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Transforming industrial waste into global green construction through scaling green cement and cement-free solutions

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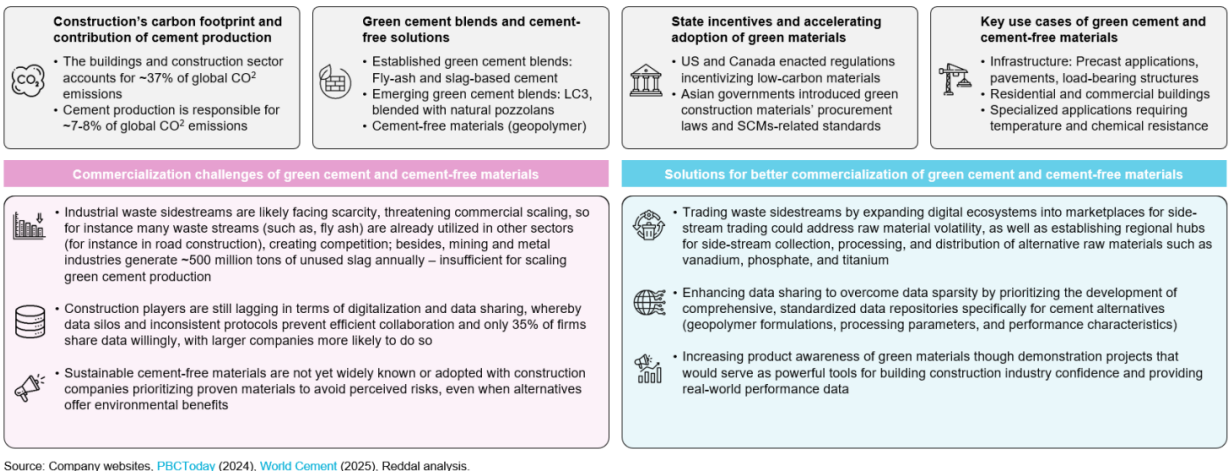
To effectively commercialize cement-free solutions globally, focus must be on trading waste sidestreams, enhancing data sharing, and increasing awareness through successful demonstration projects.

The Reddal Sustainability Practice has conducted a study on challenges and opportunities in transforming industrial waste into green construction solutions. The construction sector has been reported by the UN Environment Programme to be responsible for over 37% of global greenhouse gases' emissions, thus addressing this issue would be of both high societal and economic values. Our material "Transforming industrial waste into green construction solutions" outlines the green cement and cement-free materials (geopolymer) market size opportunities, putting a special emphasis on the geographic differences in terms of regulatory and policy developments that incentivize the adoption of green construction solutions to various degrees. We then take a perspective on how green construction materials' providers can best address the current commercialization challenges and efficiently scale their solutions on the global level through a combined approach based on multiplying industrial waste side streams, promoting data sharing, and increasing the awareness of green construction solutions in the global markets.

So far, both US and Canada have implemented federal regulations incentivizing low-carbon materials, but also individual states can have additional tighter rules, such as emissions accounting requirements. Moreover, some Asian governments are introducing green construction materials’ procurement laws, but also some states have specifically targeted cement and concrete industry with SCMs-related standards. As of today, most of the cement-free materials’ providers, such as Betolar, Wagners, and Oxara, operate in Europe, Oceania,

and North America due to stricter sustainability requirements; with some attempting market entry into Asia and Africa. However, the commercialization of green cement and cement-free materials like geopolymers faces several key challenges. First, the availability of essential industrial waste streams—such as slag and fly ash—is limited and may not meet the demands of large-scale production, especially as these materials are also used in other industries. Second, the construction sector lags in digitalization and data sharing, making it difficult to track, compare, and optimize the use of sustainable materials across projects. Finally, there is a general lack of awareness and adoption of these innovative materials, as many industry professionals are unfamiliar with their benefits and the market tends to be risk-averse.

Overcoming these barriers will require coordinated efforts in supply chain management to address waste side streams' scarcity, whereby trading waste side streams by expanding digital ecosystems into marketplaces, as well as establishing regional hubs for side-stream collection, processing, and distribution of alternative raw materials could address side streams' supply concerns. Furthermore, industry collaboration for increased data sharing will be key in order to overcome data sparsity by prioritizing the development of comprehensive, standardized data repositories specifically for cement alternatives (geopolymer formulations, processing parameters, and performance characteristics). Finally, spreading knowledge on the performance and reliability of green cement blends and cement-free materials though demonstration projects that would serve as powerful tools for building construction industry confidence. These measures in combination could significantly improve the global commercialization of green cement and cement-free materials by addressing current bottlenecks.



Industrial waste in green construction report summary

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