

Submission to Australia's transition to a green energy superpower inquiry

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Introduction

The Australian Parliament's Joint Standing Committee on Trade and Investment Growth (JSCTIG) has commenced an inquiry into *Australia's transition to a green energy superpower*.

The inquiry's Committee is particularly interested in:

- where trade and investment activities are already having a positive impact;
- emerging and possible future trends;
- the role of key commonwealth agencies including Austrade, in identifying new trade and inward investment opportunities, and assisting Australian companies to access these opportunities, including through whole of government coordination of investment;
- areas of growth, and how can these be accelerated and/or assisted, including through the use of Commonwealth Special Investment Vehicles;
- how Australia can capitalise on existing and future trade agreements and economic frameworks with countries or regions around the world; and
- the areas that play to Australia's strengths including renewable energy, battery storage, energy supply and infrastructure, electric vehicle industry, advanced manufacturing, and services and technology.

Focus of this submission: development of a battery manufacturing and technology supply chain in Australia

For Australia to become a green energy superpower, arguably the most technology-ready opportunity lies in developing a domestic battery manufacturing supply chain.

The extraction of new economy minerals is the focal point of Australia's stated opportunity from the global green energy transition. However, there is significant economic value, jobs and domestic security to be realised by supporting companies seeking to operate downstream from critical minerals extraction within a future local battery supply chain. These companies seek to process battery precursor materials with technologies for multiple different battery cell chemistries. Alongside these battery-tech start-ups, according to Valenta, Willoughby, Molyneaux, 'Australia has the research credentials in innovation in exploration, mining, beneficiation, metallurgy, nanotechnology, digitisation, data innovation and policy to build an integrated research value chain to support the development of a multi-chemistry, multi-segment [Critical Minerals to Battery-Tech] sector' [1].

The International Energy Agency (IEA) forecasts that global investment in energy storage could average US\$450 billion per year over the next decade if global net zero emissions by 2050 is to be achieved [2]. Support from both government and private sources will need to be directed to projects underway for the multiple different battery chemistry value chains being developed to accommodate the various markets which they seek to supply (e.g. transport, industry, stationary energy storage). Investment at this level will require integrated industrial policy frameworks, innovative collaborative models, investment platforms, and public-private partnerships of all shapes and sizes.

Geopolitical disruptions such as Covid-19, the war in Ukraine, and relations with China 19 has made establishing supply chain resilience for clean energies a key focus [3]. Domestically, the Australian Government needs an informed approach to develop Australia's advanced manufacturing sector - in particular the manufacturing of new battery technologies that will be required for successful decarbonisation. In past decades, Australian governments have avoided support for industry sector development, in favour of macro-economic settings to encourage investment. This approach has not led to increased investment in manufacturing in Australia. Elsewhere, new sector development has been successfully prosecuted since the second world war to

advance manufacturing in countries like Germany, Japan, Taiwan, South Korea, and China. Consideration of the common factors of successful sector development in each of these countries points to strong industry policy frameworks and mechanisms. The lessons from these countries' success indicate key areas of interest as summarised in the responses to the questions below.

Australia's stable governments and governance frameworks, world-class research capabilities, abundant minerals, proximity to ASEAN markets, skilled workforce and established extractive, manufacturing and shipping infrastructure are just some of the factors that make it well placed to become a significant player in the supply of batteries for the global energy transition.

Question 1: How does trade and investment translate into sector development?

Successful industry development is preceded by access to cheap finance, assistance with access to global customers and supply chain partners, mechanisms to facilitate integration between suppliers and customers across multiple nation states and regional clusters, support for innovation through public funds, tax breaks for R&D, and targeted investment to facilitate commercialisation and attract private investment to achieve strategic goals.

Recent announcements in Australia help to position it as a partner to the global energy transition. Large scale energy export projects being established in Northern Territory and Western Australia help to demonstrate Australia's capability [4]. Federal investment funds including the Northern Australia Infrastructure Facility (NAIF), ARENA and the Clean Energy Finance Corporation could attract private investment through financing and grant provisions, but clearly defined targets are required to increase investment for domestic manufacturing (of batteries and renewable energy) which also align with global achievement of net zero targets. At a state level, ambitious renewable energy targets and significant investment by the Queensland Government under its new energy policy is positioning Queensland as an ideal place to develop battery manufacturing capability.

Internationally, there is work to be done to attract international investment. First, Australia should follow through on recommendations under its Australian Sustainable Finance Initiative's (ASFI) Roadmap to establish international partnerships and join the International Platform on Sustainable Finance (IPSF) [4]. Second, the world is well aware of Australian mineral wealth, but has little visibility of Australian metal processing and battery-tech credentials. Only with international investment and trade assistance, will today's metal processing and battery-tech start-ups evolve into a battery manufacturing ecosystem.

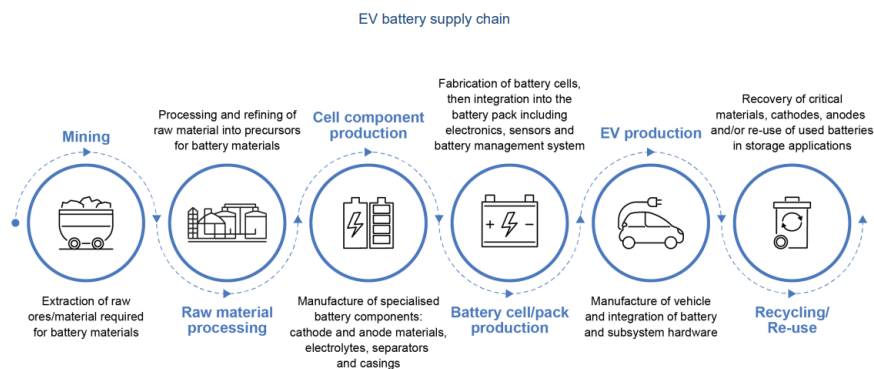
Question 2: What are the emerging trends?

The annual US\$2 trillion investment in clean energy and electrification forecast for the next decade by the IEA to meet the Paris decarbonisation goals is evidence that the world's transition to net zero emissions is the most important, fundamental trend that needs to be addressed if future generations are to continue to enjoy a stable climate and predictable economic outcomes.

Global spend on electric vehicles (EV) and demand for batteries for EVs doubled in 2021 [5]. But this exponential increase comes with the challenge of a ten-fold expansion of battery and minerals supply chains[6]. Plint and colleagues point out that minerals such as lithium and copper will need to be mined at a scale never achieved before [7]. Further downstream emerging and new technologies need to be researched, developed to commercial feasibility and then industrialised, faster than ever considered possible before.

To stay ahead of the game, Australia must innovate to harness its world-class research capabilities to lead emerging and future trends, including new sustainable battery technologies (e.g. sand batteries), and recycling and resource recovery. In addition, Australia needs to tool up because it is well placed to focus downstream from mining on the production of anodes, cathodes, electrolytes, and cells (Figure 1).

Making batteries for EVs requires several stages



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Figure 1. Stages of the EV battery production and value chain.[6].

Question 3: What is the role of Commonwealth agencies in identifying new trade and inward investment opportunities, and assisting Australian companies to access these opportunities

- Successful economic development has been achieved through proactive government intervention applying a whole-of-government approach to focus on clearly defined strategic goals.
- Experience shows that successful government interventions are preceded by careful planning to identify a strategy that can be effectively communicated to the public, investors and business elites. In the case of developing manufacturing of batteries, the interventions need to consider more than a simple message of processing local mineral resources. The primary messenger of the opportunity needs to shift from the agency focused on resources to the agency tasked with industry development.
- Planning will enable the identification of gaps in sector supply chains and outline the steps necessary to develop missing capabilities and technologies either through research or acquisition from existing technology specialists. For battery manufacture, multiple processes and components are required to create a functioning battery. Ores need to be processed with minimum carbon emissions into highly purified metals, manufactured into cathodes and anodes, combined with foils, reagents, electrolytes to create a battery cell, battery management systems for operation and battery packs designed for each application. Each of these steps requires secure supply of other manufactured product. All supply chain steps are subject to technology breakthroughs which will improve their global competitiveness but need to be funded and incentivised. The agencies responsible for education, innovation and manufacturing need an intricate understanding of the combinations of technologies required, their function in the supply chain, and how best to assist with commercialisation.
- Good governance and comprehensive understanding of the strategy and requirements will influence public and private investment to 'Make Winners' rather than pick projects that will succeed without intervention or fail because they were based on political decisions. Recent initiatives designed to support manufacturing in Australia showed a preference for ore processing over battery manufacturing, supporting older more established technologies than emerging technologies, and a state-based sectoral bias. These preferences indicate government intervention which did not consider the full spectrum of requirements for Australian made batteries.
- Both research and the acquisition of technologies and components required for batteries to be manufactured entirely from local sources will need subsidies and incentives to ensure that the parts of the supply chain that are not available in Australia missing elements do not derail sector development. Devising mechanisms that are effective but robust, requires tight integration between agencies tasked with industry support, innovation, research commercialisation, manufacturing and economic policies.

- Although trade with international partners is the goal, access to domestic markets through beneficial procurement policies to support locally made batteries, provides valuable learnings about customer requirements and deployment challenges to become more globally competitive. Thus, procurement policies to support locally made batteries of government owned corporations, agencies responsible for energy policy and agencies responsible for the development of local standards, need to consider international trade partner requirements and global market expectations.
- To be and stay globally competitive requires innovative approaches to research, supply chains, entrepreneurial hubs, technology transfers, customer models, and development of local workforce capacity, all of which need to be identified and supported by agencies across and between each level of government, if funds are not to be inefficiently distributed.
- Proactive and timely infrastructure development reduces risk and uncertainty for already challenging technology start-ups. Thus, agencies tasked with infrastructure planning and deployment need to consider carefully emerging global trends in consultation with agencies tasked with domestic and international trade, to deliver infrastructure when required for sector growth.
- Supporting collaborations between government, industry and research will develop eco-systems with strong connections between domestic and international companies, entrepreneurs, investors, and the labour force to understand the challenges and devise mechanisms to reduce or eliminate the challenges. As battery supply chains are emerging and fragmented, there is a pressing requirement to help develop networks to facilitate engagement between all sectors and across different battery chemistry supply chains to grow eco-systems for successful sector development. This responsibility should be the focus of all government agencies. The University of Queensland and a number of companies in the advanced materials and battery sector are Founder Members of the recently registered Advanced Materials and Battery Council (AMBC) to facilitate collaboration and advise government on appropriate industry frameworks for support. The burden of resourcing this group should not rest solely with industry and research, all levels of government should seek to support the AMBC to succeed at its objective to advance manufacturing in Australia.
- Together these mechanisms help small start-ups to grow and be globally competitive, however as outlined, they require integration between policies in all areas of government from education and innovation to industry, resources, treasury and trade [8] [9-15] [16].
- Austrade undertakes activities domestically and with trade partners to provide 'a national, integrated approach to the development of an Australian critical minerals sector,' including through the establishment of the Critical Minerals Facilitation Office. It is recommended that Austrade and the Department of Industry expand their current focus to include advanced hydrometallurgy for low-carbon metal purification, innovative nanotechnology to advance battery pre-cursor material and battery cell manufacturing, in addition to supporting research and development to improve metal extraction through novel recycling methods.

Question 4: How can areas of growth be assisted by Commonwealth Special Investment Vehicles?

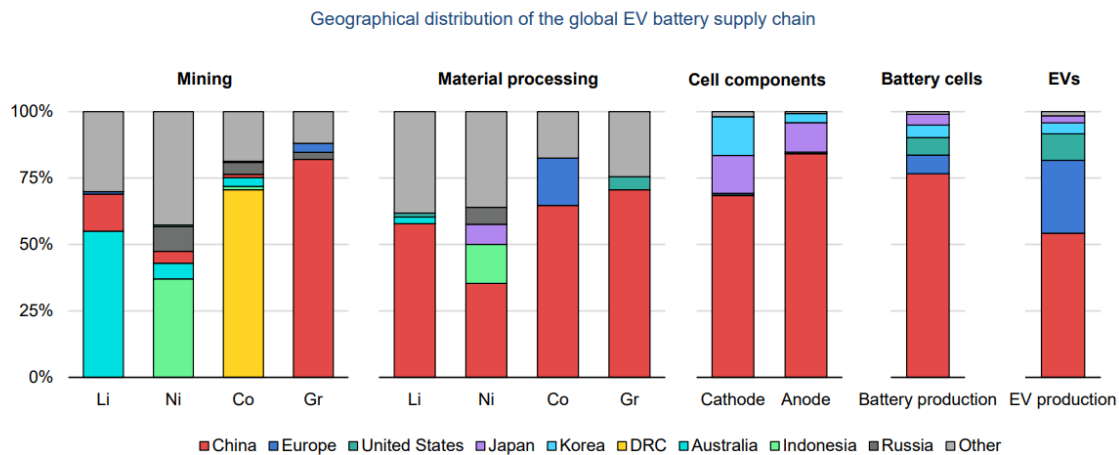
Australia has research institutions that are ranked amongst the best in the world, and yet the commercialisation of that research is generally conducted elsewhere. The companies in the multiple battery chemistry value chains in Australia are small, often spun out of university research labs, and without sustained access to capital and resources as they strive towards commercialisation. They are competing against well-funded, private and state supported organisations in Europe and North America, with less access to the mineral resources than Australian start-ups, but more access to patient investors with a higher risk-profile than Australian investors.

A Commonwealth Special Investment Vehicle or other form of fenced investment fund for projects in the local battery supply chains could facilitate the local commercialisation of our world-leading critical minerals to battery-tech research and the benefits in employment and economic development that would follow.

Question 5: How can Australia capitalise on existing and future trade agreements?

Current global geopolitical concerns focus on supply chain resilience and energy security. China has become the world’s primary manufacturer of EV batteries from metal processing to battery packs and management systems (Figure 2) and as such, it is able to dominate supply of essential goods and influence market outcomes for manufacturers around the world.

China dominates the entire downstream EV battery supply chain



Notes: Li = lithium; Ni = nickel; Co = cobalt; Gr = graphite; DRC = Democratic Republic of Congo. Geographical breakdown refers to the country where the production occurs. Mining is based on production data. Material processing is based on refining production capacity data. Cell component production is based on cathode and anode material production capacity data. Battery cell production is based on battery cell production capacity data. EV production is based on EV production data. Although Indonesia produces around 40% of total nickel, little of this is currently used in the EV battery supply chain. The largest Class 1 battery-grade nickel producers are Russia, Canada and Australia.

Sources: IEA analysis based on: [EV Volumes](#); [US Geological Survey \(2022\)](#); [Benchmark Mineral Intelligence](#); [Bloomberg NEF](#).

Figure 2: China’s dominance of the entire downstream EV Battery supply Chain[6].

Creating a diversity of supply chain partners is now the stated objective of both the European Commission and the United States. In the opening speech at the EU Industry Days 2021, President of the EC, Ursula von der Leyen said: "Green and digital technologies currently depend on a number of scarce raw materials. We import lithium for electric cars, platinum to produce clean hydrogen, silicon metal for solar panels. 98% of the rare earth elements we need come from a single supplier: China. This is not sustainable. So we must diversify our supply chains" [17].

A combined report from the US Departments of Commerce, Energy, Defence, Health and Human Services recommends strengthening US manufacturing capacity for semi-conductors, batteries, critical minerals and pharmaceuticals. The recommendations seek to confront the climate crisis through “a massive domestic build out of clean energy technology; for an issue so central to U.S. economic and national security, we cannot afford to be agnostic to where these technologies are manufactured and where the associated supply chains and inputs originate.” In addition to a long list of recommended supports to attract investment in manufacturing including research, interagency focus on expansion, and creation of quality jobs, further recommendations highlight the importance of strengthening international trade rules and “engage with allies and partners to decrease vulnerabilities”, particularly with “like-minded allies”, possibly through financing from the US Development Finance Corporation [18].

Australia should urgently focus on trade agreements with the European Commission and the United States which favour Australia as a preferential battery supply chain partner for Europe and North America’s decarbonisation plans.

Question 6: Which areas play to Australia’s strengths?

Australia has mineral deposits of all key critical minerals required for all battery chemistries, it fosters world-class research conducted internationally respected universities, and significant experience in the processing of metals and chemical manufacturing. Geopolitical trends suggest that over-reliance on a single dominant global manufacturer makes all countries vulnerable to supply chain disruption and off-shoring of commercialisation and

the benefits that commercialisation brings to economies. The manufacture of batteries in Australia plays to all its strengths and could become the cornerstone of a resurgence in manufacturing capacity across Australia.

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