

KNOWLEDGE PARTNERSHIP PROGRAMME



Progress Report- September 2015

South - South Technology Transfer: Low Carbon Building Technology

**Development Alternatives- Technology and Action for Rural Advancement
(TARA)**

Submitted to



Department for International Development (DFID)



IPE Global (P) Ltd.

September 2015

South-South Technology Transfer: Low Carbon Building Materials

Monthly Progress Report

September 2015

This document reports on the progress made under the South-South Technology Transfer project for low carbon building materials for the month of September 2015. The main activities in this context are

1. Enterprise and management support
2. Technical support and quality control
3. Business performance
4. Concrete building material technologies
5. Knowledge dissemination
6. Policy support
7. Social interventions
8. Impacts

The next sections elaborate on these activities with respect to last month.

1. Enterprise and management support

Mr. Jones Nyirenda has taken over from Peter Schramm as the new CEO of Eco Matters Ltd. Since this is a new responsibility, thus it is taking time for him to adjust to the new role and execute responsibility. In the month of September strategic business and investment plans has been prepared by Eco Matters Ltd. and is in the process of being presented to the Governing Board.

2. Technical support and quality control

2.1. Raw material quality

Three types of soils are being used for green brick making i.e. yellow, brown and black. Generally black soils are collected from the bed of streams and are plastic in nature. The brown and yellow soils are collected from land and are coarse grained in nature. Based on the request of Malawian and German experts a detailed study was undertaken to evaluate the three types of clay.

On burning in a bomb calorimeter, the black clay did not show any organic matter content although it was reported that the coal consumption during firing a brick made with black clay was substantially lower compared to the other clays.

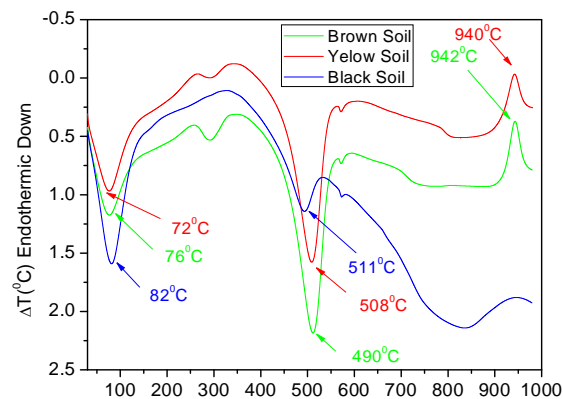


Figure 1: DTA analysis of all three types of clays from Malawi

Thermogravimetric analysis of the three soils shows that all the three soils are complex in nature. There is an appreciable mass loss both between 100-200°C and between 300-400°C. Whereas the earlier mass loss is due to free moisture loss, the later is due to chemical reactions of mineral phases. Similarly the maximum mass loss is during the period 500-600°C due to dehydroxilation of mineral phases.

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Similar results have been obtained during Differential thermogravimetric analysis. Similar kinds of endothermic reactions and observed at the stated temperatures. These are mainly due to release of chemical water. However reason for these structural changes can be determined only through a detailed characterization study which was beyond the scope of this investigation.

X-ray diffraction of powder samples show that all the three clays consist mainly quartz and alumino-silicate phases. The alumino silicates consist of phyllosilicate group of minerals containing impurities of Fe, Mg, Ca, etc. From the peak intensity it can be inferred that all the brown and yellow soil contains more quartz compared to the black soils.

Coal and internal fuel samples has also been tested for calorific values. Test results confirm no change in quality in the fuel compared to earlier period.

2.2. Green brick

Eco Matters Ltd. has invested in a high capacity extruder in addition to the soft mud moulding TBMM. In the month of September, maximum effort was given to streamline the production system of the extruder. The production of green bricks from the extruder was raised up to 20,000 bricks per day though the capacity is much more than what has been achieved till now. Extruder operation is a must to feed all the four shafts without which the unit will not achieve profits. However during the third week of the month, there was a massive breakdown of the machine in which



Figure 2: TBMM machine under operation with men and women workers

feed the running two shafts.

In the month of September, two new types of bricks has been developed. In existing hollow extruder bricks, the diameter of the holes has been increased from 25 to 30mm, reducing use of soil by another 5%. These type of bricks

the gears were broken. This has happened due to operation of the machine by inexperienced staff. No experience persons are available in Malawi to operate high capacity brick extruders. The damaged gears had to be sent to South Africa for making new ones which will take approximately 2-3 weeks since these facilities are not available in Malawi. During this time, the TBMM

is being operated in two shifts to

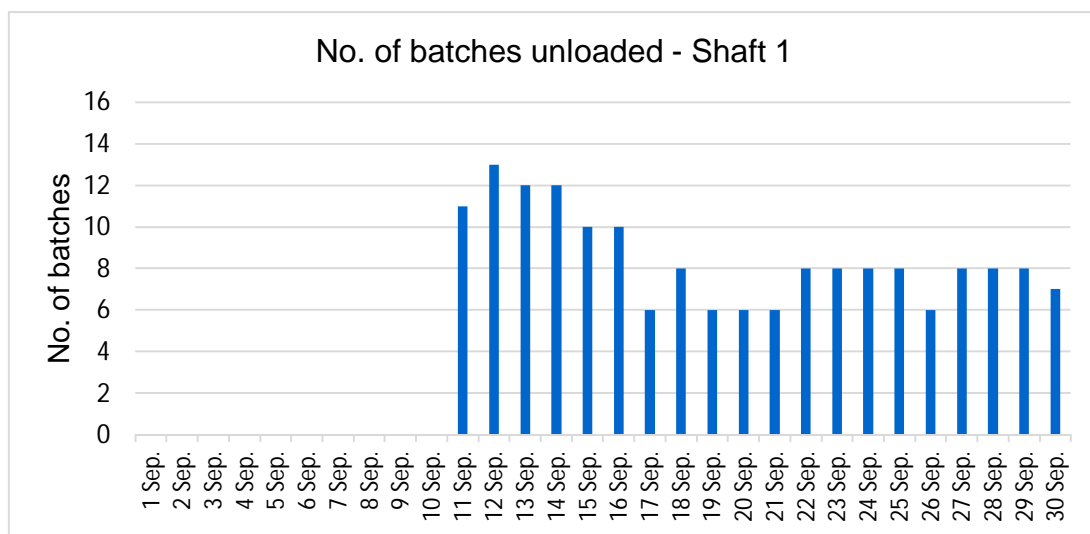


Figure 3: 25mm hollow bricks being produced

will also consume less energy to fire. During this month Eco Matters Ltd. has started experimenting with a new type of brick having higher dimension of 230x190x90 mm. This brick type would reduce cement costs from MK 3,100/m² (traditional brick) to MK 900/m² (new type). Also the time needed to construct a wall will be reduced. Thus Eco Matters, Lilongwe thinks that it would have its market here in Malawi.

2.3. VSBK operation

In the month of September, Shaft 1 was started from the 11th. and is running continuously. The shaft 2 was started on the 19th. but was closed after 5 days due to extruder breakdown and shortage of green bricks. The performance of the Shaft 1 for the month of September is plotted below.



It is seen from the graph that the VSBK was never operated in a stabilized manner. Ideally after 2-3 days of shaft initialization, the number of batches unloaded should be constant. Due to operational reasons there might be a variation of only 1-2 batches from an average of 12 batches. However in most of the cases, Shaft 1 was operated sub-optimally. This has led to lower productivity also.

Apart from the number of batches unloaded, the rate of productivity per batch also varied. Ideally in a 1-open and 5-closed packing system, the number of bricks varies between 504 to 544. Packing density is varied to control the fire position.

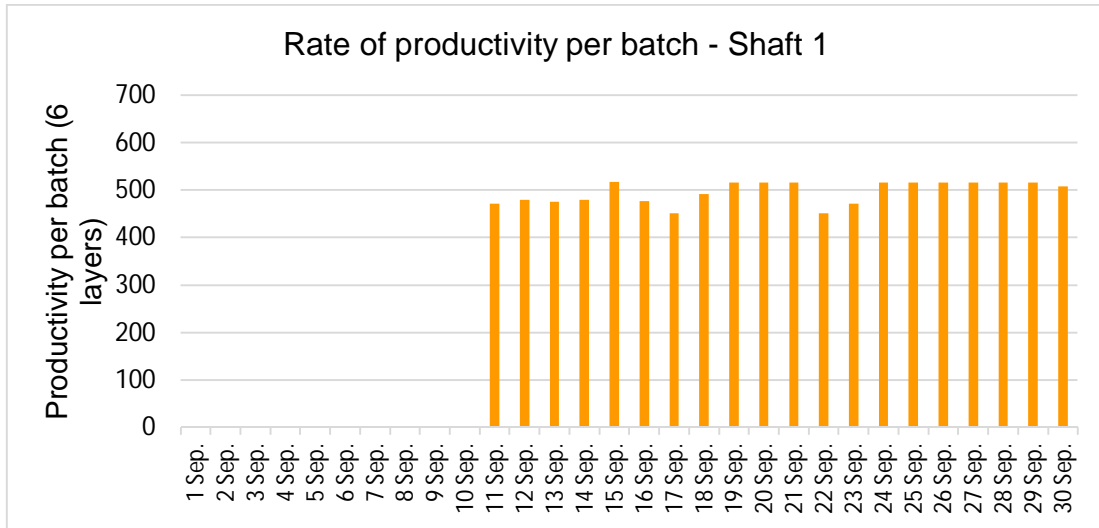


Figure 4: Fired bricks being unloaded

Except the last week there was quite a variation in the productivity also.

It was observed that the chimney exhaust temperature was quite high. We could not measure the flue gas temperature since monitoring equipments were not available. However physical evaluation confirms the high

temperature. Also it was observed that the unloading temperature was high. Thus the fire zone has prolonged itself to a couple of batches rather than being at the central batch. This is also due to the very high wind blowing from the morning to the evening. It was suggested that a mechanism be developed to close the airflow from the unloading area and control the draught.

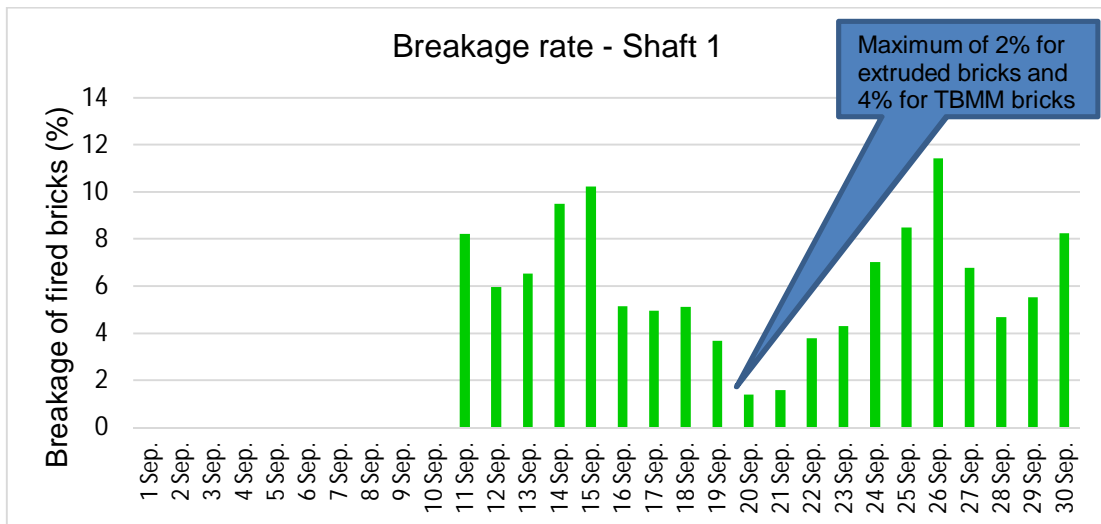


Poor quality of bricks leads to high breakage during the firing process since the VSBK follows the principle of “Garbage In = Garbage Out”. This is one of the major reasons for improvement of the quality of green bricks. With the kind of stiff extrusion being followed, the strength of the green bricks are very high which should give atleast a strength of 10MPa. No definite conclusions can be made since the strength of the fired bricks have not been measured. The graph below shows the average breakage rate in the Shaft 1. As per the quality of the extrusion process, the breakage should be less than 2%. This breakage has been achieved in the past also. It was seen that the firemen were loading all the different kinds of green bricks that we made available to them at the loading platform. Quite a number of bricks are not suitable for loading even. Thus a system of quality control of green bricks was constituted which would reject the poor quality green bricks at the drying yard only. These reject green bricks can be reused again after grinding and pulverizing.

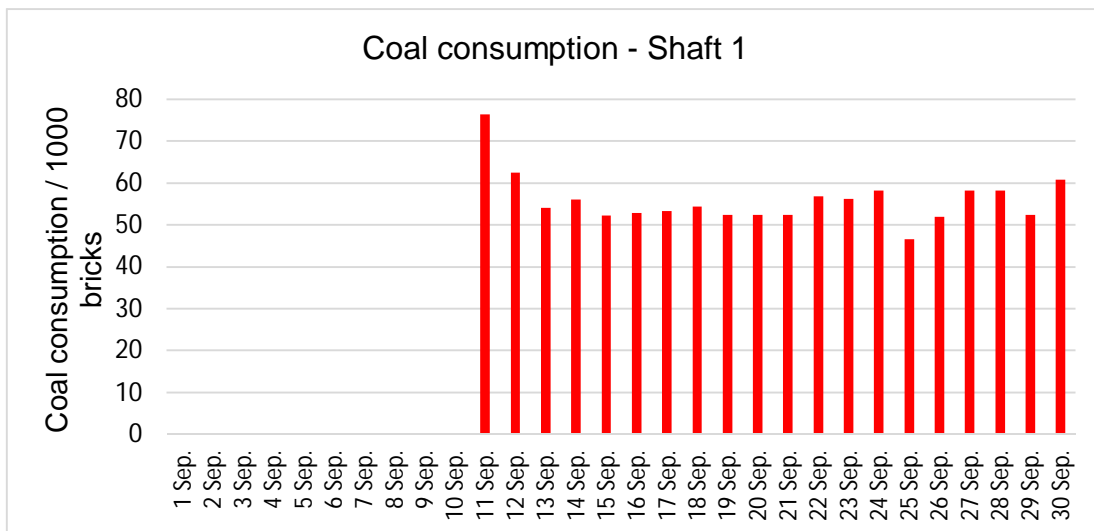


Figure 5: High fired brick breakage due to poor green brick quality

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The graph below gives the average coal consumption for the month of September for Shaft 1.



Although the coal consumption has reduced gradually, still there is a substantial scope for reduction considering the past achievements. There is quite a substantial heat loss in the present firing process from the top of the shaft, flue gas and the unloaded fired brick batches. If these energy leakages can be plugged then the efficiency of the kiln can be improved further.

3. Business performance

The business performance of Eco Matters Ltd. is quite satisfactory till date. It is a new company and will need time and investment to start producing results. There are teething problems which are being solved but are also delaying the breakeven goal. The price of the bricks has been revised from MK 55 to MK 82. This includes the high VAT and taxes as levied by the Government. The major issue with which

the company is grappling are the high overhead costs. At present the overheads are only borne by the brick business. As the concrete business comes into production, they will be reduced. Moreover the production is at less than 50% efficiency and capacity which is also a major factor for increased overheads.

At present the Housing Company of Enterprise Development Holdings is the



Figure 6: VSBK bricks being used in housing construction

major consumer of bricks. Since they have made a substantial capital investment of MK 2,000,000 thus they are getting the bricks at a subsidized rate. This is also very encouraging since there is a captive market for Eco Matters Ltd. at present. Till date around 520,000 bricks has been sold to the Housing Company.

With increased visibility Eco Matters is now getting enquiries for bricks and also corresponding orders. The GIZ project of community schools has expressed interest for 1,000,000 bricks. British Embassy has also expressed interest in these bricks. Most important that local entrepreneurs of Lilongwe are also purchasing bricks albeit small quantities.

4. Concrete building material technologies

On concrete product as informed earlier Eco Matters Ltd. have stopped production of Door frames. Following were the issues faced

- In Malawi context normal Door frame will need a different design for locking
- Present design of moulds can feed to requirement only for the door of toilet for schools.

To overcome above issue our experts will be travelling to Malawi.

5. Knowledge dissemination

The proper working of Malawi VSBK has created a lot of publicity especially in African countries. Interest has been shown from Nigeria and Myanmar to adopt this technology. Correspondence between TARA Team and Entrepreneur is going on and TARA is assessing what could be best possible way to approach to the client of Africa and Myanmar.

We have started our preparation for November Workshop on Dissemination of the VSBK technology. A draft agenda has been made and circulated to Malawi team. It has been agreed to invite entrepreneurs from neighbouring countries to attend the workshop and a corresponding site visit to get a practical feel of the VSBK.

6. Policy support

DFID Malawi has expressed interest to include the VSBK dissemination programme under their Climate Change Country Programme for the next 6 years.

Based on the requirements of DFID Malawi country programme a 2-page note is being prepared in association with IPEG and DFID India for required submission.

TARA team will be travelling to Malawi in October for follow-up with Minister's, Govt. Departments and other stakeholders for creating a platform for large scale dissemination of VSBK.

7. Social interventions

TARA team had interviewed three women as change makers of the Malawian Society. Case studies has been prepared and submitted to IPEG. These case studies reflect the importance of technologies to bring in a social change in the lives of women.

Further case studies of men and women are planned for Malawi subject to availability of additional support.

8. Impacts

Till date i.e. as on 30th September 2015 following are the key impacts achieved.

- ✓ Fired bricks produced (cumulative) - 800,000 nos.
- ✓ Coal used (cumulative) - 43 tonnes
- ✓ Bricks sold - 590,000 nos.

Triple bottom line impacts (cumulative) generated by the project:

- Environment
 - ✓ Amount of CO₂ reduced - not measured
 - ✓ Amount of firewood saved - 270 tons
 - ✓ Amount of waste utilized -100 tons (tobacco waste)
- Economic
 - ✓ Business generated by the enterprise - MK 40 million
- USD 80,000
- Social
 - ✓ No. of jobs created - 145
 - ✓ Women employed - 50

Based on the September production figures, the Specific Energy Consumption of the VSBK is 0.48 MJ/kg of fired bricks. This is by far the best performance of all and any VSBK constructed throughout the world in Asian, African and South American countries.

This is even lower that any best available clay brick firing technologies globally. TARA team is planning to get the Specific Energy Consumption certified by any competent external agency for validation.

However as per the current figures, till date Malawi VSBK is the world's most energy efficient clay brick firing technology.