

Insights from the cement sector decarbonization roadmap workshop in India

Somya Joshi, Gökçe Mete, Girish Sethi (TERI), Arupendra Nath Mullick (TERI)

Relevance and context of the roadmap workshop

Cement is an integral part of the modern world. It is the principal ingredient in concrete and is the most consumed resource in the world after water. Approximately 3 tonnes of cement per year is used for every person in the world and twice as much concrete is used in construction as all other building materials combined.¹

Yet cement production is highly emission intensive. The calcination reaction that is necessary to produce clinker, the active ingredient in cement, accounts for two-thirds of the direct emissions in the industry, with the remaining emissions resulting from fuel combustion.² In this sector, process emissions and the need for high-temperature heat account for most emissions and make it hard to abate.³

Demand for cement and concrete is set to increase as the rise in global population and urbanization leads to increased need for vital infrastructure – homes, workplaces, and infrastructure for water and transport.⁴ Current process technologies are not in sync with the Paris Agreement's commitments and objectives but the expected increase in demand for cement makes it imperative to decarbonize the sector. Reaching net-zero emissions from cement by 2050 will require reducing the clinker-cement ratio to its technical limits, as well as capturing CO₂ process emissions.⁵ Reducing emissions from the cement sector is key to achieving the goals of the Paris Agreement and to help implement the Nationally Determined Contributions of many countries.

Although technological solutions exist that would allow cement to be produced with close-to-zero emissions, decarbonizing the cement sector is more than only a technological transition.



The cement sector is deeply embedded in our economies and societies, and decarbonizing it requires a major socio-technical transition, involving co-evolutionary shifts in markets, business models, policies, infrastructure, demand-side behaviour, norms, and institutions. The transition to a decarbonized cement sector is also deeply political and local context-specific.

Use of roadmaps is one approach that can build momentum and overcome inertia around transition. The method provides a pre-determined goal associated with a desirable future and sets out possible pathways, strategic plans, actions, and policies required to reach that point. Such industry transition roadmaps can serve as analytical tools for understanding, framing and shaping complex transitions. They offer an opportunity to set out the timing and sequencing of policy, investment and innovation in such a way that reduces the risk of industries being locked into higher emission trajectories due to the long lifespan of industrial assets.

A recent roadmap workshop underscored the importance of definitive roadmaps for decarbonizing the cement sector in India. In New Delhi on 11 April 2022, stakeholders, industry representatives, and experts participated in the second roadmap workshop jointly organized by The Energy and Resources Institute (TERI), Leadership Group for Industry Transition (LeadIT) Secretariat, Ministry of Environment, Forest and Climate Change (India) and the Strategic Partnership for the Implementation of Paris Agreement (SPIPA).

The following policy recommendations emerged from the participatory workshop.

Key policy recommendations from industry

- **Define:** currently there is no clear definition of “green cement” to rely on. Although certain innovative companies have developed a set of standards on green cement, such as a minimum of 30% lower carbon footprint than ordinary cement, there is a lack of consensus or standardization. Consumer knowledge is also lacking, which points to the need for **labelling** for green cement coupled with **green public procurement policies** to reach 2050 net-zero targets.
- **Technology, finance and capacity trio:** these are the three-enabling means of decarbonization. The need of the hour is to provide cost-competitive technology and financial support to recognize the efforts of the industry and the country. The Perform, Achieve and Trade (PAT) scheme run by the Bureau of Energy Efficiency (India), which is a market-based compliance mechanism to accelerate improvements in energy efficiency in energy-intensive industries, including cement was cited as one example of a mechanism at hand to achieve these goals. Other key policies include long-term policy support on carbon capture, utilization and storage (CCUS), increasing alternate fuel requirement and designing performance matrices around low embodied carbon.
- There is a need to promote **renewable energy** in industries to reduce the use of coal, incorporate **blended cement** in public procurement policies, and for **internal carbon pricing** mechanisms for cement industries. The above gains can be further reinforced by

doubling down on waste heat recovery, uptake of high energy efficient coolers, grinding systems, and the use of variable frequency drive (VFD) in process fans. There is a clear need for an **enabling framework** to implement special policies on CCUS technologies, granting waste heat recovery systems (WHRS) a status equivalent to renewable energy to incentivize industry and to bridge payback periods.

- Policy instruments should **champion profitable solutions for decarbonizing the cement industry, such as Limestone Calcined Clay Cement (LC3)**. Policies should also aim to remove barriers caused by economic disadvantages associated with fly ash (such as the cost of transportation in states with no fly-ash availability) and examine the role of substituting clinker with LC3. In technical terms, this material offers a realistic solution, because it is potentially available in viable quantities. Among the advantages of LC3 is that it saves up to 40% of CO₂ emissions when compared to Portland cement.
- There is a need for **institutional support to make it more attractive to invest in green cement**. There is also a need to **strengthen the “polluter pays” principle** to generate demand for greener alternatives. Furthermore, de-risking investments by building up sustainable climate finance is key to accelerate the speed of transition.

Key policy recommendations from civil society

- There is a clearly articulated need to **consider the entire value chain** to reflect and highlight the true costs of cement production.
- **A just transition** is critical and should be incorporated into the roadmap tool. A case that illustrates the importance of a just transition is the circular use of agricultural waste (biomass) from farms, or municipal solid waste from neighbouring urban areas, as a source of energy for the cement industry. Here, the role of technology will not only be to reduce carbon footprints but also to alleviate poverty and create jobs for local communities.
- Policies for **eco-labelling** are necessary. Public procurement can help increase awareness among end users.
- There is a need to create diverse energy and industry transition scenarios, as well as green industrial hubs and corridors. Research institutions and think tanks can play a critical role in both, as knowledge partners and neutral facilitators of the transition process.

Summary and next steps

It is imperative to understand the role of blended finance, visibility gap funding, and transition bonds in **de-risking investments in emerging technologies and innovations linked**

to decarbonization. Hard-to-abate sectors require significant investment in low-carbon technologies that recycle carbon and materials, such as low-carbon calcined clay (LC3), to meet countries' climate goals under the Paris Agreement. It is also imperative to advance loans, grants and priority sector lending towards green cement and CCUS technologies and processes.

Government and subsidiary bodies need to **develop or modify regulations to facilitate technology uptake.** For example, shifting from prescriptive to performance-based design standards (e.g. within building codes) would stimulate uptake of lower-carbon blended cements and cements that include alternative binding materials.

In sum, industry transition roadmaps must provide actionable measures on technology, policy, public-private partnerships and finance to accelerate transition. Roadmaps should also consider the sector's competitiveness and the socioeconomic aspects of transition (e.g. jobs, social protection measures, reskilling industrial workers). It is important to include factors from the demand side (e.g. the construction sector, green buildings), as well as establishing shared standards and labelling for green cement. The entire value chain needs to be considered when designing the roadmap for India's cement sector. Green procurement is crucial to highlight the true cost of cement production. And an enabling policy framework and access to green financing are both key to sustainable supply chains and driving investment and innovation in the sector.

References

1. C. R Gagg. Cement and Concrete as an engineering material: an historic appraisal and case study analysis https://www.researchgate.net/publication/260439461_Cement_and_Concrete_as_an_engineering_material_an_historic_appraisal_and_case_study_analysis (2014)
2. International Energy Agency. Technology Roadmap Low-Carbon Transition in the Cement Industry. <https://iea.blob.core.windows.net/assets/cbaa3da1-fd61-4c2a-8719-31538f59b54f/TechnologyRoadmapLowCarbonTransitionintheCementIndustry.pdf> (2018)
3. Material Economics. Industrial Transformation 2050 - Pathways to Net-Zero Emissions from EU Heavy Industry <https://materialeconomics.com/publications/industrial-transformation-2050> (2019)
4. Global Cement and Concrete Association. Climate Ambition Statement. Towards carbon neutral concrete. [Stehttps://gccassociation.org/climate-ambition/](https://gccassociation.org/climate-ambition/)(2020)
5. International Energy Agency. Net Zero by 2050 A Roadmap for the Global Energy Sector. https://iea.blob.core.windows.net/assets/beceb956-0dcf-4d73-89fe-1310e3046d68/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf (2021)