

# Green Aluminium Production Credit design

Submission in response to consultation paper

November 2025

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## **About The Superpower Institute**

The Superpower Institute's (TSI's) mission is to help Australia seize the extraordinary economic opportunities of the post-carbon world.

A net zero Australian economy will reduce global emissions by just over 1 per cent. But if Australia successfully seizes the economic advantage in exporting zero emissions goods, this can create an opportunity for full employment with rising incomes for a growing population sustained over more than a generation, and reduce global emissions by up to 10 per cent.

Renowned economist Ross Garnaut and economic public policy expert Rod Sims have joined forces through The Superpower Institute, to focus on practical research and policy to unlock this opportunity. The Institute specialises in the policy settings and market incentives needed to make Australia an economic superpower and provides practical knowledge to governments and industry to realise this opportunity.

TSI works across the building blocks of the superpower economy including: renewable energy, green hydrogen, land carbon and minerals processing; the potential zero carbon export products including green iron and green aluminium; and the enablers of this economy including economic and fiscal policy, trade policy and regional development.

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## **About this submission**

Please contact TSI with any queries [info@superpowerinstitute.com.au](mailto:info@superpowerinstitute.com.au).

## Introduction

TSI welcomes the opportunity to contribute to the Green Aluminium Production Credit (**GAPC**) consultation process.

TSI supports the GAPC and this submission addresses some of the underlying logic for a government role and makes some comments on the appropriate design of the mechanism.

This submission also includes an extract from TSI's publication *The New Energy Trade* detailing aluminium production and the transition to decarbonising the industry (see [Appendix A](#)).

The transition for aluminium production, from a highly energy-intensive and therefore emissions-intensive process, to one powered by zero carbon energy, presents an enormous opportunity for Australia. Not only can we decarbonise and extend the life of existing facilities, but, with the right policy settings, we can expand production substantially and become a major exporter of green aluminium to the world.

We estimate that Australia can take a 30% share of global trade in green aluminium, and in doing so contribute to a 0.7% reduction in global emissions. This would equate to \$67 billion in annual export revenue in a market of current size, or \$89 billion in estimated 2060 market size.<sup>1</sup>

## Response to consultation issues

TSI's comments focus on five areas, as follows.

**First**, standing in the way of green aluminium decarbonisation and the export superpower opportunity is a significant market failure: the lack of an effective system of global prices on carbon emissions. Green production technologies will be unable to compete with fossil-fuel powered equivalents while the latter do not pay for the damage they cause.

The GAPC should be viewed not as an industry subsidy, but as a surrogate policy in the absence of an effective system of carbon prices and the expectation that these prices will emerge as the world decarbonises. It is an economically rational way to reduce the cost gap between fossil-fuel based production and green production of aluminium. The policy architecture should reflect this objective; it is not industry assistance, it is an appropriate intervention by government to address a market failure.

**Second**, in designing the eligibility criteria for the GAPC it would be optimal to establish incentives for investments in decarbonisation that are:

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<sup>1</sup> The Superpower Institute, *The New Energy Trade*, November 2024, p.102

- Additional: Would not have otherwise occurred, absent the GAPC
- Efficient: Are enduring and continue to drive decarbonisation to the lowest levels possible

This means establishing a threshold for eligibility that is low enough so that 'business as usual' efforts will not be rewarded. For example, to the extent that it already makes sense for aluminium smelters to contract for the supply of renewable energy (e.g. through PPAs) because this is the lowest cost source of supply, this should not be subsidised via the GAPC. The GAPC should be incentivising *additional* investment in renewable energy capacity that can be deployed at aluminium smelters.

Ideally, the GAPC should also be scalable so that deeper emissions cuts are rewarded with higher levels of credit. A single threshold level of carbon intensity, if set low enough, will drive decarbonisation efforts to that level but not below it. Instead, by scaling the incentive in proportion to emissions reduction, deeper levels of emissions cuts will be possible.

**Third**, it is sub-optimal to embed in the policy design a need for individual contract negotiation with each recipient of the GAPC. Optimal policy design would see general, transparent eligibility requirements set under the policy and 'self-executing' access to the GAPC when a facility produces aluminium that meets the requirements. This could be akin to the arrangements under the Hydrogen Production Tax Incentive mechanism which is embedded in legislation.

Acknowledging that the current intent is to facilitate payment of the GAPC through commonwealth grants processes, TSI urges the design of the contracting process to be as minimal as possible. It should be as close as possible to a standard-form contract for a transparent level of supply to the eligible entities, rather than one which requires individual negotiations with each recipient. This would promote transparency and credibility for the program.

**Fourth**, TSI is concerned to ensure that the design of the GAPC does not preclude its availability to new entrants, nor that it favours incumbents over new entrants. As detailed in the introduction, the magnitude of the opportunity for Australia is extremely large. With the right policy settings it will present opportunities for new entry, innovation and competition among suppliers which will drive investment and economic efficiency.

The consultation paper refers to a 'credit rate structure' which includes calculation of a facility's 'cost gap (the difference in the cost of producing aluminium using renewable energy sources and using conventional energy sources).' If this calculation is an essential requirement of eligibility of the GAPC it would appear to preclude a new entrant from accessing the credit. This would be distortionary, having the effect of

insulating incumbents from the threat of new entry and making it harder for innovative new approaches to low carbon aluminium production in Australia to compete in the global market.

The design of the GAPC should include, at a minimum, a form of support available to new entrants that is equivalent to that which would be received by incumbents producing aluminium at equivalent emissions intensity. Ideally, the structure of the credit should be agnostic to whether the producer is an incumbent or a new entrant.

**Fifth**, TSI supports, as the consultation paper proposes, using the proposed Guarantee of Origin (GO) scheme to verify production volumes and emissions. This could also help address the issue of eligibility for new entrants identified above. If a new entrant can demonstrate via the GO scheme that they have produced aluminium at or below the emissions thresholds set under the policy they should be eligible for the GAPC.

#### **Further Information**

Please contact TSI's CEO, Baethan Mullen via [info@superpowerinstitute.com.au](mailto:info@superpowerinstitute.com.au) .

## Appendix A – extract from *The New Energy Trade*

### *4.2 Aluminium*

In 2021, the world produced around 67.5 million tonnes of primary aluminium and around 22.5 million tonnes of secondary, or recycled, aluminium. The latter is already fully electrified.

Primary aluminium is mainly produced from bauxite ore, which at the higher grades found in Australia and Guinea—the top exporters—typically contains around 50-60 percent aluminium oxide. Bauxite is refined via the Bayer process into alumina, in which the aluminium oxide purity reaches around 99 percent. From there, the Hall-Héroult electrolytic reduction process strips the oxygen from alumina and converts it into aluminium.

The Hall-Héroult process is the main source of emissions in primary aluminium production. It is already mostly electrified, so most aluminium emissions can be avoided simply by using clean electricity. In China, the world's main aluminium producer and the importer of nearly all of Australia's exported bauxite, more than 80 percent of aluminium smelter electricity comes from coal power plants (IEA, 2023). The process consumes around 13-15 MWh per tonne produced (Obaidat et al, 2018; Shen & Zhang, 2024), and a typical modern coal power station releases around 1 tonne of CO<sub>2</sub> per MWh, so coal-powered Hall-Héroult would release around 13-15 tonnes of CO<sub>2</sub> per tonne of aluminium.

One part of the Hall-Héroult process is non-electrified: like the iron-making process, aluminium smelting currently uses fossil carbon. After aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) is dissolved in cryolite, the aluminium ions migrate to the cathode and settle as pure aluminium metal, while the oxygen ions migrate to the carbon anode and react to produce CO<sub>2</sub>. Around 450 kg of carbon is typically consumed per tonne of aluminium, releasing about 1.75 tonnes of CO<sub>2</sub> (Le Den et al., 2023).

Alumina refining via the Bayer process is the second most important emissions source in the aluminium production process, releasing around 1-3 tonnes of CO<sub>2</sub> per tonne of aluminium. This is mainly from fossil fuel thermal energy used to power the chemical reactions, with some contributions from electricity inputs and chemical process emissions (e.g. the use of lime and other carbonates). Some other steps, such as ingot casting, contribute a half tonne or so of CO<sub>2</sub> per tonne of aluminium.

Overall, coal-powered aluminium production releases around 18-22 tonnes of CO<sub>2</sub> per tonne of aluminium, but this may fall to around 4 tonnes for current best-practice producers using green electricity. In Europe, North America, and South America, aluminium smelting is mainly powered by hydroelectricity, and less than 7 tonnes of CO<sub>2</sub> per tonne of aluminium is typical (International Aluminium Institute, 2023; Maratou & Marcu, 2021).

Advances in electrifying alumina production (e.g. Alcoa's world-first pilot, see ARENA, 2022), and replacing carbon anodes with alternatives (e.g. with inert anodes that release oxygen instead of CO<sub>2</sub>; see He et al. 2021), may push emissions close to zero. Both add to electricity demand. Electrifying alumina production may add up to 5 MWh per tonne of aluminium (Le Den et al., 2023). Use of inert anodes is likely to increase Hall-Héroult electricity requirements given the chemical energy in the carbon anode is no longer available. The analysis in Saevarsdottir et al. (2024) implies an increase in Hall-Héroult electricity demand of around 27 percent, to 16.5-19 MWh per tonne. Thus, more completely electrified aluminium production may require on the order of 22-24 MWh of electricity per tonne.

Finally, it is assumed that advances in process efficiency into mid-century can offset this increase and limit electricity demand to 18 MWh per tonne.

Global primary aluminium production in 2021 was 67.5 million tonnes, with total emissions of around 1.1 billion tonnes of CO<sub>2</sub>—about 3 percent of global fossil fuel emissions (International

Aluminium Institute, 2023). Nearly 60 percent of primary aluminium is produced in China, which on a simple analysis would account for around 635 million tonnes of CO<sub>2</sub>. However, China's aluminium-making is primarily fuelled by coal: aluminium-making consumes about 422 TWh of coal in China, while the rest of the world uses only 58 TWh of coal and around 80 TWh of gas (ibid.). This suggests emissions of at least 700 million tonnes in China.<sup>30</sup>

More completely electrifying today's production, at 18 MWh per tonne, would lead to final electricity demand of around 1,220 TWh. The IAI forecasts that primary aluminium production will rise 33 percent to around 90 million tonnes by 2050 (International Aluminium Institute, 2023), which would raise global electricity requirements to around 1,620 TWh. It is assumed that demand is then flat to 2060.