2025 consultation

Submission type	Upload
Submitter	Cement Industry Federation
Response ID	E9

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NSW NET ZERO COMMISSION
CONSULTATION PAPER

11 July 2025

1. INTRODUCTION

Thank you for the opportunity to contribute to the NSW Net Zero Commission consultation paper. The Cement Industry Federation (CIF) is the national body representing all Australian integrated cement manufacturers – Adbri Ltd, Boral Cement Ltd and Cement Australia Pty Ltd. CIF members also produce lime, both in conjunction with existing operations and as stand-alone facilities.

CIF member companies operate various downstream activities to ensure the supply of critical cementitious products into the market. This includes an increasing amount of low carbon products where various proportions of the emissions intensive clinker component have been replaced by supplementary cementitious materials (SCMs) such as limestone, fly ash and ground granulated blast furnace slag.

Australian cement producers form part of a **critical manufacturing industry of national importance**, especially given the need for sovereign capability to support Australia's infrastructure (e.g., roads, bridges, water supply structures, medical facilities, defence structures, housing and commercial buildings) and as part of the overall transition to net zero.

Over 1,300 people are directly employed in the cement industry, corresponding to over 5,000 jobs downstream. 30,000 people are directly employed across the combined cement, concrete and aggregate sector - corresponding to over 80,000 jobs indirectly employed, generating annual revenue of A$15 billion.

For cement manufacturing with unavoidable process emissions, full decarbonisation will not be achieved without significant early focus on step-change technologies such as those associated with carbon capture, utilisation and storage (CCUS) – including key infrastructure and transport – as well as the associated legislative and regulatory frameworks.

From a policy perspective, strong, consistent and considered action by all parts of the cement and concrete value chain (including all levels of government) will be required to reduce greenhouse gas emissions while ensuring a strong economy and maintaining the competitiveness of key manufacturing industries such as cement.

It is also critical that all Australian governments support the development and implementation of a border carbon adjustment mechanism as soon as possible for simply transformed goods such as clinker, cement and lime. Not addressing the issue of carbon leakage in a timely manner will be detrimental to Australian cement and lime manufacturing and could lead to the unnecessary loss of key Australian cement and lime facilities.

2. CEMENT MANUFACTURE

Cement is a critical ingredient in concrete, one of the most used materials in the world and essential for the built environment as we know it. Australian cement production is closely linked to population growth.

Australian integrated cement manufacturers[1] produce clinker and cement at five facilities, located at Birkenhead (SA), Angaston (SA), Berrima (NSW), Gladstone (QLD) and Railton (TAS). Cement is also produced at twelve stand-alone cement mills. CIF members also produce lime, either in conjunction with their cement operations or as stand-alone facilities.

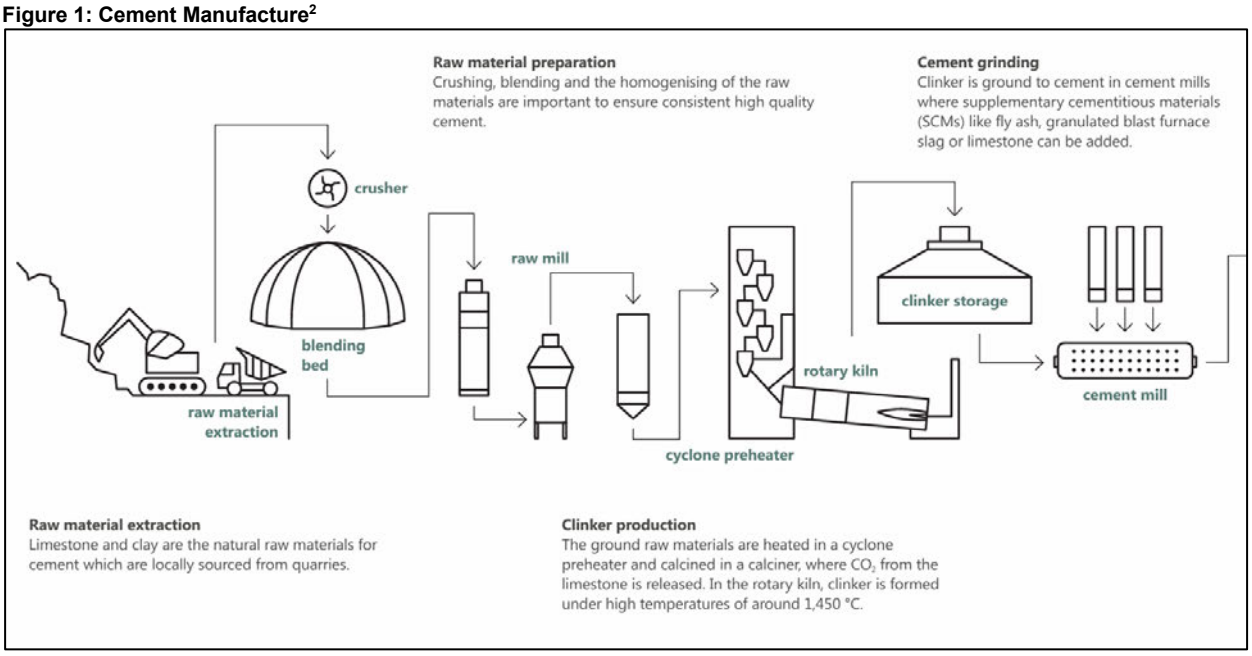
Cement manufacturing involves the calcination (heating) of limestone in a kiln to produce clinker, which is then ground and mixed with gypsum to produce what is known as Portland cement (cement). Raw materials required for the process include limestone, sand, iron ore, shales, and clays (**Figure 1**).

Clinker production is emissions intensive due to the calcination of limestone, which results in unavoidable process emissions independent of fuel use. The clinker in cement can be substituted for low-zero emissions supplementary cementitious materials (SCMs) to produce lower carbon cements.

[1] Integrated cement manufacturing is when clinker and cement is produced as an 'integrated' process at the same facility. Whilst all cement manufacturing facilities in Australia are integrated, this is not the case in other jurisdictions such as the EU where many facilities only produce clinker.

Carbon curing (concrete), mineralisation (aggregates) and recarbonation are all pathways for the reuse of carbon dioxide either obtained through direct capture from industrial processes or naturally from the atmosphere.

Figure 1: Cement Manufacture[2]



3. THE CEMENT INDUSTRY'S DECARBONISATION CHALLENGE

This submission largely focusses on responding to question 13 of the consultation paper, namely "What policies or programs at a sectoral level could complement the Safeguard Mechanism to support the accelerated decarbonisation of heavy industry in NSW?"

Australian cement manufacturing is referred to as an essential industry as it underpins virtually all Australian public and private infrastructure - including roads, bridges, schools and hospitals, as well as commercial and residential buildings.

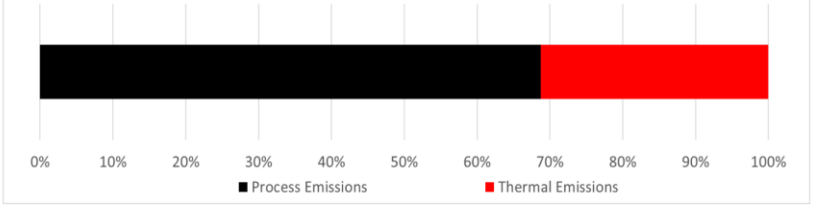
The cement industry is also considered to be one of the hardest to abate sectors in Australia due to the currently unavoidable emissions associated with the heating of the main raw material, limestone, to produce clinker – the main ingredient in cement.

Clinker production is associated with two different types of Scope 1 greenhouse gas emissions (**Figure 2**):

- **Process emissions**, which are generated when limestone is treated with high heat and releases carbon dioxide (limestone calcination), account for 70 per cent of Scope 1 emissions from clinker/cement manufacturing. This is a chemical reaction which produces carbon dioxide emissions independent of the fuels used to heat the kiln ($CaCO_3$ + heat → $CaO + CO_2$).

- Emissions from **fuel combustion** needed to generate heat (at about 1,450°C for clinkerisation) in kilns. Fuel combustion is responsible for about 30 per cent of total GHG emissions associated with cement production in Australia.

Figure 2: Scope 1 emissions profile – Australian integrated cement manufacturing



[2] Decarbonisation Pathways for the Australian Cement and Concrete Sector - An overview

While there are options to substitute existing fossil fuel use with alternative, lower emissions fuels, process emissions represent a significant challenge in terms of decarbonisation of the cement industry.

The Australian cement industry is facing significant challenges under the Safeguard Mechanism. The recent reforms and the introduction of tailored treatment for trade-exposed facilities recognises both the critical importance of our industry to the Australian economy, and the difficult nature of the emissions reduction task for our sector.

However, while CIF members are working successfully to reduce non-process emissions, there are no current commercially available step-change emissions reduction technologies that can materially address the issue of process emissions over the short to medium term.

This places our industry at a significant risk of carbon leakage, where domestic production facing significant carbon-related costs could be replaced by imports of clinker and cement from competing countries not subject to similar cost constraints.

4. WHAT CAN AUSTRALIAN GOVERNMENTS DO TO SUPPORT CEMENT MANUFACTURING TO DECARBONISE?

1) **Recognise that cement manufacturing is a hard-to-abate sector and that significant investment will be required to bring forward step-change emissions reduction pathways for currently unavoidable Scope 1 process emissions.**

   While the industry is working hard to implement emissions reduction opportunities that are available now (such as clinker substitution and increasing the use of alternative fuels), significant step-change emissions reduction opportunities such as CCUS are going to take time to develop and implement.

   From a policy perspective, strong, consistent and considered action by all parts of the cement and concrete value chain (including all levels of government) will be required to reduce greenhouse gas emissions while ensuring a strong economy and maintaining the competitiveness of key manufacturing industries such as cement.

2) **Support the Federal Government in the development and implementation of a Border Carbon Adjustment (BCA) for clinker and cement.**

   The implementation of a border carbon adjustment mechanism for clinker and cement is required to prevent manufacturing shifting to regions with less stringent emissions policies, ensuring the protection of jobs and industries in Australia.

   A BCA will ensure a level playing field and will provide the required certainty for the industry to invest in decarbonisation technologies.

   The second Carbon Leakage Review consultation paper (2024) confirms that the introduction of a carbon border adjustment will have a positive impact on the Australian economy as it:

   - Addresses the issue of imported clinker, cement and lime products that are not facing an equivalent carbon price gaining an unfair competitive advantage.
   - Assists in ensuring Australian clinker, cement and lime products are not unnecessarily relocated to jurisdictions not facing an equivalent carbon price and retains the 1,400 jobs our industry employs, especially in regional areas
   - Will positively contribute to Australia's overall carbon target, potentially reducing overall emissions rather than importing further emissions and
   - Addresses potential 'investment leakage' so that Australian clinker, cement and lime manufacturers have the confidence to attract and deploy the significant capital investment associated with implementing decarbonisation technologies.

   Without this measure, Australia risks the unnecessary closure of domestic integrated cement facilities, leading to increased reliance on imported materials with a potentially higher emissions intensity.

3) **Work with the Federal Government to create a detailed Australian Roadmap for CCUS, including in terms of the infrastructure, transport and regulatory requirements that can be quickly implemented.**

Carbon capture, use and storage (CCUS) is widely recognised as a key pathway to significant emissions reductions in the global cement industry. In Australia, it has been estimated that CCUS will be required to account for around 33 per cent of the cement and concrete industry's total emissions reduction task by 2050[3].

It is critical that the development of a CCUS Roadmap is prioritised if Australian cement manufacturers (and other key industrial sectors such as lime) can meet their long-term decarbonisation goals and attract the necessary capital investment required to commercialise CCUS, especially on the east coast of Australia.

Key issues that need to be addressed fall into two categories:

1. Enabling Framework (supportive policies, identification of storage sites, transport options, supporting use options, community licence)

2. Technology (developing and proving capture technology, commercialisation - including accounting for the significant increase in electricity usage)

All aspects of CCUS are challenging:

- **Capture**: cement kilns are well suited to capturing carbon dioxide emissions due to the relative purity of the gas stream, and all CIF members are investigating capture options. However, international experience and initial domestic trials are showing that the costs of implementing capture technology (capital and ongoing costs) are likely to be significant.

- **Use**: all CIF members are examining use options for captured carbon dioxide – including *inter alia* mineralisation and green fuel production. Mineralisation must be able to address the scale of emissions reduction required, and green fuel production is contingent on the availability of affordable 'renewable' inputs such as hydrogen.

- **Storage**: there are currently only two operational commercial CCS facilities – Gorgon and Moomba – with a further 14 sites at the feasibility stage or under development. Australia has around 403 million tonnes (Mt) of total demonstrated resources (storage capacity and contingent resources)[4]. This resource needs to be harnessed.

- **Transport**: Once captured, the carbon dioxide needs to be transported to storage and/or use sites. Given the location of Australian facilities and the large distances involved, this is likely to be via pipelines – either new or existing – with obvious cost implications.

For hard-to-abate sectors such as cement and lime this will require ongoing government support at all levels until CCUS becomes commercially viable in its own right. A detailed Australian CCUS roadmap will be an important first step to fast tracking this important emissions reduction pathway.

All Australian governments should work together to develop and implement the legislative and regulatory framework to underpin carbon capture, utilisation and/or storage (CCUS).

This could include a focus on research aimed at investigating and demonstrating CCUS at an industrial scale and adapted to the specificities of the Australian cement industry, as well as pre-feasibility studies into carbon dioxide compression and transport options relative to the location of Australian cement manufacturing facilities and potential storage locations.

[3] Decarbonisation Pathways for the Australian Cement and Concrete Sector
[4] Carbon capture and storage | Geoscience Australia

4) **Continue to support cement facilities to reduce carbon dioxide emissions through the increased use of alternative fuel and raw (AFR) material sources and the development of a consistent policy environment to encourage waste recycling and reuse initiatives.**

The cement industry, both globally and in Australia, has been using secondary materials as a resource for well over 40 years through a process known as co-processing. Co-processing is the use of by-products as a raw material to replace natural mineral resources (material recycling), and/or as an energy source to replace fossil fuels such as coal or gas (energy recovery).

Cement kilns are ideally suited to the safe recovery of energy and co-processing of a range AFRs, including demolition wood waste, refuse derived fuels, used oil and solvents, as well as spend liner from aluminium smelting.

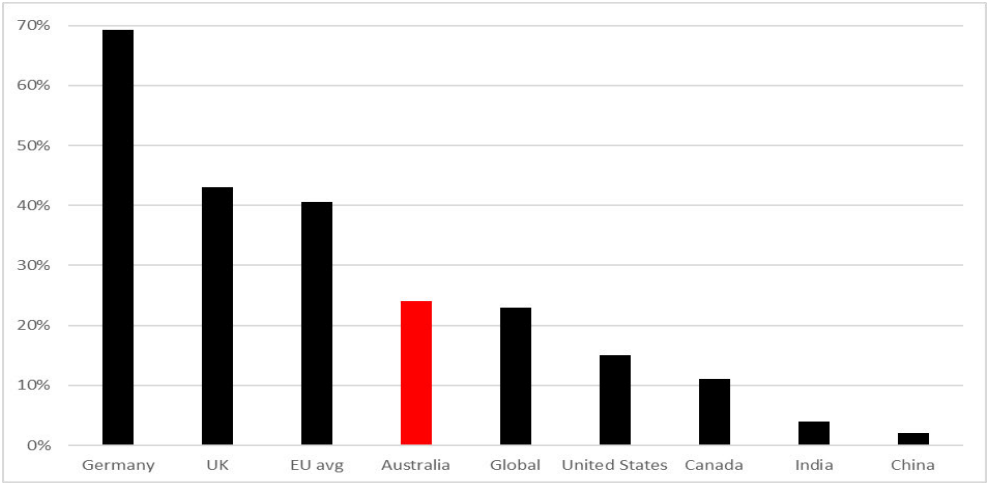
While the Australian cement industry has made significant progress in the uptake of AFRs to-date (with around 23 per cent of alternative fuel usage reported in 2023-24 – **Figure 3**), there is considerable scope for further increased use of AFRs if certain barriers, regulatory or otherwise, can be identified and addressed. Increasing the safe use of AFRs in cement manufacturing is dependent on several factors including:

- waste definitions
- the waste hierarchy
- availability
- transport
- investment requirements for on-site storage and handling systems
- regulatory limitations and
- community engagement and awareness.

Consideration should be given to regulations aimed at reducing waste to landfill and promoting the use of suitable non-recyclable secondary materials as co-processed alternative fuels for cement manufacturing (energy and material recovery, not incineration) to replace coal and gas.

These regulations should be coupled with suitable, consistent environmental approvals and permitting to ensure that globally recognised technologies can be used in Australia.

Figure 3: Examples of AFR usage as a percentage of energy consumption



5) **Continue to support Australian cement producers and materials providers to identify new supplementary cementitious materials (SCMs), and address potential supply issues for existing SCMs, such as limestone, fly ash and slag[5] – including any potential regulatory barriers.**

The increased use of SCMs, such as limestone, fly ash and slag, to replace clinker in cement and concrete is a key decarbonisation pathway available now.

Clinker, when ground with 4 to 5 per cent gypsum, develops the useful cementitious quality of reacting and hardening when mixed with water. There are other mineral compounds that also have these hydraulic properties when mixed and ground with clinker and gypsum.

These mineral compounds can be used as clinker substitutes known as SCMs, which have been used in cement and concrete manufacture for many years. They contribute to performance with the added benefit of offsetting emissions associated with clinker.

Due to the fact these compounds are pre-calcined by other industrial processes, the avoided process emissions and combustion fuels used in the kiln make SCMs a key greenhouse gas reduction lever for cement manufacturing and the built environment.

'The use of these SCMs has resulted in a clinker to cement factor of 0.84 and a total clinker to binder factor in concrete of 0.62 resulting in a 38 per cent reduction in clinker content and associated CO_2 emissions in concrete. [6]

The continued supply of SCMs for both cement and concrete applications will be critical to ensuring the availability of lower carbon cements (via clinker substitution) to the Australian market.

While limestone is abundantly available in Australia, sources of suitable fly ash are generally expected to decline due to decarbonisation of the energy sector out to 2050. While there are significant amounts of stockpiled material (possibly around 100 years' worth), this would need to be extensively processed before it would be a suitable SCM for the cement industry.

Similar issues exist for ground granulated blast furnace slag, where the steel industry will be decarbonising its process which may affect the availability and quality of this SCM into the future.

6) **Support industry calls for standards and specifications to be Updated**

Standards, Codes and Specifications for cement, SCMs and concrete need to be reviewed and updated where necessary to fully realise the emissions reduction potential of clinker substitution.

This will require the modification of existing cement types (i.e. Type GP, Type GB and Type GL) as well as the introduction of new, low carbon cement types (i.e. to allow for new SCMS such as calcined clay, as well as higher limestone cements).

For example, a reduction in clinker content to produce a lower carbon Type GP cement can be obtained by increasing the maximum mineral addition (limestone content) from 7.5 per cent to at least 10 per cent. This is currently being considered as part of a review of the Australian cement standard - AS 3972 – and will require the support of all stakeholders.

Additionally, potential modifications have been proposed for Type GL (General limestone cement) in AS-3972 to change the limestone content from 8 to 20 per cent to 10 to 15 per cent (max) and to change the compressive strength performance of Type GL to be equivalent to Type GP. This would enable GL Cement to be interchangeable with Type GP Cement as it will meet the same performance requirements.

In general, a move away from prescription-based standards towards more performance-based standards would allow cement manufacturers more flexibility in adopting more innovative and lower carbon cement products.

Other Codes and Specifications, such as those used by infrastructure authorities as well as state and local governments, should also be reviewed and updated along the same lines.

[5] Specifically Ground Granulated Blast Furnace Slag (GBFS)
[6] Decarbonisation Pathways for the Australian Cement and Concrete Sector – VDZ 2021 - pg 13

7) **Work to identify and address instances of duplication and inconsistencies in policy, legislation and regulations between Federal and other state/territory jurisdictions.**

An area of significant concern to our members involves the duplicative and lengthy environmental approval processes – specifically in terms of requirements under the Environment and Biodiversity Conservation (EPBC) Act at the Federal level coupled with State and Territory (and Local Council) environmental legislation and approvals.

In general, the regulatory burden has increased over time for our sector – driven by both regulatory pressures and a growing demand for environmentally responsible, as well as sustainable practices and products. These include:

- Climate and energy reporting (NGERS) – including entity level audited data
- Safeguard Mechanism – facility level audited data, for which the regulatory/resource burden is further increased for those applying for Trade Exposed Baseline Adjusted (TEBA) status
- Climate-related financial disclosure requirements are now in place in Australia – while some jurisdictions (e.g. EU, California) have delayed disclosure to allow capacity building (e.g. EU's 'stop the clock' (Apr 2025) directive aimed at significantly reducing the sustainability reporting and regulatory burden on companies)
- Coastal shipping cabotage regulation (which has increased Australian cement manufacturing transport costs by up to 16%)
- Environmental reporting in general (e.g. the National Pollutant Inventory, state/territory EPA monitoring and compliance reporting, as well as increased reporting around packaging)
- The NSW Government public reporting of environmental monitoring data for all operations holding an Environmental Protection Licence (EPL). If an EPL includes monitoring as a licence condition, the holder must publish or make available data relating to pollution within 14 days of obtaining that data.
- NSW load-based licencing sets limits on the pollutant loads emitted by holders of environment protection licences and links licence fees to pollutant emissions (based on an annual return) – currently under review.
- Increased regulatory requirements and expectations as a result of residential encroachment.
- Time taken to receive approvals has increased and, as a result, productivity has declined.

8) **Recognise that work is underway to determine how best to account for the removal of carbon dioxide from the atmosphere through the process of recarbonation in cement and concrete – both in domestic and international emissions inventories – and seek to engage with the Cement Industry Federation on this issue.**

The recarbonation process is a chemical reaction by which carbon dioxide reacts with hydration products in concrete to form calcium carbonate ($CaCO_3$). Carbon dioxide uptake can occur during infrastructure use, end of life and secondary use stages.

For the first time the International Panel on Climate Change's (IPCC) Sixth Assessment Report (2021) noted carbonation as a sink associated with cement and concrete production. The IPCC report also noted that the uptake of carbon dioxide in cement and concrete infrastructure (carbonation) absorbs a significant proportion of the carbonate emissions from current cement production (process emissions).

VDZ (2021) noted studies that have shown recarbonation can account for at least 20 per cent of equivalent cement industry process emissions (i.e. those associated with clinker production).

The CIF is working with the Global Cement and Concrete Association (GCCA) and other national associations to advocate for the IPCC guidelines to be updated and for inclusion of recarbonation as a carbon dioxide sink in national inventories wherever possible.

Further research has been commissioned to model the uptake of carbon dioxide in cement and concrete in Australia through a project being funded by the SmartCrete CRC. The project, along with similar research projects from a number of other countries, will feed into the IPCC method development process, as well as national carbon accounting frameworks, through the relevant national and global associations.

All levels of government can assist by recognising that work is underway to determine how best to account for the removal of carbon dioxide from the atmosphere through the process of recarbonation in cement and concrete – both in domestic and international emissions inventories – and seek to engage with the Cement Industry Federation on this issue.

5. FURTHER COMMENTS

Thank you for the opportunity to provide the above comments. For further information relating to this submission please contact the CIF at info@cement.org.au.