



## **German Development Cooperation More Income and Employment in Rural Areas (MIERA)**

**Strengthening the environmentally friendly building material sector in  
Malawi**



Implemented by

**giz** Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH

## Background

In Malawi, the bulk of building materials used is produced locally by the informal sector with businesses having limited access to finances and knowledge therefore often using unsustainable and environmentally harmful methods of production. This has brought several challenges, e.g. the quality of the building materials produced in the informal sector fluctuating widely and being mostly sub-standard compared to Malawian regulations.

The traditional production technology used to fire clay bricks requires substantial quantities of fuel wood that contributes significantly to the deforestation rate of 3-6% in Malawi.



Being aware of the problems of the building material sector in Malawi, the Malawian Government, in a first step to tackle them, gazetted in May 2018 the "Use of Sustainable Construction Materials Act 2018" that directs building developers and contractors to use sustainable building materials for all public, institutional and commercial

construction projects.

The bilateral German-Malawian Programme "More Income and Employment in Rural Areas in Malawi" (MIERA), implemented by GIZ, supports this process through its component "Environmental Friendly Building Materials" (EFBM). This component focuses in MIERA's current phase on the dissemination of the "Vertical Shaft Brick Kiln" (VSBK) Technology, an environmental friendly brick firing technology colloquially called EcoKiln Technology; the introduction of the Cold Ceramic Brick (CCB) Technology, a geopolymer technology and the introduction of Limestone Calcined Clay Cement (LC<sup>3</sup>) Technology to Malawi.

In preparation of the next programme phase, foreseen to start in February 2022, research for further possibilities, e.g. the use of bamboo in construction, is already taking place.

## Objective

The objective of MIERA's component "Environmental Friendly Building Materials" is to strengthen the environmental-friendly building material sector in Malawi. The project approach focuses on two building material areas, the walling materials and cement, by supporting the above mentioned three technologies.

While information of the wider public is an important aspect, EFBM's dissemination activities focus on entrepreneurs interested



in investing in the technologies. Entrepreneurs are informed about the potentials and opportunities and are supported in the preparation and implementation of investments in environmental friendly building material production lines.

## 1. The EcoKiln Technology

(Implementing Partner: CCODE<sup>1</sup>, Eco-Matters Ltd<sup>2</sup> and TARA<sup>3</sup>)

Traditional bricks used for construction in Malawi are produced by firing moulded clay, with fuelwood as the primary fuel in extremely inefficient kilns. Most of the fuelwood used for firing is not harvested sustainably, thus increasing pressure on Malawi's natural resources. The brick production sector is largely informal with no or extremely limited investment in technology or in skill development, which compromises the quality of bricks produced.



The EcoKiln at the Eco-Matters plant in Mthyoka

To address the challenges of improving the brick industry in Malawi, CCODE undertook in 2012 a study on the energy efficient and environmentally friendly methods of brick production and in 2013 ventured in the creation of the enterprise Eco-Matters Ltd and, supported by TARA, the construction of a VSBK pilot plant (also called EcoKiln) at Mthyoka along Salima Road in Lilongwe.

Building up on this, MIERA supports the dissemination of the EcoKiln technology in a holistic approach (including improvement of the green brick production and improved brick firing) to interested entrepreneurs.

In order to minimize the financial risk of the entrepreneurs during the decision-making process, a 3-step approach was developed, in which firstly the suitability of the raw materials is checked, secondly the plant and business planning is jointly developed, and finally the construction of a plant and its commissioning is undertaken. Although the dissemination has been hampered by the Covid-19 pandemic the following was achieved till date (March 2021):

- More than 5,000 entrepreneurs informed through workshops and online;
- 81 entrepreneurs expressed interest in the checking of the raw material suitability.
- 27 raw material tests performed.
- 10 brick plants + business plans developed.
- Construction of 3 brick plants is in progress and
- 3 Malawian engineers were introduced to the design and planning of EcoKilns

## 2. The Cold Ceramic Brick (CCB) Technology

(Implementing Partner: Terrastone Ltd and TNO<sup>4</sup>)

The Cold Ceramic Brick Technology is based on a geopolymer technology requiring neither fuelwood nor



<sup>1</sup> CCODE, Centre for Community Organisation and Development, a Malawian and slum up-grading founded in 2003 ([www.ccodemalawi.org](http://www.ccodemalawi.org))

<sup>2</sup> Eco-Matters limited, the company operating the pilot plant in Mthyoka, for

<sup>3</sup> TARA, Technology & Action for Rural Advancement, a social enterprise set belongs to the Development Alternative Group ([www.tara.in](http://www.tara.in))

<sup>4</sup> TNO, Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, a Dutch independent innovation institute, not for profit, established by law in 1932, ([www.tno.nl](http://www.tno.nl))

heat during manufacturing. To do so it makes use of chemical activation of secondary raw materials. This innovation was developed by TNO for re-use of demolition waste in the Netherlands. Tests with Malawian raw materials have been very successful and compressive strengths up to 75MPa were achieved.

The introduction of the CCB technology will among other things reduce deforestation and greenhouse emissions related to brick production, cleaning up local waste streams (e.g. demolition waste, maduka, ashes from a wide range of materials, etc.) improving availability of quality bricks for consumers and improving affordability of good housing, also for vulnerable groups and facilitate innovation.

For this project a partnership between the Malawian company Terrastone Ltd and TNO was established, supported by MIERA, to create social and economic impact. Currently, high end bricks are expensive and scarce in Malawi as they are imported from countries such as South Africa. Local production of high-end bricks will ensure availability and reduce cost of these bricks. In a second step, the development of a CCB brick recipe suitable for the mass market is foreseen. The recipe and technologies linked to it will be made available to MSMEs in the building material sector.

### 3. The Limestone Calcined Clay Cement (LC<sup>3</sup>) technology

(Implementing Partner: Lafarge Cement Malawi Ltd and TARA)

During research in the context of the VSBK Technology in Malawi it was found that Malawian clays are highly suitable to produce a pozzolanic cement known as LC<sup>3</sup>. On this cement TARA was already working on, along with an international research team from Switzerland, Cuba and India. Using the Malawian clays resulted in cements with very high quality.

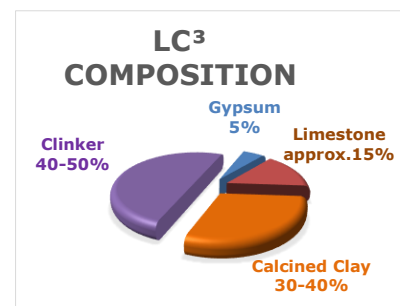
LC<sup>3</sup> is a family of composite cements containing Portland clinker, calcined clay and low-grade limestone. The LC<sup>3</sup> technology promises a sustainable growth of Malawi by reducing CO<sub>2</sub> emissions by up to 40% compared to plain Portland cement at significantly lower production costs.

Due to lower clinker content, LC<sup>3</sup> has several advantages over ordinary Portland cement (OPC) and Portland pozzolana cement (PPC).

The main advantages are:

- Similar strengths compared to OPC and PPC;
- Use of non-ceramic grade clay;
- Opportunity to utilize limestone (siliceous or dolomitic) otherwise not usable for cement production (as lot of Malawian limestone deposits);
- Lower energy consumption hence low CO<sub>2</sub> emissions;
- Lower production cost than OPC and PPC; and
- Improved durability compared to OPC due to refined pore structure.

Meanwhile, after production scale trials with Malawian clays were successfully conducted, Lafarge Cement Malawi and GIZ have concluded a Private Public Partnership in which Lafarge will be the first company to integrate the LC<sup>3</sup> technology in its standard production procedures and GIZ will support the establishment of standards and guidelines for LC<sup>3</sup> production.



The major advantages of LC<sup>3</sup> technology for Malawi include: Synergetic production system with Eco-Kiln technology as the present Eco-Kiln technology can be used for production of calcined clay along with production of environmentally efficient burnt clay bricks, reduction of clinker in cement production thereby less dependency of import and resultant savings in foreign exchange, use of locally available raw materials thus creating new jobs and associated opportunities, low carbon emissions and lower production costs which will result in low costs of cement and subsequently lower costs of cement-based building materials.

## Summary

MIERA's EFBM component seeks to address the problems in Malawian building material production sector, i.e. unsustainable & environmentally harmful production methods and low product quality, using three technologies to enhance the quality in the building material sector whilst reducing its environmental impact.

- I. Reducing energy consumption and replacing use of fuelwood in the fired clay brick production to reduce emissions and deforestation while improving quality of bricks with the VSBK technology;
- II. Replacing traditionally fired or imported bricks used in the high-end market by high quality bricks produced with the Cold Ceramic Brick (CCB) technology using waste materials; and
- III. Introducing the Limestone Calcined Clay Cement (LC<sup>3</sup>) technology an energy-efficient & low-CO<sub>2</sub> cement production technology thus expanding access to high quality cement for construction works and production of stabilised soil blocks, concrete blocks & bricks and precast elements.

In the long term this will increase the availability of affordable, high quality, environmental friendly building material to the Malawian public. Furthermore more than 1,000 small to medium scale enterprises in the building material sector and ancillary industries will be created providing more than 20,000 sustainable "GREEN JOBS".<sup>5</sup>

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