30 November 2022

Committee Secretariat
Joint Standing Committee on
Trade and Investment Growth
PO Box 6021
Parliament House
CANBERRA
Canberra ACT 2600

Inquiry into Australia's transition to a green energy superpower

The Electric Vehicle Council (EVC) welcomes the opportunity to provide input to the Joint Standing Committee on Trade and Investment Growth's (the Committee's) inquiry into Australia's transition to a green energy superpower.

The EVC is the national peak body for the electric vehicle (EV) industry in Australia. Our mission is to accelerate the electrification of transport for a sustainable and prosperous future. We represent members across the EV value chain, including car, bus and truck manufacturers, importers, operators, charging infrastructure suppliers and network providers.

Accordingly, the scope of this submission is focussed on the trade and investment opportunities that exist for Australia across the EV value chain – spanning from the mining of critical minerals, the refining and processing of these minerals, the manufacturing of batteries and other EV components, the manufacturing of electric bikes, cars, buses and trucks, and ultimately the recycling of EV components to be fed back into the value chain (see Figure 1). The entire value chain also needs to be supplied by low carbon energy to maximise emissions reductions.

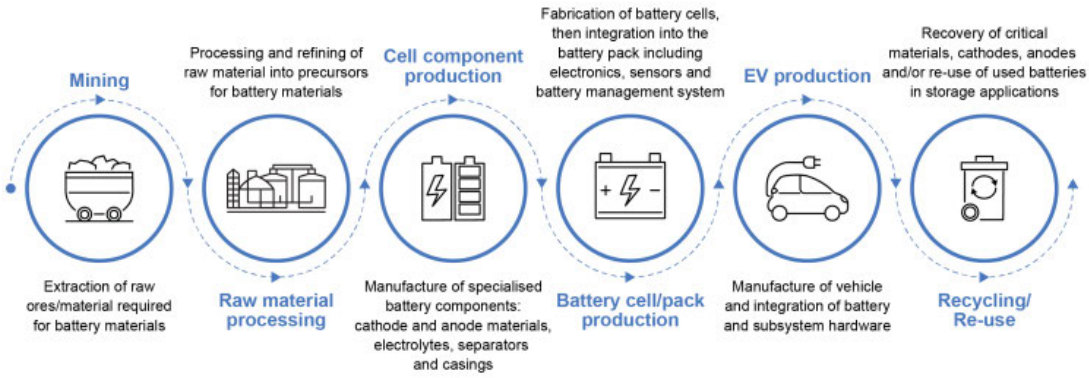

Figure 1. *An overview of the EV battery value chain. IEA, Global EV Outlook 2022 (2022).*

The electric vehicle market is rapidly expanding globally – including in terms of electric bikes, cars, buses, trucks and even the deployment of short-range electric shipping and aviation. This is in large part thanks to government and industry commitments to electrify the global transport system, combined with significant advancements in both the maturity of the technology, and an ongoing reduction in costs driven by economies-of-scale through increased global manufacturing output.

To ensure this expansion continues at a rate consistent with achieving global climate targets, there is a need for significant investment across the entire EV value chain. Australia is uniquely positioned to capitalise on this once-in-a-generation opportunity given our rich resource base; availability of cheap, low carbon energy; skilled workforce; and national security.

As shown in Figure 2, Australia has already established a global leadership position in the extraction and export of many critical minerals, building on our significant share of the world's critical mineral resources. Developing new downstream industries will help Australia, and its partners, transition to a low carbon economy while diversifying global supply chains.

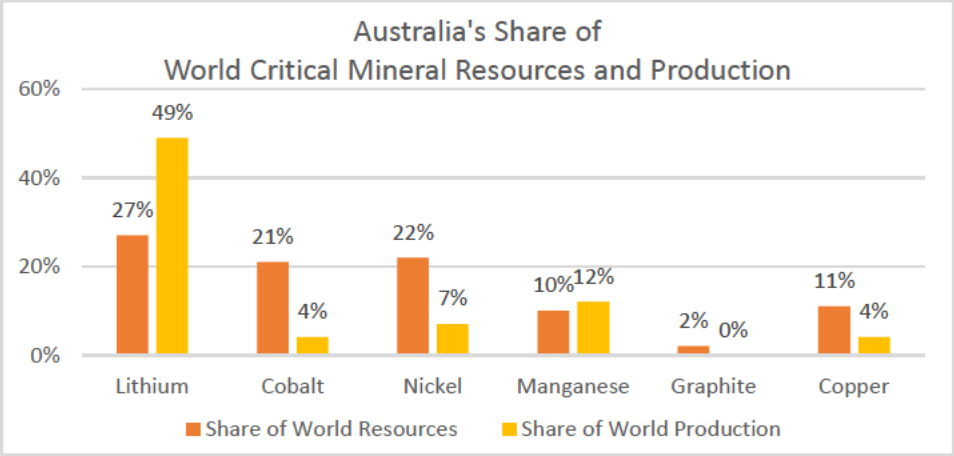

Figure 2. *Australian share of world resources and production for key minerals. Geoscience Australia (December 2020)*

Activities already underway

The green energy transition – including the electrification of transport – provides substantial economic opportunities to Australia, with the resources sector playing a fundamental role. Global demand for lithium and other minerals is set to drastically increase as manufacturers introduce new EV models to gain market share, with an estimated 2 billion batteries required by 2050.

As shown in Figure 3, under the International Energy Agency's (IEA's) Sustainable Development Scenario (SDS) – which approximately aligns with limiting global warming to 2 degrees Celsius – demand for lithium, cobalt and copper (and other metals) will increase significantly over the coming decade, beyond planned production. This presents an enormous opportunity for Australia to capture this increase in demand, however, this will only be achieved through strong growth in investment today given the length of time it takes to bring new mining production online.

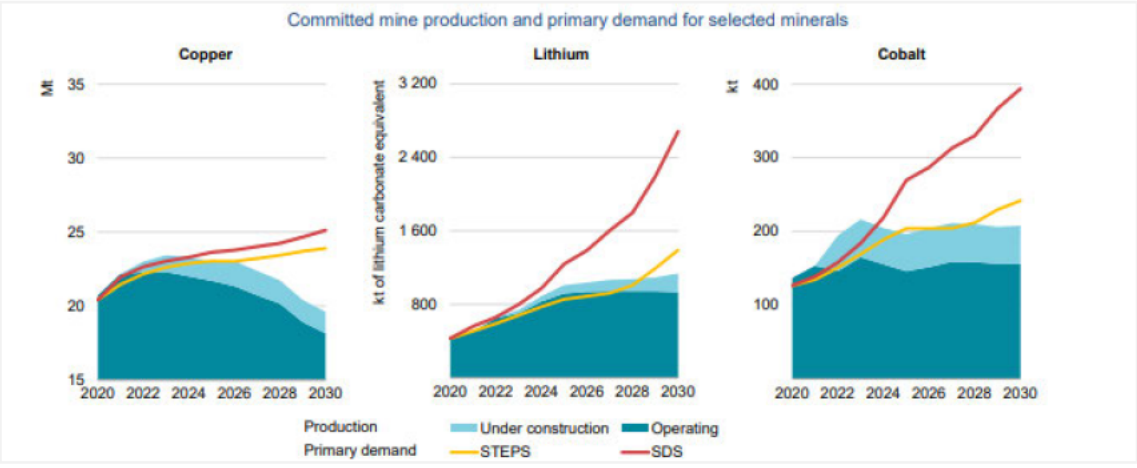

Figure 3. *Production compared with demand for selected minerals under Stated Policies Scenario (STEPS) and Sustainable Development Scenario (SDS). IEA, Role of Critical Minerals in Clean Energy Transitions (2021)*

At present, the dominant cathode chemistry for lithium-ion batteries used in EVs globally includes the use of nickel, manganese and cobalt oxides (NMC), however, other chemistries, such as lithium iron phosphate (LFP), are also accelerating in adoption – particularly in Chinese-made EVs, and more affordable EV models.

With large deposits of critical minerals and rare earth elements, established technical expertise in mineral development and integration with global supply chains, Australia is well-placed to meet increased demand throughout the energy transition.[1] Although demand for different resources may shift over coming decades due to the commercial viability of producing certain minerals and technological advancements, diverse mineral reserves enable Australia to supply the minerals necessarily to produce a range of lithium-ion battery chemistries.[2] According to the Office of the Chief Economist's forecasts, exports of metals important to the energy transition will earn Australia $33 billion in 2022-2023, twice the value from 2020-2021.[3] These opportunities are already being recognised, with sites returning to production after prolonged pauses to take advantage of the future demand.[4]

There remains significant, unrealised potential for Australia to capture more of the critical minerals market share as global demand for battery minerals increases. The strength of Australia's mining sector is demonstrated by its existing production of lithium relative to the rest of the world, however this is not represented in domestic nickel or cobalt production, which is significantly lower relative to existing reserves – see Figure 4.[5] As additional global sources of supply come online in coming years, Australia's continued dominance will be underpinned by inward investment, strong industrial capabilities, and a skilled workforce.

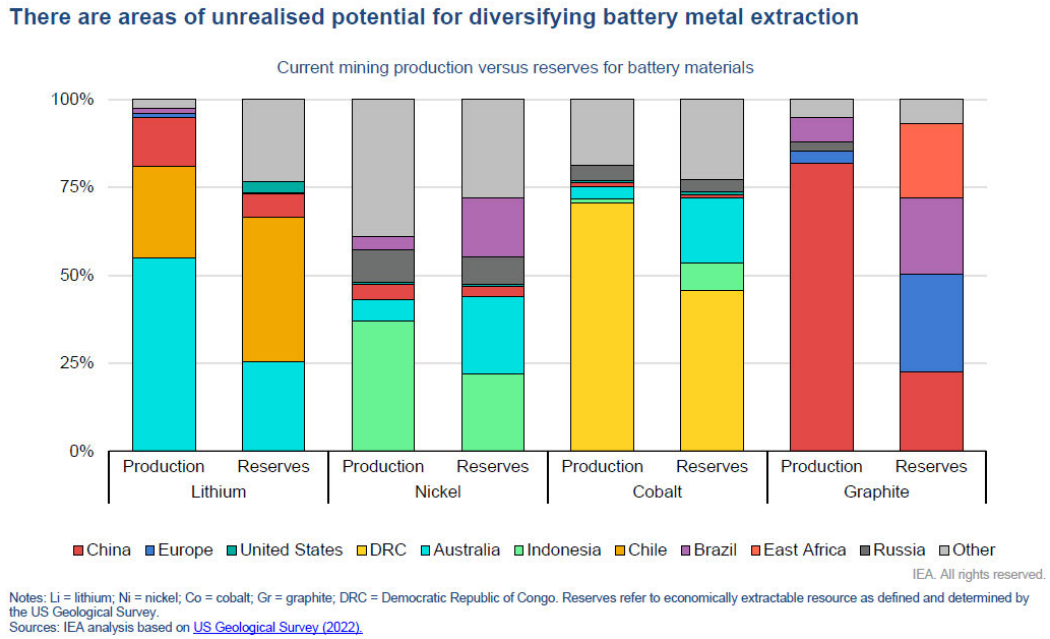

Figure 4. *Current distribution of global mining production. IEA, Global EV Outlook 2022 (2022)*

[2] CSIRO (2021), *Critical Energy Minerals Roadmap*. https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/energy-and-resources/critical-energy-minerals-roadmap
[2] CSIRO (2021), *Critical Energy Minerals Roadmap*. https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/energy-and-resources/critical-energy-minerals-roadmap
[3] Office of the Chief Economist (2022), *Resources and Energy Quarterly, September 2022*, https://www.industry.gov.au/sites/default/files/minisite/static/ba3c15bd-3747-4346-a328-6b5a43672abf/resources-and-energy-quarterly-september-2022/index.html
[4] Powell, M (2022), 'Reopened nickel mine could be Tasmania's ticket into blossoming EV industry', *ABC.* https://www.abc.net.au/news/rural/2022-11-28/avebury-nickel-mine-west-coast-tasmania-zeehan/101702622
[5] Geoscience Australia (2021), *Australia's Identified Mineral Resources 2021 – World Rankings*, https://www.ga.gov.au/digital-publication/aimr2021/world-rankings

To date the Australian Government has provided welcome policy support in the form of the Critical Minerals Strategy, Critical Minerals Research and Development Hub, and Critical Minerals Development Program providing grants to early-stage projects which assists to create additional investment certainty. Austrade also plays a key facilitatory role to promote the industry to international partners. Australia has an established history of welcoming foreign direct investment in the resources sector, with the sector attracting more than $360 billion of foreign direct investment in 2021.[6]

Strengthening existing relationships with trading partners, Australia has joined the US and other countries to establish a Minerals Security Partnership,[7] which in conjunction with the *Australia – United States Net Zero Technology Acceleration Partnership*[8] will further help to embed Australia in international critical mineral supply chains.

Despite these positive actions, Australia needs to leverage its existing strengths in mining to take a greater share of the EV supply chain. As highlighted in Bloomberg New Energy Finance's recent assessment of global competitiveness across the battery vehicle chain (see Figure 5), Australia is missing out on the value-add opportunities downstream of critical mineral extraction, including onshore mineral refining and battery production – both of which provide areas of significant trade and investment potential.

Country	Raw Materials	Battery manufacturing	ESG	Industry, innovation and infrastructure	Downstream demand	Overall ranking
China	1	1	17	9	1	1
Canada	3	8	6	4	10	2
US	6	4	16	5	2	3
Finland	9	15	2	1	11	4
Norway	18	10	1	3	7	5
Germany	21	6	4	7	2	6
South Korea	17	2	10	6	5	6
Sweden	21	9	3	2	8	8
Japan	13	3	8	12	8	9
Australia	2	15	9	13	11	10
France	24	10	5	10	5	11
UK	26	15	7	8	4	12
Czechia	23	10	11	11	18	13
Poland	24	5	15	16	15	14
Hungary	26	6	13	14	20	15
Chile	7	18	14	23	19	16
Turkey	15	18	21	15	13	17
India	13	10	26	21	13	18
Vietnam	20	10	20	18	17	19
South Africa	8	18	19	17	26	20
Brazil	4	18	23	22	20	21
Indonesia	5	18	22	27	25	22
Argentina	11	18	12	19	26	23
Slovakia	26	18	18	25	24	24
Thailand	26	18	24	20	16	25
Philippines	10	18	29	28	22	26
Mexico	16	18	27	26	23	27
Morocco	19	18	25	24	28	28
DRC	11	18	30	29	30	29
Bolivia	26	18	28	30	28	30

***Figure 5**. BNEF Global Lithium-Ion Battery Supply Chain Ranking. BNEF (2022)*

[6] Department of Foreign Affairs and Trade (2022), *Australian industries and foreign direct investment*, https://www.dfat.gov.au/trade/trade-and-investment-data-information-and-publications/foreign-investment-statistics/australian-industries-and-foreign-investment
[7] Australian Government (2022), *Australia joins global minerals security partnership*, https://www.minister.industry.gov.au/ministers/king/media-releases/australia-joins-global-minerals-security-partnership
[8] Australian Government (2022), *Australia and US join forces on path to net zero*, https://minister.dcceew.gov.au/bowen/media-releases/joint-media-release-australia-and-us-join-forces-path-net-zero

Downstream opportunities

As previously outlined, the electrification of the transport sector presents a major opportunity for Australia to expand industry development across the EV value chain, which is currently concentrated in a limited number of countries – see Figure 6. Diversified global supply networks are also key to minimise risks of supply chain disruption from severe events such as natural disasters, pandemics and political unrest. Beyond being a reliable supplier of critical minerals, by establishing the right policy settings, Australia can and should move further downstream into refining and processing critical minerals, manufacturing and recycling batteries, and EV components more broadly.

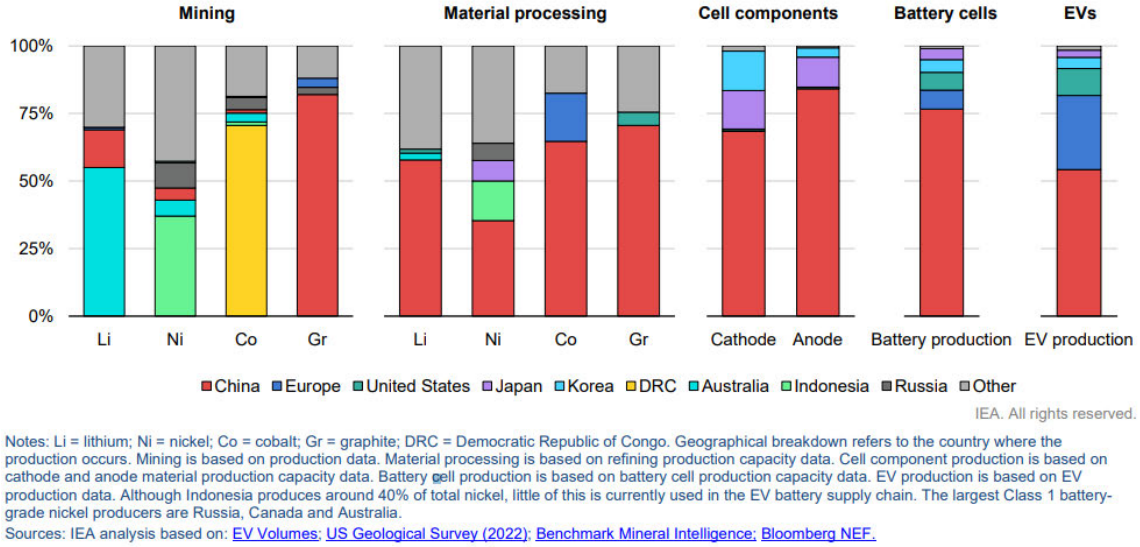

Figure 6. *Existing distribution of global EV battery supply chain. IEA, Global EV Outlook 2022 (2022)*

Global battery demand is expected to grow by 25% each year to 2030, with batteries playing a key role in the switch to clean energy technologies.[9] As the industry grows, Australia can capitalise on the opportunities provided by capturing more of the battery value chain.

The Australian Government has already recognised the need to capture more value from our minerals exports by pledging to establish the $1 billion Value-Adding in Resources Fund and providing capital to several early and mid-stage projects producing battery-grade materials and other key inputs.[10] Given increased demand for battery grade materials, the expansion of onshore processing and refining of battery materials in Australia could provide significant employment and economic growth opportunities.

Although a high level of initial investment would be required, building out our **mineral processing capacity** will enable Australia to leverage developments offshore, including the *US Inflation Reduction Act*, which provides for tax credits that support the use of minerals and battery components sourced from FTA partners like Australia (See Appendix A).[11]

A natural step following the expansion of minerals refining and processing is to develop **onshore production of battery cathodes and anodes for EV batteries**. The Future Battery Industry Cooperative and Research Centre (FBICRC) estimates that a diversified battery industry (including

[9] World Economic Forum (2019), *A Vision for a Sustainable Battery Value Chain in 2030*, https://www3.weforum.org/docs/WEF_A_Vision_for_a_Sustainable_Battery_Value_Chain_in_2030_Report.pdf
[10] Australian Government (2022), *Government support for critical minerals* https://www.minister.industry.gov.au/ministers/king/media-releases/government-support-critical-minerals
[11] US Government (2022), *Fact Sheet: The Inflation Reduction Act Supports Workers and Families*, https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/19/fact-sheet-the-inflation-reduction-act-supports-workers-and-families/

refining and processing, and cell manufacturing) can provide $7.4 billion of value add and over 30,000 jobs. [12]

Establishing a local **EV component manufacturing** capability will be key to building out Australia's domestic EV value chain. While Australia has not been a leader in this space, Australia can leverage learned experience in manufacturing as the increased learning rate for lithium-ion batteries (which describes the reduction in cost for each doubling of cumulative production) has made batteries 97% cheaper to produce compared to 1991. [13]

EV charging infrastructure will also play a fundamental role in accelerating the EV transition. In conjunction with a number of state and territory government initiatives, the ARENA Future Fuels Fund has granted $24.55 million in funding to expand Australia's public fast charging network. [14] The Government can also create policy settings that foster further growth in the domestic manufacturing of charging equipment, which can then be distributed across extensive public and private charging networks.

Case study: Tritium – one of the world's leading suppliers of EV chargers

Figure 7. *Announcement of Tritium's US manufacturing facility at the White House. Source: ABC (2022)*

- Tritium, a member of the EV Council, is a prime example of an Australian company leading in the downstream EV value chain. Established as a Brisbane technology start-up in the early 2000's, the company began designing and manufacturing DC fast chargers in 2012. It presently manufactures about 5,000 chargers a year.
- Commercial success in the burgeoning EV market led to Tritium expanding to the US in 2017, followed by Europe in 2018. By June 2022, Tritium had sold over 7600 high powered chargers to 42 countries and is one of the largest DC fast charger manufacturers globally. [15]
- In early 2022, the company listed on the NASDAQ. Tritium has since opened a US factory in Tennessee, which is expected to create 500 jobs and produce 30,000 chargers annually. [16]

As EV uptake increases, research and innovation in **second-life applications for EV batteries**, and developing a strong **battery recycling** industry, will be important to reduce the environmental impacts associated with raw minerals extraction. Estimates predict that the global EV battery reuse

[12] FBICRC (2021), *Future Charge: Building Australia's Battery Industries*, https://fbicrc.com.au/wp-content/uploads/2021/06/Future-Charge-Report-Final.pdf
[13] Our World in Data (2021), *Battery Price Decline*, https://ourworldindata.org/battery-price-decline
[14] ARENA (2021), *Future Fuels Fund revved up to provide EV charging nationally*, https://arena.gov.au/news/future-fuels-fund-revved-up-to-provide-ev-charging-nationally/
[15] Tritium (2022), *Consolidated Financial Statements*, https://investors.tritiumcharging.com/static-files/47ddc4ec-27b7-4338-baa7-7b94c46b0104
[16] US Government (2022), *Fact Sheet: Biden-Harris Administration Ensuring Future is Made in America*, https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/08/fact-sheet-biden-harris-administration-ensuring-future-is-made-in-america/

and recycling market will reach $5 billion by 2027, growing by over 50% annually over 2020 to 2027.[17]

Accordingly, the World Economic Forum established a Global Battery Alliance public-private partnership in an attempt to develop ethical and sustainable battery value chains and achieve emissions reduction goals.[18] European disclosure requirements for the carbon footprint of EV batteries also come into effect for all EVs sold in the EU from 2024, in addition to minimum recycled materials levels requirements in 2030.[19] To ensure Australia is able to strengthen domestic recycling capabilities to enhance sustainable minerals recovery, the Government should prioritise policy settings that can provide strategic direction and incentivise industry development, without slowing down the necessary transition to an electrified vehicle fleet.[20]

It is also important to recognise the role of **green energy** in supporting the development of a local EV value chain. Given the abundance of potential renewable energy sources in Australia, the energy transition presents a massive opportunity to attract investment, as other jurisdictions strengthen regulations to reduce emissions from the battery supply chain (including raw minerals extraction, manufacturing and recycling).[21] Accelerating the green energy transition also presents an avenue to bring down production costs from energy consumption, making Australia more globally competitive in downstream processing and manufacturing.[22] At present, only approximately 30% of energy generated in Australia comes from renewable sources.[23] To facilitate decarbonisation of the full EV value chain, there is a need to invest in the colocation of renewable energy generation sources at mining, manufacturing and recycling facilities.

Government action

Australia must capitalise on trade and investment opportunities from the EV transition and become a strategic partner of choice in the Asia-Pacific region, in addition to strengthening relationships with FTA countries. In particular, Australia should leverage longstanding trade and business relationships with regional partners that are already actively investing in the EV value chain, like Thailand, Indonesia, Singapore, Malaysia, and Vietnam, to build integrated industries that maximise the comparative advantages of each country, while further strengthening regional relationships. Doing this will have the dual effect of supporting economic development across the region and diversifying global supply chains.[24]

Australia remains one of the most attractive destinations for investment because of our abundant resources, political stability, highly skilled working population and industrial capabilities. While national security considerations related to critical infrastructure and resources will need to be

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[17] Market Watch (2022), *Global Electric Vehicle Battery reuse and Recycling Market Size, Share and Trends Analysis Report, Forecast 2022-2030*, https://www.marketwatch.com/press-release/global-electric-vehicle-battery-reuse-and-recycling-market-size-share-and-trends-analysis-report-forecast-2022-2030-cagr-of-542-2022-09-07?mod=search_headline

[18] Global Battery Alliance (2022), https://www.globalbattery.org/about/

[19] https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/689337/EPRS_BRI(2021)689337_EN.pdf

[20] Zhao, Y et al (2021), *Australian Landscape for Lithium Ion Battery Recycling and Reuse in 2020 - Current Status, Gap Analysis and Industry Perspectives,* CSIRO, Australia. https://publications.csiro.au/publications/publication/PIcsiro:EP208519

[21] See, e.g., European Parliament (2020), *Proposal concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020,* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020PC0798

[22] Nahum, D (2020), *Powering Onwards: Australia's Opportunity to Reinvigorate Manufacturing through Renewable Energy*, Centre for Future Work at the Australia Institute. https://d3n8a8pro7vhmx.cloudfront.net/theausinstitute/pages/3311/attachments/original/1588894059/Powering-Onwards_FINAL.pdf?1588894059

[23] Australian Government (2022), *Australian Energy Update 2022*, Figure 18. https://www.energy.gov.au/publications/australian-energy-update-2022

[24] Australian Embassy (2020), *A New Era of Trade and Investment for Australia and Indonesia* https://indonesia.embassy.gov.au/jakt/AR20_001.html

considered, inbound foreign investment will play a significant role in enabling Australia to become a green energy superpower.

Australia can look to the example set by the US in recent years, where the Federal Government has set out strong policies and introduced incentives that provide a clear roadmap for ensuring the US captures the economic opportunities provided by the decarbonisation of transport, combined with the broader energy transition (see Appendix A). While a raft of different measures may be necessary, the main ways in which Government can support industry development involve delivering policy certainty across all levels of government, guaranteeing downstream demand by committing to ambitious EV targets (across all vehicle segments), providing additional financing to innovative projects and companies, and creating opportunities for public-private collaboration.

Policy certainty and government coordination

Government has an important role to play in ensuring Australia can capitalise on the opportunities presented by the electrification of transport and the broader energy transition. Developing a **strong vision**, and the provision of **clear and consistent policy signals** across all levels of government will help to boost confidence to investors across the value chain.

Increased domestic EV adoption remains the key prerequisite to developing domestic manufacturing of batteries and charging equipment. An ambitious National Electric Vehicle Strategy that sets targets for EV sales and includes the introduction of an ambitious fuel efficiency standard, will play an important role in boosting downstream demand, in addition to increasing the supply of EVs to Australia.[25] **Governments can further support domestic industry development by providing guaranteed demand through bulk EV orders** across government vehicle fleets and introducing programs that incentivise the use of local content.

In order to achieve its vision of supporting the delivery of Australian-made batteries, the Government will need to **collaborate with state and territory governments to setup a national plan for a domestic battery industry**. This would require jurisdictions to cooperate on developing the required infrastructure and ensuring efficiencies are achieved so that instead of competing for market share, the relative strengths of each jurisdiction are recognised and enhanced through cooperation.

Co-investment, partnerships and incentives across the EV value chain

To support industry development, the Government (through ARENA, the CEFC or other investment vehicles) can provide further **debt and equity financing to innovative projects** to accelerate the clean energy transition.

Public-private partnerships are also essential to develop a thriving battery cell manufacturing industry, with a key example being the Future Battery Industry Cooperative and Research Centre (FBICRC) research collaboration which launched a pilot cathode precursor production plant (repurposing BHP's nickel sulphate pilot plant) in mid-2022,[26] and is conducting a project to develop a processing pipeline for silicon-loaded natural graphite for battery anode production.[27]

Another opportunity to develop public-private partnerships is in research and development for **decarbonisation of heavy vehicles, including mining and off-road applications**. BHP, Rio Tinto and Vale launched the Charge On Innovation Challenge in 2021,[28] an industry collaboration to

[25] Electric Vehicle Council (2022), *Submission to National Electric Vehicle Strategy Consultation*, https://electricvehiclecouncil.com.au/wp-content/uploads/2022/11/ElectricVehicleCouncil-NationalEVStrategySubmission2022.pdf
[26] Minerals Research Institute of Western Australia (2020), *Battery precursor manufacture in Australia*, https://www.mriwa.wa.gov.au/research-projects/project-portfolio/project-battery-precursor-manufacture-in-australia/; FBICRC (2022), *Cathode Facility Officially Launched*, https://fbicrc.com.au/cathode-facility-officially-launched/
[27] Minerals Research Institute of Western Australia (2021), *Super anode proposal,* https://www.mriwa.wa.gov.au/research-projects/project-portfolio/super-anode-proposal/
[28] Charge on Innovation Challenge (2022), https://chargeoninnovation.com/

commercialise charging solutions for long-haul trucks and decarbonise the mining sector which will be fundamental to reducing life-cycle emissions of EVs. In this space, ARENA and CEFC have previously committed funding to innovative projects and companies including $5 million in 3ME Technology, an Australian heavy vehicle battery manufacturer and $21 million to the RCF Jolimont Mining Innovation Fund II (RCF Jolimont Fund II) to support decarbonisation of the mining sector.

Similarly, **research and innovation in recycling** will be necessary to increase minerals recovery from end-of-life batteries. While this will likely remain a nascent industry until large volumes of EVs enter the market, investing in research now will provide opportunities to develop world-leading expertise and enable Australia to capture more of the value chain.

Government investment must also look to move beyond research, development, and trials, and **actively support commercial operations across the full EV value chain**. This could be via grants, tax concessions, or public investment in infrastructure. **Government has a key role to play in de-risking investment in a domestic EV supply chain** to attract both domestic and international private investment. A leading example of this type of government support is the US, with further details included in the attached case study (see Appendix A).

Next steps

In summary, the transition to electric vehicles presents a once-in-generation economic opportunity for Australia, which can help to secure our future prosperity as we gradually transition away the export of fossil fuel resources. Our existing advantages in minerals extraction puts us in prime position to expand across the full EV value chain into refining, and battery production, adding value to our rich resource base.

As the share of green energy continues to increase, Australia will become even more competitive at supplying both raw materials and finished products to regional partners and key FTA partners, driven by lower energy input costs.

To ensure Australia can build on its existing strengths and diversify downstream, there is a need for coordinated effort by government to direct investment where it is needed. To attract investment, Austrade can play a central role in promoting Australia's capabilities to accelerate the global transition to a low carbon future, and build strategic partnerships with countries across our region that are already actively investing in the EV supply chain. This includes supporting nations like Thailand, that are a major manufacturer of vehicles for Australia, and that should be supported to electrify their offerings to our market.

As a nation we cannot afford to adopt a wait and see approach. If we are to capture the major economic benefits from this transition, the time to act is now. The Electric Vehicle Council supports the Australian Government in cooperating with state and territory governments to move forward with a national plan than enables the rapid development of a domestic EV value chain, with the Australian EV industry ready, able and willing to help.

If you have any questions on this submission, please do not hesitate to contact Natalie Thompson, Senior Policy Officer, Electric Vehicle Council: natalie@evc.org.au

Thank you for your consideration of our submission.

Yours sincerely,

Behyad Jafari
Chief Executive Officer
Electric Vehicle Council

Appendix A – a case study of US policy support for its EV value chain

The US Federal Government has introduced a range of initiatives in recent years to bolster clean energy investment and industry development across the EV value chain. This package of initiatives is expected to create significant domestic employment opportunities, enhance US supply chain competitiveness and meet national security requirements with regards to securing inputs into the supply chains.

The US Government has also set an ambitious target to make zero-emissions vehicles comprise 50% of all new vehicles sold by 2030[29] and 100% of heavy vehicle sales by 2040[30]. The major benefit of providing strong demand signals is that it delivers forward investment certainty across the EV value chain, reducing concerns associated with unclear or inconsistent policy direction.

Measure	Description	Details
Inflation Reduction Act (2022)	The landmark legislation provides the largest investment in climate and energy in US history aimed at securing the country's position in clean energy manufacturing to help achieve climate goals.[31]	• The Act provides for a number of EV incentives: o Individual EV charger credits to cover 30% of the purchase cost. o Commercial EV charger credits to cover 6% of the cost, with requirements to be placed in low-income communities or non-urban areas from 2022. o Clean vehicle tax credits up to $7,500 available to consumers subject to local content requirements for battery components to be manufactured or assembled domestically. Additional conditions relate to critical minerals extraction or processing, with minerals required to be sourced from the US or FTA partners (including Australia). o Used EV tax credit covering up to 30% of the purchase price for vehicles older than 2 years (subject to price cap of $25,000 and income caps for consumers). • Significant debt financing commitments across the energy sector include: o Appropriates $11.7 billion for DoE Loan Programs Office (LPO) to support new loans and increasing existing LPO loan programs by approximately $100 billion

[29] US Government (2021), *Fact Sheet: President Biden announces Steps to Drive American Leadership Forward on Clean Cars and Trucks*, https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/
[30] Sheppardson, D (2022), *U.S. aims for zero-emissions heavy-duty vehicles by 2040*, Reuters, https://www.reuters.com/business/cop/us-aims-zero-emissions-heavy-duty-vehicles-by-2040-2022-11-17/
[31] US Government (2022), *Fact Sheet: Inflation Reduction Act Supports Workers and Families*, https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/19/fact-sheet-the-inflation-reduction-act-supports-workers-and-families/

		○ Appropriates $5 billion for Energy Infrastructure Reinvestment (EIR) program for up to $250 billion loans through to October 2026 ○ Removed $25 billion cap on loans under the Advanced Technology Vehicles Manufacturing (ATVM) Direct Loan Program ○ Extends loans available under the Tribal Energy Loan Guarantee Program (TELGP) to $20 billion to directly facilitate energy development investments to support Native American and Alaska Native communities.
Bipartisan Infrastructure Law	Expanded activities support projects involving critical minerals processing, manufacturing, and recycling.[32]	• Invests more than $7 billion to support domestic manufacturers to have the critical minerals and other necessary components to manufacture batteries. • Provides a $510.7 million investment for the United States Geological Services (USGS) to better map mineral resources both still in the ground and in mine wastes, to preserve historical geologic data and samples, and construct a USGS research centre in partnership with the Colorado School of Mines. • Department of Energy (DoE) is awarding $2.8 billion in grants to 20 manufacturing and processing companies for projects across 12 states. • Funding is expected to support *annual* production of: ○ battery-grade lithium to supply approximately 2 million EVs; ○ battery-grade graphite to supply approximately 1.2 million EVs; ○ battery-grade nickel to supply approximately 400,000 EVs; ○ silicon oxide to supply anode materials for an estimated 600,000 EV batteries. • Further projects funded by the initiative include: ○ the first large-scale, commercial lithium electrolyte salt (LiPF6) production facility ○ an electrode binder facility capable of supplying 45% of domestic demand for EV batteries in 2030.

[32] US Government (2022), *Fact Sheet: Biden-Harris Administration Driving US Battery Manufacturing and Good Paying Jobs*, https://www.whitehouse.gov/briefing-room/statements-releases/2022/10/19/fact-sheet-biden-harris-administration-driving-u-s-battery-manufacturing-and-good-paying-jobs/

		○ the first lithium iron phosphate cathode facility in the US.
American Battery Materials Initiative	To secure a reliable and sustainable supply of critical minerals used for power, electricity, and electric vehicles (EVs).	• Government to work with partners and allies (including through G7 Partnership for Global Infrastructure and Investment) to strengthen critical mineral supply chains • Leverage engagement with international partners and allies to map resources, advance strategic partnerships, diversify global supply chains, and raise international environmental, community, and worker-safety standards for extraction, processing, and recycling. • Improving public and private sector coordination, including aligning work on critical mineral supply chains, coordination of community and industry engagement, help guide research, grants, and loans supporting responsible critical minerals extraction, processing, and recycling • Aid diplomatic efforts to build reliable and sustainable global supply chains.
Advanced Technology Vehicles Manufacturing (ATVM) program	The ATVM provides loans to support domestic manufacture of eligible vehicles and qualifying components.	• To date, the direct loan program has funded $8 billion in loans and supported the production of more than 4 million advanced technology vehicles. [33] • Includes $102.1 million loan to subsidiary of Syrah Technologies, an Australian industrial minerals and technology company supplying battery-grade graphite active anode material (AAM) to the EV battery manufacturing industry. [34]
National Blueprint for Lithium Batteries	A roadmap to guide investments to development of a domestic lithium-battery manufacturing value chain. [35]	• The blueprint sets out goals related to securing access to materials for commercial and defence applications, growth of US processing facilities to meet domestic battery manufacturing, stimulating US electrode, cell and battery pack manufacturing, scaling end-of-life and recycling and supporting R&D and workforce development. • Following release of the blueprint, in 2021 DoE promised $200 million in funding over next five years for electric vehicles, batteries, connected vehicles

[33] US Department of Energy (2022), *Advanced Technology Vehicles Manufacturing Loan Program*, https://www.energy.gov/lpo/advanced-technology-vehicles-manufacturing-loan-program
[34] US Department of Energy (2022), *Loan Programs Office: Syrah Vidalia*, (https://www.energy.gov/lpo/syrah-vidalia
[35] US Department of Energy (2021), *National Blueprint for Lithium Batteries*, https://www.energy.gov/eere/vehicles/articles/national-blueprint-lithium-batteries

		projects at national labs and new partnerships to support electric vehicles innovation. [36] • DoE also provided $60 million for 24 university and industry-led R&D projects aimed at reducing CO_2 emissions from road transport by accelerating innovation in batteries and improving understanding of the environmental impacts of new technology. [37]
CHIPs and Science Act	Aimed at bolstering American semiconductor research, development, and production to deliver benefits to American manufacturing, supply chains and national security. [38]	• The measure is expected to increase national security and reduce risks of supply chain disruptions caused by concentrated manufacturing of semiconductors in Asia. • Substantial funding commitments and incentives include: o $52.7 billion for semiconductor research, development, manufacturing, and workforce development. o $2 billion allotted to legacy chips used in automobiles and defence systems. o 25 percent investment tax credit for capital expenses for manufacturing semiconductors and related equipment
National Electric Vehicle Infrastructure (NEVI) Formula Program	Provides dedicated funding to States to deploy EV charging infrastructure and establish an interconnected network. [39]	• Part of the $1.2 trillion Infrastructure Investment and Jobs Act • Funding covers up to 80% of eligible project costs, including: o acquisition, installation, and network connection of EV charging stations to facilitate data collection, access, and reliability; o operation and maintenance of EV charging stations; and, o Long-term EV charging station data sharing.

[36] US Department of Energy (2021), *U.S. Department of Energy Announces New Vehicle Technologies Funding and Future Partnerships with Battery Industry*, https://www.energy.gov/eere/articles/us-department-energy-announces-new-vehicle-technologies-funding-and-future
[37] US Department of Energy (2021), *DOE Awards $60 Million to Accelerate Advancements in Zero-Emissions Vehicles*, https://www.energy.gov/articles/doe-awards-60-million-accelerate-advancements-zero-emissions-vehicles
[38] US Government (2022), *Fact Sheet: CHIPs and Science Act will Lower Costs, Create Jobs, Strengthen Supply Chains and Counter China*, https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/
[39] US Department of Energy (2022), *Alternative Fuels Data Center: National Electric Vehicle Infrastructure (NEVI) Formula Program*, https://afdc.energy.gov/laws/12744