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Critical Technologies Hub
Department of Industry, Science and Resources
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Dear Minister

Australian Aluminium Council Response to 2022 List of Critical Technologies in the National Interest

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 five large (>10 Mt per annum) bauxite mines plus several smaller 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 sixth 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 recognition by the Australian Government to back critical and emerging technologies to provide the country with a clear competitive advantage, accelerate productivity growth, and create well-paying jobs and secure supply chains. The List of Critical Technologies in the National Interest (the List) provides the focus and forms the basis for further discussions around investment and collaboration across all sectors of the economy.

Aluminium should be recognised as a Critical Mineral

The Council welcomes the recognition of Critical Minerals extraction and processing in Australia in the 2021 List and believes this inclusion should be continued and strengthened. 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). Other countries include a much broader definition, for example Canada, USA and EU identify bauxite (aluminium ore) and aluminium as critical, as it is the second most widely-used metal and also essential for clean energy technologies. Australia's 2022 Critical Minerals Strategy references these inclusions, but then doesn't go on to include bauxite or aluminium. CSIRO's Critical Mineral's 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 of advantage during strategic national planning. The Council believes there is a case to change the current national definition of Critical Minerals and include aluminium ore (bauxite)/alumina/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.

Australia is leading global research

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 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_2-e/t), compared to the global industry average of 1.2 tCO_2-e/t.

Case Study 1: In May 2021 Alcoa of Australia Limited (Alcoa) announced it had received funding from the Australian Renewable Energy Agency (ARENA) to test the potential use of renewable energy technology in a process known as Mechanical Vapor Recompression (MVR). Alcoa is currently conducting technical and commercial studies to adapt MVR technology to alumina refining. Electricity sourced from renewable energy would power compressors to turn waste vapor into steam, which would then be used to provide refinery process heat. If the feasibility studies are successful, Alcoa plans by the end of 2023 to install a three-megawatt MVR module with renewable energy at its Wagerup refinery in Western Australia, to test the technology at scale.
The MVR technology powered by renewable energy could reduce an alumina refinery's carbon footprint by 70%. The technology also has the potential to significantly reduce water use in the refining process by capturing water vapor that would otherwise be lost to the atmosphere.

Case Study 2: Rio Tinto announced a partnership with ARENA in June 2021, to conduct a feasibility study investigating the potential to partially decarbonise its alumina refining operations using renewable hydrogen. Rio Tinto will investigate the technical implications of displacing natural gas with renewable hydrogen at its Yarwun alumina refinery in Gladstone, particularly focussed on simulating the use of hydrogen in the calcination process. In August 2021, Rio Tinto announced a further partnership with Sumitomo Corporation to study the construction of a hydrogen pilot plant and explore the potential use of hydrogen at the Yarwun alumina refinery.

Case Study 3: Electric pressure calcination can produce pure, uncontaminated steam exhaust, which can be captured and reused, reducing demand for steam from natural gas boilers. Electric calcination could potentially reduce Australian alumina refining emissions by 40% when powered by 100% renewable electricity. Alcoa is undertaking a $19.7 m project in conjunction with ARENA ($8.6m) and the WA Govt ($1.7 M) to test this process. The project also aims to improve understanding of load flexibility and the provision of essential systems services to the South West Interconnected Grid (SWIS).

The findings of these studies have potential applications in other high temperature Australian manufacturing processes beyond the alumina and outside the mineral processing sectors. Additionally, if successful, the technical and commercial lessons from the hydrogen calcination technology could lead to its wider implementation not only in Australia, but also globally.

Australia has the systems and processes to extract and process critical minerals, like bauxite into alumina and 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.

An enabling pathway for new critical mineral industries

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 15,000-16,000 tonnes per annum. More recently demand has grown due to the need for its

quality, purity and versatility in high-tech applications. 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.

HPA is not the only new industry linked to the existing aluminium value chain. Additionally, ABx subsidiary ALCORE Limited (Alcore) is proposing to build a $16.4M aluminium smelter bath recycling plant in Bell Bay, Tasmania. The plant is proposed to transform 1,600 tonnes per year of aluminium smelter bath into aluminium fluoride, an essential chemical for aluminium smelting, for which Australia currently imports 100% of its requirements. The potential to establishment domestic aluminium fluoride production will help protect the aluminium industry from supply chain disruption, increase Australia's manufacturing resilience and capability. This increase in the security of supply for Australian aluminium smelters will also create highly skilled manufacturing jobs, and the production of aluminium fluoride from aluminium smelter bath is an excellent illustration of the circular economy.

Conclusion

The Council believes that Australia's aluminium value chain (bauxite, alumina and aluminium), as well as HPA, should be considered as Critical Minerals on the List of Critical Technologies for reasons which are consistent with the objectives of promoting Australia as a secure nation of excellence for investment, research, innovation, collaboration and adoption of technologies both domestically and globally. This is in recognition of the existing vertically integrated supply chain, the emerging manufacturing potential and to secure future onshoring opportunities. It would help the aluminium industry to thrive and maximise its value for critical technologies needed in Australia.

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

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