



Heavy industry

Australia's population is projected to reach 33 million by 2050. This will drive construction of more infrastructure, alongside what is required to support the energy transition.

Steel, cement and aluminium are key industries in infrastructure development. They are also the highest emitting industry sectors in Australia. They also face substantial obstacles to achieving full decarbonisation with current technologies, but there are ways they can reduce or abate emissions.

- Under CSIRO's *Rapid Decarbonisation* scenario, demand for **cement** production is projected to increase by more than a quarter (27%) by 2050 relative to 2020 levels. This demand is from the electricity sector (building wind power, hydropower and new electricity infrastructure), construction (for built environment and transport) and mining.

The cement industry can reduce emissions through a mix of fuel switching, using biofuels and technologies that are currently in early demonstration or prototype phase (such as hydrogen and Carbon Capture Utilisation and Storage), which will require significant investment. The cement sector is not projected to achieve net zero by 2050, in part because of carbon dioxide emissions from clinker production, and will need to draw on negative emissions to achieve net zero objectives.

Australia's iron ore (used to make **steel**) and bauxite (used to make **aluminium**) sectors are projected to continue to grow as key metals supporting transition (iron ore by nearly 70% and bauxite by nearly 50%). Mining activities will decarbonise relatively rapidly through electrification with some use of hydrogen.

Mineral processing emissions reduction trajectories are more complex.

- Global demand for batteries, solar PV panels and wind – all of which use aluminium to some degree – is expected to increase. Australia has an opportunity to leverage its renewable energy resources to produce aluminium at lower emissions intensity than international competitors. The technical challenge to abate high temperature heating and process emissions for the aluminium sector should not be underestimated. Significant investment in research, development and pilots along with industry collaboration will be needed to commercialise decarbonisation measures.
- Under CSIRO's *Rapid Decarbonisation* scenario, electrification and decarbonisation of electricity enable significant emissions reduction in iron ore processing and smelting. Even with direct reduction and electric arc furnaces, green hydrogen will likely be part of the industry's critical path to decarbonisation.

As demand for green steel grows and value chain emissions become more important, low emissions producers are likely to find it easier to obtain finance, may be able to attract a green premium for their products, and will avoid carbon penalties.

Companies in hard-to-abate sectors will be relying on Carbon Capture Utilisation and Storage, hydrogen, or offsets to prolong their longevity in a low carbon future. Investment in research, pilots and demonstration projects will play a critical part in enabling these technologies to be commercialised at scale.

For more information, see infographic below and section 3.4 of the report *Pathways to Net Zero Emissions – An Australian Perspective on Rapid Decarbonisation*.

[csiro.au/rapiddecarbonisation](https://www.csiro.au/rapiddecarbonisation)

For further information

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2050

Clinker comprises around 60% of cement production

Direct reduced iron (via hydrogen) comprises more than half of steel smelting production

In alumina refining, energy from natural gas falls below a third whilst electricity increases to more than half

Diesel use is eliminated in bauxite and iron ore mining

2040s

CO₂ capture gains traction in cement production

Hydrogen is partially used in steel refining

Emissions intensity decreases by 22% in steel production (compared to 2020)

Anode technology gains some use in aluminium smelting

2030s

Recarbonation gains recognition in concrete industry

Recompression sees a move away from natural gas in alumina refining

In bauxite and iron ore mining, more than two thirds fuel use is electricity or biofuel

2020

Clinker comprises 84% of cement production

In alumina refining, more than two thirds fuel use is natural gas

In bauxite and iron ore mining, more than half fuel use is diesel

- Cement
- Steel production
- Aluminium
- Alumina
- Iron ore and bauxite