

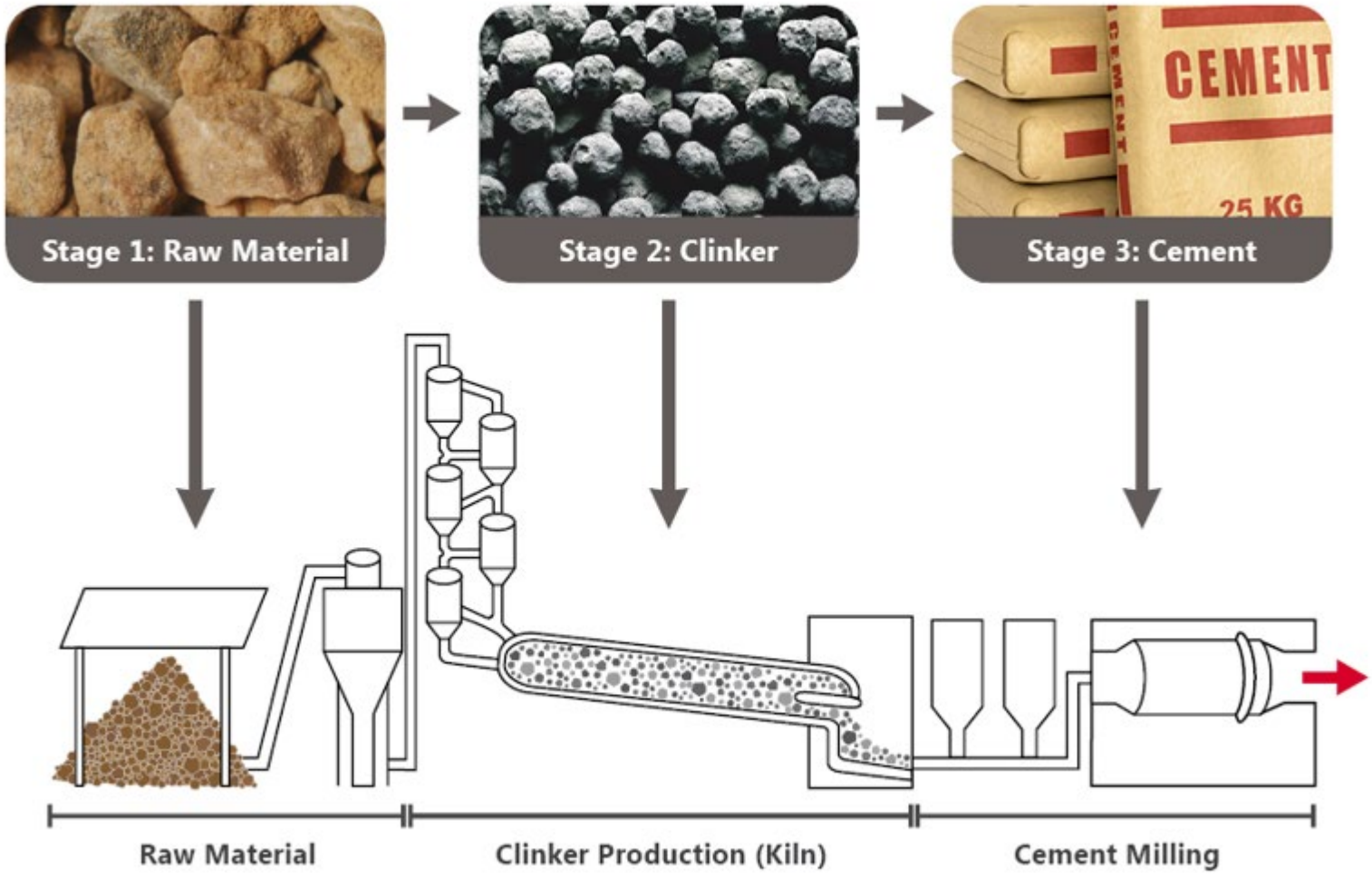
CEMENT INDUSTRY FEDERATION

Decarbonising the Australian Cement and Concrete Sector

Opportunities and Challenges

March 2022

Making Clinker and Cement



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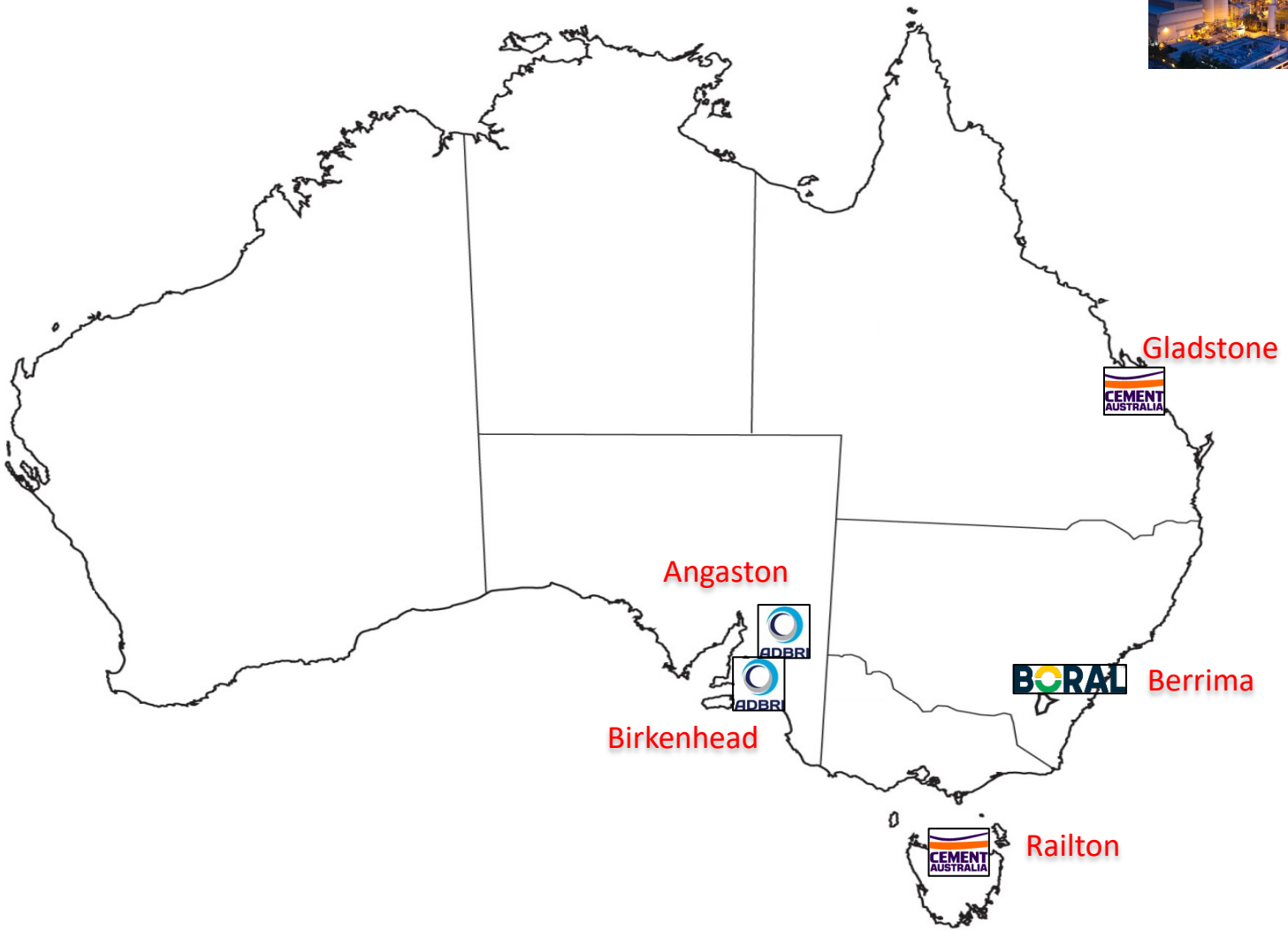
Integrated Cement Plant Locations



Australian Production and Imports

Clinker Production: 5.18 Mt

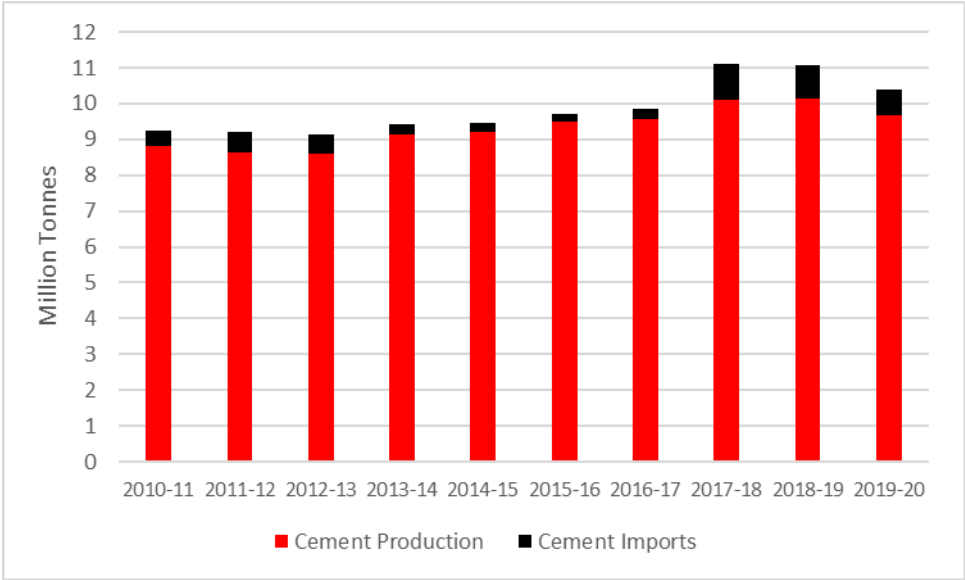
Clinker Imports: 4.03 Mt

Total Clinker: 9.21 Mt

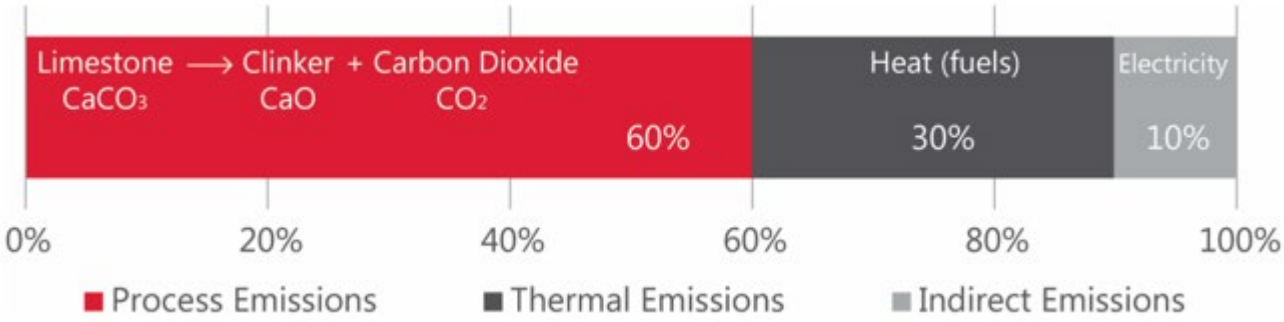
Cement Production: 9.69 Mt

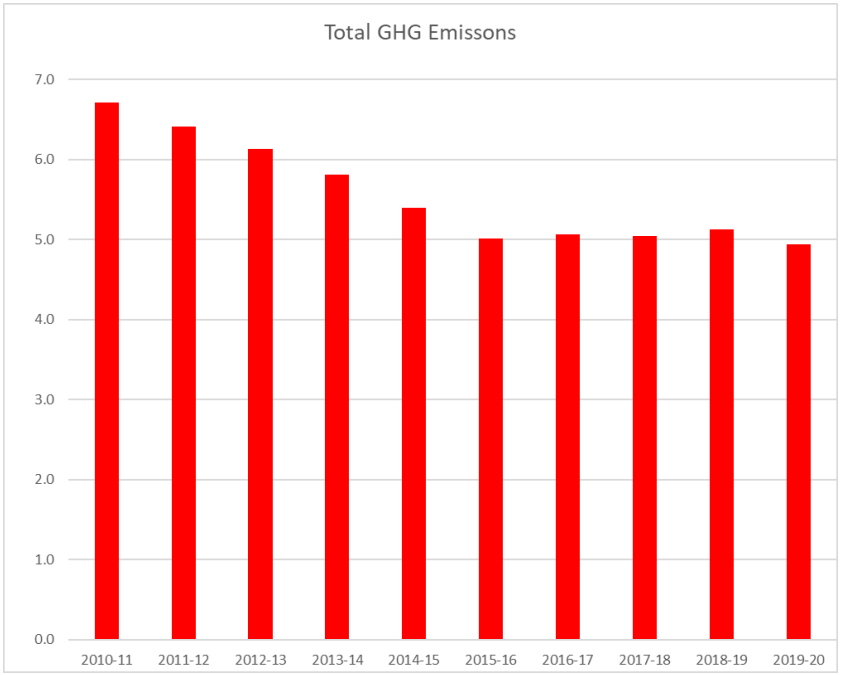
Cement Imports: 0.701 Mt

Total Cement: 10.39 Mt



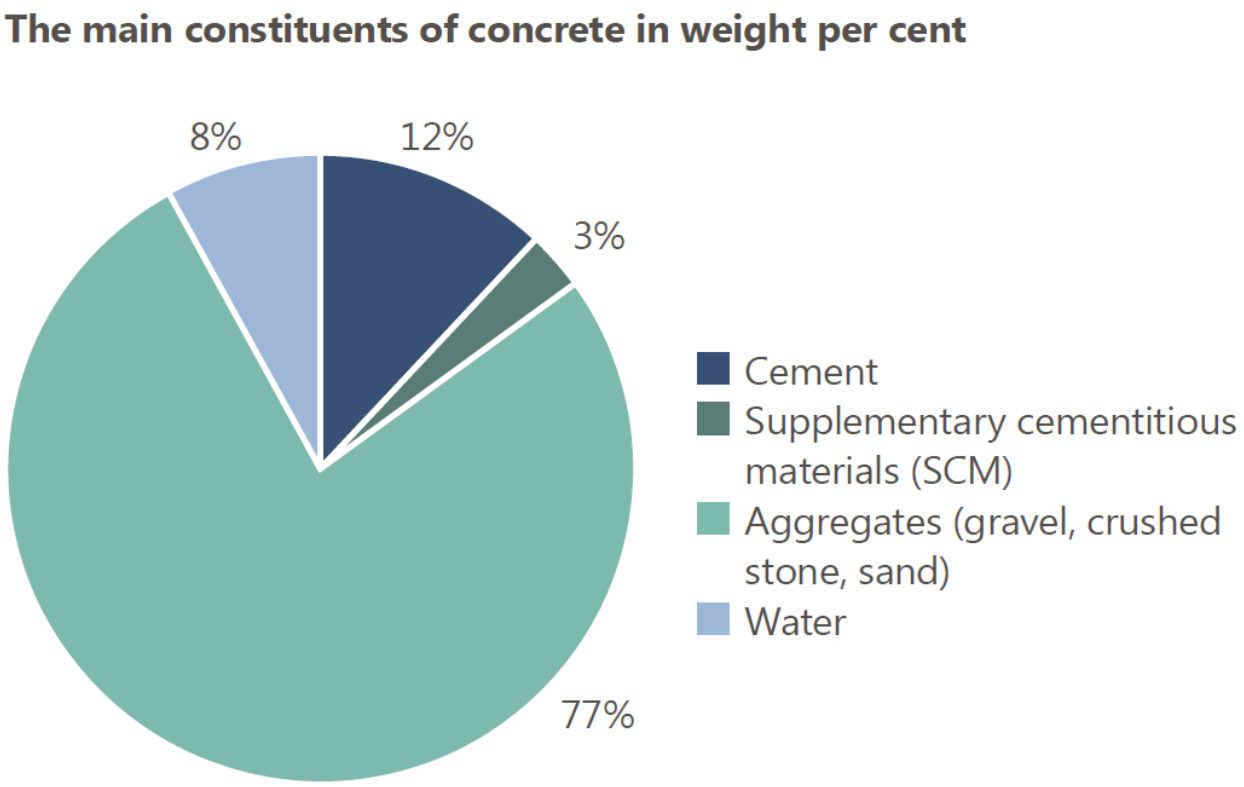
Cement Emissions Profile



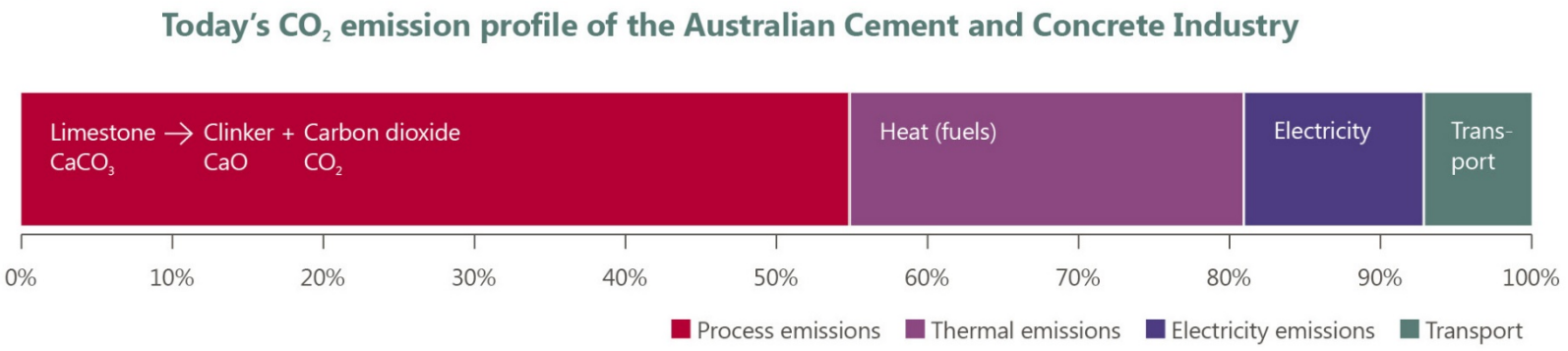


- Total emissions in 2019-20: 4.94 Mt
- Reduction in total emissions of over 20 per cent since 2010-11
- CO_2 emission factor for domestically produced clinker: 791 kg CO_2 /t of clinker
- 4 per cent below global average taking into account the fuel used and the thermal energy demand

Cement in Concrete

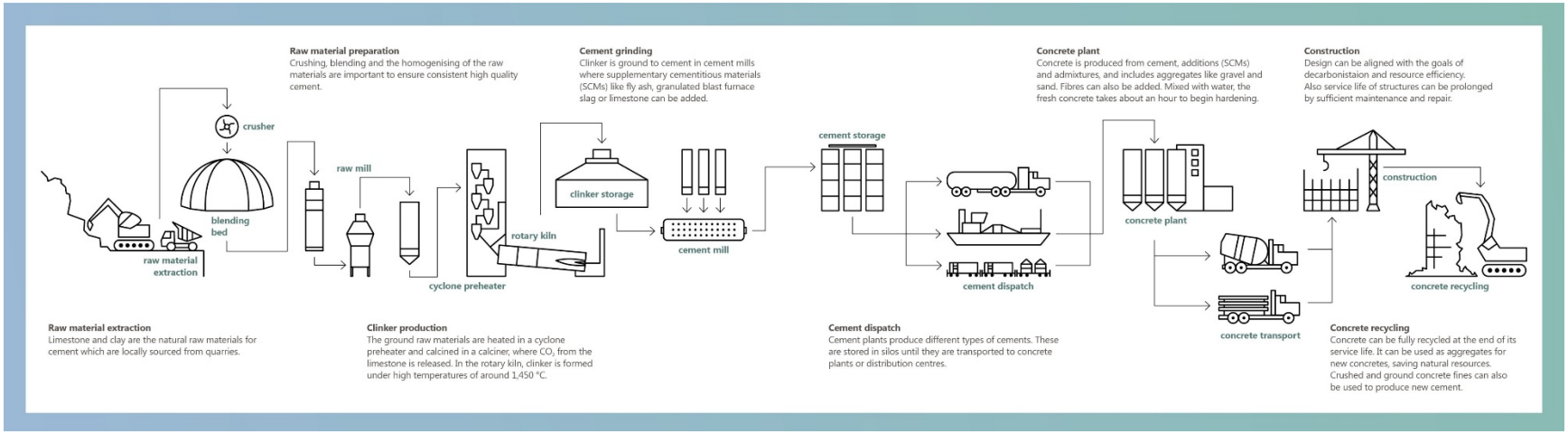


Cement and Concrete Emissions Profile



- About 55 per cent of the CO_2 emissions originate from the calcination of limestone and are commonly referred to as 'process emissions'.
- About 26 per cent can be identified as fuel-based emissions.
- About 12 per cent are indirect emissions from electrical energy usage.
- About 7 per cement are indirect emissions based on the transport of cement and concrete.

The Cement and Concrete Value Chain



Whole Life Perspective

Materials Production

- Use recycled materials
- Improve energy efficiency
- Improve material performance

Design & Construction

- Use less (i.e., stronger) material
- Create longer-lasting designs

Use

- Reduce building energy consumption
- Reduce damage from hazards
- Increase carbon uptake

End-of-Life

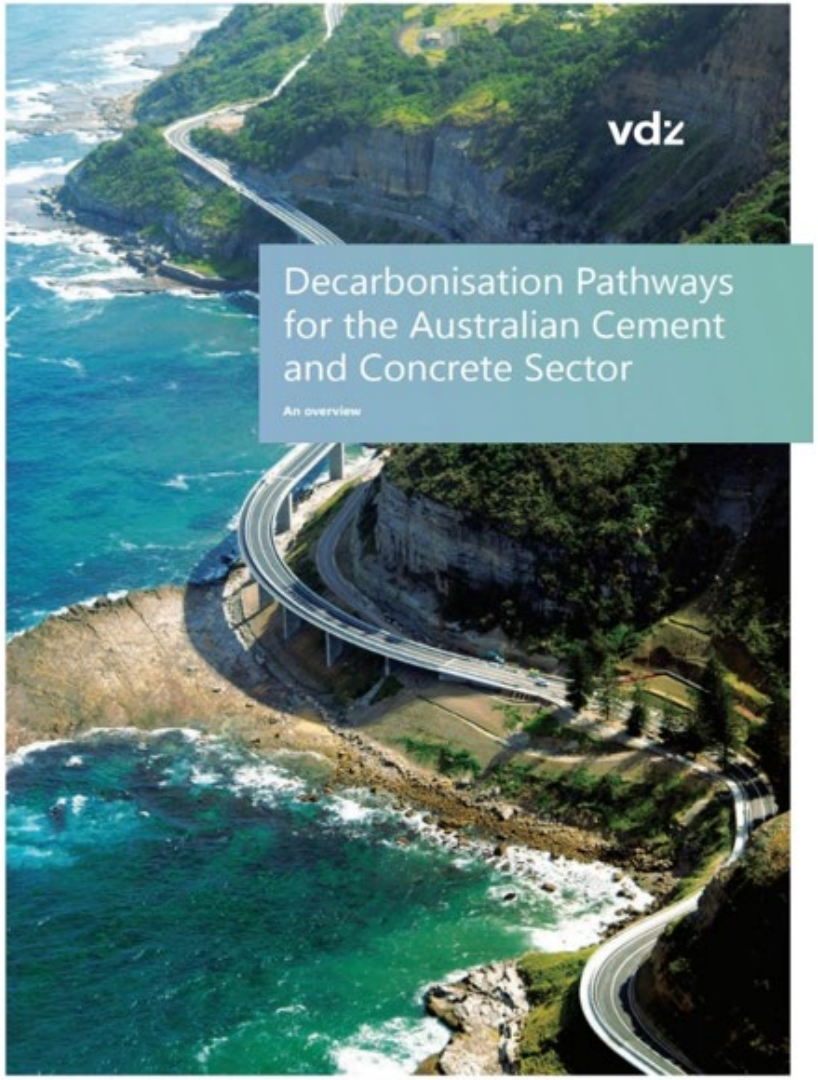
- Enable material recovery
- Increase carbon uptake

Embodied

Whole life

Image Source: *Lowering the Embodied Environmental Impacts of Cement and Concrete* – 27 Feb 2020, Jeremy Gregory, MIT Sustainability HUB

VDZ Decarbonisation Pathways Report



- Released late 2021.
- Identifies critical pathways that will enable the cement and concrete sector value chain to decarbonise by 2050.
- Will require the cooperation of the entire value chain, cement and concrete customers, developers, designers, building material procurers, architects, standards authorities, government and non-government agencies, and concrete and cement manufacturers.
- Development of key engagement plans based on the identified pathways.

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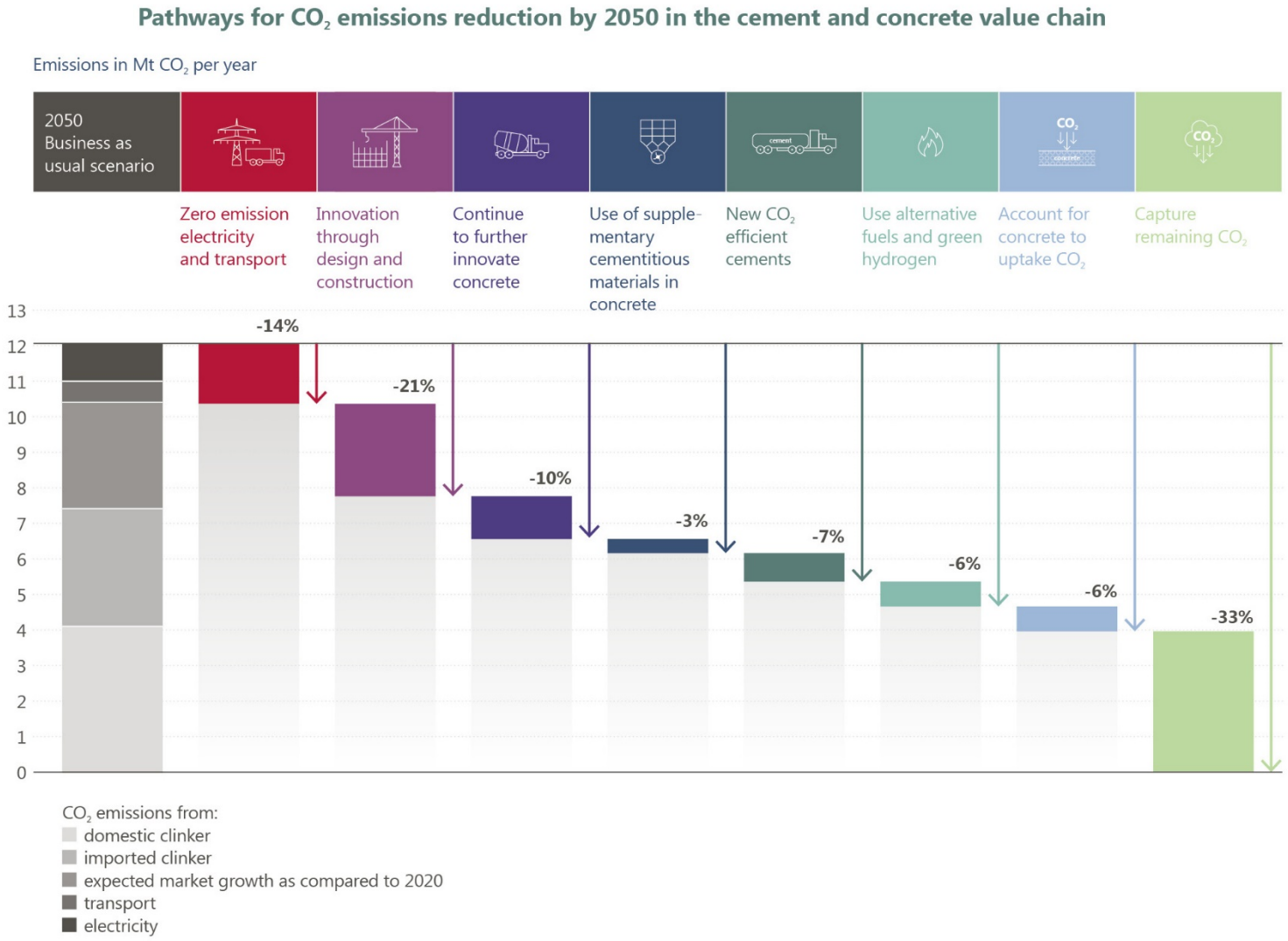
CEMENT CONCRETE & AGGREGATES AUSTRALIA
SmartCrete CRC
RACE for 2030

VDZ Decarbonisation Pathways Report

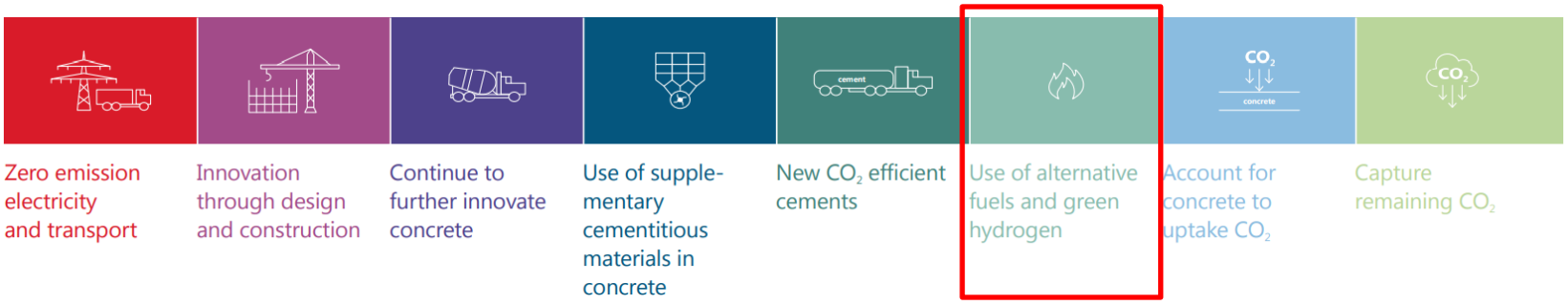


The business as usual scenario is based on a 40 per cent growth of the construction market by 2050

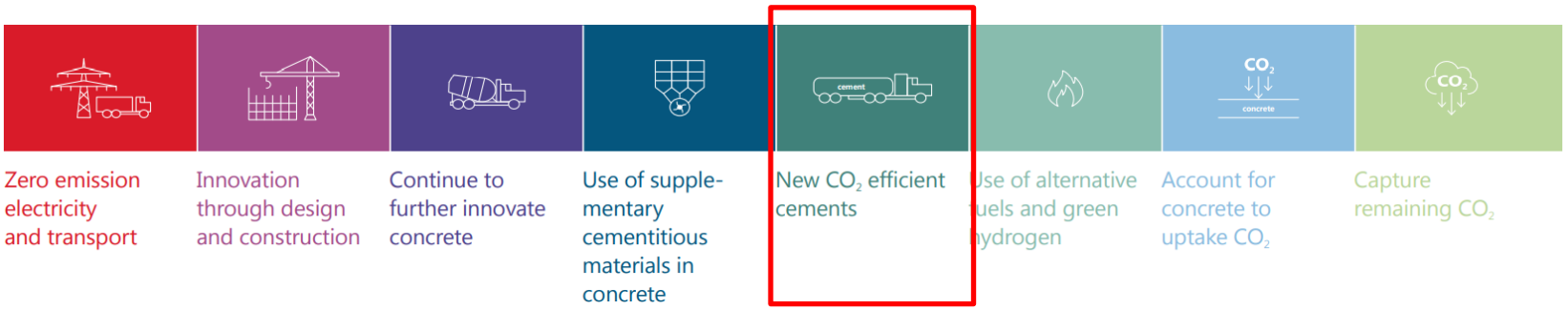
Zero Emission Electricity and Transport

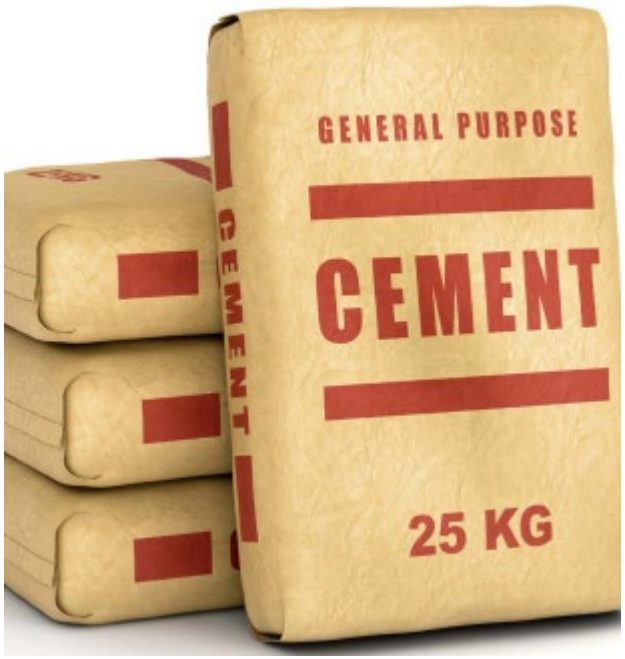
Zero emission electricity and transport	Innovation through design and construction	Continue to further innovate concrete	Use of supplementary cementitious materials in concrete	New CO_2 efficient cements	Use of alternative fuels and green hydrogen	Account for concrete to uptake CO_2	Capture remaining CO_2

Alternative Fuels and Green Hydrogen



Cement





Low clinker content in cements leads to lower CO_2 emissions

Clinker in cements can be replaced by Supplementary Cementitious Materials (SCMs), such as Fly Ash and Slag

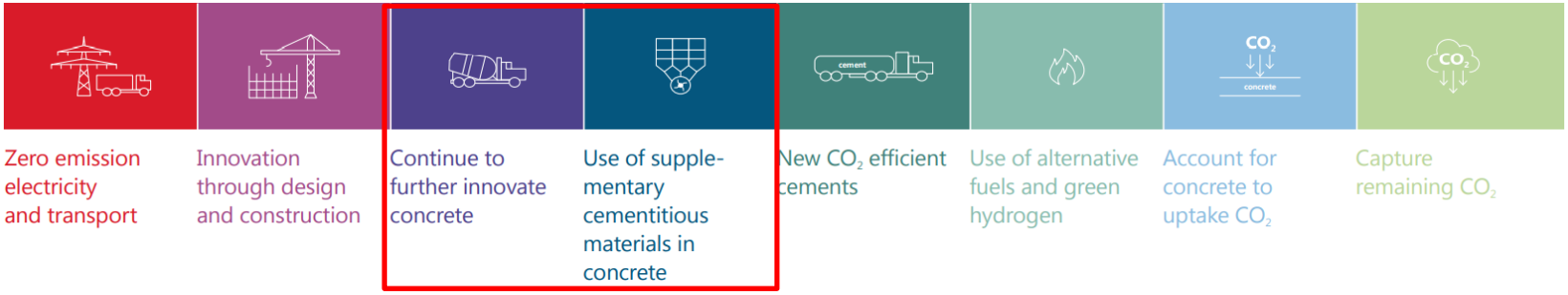
Calcined clay based cements

New clinker efficient Composite Cements are possible

Alternative binders are also available

Changes to Standards and Specifications required to support decarbonising cement

Concrete



Increased use of SCMs in concrete

Reduction of binder content

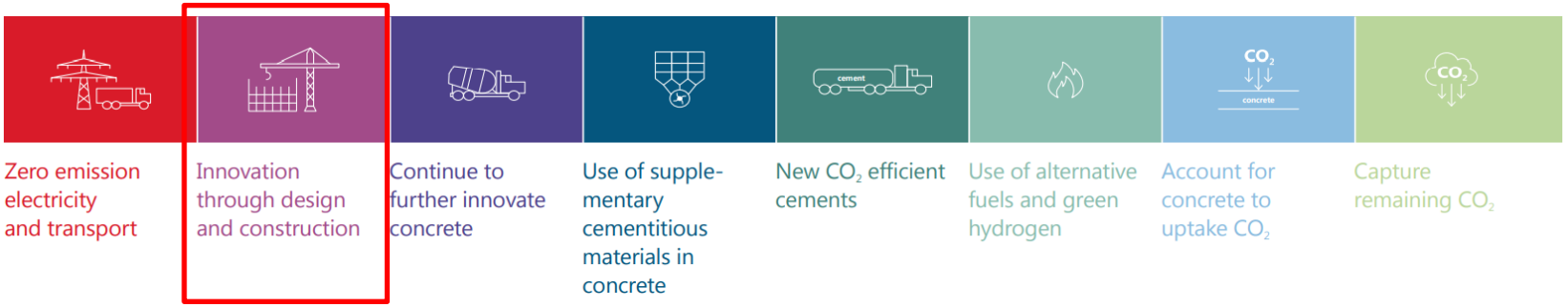
Optimisation of aggregate grading

Improvements in chemical admixtures

Reduction in waste in concrete production

Performance based specifications

Design and Construction



Structural Optimisation

Improved design assumptions and methods

Age of concrete for strength assessment

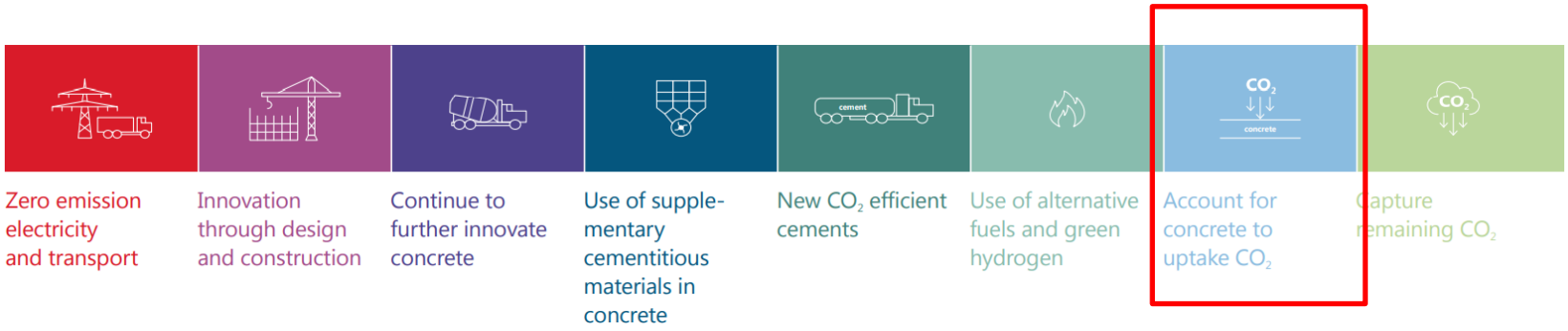
Improved construction technologies

Lifetime extension and repair

Re-use

Recycling

Recarbonation

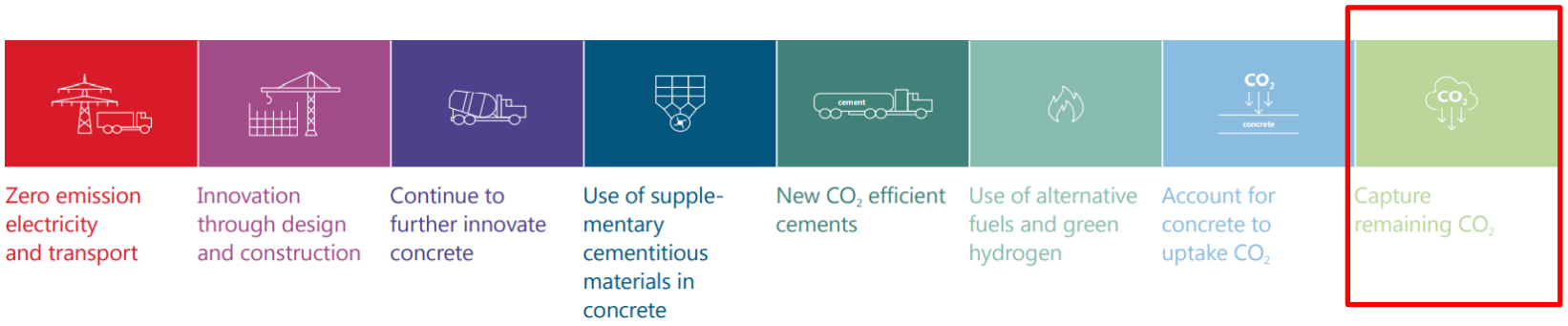


The IPCC Draft Report (2021) notes that concrete absorbs CO_2 emissions from the production of cement

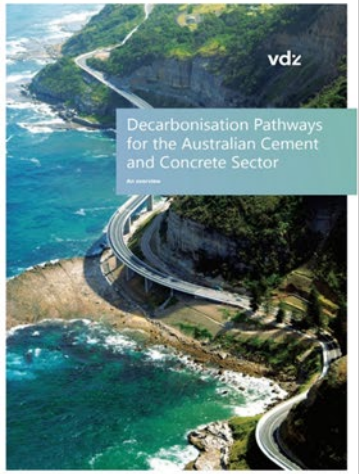
Recarbonation occurs during the lifetime of the concrete structure and after the end of its life

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

Carbon Capture, Use and Storage (CCUS)



VDZ Report recommends that the CCUS value chain be evaluated at an industrial scale this decade



Work packages

- Develop a feasibility scenario for carbon capture in the Australian cement industry.
- Apply carbon capture on demonstration scale and then scale to commercial phase in the future.
- Test indirect calcination (CALIX) to integrate domestic technology.
- Study the synergies with H_2 production at site of cement plant.

Key Recommended Innovation Areas

Clinker:

- Alternative fuels including green hydrogen
- CCUS
- Energy Efficiency

Cement and Concrete:

- Beneficiation of fly ash to be used as SCM
- Database of low carbon cement and concrete

Cement, Concrete and Construction:

- Specification of concrete durability by performance
- Potentials of additive manufacture and digitalisation
- Recarbonation - natural CO_2 uptake and active CO2 treatments

Construction:

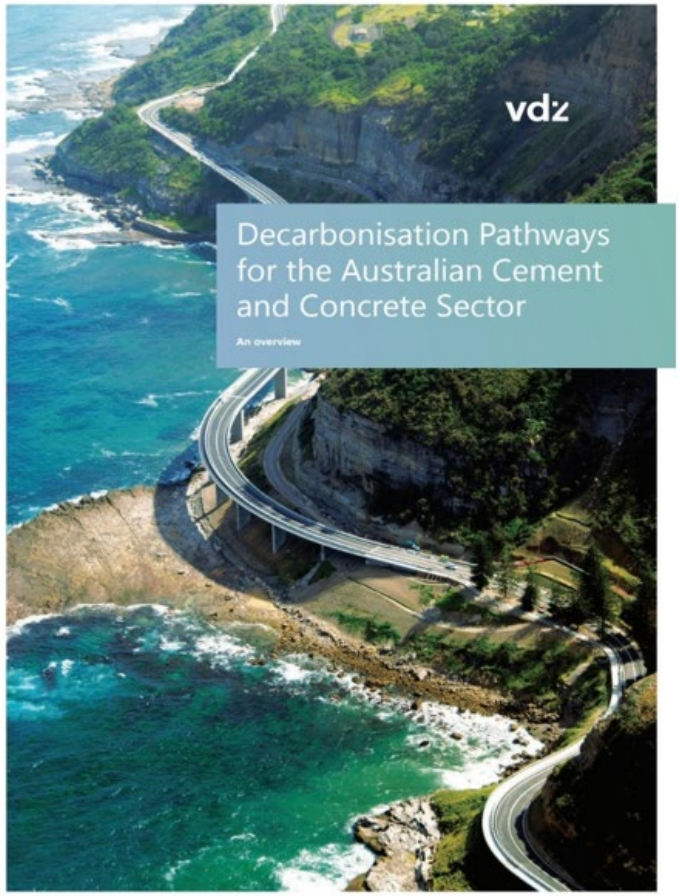
- Resource efficient design principles

Next Steps

The VDZ Report **provides an overview of the key pathways that can be used to decarbonise** the Australian cement and concrete sector.

Taking into account that not all pathways are mutually exclusive, implementation plans will need to be **cooperatively developed** by the relevant stakeholders along the value chain.

Thank you



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