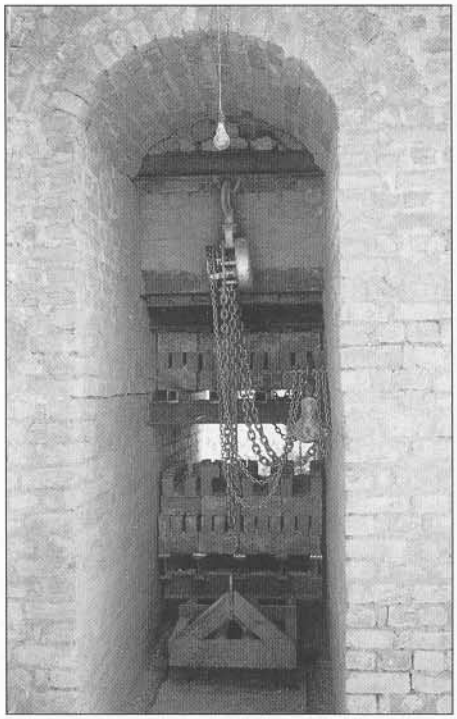

Fig. 4: Shaft 1: Chain pulley unloading arrangement

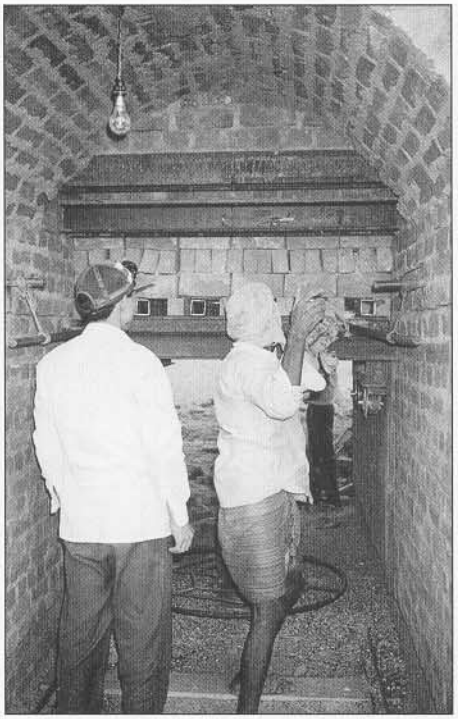

Fig. 5: Single screw unloading mechanism

The construction had a smooth run apparently due to the thorough planning done in the beginning, and was completed in about 45 days. The first shaft was fired on 30 April 1996 (Fig. 5).

Operation

Green brick supply was planned through the conventional methods prevalent in the area, to enable evaluation of performance of firing in VSBK in comparison with the clamps, keeping the other parameters in brick production similar. The conventional method employs winning clay by manual means, mixing with wheat straw and coal ash (from power plants and foundries) with the clay, and hand moulding using wooden steel- lined moulds. Green bricks were dried in the open and carried to the loading platform using animal power - donkeys. Coal from Jharia fields was procured from local sources, of size less than 6mm. A team of about 18 firemen was engaged locally for operating the kiln, who worked under the guidance and supervision of the Chinese expert and technicians. Facilities were created for the Chinese and DA technicians to stay at site during the operation phase to ensure attendance throughout day and night.

Variety was adopted in initial firing also. The Shaft No. 1 was lighted from the bottom (on 30 April 1996) and Shaft No.2 was fired from the top (on 10 May 1996).

The DA operating team members worked hand in hand with their Chinese counterparts, staying throughout the operation at the site. The Indian firemen had no difficulty in acquiring the requisite knowledge and skills for operation of the kiln and the confidence for facing any exigency arising therein. Those firemen who showed good performance and leadership qualities were upgraded as firemasters.

The operation of the kiln continued till 25 June 1996 when it was shut down for the rainy season. Various campaigns of operation, with different clays and various mixes of clay for moulding, were conducted. Environmental conditions were monitored by the ESB team of DA and Energy Audits conducted by the TERI team.

3 Results and learnings from VSBK 1

The overall findings after this phase of operation were as follows:

- Quality of bricks produced - better than those produced in nearby clamps in terms of ring and colour. But the

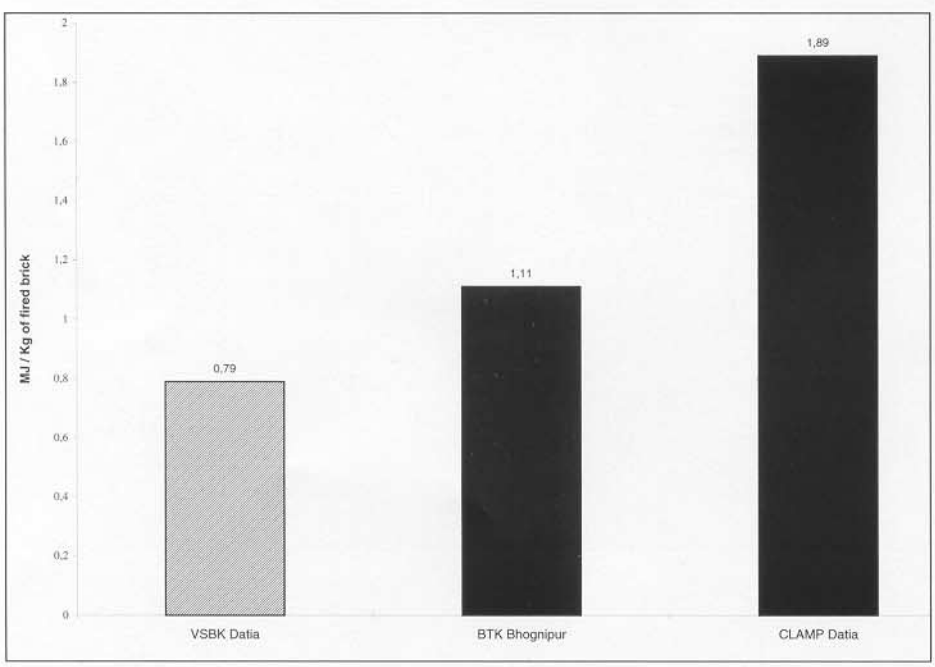

Table 1: Specific Energy Consumption - A comparison

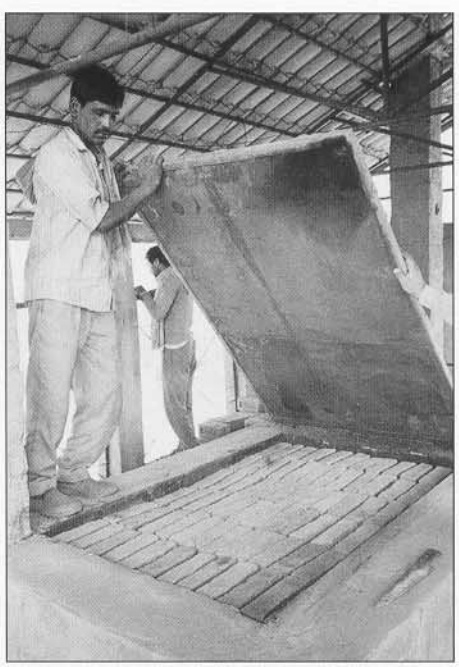

Fig. 6: Top of shaft showing Lid arrangement

quality is not as good as in traditional BTK areas, ostensibly due to inferior clay quality.

- The compressive strength (between 65 kg/cm^2 and 110 Kg / cm^2) and water absorption (around 15%) is functionally sufficient.

- The breakage of bricks during the firing is only about 2 to 4%.

- Lower level of emissions - within acceptable limits. But there is scope for improvement for working environment at the loading platform.

- Energy saving is confirmed (about 30% compared to BTKs and 60% compared to local clamps – see histogram attached - Table 1).

- Technology is viable with reasonable margins for the entrepreneur. As VSBK 1 is an experimental kiln, the cost figures obtained could only be indicators. Scope for increase in margin identified - by reduction in cost of green bricks, reduction in capital cost and increase in scale of operation.

- There is no problem envisaged in the absorption of technology by the Indian personnel.

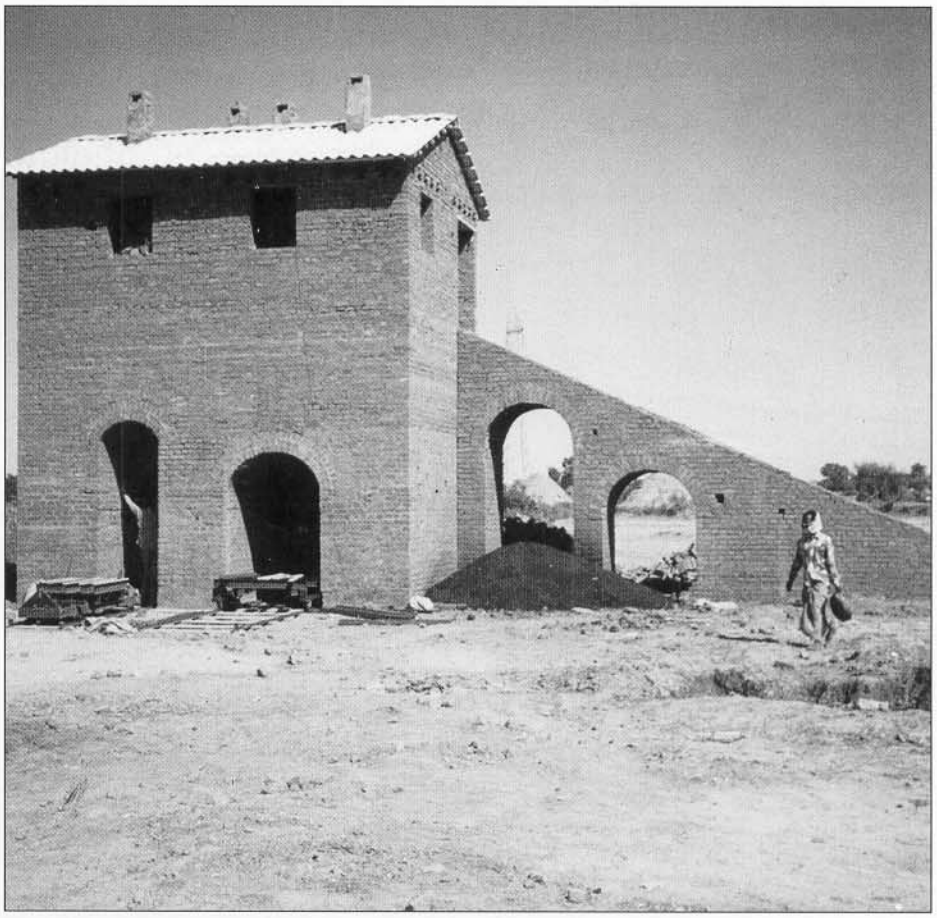

Fig. 7: Kiln after completion of construction before modification

Mid Course Review and Modifications

At this stage a workshop an "Status and Review of VSBK technology in India" was held on 27-28 June 1996 with participation of stakeholders, project team members and backstopping consultants. The group deliberated at length on all aspects of the technology transfer and performance of the project. Some ideas for further improvement in the energy and environment aspects evolved during the discussions and it was agreed to incorporate some modifications to the kiln to achieve these benefits. The major changes identified for implementation are:

- Open out the loading platform by replacing the walls with columns and grills,
- Increase height of shafts by one batch from 8 to 9,
- Increase the height of stack by about 1 metre,
- Increase the gap in roof monitor from 350mm to 700mm,
- Provide flues and dampers at two levels at the top of the shaft,

Fig. 8: Kiln after modification

- Provide lids for the shafts which can be kept closed while not loading bricks (Fig. 6).

These modification were incorporated in the kiln during October - November 1996 within the idle period of shut down due to rainy season (Fig. 7 and 8).

The workshop also evolved guidelines for setting up the second VSBK in India through a partner organisation to DA. The experience of this VSBK 2 forms the subject for case study 2.

Second phase of operation

The second phase of operation started by the end of December 1996. It is a measure of confidence in their learning that the DA team fired the shaft on their own pending arrival of the Chinese team.

The operation of the kiln was continued as in the first phase with various campaigns of different clays, different mixtures for green brick production etc. The energy and environmental aspects were monitored at different intervals. The kiln was shut down again for the rainy season by the end of May 1997.

The overall results show that the improvement in energy efficiency over the first phase is marginal whereas there is definite improvement in the environmental aspects at the work place which meet the national standards for the various parameters such as SPM, SO_2 , NO_2, CO etc.

Achievements

The following can be considered to have been achieved as a result of the VSBK technology transfer experience:

- Energy efficiency of VSBK established - other aspects of operation are also promising.
- Design improvements so that the working environment meets the relevant national standards.
- Groups of masons, firemasters, firemen and supervisors trained on the job.
- Indigenous capability built up for fabrication and manufacture of specialised mechanical equipment such as unloading device, trolleys, lid systems etc.
- An efficient energy monitoring and feed back system has seen established with TERI and for environment monitoring with DA.
- Through this monitoring system, the needs and potentials for further improvement have been identified.
- R & D work was conducted to further improve energy and environment efficiency of VSBK and further possibilities identified.
- VSBK design, construction and operation guideline documents have been prepared.
- A very good project team and cooperation between different actors and organisations has been established.

Further work

The performance of the project was reviewed in the Analysis and Outlook Workshop held during 3-5 June 1997 with wide participation. It was mainly planned to continue the good work done with the aim of further improving the performance of VSBKs in terms of quality, volume of production and economic viability. Earlier a mission consisting of DA and TERI experts and backstopping consultant visited VSBKs in China mainly for understanding the factors leading to their wide dissemination and the methodology. The findings were presented in the workshop. Some of the actions agreed during the workshop are: improving the quality of green brick production by installing extruders, building kilns with larger shafts for higher volume of production in an area with good quality clay availability, and monitoring and optimising economic performance.

Conclusion

The project team received appreciation from the stakeholders and backstopping consultants during the periodic review and evaluation missions. This greatly encouraged the team to put in greater efforts to achieve the aim and objectives of the project. The concerned officials of DA, SDC and TERI provided constant support and guidance to the project team. The project team acknowledges this as of great value in successful implementation of the project.

Text by

K. R. Lakshmikantan, Development Alternatives, B 32, TARA Crescent, Qutab Institutional Area, New Delhi/India

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
- Project Documents.

Published by **gate**

German Appropriate Technology Exchange
Dag-Hammarskjöld-Weg 1 - 5
Postfach 51 80
D-65726 Eschborn/Germany
Phone + 49 - 6169 - 79-3190
Fax + 49 - 6196 - 79-7352
(1998)