



Level 1,  
18 National Circuit  
Barton ACT 2600  
Ph: 02 6267 1800  
[info@aluminium.org.au](mailto:info@aluminium.org.au)

Department of Industry, Science, and Resources (DISR)  
Via - <https://consult.industry.gov.au/national-battery-strategy-issues-paper>  
16 March 2023

Dear Minister

***Re: National Battery Strategy - Issues Paper***

The Australian Aluminium Council (the Council) represents Australia's bauxite mining, alumina refining, aluminium smelting and downstream processing industries. The aluminium industry has been operating in Australia since 1955, and over the decades has been a significant contributor to the nation's economy. It includes six mines which collectively produce over 100 Mt per annum making Australia the world's largest producer of bauxite. Australia is the world's largest exporter of alumina with six alumina refineries producing around 20 Mt per annum of alumina. Australia is the seventh largest producer of aluminium, with four aluminium smelters and additional downstream processing industries including more than 20 extrusion presses. Aluminium is Australia's highest earning manufacturing export. The industry directly employs more than 17,000 people, including 4,000 full time equivalent contractors. It also indirectly supports around 60,000 families predominantly in regional Australia.

The Council welcomes the opportunity to provide this submission on the National Battery Strategy Issues Paper (the Paper). The Council agrees that Australia can be a renewable energy superpower and that the ability to store energy at multiple scales will become increasingly important as the world moves to net zero emissions. Australia can capture increasing parts of these growing markets, building on our strengths in critical minerals and resource value adding. While there is a considerable focus on lithium-ion batteries, the Council notes that Australia will need to have access to diverse types of batteries as demand for batteries for a variety of uses grows, including those using aluminium and its derivatives.

Australia's electricity markets are going through a once-in-a-century transformation, as Australia moves towards net zero emissions by 2050 and this transition will need to be carefully managed, to ensure that all consumers are provided with competitively priced, reliable, low emissions energy. The Council has, for many years, recognised that the National Electricity Market (NEM) is at risk of becoming a system which lacks reliability and system strength and has been actively working with the Energy Security Board (ESB) on the Post 2025 Market Reforms. Aluminium smelters already offer a range of services and functions which support the network over varying weather, network demand and operating conditions, including Reliability and Emergency Reserve Trader (RERT) and Frequency Control Ancillary Services (FCAS). Smelters' large and fast-acting interruptibility helps secure and restore stability to the network before and after contingencies occur. The industry has increasingly been called upon to support grid stability and reliability, as the challenges in managing the grid increase. For example, during May and June 2022 Tomago Aluminium provided 32 hours of modulation across 18 events which were a mixture of RERT and responding to high market price. This response by Tomago supported AEMO to manage a complex and challenging system and maintain supply to domestic

customers. Storage at scale, including through battery technologies, is one of the most urgent challenges in maintaining reliable electricity supply to Australia's domestic energy consumers.

While aluminium smelting is currently a large electricity consumer, consuming around 2.6 GW of electricity in the NEM, the potential to electrify the alumina refineries will require a further 3-5 GW<sup>1</sup>. While this needs to be combined with technology availability to enable transformation in some cases it is the supply and availability of competitively priced zero emissions electricity which may be the rate limiting step. For example, the South West Interconnected System (SWIS) may not have the generation nor transmission capacity to electrify one alumina refinery, let alone four. Additionally, in the SWIS, there is likely to be substantially less opportunity for pumped hydro than the NEM, so will require substantial long duration storage and battery technology to firm supply.

### **Making sure Australia can attract capital in an internationally competitive environment**

As outlined in the Paper, Australia is not alone in seeing value in its battery industries. Australia is competing internationally to attract the necessary capital and investment to undertake the transition but also to attract the type of priority areas which are the focus of the Government. The scale of the investment by the Government at this stage does not match the scale of investment of Australia's competitors, such as in the US. For example, under the US Inflation Reduction Act there are US\$370 billion in Energy and Climate Tax Credits and Incentives. Specifically for the aluminium and related industries:

- Advanced Manufacturing Production Tax Credit (Section 45X)
  - \$10 billion in 10% tax credit for qualifying projects;
  - Aluminium qualifies as a 'critical mineral' for clean energy technology production which includes bauxite conversion to alumina or aluminium.
- Qualifying Advanced Energy Project Tax Credit (Section 48C)
  - \$10 billion in tax credits;
  - Projects that re-equip industrial or manufacturing facilities with equipment designed to reduce greenhouse emissions by at least 20% through the installation of new heat process systems, carbon management systems, industrial processes efficiency upgrades, and other industrial technology designed to reduce emissions.
- Advanced Industrial Facilities Deployment Program
  - \$5.812 billion in grants for greenhouse emission reduction projects in energy intensive industries, where aluminium specifically qualifies.

It is also worth noting that the Act specifically includes all aspects of the aluminium value chain.

### **Capitalising on Australia's existing strengths**

Aluminium is one of the commodities most widely used in the global transition to a clean energy future<sup>2</sup>, including applications in the battery sector. It is also recognised for its importance to both economic development and low emissions transition. Aluminium use is highly correlated with GDP, so as countries urbanise, per capita use of aluminium increases. It is expected that, by 2050, global demand for aluminium is expected to nearly double from around 100Mt per annum to around 190Mt<sup>3</sup>. While an increasing proportion will be met through recycled aluminium, there will still be a need for increased production of primary aluminium requiring a comparable increase in global bauxite mining and alumina refining rates.

The Council believes there is an opportunity for Australia to capitalise on its own strategic advantage and maximise economic value. Today's aluminium industry contributes around \$16.9B<sup>4</sup> a year to the economy in export value (Figure 1). More than \$15 B of this comes from the alumina and aluminium industries, as value adding mineral processing sectors. Australia is one of the very few countries which has bauxite mining, alumina

<sup>1</sup> <https://arena.gov.au/assets/2022/11/roadmap-for-decarbonising-australian-alumina-refining-report.pdf>

<sup>2</sup> <https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action>

<sup>3</sup> International Aluminium Institute High Substitution Scenario

<sup>4</sup> <https://www.industry.gov.au/sites/default/files/minisite/static/ba3c15bd-3747-4346-a328-6b5a43672abf/resources-and-energy-quarterly-september-2022/documents/Resources-and-Energy-Quarterly-September-2022-Aluminium.pdf>

refining, aluminium smelting and aluminium extrusion industries, making aluminium one of the few commodities in which the raw materials are mined, processed and then developed into consumer products right here in Australia. Globally, there is a focus across industry to find solutions for the technology challenges required to decarbonise. There is an opportunity for Australia to lead the world in development and implementation of these technologies, capitalising on Australia’s national advantages, providing jobs and value to the economy.

Australia is the world’s largest bauxite producer, producing over 100 Mt per annum or almost 30% of global production in 2021<sup>5</sup>. Of this, around 40 Mt is exported, with more than 98% going to China<sup>6</sup>. The balance is refined to produce 21 Mt per annum of alumina (aluminium oxide) in Australia. More than 85% of this is exported to a range of countries<sup>5</sup>, with Australia being the world’s largest exporter. Australia produces around 1.6 Mt of aluminium per annum, of which more than 90% is exported. There is some downstream manufacturing of aluminium in extrusion presses (around 150 kt capacity), metal powders (~10kt) and aluminium coatings (~10kt). However, the bauxite mined in Australia produces 40 Mt of alumina, which is nearly double Australia’s current production, and around 20 Mt of primary aluminium; more than 13 times Australia’s current production. So, while the existing aluminium industry in Australia is a successful example of vertical integration, it is far from being at capacity and there is economic opportunity for Australia to be gained under the right policy conditions. The single biggest factor in determining the location of future refining, smelting and manufacturing locations is reliable, internationally competitive, low emissions energy.

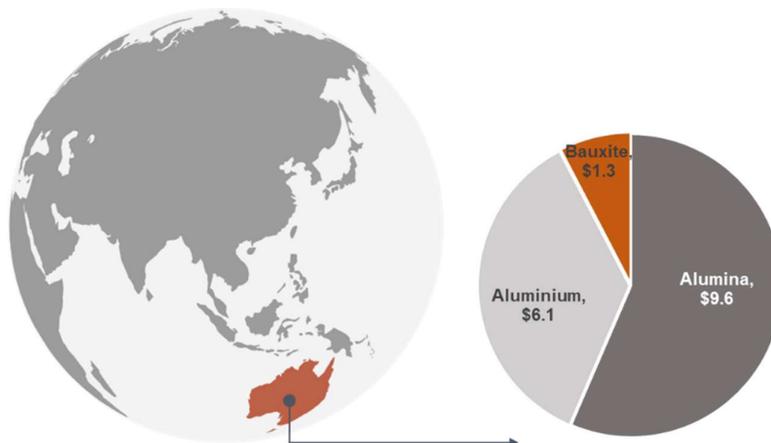


Figure 1. FY 2021-22 Industry Export Value (\$B)

*Leveraging the mining value chain*

Australia currently has a very narrow definition of Critical Minerals – which basically does not include major minerals which we already produce (e.g., aluminium, copper, nickel) and is limited largely to rare earths and new materials, including High Purity Alumina (HPA). While the Council agrees with the Paper that Australia has a narrow window of opportunity to capitalise on global critical minerals demand and unlock its potential as a clean energy superpower, the current window is also only offering a limited perspective on the strategic advantage that is possible. As outlined in the Paper, Australia has the world’s second largest demonstrated battery mineral resources for bauxite (aluminium ore). Bauxite can be used to produce both primary aluminium<sup>7</sup> and a range of other derivatives, including High Purity Alumina (HPA).

Other countries include a much broader definition, for example Canada, USA and Europe identify bauxite (aluminium ore) and aluminium as critical, as it is the second most widely used metal and also essential for

<sup>5</sup> <https://aluminium.org.au/wp-content/uploads/2022/09/221214-TRADE-AND-COMPETITIVENESS.pdf>

<sup>6</sup> China identifies aluminium as a Critical Mineral <https://www.iea.org/policies/15519-national-plan-for-mineral-resources-2016-2020>

<sup>7</sup> For example <https://www.afr.com/companies/energy/shell-backs-australian-energy-storage-disruptor-20230217-p5Clhh> and <https://graphenemg.com/energy-storage-solutions/aluminum-ion-battery/>.

clean energy technologies, including batteries. Australia's 2022 Critical Minerals Strategy references these inclusions but stops short of including bauxite or aluminium. CSIRO's Critical Energy Minerals Roadmap includes aluminium, nickel and copper. The Queensland Government uses the term New Economy Minerals to be more inclusive than Australia's Critical Minerals list. The recent address by the Prime Minister to the Sydney Energy Forum included aluminium in the list of critical minerals. Having a single consolidated list rather than the current range of lists would be advantageous during strategic national planning. Unlike Australia's current strategy, the 2022 Canadian Critical Minerals Strategy<sup>8</sup> recognises that there are three categories of critical minerals:

- those critical minerals which are priorities for economic growth today (P42),
- those with significant prospects for the future (P43); and
- those where Canada already has capacity but must maintain its existing position as a world leader in like aluminium (P43).

Australia's strategy similarly needs these multiple levels, rather than focusing on materials it does not already produce in significant quantities. The Council believes there is a case to change the current national definition of Critical Minerals and include bauxite (aluminium ore), alumina and aluminium on the Critical Minerals List, to better align with international definitions and ensure Australia is optimally placed to capitalise on its strategic resources. This would also identify the materials globally regarded as critical to a clean energy future, where Australia can be a supplier of choice including in the battery sector.

#### *High Purity Alumina (HPA)*

While alumina has been produced in Australia for more than fifty years and is largely supplied to the global aluminium smelting industry as metallurgical grade alumina, usually at purities of more than 99%, alumina refineries can also produce alumina for a range of non-metallurgical uses, including water treatment; aluminium fluoride production; ceramics, refractories and abrasives. However, there has been an emergence in demand for very high purity alumina (HPA). Until about five years ago, HPA had a very small global market demand of only 15,000 tonnes per annum. More recently demand has grown due to the need for its quality, purity and versatility in high-tech applications, such as batteries. Today the market stands at more than 40,000 tonnes per annum and has been widely forecast to have a compound annual growth rate (CAGR) of about 20%.

This is driven by an increased global demand for a new world of technologies. HPA's properties such as high brightness, resistance to corrosion, good thermal conductivity, high melting point, chemical stability and high mechanical strength make it suitable for manufacturing various electronic and vehicle components, including for both electric vehicles and the aeronautical sectors. It is used to make safer, more efficient and longer lasting lithium-ion batteries, synthetic sapphire for LED lighting and high technology optics. Use of HPA in battery technologies means batteries have a higher retention capacity compared to conventional anode materials, with potential cost benefits and increased range for electric vehicles.

Given the positive CAGR and Australia's long track record in the alumina industry there are now a range of novel Australian HPA projects in the pipeline. Indeed, it is the strong regional bauxite and alumina industry in Australia which is being leveraged to create these new manufacturing opportunities. For example, Alpha HPA has announced its intention to construct what would potentially be the world's largest HPA plant in Gladstone, with targeted production of 10,000 tonnes per annum. Gladstone is well known as the location of Rio Tinto's Yarwun and Queensland Alumina Ltd refineries, as well as the Boyne aluminium smelter. The Alpha HPA process will use a precursor sourced from one of the alumina refineries in its "Smart SX" (solvent extraction) low emissions refining technology. Alpha HPA also collaborates with other neighbouring manufacturers so that by-products from its extraction process can be recycled, making the project an almost zero discharge facility. The solvent extraction technology, combined with renewable energy, aims to generate a range of HPA products with a carbon footprint lowered by as much as 70% compared to the incumbent method of production.

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<sup>8</sup> <https://www.canada.ca/content/dam/nrcan-rncan/site/critical-minerals/Critical-minerals-strategyDec09.pdf>

### **Turning Australia's innovative ideas into an advantage**

Australia has more than 50 years of technical experience in bauxite mining and alumina refining technologies. This experience helps not only us, but our bauxite, alumina and aluminium customers, to reach their sustainability goals. Alcoa, Rio Tinto and South32's Worsley Alumina operations all have their global bauxite and alumina research headquarters in Australia, helping develop new technologies for the world. Australia's alumina already has some of the lowest emissions in the world, with an average emissions intensity of 0.7 tonnes of carbon dioxide per tonne of alumina (t CO<sub>2</sub>-e/t), compared to the global industry average of 1.2 tCO<sub>2</sub>-e/t. Additionally, Australia's alumina producers work collaboratively through the Heavy Industry Low Carbon Technology Cooperative Research Centre (HILT CRC<sup>9</sup>).

The Australian Renewable Energy Agency (ARENA), in consultation with Alcoa, Rio Tinto and South32 has published a Roadmap for Decarbonising Australian Alumina<sup>10</sup>. The Roadmap identifies four key themes for decarbonisation that could transform the way alumina refineries consume and use energy by enabling the uptake of renewables and removing the use of fossil fuels. It also provides a framework for future policy and investment decisions and serves as a call to action to collaboratively transition the sector into an industry at the forefront of the transition to net zero.

Globally, there is a focus across industry to find solutions for the technology challenges required to decarbonise. There is an opportunity for Australia to lead the world in development and implementation of these technologies, capitalising on Australia's national advantages, providing jobs and value to the economy. Australia has the systems and processes to extract and process critical minerals, like bauxite into alumina and then into aluminium, safely, efficiently and sustainably. Australia is the world's largest producer of bauxite and second largest producer of alumina and is a global leader in the ethical and environmentally responsible supply of these key critical minerals for the battery industry. Australia's aluminium industry will both need a world class battery industry to provide the storage technologies needed to support industrial decarbonisation as well as having the ability to supply the aluminium to be part of the battery value chain.

The Council believes that a model of leveraging large private corporate investment including from customers, or Original Equipment Manufacturers (OEMs), together with national and regional government support for research and collaboration has been successful internationally. For example, members of the Council, Rio Tinto and Alcoa, are involved in a joint venture with Apple in Canada on the ELYSIS process which would remove the use of carbon in the direct smelting process. This process is aiming to have this technology demonstrated by 2024<sup>11</sup>. The Council believes this model of investment and collaboration could have applicability as Australia develops its National Battery Strategy.

### **Creating the enabling environment for industry growth**

#### *Driving ESG*

Australia has a reputation as a reliable and responsible producer of bauxite, alumina, aluminium and finished goods with some of the world's most robust Environmental, Social and Governance (ESG) credentials. This is particularly true of Australian bauxite mining which is regarded as having some of the highest sustainability standards in the world, particularly for rehabilitation. At the same time, changes are occurring in global bauxite supply with new countries and new operators entering the market. Sustainable bauxite mining practices are critical to the global reputation of the industry. Sustainable practices should be perceived and valued as a competitive advantage for all mining companies, including those in the battery sector.

While seeking to maintain Australia's highest standards for ESG, it is also worth considering that global demand will continue to be met from elsewhere if not provided by Australia. This may increase the net global impact of mining, compared with continued development in Australia. It is worth noting that the global competitors

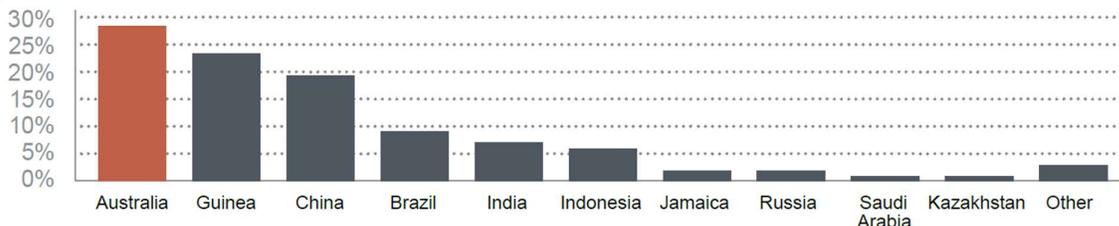
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<sup>9</sup> <https://www.hiltcrc.com.au/>

<sup>10</sup> <https://arena.gov.au/assets/2022/11/roadmap-for-decarbonising-australian-alumina-refining-report.pdf>

<sup>11</sup> <https://www.elysis.com/en>

for each part of the aluminium industry vary with commodity. For bauxite, this is principally Guinea, which is the world’s largest exporter, principally to China, including some captive bauxite mines; as well as Brazil, India, and Indonesia (Figure 2). Key competitors in alumina refining are China (>50% global production) and emerging economies such as Brazil, India, Saudi Arabia, Vietnam and Kazakhstan. Similarly, for aluminium smelting, China accounts for almost 60% of global production and the key countries for growth are India, United Arab Emirates, Bahrain, Saudi Arabia, and Malaysia.



**Figure 2 Global Bauxite Production Rankings<sup>5</sup>**

The Aluminium Stewardship Initiative (ASI) provides the industry with a global certification scheme which includes not just carbon content – but the full range of ESG issues for all parts of the value chain<sup>12</sup>. Many of Australia’s mines, refineries, smelters and chains of custody supply chains are certified. Additionally, the global industry is differentiating products on the basis of the carbon credentials<sup>13</sup>. The aluminium industry<sup>14</sup> uses blockchain technology to provide provenance traceability and transparency.

*Recycling considerations*

Recent work<sup>15</sup> undertaken by the Council, in conjunction with Deloitte and Coreo found that significant opportunities in manufacturing and recycling may be unlocked by cross-value chain coordination, including with Government and its agencies. There are clear opportunities for value-added manufacturing enabled by the existing integrated aluminium industry. One of the flagship projects identified by this work was to increase Australia’s recycling capacity - Global demand for recycled aluminium is growing rapidly, driven by emerging minimum content requirements from governments and corporate demand for low carbon products. A circular industry policy could lower cost and risk for domestic pre- and post-consumer scrap reprocessing. This could be extended to include battery and renewable energy components – creating new manufacturing opportunities with a circular industry in their design.

<sup>12</sup> <https://aluminium-stewardship.org/asi-standards/performance-standard>

<sup>13</sup> For example: <https://www.riotinto.com/-/media/Content/Documents/Products/Aluminium/RT-Aluminium-RenewAl-fact-sheet.pdf?rev=f89b8d105e15400fa053d58a364c3be8>, <https://www.alcoa.com/sustainability/en/pdf/EcoSource.pdf>

<sup>14</sup> <https://www.startresponsible.com/>

<sup>15</sup> <https://aluminium.org.au/news/aac-deloitte-and-coreo-cast-anew-project/>

## **Conclusion**

Australia is on a path towards becoming a green energy superpower, which will require battery technologies, and aluminium and its derivatives have a central role to play in this transformation. To capitalise on its wealth of natural and renewable resources and to make Australia a global leader in the battery value chain and development, Australia's critical minerals strategy needs to be broadened, and the scale of ongoing investment must be substantial to achieve this ambition. Australia's industry should strive to maintain its status at leading global research into new technologies. A key pathway to enabling new economy industries, will be to leverage the capability in the regions of existing industries. A circular economy and domestic focus to industry policy, will maximise the value of these new industries.

There is a clear opportunity for Australia to drive critical minerals growth, which can support a battery development value chain. This in turn can assist mining and manufacturing in Australia implement storage technologies to strengthen and firm our electricity grids.

The Council would be happy to provide additional information on any issues raised in this submission.

Kind regards,



Marghanita Johnson  
Chief Executive Officer  
Australian Aluminium Council  
M +61 (0)466 224 636  
[marghanita.johnson@aluminium.org.au](mailto:marghanita.johnson@aluminium.org.au)