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Project Title	LC3 Project
Industry Partner	
Industry Sector	Cement & Lime
Technology Pathway (Primary)	Alternative Materials & More Efficient Process
NIM Pillar	Technology Demonstration
Source	NIM Awards 2024
Description	Limestone Calcined Clay Cement (LC3) can reduce CO2 emissions from cement production by up to 40%. LC3 is a scalable, market-ready solution, that can be used everywhere in the world, and particularly for the growing populations in the Global South. Developed by Professor Karen Scrivener at EPFL, a leading polytechnic university in Switzerland, LC3 has already saved 15 million tons of CO2 and could achieve a significant reduction with broader adoption. As urbanization and population growth increase construction demands, particularly in the Global South, sustainable building methods are crucial. LC3 utilizes abundantly available clays thus utilizing local resources and offers a cost-effective approach, potentially reducing more than 500 million tons of CO2 every year globally by 2050. LC3 blends half of the carbon-intensive clinker with calcined clay, reducing CO2 emissions without compromising cement's strength and durability. The LC3 Project operates with the backing of philanthropic donations. The project employs a dedicated team of postdoctoral researchers and PhD students who are focused on enhancing LC3's properties. The project features three Technical Resource Centres (TRCs) located in key regions of the Global South: Africa, India, and Latin America. These TRCs play a crucial role in facilitating industry transition by collaborating with stakeholders and supporting the global deployment of calcined clay cement plants.
Innovations Employed	LC3 is a blended cement that replaces 50% or even more of the carbon-intensive clinker in Ordinary Portland Cement with calcined clay and ground limestone, reducing CO2 emissions by up to 40%. This reduction is achieved as calcining clay requires lower temperatures, saving fuel, and produces no process emissions. LC3 is more climate friendly, cost effective, and durable, offering excellent early strength without delaying construction schedules. After 7 days, LC3 outperforms conventional cement and maintains parity through 90 days. Utilizing widely available local clays, especially in the Global South, LC3 simplifies access to raw materials by reacting with lower-grade limestone.
Dimension of Novelty	It was new to the International Market
Innovation Collaboration	Lead: EPFL (Switzerland) Cooperations with scientific institutions: IIT Delhi (India), CIDEM (Cuba), Meru University of Science and Technology (Kenya), ETH Zurich (Switzerland), BAM (Germany)

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	External partners: Cementis, Ecosolutions
Intellectual Properties	LC3 is not a commercial brand. It is the name of a technology that is entirely in the public domain. There is no patent protecting the recipe of LC3. It is a market-ready and scalable solution that is handed on a silver plate to cement producers. The success of LC3 thus far is the fruit of the work of the LC3 Project team that has been supported by donations over the past 15 years with the vision to make it available to countries in the Global South where the need to use low carbon building materials are urgently needed.
IP Links	
Timetable & Progress	Developed in 2007 Technology available for consumers
Financing (Public/ Private)	From 2014-2022 the LC3 project was supported by the Swiss Government, and today it is operating thanks to the support of the Climate Works Foundation and the Grantham Foundation.
Finance Links	
Project Phase TRL	TRL 9
Problems to be Solved and Risks to be Managed	The LC3 Project faces significant challenges, including the vast scale of global cement production, the dominance of independent SMEs with varying economic constraints, and differing construction regulations across countries. Additionally, finding the right types of clays for LC3 is a critical hurdle. Despite these challenges, the project has made good progress, although a major industry shift takes time. The construction sector's complexity, with diverse stakeholders and entrenched practices, complicates efforts to adopt new solutions. Convincing stakeholders to make even small changes to production methods is time-consuming and often hindered by funding challenges for feasibility studies. The LC3 Project focuses on raising awareness about reducing embodied carbon in construction and facilitates collaboration between the public and private sectors.
Preliminary or Final Results Achieved	R&D: in-depth research and understanding of microstructural, mechanical and durability properties at small scale (cement and mortars). Currently, ongoing research at the concrete level (the construction material to be used in real life) on the optimization of the mix design, mechanical and durability properties, and fresh state properties. Structural properties (application in real-scale structural elements) and long term mechanical properties are starting to be addressed in collaboration with structural engineers. Evidence that the current code and standards have to be updated and shifted from a prescriptive to a performance-based approach.
CO2 Emissions Reduction Potential - Implementation and Future Market	Clays, weathering products of many rock types, are widely available near the Earth's surface. The most suitable clays for LC3, containing kaolinite, are abundant in the Global South, where cement demand is rising. Africa, with its fast-growing population, faces high cement costs due to the scarcity of suitable limestone for clinker production. By using LC3 technology and local clays,

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	African countries can lower housing and infrastructure costs, create jobs, and reduce clinker imports, all while cutting CO2 emissions. While Carbon Capture, Utilization, and Storage (CCUS) can help reduce emissions, it is expensive and impractical for large scale cement production, especially in developing countries. Reducing high carbon clinker with LC3 offers a faster, more scalable, and cost-effective solution. Today, LC3 is produced in about 25 plants globally, with 25 more by 2026. By 2050, around 1000 plants could potentially produce LC3, saving 500 million tons of CO2 annually.
Market Positioning	The LC3 Project does not commercialize a final product. It provides cement producers with technical advice and consultancy services to facilitate the transition to blending clinker with calcined clay. The project supports the entire sector in adopting LC3 for new construction projects, helping companies integrate this technology effectively.
Project Location	Switzerland
Project & Technology Links	Video produced by the World Economic Forum published 20 October 2023