basin BUILDING PARTNERSHIPS

Wall Building
Case Study
building advisory service and information network

Vertical Shaft Brick Kiln - Technology Transfer Indian Experience - 2

1 Introduction

The sectoral context for the transfer of Vertical Shaft Brick Kiln (VSBK) technology to India to augment supply of walling materials for meeting the demand for reasonable housing requirements for the millions is explained in the first case study. Development Alternatives (DA) with the support of Swiss Agency for Development and Cooperation (SDC) had embarked on an action research programme in 1995 of which improved performance of kilns used for firing clay bricks was an important component. Planning the strategies for the project and the activities leading to the establishment of the first pilot vertical shaft brick kiln (VSBK 1) at Datia in Madhya Pradesh state have been covered in the case study, on "Indian Experience-1".

The main objective of the project was to establish under Indian conditions the energy efficiency and lower emission of polluting gases attributed to the VSBK technology, developed in China, compare with conventional brick production methods; and once established, to devise plans for wide dissemination. The operating experience of the VSBK 1 in Datia confirmed appreciable reduction in energy consumption and emission levels. It was also established that the technology would be economically viable and better working environment could be achieved. Some modifications in this regard were identified. It was decided to go ahead with the construction of the second VSBK in a different agro-climatic zone.

2 Objectives and strategy for the second VSBK

The objective of the VSBK 2 was to establish the economic viability of the technology in an area with different agro-climatic conditions, with a higher volume of production, while further confirming the energy efficiency and lower emission levels.

At this time during the course of the project, it was felt that in the interest of building capabilities for wider dissemination of technology at the appropriate time, the establishment of the other VSBK in India should be done by another organisation - working as a partner to Development Alternatives. This case study deals with the experience of the establishment of the second VSBK 2 through a partner organisation, Gram Vikas (meaning-village development), in Orissa state.

3 The Project Partner

A set of well defined criteria for the selection of the partner was evolved by DA and the backstopping consultant. These are:

- It should be a development organisation/institution of repute, having technology development experience for some years.
- It is desirable that it has worked in the areas of building materials, and has access to an existing network of partners/organisation.
- It should have expressed concern for energy efficiency and environmental consideration.
- It should have in-house technology capacity to co-operate with and absorb the VSBK technology.
- On successful completion of the pilot phase, it should have the capability to undertake replication/dissemination of the technology through entrepreneurs within its network.
- If satisfying all or most of these conditions, the partner should agree to actively participate in the selection of site, setting up of the kiln and running operation of the kiln.
- Preferably be involved in enterprise development.
- Not be a one-man show.
- Not be religion based/politically active.
- Not be contradictory to DA + SDC objectives.
- Should be in search of new, innovative building materials producing technologies.
- Not favour subsidy policy.
- Should work in an area where coal firing is prevalent for firing bricks.

Searching for a suitable partner was done taking into consideration the project guideline that the second VSBK should be established in an area with different agro-climatic conditions than Datia. After initial consideration of more than 40 possible partners all over India, eight organisations were shortlisted for detailed evaluation. Finally Gram Vikas was chosen to be the partner organisation in this endeavour.

Gram Vikas

Gram Vikas (GV) is a grassroots voluntary organisation with headquarters at Mohuda village near Berhampur in Ganjam district of Orissa state. The main mission of Gram Vikas is integrated rural development encompassing the various components of rural life such as habitat, health & hygiene, drinking water & environmental sanitation, basic education, natural resource management, livelihood generation and community action for development.

Gram Vikas has since 1971 played a vital and effective role in integrated tribal and rural development in the area. Major achievements of Gram Vikas include the large number of village based credit institutions now operating under the ownership and management of communities. These facilities have greatly reduced the dependence of the tribals on moneylen-

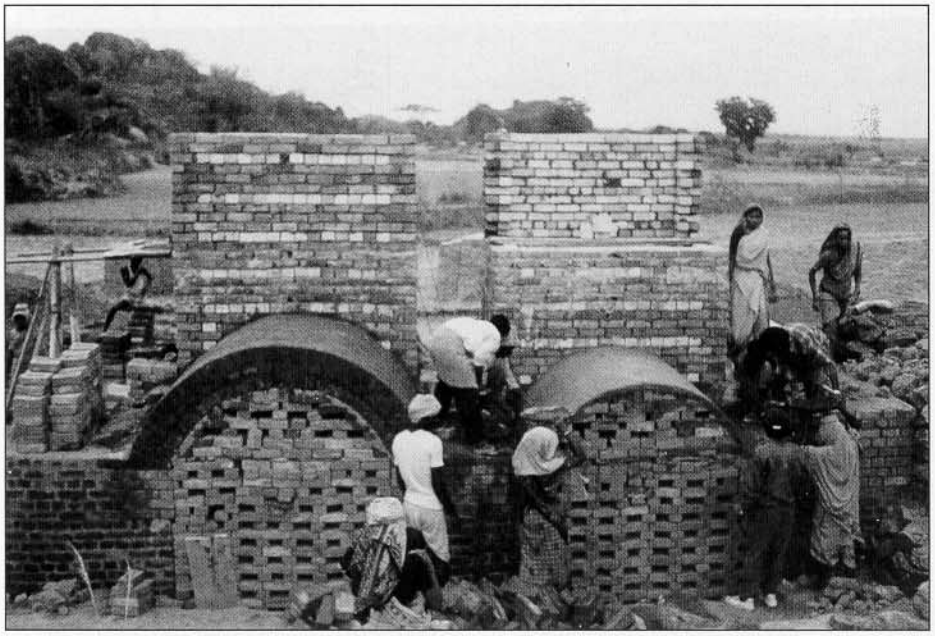

Fig. 1: VSBK 2 under construction; view showing construction of 2 arches in front of the 2 shafts

ders. Gram Vikas is a key player in the National Biogas Extension Programme under which it has installed nearly 60 000 biogas plants, representing about 75 % of plants installed in Orissa. Gram Vikas has taken up a number of schemes to provide low cost houses to the rural population in areas of their work.

4 Implementation and results

A protocol of collaboration and a specific Memorandum of Understanding for the VSBK technology between Development Alternatives and Gram Vikas were signed between the heads of the two organisations on 25 February 1997 in presence of senior officials of Swiss Agency for Development and Cooperation. A mission consisting of DA coordinator, Chinese expert and the backstopping consultant visited the Gram Vikas setup immediately thereafter. The mission went round various places in the area to understand the prevalent aspects of brickmaking. A few prospective sites for the location of VSBK 2 were selected for detailed consideration and logistics. Finally it was decided to locate the kiln at Kankia village about 7 km from the Gram Vikas headquarters at Mohuda. Various aspects of design, construction, firing, green brick production, manpower planning and training were considered during the mission and a time schedule for activities by various agencies responsible for taking action was drawn out.

Planning

The main thrust at this stage of technology transfer was that DA experts and craftsmen who had gained experience in the various activities for the establishment of VSBK 1 by working closely with the Chinese team, would fully participate in the training of their counterparts in the partner organisation. However, a skeleton team of Chinese experts would be available during the process of south-south transfer of technology, so that they could work through and support the DA trainers trained by them earlier. It was envisaged that all the activities would be planned for implementation so that brick production is started in the kiln before the end of the brick season in 1997.

Design

From the outset, it was decided that the recommendations and plan of action evolved during the VSBK Status and Review Workshop held in June 1996 with participation of all groups of the project team, all the backstopping consultants and the stakeholders, based on the experience of VSBK 1 at Datia, and keeping the project aims and objects in mind, would be incorporated in the design of VSBK 2. The main thrust was to improve performance and economic viability by reducing construction costs and boosting production capacity, and also provide features to improve energy efficiency and environmental aspects. The professionals of Tata Energy Research Institute (TERI) offered valuable inputs to the design concept.

It was decided to have two shafts of 1m x 1.75m size to yield about 6000 to 7000 fired bricks per day (Fig. 1). In order to reduce the ramp height, the unloading area was kept 0.72 m below ground level (as is common in China). This will also reduce the effect of wind and sudden chilling of hot bricks on unloading. The location of the kiln ensured using a natural grade separation to build the ramp for lifting green bricks, which entails less cost. The shaft height was designed to provide for 9 batches. However, the roof height provides for an increase to 11 batches. The shaft wall thickness was kept at 230 mm (Fig. 2). To reduce cost, the refractory bricks were laid on face accounting for 10 cm of wall thickness. The flues are designed to facilitate operation with lids. The inside dimensions of the chimney were kept at the enlarged figure of 170 mm x 410 mm. Single screw unloading device which operated very well in Datia was adopted for both the shafts. The loading platform is airy and well ventilated with a gap of 0.75 m in the monitor of the sloping roof. The eaves level is kept at a height to accommodate 11 batch operation (Fig. 3).

Construction

The detailed planning done in the very beginning helped smooth progress of the construction of the kiln. Masons from Gram Vikas and local labour formed the main workforce. Support was provided by other sections of Gram Vikas such as mechanical workshop etc. An engineer and masons from Development Alternatives who had gained experience during construction of VSBK 1 at Datia worked with Gram Vikas staff, training and guiding them throughout. The Chinese expert and one craftsman were at site providing further support to the construction team. Problems and hurdles faced during the progress of construction were overcome with cooperative effort.

Development Alternatives took the responsibility to provide the specialised mechanical equipment required for incorporation in the kiln construction. To widen the area of indigenous capability in this regard, it was felt that this should be manufactured at Berhampur. Accordingly, the trolleys were fabricated locally at Berhampur, under constant guidance and supervision of the DA mechanical engineer. The single screw unloading mechanism, which could not be manufactured at Berhampur, was fabricated at Jhansi and transported to Kankia.

The construction started on 7 April 1997. Local materials with the traditionally relevant methods were used for the construction of the ramp and buildings.

The kiln with the operating room and stores etc. was ready by 24 May 1997 (Fig. 4).

The Gram Vikas team for the construction, besides the coordinator, consisted of 2 site engineers (not for full duration of construction), 4 masons and 10 helpers.

Operation

Green brick production: The green bricks were produced by the traditional methods prevalent in the area. This involves mixing of some rice husk along with the clay and hand moulding in wooden or steel moulds. Initially it was decided to train some unskilled local men and women with the objective of providing livelihoods to the local people. The Chinese team tried to train some persons from the villages nearby. Though some of the trainees learnt the trade fast, it was found that their productivity was low and would not match with the requirements for high volume of production in the kiln (about 7000 bricks per day). Finally families of traditional brick makers had to be utilised to supply the requisite green bricks.

The green bricks are dried in the open, with provision to be covered with wide polythene sheets in case of untimely rain. The dried bricks are lifted to the loading platform by workers carrying them on their heads up the ramp. Coal from the Talcher coalfields was used for firing the kiln.

The unloading mechanism performed smoothly. The operation started on 24 May 1997 (Fig. 5). It was fired from the bottom using firewood for lighting. The operation continued till 24 June 1997 when it was shut down for the rainy season. It produced 269 batches amounting to about 80 000 bricks. Various campaigns with clays from different areas of the brickfield and also from a nearby BTK area were tried. The bricks from the BTK clay were of good colour, ring and strength. The bricks from the local clay were not so good, but with clay from some other areas were better than bricks produced in local clamps. The overall breakage rate was about 4 to 5 %.

Fig. 2: View showing flue details

3 firemasters and 12 firemen from Gram Vikas were trained in operation. DA firemaster and supervisor participated in this and the training of the Gram Vikas staff. The Chinese expert and the technician provided valuable support in the training.

Monitoring

The energy consumption and efficiency were evaluated by the TERI team which conducted an energy audit in May 1997. The audit confirms the energy efficiency of the VSBK technology with an average specific energy consumption of 0.833 MJ/kg of fired brick.

5 Conclusion and further steps

The establishment of the kiln has attracted great attention from the brickmakers and development officials in the area. The energy efficiency and cleaner production in VSBK technology have created an initial impact.

The methodology of setting up pilot units under a technology transfer programme through a partner organisation has been well established and may be replicated for further units.

Support of professionals at various levels of DA, TERI and Gram Vikas, and frequent review and advice from the backstopping consultants, periodic evaluation and guidance from SDC officials have

Typical Operation Details

Size of Bricks:	235 x 110 x 66 mm.
Approx. weight of fired bricks:	3.00 kg.
Internal fuel: Rice Husk per brick:	0.025 kg.
External fuel: Coal per brick:	0.157 kg.
Breakage rate:	4 to 5 %
Specific energy consumption:	0.833 MJ/kg fired brick

Table

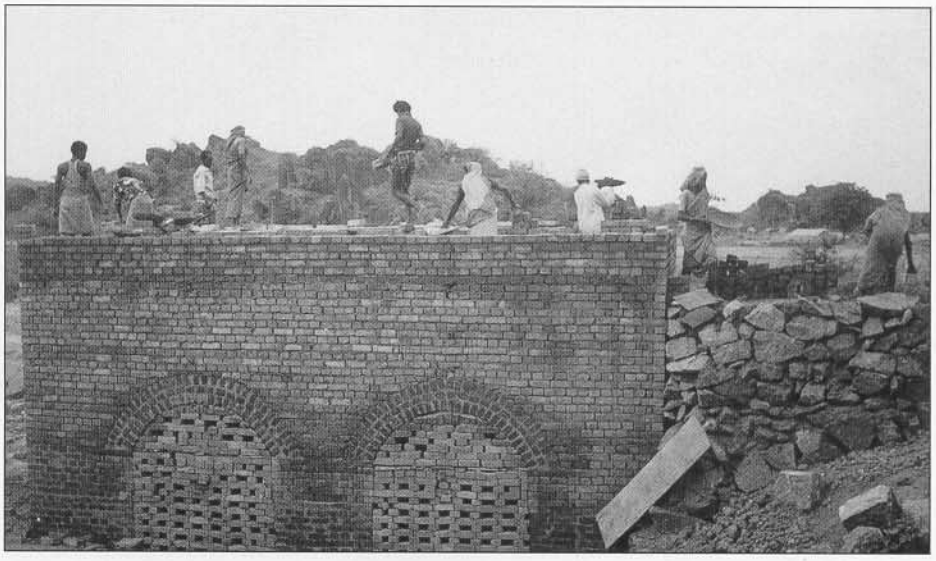

Fig. 3: Kiln construction at the level of the loading platform

Fig. 4: Kiln construction nearing completion May 1997

contributed to the smooth progress of the project.

The "Analysis and Outlook Workshop" of the project held in May - June 1997 led to the consensus that in the next phase VSBK 2 at Kankia will operate on commercial basis. Local operators and firemen will be trained by DA and the partner organisation, Gram Vikas, will be involved in all the aspects. This will allow institutional anchoring of know-how right from the initial stages

The workshop also identified the need to increase the brick production output in VSBK. It was also decided to compile a VSBK technology package with regard to economics, energy, environment, quality and scale of operation for early validation. For further improving the quality of bricks, it was felt that the project should enlarge from just the firing technology to the wider brick production system. The introduction of the extruder system for green brick production was identified for adoption in this regard. The need to anchor the technology in a different mode - through a well established commercial organisation was also recognised. One such organisation, Comtrust, in south India which has more than 150 years experience in clay products production and is a pioneer and leading maker of fired clay roof tiles was selected as the partner for setting up VSBK 3.

References

- The Basics of Brick Kiln Technology by Tim Jones published by GATE., 1996
- Technical Brief - The Vertical Shaft Brick Kiln by Tim Jones published by basin at GATE 1995.
- Case Study - The Vertical Shaft Brick Kiln: A problematic introduction into Pakistan by Tim Jones published by basin at GATE 1997.
- Chinese Vertical Shaft Brick Kiln (VSBK) Nepal by Heini Mueller.
- Energy Saving Brick Kilns : Report by Henrik Norsker for Swiss Development Cooperation, April 1994.
- Evaluation of a continuous vertical brick kiln in China : NIFES report for Overseas Development Administration, , London June 1993.
- Development Alternatives Newsletter - Sept. 1996 & December 1997
- Project Documents.

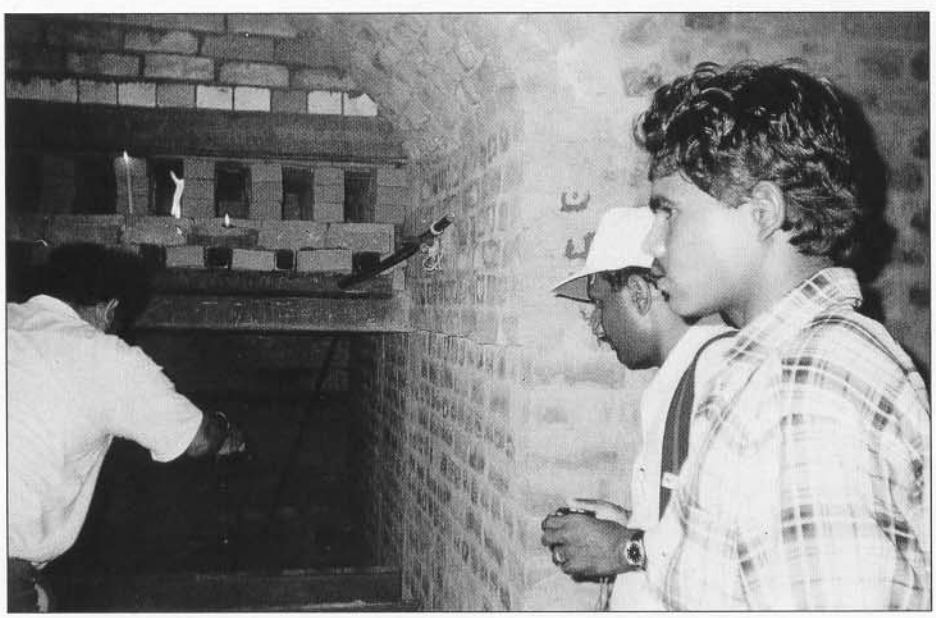

Fig. 5: Start of firing the kiln in May 1997.

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What is basin?

The building advisory service and information network (**basin**) - of which GATE/GTZ is one of the founding members - was set up in 1988 to provide information and advice on appropriate building technology and to create links with know-how resources in the world for all those in need of relevant information.

basin attaches importance to giving individual specialised support to its clients whilst balancing this with the comprehensive view that comes from the long and diverse experience of its partner organisations.

basin porvides a comprehensive range of expertise, experience, knowledge and skills for the support of new initiatives in the low-cost building sector.

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