AUSTRALIAN ALUMINIUM COUNCIL LTD

Bauxite

Australian Bauxite Will Help Meet Global Demand For Aluminium

Primary aluminium is made from an ore called bauxite, which is refined to make alumina before being smelted to make aluminium.

It takes **4-6 tonnes of bauxite** (depending on the quality) to make ~2 tonnes of alumina, which then makes 1 tonne of aluminium.

Australia is the world's largest producer of bauxite. We mine more than **100Mt of bauxite a year** (about a quarter of global production). About 40% of this is exported and 60% is turned into alumina here in Australia. Meeting the continued and increasing demand for primary aluminium, will require the additional mining globally of at least **100Mt per annum of bauxite by 2050**, over and above today's global production rates of ~ 400 Mt.

Australia has more than 60 years of technical experience in bauxite mining and alumina refining technologies.

This experience helps not only us, but our customers of bauxite, alumina and aluminium, to reach their sustainability goals. Global research headquarters for alumina for Alcoa, Rio Tinto and South32's Worsley Alumina operations are based in Australia, helping develop new technologies for the world.

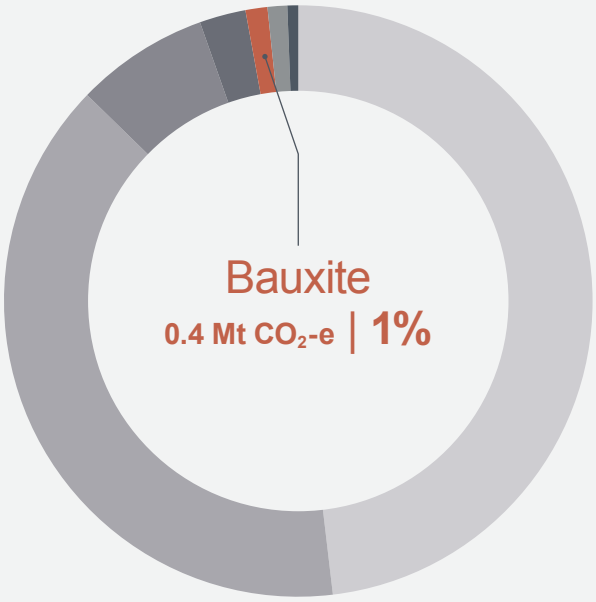
Bauxite Mining

Australian bauxite deposits generally have high grades and are shallow and relatively easy to mine. Bauxite mining is a relatively simple process with only minor processing requirements (crushing / beneficiation) and as such, bauxite mining is not very emissions intensive. However, as a surface mine, haul distances can be significant.

While Australia produces around 100Mt a year of bauxite, national emissions from bauxite production are only around 0.4 Mt CO_2-e or **1% of the total Australian aluminium industry's emissions**.

The main sources of emissions are diesel consumption in vehicles and electricity consumption. About 80% of emissions are associated with diesel consumption in mining and haulage and around 20% from electricity consumption for processing and ship loading activity. Emissions per tonne of bauxite produced are approximately 0.004 t CO_2-e/t bauxite.

2022 Industry Emissions



	(Mt CO_2-e)
Aluminium - Indirect	16.2
Alumina - Direct	13.2
Aluminium - Direct ex: PFCs	2.5
Alumina - Indirect	0.9
Bauxite	**0.4**
Aluminium - PFCs	0.4
Aluminium - Gas Use	0.2

Australian Aluminium Council
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Alternate Technologies

Electricity

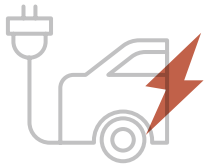
The bauxite mines located in northern Australia are not located near any electricity grids and therefore self-generate electricity. The bauxite mines located in the southwest of Australia are largely grid connected and will not only decarbonise at the rate of the grid but may also be able to offer some demand management.

In 2014 the industry pioneered the application of renewable energy to partially power critical mining operations in a remote location where there is no access to Australia's main electricity grids, through a collaborative project with the Australian Renewable Energy Agency (ARENA). **(arena.gov.au/projects/weipa-solar-farm)**.

The industry continues to explore opportunities to expand renewable energy and battery storage, particularly in remote locations[3].

Alternate Fuels

Vehicle and equipment currently powered by diesel, could be converted to a range of electric; biofuel or hydrogen powered alternatives in the future. The industry is currently investigating a range of zero emission haulage solutions, including trucks[1].



Summary of Pathways

TECHNOLOGY SOLUTION	STATUS[2]
READY Grid Connected Electricity	Grid connected mines may be able to offer some demand management. The grid has increased penetration of renewable energy. Potential for commercial contracting arrangements to allow more rapid decarbonisation of electricity supply.
Renewable Generation and Energy Storage in Non-Grid Connected Electricity	Renewable penetration limited by ability to provide reliable, firm electricity commercially at scale in remote locations.
Trolley Assist replacement of diesel vehicles	Deployable, but benefits depend on source of electricity. Long haul distances in bauxite mining may also be challenging.
Battery-electric replacement of diesel vehicles	Not commercially available until after 2025 and benefits depend on source of electricity.
Biodiesel vehicles	Biodiesel can be blended with conventional diesel, to reduce emissions by up to 20% with limited or no modifications to existing fleet. Remote locations and constraints in biodiesel production within Australia may make this economically unviable.
Hydrogen Fuel Cell	There is long term potential, however, the major uncertainties relate to the long-term cost, scale and supply for green hydrogen.

Source: [1]https://www.riotinto.com/news/releases/2021/Rio-Tinto-and-Komatsu-partnering-for-zero-emission-mining/
[2]Partially derived from Energy Transitions Initiative, Phase 1 Technical Report available from https://energytransitionsinitiative.org/
[3]https://www.riotinto.com/news/releases/2021/Rio-Tinto-to-triple-Weipa-solar-capacity-and-add-battery-storage-to-help-power-operations