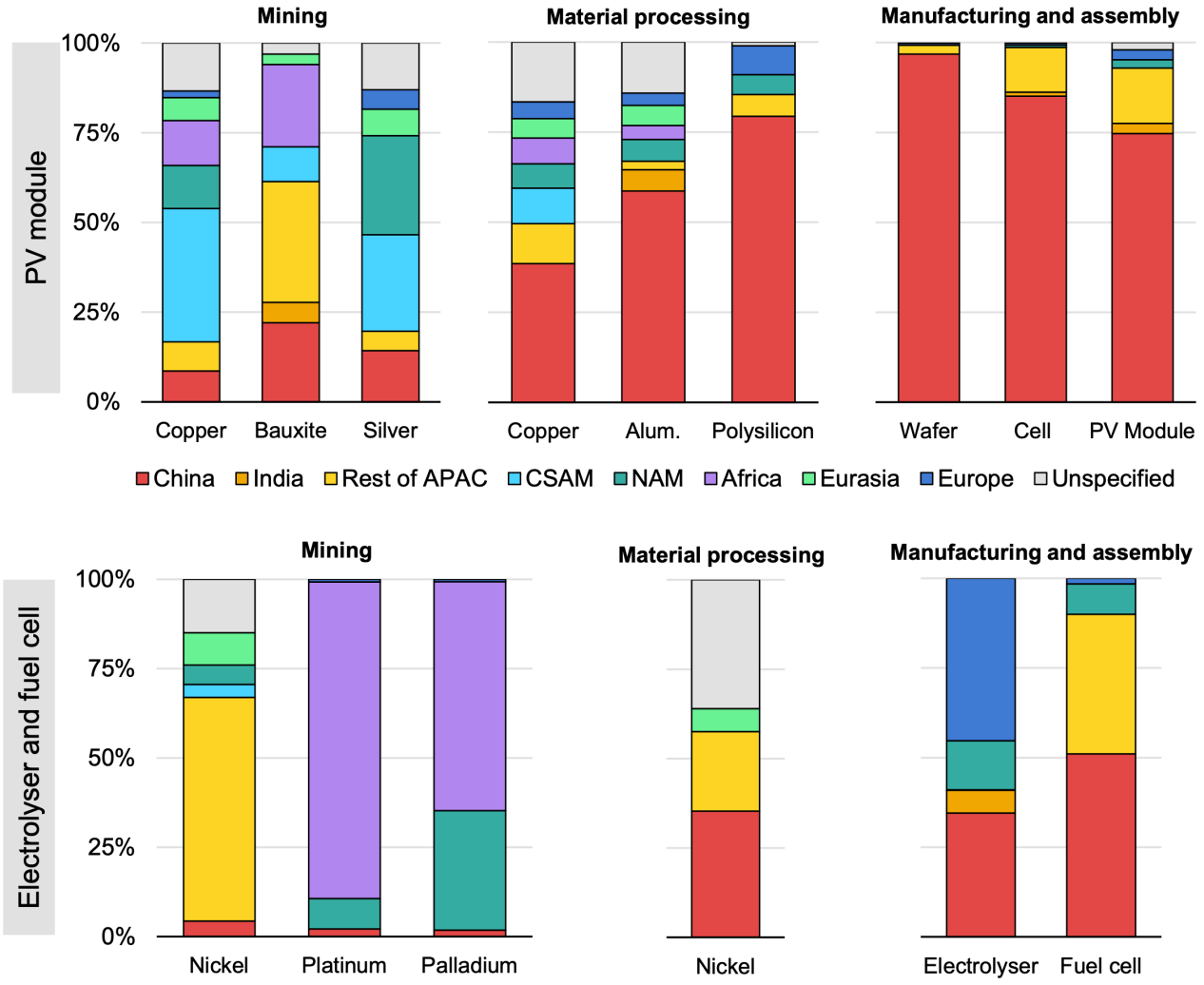
Source: China National Bureau of Statistics

Figure 1.6 Global deployment Scenario



3. 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



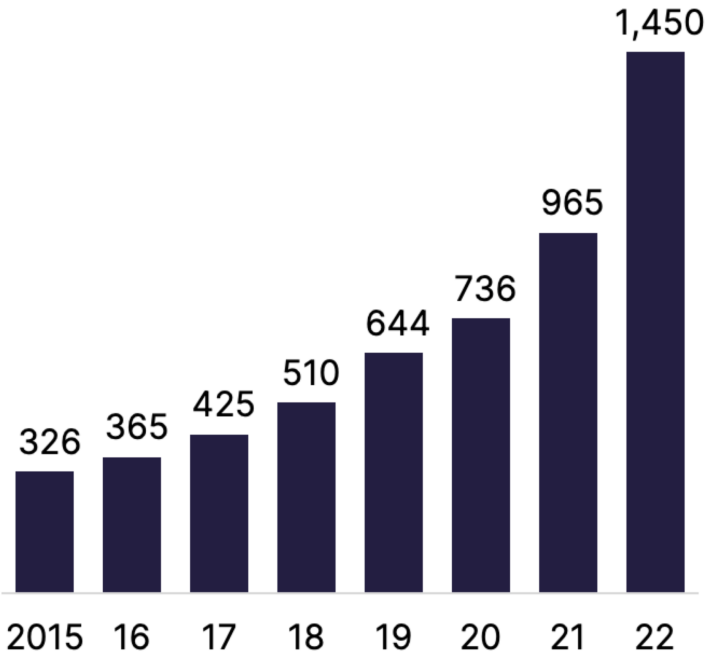
Source: IEA Securing Clean Energy Technology Supply Chains July 2022

3. US Inflation Reduction Act 2022

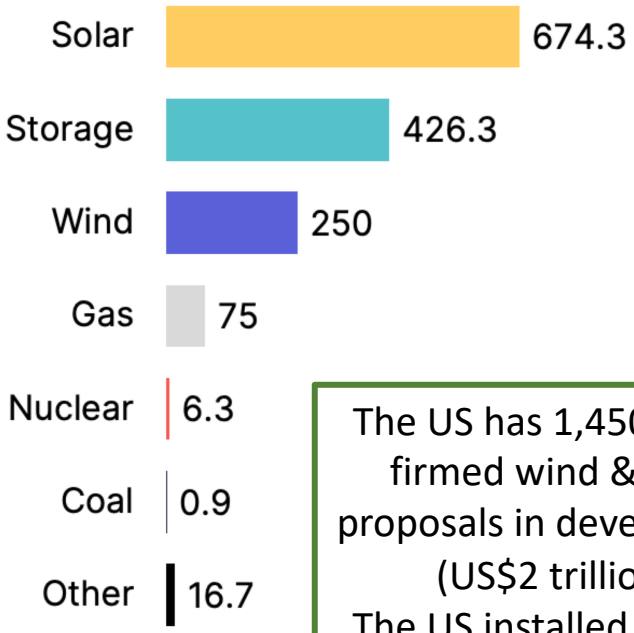
The US under President Biden has talked the talk, the IRA 2022 delivers serious firepower – US$369bn + US$400bn DoE Loan Program

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.

Source: Nat Bullard BNEF Feb 2023

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.

Source: EU 16 March 2023 https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1665

4. Electricity

A US example
(with no price on carbon emissions)

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

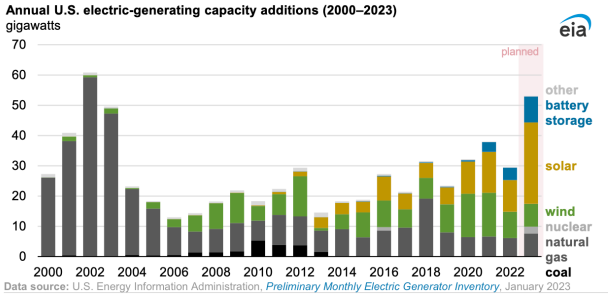


Table 1b. Estimated unweighted levelized cost of electricity (LCOE) and levelized cost of storage (LCOS) for new resources entering service in 2027 (2021 dollars per megawatthour)

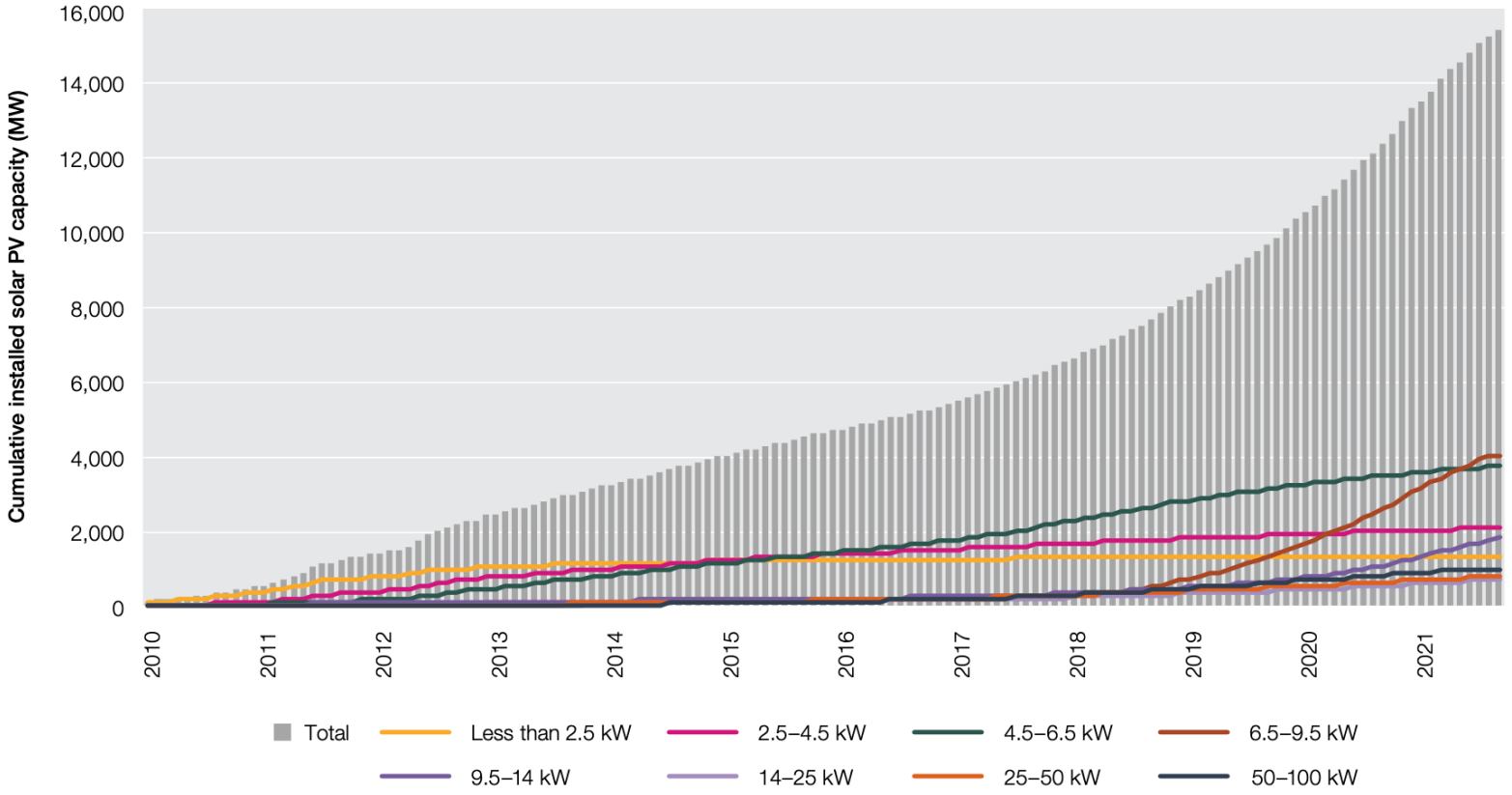
Plant type	Capacity factor (percent)	Levelized capital cost	Levelized fixed O&M[a]	Levelized variable cost	Levelized transmis-sion cost	Total system LCOE or LCOS	Levelized tax credit[b]	Total LCOE or LCOS including tax credit
Dispatchable technologies								
Ultra-supercritical coal	85%	$52.11	$5.71	$23.67	$1.12	$82.61	*NA*	$82.61
Combined cycle	87%	$9.36	$1.68	$27.77	$1.14	$39.94	*NA*	$39.94
Advanced nuclear	90%	$60.71	$16.15	$10.30	$1.08	$88.24	-$6.52	$81.71
Geothermal	90%	$22.04	$15.18	$1.21	$1.40	$39.82	-$2.20	$37.62
Biomass	83%	$40.80	$18.10	$30.07	$1.19	$90.17	*NA*	$90.17
Resource-constrained technologies								
Wind, onshore	41%	$29.90	$7.70	$0.00	$2.63	$40.23	*NA*	$40.23
Wind, offshore	44%	$103.77	$30.17	$0.00	$2.57	$136.51	-$31.13	$105.38
Solar, standalone[c]	29%	$26.60	$6.38	$0.00	$3.52	$36.49	-$2.66	$33.83
Solar, hybrid[c,d]	28%	$34.98	$13.92	$0.00	$3.63	$52.53	-$3.50	$49.03
Hydroelectric[d]	54%	$46.58	$11.48	$4.13	$2.08	$64.27	*NA*	$64.27
Capacity resource technologies								
Combustion turbine	10%	$53.78	$8.37	$45.83	$9.89	$117.86	*NA*	$117.86
Battery storage	10%	$64.03	$29.64	$24.83	$10.05	$128.55	*NA*	$128.55

Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

Source: US EIA March 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

Source: Australian Energy Regulator, September 2022

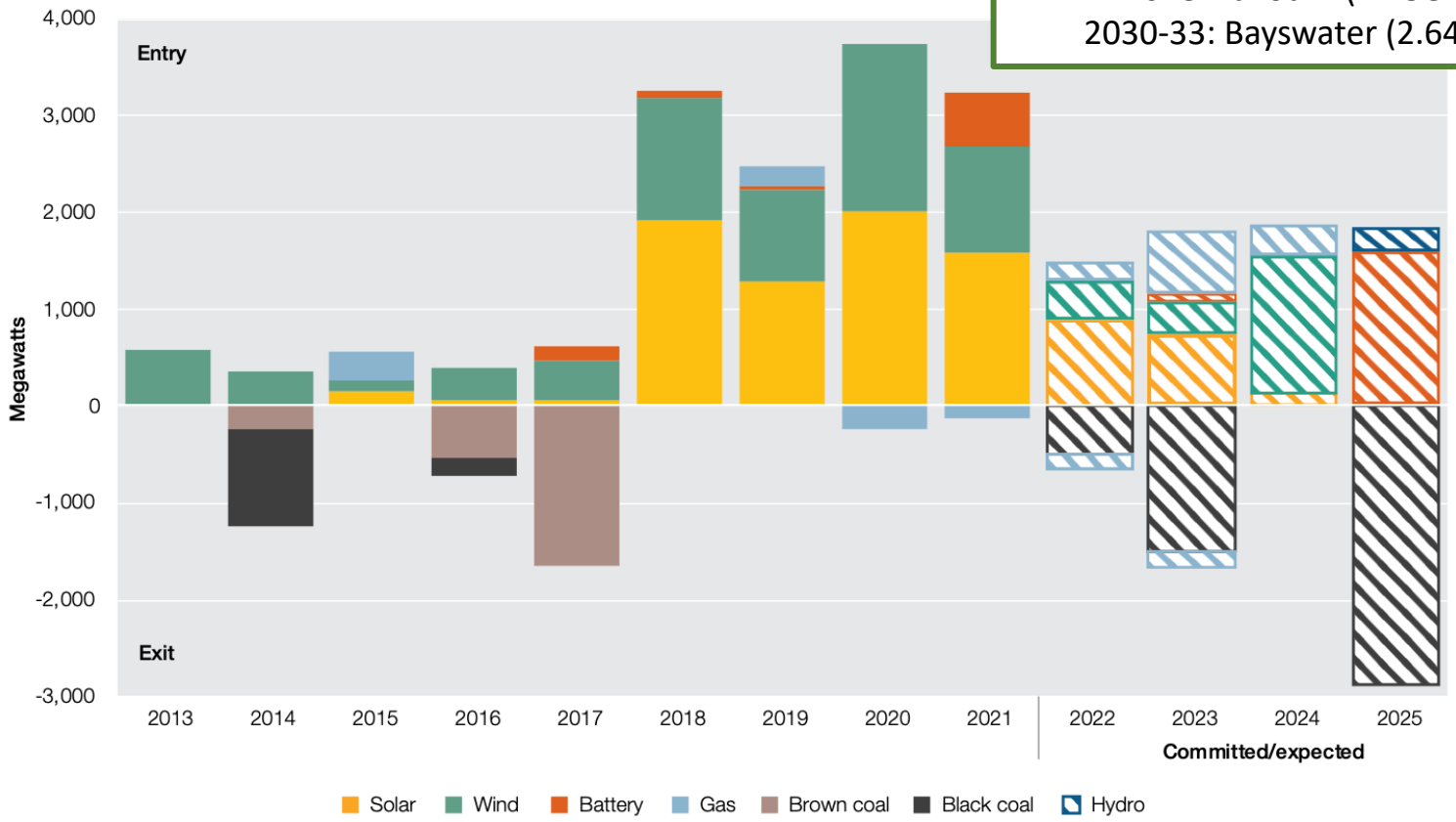
4. Australian Electricity Generation

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

AEMO ESOO 22 Feb'2023 reports investor firmed 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)



Source: Australian Energy Regulator, September 2022

5. 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_2 emissions due to fossil fuel exports[4]

billion tonnes

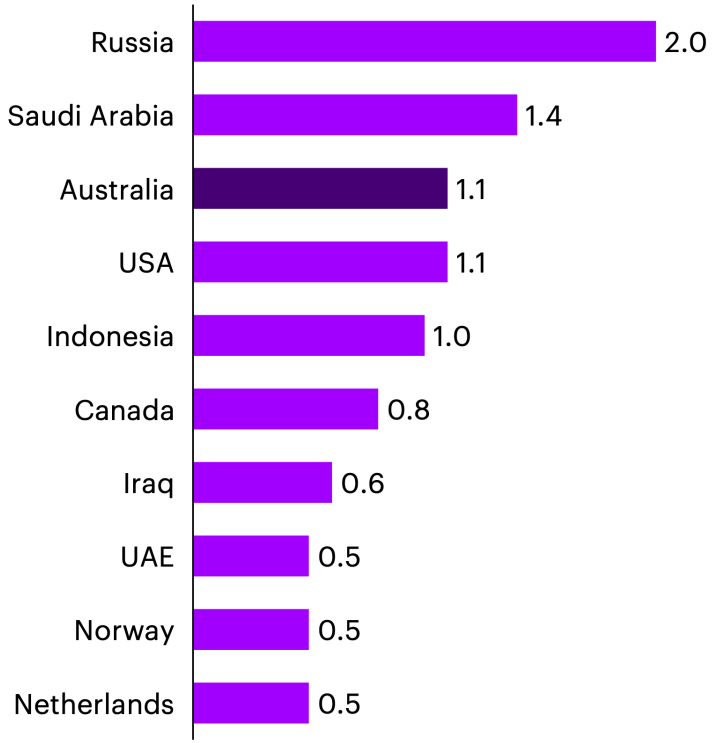
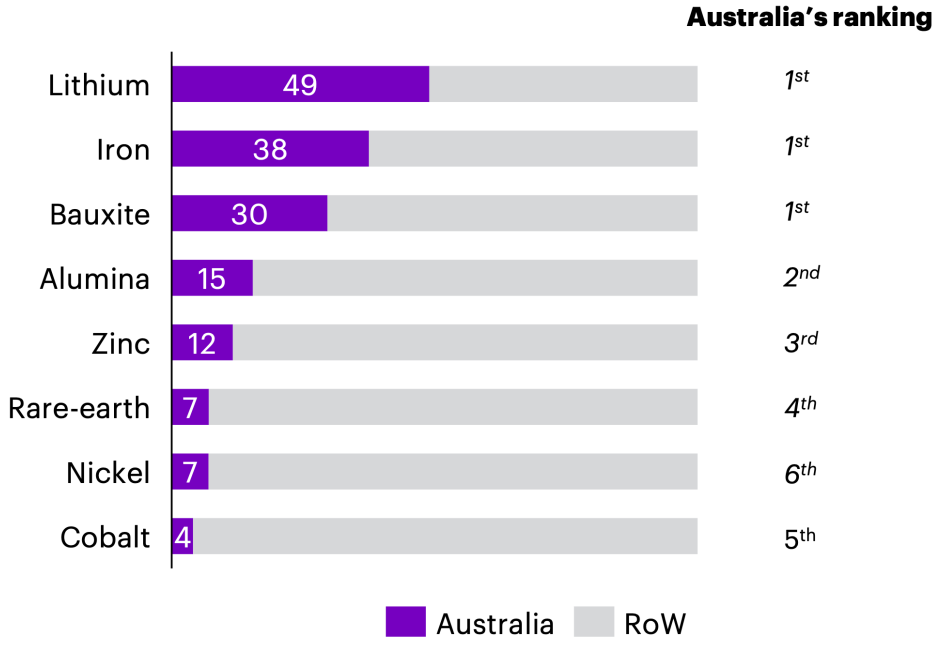


Figure 8: Australia's production of select metals and minerals essential for the energy transition[3]

% of global production

2021



Source: Business Council of Australia, Sunshot : Australia's opportunity to create 395,000 clean export jobs, October 2021
https://www.bca.com.au/sunshot_australia_s_opportunity_to_create_395_000_clean_export_jobs

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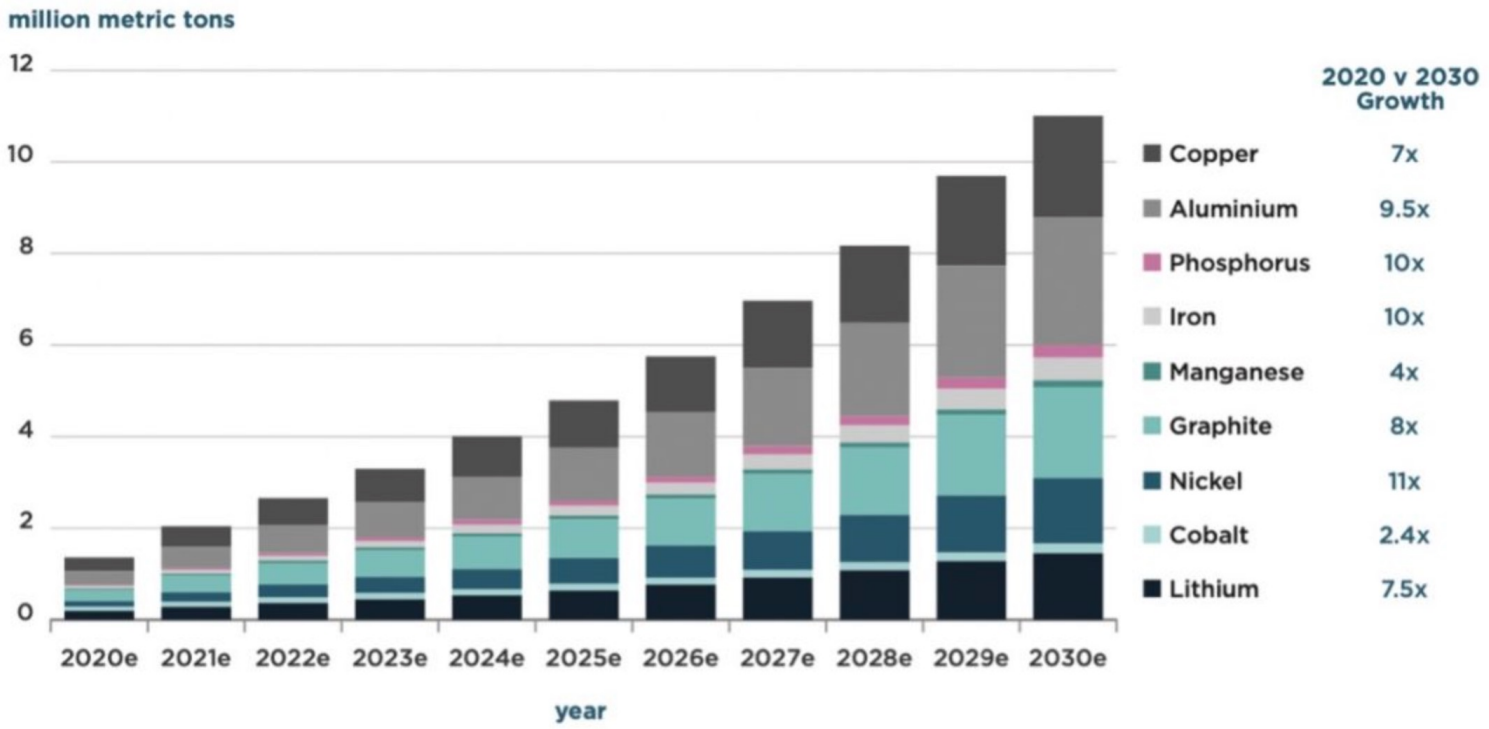

Source: BloombergNEF
Note: Metals demand is assumed to occur approximately one year before battery demand, i.e. metals demand in 2030 is metal content of batteries deployed in 2031 (with allowances for material waste fabrication). Lithium includes material used in cathodes and electrolytes. It is expressed 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.

Source: Renew Economy October 25 2022
https://reneweconomy.com.au/australias-mammoth-renewable-minerals-opportunity-and-how-to-harness-it/

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CLIMATE ENERGY FINANCE

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!

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

with a Foreword by Dr Alan Finkel

Source: https://climateenergyfinance.org/wp-content/uploads/2023/03/1MARCH23final_CRITICAL-MINERALS-REPORT_CLIMATE-ENERGY-FINANCE.pdf

5. 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 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 electrolysers 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.	Government of Western Australia (2022)

Source: "Sunshot in 2023"by Accenture BCA/ACTU/WWF/ACF report, March 2023
https://www.wwf.org.au/news/news/2023/federal-budget-could-shape-australia-s-future-in-the-global-energy-transition#gs.skqp1y