

Reducing the Carbon Intensity of Cement

The Role of Limestone

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Contents

- Understanding the role of Cement
- Climate Change - a key issue for the Cement Industry
- Cement Industry response to Climate Change
- Reduction of Cement Clinker Content - the role of limestone
- Global View of reduction of Cement Clinker Content
- Summary

Understanding the role of Cement

- Critical material contributing to health and wealth of society
- Enabler for developing countries
- Nearly 1 million workers globally in over 150 countries
- Global growth rates of 4 percent per year

- The Australian Cement Industry has plants in all States, with a capital investment of around \$2.5 billion.
- An annual sales turnover of more than \$1.6 billion
- During 2007, close to 10 million tonnes of cement was used in Australia

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- Global View of reduction of Cement Clinker Content
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Climate Change - a key issue for the Cement Industry

- Manufacturing cement is a resource and energy-intensive process with the following environmental impacts:
 - **Calcination** – This chemical reaction (the first phase of cement production) releases almost half a tonne of CO₂ for every tonne of cement produced
 - **Thermal Energy Consumption** – Temperatures of over 1,500 degrees required to fire cement clinker kilns, releasing typically an additional one third of a tonne of CO₂ per tonne of cement

Climate Change - a key issue for the Cement Industry cont'd

- **Cement Grinding** – Grinding of clinker and other raw materials into cement requires heavy use of electrical energy and water for cooling
- **Transport** – Cement is most efficiently produced in large quantities, requiring large amounts of transport infrastructure and associated environmental impacts

Contents

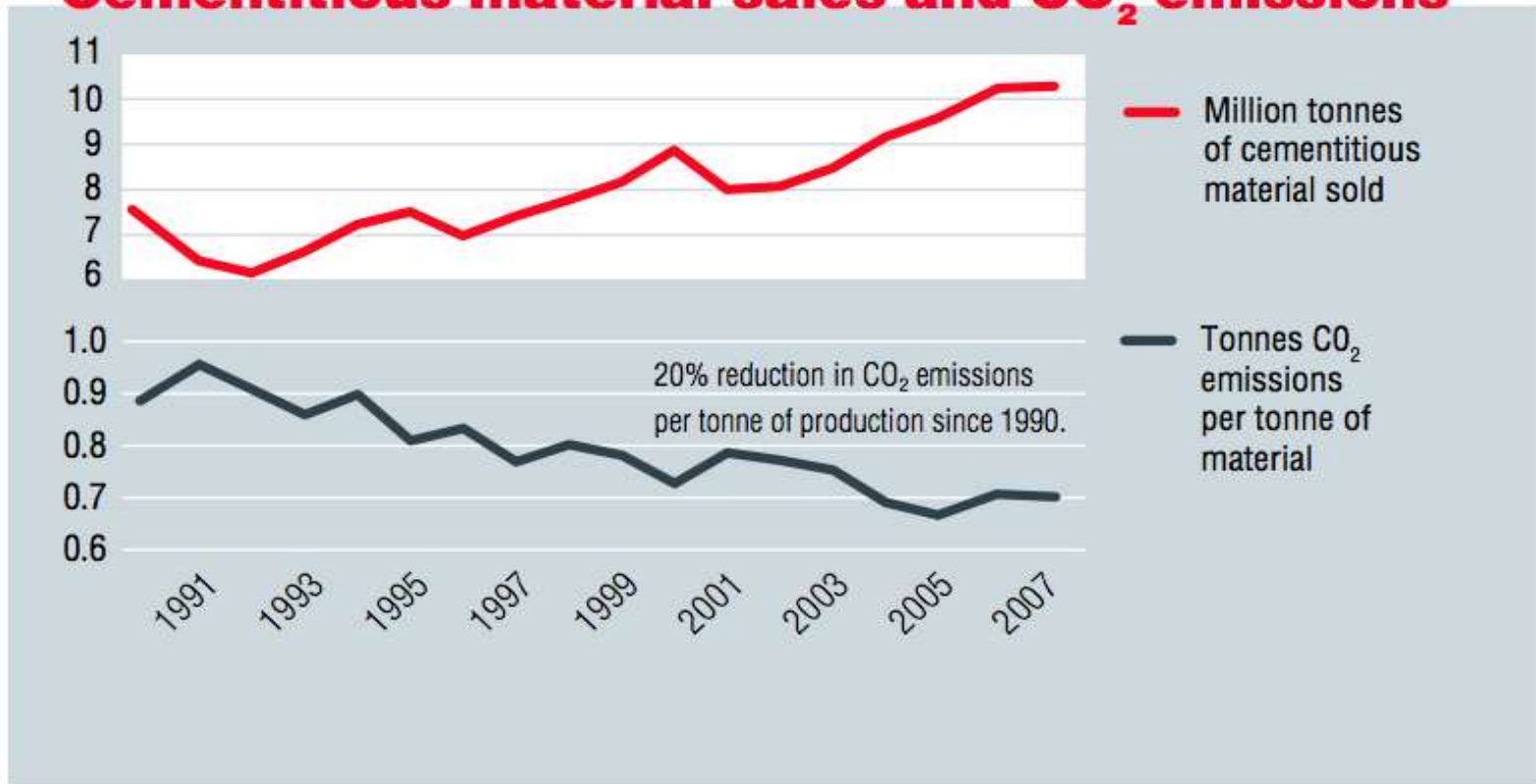
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Cement Industry Response to Climate Change

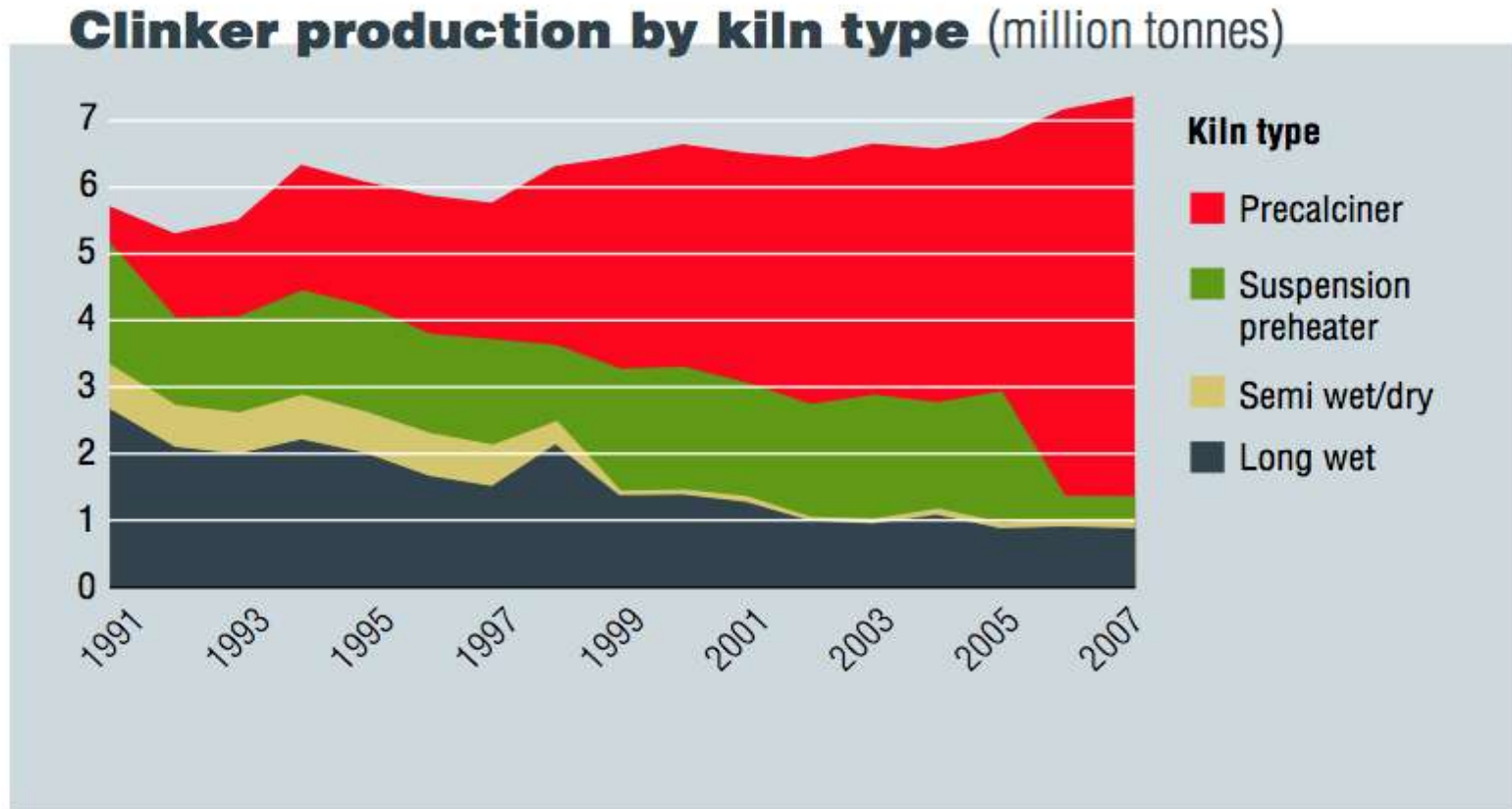
- The Australian Cement Industry has been active in reducing its carbon footprint for many years on many different fronts.
- Significant initiatives such as the following have delivered real and measurable reductions in the carbon footprint:
 - the move from wet to dry process clinker manufacture,
 - increased use of alternative raw materials and fuels,
 - reductions in fuel and electrical energy consumption,
 - improved monitoring, systems and reporting of emissions,
 - reduction of the clinker content of cement eg. use of SCM's, mineral addition

Cement Industry Response to Climate Change

Cementitious material sales and CO₂ emissions

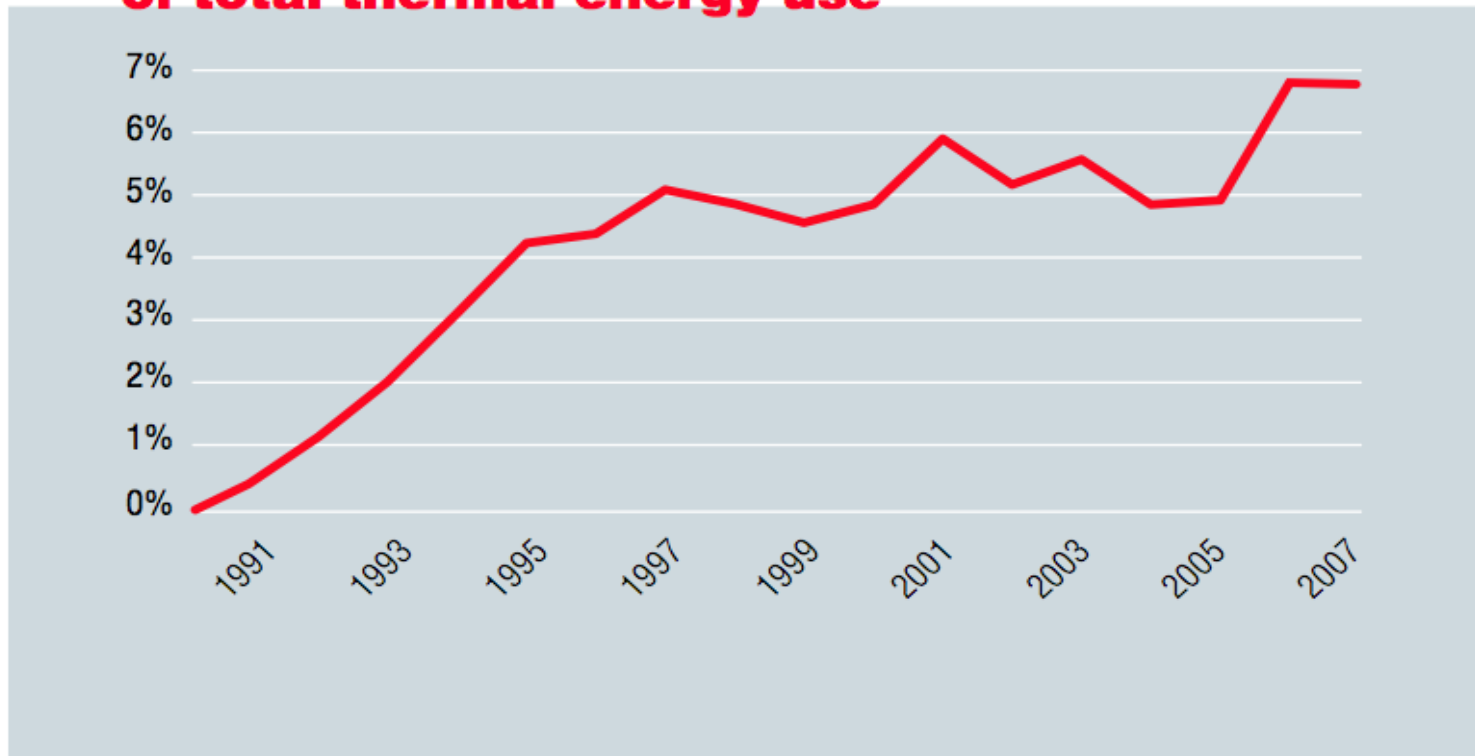


Cement Industry Response to Climate Change



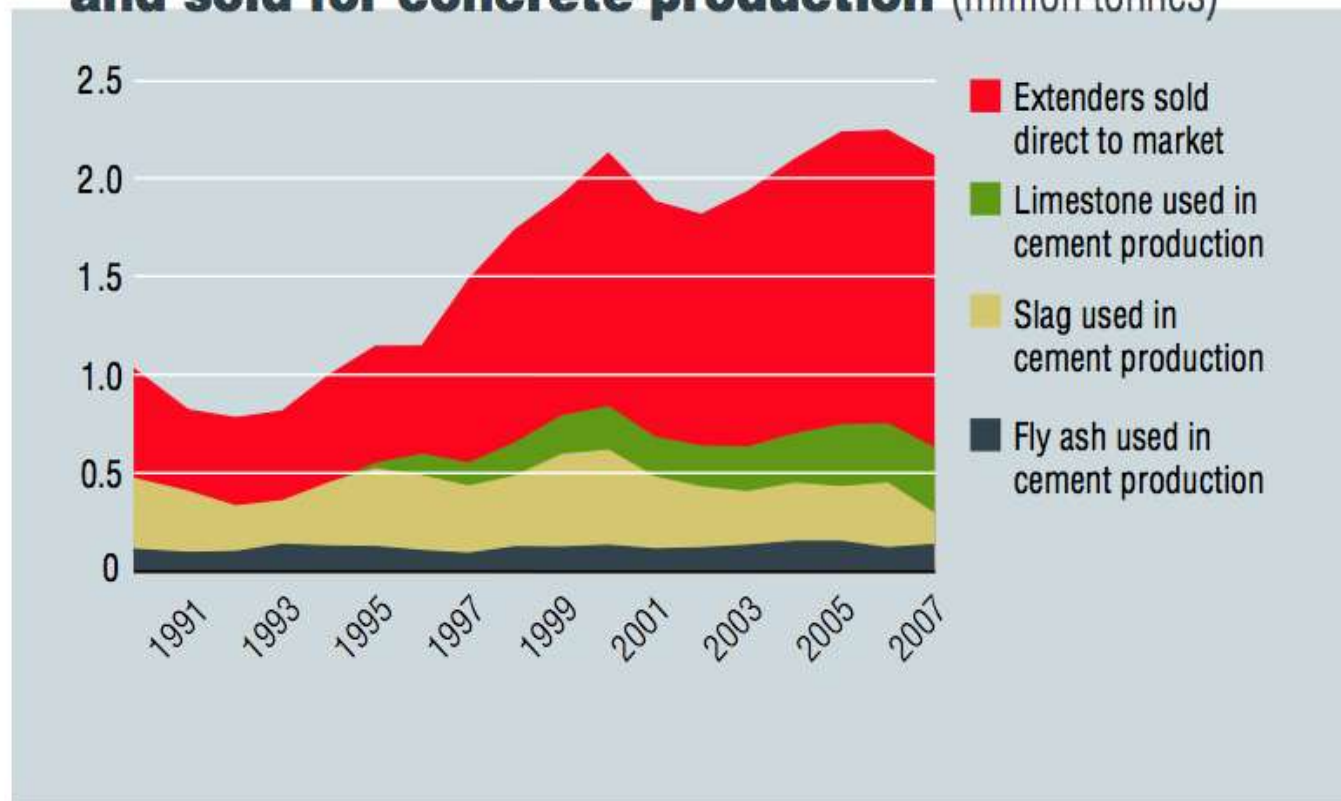
Cement Industry Response to Climate Change

Alternative fuel use as a percentage of total thermal energy use



Cement Industry Response to Climate Change

Cement extenders used in cement production and sold for concrete production (million tonnes)



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Reduction of Clinker Content - the role of limestone

- AS 3972 is the Australian Standard for Portland and Blended Cements.
- AS 3972 is a performance based specification and defines the following cement types

<u>General Purpose Cement</u>	<u>Special Purpose Cement</u>
Type GP – General Purpose Cement	Type HE – High Early Strength Cement
Type GB – General Purpose Blended Cement	Type SL – Shrinkage Limited Cement
	Type LH – Low Heat Cement
	Type SR – Sulfate Resisting Cement

Reduction of Clinker Content - the role of limestone

AS 3972 Portland Cement manufacture

- Clinker
- Gypsum (typically 5%)
- Mineral Addition (up to 5% of permissible mineral addition – limestone, fly ash, granulated iron-blast furnace slag, or combinations of these materials)

AS 3972 Blended Cement manufacture

- Portland Cement as defined above
- Greater than 5% of fly ash or granulated iron blast furnace slag, or both
- Up to 10% Silica Fume

Reduction of Clinker Content - the role of limestone

- Additional reductions in clinker content can be achieved through an increase in the permitted level of mineral addition to cement.
- There are good technical, economical and environmental reasons for producing cements with higher limestone contents, eg .
 - Improved concrete strength performance
 - potential reduction in water demand
 - densification of concrete pore structure
 - reduction in fuel and energy consumption
 - significant reductions in CO₂ emissions per tonne of cement

Reduction of Clinker Content - the role of limestone

- The Australian Cement industry is currently investigating the following:
 1. Increasing the permissible level of mineral addition in Type GP cement to 10%, without significantly impacting on end product performance in mortar and concrete.
 2. By definition, the maximum content of limestone mineral addition in Type GB cements would increase to 10%.

Reduction of Clinker Content - the role of limestone

- Under the auspices of the CCAA, a comprehensive trial program has been developed to investigate the merits of increased mineral addition.
- The program involves extensive plant, laboratory and field trials and is being conducted by all CCAA member cement companies and some concrete companies.
- Data from the trials are being provided to the CCAA for aggregation, analysis and reporting.
- Upon finalisation of the program, a submission will be made to Standards Australia, to modify AS3972 accordingly.

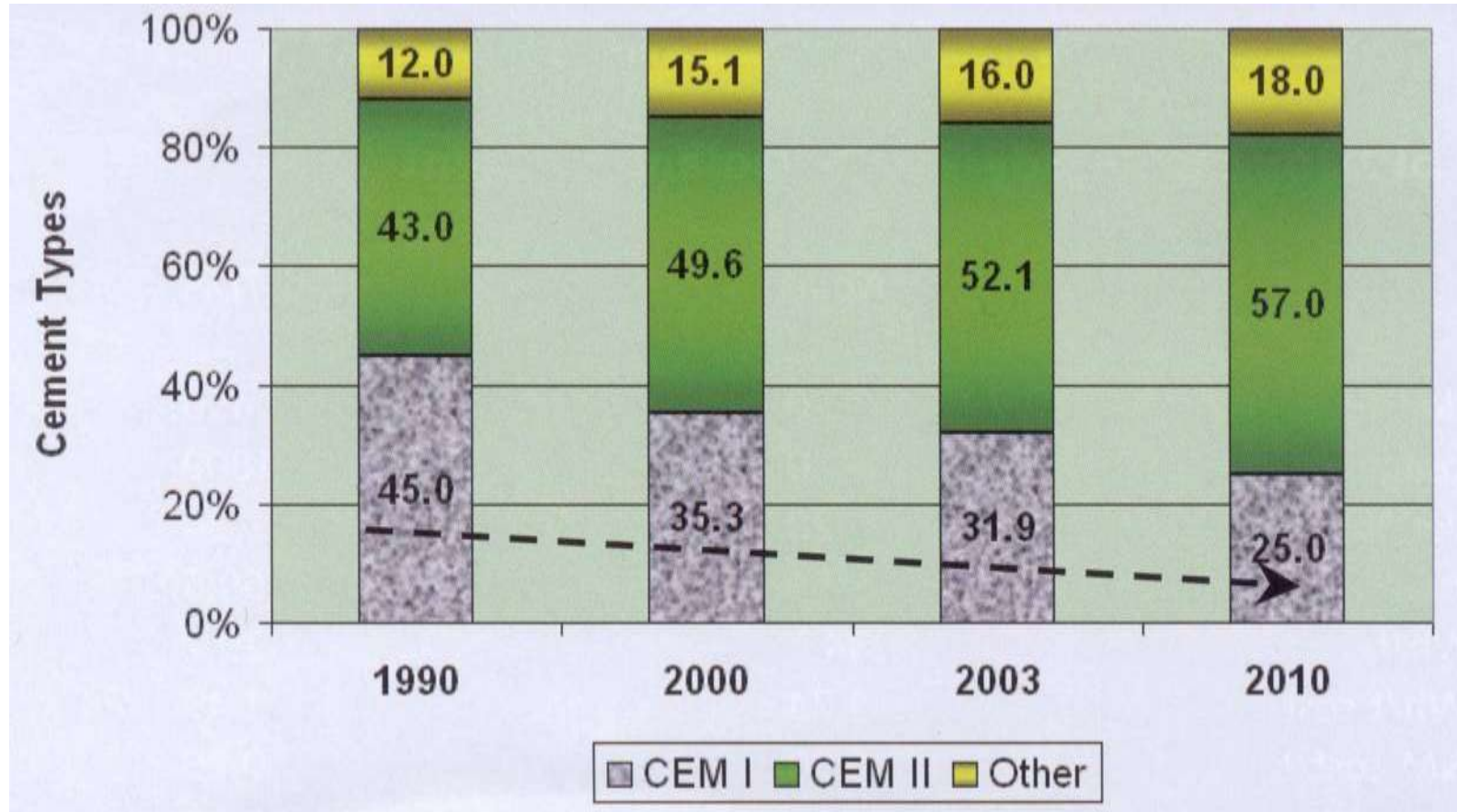
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Global View of the Reduction of Clinker Content

- The reduction of clinker content in cement is a necessary world wide practice.
- Within the European Union, the use of >5% limestone is common practice. EN 197 -1 "Composition, Specifications and Conformity Criteria for Common Cements" allows up to 35% limestone addition in cement (CEMII).
- Within North America, ASTM C1157 "Standard Performance Specification for Hydraulic Cement" allows the use of up to 15% mineral additions in *Modified Portland* cements. *Other Blended Hydraulic* cements may contain greater than 15% mineral additions.

Global View of the Reduction of Clinker Content



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Summary

- The Australian Cement Industry has been actively reducing its carbon footprint, via a number of initiatives and improvements.
- The use of SCM's to reduce the clinker content of cement is well understood and established in Australia.
- An area that is yet to be fully taken advantage of is the use of increased mineral addition, in particular limestone.
- Via the CCAA, the Australian Cement Industry has a well developed program in place, designed to provide the necessary supporting data required to demonstrate that an increase in limestone mineral addition from 5% to 10% will have no significant impacts on end product performance.
- Limestone mineral additions of greater than 5% are consistent with current global practice.
- It is the intention of the industry to seek the necessary changes to AS 3972, to support this important initiative.