

## Using agricultural residues to fire high-quality bricks for low-cost housing

| Organisation                          | Award Category       | Technology | Region | Year |
|---------------------------------------|----------------------|------------|--------|------|
| Mwanza Rural Housing Programme (MRHP) | Special Africa Award | Biomass    | Africa | 2006 |

### Summary of the Award-winning work

The Mwanza Rural Housing Programme (MRHP) has trained villagers in northern Tanzania to set up enterprises making high-quality bricks from local clay, fired with agricultural residues rather than wood. These enterprises have made sufficient bricks to construct over 100,000 homes with greatly improved comfort and durability, in 70 villages.

Mwanza, the second city of Tanzania, is on the southern shores of Lake Victoria. The area close to the lake is fertile, but further away the land and people are poorer and there is extensive deforestation. Here houses are usually made from mud, and need frequent repairs and rebuilding because of damage from rain and minor earth tremors. Using wood to make durable, fired bricks has exacerbated the deforestation.



Bricks waiting to be fired using agricultural waste

MRHP has developed processes for making high-quality bricks from local clay, which are fired using readily-available agricultural residues like rice husk and cotton waste, instead of wood. Houses made from the fired bricks are durable, comfortable and clean. Homeowners are freed from the hassle of frequent rebuilding, and many use their improved housing for businesses as well. The quality of the bricks is such that they are now being used in building programmes in the city as well as in the rural areas.

MRHP has trained local people in brick-making and business management, and has provided loans through a savings-and-credit scheme to start businesses. This has enabled over 50 brick-making businesses to become established in the 70 villages where MRHP works. MRHP itself operates a large kiln which is fired using sawdust. To date about 100,000 homes have been built using bricks from MRHP businesses. MRHP also runs a programme of tree planting and reforestation in all the project villages, and has trained entrepreneurs to make and sell efficient cooking stoves.

The first prize Ashden Award to MRHP recognises the multiple benefits which their work has brought to Tanzania, providing better homes, creating new businesses and reducing pressure on scarce fuelwood.

### The organisation

MRHP was established in 1990 by the Belgian agency COOPIBO in response to local requests for help to improve the quality of housing. Since 1995, MRHP has become a fully Tanzanian NGO working at the local level. It employs 11 people and operates in five districts of the Mwanza Region of northern Tanzania.

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### Technology

Traditional housing in northern Tanzania consists of huts built from mud which often need to be repaired or even rebuilt completely after heavy rain or minor earth tremors. MRHP looked in detail at what could be done to make housing more durable and identified the foundations and walls as major problems.

The region has a good supply of local clay which can be used to make durable, fired bricks for walls although there is a shortage of wood to fire the bricks, owing to severe deforestation. The region does, however, have a good supply of agricultural residues, including rice husks and cotton waste which can replace wood in the firing process. The husks are the dry coverings of rice grains which are discarded during rice-milling to give polished white rice. The cotton waste consists of the outer shell of cotton seeds, poor quality seeds and dirty or broken cotton fibres which are removed during the processing of cotton seed oil. Coffee waste can also be used as a fuel, although this is not grown near Mwanza but in the Musoma Region of northern Tanzania.

MRHP developed a mould so that all bricks can be made the same size. After drying in the sun, about 4,500 bricks are stacked into a specified shape to make a temporary kiln (the 'kiln' is made of the bricks that are being fired and is dismantled as soon as firing is complete). MRHP has determined the best method of stacking the bricks to give effective flow of heat and water vapour between them which produces uniform firing. The agricultural residue is poured between the stacked bricks and the outside of the structure has a wall made of unfired bricks. Users find it much easier to pack a kiln with residue than with wood because it flows more easily into the gaps between the bricks. Paper or dried grass is used to start the fire which then ignites the residue. This burns slowly for three days during which time the bricks are fired. After four days the kiln is cool enough to be dismantled and the bricks are then ready for sale.



Bricks after firing

MRHP encourages brick-makers to build a simple canopy over their temporary kilns to protect their bricks from rain which can damage them during brick making, drying and firing. The development of the kiln system has

been participatory with entrepreneurs feeding back suggestions for modifications.

MRHP also has a permanent kiln which has outer walls made from fired bricks. This can fire larger quantities of bricks at a lower cost but is fixed in one place. Unlike the temporary kilns the permanent kiln uses sawdust as the fuel.

MRHP has also developed energy saving stoves using local clay which can be stoked with agricultural waste instead of wood. The simplest stoves can be built in the home at a cost of only about £0.50. Prefabricated 'Upesi' stoves sell for about £1.50 in the market and last for at least 18 months. They reduce fuelwood use by about 25% compared to conventional stoves.

MRHP runs programmes in all 70 villages to encourage people to plant trees in designated common areas and around their homes, in order to replace lost timber. A programme to supply PV lighting systems to homes and community buildings has recently started.

### How users pay

At the time of writing (July 2006), 2300 Tanzanian Shillings (TSh) = UK£1 = US\$1.8.

MRHP has a savings and credit scheme from which it provides loans to trained brick-makers to help them set up businesses. 12 production enterprises have borrowed from 1 million to 3 million TSh (£500 to £1500) as start-up capital. Loans are charged at an annual interest rate of 15%. The brick-makers sell their bricks commercially and repayments go back into the credit fund. A repayment rate of 91% has been achieved. MRHP prefers to lend to brick-makers who have canopies over their kilns as these produce better bricks increasing the reliability of loan repayments.

Many stove producers also belong to the savings and credit scheme.

### Training, support and quality control

In the early 1990s when the project started, MRHP used donor funds to train brick-makers in low cost methods of house construction. It continues to provide essential training including business training to help enterprises start up. Existing brick-making entrepreneurs also train people to assist them. MRHP has tried to encourage the full participation of women in both the brick-making and stove-making businesses.

The field kilns do not require servicing, since they are rebuilt for every new firing. The permanent MRHP kiln is expected to last over 50 years with minimal maintenance.

Bricks made using the MRHP process have been approved to an international quality standard and this has enabled enterprises run on the MRHP model to sell to the high-quality housing market.

### Benefits and replicability

Prior to the establishment of brick-making enterprises brick housing was relatively rare. Many people now live in houses that are more durable and of much higher quality. They are also cleaner and healthier and attract fewer insects. The bricks which have been produced by MRHP and its trained entrepreneurs have been used to build an average of 1,500 homes in each of the 70 villages where MRHP works amounting to a total of over 100,000 homes. Most houses are constructed in the more urbanised villages known as 'trading centres'. These houses have more value because they have the additional potential for commercial use.

MRHP has enabled over 50 brick-making businesses to become established in the 70 villages where it works, 30% of which are run by women's groups. In addition, MRHP runs one large permanent kiln. Each of the local businesses employs between three and five people directly. By running a temporary kiln three times per month, a business can produce about 13,000 bricks which sell for TSh 100 (5p) each, thus giving a monthly income of TSh 1,300,000 (£650). Informal employment is also created for producers of un-fired bricks, who can sell them to the kiln businesses for about TSh 10 (0.5p) each. To date about 100,000 homes in 70 villages have been built using 300 million bricks from MRHP businesses. MRHP has also trained six women in each village in stove production. These women have in turn trained their neighbours and together they have produced and sold about 14,000 stoves since 2000.

The clay and agricultural waste for brick-making are all sourced locally. Using agricultural waste substantially reduces the pressure on the scarce wood supply. Prior to MRHP's work, makers of fired bricks had even started to cut down mango trees as fuelwood. MRHP estimates that the traditional firing of the 3,000 bricks needed for a typical house consumes 1 m<sup>3</sup> of fuelwood; the 300 million bricks produced by MRHP entrepreneurs would therefore have used about 100,000 m<sup>3</sup> of wood (roughly 50,000 tonnes). The agricultural residue is produced sustainably, and burning it does not contribute a net amount of carbon dioxide to the atmosphere, unlike burning unsustainable wood.

Demand for MRHP bricks is also growing in urban areas. The bricks are currently being used in a programme run by one of the national pension funds to construct 3,000 quality houses for retired civil servants and members of parliament. This will raise awareness of the work of MRHP at a national level. There is also demand for bricks to use in constructing secondary schools and in other social housing programmes, and in renovating the sewage systems.

### Management, finance and partnerships

MRHP is highly regarded by the Tanzanian Government as a result of developing and promoting local sustainable energy projects with full participation from local communities. MRHP has good links with local government, particularly local planning offices and town planning departments who sometimes second staff to work with MRHP. A range of international organisations have supported and funded the organisation and it maintains close



House built using bricks fired in an MRHP-designed kiln