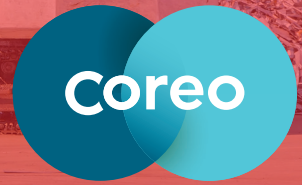


Getting to Circular Aluminium

A Challenge-Led Innovation Opportunity for Australia



What's the issue?

Producing aluminium involves mining bauxite then refining it using significant natural resources, to produce alumina and then the aluminium. The aluminium is then (primarily) exported and made into products that are then imported back into Australia. When aluminium products are considered at the end-of-use cycle, over 95% are then re-exported for recycling, and the cycle starts again.

All that despite the fact that **aluminium is infinitely recyclable**.

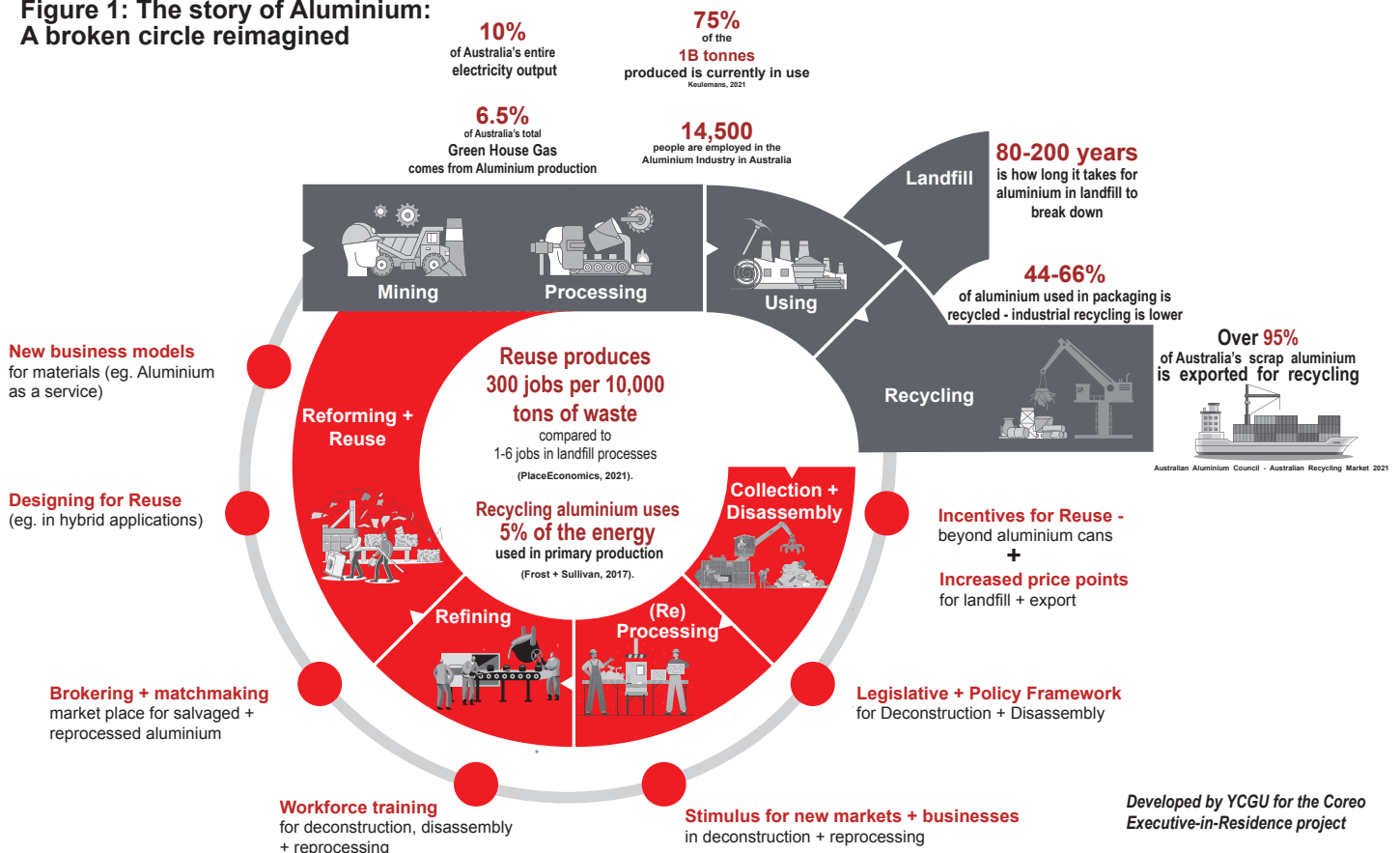
This short 'provocation' piece aims to draw attention to how broken this linear approach to aluminium use and re-use is. As shown in Figure 1, there is significant untapped potential 'stuck' in a 'broken circle' that could be repositioned, so as to generate substantial value flows for Australia and for specific communities and Regions.

In addition to failing to realise the full value of aluminium, the linear approach also accrues negative environmental impacts including:

- significant energy consumption with the four smelters in Australia using approximately 10% of the country's electricity and contributing approximately 6.5% of Australia's total greenhouse gas emissions (Clean Energy Regulator, 2021).¹

- generation of scope three emissions, from extensive logistics related to pit to product and back again, and resulting in generation of millions of tons of red mud tailings through mining activity; which in turn pose significant environmental risks, as well as representing potential and untapped recovery benefits (see for example, Mayes et al., 2016).²

Figure 1: The story of Aluminium: A broken circle reimaged



- reductions in 'natural capitals' - such as water and land for biodiversity - as a result of deforestation, sedimentation loading, dust pollution and tailings / spoil storage (see Yadav et al., 2022).³

Whilst these impacts are accrued in Australia, the majority of aluminium is exported - achieving only a 0.2% contribution to Australian GDP (Australian Aluminium Council Ltd, 2019).

What's the opportunity?

To realise the full potential of our resource opportunities, a shift towards a 'circularity mindset' is needed.⁴ This mindset shift would involve the aluminium industry moving from extractive to restorative models, from ownership to access, from monopolies to networks, from scale to scope, and from products to services. This would create opportunities to capture the immense value currently leaking out of the Australian economy, and to deliver benefits into local communities – including those most directly impacted by mining and production activities - whilst also creating critical competitive advantage for the Australian economy more broadly. While sourcing, recovering, refining and recirculating aluminium in Australia may add to our carbon footprint in the short term, it will also improve our understanding of the levers available to help unlock the strategic opportunity over the long term.

For Central Queensland, one of the Regions at the heart of the aluminium industry in Australia,

transitioning towards a circular model could deliver significant cumulative benefits - such as life-cycle efficiencies, cost reductions, lower resource and energy consumption, and a decreased need for waste management. Circular economy models mitigate against exposure to commodity price fluctuations and extended linear supply-chain risks, while enhancing preparedness for regulatory and consumer changes, and securing greater control over closed-loop supply chains.

How could it be realised?

This provocation outlines a bold vision for Circular Aluminum in Australia and introduces Challenge-led Innovation as a framework that could be used to support diverse actors to align their efforts towards a shared and transformative goal. Challenge-led approaches (also referred to as Mission-Oriented Innovation)⁵ are being increasingly adopted internationally, and by Australian agencies such as the CSIRO, to tackle complex challenges which no single industry or set of actors can address on their own. Challenge-led Innovation initiatives begin with a bold and inspiring directional goal and seek to catalyse innovation and bottom-up solutions across sectors in the direction of that goal.

The Challenge Map sketch set out in Figure 2 is offered as an example of how portfolios of activities delivered by diverse actors could be developed to tackle industry-wide challenges and advance a shared directional goal. For illustrative purposes it focuses on Central Queensland, which is a

significant producer of alumina and aluminium, and has the potential to become a catalyst for circular economy innovation and implementation.

The Challenge Map highlights potential portfolios of activities relating to data, market mechanisms, mindsets and regional economic development. It identifies the opportunity to generate and sustain quality jobs in the region, through transitioning existing workforces into new service areas, and through establishing new businesses purposefully designed to fill niche roles within the re-designed supply chain. It also highlights potentially complementary reforms such as green hydrogen generation.

What could it look like in practice?

Let's consider the Developing Market Mechanisms portfolio suggested in the Challenge Map. Each year Australia sends over \$2 billion worth of metal waste offshore for recycling. In 2020 Australia exported 119,075 tonnes of aluminium, an increase of 25.13% on the previous year⁶ relinquishing the value of those metals for our economy but also highlighting significant opportunities, including local recycling. There are significant benefits to recycling, including a potential 95% reduction on the energy required to make new aluminium, providing our manufacturers with competitive advantage in being able to produce low carbon products in a market demanding them. But are there also other potential innovations? Why extract and sell aluminium once, when we could rent and recirculate it long term?

In Figure 3 below, we explore how a constellation of activities included in the portfolios in the Challenge Map could be aligned to support the creation of a new market mechanism – Aluminium-as-a-Service.

As we look to the future, we recognise that the circulation of finite resources will provide not only economic growth opportunities, but also a mechanism to decarbonise industries and upskill key workers. This is particularly true for the Gladstone Region in Central Queensland, with well-established aluminium processing infrastructure and a long-established expert workforce already existing in the region. Significant local economic growth opportunities are possible, through the re-focusing of existing businesses and the establishment of new businesses to meet new supply chain demands. And in turn these businesses can be structured to prioritise the creation and maintenance of quality jobs, jobs that provide stable and meaningful income generating opportunities for local people.

One example of how this could be achieved is through a de-emphasis on selling aluminium as a commodity and a repositioning of Aluminium-as-a-Service - around the product, its performance, and related knowledge. In addition to maximising the value flows generated through aluminium production and reuse in Australia, this approach also contributes to de-risking the future of mining operations, through capturing profit generated by a shift from value creation to value re-creation.

Directional Goal

Goal that sets the direction, orientation, intent + ambition for + of action

Challenges

Systemic fields of action needed to create momentum towards the directional goal

Portfolios

Coherent combinations of cross-sector projects, actions + innovations

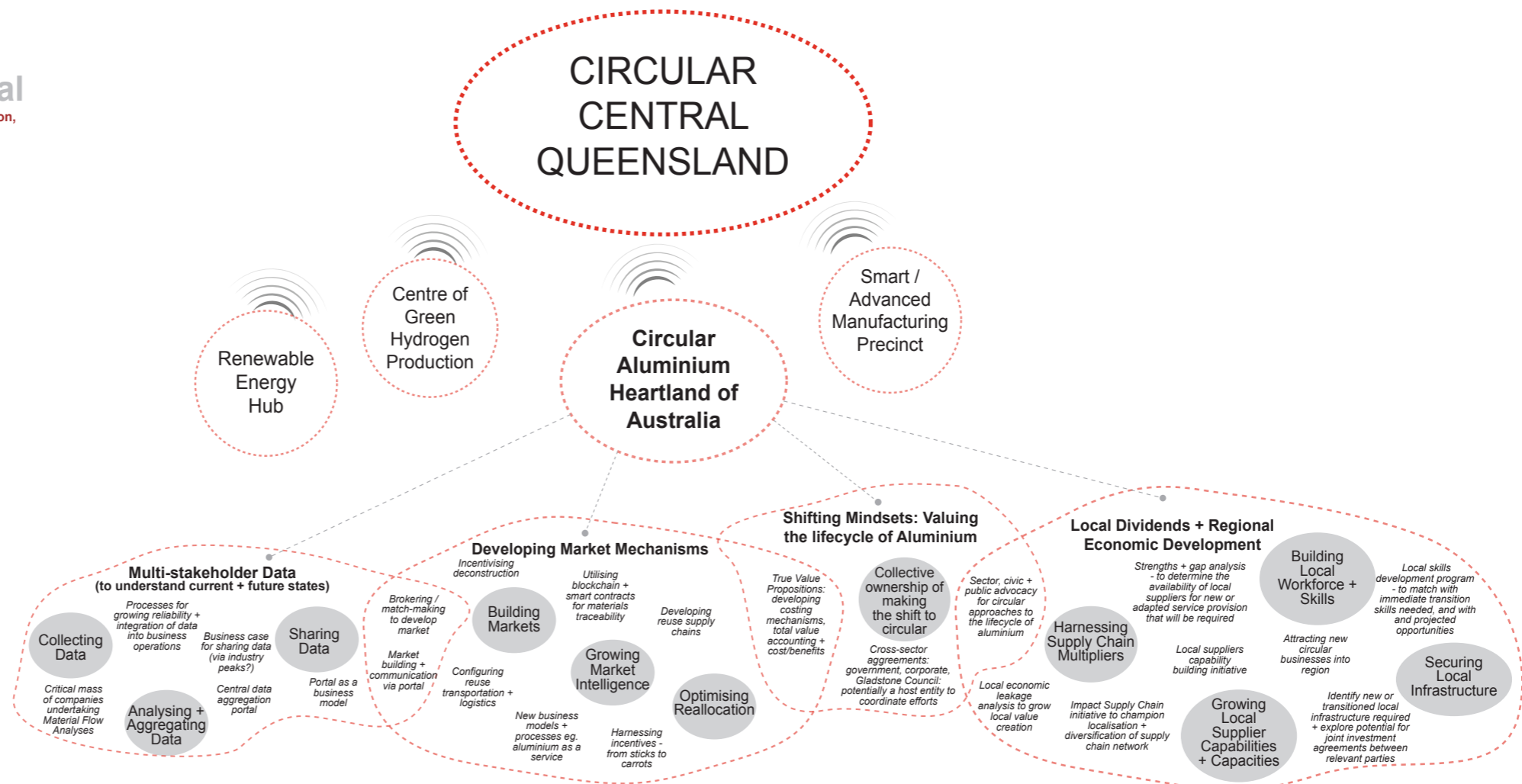
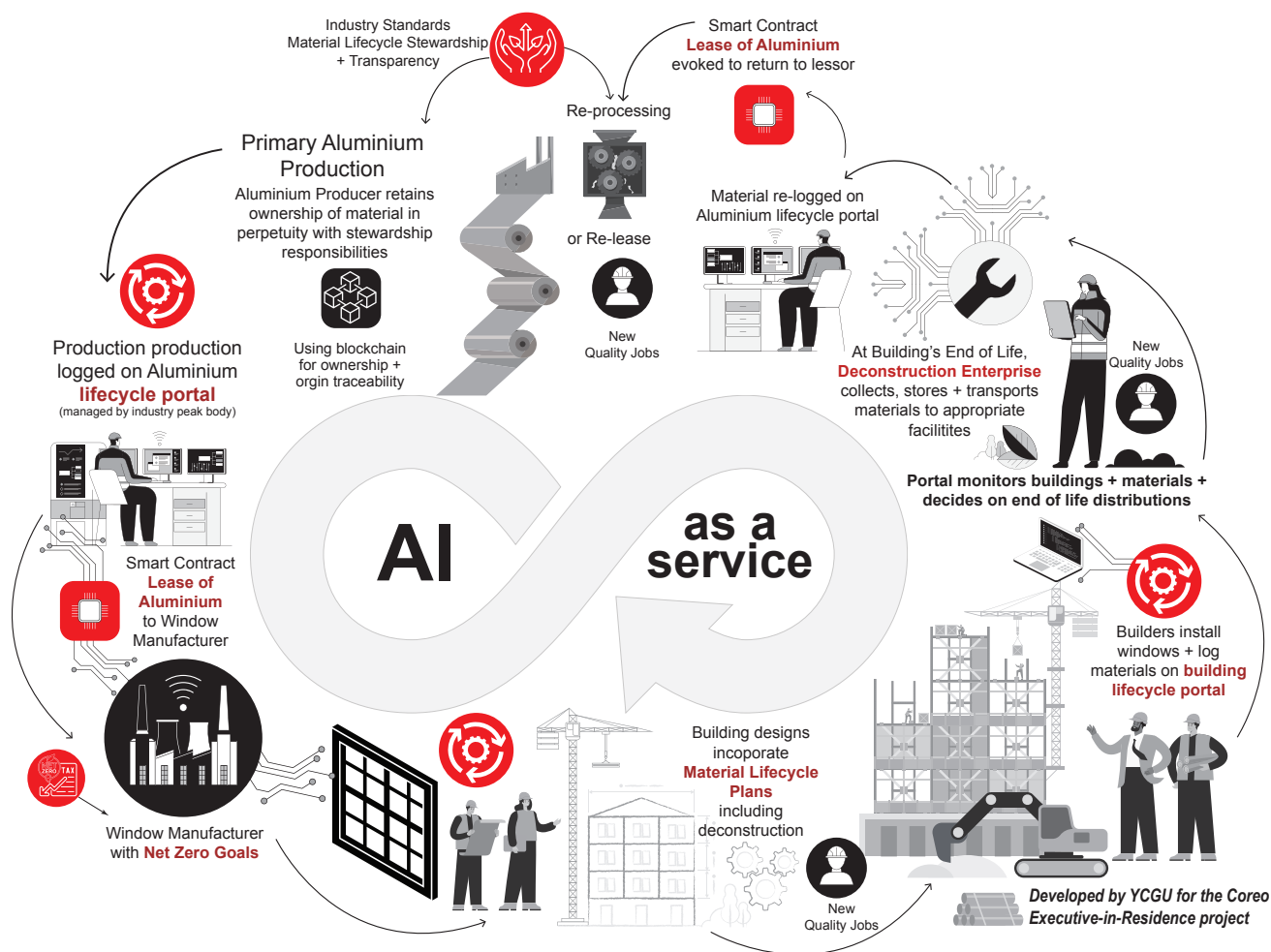


Figure 2: A Challenge-Led Innovation approach to imagining Circular Central Queensland

Developed by YCGU for the Coreo Executive-in-Residence project

Figure 3: Visualising Aluminium-as-a-Service - what if we were able to 'rent and reuse'?



Thinking and working differently to achieve circular aluminium

Whilst the aspiration for circular aluminium described here is ambitious – we believe it is achievable through the adoption of the circularity mindset shift described above. This requires us to think and work differently.

For example, in the resources sector, the traditional narrative positions economic viability against environmental liability. Through a circularity mindset, we don't have to pick a side. Instead, we can move away from a linear economy where each actor in the supply chain is driven to maximise its own profits at the expense of the overall value. And move into reimagining what a 'value for all' approach to productivity could look like across supply chain management, purchasing, finance and sales, transport, site restoration and next life uses.

Using the Challenge Map process as an organising framework, it becomes possible to see how we could act collectively to explore innovative responses (such as Aluminium-as-a-Service) to our shared challenges. With each actor playing a different role, but contributing to the whole, it becomes possible to imagine how we might develop new and innovative ways to work across sectors and with diverse stakeholders to prototype promising ideas and to scale effective solutions that help fix the 'broken circle'.

What's the provocation?

It is time for a serious conversation about disrupting the 'take-make-waste' linear economy model in this country, including the broken circle of aluminium use and re-use.

We call upon industry, government and communities to come together – to recognise the opportunity at hand, to show leadership around the adoption of circular models, and to explore what mindsets and practices are needed to deliver on the potential of an Australian Circular Aluminium Challenge that returns value to people, places and the planet now and into the future.

For more information and/or to signal your interest in joining this conversation, please contact: Ashleigh Morris CEO and Co-Founder of Coreo: ashleigh@coreo.com.au

Notes:

- 1 Clean Energy Regulator, 2021
- 2 Mayes, W.M., et al. (2016) Advances in Understanding Environmental Risks of Red Mud After the Ajka Spill Journal of Sustainable Metallurgy 2, pp332–343
- 3 Yadav, S.K., et al. Eco-restoration of bauxite mining: An ecological approach, In Jhariya, M.K., et al (eds) Natural Resources Conservation and Advances for Sustainability, Elsevier, 2022, pp173-193
- 4 For a description of how YCGU positions 'circularity mindsets' see: <https://bit.ly/35WIGsO>
- 5 For more information on Challenge-led Innovation, and the role it can play in supporting transitions see: <https://bit.ly/3NVquQB>
- 6 See AAC Recycling Summary: <https://bit.ly/379A1Tp>

This 'provocation' is the output from a collaboration between Coreo and The Yunus Centre Griffith University (YCGU). The collaboration involved a funded twelve-month Executive in Residence position which was shared by Ashleigh and Jaine Morris over 2021. During this time Ashleigh and Jaine worked with the YUGC team to explore and develop this Circular Economy Challenge.