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Via [https://www.apf.gov.au/Parliamentary\\_Business/Committees/OnlineSubmission](https://www.apf.gov.au/Parliamentary_Business/Committees/OnlineSubmission)

30 November 2022

Dear Chair

***Re: Inquiry into Australia's transition to a Green Energy Superpower***

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 opportunity to provide this submission to the Joint Standing Committee on Trade and Investment Growth Inquiry into Australia's transition to a green energy superpower (the Inquiry). The Inquiry is investigating how trade and investment can support Australia's transition to a green energy superpower. Australia is in a unique position to leverage its existing, and potential future, manufacturing opportunities from mine to global clean energy markets. The key policy levers include a broader strategy on Critical Minerals, decarbonisation of electricity supply, funding work leading technology research and development of a circular industry policy. A summary of key industry initiatives is included in Table 1 at the end of this submission.

**Aluminium is part of a clean energy future and Australia has a central role to play**

Aluminium is one of the commodities most widely used in the global transition to a clean energy future<sup>1</sup>. 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. While an increasing proportion will be met through recycled aluminium, there will still be increased production of primary aluminium requiring a comparable increase in global bauxite mining and alumina refining rates.

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<sup>1</sup> <https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action>

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>2</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 refining, aluminium smelting and aluminium extrusion industries, making aluminium one of the few commodities in which the raw materials are mined and are processed all the way to a consumer product 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.

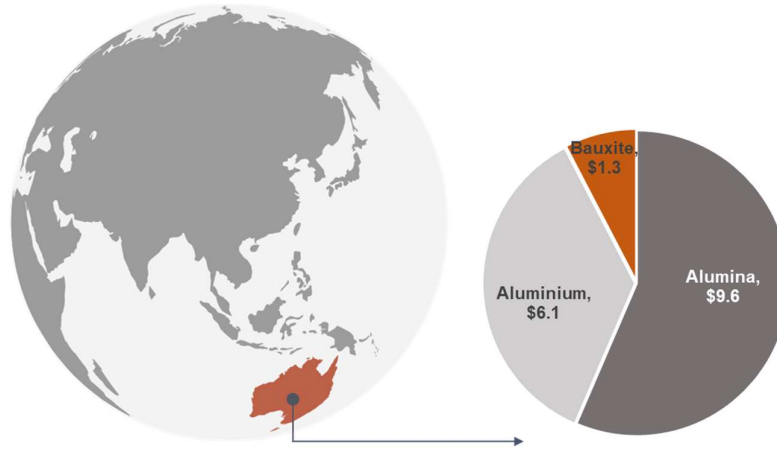


Figure 1. FY 2021-22 Industry Export Value (\$B)

It is worth noting that the global competitors for each part of the industry vary with commodity<sup>3</sup>. 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. 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.

**Aluminium should be recognised as a Critical Mineral and Australia as a supplier of choice**

The Council welcomes the Australian Government’s commitment<sup>4</sup> to develop a new National Critical Minerals Strategy in consultation with industry. Australia currently has a very narrow definition<sup>5</sup> of Critical Minerals – which 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 aluminium is the second most widely used metal and also essential for clean energy technologies. Australia’s 2022 Critical Minerals Strategy<sup>5</sup> references these inclusions, but then doesn’t go on to include bauxite or aluminium. CSIRO’s Critical Mineral’s Roadmap<sup>6</sup> includes aluminium, nickel and copper. The Queensland Government<sup>7</sup> has updated their list of critical minerals to

<sup>2</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>

<sup>3</sup> <https://aluminium.org.au/wp-content/uploads/2021/10/220913-TRADE-AND-COMPETITIVENESS.pdf>

<sup>4</sup> <https://www.minister.industry.gov.au/ministers/king/media-releases/support-critical-minerals-breakthroughs>

<sup>5</sup> <https://www.industry.gov.au/publications/critical-minerals-strategy-2022>

<sup>6</sup> <https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/energy-and-resources/critical-energy-minerals-roadmap>

<sup>7</sup> <https://www.resources.qld.gov.au/mining-exploration/initiatives/critical-minerals/uses-of-critical-minerals>

include aluminium (bauxite). The recent address by the Prime Minister<sup>8</sup> 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.

### **Substantial investment will be required in the transition to a green energy superpower**

The Mission Possible Partnership in collaboration with the International Aluminium Institute, recently released Making Net Zero Aluminium Possible: A Transition Strategy for a 1.5°C-compliant Aluminium Sector<sup>9</sup> (the Strategy). The release of the Strategy was supported by the Council and its members. This work brought together companies across the global industry, including those operating across the value chain in Australia. The Strategy recognised that it is possible to meet rising aluminium demand, reduce emissions from the sector to net zero by 2050, and align with a 1.5°C target. The Strategy also highlighted that a global investment of approximately US\$1 trillion will be required for the aluminium sector transition, including significant investment to supply the required zero-emissions electricity. It outlined not only actions the industry needs to take, but also actions required by Governments to support this. In particular, developing policy which is predictable, stable and transparent to enable businesses to confidently plan for this substantial investment. Governments also have a vital role to play designing electricity markets to support the transition and minimising the risks of carbon leakage.

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.

### **Decarbonisation of electricity supply is the biggest opportunity in the next decade**

Decarbonisation of Australia's electricity supply is the single biggest opportunity to decarbonise the vertically integrated domestic aluminium industry in the coming decade. Providing electricity is supplied consistently, with firm power, and at internationally competitive prices, aluminium smelting can be run on renewable electricity. The carbon intensity of the Australian grid is declining rapidly<sup>11</sup>, with this increased penetration of variable renewables. The owners of Australia's four smelters have signalled their desire to recontract renewable electricity at the end of their current terms (2025-2029).

Australia's grid-connected mines, refineries and particularly smelters perform an enabling function in grid stabilisation which helps with increased penetration of variable renewable electricity. Over the longer term, smelters play a key role in being more flexible users of power to help balance variable generation grid systems. The Strategy notes that aluminium smelters in Australia are providing a leading role in already delivering this flexibility.

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

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<sup>8</sup> <https://www.pm.gov.au/media/address-sydney-energy-forum>

<sup>9</sup> <https://missionpossiblepartnership.org/wp-content/uploads/2022/10/Making-1.5-Aligned-Aluminium-possible.pdf>

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

<sup>11</sup> <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/market-operations/settlements-and-payments/settlements/carbon-dioxide-equivalent-intensity-index>

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.

As noted in the Strategy, the deployment of technologies such as inert anodes in smelters and electrification of refineries remain contingent on sufficient supply of zero emissions electricity and green hydrogen. Decarbonisation of Australia's electricity supply is the most significant opportunity and challenge in the transformation of Australia's industry, in the biggest clean industrial and economic revolution this country has seen.

### **Australia should invest where it 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 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<sub>2</sub>-e/t), compared to the global industry average of 1.2 tCO<sub>2</sub>-e/t.

**Case Study 1:** In May 2021<sup>12</sup> Alcoa of Australia Limited (Alcoa) announced it had received funding from 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<sup>13</sup>, 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<sup>14</sup> can produce pure, uncontaminated steam exhaust, which can be captured and reused, reducing demand for steam from natural gas boilers. Electric calcination could

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<sup>12</sup> <https://arena.gov.au/projects/mechanical-vapour-recompression-for-low-carbon-alumina-refining/>

<sup>13</sup> <https://arena.gov.au/projects/rio-tinto-pacific-operations-hydrogen-program/>

<sup>14</sup> <https://arena.gov.au/projects/alcoa-renewable-powered-electric-calcination-pilot/>

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 System (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.

### **Existing industry is already an enabling pathway for new economy industries**

The vertically integrated aluminium industry has been operating in Australia since 1955; almost 70 years. This strong regional manufacturing base in Australia enables existing industry to be leveraged to create new manufacturing opportunities. Strengthening our national manufacturing capabilities now will put Australia in the strongest possible position to meet these future forecasts for not only traditional commodities such as bauxite, alumina and aluminium; but also, other emerging aluminium related commodities, like high purity alumina (HPA), aluminium alloys and aluminium salts. As the world's largest producer of bauxite and the largest exporter of alumina, Australia is strategically positioned to support this opportunity.

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. 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 establish 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.

### **Opportunities for hydrogen should be considered in a domestic context**

There has been considerable focus on the creation of an internationally traded hydrogen export industry. The Council believes that, while Australia is well placed to be a major exporter, increased focus needs to be on hydrogen as an input into downstream products in Australia, reducing emissions associated with their production; and on alternative uses for electricity as a green energy super power.

While Australia should seek to grow suitable export markets for hydrogen globally, the Council believes that before opportunities to export hydrogen are investigated, Australia should maximise the domestic application to capitalise on its own strategic advantage and maximise economic value. The Council believes Australia should seek to maximise its own value adding domestic sectors, providing them with internationally competitive zero emissions hydrogen, prioritised over exports; including through a domestic hydrogen reservation scheme. This would capitalise on Australia's national advantage providing jobs and value to the economy.

The industry is currently investigating options which include the use of renewable hydrogen in its processes, particularly in the production of alumina. Additionally, hydrogen is likely to have a role as an alternative technology in large vehicle transport; potentially including bauxite mining.

### **... and there are further enabling opportunities for new green economy industries**

Recent work<sup>15</sup> undertaken by the Council in conjunction with Deloitte and Coreo found that significant opportunities in manufacturing and recycling can 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.

The work identified three flagship projects which the Council believes would present a different approach to industry policy, consistent with Australia's future as a green energy superpower. By focusing on narrow value chains, these projects have the potential to unearth challenges and opportunities which could then be more broadly applied to other commodities and across industries.

1. A closed-loop mine-to-panel solar value chain - Aluminium is the second largest input by weight, and domestic extruders already have the capability to produce frame and rail for the sector. In addition, the upstream industry has a growing demand for renewables, which could further catalyse demand for manufacturing.
2. Green caustic soda production - Caustic is a critical input into alumina refining (and other industries) but is currently 100% imported in Australia. A broader review of supply chains for energy intensive products currently imported into Australia may identify opportunities, like caustic, to increase domestic manufacturing, reducing supply chain risk while increasing sovereign capability.
3. Increase 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.

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

## **Conclusion**

Aluminium is part of a clean energy future and Australia has a central role to play, as it transforms into a green energy superpower. To capitalise on its wealth of resources and to make Australia a supplier of choice, Australia's critical minerals strategy needs to be broader, including recognising aluminium. The Australian industry is investing in the transition; however, the scale of the investment is substantial and decarbonising Australia's electricity supply is the biggest opportunity in the next decade. This will require Government support. Australia's industry is already leading global research into new technologies, and further investment is required. 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.

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

Kind regards,



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**Table 1 Key Australian Aluminium Industry Initiatives**

<b>Activity</b>	<b>Link</b>
Electric Calcination Study	<a href="https://arena.gov.au/projects/alcoa-renewable-powered-electric-calcination-pilot/">https://arena.gov.au/projects/alcoa-renewable-powered-electric-calcination-pilot/</a>
Gladstone Renewable Request for Proposals	<a href="https://www.riotinto.com/news/releases/2022/Rio-Tinto-calls-for-proposals-for-large-scale-wind-and-solar-power-in-Queensland">https://www.riotinto.com/news/releases/2022/Rio-Tinto-calls-for-proposals-for-large-scale-wind-and-solar-power-in-Queensland</a>
Hydrogen Calcination Study	<a href="https://arena.gov.au/projects/rio-tinto-pacific-operations-hydrogen-program/">https://arena.gov.au/projects/rio-tinto-pacific-operations-hydrogen-program/</a>
Hydrogen Pilot Plant	<a href="https://www.riotinto.com/news/releases/2021/Rio-Tinto-and-Sumitomo-to-assess-hydrogen-pilot-plant-at-Gladstones-Yarwun-alumina-refinery">https://www.riotinto.com/news/releases/2021/Rio-Tinto-and-Sumitomo-to-assess-hydrogen-pilot-plant-at-Gladstones-Yarwun-alumina-refinery</a>
Mechanical Vapour Recompression Study	<a href="https://arena.gov.au/projects/mechanical-vapour-recompression-for-low-carbon-alumina-refining/">https://arena.gov.au/projects/mechanical-vapour-recompression-for-low-carbon-alumina-refining/</a>
Memorandum of Understanding between Tasmania and Rio Tinto	<a href="https://www.stategrowth.tas.gov.au/_data/assets/pdf_file/0010/334558/TAS-RIO_TINTO_MOU_Feb_2022.pdf">https://www.stategrowth.tas.gov.au/_data/assets/pdf_file/0010/334558/TAS-RIO_TINTO_MOU_Feb_2022.pdf</a>
Refinery of the Future	<a href="https://www.alcoa.com/global/en/stories/releases?id=2021/11/alcoa-to-design-an-alumina-refinery-of-the-future">https://www.alcoa.com/global/en/stories/releases?id=2021/11/alcoa-to-design-an-alumina-refinery-of-the-future</a>
Rio Tinto and GMG	<a href="https://graphenemg.com/gmg-riotinto-energysavings-battery/">https://graphenemg.com/gmg-riotinto-energysavings-battery/</a>
Spinifex Wind Farm (Portland)	<a href="https://arena.gov.au/news/offshore-wind-could-power-portland-aluminium-smelter/">https://arena.gov.au/news/offshore-wind-could-power-portland-aluminium-smelter/</a> <a href="https://www.spinifexoffshore.com.au/#/">https://www.spinifexoffshore.com.au/#/</a>
Tomago Aluminium Renewable Future	<a href="https://www.tomago.com.au/tomago-aluminium-future-renewable-energy-needs/">https://www.tomago.com.au/tomago-aluminium-future-renewable-energy-needs/</a>
Weipa Solar and Battery Capacity	<a href="https://www.riotinto.com/news/releases/2021/Rio-Tinto-to-triple-Weipa-solar-capacity-and-add-battery-storage-to-help-power-operations">https://www.riotinto.com/news/releases/2021/Rio-Tinto-to-triple-Weipa-solar-capacity-and-add-battery-storage-to-help-power-operations</a>
Mission Possible Partnership	<a href="https://missionpossiblepartnership.org/wp-content/uploads/2022/10/Making-1.5-Aligned-Aluminium-possible.pdf">https://missionpossiblepartnership.org/wp-content/uploads/2022/10/Making-1.5-Aligned-Aluminium-possible.pdf</a>