

# ECO-KILN TECHNOLOGY IN MALAWI



## ECO-KILN FACTS & FIGURES

(Approximate figures for a 2 shaft kiln, producing a maximum of 9,000 - 10,000 bricks per 24 hours)

The Eco-Kiln is a continuous burnt clay brick firing system operated round the year. The Kiln is a modular box like structure constructed in brick cement masonry. It consists of vertical shafts of rectangular cross sections lined with refractory bricks. Spaces between the shaft wall and outer kiln wall are filled with insulating materials to arrest heat loss. A loading platform on the top ensures stacking of green bricks for production. A roof over the top allows year round production. The Eco-Kiln technology is extremely energy efficient with very low levels of environmental emissions. The Eco-Kiln technology was introduced to Malawi in 2013 through a cooperation of the Indian social enterprise TARA and the Malawian company Eco-Matters Ltd.

## LAND REQUIREMENTS

|   |                                                    |                           |
|---|----------------------------------------------------|---------------------------|
| 1 | KILN OPERATION                                     | 400m <sup>2</sup>         |
| 2 | GREEN BRICK PRODUCTION                             |                           |
|   | Soil storage and ageing                            | 400m <sup>2</sup>         |
|   | Coal storage                                       | 160m <sup>2</sup>         |
|   | Coal crushing                                      | 40m <sup>2</sup>          |
|   | Crusher operation                                  | 80m <sup>2</sup>          |
|   | Moulding (mechanized & semi-mechanized) and drying | 3,500m <sup>2</sup>       |
|   | TOTAL GREEN BRICK PRODUCTION                       | 2,680m <sup>2</sup>       |
| 3 | GREEN BRICK STORAGE                                | 400m <sup>2</sup>         |
| 4 | FIRED BRICK STORAGE                                | 600m <sup>2</sup>         |
| 5 | OFFICE SPACES                                      | 80m <sup>2</sup>          |
|   | <b>TOTAL</b>                                       | <b>5,660m<sup>2</sup></b> |

## KILN CONSTRUCTION

(Approximate cost, will vary depending upon site conditions)

- Construction cost approx. MK60M
- Construction time 90-120 days (if all materials are at site on time)
- Materials availability All the required materials are locally available
- Manpower Expert supervisors, trained mason's, helpers, carpenters, welders

## INTERNAL FUEL

Internal fuels are materials having a medium calorific value (2000 – 2500 kcal/kg). They are mixed with the soil during the green brick moulding process. The various types of internal fuels recommended for use in brick making are generally waste materials e.g. tobacco dust, boiler ash, rice husk, saw dust and other carbon bearing wastes. In the absence of waste materials coal dust can be used as an internal fuel too.

Before using these materials they must be processed in a pre-determined way so as to retain the characteristics and quality of the fired product. Various heat value tests and theoretical energy calculations need to be done to determine the quantity and process of internal fuel to be mixed. Careful soil selection, processing and moulding needs to be applied properly to achieve the most cost effective and beneficial way for mixing of internal fuel.

### Facts and figures about the internal fuel used in the **Eco Matters** Pilot Plant

- Type boiler ash / tobacco dust
- Quantity 3-3.5% by weight of green bricks
- Size < 2 mm
- Calorific value approx. 2,300 kcal/kg

### Frequent asked questions:

- Q.: How much internal fuel can be mixed into the soil?  
Ans.: Usually 3 – 5% according to the calorific value of the internal fuel and the soil type. The final quantity can only be determined after testing the internal fuel, coal and soil quality.
- Q.: Will the product quality degrade?  
Ans.: The product quality does not degrade due to use of internal fuel. In fact in certain cases higher strength has been achieved with addition of specific internal fuels. However care needs to be taken on the right type, quantity, particle size and the mixing process.

- Q.: What are the advantages of internal fuel use?  
Ans.: Internal fuel usage reduces environmental emissions (SPM, PM<sub>10</sub>, PM<sub>2.5</sub> etc.), energy consumption and improves product quality.
- Q.: What are the disadvantages of internal fuel use?  
Ans.: If the size is not as per advice it leaves gaps on the surface of the brick. If not properly mixed, results in localized bloating and blistering. If more than the required quantity is added it results in over firing and melting of the bricks.

## PRODUCT QUALITY

The Eco-Kiln technology is only a firing system for producing fired clay bricks. The quality of the fired product depends largely upon the quality of the green brick being used. **Better the green bricks, Better the quality of the fired brick.** The quality of the green brick depends on the selected soils, the amount of internal fuel, mixing

process and quality of moulding. Good quality, dry green bricks is an absolute prerequisite for a uniform quality of the fired product.

## PRODUCT ECONOMICS

The advantage of Eco-Kiln lies in its energy efficiency achieved through arresting heat losses due to its inherent firing system. It is a continuous operation of 24 hours requiring working in shifts. Bricks are fired within 24-30 hours instead of 7-10 days as required in a clamp.

### Facts and figures about the firing costs in the **EcoMatters** Pilot Plant

(4 shaft kiln, maximum of 18,000 -20,000 bricks per 24 hours realised in 2 shifts (3 rotating teams))

|                  |               |                                                          |
|------------------|---------------|----------------------------------------------------------|
| • Raw mat. costs | Internal fuel | approx. MK4,000 per t                                    |
|                  | External fuel | approx. MK90,000 per t                                   |
| • Quantity       | Internal fuel | approx. 0.087t per 1,000 bricks                          |
|                  | External fuel | approx. 0.019t per 1,000 bricks                          |
| • Fuel costs     | Internal fuel | approx. MK300 per 1,000 bricks                           |
|                  | External fuel | approx. MK1,640 per 1,000 bricks                         |
|                  | <b>Total</b>  | <b>approx. MK1,940 per 1,000 bricks</b>                  |
| • Firing team    | Supervision   | 1 senior firemaster                                      |
|                  | Shift team    | 1 firemaster<br>6 firemen                                |
|                  |               | (1 senior firemaster + 3 teams @ 7 men, in total 22 men) |

Brick size: Standard Brick 230x110x70mm (approx. 2.8kg)

Fuel costs for a 2 shaft kiln will be similar, required manpower will be accordingly lower. (All figures as of 2016)

## TECHNOLOGY DISTRIBUTOR IN MALAWI



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