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Select Committee on Nuclear Energy
https://www.aph.gov.au/Parliamentary_Business/Committees/House/Select_Committee_on_Nuclear_Energy

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Dear Chair,

Re: Select Committee on Nuclear Energy

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 Australian aluminium (including alumina) industry requires internationally competitive, reliable energy at scale. The Council supports a technology neutral and least cost approach to the transition.

[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

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 or nuclear electricity. Globally, around 39% of primary aluminium[5] is produced using renewables and 0.6% using nuclear energy. The nuclear energy currently used in the industry is predominantly used in Europe and China. 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 complementing Australia's pre 1997 hydro assets.

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). Due to the increased penetration of variable renewable technologies, there is already 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. 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[6].

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.

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[7]. 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[8] for the first time ever, the role of smelters in underpinning critical minimum demand should not be underestimated. 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[9] firm in the NEM and the SWIS depending on the technology applied in digestion and calcination[10]. 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

[5] https://international-aluminium.org/statistics/primary-aluminium-smelting-power-consumption/ data for 2023.
[6] https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2023/august/portland-smelter-contract-renewal-finalised
[7] 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
[8] https://wattclarity.com.au/articles/2024/09/24sept-aemo-minimumsystemload-alert-vic/
[9] 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
[10] https://aluminium.org.au/wp-content/uploads/2022/07/FACT-SHEET-03-ALUMINA.pdf

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[11]. For example, Worsley Alumina[12] have confirmed that a substantial expansion and modification of the energy grid would be required to deliver 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 energy for the refinery, which would require broader investment in shared energy infrastructure in the region.

The largest factor in determining the location of future refining, smelting and manufacturing locations is reliable, internationally competitive, low emissions energy. New large scale 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. Without the option of large-scale hydropower assets available to alumina, aluminium and downstream manufacturing industries in countries like Brazil and Canada, Australian assets are currently highly dependent on gas for their operations and viability; directly using around 150 PJ of gas per annum as well as indirect consumption via the electricity market. The Council believes that while the long term solution is zero carbon 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 as well as being key in firming variable renewable electricity.

Australia's Energy Transition

The Council understands the Inquiry intends to examine factors which will impact on the consideration of nuclear power generation, including deployment of small modular reactors in Australia.

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. Australia's ageing coal fired generators in the NEM are retiring with up to 90% projected to retire before 2035 and the balance by 2040[13]. In the WEM, coal fired generation will exit within the next decade[14]. Investment is needed to ensure new generation, storage and firming are in place before existing power stations retire, to meet both current and future demand for electricity.

[11] https://www.worley.com/~/media/Files/W/Worley-V3/documents/our-thinking/from-ambition-to-reality/from-ambition-to-reality-report.pdf

[12] P73, https://www.south32.net/docs/default-source/all-financial-results/2022-annual-reporting-suite/sustainable-development-report-2022.pdf

[13] https://aemo.com.au/-/media/files/major-publications/isp/2024/2024-integrated-system-plan-isp.pdf

[14] https://aemo.com.au/-/media/files/electricity/wem/planning_and_forecasting/esoo/2023/2023-wholesale-electricity-market-electricity-statement-of-opportunities-wem-esoo.pdf

The NEM and WEM are currently heading towards systems which lack 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 Council's concern is ensuring that the transition is carefully managed to ensure all the required services are delivered in a way which delivers least cost energy, in the long term, to consumers.

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.

The Council supports a technology neutral and least cost approach to the transition away from the current thermal generation fleet, noting that the timeline for this is largely dictated by the declining reliability, challenging maintenance and decreasing competitiveness of Australia's current coal fired generators. The owners of Australia's four smelters[15] 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 Australia's largest electricity users, maintaining a reliable, competitive energy supply during this transition period is vital to Australia's aluminium smelters. This is a challenge that requires support across a broad group of stakeholders for the immediate investment decisions needed in the energy system. Delivering the necessary transformation of Australia's electricity system requires predicable policy and regulator settings, including for transmission, new generation and environmental approvals. Policy instability results in increased risk, time and cost – costs which are borne by consumers, resulting in delays in investment in Australia's electricity system, when time is of the essence and risking investors seeking alternate markets for investment.

Further, Australia will need to improve substantially on its track record in delivering large capital investment projects on time and on budget across a range of infrastructure types. The Council notes that there are substantial technical, regulatory and cost challenges to be overcome in Australia developing a nuclear industry, and there is a large body of research suggesting that nuclear power plants are the class of infrastructure investment which is more prone to cost and schedule blowouts because of these challenges[16]. The most recent Western nuclear builds on already permitted sites (US, UK, France, Finland) have taken between 17-23 years from design commencement to first power. The time required to develop any potential nuclear energy industry in Australia will already have needed substantial investment in alternatives to continue to maintain Australia's aluminium industry and any duplication of resources is unlikely to result in a least cost outcome for consumers.

[15] 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

[16] How Big Things Get Done, Flyvbjerg and Gardner (2023)

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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