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The Hon Angus Taylor MP
Minister for Energy and Emissions Reduction
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19 June 2020

Dear Minister

***Re: Technology Investment Roadmap Discussion Paper:
A framework to accelerate low emissions technologies***

The Australian Aluminium Council (the Council) represents Australia's bauxite mining, alumina refining and aluminium smelting industries. The Council welcomes the opportunity to provide a submission on the Technology Investment Roadmap Discussion Paper (the Roadmap). In its response the Council considered the Government's five areas of focus, on which it sought stakeholder views, as well as development of economic stretch goals.

In its responses to the Roadmap, the Council has considered how the framework fits with the Council's climate position. The Council supports the Paris Agreement and 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 industry is currently developing new technologies and articulating a range of costed technology pathways, which will inform the bauxite, alumina and aluminium industries in this transition. Critical to this transition will be a future where Australia's 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.

Aluminium as a regional contributor and enabler

The Australian aluminium industry has been operating in Australia since 1955 and has been a significant contributor to the Australian economy since this time. The industry is globally comparatively young and well maintained. The industry includes five bauxite mines (>10 Mt per annum), six alumina refineries and four aluminium smelters (Figure 1). Australia is the world's largest producer of bauxite and largest exporter of alumina, and the sixth largest producer of aluminium. As such, the industry should be considered as three processes which each have their own globally significant standing. Australia's aluminium industry is a key employer and contributor in the communities in which we operate. In 2018 we:

- Directly employed more than 14,500 people;
- Provided income for another 40,000 families;
- Paid \$1B in wages, at a rate nearly double the Australian manufacturing average;
- Spent more than \$4 B in our local communities; and
- Contributed more than \$15B to the Australian economy in export revenue.

Within the regions in which the industry operates, there is not only high-quality direct employment at mines, refineries and smelters, but also the opportunities for local manufacturers to grow where the aluminium industry provides a baseline of work on which they can then build. For example, Keppel Princeⁱ in Portland

began in 1968 specialising in the aluminium and forestry industries. While maintaining a long-term maintenance and full-service partnership with Portland Aluminium Smelter since 1986, for the last twenty years Keppel Prince have also expanded to be at the forefront of renewable energy production with projects across wind, solar, wave and hydro energy. This regional capability with associated infrastructure underpinned by the aluminium industry is an important enabler for low emissions technology development and manufacture.



Figure 1. Aluminium industry operations

Aluminium industry challenges, global trends and competitive advantages

While the focus of this submission is in the context of the Roadmap, it is important to recognise Australia’s electricity intense manufacturing sector is facing intense near-term challenges securing and maintaining internationally competitive energy contracts. These challenges have been exacerbated by the collapse in aluminium and alumina prices, because of COVID-19, and the longer-term future of industry will depend on the rate of recovery of the global manufacturing sector and the impact this has on international demand. Equally, the COVID-19 pandemic has underscored the importance of electricity intense manufacturing domestically, both in terms of economic and employment contribution but also in underpinning the stable operation of the NEM, supporting a productive and resilient economy.

The COVID crisis has demonstrated the advantages of not only the ability to value add within an almost exclusively domestic supply chain but also the importance of local industry which provides the underpinning market for our dependent contracting and manufacturing sector. This sector was able to pivot to meet rapidly changing domestic needs such as sanitiser, face shields and ventilators. Energy intensive industry provides not only current regional jobs, but also supports the smart Australian jobs of the future. To ensure this, the costs and risks associated the energy transition need to be valued and shared.

A report by the CM Groupⁱⁱ in May 2020, found even accounting for the COVID-19 pandemic, the 30-year global outlook for aluminium demand is strongly positive with a forecast compound annual growth rate of 3.8% over the 30-year period to 2050, resulting in annual demand of approximately 335 million tonnes per year by 2050 (across both primary and secondary aluminium consumption). This is consistent with World Bankⁱⁱⁱ projections of 100 million tonnes of primary production by 2050. The World Bank found that as

aluminium is used across a broad range of low emission technologies, it is less susceptible to changes in technology deployment, and it has the highest absolute levels of demand from any of the minerals included in their analysis. As the world's largest producer of bauxite and largest exporter of alumina, and with a wealth of energy resources, Australia should be well placed to capitalise on these competitive advantages, and these advantages must be considered when setting the focus for Australia's Roadmap.

Aluminium technology pathways – leveraging private investment and collaboration

The Council does not look at the opportunities for development and application of low emissions technology in Australia in isolation of the global industry. The Council, and its members, are investing in the development of a range of industry specific pathways:

- IAI project to articulate the range of technology pathways across the industry;
- Aluminium Stewardship Initiative (ASI) – 2020 / 2021 Standards Review process particularly focuses on greenhouse gas pathways (<https://aluminium-stewardship.org/asi-standards-revision/>);
- World Economic Forum (WEF) – through its membership of the IAI, the Council contributes to the development of the WEF aluminium pathway (<https://www.weforum.org/our-impact/mission-possible-we-re-helping-heavy-industry-reach-net-zero-carbon-emissions-by-2050>);
- Science Based Targets – Development of an aluminium specific pathway in partnership with Alcoa <https://sciencebasedtargets.org/aluminium/>, <https://sciencebasedtargets.org/wp-content/uploads/2015/05/Sectoral-Decarbonization-Approach-Report.pdf>;
- International Energy Agency (IEA) -through its membership of the IAI, the Council contributes to the development of the IEA aluminium pathway <https://www.iea.org/reports/tracking-industry/aluminium>, as well as non-aluminium specific pathways <https://www.iea.org/topics/tracking-clean-energy-progress>, <https://www.iea.org/topics/energy-technology-perspectives>; and
- COP26 – Aluminium Pathway under development (<https://unfccc.int/climate-action/marrakech-partnership/background>)

The Roadmap's identified sectors span the processes across the aluminium industry:

- Mining and Industrial Equipment
 - Scope 1 emissions associated with bauxite mining processes represents about 400 kt CO₂-e, predominantly associated with diesel consumption in vehicles. While only a small source of emissions for the Aluminium sector, the Council believes the similarities of vehicle movements with the nationally significant transport and mining sector, means this source of emissions should be included in future analysis.
 - Bauxite mines also use electricity, including renewable energy^{iv}.
 - About 5-10% of alumina refineries energy is used in sources such as pumps, fans and conveyors. With energy accounting for 30-40% of alumina refineries costs, there is already a strong focus on control system and energy optimisation. The Council supports the analysis that these technologies are largely commercially ready, but do not present substantial further opportunities for abatement.
- Industrial Process Heating
 - The major uses of industrial process heating are the digestion and calcination in alumina refining, representing about 90% of energy use in alumina refining (13 Mt CO₂-e of the 14.5 Mt CO₂-e from alumina refining).
 - As noted in the Paper, the Australian industry has already been working through ways to use concentrated solar thermal (CST) to reduce emissions in the Bayer process^v.
 - All of Australia's alumina refineries have combined heat and power generation (cogeneration) facilities which use coal, gas or biomass^{vi} fuel sources. This cogeneration results in the refineries using, and in some circumstances exporting, low emissions electricity.

- Alumina refineries already provide some demand response to the grid. However, if there was to be an increased supply of competitively priced zero emissions electricity, there is the potential to materially increase the electrification of alumina refineries combined with demand response, which could supplement electricity firming.
- Electricity Supply
 - Indirect emissions associated with electricity consumed in aluminium smelting accounted for 16.8 Mt CO₂-e in 2018.
 - Providing electricity is supplied consistently, 24/7 firm power, and at internationally competitive prices, aluminium smelting can be run on increasing proportions of firmed renewable electricity. This is the single biggest opportunity for the aluminium industry to contribute to the increased deployment of low emissions technologies.
- Feedstocks
 - The chemical reaction associated with the Hall–Héroult process used to produce aluminium from aluminium oxide (alumina) requires the consumption of a carbon anode in smelting. This process currently contributes just under 2.5 Mt CO₂-e per annum in Australia.
 - Members of the Council, Rio Tinto and Alcoa, are involved in a joint venture with Apple in Canada on the Elysis process which would remove the use of carbon in the direct smelting process. This process is aiming to have this technology demonstrated by 2024.
 - En+ Group, the holding company for Rusal, also a Council member, is investing in zero direct emissions technology and targeting a 2021 timeline.
 - However, application of any new technology in Australia’s aluminium smelting industry would require substantial capital investment, and this could only be undertaken when combined with internationally competitive long-term electricity contracts.
 - The Elysis process uses a model of leveraging large private corporate investment including from customers together with national and regional government support (Canada and Quebec)^{vii}. The Council believes this model of investment and collaboration could have applicability as Australia develops its Roadmap.

Aluminium Industry Priority Technologies

The largest opportunities by abatement for the aluminium industry are the opportunities to:

- a) Use aluminium smelters to support the low-emissions electricity transition in the NEM;
- b) In the short to medium term, use gas to firm variable renewables, as part of a transition to a lower emissions grid;
- c) In the medium to longer term, a technology neutral, least cost approach to firming technology to firm renewables, noting that achieving an internationally competitive electricity price is likely to need a range of technologies; and
- d) Once firmed renewables are internationally competitive in price, use these to increase the electrification of alumina refineries which could in turn provide increased support for both the NEM and SWIS electricity markets.

It is essential during this transition, Australia retains major industrial loads, through these short- and medium-term challenges, to ensure Australia can capitalise on its long-term strategic advantages.

Aluminium smelters have increasingly been called upon to provide demand management services, to support grid stability and reliability, particularly in recent summers because of their large and fast acting interruptibility. Retaining these large industrial loads within the National Electricity Market will help support the transition to low-emissions electricity. One of the key barriers for increased deployment technologies for smelters to enhance their capability to provide additional services to the market is policy certainty over the market structure for these services and incentive over a commercially bankable timeframe to make these investments.

Support for Priority Technologies

The aluminium industry believes the Australian Renewable Energy Agency (ARENA) has been the most successful enabling vehicle for the deployment of priority technologies to date and notes it is currently expected that all of ARENA's funds will be committed by the end of 2020^{viii}. The King Review recommended providing ARENA, and the CEFC, with an expanded, technology-neutral remit which would support key technologies across all sectors and be involved in the delivery of a goal-oriented co-investment program. The Council believes support for ARENA or a similar funding model should be extended as it provides support to the widest range of low emission technologies and is consistent with the Government's response to the King Review.

Economic stretch goals

Australia's industry is seeking a restoration of international competitiveness. A future where Australia's world class energy resources are translated into internationally competitive, low emissions, reliable energy will ensure industrial production, emissions and jobs are not exported to other countries. Efficient deployment of technological changes will support the transition of economically important industrial sectors such as alumina and aluminium, enabling a greater manufacturing sector. In deploying these technologies, Australia will also need to address its relatively high cost capital costs, compared to international competitors. Positioning Australia as a leader in low emissions technologies will require partnerships across government and industry. The Council believes the single most effective mechanism is low emissions electricity delivered reliably and affordably, which will result in rapid increases in the rate of the transition across the aluminium and alumina sectors

Enabling Australia's competitive advantage means a restoration of internationally competitive energy prices. This is not a stationary target but will move as there is global development and adoption of new technologies. Competitiveness can be considered as a ranking, compared to global energy prices where:

- First quartile energy prices – lowest cost, most viable, continued operation of energy intensive industries is secure, Australia would be able to attract new energy intensive sectors with its competitive advantage;
- Second quartile – viable, continued operation secure, capital re-investment in energy intensive industries likely;
- Third quartile – must make substantial investment to reach first or second quartile or operate while profitable but eventually curtail and close and
- Fourth quartile – short term curtailment certain in response to market, closure virtually inevitable with capacity replaced globally by new investment in first or second quartile.

The Council has therefore framed its consideration of economic stretch goals around the delivered energy sources which could create the greatest abatement for this sector, that is:

- Low or zero emissions electricity;
- Gas as a transitional fuel for both direct consumption and to firm renewables; and
- Hydrogen.

Electricity in the Australian market has in recent times been consistently priced in the fourth quartile of global prices for electricity intensive manufacturing. Internationally competitive electricity prices which would drive growth in the electricity intense sector, would require a long-term stretch goal of delivering a first quartile electricity price, with an initial target of achieving second quartile electricity prices. This would move Australia's electricity intensive industries facing the question of survival, to being facilities able to attract capital investment and from there through to being able to capitalise on our national energy competitive advantage.

For the aluminium industry, it is the delivered cost (including transmission) of electricity which drives international competitiveness. Supported by economically priced gas to firm renewables in the short term and a broader range of technologies in the medium to long term, the Council believes a short-term goal of second quartile, with a stretch goal of first quartile is achievable.

With regard to gas as a transition fuel, as noted in the CSIRO, National Hydrogen Roadmap^{ix}, Australian gas prices are high (\$8-10/GJ) compared to overseas markets, particularly the United States (\$2-4/GJ); largely due to significant reductions in local gas supplies, with reserves on the North West Shelf tied up in long term contracts for LNG export and a moratorium on unconventional gas exploration in the eastern states. These high prices support the need for the establishment of a first quartile stretch goal for gas prices as part of setting the framework for the Roadmap.

The Council notes the Government has already set a stretch goal of *H2 under \$2/ kg*. This is a useful stepping-stone towards hydrogen becoming competitive as a baseload fuel. Hydrogen offers potential both in energy storage as well as a direct reductant for some industries but must ultimately be competitive with conventional technologies. This means also requiring a falling price trajectory for hydrogen beyond this near-term price objective.

Given the importance of technology, greenhouse and energy policy to the Aluminium industry, the Council welcomes the opportunity to be involved in ongoing consultation ahead of the release of the Government's first Low Emissions Technology Statement.

Kind regards,



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ⁱ <http://www.keppelprince.com/default.asp?id=1,3,0,3>

ⁱⁱ An Initial Assessment of the Impact of the COVID-19 Pandemic on Global Aluminium Demand, CM Group, May 2020. http://www.world-aluminium.org/media/filer_public/2020/05/28/initial_assessment_of_the_impact_of_the_covid-19_on_global_al_demand_.pdf

ⁱⁱⁱ Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition, May 2020

<http://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf>

^{iv} <https://arena.gov.au/projects/weipa-solar-farm/>

^v <https://arena.gov.au/projects/integrating-concentrating-solar-thermal-energy-into-the-bayer-alumina-process/>

^{vi} <https://www.south32.net/our-news/worsley-alumina-biomass-trial>

^{vii} <https://www.elysis.com/en/what-is-elysis>

^{viii} <https://arena.gov.au/funding/>

^{ix} <https://www.csiro.au/en/Do-business/Futures/Reports/Energy-and-Resources/Hydrogen-Roadmap>