Delivering decarbonisation with demand-side initiatives

Adam Auer and Sarah Petrevan, Cement Association of Canada (CAC), explore an industry-wide project to decarbonise cement and discuss the role of demand-side initiatives in this process.

Canada's cement industry is charting a course to reduce its carbon emissions by up to 40% by 2030 and deliver net zero concrete by 2050. It is essential that all major emitters do their part, not just to contribute to the health and well-being of the environment, but also to ensure the industry's future economic competitiveness in a rapidly decarbonising world.

Globally, the cement industry is responsible for approximately 7% of carbon emissions with the highest carbon intensity of any industry per unit of revenue.[1] In Canada, the manufacture of cement accounted for 1.5% of the country's emissions in 2019. Given that the use of cement is fundamental to economic development with a projected global market size of US$463 billion in 2026,[2,3] reducing its embodied emissions is essential.

Approximately 60% of the cement industry's emissions are process-inherent, resulting from the calcination reaction of limestone, and 40% are from the fossil-fuel emissions generated to produce the high temperatures (approximately 1450 C) required to achieve that process. Process emissions are particularly challenging to mitigate since net zero requires that either the entire process must be replaced by low emission alternatives, or the emissions must be captured from the process and permanently stored.

While the scale and scope of the challenge cannot be understated, the hard work has already begun. In addition to supporting carbon pricing and other regulatory approaches to reduce emissions, the cement industry is at the centre of a growing incubator for industrial decarbonisation in Canada. Launched with a partnership between the Government of Canada and the Canadian cement sector, the collaborative effort to support the development and implementation of

a ‘Roadmap to Net Zero-Carbon Concrete’ is underway in earnest. This work will provide the Canadian cement and concrete industry with the technologies, tools, and policies needed to achieve net zero carbon concrete by 2050.

Canada’s cement industry was also the first industry-wide participant in the federal government’s ‘Net Zero Challenge’ – a voluntary initiative that encourages Canadian businesses to develop and implement credible and effective plans to transition their facilities and operations to net zero emissions by 2050.

The Cement Association of Canada’s President and CEO Adam Auer delivers a speech at the Net-Zero Challenge launch on 26 August, 2022. Photo Credit: Christian Brault.

In Richmond, BC Lafarge Canada’s CO2MENT carbon capture utilisation and storage demonstrations project has accumulated more than 1000 hours with 85% CO_2 recovery.

But what will it take to accomplish these targets? Much has been stated in recent literature about the cement industry’s challenges as a ‘hard-to-abate’ sector. Along with steel, chemicals, and heavy-duty transportation (aviation, trucking, shipping), cement’s transition to net zero is not nearly so straightforward, because the technology is lacking, or it is cost prohibitive. This is especially true when considering the ‘first-in-kind’ or ‘first commercialisation’ technologies that the cement industry will require to increase the supply of net zero cement and concrete, namely carbon, capture utilisation and storage (CCUS).

That is just the tip of the iceberg. In addition to the need to scale up the technologies required to decarbonise cement products, there also needs to be a similar increase in the demand for the lower-carbon and net zero products. Those products must not only emerge but diffuse through the construction market until they become the new normal.

Less has been said about how to support the uptake of lower-carbon or net zero cement and concrete. How will these be pulled into the market? Experience shows that even the adoption of simple solutions, such as Portland-limestone cement and blended Portland-limestone cements can be a challenge for the construction sector which sees risk in novelty and tends to resist change in favour of ‘tried and true’ methods.

A business case for deploying net zero technologies such as CCUS requires a high certainty that there will be a buyer for the materials produced and that the carbon reduction will have a market value in either a regulated market (e.g., carbon credits, offsets, etc.) and/or in private markets willing to pay a premium for lower-carbon products. While there remain underutilised opportunities to reduce emissions at little to no cost, in nearly all cases, the cost of producing materials with net zero technologies will be higher than production with conventional technologies. This poses a challenge in a competitive marketplace. Higher production costs are to be expected, at least in the initial stages of deployment, until full-scale deployment of the technology reduces costs, and a broader economic transition takes hold.

The cost of materials production depends on capital expenditures as well as operating expenditures – the latter including costs for energy, raw materials, and for transporting and storing carbon, if applicable. Though capital costs can be supported through government programmes such as Canada's Strategic Innovation Fund-Net Zero Accelerator, or the proposed CCUS Investment Tax Credit – high operating costs still leave net zero emission technologies at a competitive disadvantage. Dramatically scaling up demand-side policies will help to secure the business case for investment and operation.

Two key demand-side strategies being developed in Canada with the support of the Canadian cement and concrete industry include procurement policies and the codes, standards, and specifications needed to support them, and targeted market price assurance mechanisms, such as Carbon Contracts for Difference (CCfD).

Low-carbon procurement

Low-carbon procurement, sometimes better known as 'green' or 'sustainable procurement', is one of the most powerful tools governments have to support the uptake of low-carbon materials. Governments can establish a willing market for lower and net zero emission production despite higher production costs, as well as providing incentives for material efficiencies. Procurement policies provide producers with confidence in the economic viability of investing in lower carbon and net zero production.

Canada's cement industry has been moving in step with the federal government to unlock procurement policies to support the uptake of lower carbon concretes. A significant objective of the partnership between Innovation, Science and Economic Development (ISED) and the cement and concrete industry is to support the further development of a low-emissions building materials supply chain in Canada, North America, and beyond. Progress is being made, through a variety of initiatives, including the creation of a primer for federal procurement on 'Strategies for Low Carbon Concrete', and the development of a government Standard on Embodied Carbon in Construction. In fact, the cement industry demonstrated its climate leadership by working closely with the federal government to establish first-in-kind low-carbon procurement standards for ready-mix concrete used in federal projects across Canada (scheduled to come into effect 1 January, 2023). These efforts are supported by recently published regional specific Environmental Production Declarations (EPDs) for ready-mix and facility specific EPDs for cement,

The LEED Silver certified Pan Am Soccer Stadium in Hamilton, ON used lower carbon, Portland limestone cement.

Globally, the cement industry is responsible for approximately 7% of all carbon emissions with the highest carbon intensity of any industry per unit of revenue.

again leading the way in product transparency among material manufacturers.

A significant and future opportunity in low-carbon procurement is the creation of performance-based standards and specifications. Notwithstanding the existence of a national codes and standards system, these codes, standards, and specifications are interpreted and applied differently in almost every market in Canada. Too often, regional and local specifications establish prescriptive requirements (e.g., minimum cement content, maximum SCM content, etc.) that limit the ability of producers to deploy cost-effective low-carbon solutions, whilst also discouraging innovation.

A performance-based approach can prescribe the expected environmental and other performance outcomes, but not how the result is to be achieved. With such an approach, the producer can choose the easiest or most cost-effective way to comply with a standard or specification. Performance-based standards are most appropriate where adverse environmental effects (e.g. carbon emissions) may still be the occur despite a design or technology standard having been imposed because they are designed to continually support better environmental outcomes. Outcome-focused standards allow producers to find the most cost-effective approaches to reach targets, while promoting innovation in the creation and adoption of new technologies to support emissions reduction. Performance-based standards can spur competitive advantages amongst firms within jurisdictions that employ such standards, to that of firms in jurisdictions that rely on traditional regulatory tools or prescriptive standards and specifications.

In the cement and concrete industry, performance-based standards and specifications would not put parameters around the components or proportions of a mixture, but instead allow the producer to meet specifications on strength, permeability, embodied carbon, and others in the most effective way. Producers are best positioned to understand the performance of their material in different circumstances and can provide solutions to reducing emissions while maintaining optimum performance in all applications.

Performance-based standards and specifications can also be combined with incentives (e.g. additional 'points' in a tender process, monetary incentives, etc.), which can accelerate innovation by rewarding producers that outpace competitors through the early adoption of promising novel technologies (e.g. mineralisation).

Market-price assurance mechanisms: Carbon Contracts for Difference (CCfD)

Addressing the challenges of higher capital and operating costs of near zero emission production is equally important to supporting the uptake of lower to net zero carbon materials. While it is technologically feasible to produce low-carbon or even net zero cement and concrete today, the economics remain an insurmountable barrier: there are currently no markets willing to pay the higher production cost of very low-carbon or net zero basic materials. Even in markets with carbon pricing, there remains significant uncertainty (political and otherwise) with respect to the value of carbon reduction over medium- and long-term investment horizons. While a US$170/t of CO_2e carbon price may be enough in the long-term to decarbonise most industrial products, demonstrating the technology in first-of-kind plants has additional costs, risks, and uncertainties that suggest many companies would choose to delay these investments, rather than face a high risk of unprofitable investments. This is particularly true for Emissions Intensive and Trade Exposed (EITE) sectors such as cement, which are subject to global market forces, including competitors in jurisdictions who may not have equivalent carbon pricing policies, nor benefit from climate related competitiveness protection measures, such as Carbon Border Adjustment Mechanisms (CBAM). Nothing limits commercial-scale investments in transformative low-carbon solutions like regulatory and political uncertainty regarding future carbon prices.

Earlier this spring, the Government of Canada released its 2030 Emissions Reduction Plan (ERP), which details a series of measures to help Canada reach its emissions reduction target of 40 – 45% below 2005 levels by 2030, and net zero emissions by 2050. The plan contains a commitment to maintain the country's approach to pricing pollution, to avoid the need for additional actions beyond these pricing measures.

Specifically, the ERP commits the Government of Canada to exploring measures that help guarantee the price of pollution. This includes investment approaches, like carbon contracts for difference (CCfD), which enshrine future price levels in contracts between the Government and low-carbon project investors, thereby de-risking private sector low-carbon investments. This also includes exploring legislative approaches to support a durable price on pollution.

A CCfD directly addresses the higher capital and operating costs of near zero emission production by guaranteeing to fund the carbon abatement cost for a guaranteed quantity of production over a fixed period. By providing a long-term contract (such as 15 – 20 years) producers are given a high degree of confidence in the economic viability of investing in net zero emission production. To ensure the best use of public funds, it is important to incorporate regular updates to the costs used in calculating

the funding amount – with the level of support declining with production costs over time as technology learning deepens and as Canada's carbon price rises.

CCfDs are a specialised tool for overcoming a specific problem – accelerating investment in net zero heavy industry production in Canada where current markets do not exist and investments are too risky due to production costs that are much higher than expected market prices.

However, to succeed in supporting the larger objective of industrial decarbonisation, CCfDs must be efficiently nested with both supply and demand-side net zero policies (e.g. the CCUS investment tax credit, green procurement, or carbon border adjustments) to have the transformative, time-limited impact needed to bolster first commercialisation. CCfDs are intended to create markets for low-carbon products and do not replace the need for many other necessary industry policies to achieve net zero targets.

Conclusion

Simply put, demand-side measures are essential to support the development of a market for low-carbon products. By stimulating demand through the introduction of procurement policies, performance-based standards, and targeted market-price assurance, all those involved can work together to achieve net zero in Canada's cement industry.

Supporting the uptake of lower carbon, transitioning to net zero cement and concrete, is not only vital to reducing Canada's emissions, but it will also help build a more climate-resilient, sustainable future. As the second-most used material in the world after water, concrete has unsurpassed characteristics of strength and durability, all while standing up to the increased pressures of climate change. This industry remains steadfast in its commitment to lead in the industrial transition to net zero, and the forthcoming cement industry action plan will outline exactly how the cement industry will achieve its ambition. It is too important not to. ■

References

1. CZIGLER, T., REITER, S., SCHULZE, P. & SOMERS, K., 'Laying the foundation for zero-carbon cement', McKinsey & Company, 2020.

2. 'Cement Market Size, Share & Industry Analysis, by Type, by Application and Regional Forecast' – https://www.fortunebusinessinsights.com/industry-reports/cement-market-101825

3. 'Global Cement Market to Reach 6.08 Billion Tons by 2026', Expert Market Research – https://www.expertmarketresearch.com/pressrelease/global-cement-market#:~:text=According%20to%20a%20new%20report,6.08%20Billion%20Tons%20by%202026