

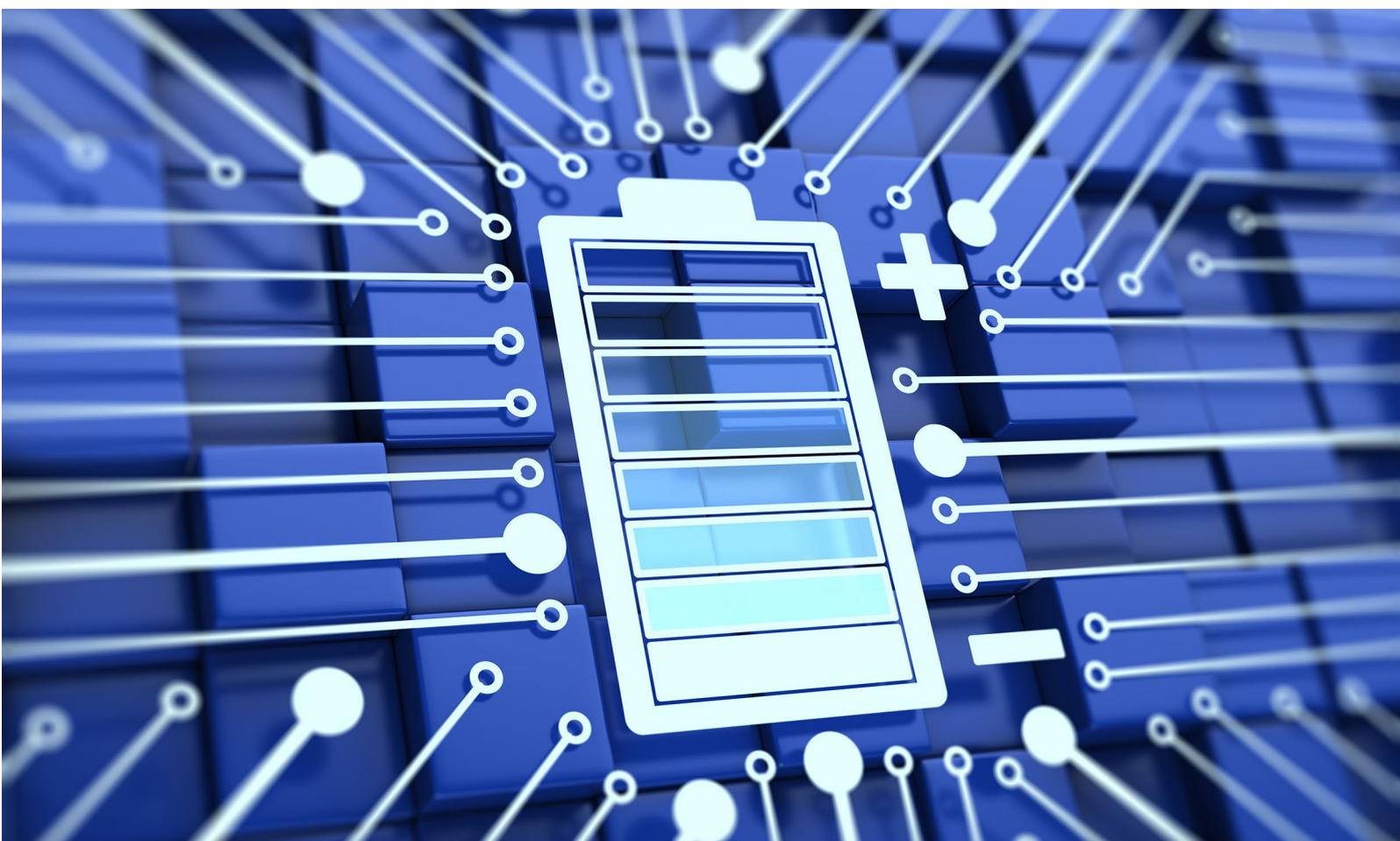


Australian Government
Department of Industry,
Science and Resources

National Battery Strategy

Issues Paper

February 2023



Copyright

© Commonwealth of Australia 2023

Ownership of intellectual property rights

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.

Creative Commons licence



Attribution

CC BY

All material in this publication is licensed under a Creative Commons Attribution 4.0 International Licence, save for content supplied by third parties, logos, any material protected by trademark or otherwise noted in this publication, and the Commonwealth Coat of Arms.

Creative Commons Attribution 4.0 International Licence is a standard form licence agreement that allows you to copy, distribute, transmit and adapt this publication provided you attribute the work. A summary of the licence terms is available from <https://creativecommons.org/licenses/by/4.0/>

The full licence terms are available from <https://creativecommons.org/licenses/by/4.0/legalcode>

Content contained herein should be attributed as *National Battery Strategy: Issues Paper, Australian Government Department of Industry, Science and Resources*.

Disclaimer

The Australian Government as represented by the Department of Industry, Science and Resources has exercised due care and skill in the preparation and compilation of the information and data in this publication. Notwithstanding, the Commonwealth of Australia, its officers, employees, or agents disclaim any liability, including liability for negligence, loss howsoever caused, damage, injury, expense or cost incurred by any person as a result of accessing, using or relying upon any of the information or data in this publication to the maximum extent permitted by law. No representation expressed or implied is made as to the currency, accuracy, reliability or completeness of the information contained in this publication. The reader should rely on their own inquiries to independently confirm the information and comment on which they intend to act. This publication does not indicate commitment by the Australian Government to a particular course of action.

Contents

Introduction	3
Why champion a National Battery Strategy?	3
Domestic battery landscape – state of play	6
Theme 1: Capitalising on our existing advantages	8
Future battery demand	8
Supply chain constraints	8
Australia’s opportunity and challenge	9
Leveraging the mining value chain	10
Theme 2: Turning our innovative ideas into opportunity	12
Theme 3: Encouraging investment to grow our battery industries	14
Battery industry economics	14
Australia’s competitive advantages	14
Government support	15
Theme 4: Creating the enabling environment for industry growth	16
Driving ESG and social license	16
Developing skills and training	17
Product safety	17
Recycling considerations	17
Summary of consultation questions.....	19
How to get involved	20
More information	20

Introduction

Australia can be a renewable energy superpower. As the world moves to net zero emissions, batteries will become a bigger part of our energy mix. Batteries will power electric vehicles (EVs), residential and community scale energy storage, and grid energy storage for small and large systems. Australia can capture increasing parts of these growing markets, building on our strengths in mining and range of battery minerals.

Australia can offer mineral and manufacturing inputs into a wide range of battery chemistries across the value chain. Lithium-ion, sodium-ion, vanadium flow batteries and others, present opportunities for Australia and can support the transition to a net zero emissions economy. Australia will need to have access to diverse types of batteries as demand for batteries for a variety of uses grows.

The Australian Government has announced that it will put in place the building blocks to support battery industries in Australia by:

- releasing a National Battery Strategy, which will outline actions for governments and industry to help build scale and competitiveness
- establishing a Battery Manufacturing Precinct to boost domestic manufacturing
- establishing a Powering Australia Industry Growth Centre to convert Australia's competitive advantages in renewables into local jobs and investment.

This Issues Paper marks the formal launch of the government's consultation on the National Battery Strategy. The National Battery Strategy will complement other government priorities such as the AUD\$15 billion National Reconstruction Fund (NRF), Powering Australia plan (including the National Electric Vehicle Strategy and Australia's emissions reduction target), Rewiring the Nation, A Future Made in Australia, and the Critical Minerals Strategy.

Your views on the National Battery Strategy will help Australia develop a vision to grow a sustainable and thriving battery manufacturing ecosystem. By sharing your views on this Issues Paper you will help the government to identify:

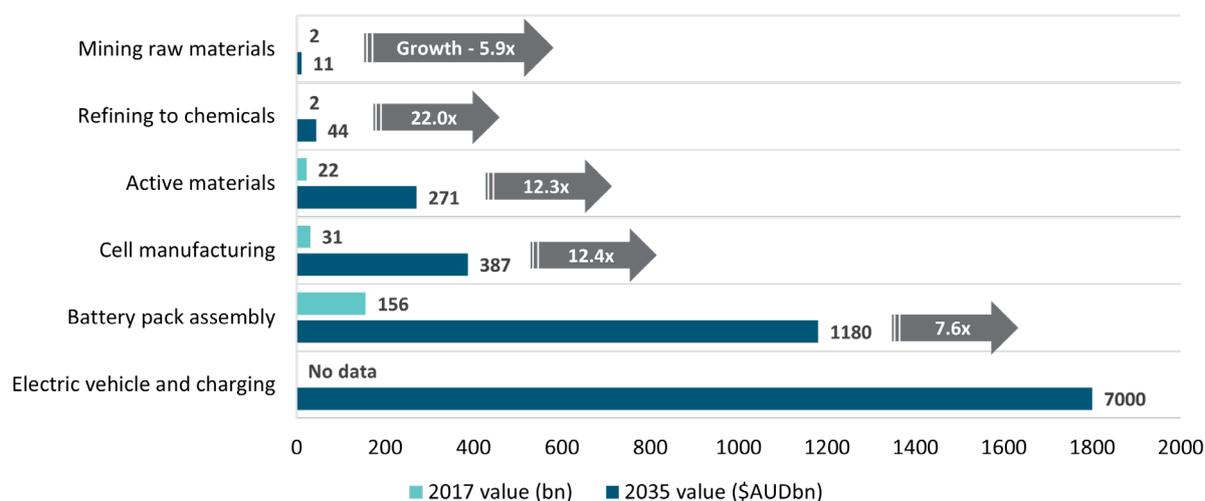
- what Australia's vision should be for our battery industries
- what is achievable and by when
- what actions are needed from government, the research sector and industry.

Why champion a National Battery Strategy?

The National Battery Strategy will help support globally competitive Australian battery industries. It will signal to international partners that Australia is open for investment and ready to play a role in diversifying concentrated global supply chains.

Australia is well positioned to capture opportunities to move up the value chain. The global battery market is expected to expand. In particular, the lithium-ion battery industry is expected to grow by 6 to 22 times across the full value chain (Figure 1). A range of lithium-ion battery chemistries in production have varying costs and different performance characteristics. Vanadium flow batteries present another opportunity for Australia because of our significant vanadium resources and strong research and development (R&D) capacity. New technologies are coming online and present opportunities for Australia to service different parts of the battery value chain.

Figure 1. The global value chain of lithium-ion batteries in 2017 and 2035 per annum in AUD (\$billion)



Source: BloombergNEF analysis, 2021, Australasian Institute of Mining and Metallurgy: Thought Leadership conference, September 2021, Future Battery Industries Cooperative Research Centre

Domestically, batteries will play a critical role in supporting Australia to achieve its net zero emissions targets. Batteries can deliver firming capacity to support an increasing share of renewable energy generation. Firming capacity is needed for the National Electricity Market (NEM) to increase its use of renewables to 82 per cent by 2030 under the Powering Australia plan. Demand for batteries is forecast to accelerate by as much as tenfold over the next decade. This is more than solar photovoltaics (PV) grew over the last decade.¹

Australia’s competitive advantages in critical minerals and strong R&D capacity can help diversify and grow our battery industries. This provides Australia with a unique opportunity to be a world leader in a future industry that will create jobs and attract investment. Analysis carried out in 2021 showed that investment in Australia’s battery industries could create 34,700 jobs and add AUD\$7.4 billion in gross value to the economy.² Since the release of this report, rising lithium prices are now expected to see Australia’s mined exports of lithium alone reach more than AUD\$16 billion in 2022–23.³

¹ Accenture, 2021, *Future Charge: Building Australia's Battery Industries*, Future Battery Industries Cooperative Research Centre

² Accenture, 2021, *Future Charge: Building Australia's Battery Industries*, Future Battery Industries Cooperative Research Centre

³ Department of Industry, Science and Resources, 2022, *Resources and Energy Quarterly*, Published December 2022

Australia's battery industries could help support domestic and global moves to a clean energy economy in the following ways:

- Australia can play a role to advance secure, resilient, and sustainable global supply chains. This could be achieved by supporting the development of a domestic battery manufacturing ecosystem. This could improve export opportunities and help mitigate the risks of supply chain disruption in the Indo-Pacific and beyond as the world transitions to net zero emissions.
- Our research sector is advanced. Australian universities, research institutions, and the private sector have expertise in mineral extraction and refining, as well as battery production and deployment. This know-how could be used to manufacture battery grade chemicals and precursors.

Australia is not alone in seeing value in battery industries. Internationally, governments are moving fast to diversify their countries' economies and scale-up battery production. For example:

- China, the United States (US), the European Union (EU), and Japan have adopted battery industry development strategies. These strategies aim to secure the rights to low value raw materials overseas, while preserving domestic value adding activities.
- The US Government's *Inflation Reduction Act* will result in USD\$369 billion in new climate and energy spending. This includes USD\$7 billion of direct subsidies for projects that support battery production, from raw mineral extraction through to cell and pack manufacturing.⁴ The US intends to give significant tax credits to purchasers of EVs that meet critical mineral and battery component content requirements. This has accelerated investment momentum in the US.
- Canada has earmarked up to CAD\$3.8 billion to build a domestic critical metals supply chain.⁵

Battery manufacturing industries overseas have benefited from government support, for example:

- The first Tesla Gigafactory in Nevada (US), built in 2015, received USD\$1.3 billion in state tax concessions and enabling infrastructure. In return, Nevada set a benchmark of USD\$3.5 billion of private capital investment, which was met within 4 years of the agreement.⁶
- The EU committed over AUD\$9.6 billion in subsidies for battery production.⁷
- The United Kingdom (UK) gave AUD\$740 million in R&D support to create the Faraday Institution and UK Battery Industrialisation Centre.⁸

⁴ ibid

⁵ ibid

⁶ Spillman, B., 2018, "Tesla Gigafactory surges past Nevada tax break benchmarks despite bumpy ride", *Reno Gazette Journal*, published 21 August 2018

⁷ Future Battery Industries Cooperative Research Centre, 2022, *Pre-Budget Submission 2022*

⁸ ibid

Domestic battery landscape – state of play

Australian businesses and researchers are present at every stage of the battery value chain. As the industry expands there will be opportunities to grow that presence. These opportunities go beyond manufacturing, and include research, servicing, and recycling. States and territories continue to set ever higher targets for renewable energy uptake, batteries will be an important part of this transition. This demand for batteries creates a market for Australian battery industries.

This section includes examples of activity in each state and territory. This is not a complete summary of the industry activities in each state.

New South Wales (NSW) – NSW is home to battery minerals, energy storage projects, research and several local battery manufacturers. This will be boosted by the NSW Government’s \$250 million Renewable Manufacturing Fund. Battery projects are reported in their accelerated NSW Electricity Infrastructure Roadmap, including the 850MW/1,680 MWh Waratah Super Battery.⁹

Victoria (VIC) – The VIC Government has recently released its Made in Victoria 2030: Manufacturing Statement. This outlines the state’s plans and vision for the future of Victorian manufacturing.¹⁰ The plan includes the development and production of zero and low emissions technologies, with batteries earmarked as a state priority. VIC is also trialling domestically manufactured electric buses with all new buses to be electric from 2025.

Queensland (QLD) – In October 2022, the QLD Government released its Energy and Jobs Plan. It has an approach to reach 70 per cent renewable energy by 2032. Battery manufacturing is noted as a critical part of the plan, with a commitment of AUD\$500 million for grid and community batteries. The QLD Government is also developing a Queensland Battery Industry Strategy. The Commonwealth Government will inject up to AUD\$100 million into an Australian Made Battery Precinct to support the development of Australian battery industries.

Western Australia (WA) – WA has vast reserves of critical minerals, existing export markets and integrated industrial expertise, including battery grade chemical production. In 2021, WA produced 55,000 tonnes of lithium for AUD\$2.6 billion, making it the largest producer of lithium worldwide.¹¹ In 2019, the WA Government produced a Future Battery Industry Strategy seeking to have a well-known battery industry in WA by 2025.¹² WA’s state-owned Western Power intends to roll out 4,000 standalone power systems, with over 100 installed so far.

South Australia (SA) – In 2021, renewable energy generated 63 per cent of underlying demand in SA and exceeded demand on 180 days in 2021.¹³ This includes large battery projects funded by the SA Government’s AUD\$50 million grid scale storage fund. SA has a battery minerals endowment, with 67 per cent of Australia’s copper resources, and 65 per cent of the country’s graphite.¹⁴

Tasmania (TAS) – TAS has reserves of nickel and cobalt. The Barnes Hill nickel-cobalt mine, in the Tamar Development Corridor, aims to mine 500,000 tonnes of nickel and cobalt per year.¹⁵ TAS also has a reputable chemical industry, which produces key battery chemical precursors. Chemical processing expertise is a critical aspect of any value adding industry in battery materials.

⁹ NSW Government, 2022, *Electricity Infrastructure Roadmap*

¹⁰ Department of Jobs, Skills, and Regions, 2022, *Made in Victoria*, Victoria State Government

¹¹ Government of Western Australia, 2022, *A Global Battery and Critical Minerals Hub*

¹² Western Australia Government, 2019, *Future Battery Industry Strategy*

¹³ Government of South Australia, 2022, *Leading the Green Economy: Renewable Energy*

¹⁴ *ibid*

¹⁵ Mining Technology, 2013, *Barnes Hill Nickel-Cobalt Mine, Tasmania*, published 31 July 2013

Australian Capital Territory (ACT) – The ACT’s Battery Storage and Grid Integration Program (BSGIP) at the Australian National University (ANU) supports battery R&D. The ACT has a target of 65 to 75 per cent emission reductions by 2030, 90 per cent by 2040 and net-zero emissions by 2045. The strategy to hit these targets includes large installations such as the Big Canberra Battery, a large scale battery storage system of at least 250MW.¹⁶

Northern Territory (NT) – The NT Government has set a target of 50 per cent renewable energy by 2030. The NT is home to some mineral deposits needed for batteries. This includes the world’s largest high-grade manganese deposit at Groote Eylandt and the Bynoe Pegmatite Field, which has been identified as a potential lithium district.¹⁷ The NT Government has also signalled intent for local precursor cathode material manufacturing plant.

¹⁶ ACT Government, 2021, *Big Canberra Battery*

¹⁷ Rawlings, D., 2017, *Lithium-rich pegmatites of the Bynoe Field*, Northern Territory Government

Theme 1: Capitalising on our existing advantages

Australia is the dominant player in the mining of battery materials. Australia's access to significant raw material reserves positions us to realise greater value. Australia can help to diversify global supply chains by developing local industry and working closely with its international partners.

Future battery demand

As the world transitions to net zero emissions, the global battery market is expected to grow at an unprecedented rate. Energy storage is forecast to grow to 1,028GWh by 2030. This is up from 34GWh in 2020. This is expected to attract USD\$262 billion in investment between 2021 and 2030.¹⁸

The International Energy Agency (IEA) reports that annual global battery production for EVs could increase from 160GWh to 6,600GWh in 2030. This is the equivalent of adding 20 gigafactories each year this decade.¹⁹

Supply chain constraints

The battery production supply chain is geographically concentrated. China currently holds the largest market share of battery production at most stages of the supply chain (see Figure 2), particularly in the EV battery market.²⁰ It accounts for about 75 per cent of the world's production capacity for battery cells, 70 per cent of cathode capacity, and 85 per cent of anode capacity.²¹

The battery supply chain is complex and is at high risk of disruption due to geographic and ownership concentration. Supply risks are acute for battery components due to diverse inputs and complex processing required for manufacturing. The IEA reports that *'concentration at any point along the supply chain makes the entire supply chain vulnerable to incidents, be they related to individual country policy choices, natural disasters, technical failures or company decisions'*.²²

Vulnerabilities are noticeable across the lithium supply chain, where there are no alternative battery chemistries to replace lithium products at scale.²³ Recent events, such as Russia's illegal invasion of Ukraine, have led to international trade disruptions.

Australia has an opportunity to add diversity to supply chains and benefit as a result. Development of Australia's nickel, cobalt, graphite, and vanadium resources and downstream investment could aid the diversification of battery supply chains and add value domestically.

¹⁸ Bloomberg New Energy Finance, 2021, *Global Energy Storage Market Set to Hit One Terawatt-Hour by 2030*

¹⁹ International Energy Agency, 2021, *Net Zero by 2050: A roadmap for the global energy sector*

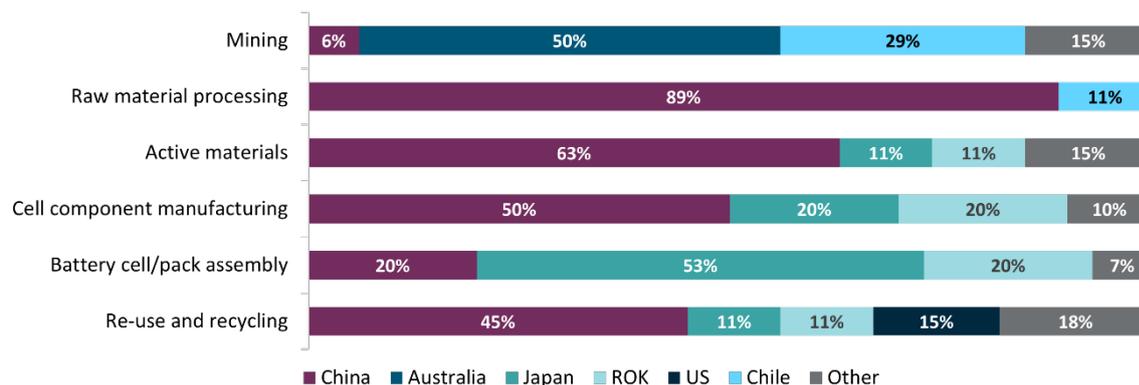
²⁰ International Energy Agency, 2022, *Securing clean energy technology supply chains*

²¹ *ibid*

²² International Energy Agency, 2022, *Securing clean energy technology supply chains*, p.20

²³ *ibid*

Figure 2: The global lithium-ion battery value chain segments and market shares



Source: Accenture, 2021, *Future Charge: Building Australia's Battery Industries*, Future Battery Industries Cooperative Research Centre.

Australia's opportunity and challenge

Australia could de-risk investment in domestic manufacturing by promoting battery technologies forecast to be deployed locally. Australian battery manufacturers are developing niche products that will support continued access for customers. Australia could capture more opportunities by playing to our innovation strengths and developing our own niche products for export.

Australia's unique climate could present opportunities for Australia to research and develop specialist battery applications for hot climates. This could improve market access to like-climate countries for such products. Australia's geography has resulted in advances in distributed energy resources and remote area power systems, which could be another area for specialisation.

Novel solutions could see buyers willing to pay a price premium. Australia can promote its battery safety and reliability standards, and its ESG credentials.

Energy Storage Systems (ESS) are being installed around Australia to manage a range of challenges for businesses and the grid. Diversity in dispatchable firming resources will become more valuable as renewables become the dominant source of generation. This could present opportunities for domestic battery manufacturers to maintain and service these batteries. The Australian Energy Market Operator's (AEMO) Integrated System Plan shows that the NEM will need firming capacity of 640GWh by 2050. This includes 16GW from utility-scale battery and pumped hydro storage.²⁴

By 2032, AEMO reports that over half of the homes in the NEM are likely to have installed a solar PV rooftop system. This rises to 65 per cent by 2050, for a capacity of 69GW.²⁵ It is reported that most systems will be complemented by behind-the-meter battery energy storage.²⁶ The Commonwealth Scientific and Industrial Research Organisation (CSIRO) reports that Australia could deploy 212GWh of stationary energy storage by 2050 for commercial and residential applications.²⁷ Growth in urban and regional battery use could be leveraged in Australia to offer integrated design and after-service solutions.

²⁴ Australian Energy Market Operator, *2022 Integrated System Plan*, published June 2022

²⁵ *ibid*

²⁶ *ibid*

²⁷ Bruce S, Delaval B, Moisi A, Ford J, West J, Loh J, Hayward J, 2021, *Critical Energy Minerals Roadmap*. CSIRO, Australia

Local battery production could help meet domestic ESS forecasts and mitigate constraints in export markets. Australia's location in the Indo-Pacific, which is expected to see substantial growth in battery technology uptake, is an advantage.

Leveraging the mining value chain

The future global economy will be supported by technologies that rely on critical minerals. ESS and EVs will account for about half of the mineral demand from clean energy technologies over the next 2 decades.²⁸ Australia's new Critical Minerals Strategy, currently under development, is the government's primary vehicle for encouraging industry to move downstream from raw materials into processed chemicals and production of metals.

Critical Minerals Strategy

The Critical Minerals Strategy will outline the Government's priorities for the development of the critical minerals sector. Critical minerals are crucial inputs to battery technologies, so there are close links between the National Battery Strategy and the Critical Minerals Strategy. Both strategies will work together to target different parts of the battery value chain. The Critical Minerals Strategy will support the development of Australia's upstream critical minerals mining and processing sector, while the National Battery Strategy will focus on the downstream manufacturing and assembly components of the value chain. Cross-cutting issues, such as strong partnerships with First Nations people, ensuring high Environmental, Social and Governance (ESG) standards, reducing emissions and recycling, will be a focus of both strategies. Further information on the work of the Critical Minerals Office can be found on the Departments [website](#).

A current area of strength for Australia, in global battery industries, is clearly shown in the mining of battery raw materials (see Figure 2). Mining also generates significant and rapidly expanding value for Australia. Lithium exports alone are expected to more than triple in 2022-23 to reach \$16 billion in value.²⁹ Australia can maintain its position as a world leader in the mining of raw materials. Pursuing diversified battery industries can add more value to the Australian economy. By moving up the value chain, Australia can capture greater opportunities, including in segments like chemical refining and active materials manufacturing.

Australia has limited mineral refining capacity, with few existing projects producing battery grade chemicals, and cathode and anode active materials. Australian minerals are often shipped as raw materials for overseas processing. Australia has an opportunity to build on its early success in mineral refinement and move up the value chain to add more value domestically.

²⁸ International Energy Agency, 2021, *Security of Clean Energy Transitions*, published July 2021

²⁹ Department of Industry, Science and Resources, December 2022, *Resources and Energy Quarterly*

Australia ranks in the top ten for economically demonstrated battery mineral resources;³⁰

- Nickel (1st)
- Zinc (1st)
- Lithium (2nd)
- Vanadium (2nd)
- Cobalt (2nd)
- Bauxite – Aluminium/High Purity Alumina – (2nd)
- Manganese ore (4th)
- Graphite (8th).

This shows the potential for Australia to capture more value from its own natural endowments. However, mining cycles can result in shifts to supply in the short term and may require careful consideration of investments to capture more value.

To capture these opportunities Australia could co-locate mining operations and precursor cathode active material (pCAM) production to facilitate vertical integration, with shared infrastructure having the potential to spread upfront capital costs.

While innovation and economies of scale have rapidly reduced the cost of batteries, new technologies can also be explored. Investments made through investment vehicles like the NRF could support commercialisation of prospective battery capabilities. Long term offtake agreements can help mitigate market risks.

Brownfield projects could also be developed, for example, opportunities could exist by extracting metals from tailings. It is estimated, that in WA alone, 720 kt of nickel could be recovered from more than 240 Mt of tailings containing 0.5 per cent nickel. This is a quarter of current global demand.³¹

Theme 1: Moving up the value chain

Q1.1: What are Australia's existing advantages? How can Australia capitalise on its existing advantages? And how can Australia expand these advantages?

Q1.2: What areas of the global battery supply chain should Australia focus on, and where are the potential barriers and vulnerabilities for Australian industries in the global supply chain?

Q1.3: How should government, industry, and researchers support Australia's battery industries to grow and compete?

³⁰ Geoscience Australia, 2021, *Australia's Identified Mineral Resources 2021*

³¹ International Energy Agency, 2022, *World Energy Investment 2022*, published June 2022.

Theme 2: Turning our innovative ideas into opportunity

Australia has world-class technical expertise, research capabilities and facilities. As battery technologies evolve, manufacturers are seeking to make improvements to the stability and performance of their batteries. Australian research bodies are advancing technologies and developing marketable products across the battery value chain.

Australia has significant capacity through university, industry, and government-supported research systems. This helps drive innovation in battery technologies, such as materials for batteries, devices, integration, and the application of these technologies. This can foster strong international impact by developing and commercialising R&D in battery technologies. However, private research and development investment in Australia is largely at the same level as it was a decade ago and is down 4.5 per cent between September 2012 and September 2022, according to the Australian National Accounts. Encouraging increased private R&D investment will be important to support battery innovation in Australia.

Supporting battery technology innovation is critical to tackling energy policy aims, such as the global transition to net zero emissions by 2050. Tracking progress on clean technology innovation is challenging. The correlation between inputs – finance and skills – and intermediate outputs – patents and products – can be unclear.³² However, some indicators can help shed light on clean energy innovation.

IP Australia reports that Australian applicants or inventors are successful in co-filing patents in battery technologies.³³ This indicates Australian entities' abilities to export and import battery technology knowledge. Australian entities have filed 3,487 trademarks to do with batteries and 2,052 to do with energy supply and storage.³⁴

The CSIRO reports that Australia runs into intellectual property (IP) barriers in the manufacturing of components. This is evident when a high degree of specification is required.³⁵ Local manufacturing may need to depend on the licencing of IP and partnering with international original equipment manufacturers (OEMs). The US, EU and Asia have mitigated this risk through sizeable investments in battery technology. This has led to significant domestic know-how and IP in manufacturing processes and technology design.³⁶

Australia indexes well on innovation inputs but is inefficient in translating its investments in innovation into commercialised products.³⁷ Australia continues to rank highly in the Global Innovation Index (2021) for its institutions (10th) and human capital and research (12th).³⁸

³² International Energy Agency, 2020, *Energy Technology Perspectives 2020*, published September 2020.

³³ IP Australia, 2021, *The Power of Innovation: A patent analytics report on the Australian Battery Industry*, published June 2021, Australian Government

³⁴ *ibid.*

³⁵ Bruce S, Delaval B, Moisi A, Ford J, West J, Loh J, Hayward J, 2021, *Critical Energy Minerals Roadmap*. CSIRO, Australia.

³⁶ *ibid.*

³⁷ World Intellectual Property Organisation, 2021, *Global Innovation Index 2021*

³⁸ For the purposes here: human capital and research refers to – Education; Tertiary education; and Research and development (R&D); Institutions – Political environment; Regulatory environment; and Business environment; and Knowledge and technology outputs – Knowledge creation; Knowledge impact; and Knowledge diffusion

Theme 2: Turning our innovative ideas into opportunity

Q2.1: How should Australia build on its strengths in R&D and innovation to commercialise more battery related research?

Q2.2: How could Australia best promote its strengths in R&D to grow domestic battery industries?

Q2.3: What steps should governments, or a Growth Centre-like entity, take to support growth of domestic battery industries?

Theme 3: Encouraging investment to grow our battery industries

Capital investment and demand security is critical to growing domestic battery industries. Local demand for batteries and Australia’s investment attractiveness can support growth of Australian battery industries. Initial investment and support for Australian battery industries could be targeted to support areas that build on Australia’s advantages, minimise barriers, and deliver stronger value for money.

Battery industry economics

Significant capital expenditure is required for battery manufacturing to operate at scale. For example, a feasibility study found that a gigafactory in Townsville would cost an estimated AUD\$3 billion.³⁹

Australia has a proven record of attracting significant investment. Since the mid-2010s, WA has attracted more than AUD\$9 billion in investment for a range of battery and critical mineral projects.⁴⁰ However, increasing the pace of R&D investment will be critical in stepping up our overall R&D effort. To diversify Australia’s battery industries, it is estimated that AUD\$17–\$23 billion of investment is needed by 2030.⁴¹

Australia’s competitive advantages

Australia’s strength in the mining industry could be consolidated into downstream processing to realise advantages from vertical integration. This is discussed in [Theme 1](#). There are skills, technology, and process overlap across the mining and chemical industries that are involved in manufacturing active materials and battery cells.

Australia is a world leader in Mining Equipment, Technology and Services (METS). With mining equipment batteries increasing in demand there could be an advantage for local mining industries if these batteries are manufactured and serviced in Australia. Australia has also established standalone power system, bus, truck and defence manufacturing for local offtake.

Australia’s abundance of renewable electricity resources can be an advantage for ESG, helping to decarbonise emissions intensive parts of the battery value chain. Emissions intensity is an important factor in Australia’s global competitiveness. This is particularly relevant in markets considering scope 3 emissions – indirect emissions generated as a consequence of a facility’s activities.

³⁹ Parkinson, G., 2019, *Magnis puts cost of Townsville battery “gigafactory” at \$3 billion*, Renew Economy, published 4 October 2019

⁴⁰ Government of Western Australia, 2022, *New battery and critical minerals prospectus to power investment*, published 22 June 2022

⁴¹ Accenture, 2021, *Future Charge: Building Australia’s Battery Industries*, Future Battery Industries Cooperative Research Centre

Government support

Battery industries globally have benefited from government support. In developing the National Battery Strategy, Government may consider a range of actions, such as local content requirements, to support the growth of our battery industries.

The government has committed to establishing a Powering Australia Industry Growth Centre. This could provide advanced technology and skills development to businesses looking to locally manufacture renewable energy technologies.

The AUD\$15 billion NRF is being established to support, diversify and transform Australia's industry. The government has targeted up to AUD\$6 billion in NRF finance to areas which cut across the battery value chain:

- AUD\$1 billion for advanced manufacturing
- Up to AUD\$3 billion for renewables and low emissions technologies
- AUD\$1 billion for value-adding in resources
- AUD\$1 billion for critical technologies.

The development of manufacturing precincts can be another form of support for Australian battery industries. Precincts can help networks of organisations to work together. This can achieve cost savings on logistics and materials, aid knowledge transfers and the sharing of infrastructure to reduce waste. This can encourage consistent application of compliance and help with product differentiation and marketing in this globally competitive industry.

The Australian Government, in partnership with the Queensland Government, is investigating methods to deliver a Battery Manufacturing Precinct. This includes a commitment of up to AUD\$100 million in equity to support establishing a battery manufacturing precinct in Queensland.

Theme 3: Encouraging investment to grow our battery industries

Q3.1: What are the barriers to investing in Australia's battery industries, and how can they be mitigated? How can governments encourage more investment?

Q3.2 What areas could Australian-made batteries have a competitive advantage for use in Australia and for export?

Q3.3: What functions or forms of help should the Powering Australia Industry Growth Centre deliver to support Australian battery industries?

Q3.4: How can the additional advantages of a precinct model and collaborative vertical integration be achieved for our battery industries?

Theme 4: Creating the enabling environment for industry growth

Community support, social license to operate, and a skilled and diverse workforce are vital for successful and sustainable domestic battery industries.

Australia has an enviable record on product safety and compliance with international standards. This is an advantage and opportunity to show to international markets that batteries manufactured here can be of high quality. As demand for batteries grows, there is an opportunity for Australia to create a circular economy by developing a robust recycling program.

Driving ESG and social license

As ESG standards play an important role in the manufacturing and resources sectors, Australia's ESG environment understands the need to maintain social license to operate. ESG can play an important role in securing community endorsement and fulfilling the broader objectives of the government. This includes priorities such as gender equality and respect in the workplace, biodiversity protection, and meaningful consultation with First Nations communities.

Ensuring that the battery supply chain is ethical and complies with leading ESG practices is necessary for Australia to develop reliable and attractive supply chains. Creating growing battery industries in Australia could see a rapid scale up in production across different sectors. ESG standards should not be overlooked during this transition. Transparency is an area of strength for Australia. It is easier to verify, for example, that no child labour practices are present when sourcing lithium or cobalt in Australia.⁴²

While batteries are vital for the renewable energy transition, environmental impacts are present throughout the value chain. Battery manufacturing can be water and energy intensive; for example, the extraction of lithium can use over 2 tonnes of water per tonne of lithium.⁴³ Australia has strong environmental regulations which will help mitigate many of these risks. Conserving water and energy, where possible, in battery manufacturing projects will be vital to upholding social license and limiting environmental impacts. To ensure this occurs, the government is currently reforming the *Environment Protection and Biodiversity Conservation Act 1999* to help protect and manage our environment.⁴⁴

Battery manufacturing in Australia presents an opportunity for First Nations communities to support and achieve independent and renewable energy storage. First Nations Australians play an important role in Australia's long term economic prosperity. First Nations businesses contribute AUD\$2.2 to AUD\$6.6 billion to Australia's gross domestic product.⁴⁵ Much of the land required at various stages of the battery value chain is Aboriginal land or subject to Native Title claims. Working together in partnership with communities will result in shared benefits for industry and people. Alignment with the objectives of Closing the Gap and the implementation of the Uluru Statement of the Heart will further these benefits.

⁴² Australian Government, 2022, *Towards a clean and secure energy in the Indo-Pacific*, published 24 September 2022

⁴³ Institute for Energy Research, 2020, *The Environmental Impact of Lithium Batteries*, published 12 November 2020

⁴⁴ Department of Climate Change, Energy, Environment and Water, 2022, *EPBC Act reform*

⁴⁵ PricewaterhouseCoopers Consulting Australia, 2018, *The contribution of the Indigenous business sector to Australia's economy*

Internationally, ESG considerations for battery manufacturing are continuing to mature. Currently, the EU is developing a Battery Passport that certifies compliance with legal and societal emission standards.⁴⁶ Initiatives like this are an opportunity for Australia to promote itself as an attractive source across the battery value chain due to our high ESG implementation and product standards.

Developing skills and training

Australia has a substantial university-educated population, yet several of the most specialised battery-relevant fields are seeing declining graduate numbers. This is a trend that could impact growing battery industries seeking to find local talent.⁴⁷ However, there are opportunities to link knowledge in mining and metallurgy (i.e. engineers and metallurgists) with chemical knowledge, to improve manufacturing of battery products. Australia should foster both skillsets and encourage crossover and knowledge-sharing opportunities.

To help the skills needed for Australia's clean energy infrastructure the government has pledged AUD\$95.6 million over 4 years to fund 10,000 New Energy Apprenticeships and AUD\$9.6 million for a New Energy Skills Program. The government has also committed to a Clean Energy Capacity Study, to help identify and develop the skills needed for Australia's Clean Energy Sector.

Product safety

Australia generally has strong product safety standards, and any batteries and supply chain products manufactured here must continue to be consistent with those. However, imported batteries, particularly in small e-mobility devices, have led to fires. The ACCC is currently scoping product safety issues for consumer lithium-ion batteries and hazard prevention strategies.⁴⁸

Australian batteries could be more attractive if produced to high quality manufacturing standards. Reputable manufacturers, or jurisdictions with strong regulations and standards, who have adopted relevant international protocols, will play a critical role. In March 2022, Australia became a signatory to the United Nations Global Technical Regulation (GTR) on In-Vehicle Battery Durability. This helps ensure that minimum requirements are met for batteries fitted in EVs, mitigating the use of low-quality batteries and increasing the environmental performance of EVs.⁴⁹

Recycling considerations

Australia could capitalise on a longer-term opportunity by recycling batteries and recovering their materials to create a circular economy. Circularity can improve the environmental benefits of batteries. This could be achieved by limiting turnover of batteries in use, repurposing older batteries for different applications, and recycling used materials to manufacture new batteries. Battery recycling represents an opportunity to develop an additional local industry for Australians, creating additional jobs and adding value to the economy.

Lithium-ion batteries are not being recycled at scale globally due to a lack of waste stock to feed recycling. However, demand for materials and constrained supply in the coming years means that the recycling of batteries may become cost effective for certain battery chemistries.

⁴⁶ Global Battery Alliance, 2022, *Greenhouse Gas Rulebook*

⁴⁷ Accenture, 2021, *Future Charge: Building Australia's Battery Industries*, Future Battery Industries Cooperative Research Centre

⁴⁸ Australian Competition & Consumer Commission, 2023, *Lithium-ion Batteries – Issues Paper*

⁴⁹ International Energy Agency, 2022, *Global Supply Chains of EV Batteries*, published July 2022

Recycling rates for lithium-ion batteries in Australia are under 10 per cent, compared to 95 per cent for lead-acid batteries.⁵⁰ There is potential to recover 90 per cent of lithium-ion materials by developing higher value recycling processes. Batteries that are not recycled effectively and end up in landfill can lead to further environmental and safety risks, for example, through mixed waste fires.⁵¹

Australia has a Battery Stewardship Scheme in place for small consumer batteries (B-Cycle). This increases and encourages the recovery and recycling of end-of-life batteries.⁵² Mobile and stationary storage batteries currently do not have similar schemes. The nature of battery recycling processes could present an opportunity in Australia as OEM's move towards batteries designed for recyclability.

Theme 4: Creating the enabling environment for industry growth

Q4.1: What can be done to develop the workforce necessary for domestic battery industries?

Q4.2: How can Australia best maintain a world leading environmental, social and governance reputation for products?

Q4.3: What can be done to give confidence that Australian product safety risks are effectively understood, mitigated and managed?

Q4.4: How can governments and industry ensure circular economy principles are incorporated into the life cycles of batteries made and used in Australia?

⁵⁰ Zhao, Y., Ruehter, T., Bhatt, A., & Stains, J., 2021, *Australian landscape for lithium-ion battery recycling and reuse in 2020*, published 25 February 2021, Future Battery Industries Cooperative Research Centre

⁵¹ *ibid*

⁵² Battery Stewardship Council, 2022, *Factsheet*

Summary of consultation questions

Theme 1: Moving up the value chain

Q1.1: What are Australia's existing advantages? How can Australia capitalise on its existing advantages? And how can Australia expand these advantages?

Q1.2: What areas of the global battery supply chain should Australia focus on, and where are the potential barriers and vulnerabilities for Australian industries in the global supply chain?

Q1.3: How should government, industry, and researchers support Australia's battery industries to grow and compete?

Theme 2: Turning our innovative ideas into opportunity

Q2.1: How should Australia build on its strengths in R&D and innovation to commercialise more battery related research?

Q2.2: How could Australia best promote its strengths in R&D to grow domestic battery industries?

Q2.3: What steps should governments, or a Growth Centre-like entity, take to support growth of domestic battery industries?

Theme 3: Encouraging investment to grow our battery industries

Q3.1: What are the barriers to investing in Australia's battery industries, and how can they be mitigated? How can governments encourage more investment?

Q3.2: What areas could Australian-made batteries have a competitive advantage for use in Australia and for export?

Q3.3: What functions or forms of help should the Powering Australia Industry Growth Centre deliver to support Australian battery industries?

Q3.4: How can the additional advantages of a precinct model and collaborative vertical integration be achieved for our battery industries?

Theme 4: Creating the enabling environment for industry growth

Q4.1: What can be done to develop the workforce necessary for domestic battery industries?

Q4.2: How can Australia best maintain a world leading environmental, social and governance reputation for products?

Q4.3: What can be done to give confidence that Australian product safety risks are effectively understood, mitigated and managed?

Q4.4: How can governments and industry ensure circular economy principles are incorporated into the life cycles of batteries made and used in Australia?

How to get involved

We welcome your views on the National Battery Strategy. This is your opportunity to help us identify a vision for Australia's future battery industries and understand actions needed from government, industry and researchers.

If there are any insights you wish to share that are not covered by the above questions, please include them in your submission.

To have your say visit: <https://consult.industry.gov.au/national-battery-strategy-issues-paper>

More information

For more information on the National Battery Strategy visit industry.gov.au/batterystrategy