

Research Challenge Brief



Calling all Innovators!

Searching for Research Solutions to solve
challenges and barriers towards

LC3 Market Pathways

Australia's cement and concrete industry has ambitious targets towards a net-zero future. Amongst various lower carbon cement and concrete developed to meet these targets, Limestone Calcined Clay Cement (LC³) has been widely acknowledged to be highly feasible and scalable. Further, due to abundance of suitable clay sources, there is an opportunity to kick-start the adoption of alternative supplementary cementitious material (SCM) to bridge future gaps when finite supplies of well understood SCMs are expected to deplete i.e. fly ash and slag. Additionally, clay's availability represents opportunities for of low carbon concrete in regions where existing requisite materials are not currently available.

However, to enable widespread adoption of LC³, it is crucial that the requirements and objectives of all key stakeholders involved in concrete's value chain are considered and inform the product development and post-development activities. We are looking for researcher participants to propose research solutions towards the barriers and opportunities for adoption of LC³ with the objective of enable and accelerate adoption of LC³ in Australia's construction industry as a whole.

Limestone Calcined Clay Cement



Typical cements are primarily limestone based and are very energy intensive to produce into cement clinker. LC³ is an alternative cement which is based on a mixture of Portland cement, calcined clay, limestone and gypsum, which has the potential to reduce carbon emissions by up to 40%¹. Research and global trials have produced LC³ locally produced calcined clay. As clay can be calcined at half the clinkerization temperature, resulting in a reduction of CO₂ emissions, compared with standard cement². Depending on availability of appropriate clay in Australia, as well as appropriate cement performance properties and commercial pathways, LC³ may present a pathway towards decarbonisation of the Australian cement sector.

Industry

In early September 2022, SmartCrete CRC brought together members of the concrete industry ecosystem to map out barriers and challenges towards commercial acceptance and adoption of a LC³ concrete.

Participants worked through a facilitated challenge scoping session and have identified key challenges which could be solved with a research focus.

SmartCrete is now calling for early stage research proposal Expressions of Interest which can demonstrate multi-disciplinary, innovative solutions to meet industry needs.



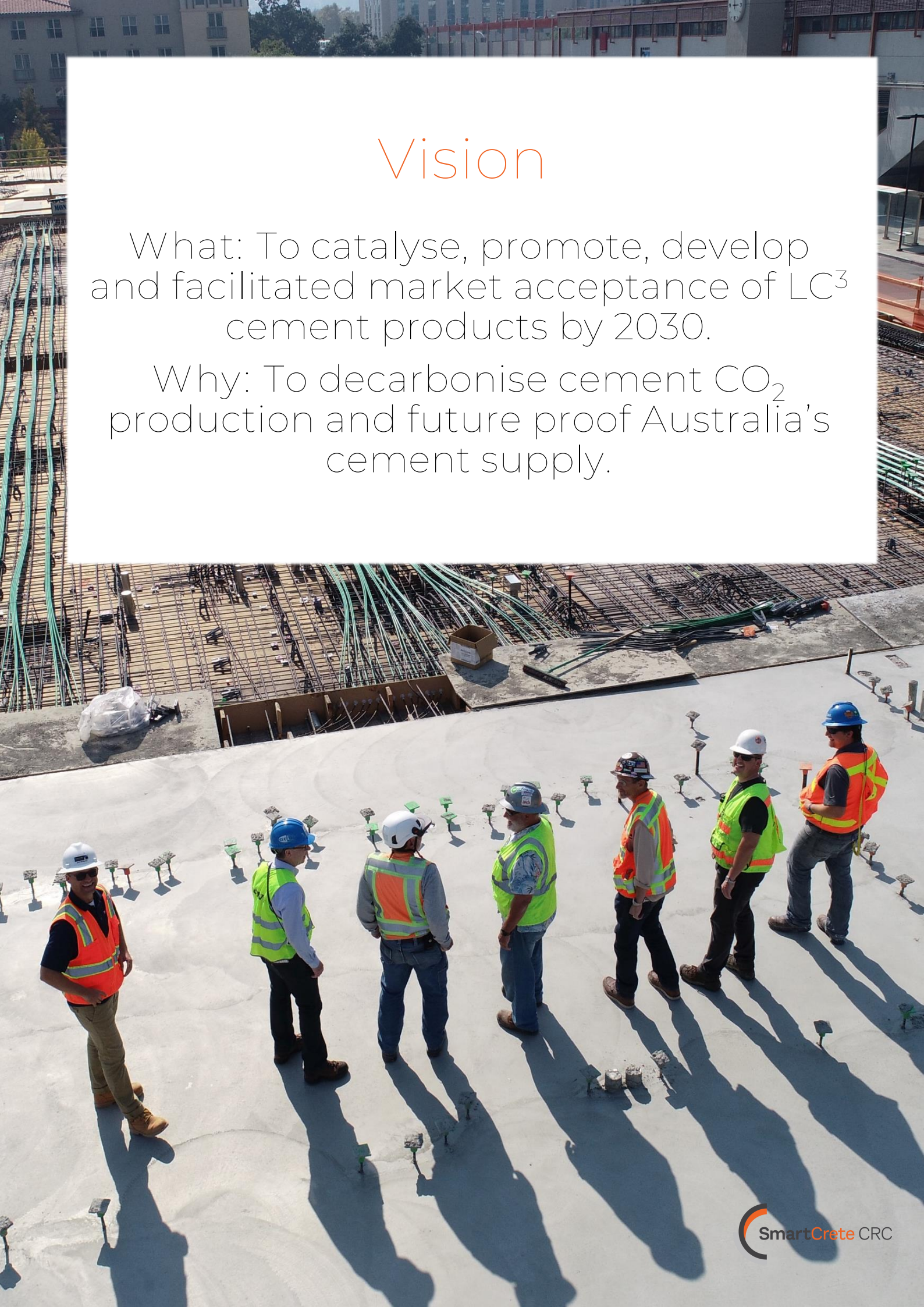
1. <https://lc3.ch/>

2. <https://www.sciencedirect.com/science/article/pii/S2352728516300240>

Vision

What: To catalyse, promote, develop and facilitated market acceptance of LC³ cement products by 2030.

Why: To decarbonise cement CO₂ production and future proof Australia's cement supply.



The Challenges

Technical



Facilitating the adoption of LC³ cement products will require investigation of the physical properties of clay-based cement, availability of raw products and development of appropriate testing protocols. The following challenges have been identified:

Availability of Clay

- What raw material does Australia have available and where?
- What is the performance and impact of different clay types?

Carbon performance

- What is the decarbonisation potential of LC³?
- What is the lifecycle carbon mapping of LC³ against other SCMs?

Material Properties

- What are the workability properties?
- What are the mechanical properties?
- What are the durability properties?

Structural Engineering

- How does LC³ perform structurally?
- How do we interpret and adjust international LC³ performance for Australian conditions?

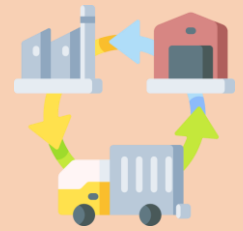
Performance Testing and Evidence

- How do we collect evidence and build product confidence?
- Rapid age testing protocols are developed to test Portland Cement products. Are testing protocols appropriate for other SCMs?

Lab to Scale

- How do we test lab results in real-world conditions?
- How do we translate scientific outcomes for commercial application?
- How do we create commercial mixes not “lab-crete”

Commercial



Market adoption will require innovations to support participants across the cement and concrete ecosystem, including suppliers, architects, engineers, contractors and asset owners. The following challenges have been identified:

Risks and Uncertainty

- Who bears the ‘risk’ of a new cement product?
- What are the risks?
- Who bears the responsibility for carbon emissions?

Commercialisation

- What facilities, machinery and infrastructure is required to transition and support commercialisation?
- What is the business case to convert ‘mothball’ kilns or build new kiln infrastructure?
- What is the value of the economic opportunity for LC³?

Standards Development and Refinement

- How do we collect appropriate evidence to support new cement product approvals?
- How do we improve testing protocols and rapid-aging testing procedures to better understand product performance and reduce risk?
- How do we streamline standards interpretation and use?

Education and Awareness

- How do we achieve acceptance by structural engineers, architects and infrastructure owners?
- How do we build credibility and confidence in the supply chain?



The Collaborators



Calling for Research Solutions! 📢



SmartCrete in collaboration with participants in the Australian cement industry ecosystem is calling for innovative, multi-disciplinary and collaborative research Expressions of Interest to address all or part of the challenges identified towards market acceptance and adoption of LC³ cement.

Research partners of SmartCrete CRC are asked to demonstrate your interest in this proposal through this short EOI form:

[Submit Your Expression of Interest!](#)

Approximate Project Value: \$750k - \$2m

The EOI requires only high level details of the research proposal. Upon review by the industry participants, successful research submissions will be approached to provide more information about the proposed research program and outputs.

Submissions close: **Friday 28th of October 2022**

For more information contact
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