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Department of Climate Change, Energy, the Environment and Water
Via https://consult.dcceew.gov.au/neps-consultation-paper

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Dear Ministers

***Re: National Energy Performance Strategy: Consultation 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 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 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 to the National Energy Performance Strategy (NEPS) Consultation Paper (the Paper). The Paper recognises that Australian households and industry are under pressure from high energy prices and that improving energy performance has a role in making businesses more competitive, supporting Australian jobs and reducing the strain on energy systems, while also reducing greenhouse gas emissions. The Council has considered how a NEPS contributes towards meeting the continued global competitiveness of the Australian aluminium industry, in the context of Australia's target of net zero by 2050 and 43% by 2030, as well as corporate ambitions over similar periods. The Council has also considered the needs for policy settings which will provide a transition to certainty for businesses through to 2030 and beyond.

**Aluminium industry energy use**

The Australian alumina and aluminium industries are energy intensive with energy typically accounting for 30-40% of the industries' cost base, and therefore it is a key determinant of their international competitiveness. The industries' energy usage can be summarised as follows:

- Electricity consumption in the National Electricity Market (NEM) where the industry has four aluminium smelters, two alumina refineries and a number of extruders; and uses more than 10% of the electricity consumed in the NEM.
- Gas usage by alumina refineries (WA Gas Market) of ~125 PJ, which is 32 % of WA's domestic gas market.
- Gas usage by alumina refineries and aluminium smelters (East Coast Gas Market) ~40 PJ, which is 7% of the East Coast domestic gas market; and
- Coal usage in refineries of 63GJ.

As energy is a key determinant of international competitiveness, the industry already recognises energy efficiency as the 'first fuel' and the industry is already focussed on energy efficiency as part of overall business practices. Additional programs which only serve as a regulatory burden but do not delivery further efficiency gains

**Aluminium Industry's Decarbonisation Strategy**

The Council has produced a series of five factsheets:

1. Australia's role in a global aluminium decarbonisation pathway;
2. How Australian bauxite will help meet global demand for aluminium;
3. Australia's role in developing low carbon alumina refining technologies for the world;
4. The role of Australia's aluminium smelters in providing baseload stability in a decarbonising grid; and
5. Decarbonisation of Australia's electricity supply, which the Council sees as the single biggest opportunity to decarbonise the vertically integrated domestic aluminium industry.

The Council intends to update these factsheets annually; reflecting not only progress in decarbonisation in the industry; but also updating the industry's views of the evolution of decarbonisation technologies, based on research undertaken in Australia and through global partnerships. The single biggest opportunity to decarbonise the energy intensive Australian vertically integrated aluminium industry is through the combination of electrification of existing processes and decarbonisation of the electricity supply.

In September 2022, 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[1] (the Strategy). The Council and its members supported the release of the Strategy. 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.

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

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. The carbon intensity of the Australian grid is declining rapidly[2], with this increased penetration of variable renewables. Our industry also will have the opportunity, as part of contract renewal, to contract a substantial share of electricity supply from firmed renewable electricity from on grid sources or behind the meter sources and members have signalled their intentions to do so[3].

In 2021 the industry's indirect emissions associated with the consumption of grid purchased electricity are around 17.6 Mt $CO_2$-e, of which 95% is from the production of primary aluminium (**Figure 1**). However, technologies which electrify the digestion process in alumina refineries could offset an additional 11 Mt $CO_2$-e of the 13.7 Mt alumina Scope 1 emissions.

[1] https://missionpossiblepartnership.org/wp-content/uploads/2022/10/Making-1.5-Aligned-Aluminium-possible.pdf
[2] https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/market-operations/settlements-and-payments/settlements/carbon-dioxide-equivalent-intensity-index
[3] https://www.riotinto.com/-/media/Content/Documents/Invest/Presentations/2021/RT-Investor-Seminar-2021-combined.pdf?rev=2e127f507f204ecc81e2d22527949560

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.

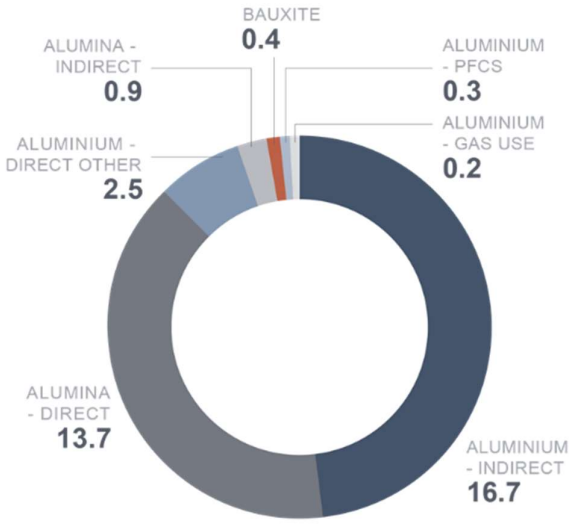


**Figure 1. 2021 Industry Emissions (Mt $CO_2$-e)**

Providing electricity is supplied consistently, with firm power, and at internationally competitive prices, aluminium smelting can be run on renewable electricity. For aluminium smelters, more than 95% of Scope 1 emissions could be eliminated with conversion to inert anodes (eliminating direct anode consumption, energy used in carbon bakes plus perfluorocarbons). The technology for inert anodes is currently under development and will be more easily *assessed* in 5 years. Deployment of this technology is not anticipated to be readily available before 2030. Additionally, this would only be implemented in conjunction with long-term internationally competitive electricity contracts to underpin investment and available renewable electricity supply because they are more electricity-intensive (~10-15%). And even with competitive low emissions electricity, the investment would be substantial, and implementation would vary from smelter to smelter, or even potline to potline.

Decarbonisation of Australia's electricity supply is the single biggest opportunity to decarbonise the vertically integrated domestic aluminium industry in the coming decade. The carbon intensity of the Australian grid is declining rapidly[4], 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.

[4] https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/market-operations/settlements-and-payments/settlements/carbon-dioxide-equivalent-intensity-index

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.

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.

**Electrification and Energy Efficiency**

Australia's alumina industry already has some of the lowest emissions in the world, with an average emissions intensity for alumina of 0.7 t $CO_2$-e/t compared to the global industry average of 1.2 t $CO_2$-e/t. Alumina refining is an energy intensive process, using about 10.5 GJ / t produced. Digestion and calcination are the two most energy intensive steps, with digestion consuming around two thirds of this energy. Currently, this energy is largely derived from gas and coal, as well as electricity. All of Australia's alumina refineries have some combined heat and power generation (cogeneration) facilities which use coal, gas, or biomass fuels. Cogeneration is an efficient way to produce process heat from the waste steam from electricity generation, resulting in the refineries using, and in some circumstances, also exporting low emissions electricity.

Around 150 PJ of energy, derived from gas or coal, is currently used in the digestion phase in alumina refineries to generate steam and electricity. This has the potential to be replaced by internationally competitive renewable electricity, subject to the successful development and commercialisation of refinery side technology (including Mechanical Vapour Recompression, thermal storage and Electric Boilers). This has the potential to require more than 4000 MW of electricity at a national level to replace the existing energy supply, on a like for like basis. This would transform both the NEM and South West Interconnected System (SWIS) electricity markets.

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 infrastructure is delivered in the manner and at the pace it has historically, this will become the rate limiting step in the transition[5]. For example, the SWIS may not have the generation nor transmission capacity to electrify one alumina refinery, let alone four. For example, Worsley Alumina[6] have confirmed that a substantial expansion and modification of the energy grid would be required to deliver

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

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

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.

It is the 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.

**Australian Alumina 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.

**Case Study 1:** In May 2021[7] 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 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[8], 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[9] 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 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.

[7] https://arena.gov.au/projects/mechanical-vapour-recompression-for-low-carbon-alumina-refining/
[8] https://arena.gov.au/projects/rio-tinto-pacific-operations-hydrogen-program/
[9] https://arena.gov.au/projects/alcoa-renewable-powered-electric-calcination-pilot/

**Previous Federal and Current State Schemes**

The aluminium industry was covered by the Energy Efficiency Opportunities Program (EEO Program) from 2006. The Program required that if the total energy used by the members of a corporate group is more than 0.5 petajoules in a financial year, the corporation must submit an assessment plan to the Department of Industry which set out proposals for assessing opportunities to improve the energy efficiency of the controlling corporation's group. The controlling corporation must also prepare and make publicly available reports that include information on how the proposals in the approved assessment plan were carried out, the results of carrying out those proposals, the response of the corporation to those results, the total energy use covered by all assessments, and resultant energy savings.

During the repeal of the legislation in 2014, a review found that since the introduction of the EEO Program companies had improved their internal management processes to such an extent that the EEO Program is no longer needed, since its introduction other national regulation to drive energy efficiency improvements, such as the National Greenhouse and Energy Reporting Scheme and the Emissions Reduction Fund, as well as state-based energy efficiency programs had been implemented. Additionally, and as noted in the Paper rising energy prices have driven increased energy efficiency activity in businesses, and consequently have reduced the need for the EEO Program.

In its submission of 2013, regarding the EEO Program, the Council noted that Member feedback suggests there have been no significant improvements to energy efficiency of operations attributable to the EEO Program. The EEO Program was developed to address a market failure relating to the availability and use of market data on energy efficiency. From an industry perspective the Council believed that there was no demonstrated market failure. In considering the NEPS, the Council encourages the Government to review the outcomes of the EEO Program so only genuine market failures are addressed.

There can be lessons learned from NSW's Energy Savings Scheme (ESS) as the state's largest energy efficiency program. The enhancement of the creation of Energy Savings Certificates (ESC) or the additionality test for those already under this scheme needs to be considered.

**Energy Efficiency Targets**

The Council recognises the Government's desire to set energy efficiency targets for Australia. While this may be useful at a national level or for improvements in household and commercial energy efficiency, the Council does not believe this is the most effective driver for energy efficiency and emissions reductions in large industry. The Council considers the Government's proposed Safeguard Mechanism reforms to be a more efficient and effective policy to improve industrial energy efficiency if well-supported by the government with adequate funds and mechanisms to enable development of technology and projects that will address deficiencies in this area.

**Industrial Energy Efficiency**

There are already ongoing business improvement activities that focus on energy efficiency, which should further be incentivised by the government. Business support is currently limited by very restrictive eligibility requirement barriers. Funds to develop emerging technologies under investigation are also needed to hasten their adoption at an industry scale.

**Conclusion**

The Council recognises that Australian households and industry are under pressure from high energy prices and that improving energy performance has a role in making businesses more competitive, supporting Australian jobs and reducing the strain on energy systems, while also reducing emissions. However, in considering the need for additional energy efficiency performance measures, the Council encourages the Government to review current and previous schemes and target new measures towards policy gaps, rather than creating duplication.

The Council seeks a national climate and energy policy framework which is transparent, stable and predictable, while maintaining the economic health of the nation including vital import and export competing industries. The Council is happy to provide further information on any of the issues raised in this submission and looks forward to continuing to work with the Government on the development of climate and energy policy.

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

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