LocAl® 13

Verified Lower-Carbon Aluminium

Transparency, Certification and Embodied Carbon in Australian Aluminium Extrusion

WHITEPAPER

CAPRAL ALUMINIUM

Introduction

As sustainability expectations continue to evolve across the built environment, greater attention is being placed on embodied carbon, supply chain transparency and independently verified environmental performance.

Architects, designers, builders and manufacturers are increasingly seeking reliable environmental data to support responsible procurement and specification decisions. In response, Environmental Product Declarations (EPDs), lifecycle assessment and supply chain certification are becoming increasingly important considerations across construction and manufacturing industries.

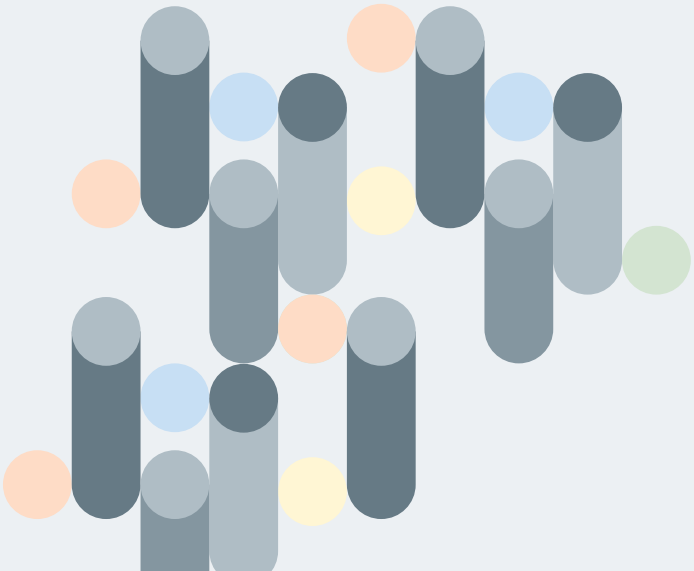
Aluminium plays a significant role in modern construction, transport, infrastructure and manufacturing due to its strength, durability, corrosion resistance and recyclability. However, not all aluminium products carry the same environmental impact. Factors including electricity sources, production pathways, recycling content and manufacturing processes can significantly influence embodied carbon outcomes.

As Australia's largest manufacturer and distributor of aluminium extrusions, Capral Aluminium has invested in lower-carbon aluminium solutions supported by independently verified environmental data and internationally recognised certification frameworks.

Capral's LocAl® and LocAl SG® aluminium extrusion ranges are supported by independently verified Environmental Product Declarations (EPDs) published through The International EPD® System and prepared in accordance with ISO 14025 and EN15804+A2.

These EPDs provide transparent lifecycle assessment data to support embodied carbon reporting, responsible procurement and informed material selection.

This paper explores the role of aluminium in the transition toward lower embodied carbon construction and manufacturing outcomes, while outlining the growing importance of transparency, certification and independently verified environmental performance data.



Understanding Embodied Carbon

Every product has a carbon footprint associated with the energy and resources required to produce it. This includes the extraction of raw materials, manufacturing processes, transport, fabrication and, ultimately, what happens to the product at the end of its life.

These emissions are commonly referred to as embodied carbon.

For aluminium products, embodied carbon may include emissions associated with:

- mining and refining raw materials
- aluminium smelting
- electricity consumption
- manufacturing and extrusion
- transport and distribution
- fabrication and installation
- recycling or disposal at end-of-life

Embodied carbon is different from operational carbon, which relates to emissions generated during the use of a product or asset, such as the energy used to heat, cool or operate a building, vehicle, or system.

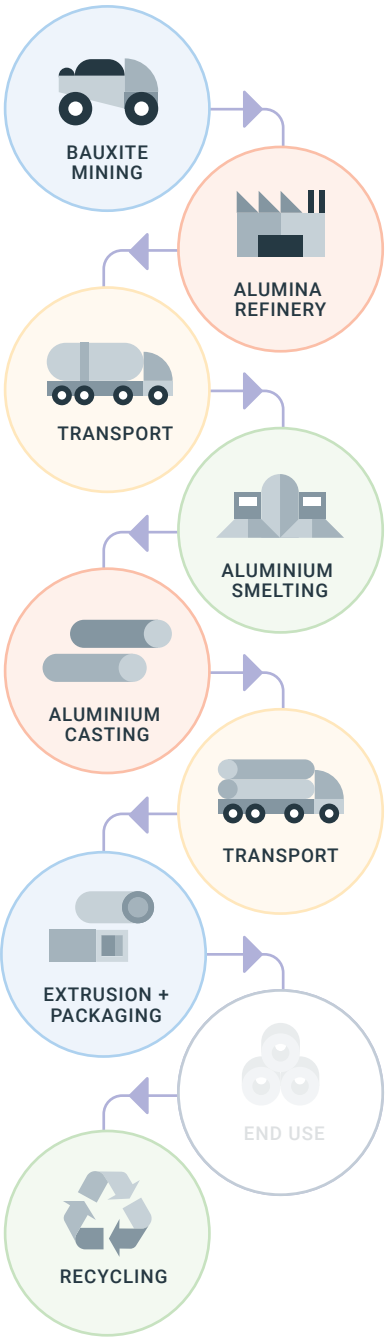
Historically, sustainability discussions focused heavily on operational emissions. However, as industries improve operational efficiency, increasing attention is being placed on the emissions associated with the materials and products themselves.

This shift is occurring across a wide range of industries. Governments, asset owners, developers, manufacturers and procurement teams are increasingly seeking greater transparency around the environmental impacts of the products they specify and purchase.

As a result, demand is growing for:

- lower-carbon materials
- independently verified environmental data
- responsible sourcing
- supply chain transparency
- lifecycle assessment reporting

EPDs and lifecycle assessment methodologies help provide a more transparent and consistent way to measure and communicate these impacts across the lifecycle of a product. This allows businesses and project teams to make more informed decisions when evaluating materials and suppliers.



Embodied carbon refers to the greenhouse gas emissions associated with the extraction, manufacture, transport, installation, and end-of-life processing of a product. It occurs across the whole life cycle.

Primary Aluminium Production

Aluminium is produced through a multi-stage process beginning with the mining of bauxite ore, which is refined into alumina before being converted into aluminium metal through an electrolytic smelting process.

Primary aluminium production is energy intensive, particularly during the smelting stage where large amounts of electricity are required to separate aluminium from oxygen within alumina.

It takes 4-6 kilograms of bauxite (depending on the grade) to make ~2 kilograms of alumina, which then makes 1 kilogram of aluminium.

KEY FACTS

- Australia has the world's largest bauxite industry, producing 100.2Mt of bauxite in 2024.
- Australia is the world's second-largest producer of alumina, producing 17.54Mt in 2024 and remains the world's largest alumina exporter.
- Australia produced 1.58Mt of primary aluminium in 2024, making it the world's seventh-largest producer.
- It takes approximately 4–6kg of bauxite to produce 2kg of alumina, which in turn produces about 1kg of aluminium.

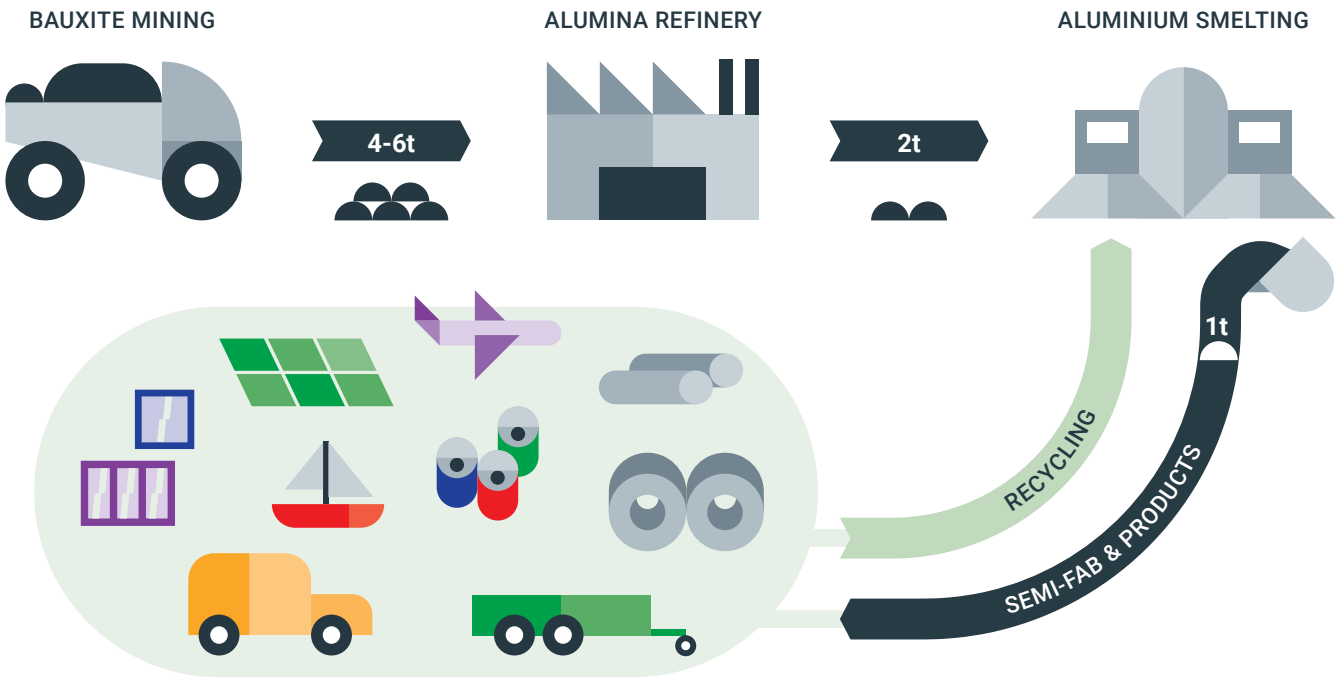


Fig 1: Illustrating the flow of material in Aluminium production and recycling, from raw material to finished goods

Carbon Emissions associated with Primary Aluminium Production

There are significant variations in the greenhouse gas (GHG) intensity of primary aluminium production, driven primarily by the source of electricity used in smelting, as well as differences in technology and operational efficiency. The International Aluminium Institute (IAI) reports that the global average greenhouse gas intensity of primary aluminium production was 14.8 kg CO_2e per kilogram of primary aluminium in 2023[1], measured on a cradle-to-gate basis including bauxite mining, alumina refining, smelting and casting.

The largest share of emissions associated with primary aluminium production occurs during the smelting stage, particularly from the electricity required for the Hall-Héroult electrolysis process. The IAI estimates that approximately 60% of the aluminium sector's greenhouse gas emissions are attributable to the generation of electricity consumed during aluminium smelting[2].

Australian aluminium smelters are among the nation's largest industrial electricity users, reflecting the substantial energy required to separate aluminium from oxygen during the Hall-Héroult process. As electricity is the dominant source of emissions in aluminium production, the carbon intensity of the power supply is a key determinant of the industry's overall greenhouse gas footprint. The Australian Aluminium Council reports that aluminium smelting accounts for almost 55% of the sector's emissions, with electricity consumption alone responsible for approximately 45% of total industry emissions, equivalent to around 15.1 million tonnes of CO_2-e per year[3]. As Australia's electricity grid continues to decarbonise, significant opportunities exist to reduce the carbon footprint of both primary aluminium production and downstream aluminium manufacturing.

In addition to electricity-related emissions, other major sources of greenhouse gases within the aluminium value chain include fuel combustion in alumina refining, carbon anode production and consumption during smelting, and process-related perfluorocarbon emissions generated during anode effects. Together, these sources represent the remaining emissions associated with primary aluminium production and are an important focus of ongoing industry decarbonisation efforts.

The IAI estimates that the global aluminium sector generated approximately 1.1 billion tonnes of CO_2e emissions in 2023, representing around 2% of total global greenhouse gas emissions[4]. Primary aluminium production accounts for approximately 95% of the sector's total emissions, highlighting the importance of decarbonising primary metal production as the industry works towards its long-term net-zero ambitions.

1 International Aluminium Institute (2025) Primary Aluminium Greenhouse Gas Emissions Intensity. Available at: https://international-aluminium.org/statistics/greenhouse-gas-emissions-primary-aluminium/ (Accessed: 19 June 2026).

2 International Aluminium Institute (2025) Low Carbon Aluminium Factsheet. Available at: https://international-aluminium.org/landing/low-carbon-aluminium-factsheet/ (Accessed: 19 June 2026).

3 Australian Aluminium Council (2025) Facts and Figures of the Australian Aluminium Industry. Available at: https://aluminium.org.au/facts-and-figures/ (Accessed: 19 June 2026).

4 International Aluminium Institute (2025) Low Carbon Aluminium Factsheet. Available at: https://international-aluminium.org/landing/low-carbon-aluminium-factsheet/ (Accessed: 19 June 2026).

POWER SOURCE	TYPICAL GHG INTENSITY (CRADLE-TO-GATE)
Hydro / renewables	~4–8 kg CO_2e/kg Al
Natural gas	~8–12 kg CO_2e/kg Al
Global average (2023 IAI)	**14.8 kg CO_2e/kg Al**
Coal	~18–22 kg CO_2e/kg Al

Ranges shown are indicative only and depend on system boundaries, electricity mix, technology and geographic location.

KEY FACTS

Global average primary aluminium emissions:

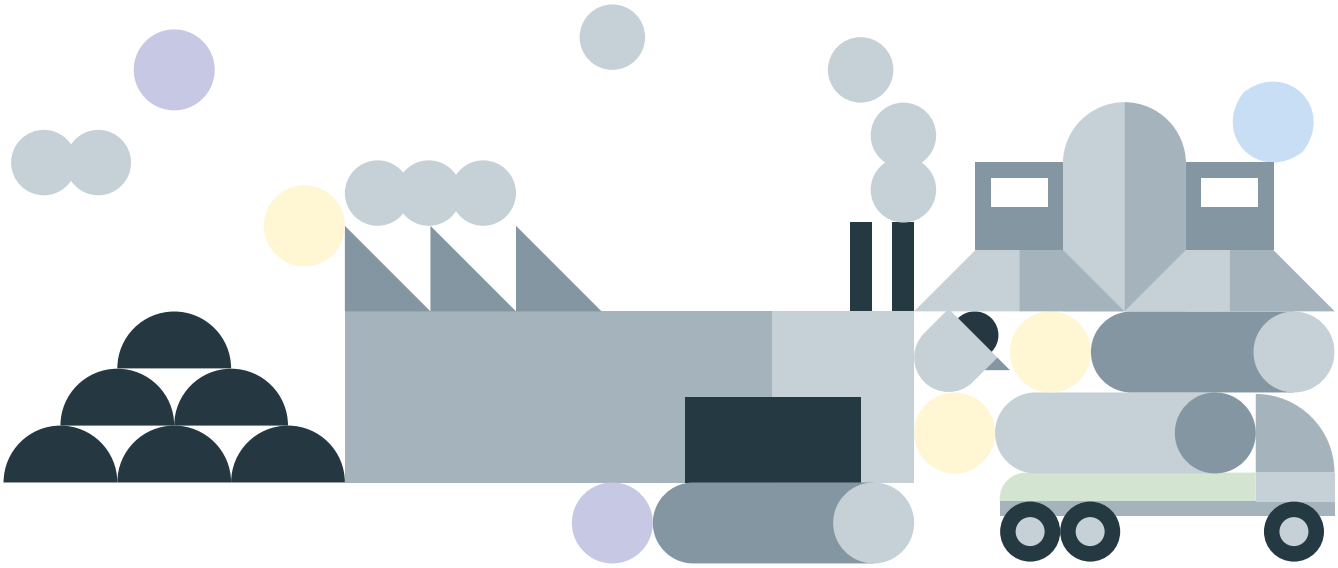
The International Aluminium Institute (IAI) reports a global average greenhouse gas intensity of 14.8 kg CO_2e per kilogram of primary aluminium (2023), measured on a cradle-to-gate basis.

Electricity is the largest emissions source:

Approximately 60% of the aluminium sector's greenhouse gas emissions are associated with the generation of electricity used during the smelting process.

Carbon intensity varies significantly:

The greenhouse gas intensity of primary aluminium can range from less than 4 kg CO_2e/kg Al for renewable-powered production to more than 20 kg CO_2e/kg Al where coal-fired electricity is the primary energy source.



Lower-carbon Aluminium

Lower-carbon aluminium has become an established category within the aluminium industry, providing manufacturers, architects and project teams with opportunities to reduce embodied carbon without compromising product performance. Lower-carbon aluminium retains the same technical properties, durability and recyclability as conventionally produced aluminium, making it suitable for the same range of applications.

Increasingly, the environmental performance of aluminium products is being communicated through independently verifiedEPDs. EPDs provide transparent, standardised and third-party verified information about a product's environmental impacts across its life cycle, including raw material extraction, processing, manufacturing, transport, packaging and end-of-life scenarios. This enables meaningful product comparisons while supporting sustainability reporting, procurement decisions and green building certification requirements.

Capral has expanded the availability of lower-carbon aluminium through its LocAl® product range and, in 2026, published independently verified EPDs for both LocAl® and LocAl® SG aluminium extrusions under The International EPD® System. These EPDs cover aluminium extrusions manufactured in Australia and provide project teams with robust life cycle assessment data in accordance with ISO 14025 and EN 15804 standards. By making independently verified environmental performance data publicly available, EPDs enable designers, builders and asset owners to make more informed material selection decisions and better understand the embodied carbon impacts of their projects.

PRODUCT	VERIFIED CARBON FOOTPRINT (CRADLE-TO-GATE)
LocAl®	13.0 kg CO_2e/kg product
LocAl® SG	7.7 kg CO_2e/kg product

Measured using independently verified EPDs. Includes emissions associated with raw material extraction, processing, transport and manufacturing (life cycle stages A1–A3, often referred to as "cradle-to-gate").

Available across Capral's extrusion range Capral's LocAl® offer allows customers to specify lower-carbon aluminium while maintaining the performance, quality and compliance expected of Australian-made aluminium systems

KEY FACTS

Same performance, lower embodied carbon

Lower-carbon aluminium delivers the same strength, durability, corrosion resistance and recyclability as conventionally produced aluminium, while offering a reduced carbon footprint.

Independently verified environmental data

Capral's LocAl® and LocAl® SG aluminium extrusions are supported by independently verified EPDs, providing transparent life cycle assessment data in accordance with ISO 14025 and EN 15804 standards.

Verified carbon footprint reductions

Capral's EPDs report an A1–A3 carbon footprint of:

- 13.0 kg CO_2e/kg product for LocAl® and,
- 7.7 kg CO_2e/kg product for LocAl® SG,

providing project teams with independently verified data to support sustainable material selection.

Independently Verified Environmental Performance

Capral's LocAl® and LocAl SG® aluminium extrusion products are supported by independently verified EPDs, providing transparent lifecycle assessment data for aluminium extrusion manufactured in Australia.

EPDs are internationally recognised documents that report on the quantified environmental impacts of a product across its lifecycle using a consistent and independently verified methodology.

Capral's EPDs have been:

- independently verified by a third party
- published through The International EPD® System
- prepared in accordance with ISO 14025 and EN15804+A2
- developed using detailed lifecycle assessment methodology
- based on Australian extrusion manufacturing data

The EPDs assess environmental impacts across multiple lifecycle categories including:

- global warming potential
- resource use
- water use
- waste generation
- recycling potential

The declared unit for the EPDs is one kilogram of aluminium extrusion including packaging.

For LocAl® aluminium extrusion, the independently verified cradle-to-gate Global Warming Potential (A1-A3) is 13 kg CO_2e per kilogram of extruded aluminium profile for LocAl SG it is 7.7 kg CO_2e per kilogram of extruded aluminium.

The EPD also recognises the significant recycling and recovery potential of aluminium through Module D benefits associated with future material recovery and recycling.

By publishing independently verified environmental data, Capral provides greater transparency and confidence for project teams seeking reliable environmental information for specification and procurement.

Aluminium and the Circular Economy

Aluminium is one of the world's most recyclable materials and can be recovered and reprocessed repeatedly without losing its strength, durability or performance characteristics. This unique property allows aluminium to remain in productive use for generations, making it well suited to circular economy principles where materials are retained at their highest value for as long as possible.

Compared with the production of primary aluminium from bauxite ore, recycling aluminium requires significantly less energy and generates substantially lower greenhouse gas emissions. As a result, the recovery and reuse of aluminium plays an important role in reducing the environmental footprint of the aluminium value chain and supporting more efficient use of resources.

In the building and construction sector, aluminium products often have long service lives and can be readily recovered at the end of their use phase for recycling into new products. Capral's EPDs recognise this high recovery potential by modelling a 90% end-of-life recycling rate for aluminium extrusion products, reflecting the well-established recycling pathways that exist for aluminium in the built environment.

Historically, a significant proportion of Australia's recovered aluminium scrap has been exported for processing and recycling overseas due to limited domestic remelting capacity. However, there is growing recognition of the opportunity to retain more of this valuable material within Australia, strengthening domestic manufacturing capability while advancing circular economy outcomes.

The aluminium industry is increasingly investing in initiatives that support the recovery, reuse and recycling of aluminium within local supply chains. Capral is actively contributing to this transition through a range of recycling and circularity initiatives, including closed-loop recycling programs that recover aluminium offcuts and manufacturing scrap for reprocessing into new aluminium products. Through collaboration with suppliers and industry partners, including Rio Tinto, these programs help keep valuable aluminium in circulation, reduce reliance on virgin raw materials and support the development of lower-carbon aluminium supply chains.

By combining durability, long service life and exceptional recyclability, aluminium extrusion can support more circular construction and manufacturing outcomes while contributing to the transition towards a lower-carbon built environment.

KEY FACTS

Aluminium is infinitely recyclable

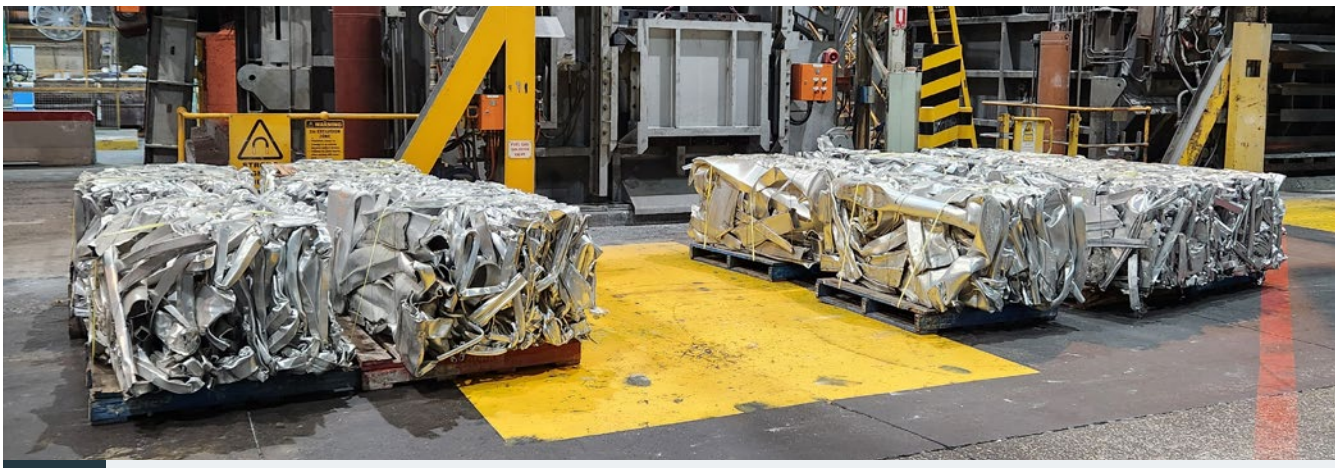
Aluminium can be recovered and recycled repeatedly without losing its core properties, making it one of the world's most valuable materials in a circular economy.

Recycling significantly reduces energy demand

Producing aluminium from recycled material requires up to 95% less energy than producing primary aluminium from bauxite ore, resulting in substantially lower greenhouse gas emissions.

Closed-loop recycling is growing in Australia

Capral and Rio Tinto are helping advance aluminium circularity in Australia through closed-loop recycling initiatives that recover manufacturing scrap and reprocess it into locally produced aluminium billet containing a minimum of 20% recycled content.



CASE STUDY

Closing the Loop: Advancing Circular Aluminium Manufacturing in Australia

A practical example of circularity in action.

Capral's collaboration with Rio Tinto and Sims Metal demonstrates how Australian manufacturers can work together to keep valuable aluminium in use for longer through a domestic closed-loop recycling model.

Following a successful pilot in 2024, the partnership has expanded into a commercial initiative that captures post-production aluminium scrap from Capral's Bremer Park extrusion facility, processes and sorts it through Sims Metal, and remelts it at Rio Tinto's Boyne Smelter in Queensland. The recycled aluminium is then returned to Capral as billet containing a minimum of 20% recycled content for use in new extrusion products.

The initiative creates an Australian circular supply chain, with mining, refining, smelting, recycling and extrusion all taking place domestically. By keeping aluminium within the local manufacturing ecosystem, the partnership strengthens supply chain resilience, supports Australian manufacturing capability and demonstrates the commercial viability of onshore aluminium recycling.

The project also highlights the role of collaboration in reducing the environmental impact of aluminium production. Recycling aluminium requires only a fraction of the energy needed to produce primary aluminium, while preserving the material's performance and quality for demanding applications. By incorporating recycled content into new billet, the partnership supports resource efficiency, reduces waste and advances circular economy outcomes without compromising product performance.

KEY OUTCOMES

- Demonstrated the successful production of high-quality aluminium billet containing a minimum of 20% recycled content.
- Expanded from a successful 2024 trial to a commercial-scale program producing 1,000 tonnes of recycled-content billet in 2025.
- Established a domestic closed-loop recycling pathway that keeps aluminium in productive use within Australia.
- Supports lower-carbon aluminium manufacturing, improved resource efficiency and increased circularity across the aluminium value chain.

Responsible Sourcing and the Aluminium Stewardship Initiative (ASI)

The Aluminium Stewardship Initiative (ASI) is a global, multi-stakeholder organisation that promotes responsible production, sourcing and stewardship across the aluminium value chain. Through a comprehensive certification framework, ASI provides independent assurance that aluminium is produced and managed in accordance with recognised environmental, social and governance (ESG) standards.

ASI certification covers the entire aluminium value chain, from mining and refining through to smelting, manufacturing and distribution. This enables greater transparency and traceability, helping manufacturers, specifiers and end users make informed procurement decisions and support responsible supply chains.

Two complementary ASI standards underpin the certification process. The ASI Performance Standard assesses environmental, social and governance practices at certified facilities, while the ASI Chain of Custody Standard provides a framework for tracing responsibly sourced aluminium through the supply chain.

Capral was the first aluminium extruder in Australia to achieve ASI certification and has been certified to both the ASI Performance Standard and ASI Chain of Custody Standard across its national network of extrusion plants, distribution centres and trade outlets. These certifications demonstrate Capral's commitment to responsible sourcing, ethical business practices, environmental stewardship and supply chain transparency.

Together with independentlyverifiedEPDS, ASI certification provides customers with greater confidence in both the environmental performance and responsible sourcing credentials of the aluminium products they specify and procure from Capral.

KEY FACTS

Independent assurance across the aluminium value chain

ASI provides a globally recognised certification framework that promotes responsible production, sourcing and stewardship of aluminium.

Traceability and transparency

ASI certification combines performance and chain of custody requirements, providing greater confidence in the environmental, social and governance credentials of aluminium products throughout the supply chain.

Supporting responsible procurement

By specifying ASI-certified aluminium, manufacturers, project teams and end users can demonstrate their commitment to responsible sourcing and sustainable supply chain practices.

The Role of Lower-Carbon Aluminium in Sustainable Procurement

The transition to a lower-carbon economy is reshaping how materials are specified, procured and reported across the built environment. As organisations increasingly seek to reduce embodied carbon and improve supply chain transparency, the environmental performance of construction materials has become an important consideration in procurement and project delivery.

Lower-carbon aluminium provides an opportunity to reduce the carbon footprint of buildings and infrastructure without compromising product performance, durability or design flexibility. Supported by independently verifiedEPDs and responsible sourcing certifications such as ASI , lower-carbon aluminium enables project teams to make informed decisions based on transparent and credible environmental data.

The growing focus on sustainability is also influencing customer expectations, investor priorities and regulatory frameworks. Across both public and private sectors, organisations are increasingly being asked to understand, measure and report the environmental impacts associated with their products, projects and supply chains. As a result, materials that offer verified environmental performance and supply chain transparency are becoming an important component of sustainable procurement strategies.

For manufacturers, builders, architects and asset owners, specifying lower-carbon aluminium can support sustainability objectives, contribute to embodied carbon reduction targets and demonstrate a commitment to responsible sourcing. As reporting requirements and market expectations continue to evolve, organisations that proactively adopt lower-carbon materials are likely to be better positioned to respond to future opportunities and stakeholder expectations.

When evaluating aluminium products for a project, consideration should be given to embodied carbon, recycled content, environmental transparency, supply chain traceability and the supplier's broader sustainability commitments. Increasingly, these factors are being incorporated into project specifications, sustainability reporting frameworks and procurement requirements across the built environment sector.

RESPONSIBLE PROCUREMENT CONSIDERATIONS

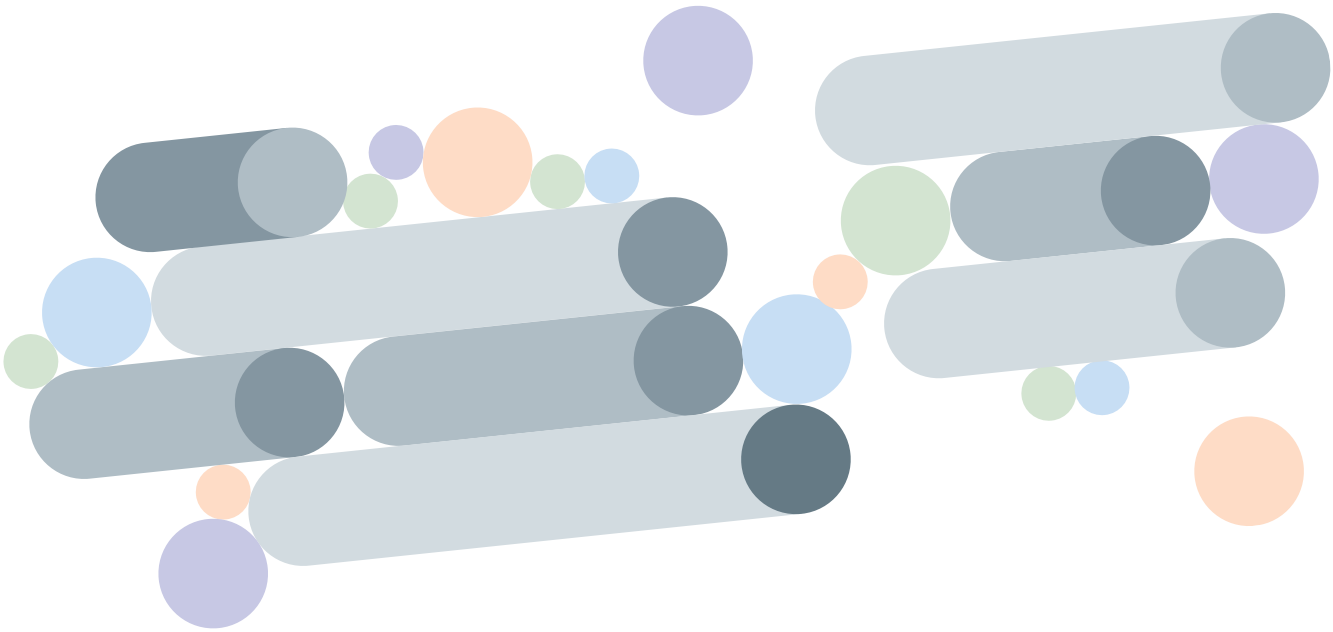
When specifying aluminium products, organisations should consider the following to support responsible procurement and embodied carbon reduction objectives:

- Review independently verified EPDs to understand the environmental impacts associated with aluminium products and enable informed product comparisons.
- Consider lower-carbon aluminium products that provide transparent embodied carbon data, supporting project sustainability objectives and emerging embodied carbon reporting requirements.
- Specify aluminium supplied through recognised certification schemes such as the Aluminium Stewardship Initiative (ASI), demonstrating responsible sourcing and production practices.

Engage with suppliers to understand their sustainability commitments, emissions reduction strategies and circular economy initiatives, including the use of recycled content and end-of-life material recovery.

Select suppliers that demonstrate transparency, responsible sourcing and ongoing investment in decarbonisation and sustainability initiatives. These considerations can assist projects seeking to align with sustainability frameworks and procurement requirements, including Green Star Materials credits, the Commonwealth Environmentally Sustainable Procurement Policy, emerging NABERS embodied carbon initiatives and the National Construction Code (NCC) 2025. Verified EPDs can also support customers' own Scope 3 greenhouse gas accounting and climate-related disclosures, including reporting under the Australian Sustainability Reporting Standards (ASRS S2), by providing robust embodied carbon data for purchased construction products.

By incorporating these considerations into procurement decisions, organisations can strengthen responsible supply chains, support embodied carbon reduction objectives and contribute to more sustainable outcomes across the built environment.



Supporting Australia's Transition to Lower-Carbon Aluminium

As Australia's largest extruder and distributor of aluminium products, Capral is committed to supporting the transition to a lower-carbon and more circular built environment. Through ongoing investment in responsible sourcing, environmental transparency and recycling initiatives, Capral is working to provide customers with practical pathways to reduce embodied carbon without compromising product performance, quality or availability.

A key part of this commitment is the continued expansion of the LocAl® product range, providing Australian manufacturers, builders and project teams with access to lower-carbon aluminium extrusion products supported by independently verified EPDs. These EPDs provide transparent environmental performance data, enabling customers to make informed procurement decisions and better understand the embodied carbon impacts of the materials they specify.

Capral's commitment to responsible sourcing is further supported through certification to both the ASI Performance Standard and Chain of Custody Standard across its national network of extrusion plants, distribution centres and trade outlets. Together, these certifications provide confidence in the environmental, social and governance credentials of the aluminium supplied through Capral's operations.

As an Australian manufacturer, Capral continues to invest in local extrusion capability, recycling initiatives and supply chain partnerships that support the development of lower-carbon aluminium solutions for the Australian market. Through collaborations with industry partners, including Rio Tinto, Capral is helping advance circular economy outcomes and increase the use of recycled content within locally manufactured aluminium products.

As expectations around embodied carbon, responsible sourcing and sustainability reporting continue to evolve, access to transparent, independently verified environmental information will become increasingly important. By combining Australian manufacturing, responsible sourcing, independently verified EPDs and ongoing investment in circularity initiatives, Capral is helping customers make informed material choices and contribute to a more sustainable built environment.

LocAl® Environmental Product Declarations

AUSTRALASIA EPD®
INTERNATIONAL EPD SYSTEM

Local® EPD

Programme:	The International EPD System www.environdec.com
Programme operator:	EPD International AB
Licensee:	EPD Australasia Limited
EPD registration number:	EPD-IES-0031050:001
Version date:	2026-04-28
Validity date:	2031-04-27

Local® SG EPD

Programme:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
Licensee:	EPD Australasia Limited
EPD registration number:	EPD-IES-0032247:001
Version date:	2026-06-12
Validity date:	2031-06-11

Access the EPDs here: epd-australasia.com/epd/capral-local-aluminium-extrusion/

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