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Select Committee on Energy Planning and Regulation in Australia
https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Energy_Planning_and_Regulation_in_Australia
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Dear Chair

Re: Select Committee on Energy Planning and Regulation in Australia

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. Department of Industry, Science and Resources has recently forecast[1] that earnings for Australian exports of aluminium, alumina and bauxite are expected to rise from $16 billion in 2023–24 to $18 billion in 2024–25. More than $14B of this comes from the alumina and aluminium industries, as value adding mineral processing sectors. The industry includes six large bauxite mines plus several smaller mines which collectively produce over 100 Mt per annum making Australia one of the world's largest producers of bauxite. Australia is the world's largest exporter of alumina with five 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[2] is one of the commodities most widely used in the global transition to a clean energy future. It is also recognised for its importance to both economic development and low emissions transition. Aluminium is Australia's top manufacturing export. The industry directly employs more than 21,000 people, including 6,600 full time equivalent contractors. It also indirectly supports a further 55,000,000 families predominantly in regional Australia. The integrated industry contributes around $18 b to Australia's GDP.

Aluminium Industry Context

Aluminium is one of the commodities most widely used in the global transition to a clean energy future[3]. 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 will nearly double[4]. 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.

Australia is one of the very few countries which has bauxite mining, alumina refining, aluminium smelting and aluminium extrusion all within its borders, making aluminium one of only two commodities in which the raw materials are mined and processed all the way to a consumer product right here in Australia. The single biggest opportunity to decarbonise the energy intensive, vertically integrated Australian aluminium industry is through the combination of electrification or conversion to low emissions fuels for existing industrial processes and decarbonisation of the national electricity supply.

Australia has a large resource and industrial base and has great potential for conversion to zero- and low-emissions industrial production including for export, with economic benefits to match. While industrial

[1] https://www.industry.gov.au/publications/resources-and-energy-quarterly-december-2023
[2] https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action
[3] https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action
[4] International Aluminium Institute High Substitution Scenario

production is a major contributor to Australia's overall emissions, both directly and via consumed electricity, Australia's green industry ambition is linked to opportunities created by the global transition to net zero.

As the Council has maintained throughout our dialogue with Government, the future of the industry in Australia cannot be taken for granted[5]. Key risks include high energy costs combined with a high cost to decarbonise industrial processes, proactive industry policy among competitor nations, as well as regulatory complexity and uncertainty.

To support this industrial decarbonisation, Australia must be sufficiently competitive to be able to attract global decarbonisation investment. Recent analysis by the Council compared industry policy measures in Australia with other key aluminium and alumina producing jurisdictions[6] and found more is required to ensure appropriate policy settings are in place to support a positive future for this strategically important industry.

Aluminium Industry Energy Use

Australia's aluminium smelters are already a large electricity consumer, with the four smelters using around 2,600 MW or ~10% of the electricity consumed in the NEM. Providing electricity is supplied consistently, with firm power, and at internationally competitive prices, aluminium smelting can be run on renewable electricity. As smelters are already electrified, no technological conversion is required. The carbon intensity of the Australian grid is declining rapidly, with this increased penetration of variable renewables. The owners of Australia's four smelters[7] are in the process of recontracting for electricity at the end of their current terms (2025-2029), with the terms of these new arrangements extending to between 2035-2055.

As there is an increased penetration of variable renewable technologies, there will be increased demand by the grid for smelters to be able to offer power flexibility and interruptibility. Interruptibility is the short term loss of power to part of or whole potline or whole smelter. Flexibility is the ability to use more or less power than normal, for short term periods (seconds to minutes through to hours) without creating too much process instability. 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 the Australian Energy Market Operator (AEMO) to manage a complex and challenging system and maintain supply to domestic customers. Additionally, smelters are increasingly offering rights in in relation to the short-term reduction of volume at times of peak demand via contractual arrangements[8].

The ability to offer these services varies as each smelter has a unique aluminium reduction cell (also called a pot) design which impacts its ability to offer demand response into the system. After around 75 minutes without electricity, aluminium begins to "freeze" in the pots, which can force plant/line interruption and potentially freezing cells with a restart which can take months to complete at significant cost. It is imperative that the regulatory framework supports the development and implementation of technologies capable of restarting the network infrastructure in emergency events to mitigate this risk.

[5] https://news.alcoa.com/press-releases/press-release-details/2024/Alcoa-announces-curtailment-of-Kwinana-Alumina-Refinery-in-Western-Australia/default.aspx

[6] https://aluminium.org.au/wp-content/uploads/2023/11/Aluminium-Critical-Mineral-Report-Nov23.pdf

[7] https://www.alcoa.com/australia/en/news/releases?id=2024/09/portland-aluminium-secures-new-energy-contract, https://www.tomago.com.au/tomago-aluminium-future-renewable-energy-needs/, https://www.riotinto.com/en/news/releases/2024/rio-tinto-signs-australias-biggest-renewable-power-deal-as-it-works-to-repower-its-gladstone-operations

[8] https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2023/august/portland-smelter-contract-renewal-finalised

While the industry nominally uses 10% of the NEM, the Minimum Operational Demand in the NEM was set on 20 October 2024 at only 10,305 GW [9]. At times such as these, the aluminium industry uses more than 25% of the NEM. With AEMO now needing to issue "Minimum System Load" Market Notices[10] for the first time ever, the role of smelters in underpinning critical minimum demand should not be underestimate. This is currently unvalued in the market.

The alumina industry also consumes around 220 PJ of energy, currently as gas and coal in the refineries. This energy use may convert to electricity requirements of 3-5GW[11] firm in the NEM and the SWIS depending on the technology applied in digestion and calcination[12]. This would transform both the NEM and SWIS electricity markets. Alumina refineries will require technology changes for both digestion and calcination processes to meet zero-emissions goals; either in the form of electrification or adaptation to use hydrogen for process heating. Development of this technology and its application will be stepwise as new technologies to reduce overall emissions become viable. The required thresholds for implementation will be differentiated by refinery (and processes within a refinery); locational access to energy, including supporting transmission infrastructure; the local emissions intensity of electricity supply and bauxite type. The investment required to implement these changes will be substantial.

However, this relies on not only the development of commercial and technological solutions for electrification of alumina refineries but also the development of sufficient competitively priced low emissions generation and storage, and transmission capacity at scale to match. The electrification of existing industry, combined with the development of new electricity intensive industries, such as hydrogen, will require substantial volumes of electricity delivered reliably, affordably and at scale. The Council is concerned that if technology development lags, or energy transmission and supporting infrastructure is delivered in the manner and at the pace it has historically, this will become the rate limiting step in the transition[13]. For example, Worsley Alumina[14] have confirmed that a substantial expansion and modification of the energy grid would be required to deliver renewable power at the necessary scale for industrial users in the region (SWIS). Therefore, decarbonisation of Worsley Alumina may be in two stages, firstly conversion of the onsite boilers to natural gas and only in the longer-term application of new technologies to support increased electrification and renewable energy for the refinery, which would require broader investment in shared energy infrastructure in the region.

An internationally competitive cost of zero carbon electricity at industrial scale to facilities, which will enable the greatest transformation of the sector. It is hoped that some technologies for refinery digestion may be able to be deployed prior to 2030. However, access to the required generation, storage and infrastructure outside the facility could be the rate limiting step in the electrification process. To assist with this, one solution is that Government could accelerate significant private investment in renewable generation, low-carbon industries and industrial decarbonisation projects by committing to upfront funding of transmission upgrades, that could be recovered from users (as needed) once operating.

The largest factor in determining the location of future refining, smelting and manufacturing locations is reliable, internationally competitive, low emissions energy. New large scale renewable energy, firming and transmission assets to meet the needs of a decarbonising aluminium industry must be developed in a timely fashion to enable emissions associated with the industry to be reduced at scale. The Council believes that

[9] https://www.linkedin.com/posts/australian-energy-market-operator_big-news-for-renewable-energy-in-australia-activity-7254236785872941057-D24_?utm_source=share&utm_medium=member_desktop
[10] https://wattclarity.com.au/articles/2024/09/24sept-aemo-minimumsystemload-alert-vic/
[11] The potential renewable capacity required to meet this demand is likely 3 to 5 times this amount. https://arena.gov.au/assets/2022/11/roadmap-for-decarbonising-australian-alumina-refining-report.pdf
[12] https://aluminium.org.au/wp-content/uploads/2022/07/FACT-SHEET-03-ALUMINA.pdf
[13] https://www.worley.com/~/media/Files/W/Worley-V3/documents/our-thinking/from-ambition-to-reality/from-ambition-to-reality-report.pdf
[14] P73, https://www.south32.net/docs/default-source/all-financial-results/2022-annual-reporting-suite/sustainable-development-report-2022.pdf

while the long term solution is renewable electricity, gas will have a necessary bridging role in lowering carbon emissions from refineries in the medium term, while low emissions alternatives are further developed and rolled out in the future.

Australia's Energy Markets

The Council understands the Inquiry intends to examine the institutional structures, governance, regulation, functions, and operation of the Australian energy market and will focus its response with regard to that.

Both the National Electricity Market (NEM) and Wholesale Electricity Market (WEM) are going through a once in a century transformation and as Australia moves towards net zero emissions by 2050, this transition will need to be carefully managed to ensure that all consumers are provided with internationally competitively priced, reliable, low emissions energy. The NEM and WEM are currently heading towards systems which lacks the inertia and demand response requirements needed to address the risk of instability, which is becoming increasingly problematic for industries which rely on firm, uninterrupted power supplies.

The biggest single opportunity to decarbonise the vertically integrated domestic aluminium industry is via decarbonisation of the electricity supply, which assists with both direct electrification and other potential pathways, such as hydrogen. Decarbonising the electricity supply needs to be combined with technology availability for the facilities to enable transformation. Both are long-term, complex endeavours, which need to move together. However, in some cases it is the supply and availability of competitively priced zero emissions electricity which may be the rate limiting step.

While the cost of variable renewable energy generation has fallen dramatically, the delivered cost (including transmission and distribution) of firmed electricity has not. The cost of firming renewable energy supply is likely to be one of the largest differentiators of Australia's future competitiveness for electricity-intensive industries. There is no transition without transmission and in both the NEM and the South West Interconnected System (SWIS) effort is needed to continue to progress future state transmissions networks, to support the large volume of renewable energy required to offset not only existing coal fired generation but also increased demand for facilities to electrify once this technology becomes viable. For example, the SWIS does not have the generation nor transmission capacity to electrify one alumina refinery, let alone three. The fundamental pillar of global competitiveness is low-cost renewable energy, firming and transmission. Despite recent announcements, such as the expansion of the Capacity Investment Scheme (CIS)[15], the scale of the investment at this stage does not match the scale of investment of Australia's competitors.

Conclusion

The Council notes that it is critical that Australia finds a pathway where its world class energy resources are translated into internationally competitive, low emissions, reliable energy to ensure industrial production, emissions and jobs are not exported to other countries. Australia has the opportunity to shape its future, including its energy transition and industrial transformation, in a manner which is consistent with not only its net zero ambitions, but which maximises the social and economic potential of its resources. The Council is happy to provide further information on any of the issues raised in this submission.

Kind regards,

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[15] https://minister.dcceew.gov.au/bowen/media-releases/delivering-more-reliable-energy-all-australians