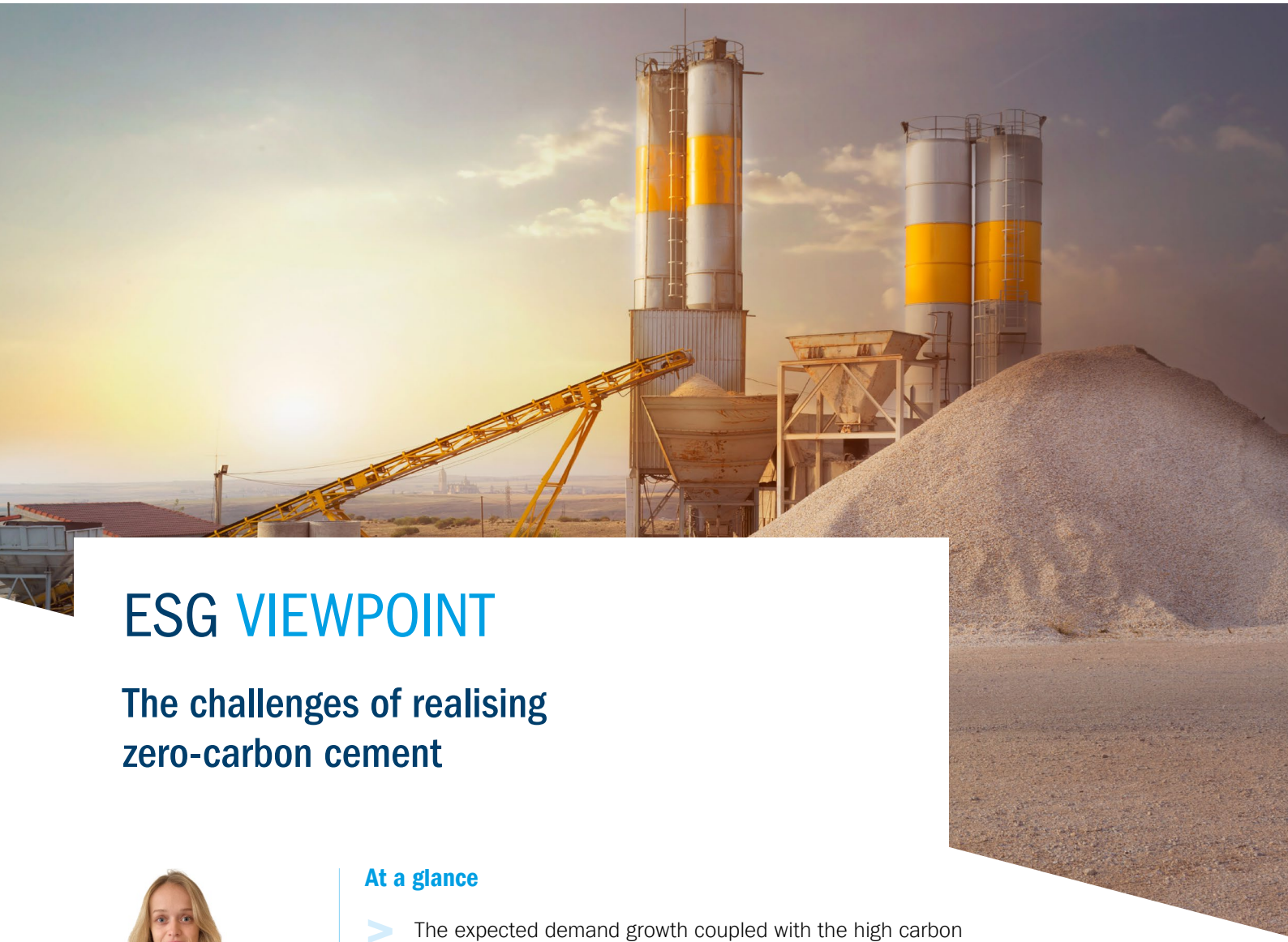

ESG VIEWPOINT

The challenges of realising zero-carbon cement

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At a glance

- The expected demand growth coupled with the high carbon intensity of producing cement – currently responsible for about 7% of global emissions – poses an immense challenge to achieving corporate and government net zero emissions targets.
- In Europe, all major cement companies are committed to net zero. The task now is to ensure that net-zero plans are ambitious and achievable; that sufficient capital is allocated to the strategies; and that barriers to implementation, such as financing and policy, are located and resolved.
- We are engaging with the cement sector through our net zero strategy. In November 2022 we visited two cement plants in Ireland. We offer some insights gained on the challenges (and opportunities) of cement decarbonisation.

Engagement and voting efforts as well as expectations outlined in this Viewpoint reflect the assets of a group of legal entities whose parent company is Columbia Threadneedle Investments UK International Limited and that formerly traded as BMO Global Asset Management EMEA. These entities are now part of Columbia Threadneedle Investments which is the asset management business of Ameriprise Financial, Inc.

Introduction

Can cement emissions be curbed, while still allowing for crucial infrastructure growth?

After water, concrete is the most consumed material globally, due to its utility, abundance, and low cost. Cement acts as the binder between fine rocks (aggregates) in the formation of concrete and, though it only makes up about 10% of the mix, it is responsible for nearly all of concrete's CO_2 emissions.

Globally, the production and use of cement is responsible for about 7% of CO2 emissions and generates the largest emissions per dollar revenue of all industrial emissions. In the coming decades the demand for cement is expected to grow, largely due to the expansion of urban areas and public infrastructure, particularly in emerging economies. Between 2015 and 2021 the global carbon intensity of cement increased by about 1.5% annually. This is far off the IEA's net zero pathway, which sees the carbon intensity of cement decrease by 3% every year until 2030.

Significant investment is needed by cement companies to address these challenges. Yet the sector's high carbon intensity may make it more difficult to raise the capital required, as investors looking to achieve portfolio decarbonisation goals could be tempted to cut their carbon footprint by re-allocating to other sectors with fewer challenges. A net zero approach that allows continued investment in cement players with clear net zero strategies is required to achieve real-world results, which is the aim of the net zero strategy we have tailored and adopted at Columbia Threadneedle Investments.

Interested in learning more? Keep scrolling or click the quick links

Our visit to two cement plants in Ireland

First steps – energy efficiency and fuel replacement

Is carbon capture and storage the answer?

Engagement and our conclusions

Regulatory changes present significant risks to the sector

Cement companies face stringent regulatory, tax and policy risks that could affect long-term growth

According to the IEA creating demand for near zero cement will be crucial, and policies that encourage cements with lower clinker-factor are required to incentivise this shift. However, though there is clear consensus surrounding the levers for cement decarbonisation, when it comes to the policies needed to implement these it is more obscure. A study reviewing 33 peer-reviewed articles on cement decarbonisation found that research focuses on technical solutions, but often omits discussions of barriers to implementation or specific policy actions required to overcome them.

There is nevertheless wide consensus that CO_2 prices will rise across Europe. So far, the cement sector has been allowed free emission allocations within the EU ETS, on the grounds that it minimises risks from competitors who are not subject to comparable legislation outside of the EU. However, the new proposal of a EU Carbon Border Adjustment Mechanism – which may be operational as early as October 2023 – will phase out free allocations over time, instead favouring a carbon tax on cement imports with high emissions. It remains to be seen if this is approved, and what impact this may have.

However, there are some factors mitigating these risks. If demand remains resilient, cement's low substitution risk should mean that increasing costs can be passed on to end-consumers in the foreseeable future. And forward-looking companies developing greener technologies could benefit from opportunities for green premiums – though they will come with high upfront investment requirements.

There is consensus around the levers for cement decarbonisation but the policies needed for implementation are obscure

Figure 1: Analysts at site visit to Breedon's Kinnegad cement plant in Ireland.

Exploring best practice through site visits

In November 2022, we visited two cement plants in Ireland, at the invitation of CRH and Breedon Group

The two companies differ in size and scale: Breedon has around 320 sites in the UK and Ireland, with two cement plants, and about 3,500 employees; CRH operates over 3,200 locations across 28 countries and employs around 77,400 people. What they share is trying to solve the puzzle of lowering their carbon emissions while growing their businesses. They have committed to net-zero by 2050 and published strategies that include improving energy efficiency, switching to low-carbon fuels, and advancing technologies like Carbon Capture and Storage (CCS).

At Breedon's Kinnegad plant and CRH's Platin plant we spoke to senior company employees, including their heads of sustainability, as well as on-site staff, with the tours led by the plant managers at both locations. These visits allowed us to see first-hand the challenges of exacting plant-level decarbonisation plans, and the complexities of bringing group-level targets to plant implementation.

We've seen first-hand the challenges of decarbonising cement production

The first net-zero steps: increased energy efficiency and fuel replacement

Globally, about 15% of CO_2 emissions from cement come from electricity use and 30% from the combustion of fossil fuels

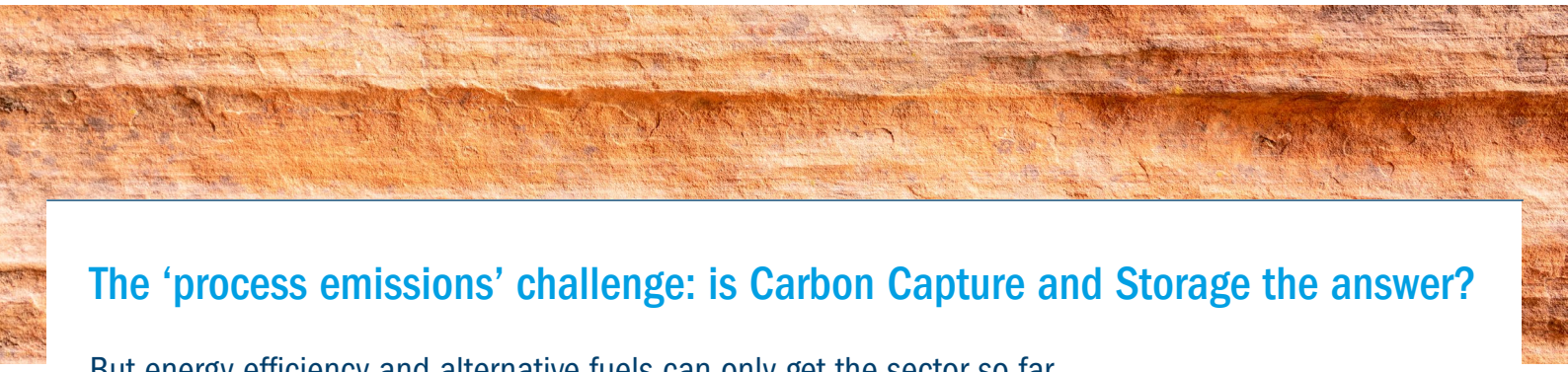
These two sources of emissions are the "easiest" for cement manufacturers to deal with, as the solutions are available today. For example, Breedon's Kinnegad cement plant reached a world-leading alternative fuel replacement rate of 75% by 2021, and are aiming to increase this further. The alternative fuels include meat and bonemeal (residues of the meat industry) as well commercial waste, both solid and liquid recovery. By switching from high-emitting fossil fuels, like coal, to these alternative fuel-sources, cement plants can get some way towards net-zero. Kinnegad also reported cost benefits of fuel-switching, particularly as the price of coal soared this year.

Energy efficiency and renewable procurement are other levers available to cement manufacturers, for example, CRH have set group-wide targets to increase the use of renewable energy and Breedon are investing in onsite renewable at Kinnegad. Other areas of focus include improving operational power efficiencies and reducing energy use. Many companies are also setting targets related to the transport of cement, including reducing idling, upgrading fleets, and reducing road transport.

Nearly all European cement manufacturers have committed to reduce scope 1 CO_2 emissions per ton of cement produced by 30% within 2030, which will mostly be achieved by energy efficiency and fuel switching. And so far, Europe's large cement companies have made significant emission cuts by focusing on these two available levers.[1]

By switching fossil fuels, like coal, to alternative fuel-sources, cement plants can get some way towards net zero

[1] It is important to note that a careful distinction between cement-specific and company-wide targets must be made when reviewing emissions pledges. The total CO_2 emissions of a company will vary based on both emissions and the degree of diversity into other building products. For example, CRH (alone in its peer-group) has set a goal to reduce absolute CO2 emissions (scope 1 and 2) by 25% 2030 in addition to a 33% reduction in CO_2 per tonne cement produced by 2025. As cement makes up only 15% of its revenue, CRH displays a lower intensity ratio than European peers across scope 1 emissions.



The 'process emissions' challenge: is Carbon Capture and Storage the answer?

But energy efficiency and alternative fuels can only get the sector so far

Well over 50% of emissions come from the chemical reaction that takes place (called calcination) when carbonate rock (limestone) is heated to make clinker (a key material in cement). These are "process emissions", also called geogenic, that cannot be mitigated by switching fuels or reducing electricity use.

A key strategy to cut geogenic emissions is the production of alternative cements with a reduced clinker factor. For example, in 2021 CRH released a new cement product in Finland which reduced emissions by 40% by using the left-overs (slag) from the production of steel, replacing some clinker. Other replacement materials include fly ash, kaolin, or limestone. However, companies face regulatory hurdles to approving cements with lower clinker factors, as altering the clinker changes the properties of the cement. During our visit, CRH stressed these regulatory hurdles, and highlighted the work they are doing to show regulators that cements with a lower clinker factor can be used safely in construction. Today these replacement materials are inexpensive, and can in fact lead to cost reductions – though this may not be true in the future, as access to the materials could become competitive, pushing prices up.

However, clinker replacement alone can't get cement emissions to zero. Most net-zero strategies rely on sharp emissions cuts after 2030, which are primarily achieved by the large-scale introduction of Carbon Capture and Storage (CCS); a technology which aims to capture CO_2 before it is released into the atmosphere, and then store it permanently, often in geological reservoirs.

The only European cement player that includes CCS in its pre-2030 strategy is **HeidelbergMaterials**. The company is aiming to capture 10 million tonnes of CO_2 before 2030, and is invested in the Breivik CCS project in Norway and the LEILAC project in Hanover. However, in the IEA's net-zero scenario for cement, CCS captures about 180 million tonnes of CO2 per year (Mtpa) by 2030. This is a huge amount of growth and does not match the current ambition set out by the cement industry.

CCS has faced a barrage of criticism due to its high costs and the repeated failure to get the technology off the ground. 61 new CCS projects were announced from January to mid-September 2022, according to Dutch bank ING. Yet only three projects in development-phases (two in China and one in Australia) are expected to be operational in 2023. ING foresees that the rapid growth period for CCS will only arrive in 2025, when it forecast a tripling in current capacity. ING also predict continued growth post-2025, reaching over 250 Mtpa by 2030 (from about 44 Mpta today). The growth forecast is based on new policies, like US tax incentives, as well as the establishment of several EU and UK subsidies schemes aiming to facilitate the development of CCS (see this list of European CCS projects on track to be operationalised by 2030).

The levelized cost of cement production with CCS can range from USD 70 – 130 per tonne, increasing the cost of cement without CCS from USD 30 – 80 per tonne, according to ING. However, defining break-even costs for the future of CCS is hard, as it will depend on several factors, including the price of carbon, storage-sites, technology take-up, and financial incentives. Clearly, the scale-up of CCS will require cross-industry collaboration, as well as local and central government support. Building heavy industry clusters that would allow the collection and disposal of waste CO_2 to be shared could also reduce costs. Clusters like this are being developed in Denmark, the UK, the Netherlands, and Norway.

However, many questions remain, including which industries will be the priority for the build-out of CCS. Cement is a clear frontrunner due to lack of alternative abatement, unlike industries such as power where a shift to renewables can replace most emissions. Currently, nearly all CO2 captured today is used in processes liked Enhanced Oil Recovery (EOR) (which eventually leads to it being re-emitted to the atmosphere), hence the storage part of the CCS equation is still nascent. Questions also pertain to the risk of leakage from geological storage sites, with experts endorsing comprehensive monitoring programs would have to be installed along sites and pipeline to monitor the integrity and permanence.

Clearly, heavy emitting companies must be active in researching and developing how CCS technologies can be integrated to their production processes if net zero goals are to be achieved. Policymakers also need to play an active role in creating enabling conditions for the transition to net zero. Breedon, for example, report that the industry will need certainty of technology roadmaps (regarding CSS, but also other levers of potential change) as well as clearer visibility on the financial support available.

Alternative solutions to the emissions challenge

Some analysts **suspect that the abatement costs** of cement emissions, particularly CCS, could prompt a full-scale transformation of the construction business

A largely under-explored question is how far demand-side changes can go in curbing cement emissions. One study of the Japanese cement industry found that demand measures could reduce the dependence on technologies such as CCS. The IEA has suggested that small, but significant, changes to building codes and education of architects, contractors and engineers could lead to significant reductions in cement demand.

We may also see a shift to more carbon-friendly materials in construction, such as timber. Alternative and innovative building materials have also been proposed, such as concretes made from shredded cork 'corcrete', or a mycelium-based material designed by Italian company Mogu. However, there is a long way to go for these to be anywhere near as cost-efficient, user-friendly, and based on such abundant materials as cement is. There are also concerns that if the whole-life carbon impacts of the materials are considered – including the reclaim/recycling of cement as well as the energy requirements needed for cement buildings compared to timber ones – just shifting construction from cement to other materials will not solve the carbon problem alone.

Cement manufactures also stress the natural 'recarbonation' that occurs when concrete is exposed to the atmosphere (a geochemical process which extracts CO_2 from the atmosphere), though this cannot contribute to climate targets due to the long time-scale, according to the SBTI. Some companies, like Holcim and CRH, have invested in ways to speed up this recarbonation process and intend to offer innovative products that rely on the reinjection of CO_2 to demolition and construction waste to create concrete. Canadian company CarbonCure has designed a process that relies on injecting CO_2 into fresh concrete, which then undergoes a mineralization process and becomes permanently embedded.

We may see a shift to more carbon-friendly materials in construction

Engagement questions for the cement industry

Our engagement with the cement industry is based on based **on the CA 100+ framework** and the guidelines in the TCFD, as well as sector specific insights published by the SBTI and the IEA.

The questions we ask of companies are designed to locate the main risks and opportunities as well as critically appraise the solutions proposed by the cement manufacturers.

General framing questions

1. **Risks:** What are the major climate risks you identify? How do you manage and model these?
2. **Opportunities:** Are there opportunities? Is a green premium possible on more sustainable products?
3. **Targets:** Do you have short-, medium-, and long-term targets in place? Are you aiming for Science-Base Target Initiative approval, if not, why not?
4. **Capital:** How are climate targets integrated into capital project plans? How are returns affected?
5. **Governance:** Who oversees the risk management and climate strategy? Is there board level oversight?

Cement strategy specific questions

6. **Levers:** How do you intend to meet short- and medium-term targets? How much will it rely on reduced clinker content, energy efficiency and alternative fuels – or other levers?
7. **Procurement:** What alternative materials (fuels and clinker replacement) does your strategy encompass? What is the company doing now to secure access to these materials in the next decade? Does it have a public procurement strategy?
8. **CCS:** How much does your strategy rely on CCS? How are you directing capital to new technologies? How are you engaging with regulators and peers? Do you receive any funding from CCS subsidy schemes? Do you have any pilot projects?
9. **Opportunities:** What low-carbon products do you offer (or planning to offer)? What are the emissions savings of these products? Do these attract a green premium in the current market?
10. **Regulatory risks:** How do you monitor and engage with incoming policies? How does this vary depending on the complexity of your supply chain?

Conclusion

Cement is crucial to building a sustainable future, through its role in cities, net zero, and renewable infrastructure – but also a huge risk to this future, through its contribution to greenhouse gas emissions. This creates a net zero puzzle. The question of carbon reduction is unavoidable for cement companies, but it is not unanswerable. Initial levers to reduce emissions have been recognised, but, for post-2030 reduction, two things are needed: a more supportive and clear policy regime and investment in new technologies, such as CCS.

In Europe all major cement players are committed to net-zero. Our task is now to ensure those companies are meeting their net-zero plans and that these plans have teeth, including ambitious, achievable milestones, and appropriate capital allocation. Outside of Europe, progress is slower – we will take some of our learnings from speaking to European sector leaders and use these to engage with the wider industry.

Regulation is rapidly changing, as are technological advancements. As active and engaged investors, it is incumbent upon us to thoroughly assess risks and opportunities on a company-by-company basis and allocate capital to those companies that we believe are best placed to produce this critical material, sustainably.

Our task is to ensure companies are meeting their net-zero plans and that these plans have teeth

Meet the authors

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Albertine joined the Responsible Investment team in the summer of 2022, concentrating on climate change. Albertine's background is in climate science and before joining she worked as a researcher and adviser at a range of academic, third- and public-sector organisations. When not working she enjoys spending her time reading, running, and climbing.

Michael Hamblett, Equities Analyst

Michael joined Columbia Threadneedle in 2014 as a member of the Responsible Investment team and, latterly, the UK Equities team where he works as an equities analyst. Michael focuses on the integration and analysis of ESG matters into fundamental company research and engagement. Outside of work, he spends his time walking his dog, Magnus.

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