basin BUILDING PARTNERSHIPS

Wall Building
Case Study
building advisory service and information network

Vertical Shaft Brick Kiln - Technology Transfer Indian Experience - 1

1 Introduction

Sectoral Context

Shelter forms one of the basic needs of humankind next only in importance to food and clothing. With rapidly increasing population in countries like India it is a colossal task to provide shelter to the teeming millions. Government and non - governmental organisations have tried to address this problem and come out with various schemes and technologies to bridge the ever widening gap between the need and availability of dwelling units in the country.

In meeting the walling material requirement for this quantum jump in construction of dwelling units, it is expected that burnt clay bricks will continue to be the principal walling material, in spite of various alternative technologies based on local and sustainable resources propagated for providing low cost housing to the millions.

The current technologies prevalent for firing clay bricks in the country such as intermittent clamps and continuous Bull's trench kilns consume huge quantities of energy. The emissions from these kilns have high negative impact on the environment in terms of damage to the people and crops in the nearby areas, and contribution of CO_2 emissions for global warming. Thus, any technology for augmenting supply of burnt clay bricks with lower specific energy consumption and promising lower negative impact on the environment would merit consideration for adoption.

VSBK technology in China

In China, a technology claiming high energy efficiency and consequent lower emissions has been developed over the past three to four decades and has had wide dissemination in more than ten provinces of the country. It is the Vertical Shaft Brick Kiln (VSBK) technology which has spread widely in recent times. VSBK essentially consists of one or more rectangular shafts within a kiln structure, where dried green bricks are loaded at the top along with powdered fuel - coal. These move down through the preheating, firing and cooling zones and are unloaded at the bottom. The details of concept, design and operation of VSBK's have been covered in detail in other literature (References 1 to 5) and so is not repeated here. It is reported that there are more than 50000 kilns operating in China now with more than 3000 in Funan county alone. The main reasons for the success of the technology are - about 40 to 50% reduction in energy consumption, simplicity of operation and economic viability.

It was in this context that the transfer of VSBK technology from China to India and its dissemination after validating its suitability to Indian conditions was conceived.

VSBK technology route-from China to India

The first VSBK outside China is reported to have been established in Nepal. Subsequently VSBKs have been constructed in Bangladesh, Pakistan, Afghanistan and lately in Sudan. The projects in these countries have met with varying degrees of success and setbacks. The experiences have been documented in literature such as Reference 3 which deals with the experience in Pakistan. This information on lessons learnt from the earlier experiences was helpful in formulation of the current project.
This case study tries to give an account of the Indian experience detailing the steps taken to ensure effective transfer of technology to India.

VSBK Project in India - Main agencies involved

Development Alternatives, a leading NGO with concerns for sustainable livelihoods, conceived an action research programme on sustainable production systems for construction material including kilns for burning bricks. The Swiss Agency for Development and Co-operation supported the project, within its "Energy Efficient and Renewable Energy Sources" programme.

The Tata Energy Research Institute -a major Indian organisation in the field of energy and environment was another significant member of the project team, contributing to the energy aspects. SKAT and Sorane - two Swiss consulting organisations were assigned advisory and backstopping responsibilities for the project. A Chinese expert team from the Henan Academy of Sciences was engaged on a long term basis for providing the technology support.

2 Objectives - Strategy - Implementation

Four main steps and the role of the implementing agencies in the network as envisaged were:

1. Baseline studies for auditing the energy and environmental aspects of brick production in various traditional high volume brick production areas:
   - Energy Audit by Tata Energy Research Institute (TERI),
   - Environmental Audit by Environment Services Branch of Development Alternatives.

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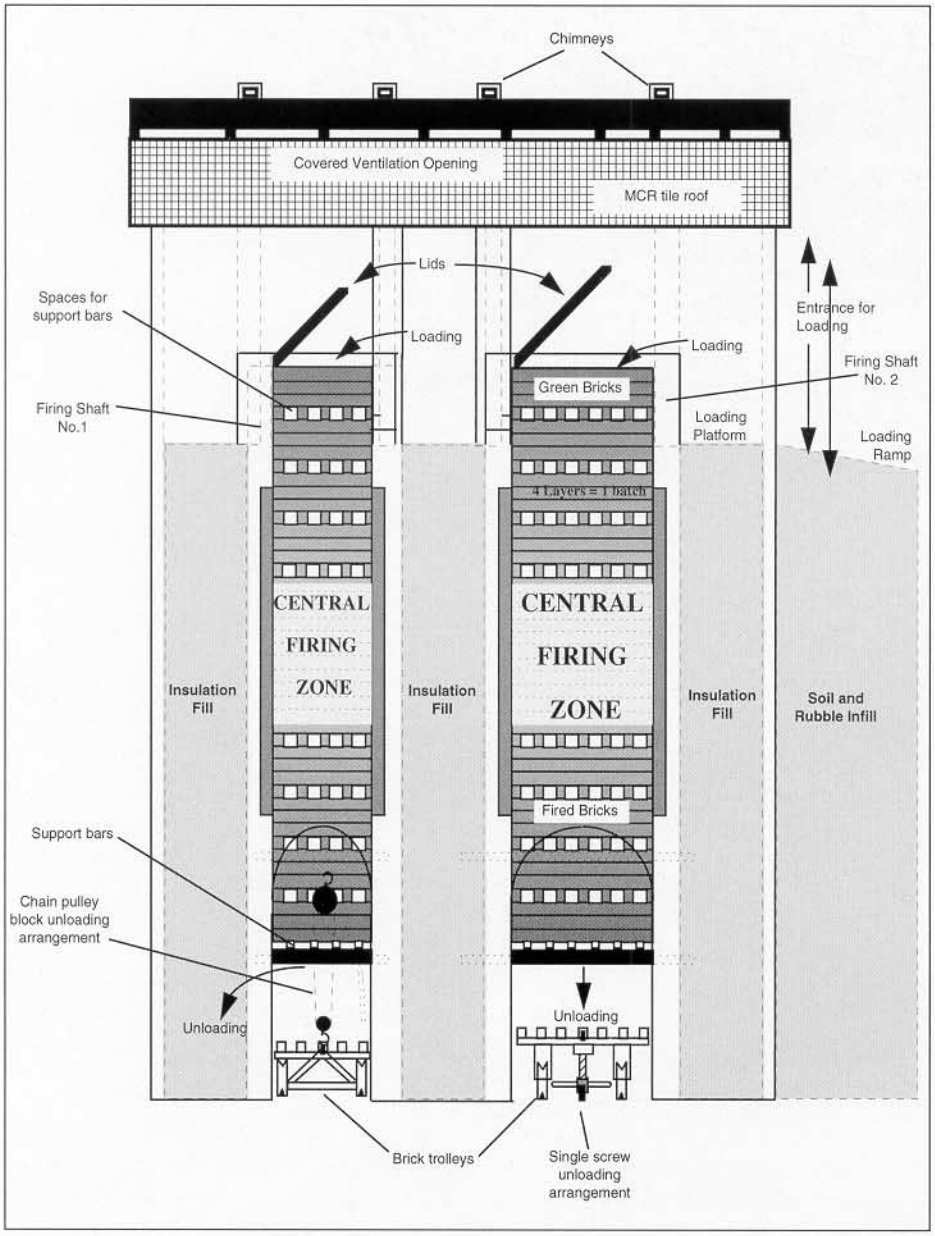

Fig. 1: A cross-sectional schematic diagram of VSBK-1

2. Design, construct and operate two pilot kilns in two distinctly different agro-climatic geographical areas:
   - association of Chinese Experts for the full period,
   - association of brick kiln entrepreneurs for construction and operation of the kiln,
   - advice of backstopping consultants through different milestones for periodic evaluation and mid course correction,
   - DA to undertake implementation and overall co-ordination.

3. Evaluation and Validation of technology:
   - Environmental Services Branch of DA for Environmental Audit,
   - TERI for Energy Audit,
   - DA for operational & economic audit and overall co-ordination in association with outside players in brick industry.

4. Market study and Large Scale Dissemination if the steps 1 to 3 pass the requirements as one moves progressively through a carefully planned decision tree.

Initially, the main objective of the sub project was to asses the potential of VSBKs against the Bull's Trench Kiln (BTKs) in terms of energy saving, environmental aspects and economic operation, and if found favourable, to study the market, validate the technology and plan for wide dissemination of the technology.

Initial Implementation

The first steps in the implementation of the project were carried out in 1995. These were the baseline studies of BTK operations in significant brick production areas in Bhognipur - Kanpur belt and in Pathankot area. Environmental Audit and Energy Audit were conducted by the respective agencies between April and October 1995.

In January 1996, a team consisting of DA coordinator and the backstopping consultants visited Peshawar, Pakistan to learn from the experience of VSBK technology transfer in Pakistan.

Main observations and recommendation which evolved out of the mission to Pakistan are given below. Observations in Reference 3 are also relevant in this regard:

- VSBK technology is not yet sufficiently developed as an alternative to large scale brick production.

- Further basic technology development is required to optimise operating parameters and economy.

- The VSBK probably operates most successfully in a decentralized set up where owner and family are fully and continuously involved.

- The project team should construct and operate a two-shaft VSBK, preferably on its own and/or in a protected environment independent of interference from kiln owners.

- The building up of local know-how as well as basic acceptance is vital for the dissemination and sustainability of VSBK technology. For this, two teams for construction and two firing crews should be trained, DA experts must lay their hands on and work on all phases of operation while learning from their Chinese counterparts and be responsible for the operation, especially for the firing.

- First audit the energy and environmental factors and evaluate overall performance and then plan for dissemination.

- The Chinese expert team - the technology provider - should be associated with the project on a long term basis.

With the strategy revised in accordance with the above, it was decided to set up the first VSBK in India in an area where clamps are prevalent for brick making. It was also decided that the kiln would be constructed and operated by the Development Alternatives team under controlled conditions so that the technology absorption and any adaptation necessary to meet the requirements under Indian conditions, identified by the project team, could be implemented.

Implementation

The implementation on the ground started with this background. A participative approach was adopted with all the team members involved in decision making and planning and significant aspects reviewed and guided by the consultant backstoppers.

Design

The designs and drawings were prepared by the Chinese team with the DA team actively participating in the process and providing all the required data relevant to Indian and local conditions of material availability, standardisation and construction methodology. Energy experts from TERI and environmental experts from DA made significant contributions not only in their respective fields but to the development of the overall concept.

It was decided to include as many alternative features in the design of the kiln as possible so that the Indian team got familiar with the various options available and as a result technology absorption is accelerated. Thus, the two shafts (both of 8 batches height) were of two different sizes 1m x 1m and 1m x 1.5m. The unloading device for the smaller shaft (Shaft no. 1) was to be of chain pulley block design, whereas the bigger shaft (Shaft no. 2) was to have single screw unloading mechanism. Loading platform had a monitor roof for better ventilation and two chimneys per shaft were provided to evacuate the exhaust gases (Fig. 1).

Site selection

A rapid survey was conducted in the clamp areas around Jhansi initially by the DA energy team which shortlisted about 11 locations. This was reviewed by the Chinese experts, DA project team and the backstopping consultants and final decision taken to locate the first Indian Vertical Shaft Brick Kiln at Datia in Madhya Pradesh state of India. The site was to be leased / rented / bought by the project so that operations could be conducted under controlled conditions.

Construction

The construction activity was thoroughly planned with a detailed work breakdown structure and all the players in the team assigned their respective responsibilities and time schedules. In an interesting and effective planning seminar, the backstopper made sure what each team member would do and would not do.

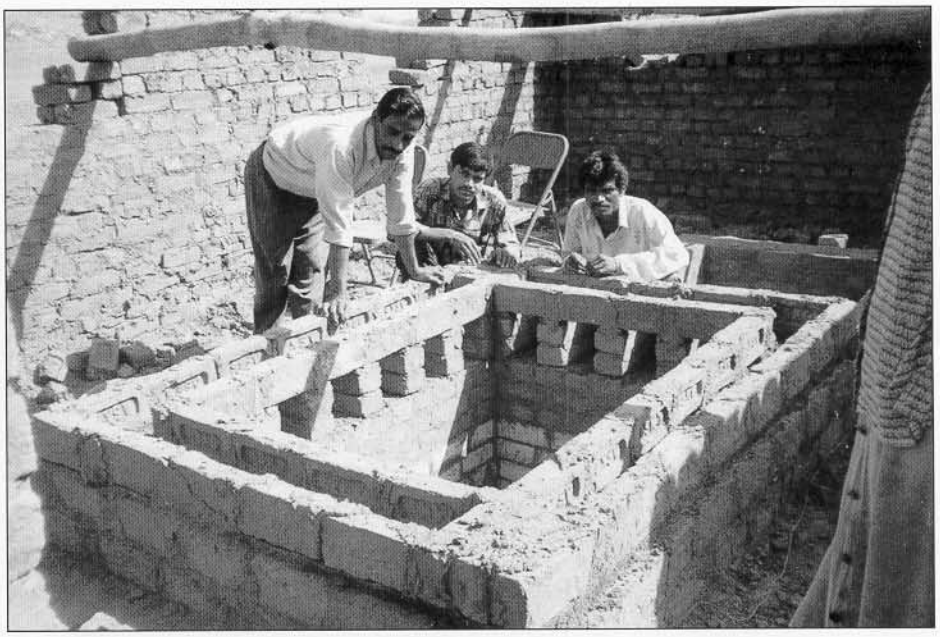

Fig. 2: Shaft No 2 showing flue passage

The construction of the kiln started on 13 March 1996. Expert masons from DA and local labour formed the main construction force. Chinese craftsmen actively participated and guided the Indian team during all stages of construction. Constant supervision was provided by the Chinese experts and DA engineers. Energy experts from TERI and environment experts from DA made periodic visits to ensure compliance with their concepts and requirements (Fig. 2).

Specialized mechanical equipment was manufactured locally (Fig 3). DA engineers planned and executed all stages of work - procurement of materials and components, fabrication, assembly and testing. DA and Chinese engineers provided periodic advice and guidance to the local manufacturer. That the local manufacturers have imbibed thorough capability in manufacture is evident from the fact that later orders for the other kiln were executed by them without any hassle.

For the actual construction of the kiln and the operating room, a team of about 5 masons and 10 helpers was engaged (not all were working at the same time). The larger number was engaged to create a group of workers who have acquired the skills of constructing the VSBK (Fig. 4).

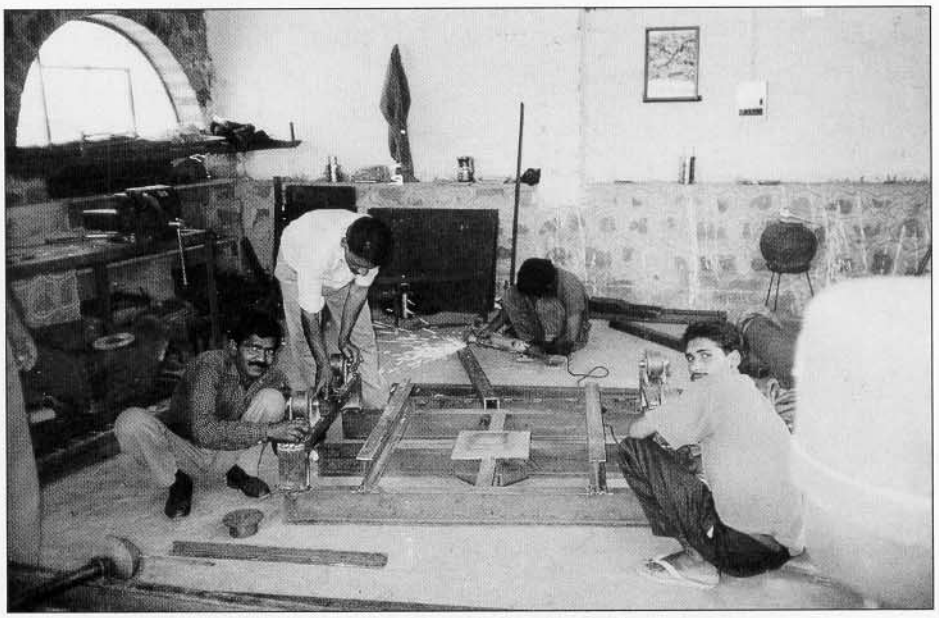

Fig. 3: Manufacture of trolleys at ATC workshop in Orchha