

# ASIA BRIEF

## NEW APPROACHES IN THE VIETNAMESE BRICK SECTOR PARTNERSHIP RESULTS



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### EDITORIAL

*The Asia Briefing Paper Series aims to inform the development practitioners and the (Swiss) public about new innovations, results and impacts of Swiss development cooperation in Asia. It shall particularly highlight past and present efforts to achieve aid effectiveness through partnerships between Swiss agencies and local partners.*

*Pradeep Itty, Head East Asia Division*



*Mechanized Bricks-production in Nam Dinh Province, Vietnam*

### RESULTS OF THE SWISS PARTNERSHIP WITH THE VIETNAMESE BRICK INDUSTRY

The partnership of the government of Vietnam and SDC in the Vietnam Sustainable Brick-making Production (VSBP) aims at making the brick sector sustainable – socially, environmentally and economically.

#### SOCIAL IMPROVEMENTS

The traditional brick industry is a low-investment, seasonal activity unfolding under difficult working conditions:

- 1. Selective mechanization:** green brick-making has been improved by selective mechanization such as a winch loading system, small extruders and hydraulic unloading systems, but is still not fully automatic.
- 2. No health hazards through pollution:** through the introduction of air flow control devices on Vertical Shaft Brick Kilns (VSBK, see below), workers are no longer exposed to toxic flue gases such as CO (carbon monoxide) and SO (sulphur oxide) when loading the kiln.
- 3. Small and medium-sized industries:** The partnership has provided viable intermediate technical solutions: instead of replacing traditional kilns with fully automated industries, the transformation process can be socially “cushioned”.

#### ENVIRONMENTAL IMPROVEMENTS

The brick industry consumes large amounts of coal and thus produces emissions that are harmful to the local and the global environment.

- 1. Less flue gases that pollute crops:** toxic flue gas emissions were affecting the surrounding crops and this had led to high compensation payments.
- 2. Reduction in CO<sub>2</sub> emissions:** Every brick produced in an inefficient traditional kiln consumes up to 500 grams of coal. This can be reduced to 110 grams if fired in the most efficient kiln. The over 300 VSBKs are already saving some 150,000 tons of CO<sub>2</sub> per annum

or the equivalent of compensating 75,000 flights from Europe to Hanoi.

- 3. Hollow bricks:** while traditional kilns can produce only solid bricks, modern kilns can produce hollow bricks that consume much less energy for firing, use 40% less clay, and have much better insulation standards. Better insulation can lead to considerable energy saving over the lifespan of a brick if the energy spent on heating and cooling can be reduced.

#### ECONOMIC IMPROVEMENTS

The partnership has introduced intermediate technologies and overcome the dichotomy between choosing either traditional, polluting kilns with investments in the order of 10,000 to 35,000 dollars, and modern tunnel kilns with an investment of several million dollars.

- 1. Industrialization of the brick industry:** While the brick industry was formerly a seasonal and intermittent production, industrial brick production with continuous brick-firing kilns and all-year round production has now been introduced.
- 2. Low-investment tunnel kilns:** Innovative entrepreneurs reduced the investment costs for tunnel kilns from several million to less than 500,000 dollars. These can be operated by the private sector with improved energy efficiency and better management.
- 3. Model enterprise:** The Vertical Shaft Brick Kiln (VSBK) is the most energy efficient kiln, and a model enterprise was developed fulfilling all the requirements of the government. Over 300 VSBKs are operating and have led to much higher incomes.
- 4. Sustainable use of clay and green bricks of better quality:** Traditional kilns used the topsoil of agricultural lands. A systematic mapping of clay resources now allows for the sustainable use of clay. This has led to better quality of bricks and less competition with agriculture.

## INTRODUCTION AND BACKGROUND



*The brick industry provides jobs to millions of unskilled laborers; selective mechanization has preserved decent jobs and converted them into all-year-round activities; workers have increased their income fourfold.*

The fast economic growth in Vietnam – which the brick industry has contributed to - has reduced poverty, and the brick industry is an important pillar of this growth. It is estimated that Vietnam consumes over 20 billion bricks per year, almost 250 bricks per capita. Every family of five would thus consume 1250 bricks per year, good for some 50 m<sup>2</sup> of wall.

The fast growth of the brick industry also has its downside. Over 10,000 traditional brick kilns are still in operation and are heavily polluting the environment. They have very high energy consumption (coal and firewood) and provide bad working conditions. Traditional brick kilns are seasonally and batch operated. They work in the dry season, use the topsoil of agricultural land and are fired in batches, as opposed to continuous kilns. Batch operated kilns are by definition less energy efficient than continuous kilns as the heat can neither be used for pre-heating new bricks nor for cooling the fired bricks. The high coal consumption and flue gas emissions have led to severe local pollution. The surrounding rice fields and other crops have been intoxicated with fluorine and sulphur emissions, and this has led to high compensation payments.

### **PARTNERSHIP VIETNAM – SDC**

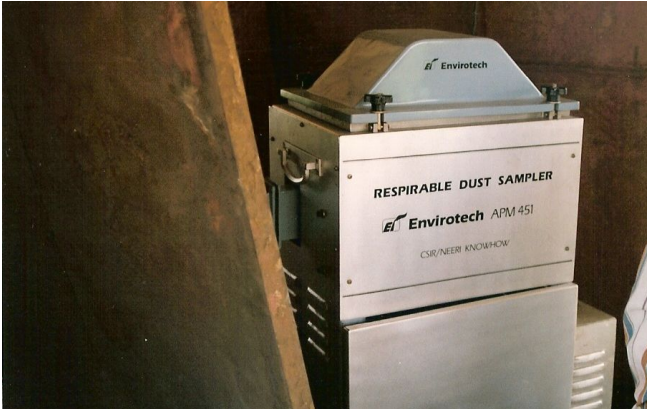
The Vietnam Sustainable Brick-making Project (VSBP) is a cooperation between SDC and the authorities of the Nam Dinh Province, located some 90 kms south of Hanoi. SDC had already previously worked with the provincial authorities of Nam Dinh. The region has a thriving brick industry with more than 600 kilns due to its location in the Red-River delta and its clay resources.

To address the environmental problems, the government of Vietnam had decided to modernise the brick industry. In 2001, it decreed that traditional brick-making would be eliminated from urban areas by 2005 and phased out entirely by 2010.

Achievement of this objective has been fraught with difficulties. Early attempts made by local authorities in Nam Dinh included efforts to heighten the chimney to lessen the impact of flue gas emissions on crops and the surrounding environment. However, this measure was not sufficient to mitigate the environmental damage, and the rapid elimination of traditional brick kilns would have involved considerable social costs. Furthermore, investment capacity was not sufficient for industrial tunnel kilns to expand quickly enough to replace the thousands of traditional kilns.



## SOCIAL IMPROVEMENTS



*Extensive tests were made to reduce air pollution*

The brick industry is traditionally very labour-intensive and employs millions of unskilled and semi-skilled workers. Some tasks, such as firing, require skilled workers, but the majority of jobs can be done by anybody willing and capable of carrying around clay, bricks, and coal. Replacing these millions of jobs through capital-intensive tunnel kiln technologies would not only destroy many jobs, but would also be in contradiction with the economic production factors where capital is scarce and labour abundant. Some 24 out of 25 jobs would become obsolete. Finding intermediate solutions and introducing selective mechanization was thus an important contribution to inclusive social development. The income of the workers has increased about fourfold as the jobs are now available all year round.

### SELECTIVE MECHANIZATION

All tasks that were associated with heavy work are now mechanized, especially the moulding of clay into green bricks and the transportation of the bricks on carts. Especially on the vertical shaft brick kilns, green bricks are lifted with a winch and unloaded with a hydraulic system. Mechanical extruders have replaced hand-moulding and at the same time allowed for the making of hollow bricks.

### CLEAN AIR FOR THE WORKERS

Much attention was paid to improving the flue gas systems and to eliminating all toxic gases on the Vertical Shaft Brick Kiln (VSBK, see below) that could lead to health hazards for the workers. Double air ducts for flue gas collection to the chimney were introduced to allow minimal flue gas releases on the top of the VSBK.



*Selective mechanization: mechanical extruders have replaced hand-moulding of bricks and have been introduced almost everywhere in the Vietnamese brick industry. This makes work easier and produces better bricks.*



## ENVIRONMENTAL IMPROVEMENTS

Several important improvements to the local environment were able to be achieved:



*Banana crop damaged by toxic flue gases*

### CROP DAMAGES

The clay of the Red-River delta contains high amounts of fluoride; and the coal, high amounts of sulphur. This combination led to highly toxic flue gases that damaged the surrounding crops. A relatively simple and cheap solution was to add limestone to the green bricks in order to neutralize the SO<sub>2</sub> and fluorine of the flue gases.



*Mapping of clay deposits in Nam Dinh*

### SOIL DEPLETION

An even more annoying environmental impact of the traditional brick industry is the use of topsoil for green brick-making. The brick industry was hitherto a seasonal industry using only the upper part of agricultural soils for brick-making, and the growing number of bricks produced resulted

in a conflict of interests between agriculture and industry. New clay extraction methods and participatory processes with the community have led to the identification of long-term clay deposits. Moreover, hollow bricks not only save energy in firing, but also use some 40% less clay for the same volume.

### CO<sub>2</sub> EMISSIONS

The brick industry in Vietnam consumes some 2.2 million tons of coal per year. Loaded on 220,000 10-ton trucks, this would be equal to a traffic queue of 2200 km, more than the entire distance from the northern to the southern tip of Vietnam.

One single vertical shaft brick kiln can save some 500 tons of CO<sub>2</sub> per year, and reduces 40 to 60% of green-house gas emissions. The over 300 VSBKs are already contributing significantly to reduced CO<sub>2</sub> emissions. The process of cleaning up the Vietnamese brick industry could be accelerated if supported by the carbon finance certificates of the CDM (clean development mechanism) or through voluntary emission-reduction certificates such as "myclimate". One single VSBK kiln could thus compensate some 250 passenger flights (full airplane, one-way) from Europe to Vietnam. Similarly, better insulation of the low-cost tunnel kilns and the introduction of best practices have led to better energy performance.

But an even higher impact on energy conservation may be the result of using hollow bricks with better insulation properties: it is estimated that a wall made of hollow bricks saves some 5% of the electricity spent on air-conditioning.



*One VSBK compensates in one year CO<sub>2</sub> emissions to the tune of a full Airbus flight Europe – Vietnam.*

## ECONOMIC IMPROVEMENTS: LOW-COST TUNNEL KILN

When the government of Vietnam decreed the phasing out of traditional brick kilns by the year 2010, there was hardly any other technical solution available than the tunnel kiln used by large, state-owned industries. This technology was, however, not accessible for small and medium-sized enterprises.

A low-cost version of tunnel kilns corresponding to the tunnel kilns prevailing in Europe in the 60s was introduced by private entrepreneurs.

The partnership has supported these tunnel kilns with a series of technical and organizational measures to improve the economic efficiency and performance, and to optimize the firing methods.

### TUNNEL KILN IMPROVEMENTS

The tunnel kiln is considered to be the most advanced brick-making technology. Its main advantage derives from the continuous flow of bricks loaded on carts through a tunnel of over 60 meters. Interestingly, low-cost versions of tunnel kilns have been developed in Vietnam at a cost of less than USD 500,000, considerably less than the conventional Western models that require at least 5 times higher investments while operating at double capacity at minimum. The Vietnamese tunnel kilns produce some 50,000 bricks per day, while Western kilns operate at 100,000 bricks and more.

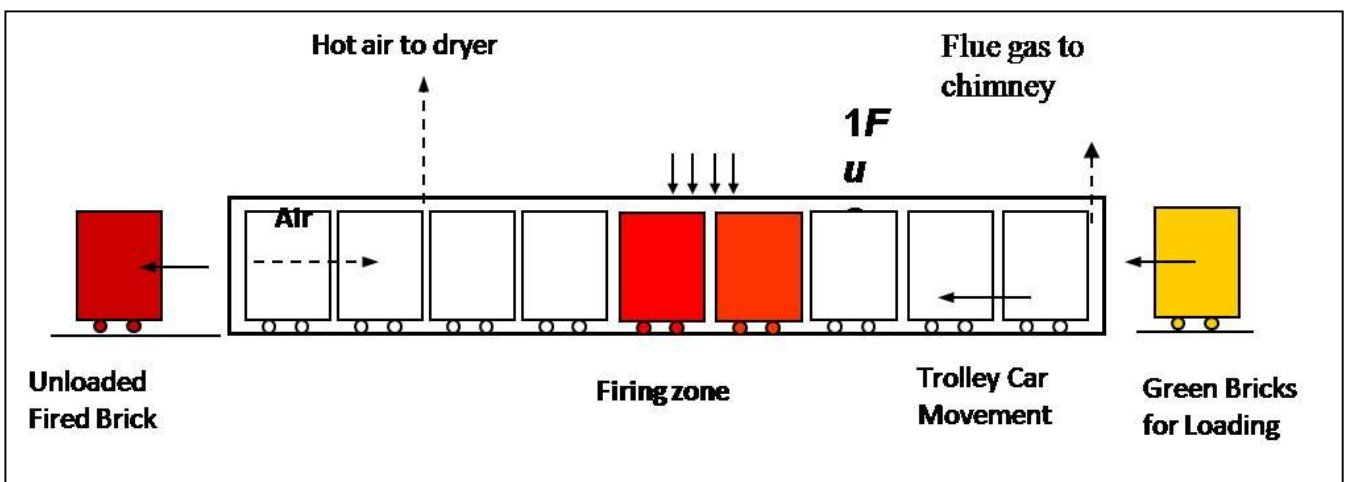
However, the kilns were not operating in an optimal way and experts from Germany and India were contracted to analyze the process and recommended improved “housekeeping” measures or best practices. Better insulation led to higher energy efficiency; a better brick cart was designed; and many small improvements were recommended. Due to the relatively low investment, these tunnel kilns are highly profitable. A typical tunnel kiln requires an investment of USD 424,000 and yields a net profit of some USD 160,000 p/a.

The low-cost tunnel kilns are also a very interesting option in other Asian countries, and a Vietnamese delegation met with a lot of interest from brick-makers during a study tour to India.

In Nam Dinh alone, more than 25 of these low-cost tunnel kilns are already in operation. Brick prices are very high at the moment due to high demand and increased coal prices; this makes the brick business very attractive. The lower investment costs also allow the private sector to operate these tunnel kilns, while Western tunnel kilns would require state-owned enterprises.



The bricks pass through the tunnel kiln on such carts. These carts need to withstand up to 1,000 °C in the firing zone.



Schematic drawing of a tunnel kiln: The green bricks are loaded on carts that move slowly through the tunnel and get gradually heated up to 950 degrees Celsius in the central firing zone. The flue gases are used for pre-heating the green bricks and for cooling the fired bricks.



# ECONOMIC IMPROVEMENTS OF THE VERTICAL SHAFT BRICK KILN (VSBK)

Even a relatively low-cost tunnel kiln is not accessible for the many family-owned and co-operative traditional brick producers. They are more interested in medium-range investments, and the vertical shaft brick kiln was thus a more accessible solution. Many VSBKs were constructed in a short period, but without systematic know-how. Some of these kilns had design mistakes and low operating performances. Initially, the government did not approve the VSBK as a viable, socially and ecologically acceptable alternative to traditional kilns.

Through discussions with the Provincial government, it emerged that their main concerns regarding the VSBK technology was its poor track record with respect to occupational health and product quality, as well as its 'traditional' nature – that is, it is meant for small-scale and seasonal production. To address these concerns adequately and to help the Provincial Authorities in the process of granting approval for the technology, it was decided to support setting up a 'Model VSBK Enterprise' in Nam Dinh.

In contrast to traditional brick-making, the model enterprise was conceived as an all-year-round industrial activity with an impeccable social and environmental performance record. It was to be less capital-intensive than a tunnel kiln, but still become a formal enterprise. The model VSBK required an investment of some USD 60,000 and yields a net profit of some USD 10,000 p/a.

## MODEL ENTERPRISE VSBK

The model VSBK enterprise in Nam Dinh has now received all approvals needed from the government. Its main features are as follows:

### Technical:

- § Improved VSBK design incorporating modifications in the flue gas system and chimneys, and use of a hydraulically operated unloading system
- § A good quality de-airing extruder to mould hollow bricks
- § Adequately sized drying shed to ensure uninterrupted supply of dried green bricks to the kiln even in the rainy season

### Business:

- § Long-term availability of clay at source
- § Accessing credit from commercial banks

### Regulatory

- § Compliance with all necessary government clearances and approvals

So far, some 300 VSBKs with over 600 shafts have been introduced in Vietnam, and the soon forthcoming phasing-out deadline for traditional kilns may boost their dissemination further. Some 10,000 kilns may potentially be replaced by VSBKs.



Model VSBK enterprise (left) and drawing (right) of how a VSBK functions. It can be compared to a vertical-shaft tunnel kiln where the bricks slowly glide down the shaft. The VSBK is the most energy efficient of all brick kilns.

## INSTITUTIONAL IMPROVEMENTS OF THE CO-OPERATION

The partnership has identified and tested technical and organizational options for brick-making that are environmentally sound, economically viable and, at the same time, accessible to small-scale producers. Furthermore, investigations have revealed shortcomings in large-scale units, while options for improving the environmental and economic performance of industrial tunnel kilns have been identified. The partnership thus aims at improvements along the entire production chain and does not simply promote one solution to fit all needs.

### DEMAND-DRIVEN DEVELOPMENT SUPPORT

The identification and testing of options concerned the entire cycle of brick production, including clay extraction, green brick production, the firing processes, as well as production organization and business management.

Additionally, options have been identified that provide authorities with more effective methods, equipment, and capacities for “state management” functions such as: emissions measurement, environmental monitoring, clay resource management, planning, and promotion of development in the brick-making industry.

In all of these areas, a demand-driven approach was applied involving authorities and private brick-makers in a dialogue process of assessing existing problems, identifying options, and developing appropriate technical and organizational solutions.

### PARTICIPATORY STATE MANAGEMENT

Appropriate technical solutions are crucial, but not sufficient to achieve policy objectives. In addition, the transition to sustainable brick-making requires significant changes in the state management of brick-making.

The challenges in this area were considerable. At the outset, policy application was hindered by the lack of reliable information on actual conditions and processes of brick-making, clay resources, energy efficiency, emissions, environmental impact, enterprise economics, etc. Authorities had limited contact with brick-makers and – besides the unpromising prospect of attempting to close traditional units – they could propose no technical alternatives for improving the environmental performance of brick-making. Lastly, the authorities lacked practical instruments for enforcing regulations and guiding development processes.

The partnership began with an extensive series of diagnostic studies to establish an adequate basis for deliberations. Then, through an intensive programme of workshops, seminar, forums, training courses and study tours, it built up contacts and mutual trust to establish a platform for exchange and cooperation that encompassed all stakeholders – large- and small-scale brick-makers, as well as provincial and district authorities.

With strong official support, a pro-active and participatory approach has thus emerged towards state-management of the brick-making sub-sector. Provincial authorities have recognized that more effective management requires the decentralization of certain regulatory and support functions to the district and commune levels.

Furthermore, it has become apparent that an extensive shift out of traditional brick-making cannot be left to the individual decisions of small-scale producers alone. It needs to be promoted within the framework of local, community-managed development.

### ENABLING SUSTAINABLE DEVELOPMENT

An enabling environment for sustainable brick-making involves the institutional anchoring, scaling-up, and dissemination of solutions, techniques and programmes that have been developed and piloted by the cooperation.

The cooperation approach encompasses strengthening the policy framework, namely:

- § building the platform for public-private cooperation
- § setting up a “sustainable brick-making support unit”
- § supporting establishment of a brick-makers association
- § facilitating the regularization of small-scale enterprises
- § disseminating the sustainable brick-making approach.

### WORKING LOCALLY WITH A NATIONAL IMPACT

The Vietnam-Swiss cooperation has a local dimension and works in Nam Dinh Province. There are significant results to be shown at local level, while many institutional improvements are shared at the national level.

The number of tunnel kilns in Nam Dinh Province has more than doubled in three years, from 11 to 25. Of course, there are many reasons for this expansion: the economic climate is good and the demand for bricks is growing. It is noteworthy that all of the new investors have participated in training courses and many have employed planning tools developed by the partnership programme. The cooperation has certainly made a positive contribution.

For the Nam Dinh authorities, the available basis for decision-making has also been greatly expanded through improved information on the brick-making industry, documented technical solutions, guidelines and instruments for policy application, methods and capacities for environmental monitoring, etc.

From the national perspective, the Nam Dinh approach is considered to be a pilot effort which aims to produce a practical model of sustainable development that may also be applicable in other provinces and sectors.

## CAPACITY BUILDING

The main impact of the partnership's activities derives not only from the technical results, but also from the processes and methods which it has introduced to achieve them. As described above, prior to the partnership programme, policy application had been stalled by inadequate information on brick-making, lack of working contacts, insufficient policy instruments, as well as the absence of technical alternatives. With Swiss support, a systematic, goal-oriented programme has been initiated involving the stakeholders in coordinated, mutually reinforcing activities of information gathering, problem-analysis, technical development, training, capacity building and policy application.

### BASIS FOR DECISION-MAKING

The objective of establishing a "basis for decision-making" has been achieved by promoting the transfer of available information and solutions into actions. Contributions in this regard include: training courses; distribution of plans, guidelines and tools; technical assistance and field service for brick-makers; as well as policy instruments and capacity strengthening for authorities.

### TRAINING ACTIVITIES

#### ¾ Brick-makers and technical staff training course

Due to high demand, this 8-day course was held twice with a total attendance of about 100 participants.

The curriculum covered selected aspects of: labour protection and safety; equipment and technology; brick-making techniques; management skills.

#### ¾ Production supervisors training course

The 5-day course was held once with about 70 participants.

Training modules dealt with: production techniques; quality control; trouble-shooting; energy efficiency; management functions, etc.

#### ¾ Directors Forum

Three two-day forums were attended by 45 directors and owners of brick enterprises.

Based on participant priorities, the subjects covered included: investment decisions and enterprise expansion; technology and product design; planning and management of the enterprise; clay exploitation; environmental impact; production economics and cost efficiency; sales management; and human resource management.

Printed guidelines and tools have been prepared for brick-makers addressing topics such as: enterprise economics; financial planning tools; credit application template; VSBK manual; and guidelines for mitigating the environmental impact of brick-making. Documentation has also been produced on a "model VSBK enterprise", including: plant layout; construction plans; financial planning format; registration and legalization procedures. This material has been distributed – and/or is available – to all participants in the training courses. Finally, technical assistance in the field was provided to brick-makers to assist them in solving practical problems associated with technical innovations.

The main impact of these measures on enterprise development is two-fold. First, through financial analysis and tools, entrepreneurs have become far more aware of the economic attractiveness of both tunnel kilns and VSBK. Second, the availability of tested designs, know-how, and competent technical assistance has given investors much higher confidence in their ability to establish a successful enterprise with high environmental standards.

### OUTLOOK: DISSEMINATION IN LAOS AND MONGOLIA?

Given the importance of the brick industry in Asia, and based on the positive experiences in Vietnam, India and Nepal, SDC is considering the replication of similar brick programmes in Laos and Mongolia. Scaling-up the dissemination of VSBKs in Vietnam would have a significant impact on CO<sub>2</sub> emissions and could avoid some 5 million tons of CO<sub>2</sub> emissions per annum if all the 10,000 traditional brick kilns shifted to VSBKs.

Brick and VSBK programmes have already started in Afghanistan and Pakistan, and interest for further dissemination has been shown by various countries, including Cuba, Peru, and South Africa.

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further reading: "Brick by Brick: the Herculean task of cleaning up the Asian brick industry", by Urs Heierli / Sameer Maithel; can be downloaded at: [www.poverty.ch/bricks](http://www.poverty.ch/bricks) or [www.entec.vn/en](http://www.entec.vn/en)