

PROJECT COMPLETION REPORT

March 2000

Title of project: Energy efficiency in small scale brick making
R 6483
Organisation: ITDG
Reporting period: April 1996 to March 2000

1. Objectives of the project:

The purpose of the project is:

“to provide information on methodologies for promoting fuel efficient technological change for small scale brick producers world-wide”.

The objectives of the project were described as follows:

- a) In the first phase, the project will assess the needs of the brick makers (consolidating work already carried out and moving into new areas of Peru and new countries in the region), identify appropriate technologies and techniques for adaptation, and document experiences from elsewhere in the successful transfer of technologies.
- b) Phase 2 will involve working closely with brick makers on the adaptation of technologies to suit local conditions in Peru and one other country in Latin America, assumed to be Ecuador. This will draw heavily on the experience and expertise of IT Zimbabwe.
- c) Phase 3 will focus on the development and testing of appropriate methods and materials for transferring proven energy-efficient technologies to other brick makers in Peru and subsequently Ecuador.
- d) Phase 4 will start with an evaluation of the output and impact of the project so far, followed by a discussion of their relevance at the regional level. Both the evaluation and the ensuing workshop will provide important inputs in the Guide for Technology Transfer to small-scale Brick makers.

2. Summary of project work carried out

Field research, technology transfer and development

This project supported an in-depth review of the technologies and processes used in the small scale sector which lead to the up-take of coal/boiler waste fired clamp technology in Zimbabwe. These informed the detailed development of project work in Latin America and identified gaps in existing knowledge and practise. For example, the project team determined that the technology which was due to be transferred from Africa to Latin America was not suited to local conditions. Subsequently a process of development of local alternatives that would increase energy efficiency using alternatives to fuelwood begun.

Research identified another limitation on the effective transfer and comparison of technologies, that is the lack of a standard methodology for comparing energy efficiency in small scale brick firing. Considerable international debate and effort resulted in the development of such a methodology which is based on field tests along with some input from laboratory testing.

52 trial firings were undertaken in eight locations in Peru, Ecuador and Colombia in partnership with brick makers as an integral part of the technology development, transfer and adaptation process facilitated by the project. These have been as follows:

- 27 trial firings in Peru
- 9 trial firings in Ecuador
- 1 trial firing in Colombia

Four workshops, national and international (see below for the list of associated papers/presentations), have been organised to enable exchange of experience between individuals and organisations working in Peru, Ecuador, Bolivia, Brazil, Zimbabwe, Colombia and UK. Partnerships evolved with key partners and ITDG collaborators in support of project thinking and processes e.g. Prof. A. Barriga of ESPOL, Quito, Ecuador who subsequently developed the national team to include staff from ESPOCH, SECAP and FEDETA; in Peru organisational linkages developed with SENCICO and ITACAB; CORPOTUNIA have more recently adopted technologies for trial and dissemination in Colombia. Occasional support has also been given by UK based experts including Ray Austin.

Technology transfer and development have proven to be organic processes based on practical experimentation in several locations (3 in Peru, 2 in Ecuador and 2 in Colombia), as well as exchange between the stakeholders engaged in work at each demonstration site i.e. brick producers, firers, mechanics and equipment producers, technicians, professionals and their organisations. Exchange visits have been a key element in developing the technical skills of small scale brick makers and have included:

- two visits by La Huaca brick makers to Ayacucho;
- one visit by La Huaca brick makers to Trujillo;
- one visit by Trujillo brick makers to Ayacucho;
- one visit by Trujillo brick makers to Cajamarca;
- three visits by Trujillo brick makers to Piura;
- two visits by Trujillo brick makers to Chambo, Ecuador;
- one visit to Piura from Cajamarca, Ayacucho, Chambo.

Development, transfer and adaptation of hardware has included the following items of production and firing equipment:

- Pendulum Clay Crusher, Parry Associates, UK
- Locally manufactured, manually operated extruder
- 5 petrol fired engines with air pumps and oil jets for firing with recycled engine oil in Cajamarca, Ayacucho and Piura in Peru; Chambo in Ecuador and Tunia in Colombia. Engines are second hand, two of which purchased in Trujillo the site of the original technology development, one bought by brick maker (Don Juan Francisco Coronado), one bought new in Ecuador and the last by the brick makers of Tunia.
- Construction of two Scotch kilns, one in La Compania, Ayacucho of 23 000 brick capacity and one of 13 000 brick capacity in La Huaca, Piura.

Information exchange and dissemination:

Several local, national and international workshops have been supported by the project, creating the space for exchange of ideas, exploration of issues arising from field studies and action research, project development and ultimately the establishment of working relationships between professionals, technicians and brick producers:

- 15-17 February 1997 – early international, issues based, discussion to develop project thinking, processes and partnerships.
- 10-12 February 1998 – international team discussions engaged brick makers, cola suppliers and national technology transfer organisations in debate on participation in technology transfer, revision of the energy efficiency monitoring methodology as well as practicalities of project implementation.
- November 1999 – regional training workshop for Peruvian and Ecuadorian brick makers held in Riobamba, Ecuador for brick makers, project staff and consultants to consolidate and enhance technology adoption and adaptation.
- February 2000 – international workshop involving brick makers, technicians and professionals to consider project implementation and future opportunities.

National and regional dissemination and capacity building has been enhanced through collaboration with SENCICO (Servicio Nacional de Capacitacion en la Industria de la Construccion) and ITACAB (El Instituto de Transferencia de Tecnologias Apropriadas del Convenio Andres Bello) in Peru; ESPOL (la Escuela Superior Politecnica del Litoral), ESPOCH (la Escuela Superior Politecnica de Chimborazo), FEDETA (la Fundacion Ecuatoriana de Tecnologia Apropriada) and SECAP (el Servicio Ecuatoriano de Capacitacion Profesional) in Ecuador; CORPOTUNIA (la Fundacion para el Desarrollo de Tunia) and SENA (el Servicio Nacional de Adiestramiento) in Colombia whom assisted in the elaboration of the transfer methodology and activities.

3. Results of findings

Dissemination documentation

Project research and activities have enabled project staff, consultants and partners to produce a considerable number of dissemination outputs; these are listed below.

1. Barriga A. Brick manufacturing problems in Ecuador. Lima, February 1998.
2. Barriga A. & Zabala G. Analysis of the operations of brick factories in Ecuador. Applications of rational use of firewood. Guayaquil , February 1997.
3. Carneiro R. Reforesting.Dendroenergy: The Latinamerican experience. Managua, February, 1997.
4. Corria M. Substitution of the firewood by sugar cane in the Brazilian brickmaking industry. Campinas, February, 1997.

5. Diaz R F, Analisis de Los Hornos Ladrilleros de Chambo, Ecuador, February 2000.
6. Jara M. The brick firing process using coal in Piura and Ayacucho. Lima, February 1998.
7. Jara M. Diagnostic of artisanal clay brick making production in Piura. Lima, February, 1997.
8. Jara M. Diagnostic of artisanal clay brick making production in Alto Mayo. Lima, February 1997.
9. Jara M. Technological diagnostic of artisanal clay brick production in Ayacucho, Lima February 1997.
10. Jara M Analisis Y mejoramiento del sistema de produccion artisanal de ladrillos a pequena escala en el valle de La Compania, Ayacucho, February 2000.
11. Lowe, L. Energy efficiency & technology transfer. Rugby, March 1998.
12. Lowe, L. Participaty technology Development. UK, February `1998.
13. Mason, K. Literature Review, Discussion of a Standard Methodology for the comparison of energy use in brick production, and technical recommendations for project development, August 1996.
14. Mason, K. Energy Efficiency in Small-Scale Brickmaking: Experience of the Intermediate Technology Development Group in Zimbabwe, Science, Technology & Development, Vol 15 No1 April 1997.
15. Mason, K. Solidarios. Zimbabwe, February 1998.
16. Mason, K. Assessing the technical problems of small scale brickmakers. Zimbabwe, (February 1998 – published December 1999; also published in Spanish).
17. Mason, K. Evolving a standard to compare the energy efficiency of brick firing processes. Zimbabwe, (April 1998 – published as How to measure the energy used to fire clay bricks December 1999).
18. Mason, K. Energy consumption of brick firing: Case study – Fambidzanai. Zimbabwe, January 1998.
19. Mason, K. Small-scale brick firing: The experience of ITDG in Zimbabwe, February 1997.
20. Mason, K. Ten basic rules for energy and cost efficient brick firing. Zimbabwe, (May 1997 – published as Ten Rules for energy efficient, cost effective brick firing December 1999).
21. Mayorga E. Use of rice husks as fuel in brick factories. Lima, January 1998.
22. Mayorga, E & Sánchez, T. Energy efficiency in small scale brickmaking. Piura, December 1998.
23. Mayorga E. Adaptation of brick production technologies in Peru. Lima, February 1998.
24. Mayorga E & Rodriguez L Tercnicas de Construccion de Hornos Artesanales Para Quemar de Ladrillos, January 2000
25. Mayorga E & Marquina J, Metodologia de Transferencia Aplicada por el proyecto en Peru. Resultado de las actividades en Piura y Cajamarca, February 2000.
26. Penafiel S El Componente de Genero en Chambo, Ecuador, February 2000
27. Saavedra, M. Use of firewood and other fuels in small industry. La Paz. February 1997.
28. Sanchez J. Methodology for the transfer of appropriate technology in rural areas. Lima, February 1998.

29. Schilderman, T. Sustainable materials production: A question of energy?. La Habana, December 1998. Published as Sustainable Small-scale Brick Production: A question of energy? A technical brief by ITDG in English and Spanish March 2000.
30. Tawodzera, P. Use of brickmaking equipment. Zimbabwean experience. Lima, February 1998.
31. Zabala G Limitaciones para la Transferencia de Tecnologia en Chambo, Ecuador February 2000.

In addition to targeted information more general publicity has been gained through local, national and international media channels including printed press, radio and TV coverage. For example, Hands On – Brick by Brick broadcast by BBC World Service; February 2000 workshop resulted in 5 articles in regional and national newspapers; 1 radio interview with project staff for Cultivalu, another with Andina de Radiodifusion and 2 further mentions by other national station; interview with project staff on Panamerica Television aired twice.

Articles in journals, newsletters and sector specific web based databases has given the project exposure to an interested audience and resulted in follow-up enquiries enabling information outputs to be disseminated further. For example:

- **basin** news: Energy Efficiency and Technology Transfer, May 1998; Report: Brick by Brick May 2000
- Abstract to be included on **basin** Knowledge database: <http://www.gtz.de/basin> before June 2000.
- DFID Energy Newsletter: Issue 6 May 1998, Issue 10 May 2000.

4 Implications of the results for achieving the objectives of the project

The combination of research and action in the field mean that there are now brick makers with improved, more energy efficient production capacity and an enhanced ability to adapt practices in the light of changing environmental pressures and commercial imperatives in Peru, Ecuador and Columbia. Overall energy consumption among producers in Cajamarca using the improved technologies as reduced by 75% and 47% in Piura. In the demonstration area of La Huaca, 62% of producers are now using alternative fuels, fuel costs have been brought down by 30% leading to a reduction of total production costs in the region of 15%.

The majority of the lessons learnt during the project implementation have been captured by the project's collaborative activities, dissemination outputs, quarterly progress reports and the end of project evaluation.

The above results clearly demonstrate that the project outputs have to a large extent been achieved. Evidence also exists to show that output to purpose impacts exist in terms of the indicators given in the logical framework i.e. that a number of institutions in Peru, Ecuador and Colombia are actively engaged in employing the technologies and transfer methodologies employed and developed by the project. Individuals and institutions concerned with issues of energy efficiency and small scale brick production in other continents have also benefitted from sharing in the lessons learnt via communications outputs.

The EoP evaluation report identifies shortcomings in the project's ability to develop national capacity to sustain a process of technology dissemination in Peru. The project has resulted in the establishment of an informal network of professionals in the region whom belong to institutions (listed above under section 2) focused on technology transfer. It has also raised awareness among the government of Peru for the need and potential of establishing national/regional initiatives in support of artisanal brick makers. Project partners in La Huaca gained recognition from the Banco de Materiales, of the Ministry of Housing, and were given credit to reconstruct their kilns post-El Nino. Peru's Ministry of Energy also consulted project staff to inform the national statistical records on energy usage in the brick making sector.

A project proposal for new work was developed and subsequently funded by USAID and integrated into the programme of work in 4 Latin American countries; the main focus of this work has been to develop the technological capability to employ rice husk ash in order to completely substitute for fuelwood in brick firing. Another project proposal is currently being elaborated with GERES, in France, and partners in 4 Latin American countries to introduce Chinese VSBK technology in addition to undertaking comprehensive surveys into all the existing technologies and the requirements for optimisation of the same.

An international project proposal has not yet been prepared but ITDG wishes to develop the discourse with DFID KaR's Energy Adviser in order to identify which of the areas of need, identified by ITDG in several countries, they are interested to support in the future.

5) Priority tasks for follow-up

Many of the project outputs are in the form of dissemination materials. These documents and videos have been, and will continue to be, distributed via ITDG's staff contacts and networks such as the building advisory service and information network; DFID websites and ITDG's international technical enquiry service. Additionally direct mailing of materials to a targeted audience will continue. Some feedback from recipients of project information has highlighted that the materials meet demand from intermediaries working in the building materials sector.

This research project has informed ITDG's wider programme of activities in the small scale brick production sector including work on development and application of alternative fuels such as by-products of agro-processing; technological improvements in production processes in order to achieve increased energy efficiency and commercial viability. Much of this work has been funded by a range of private and public sector donors and consultancy opportunities. These initiatives include the use of rice husk ash in Peru; a range of participatory technology development activities in Sri Lanka; support to establish productive co-operatives, influence national policies and build local markets in securing livelihoods of peri-urban communities in Eastern Sudan.

The above range of initiatives are currently being pursued under, and have fed into the development of, ITDG's International Shelter Strategy which states:

The programme aims to improve poor people's livelihoods. In doing so, it subscribes to the Rio declaration (1987) to "develop the needs of the present generation without compromising the ability of future generations to meet their own needs". This implies a very careful use of their assets, in particular their natural capital, so that living environments are improving rather than deteriorating, and resources are not exhausted or damaged. It also raises the issue of how waste can be minimised and returned to the environment in safe ways. In attempting to achieve this, the programme has much experience to build on, e.g. in terms of a more efficient and diversified use of energy in building materials production; there has also been some work on more responsible quarrying and the use of residues as fuel.

New activities identified in the strategy document include the following:

- Continue to research the reduction of the environmental impact of the most polluting building materials industries, such as heavy clay products and binders. This will build on ongoing work and should lead to one or more publications.
- Develop technologies to reduce, recycle and safely dispose of waste, in that order. The programme will encourage building materials producers, builders and residents to produce less waste, e.g. by more systematic quarrying. Secondly, it will investigate how current waste can be re-used as a resource for building materials production or fuel. And finally, it will address the safe disposal of all remaining waste in productive or residential environments. This is an issue cutting across most current projects, which can be adjusted to address it better. Some specific new work needs to be undertaken, e.g. in Zimbabwe and Kenya, to explore the recycling potential. And it would be beneficial to incorporate the research into the use of residues as fuel in brick production, ongoing in 4 countries, into a single international research project leading to a publication.

There is a clear need to build on the work to date to address issues impacting on the environment and the livelihoods of SMEs in the small scale building materials production sector, yet, failure to identify donor support for further research and implementation has constrained progress.

6) Summary of financial expenditure

Financial year	1996/97	1997/98	1998/99	1999/2000
Personal emoluments £	37,571	40,763	43,878.49	47,339.00
Capital costs £		10,000		
Other charges £	22,764	22,496	18,741.77	45,424.74
VAT £				
Total costs £288,978	60,335	73,259	62,620.26	92,763.74

7) Name and signature of author of the final report

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