CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

India - Vertical Shaft Brick Kiln Cluster Project - IV
June 05, 2008; Version 01

A.2. Description of the small-scale project activity:

The Indian brick industry is primarily an informal, or unorganised, sector composed of more than 100,000 brick kilns operating in clusters in rural and peri-urban areas in the country producing fired clay bricks. The choice of technology for firing of bricks depends generally on factors such as the scale of production, availability of soil and fuel, market conditions and availability of skills. Due to their simplicity in operation and low capital investment requirements, the conventional technologies, such as the clamps, continue to be the brick manufacturers' preferred option. However, the energy demand of this technology is high, representing 35-50% of the total production costs.

The project activity aims to improve the thermal performance of the brick manufacturing units in selected clusters of the country, especially in the states Chattishgarh, Madhya Pradesh, Rajasthan and Orissa, through introducing the Vertical Shaft Brick Kiln (VSBK) technology. This technology is both cleaner and more energy efficient than the clamp technology, which is commonly used by the brick manufacturers. Technology and Action for Rural Advancement (TARA), the agency which provides the VSBK technology in the country, intends to set up a total of about 126 VSBK plants, in a time frame of 4-5 years in selected clusters in the above mentioned states through different entrepreneurs. This Project Design Document is the fourth bundle applicable to 16 VSBK plants that are being set up at various locations. The second and third bundles are currently at the validation and registration stage. The first bundle of 14 VSBK units has already been registered with the UNFCCC on 08 October, 2006 as project reference number 0582.

The VSBK technology is originally invented in China. It has been adapted to the Indian conditions by TARA and it has been proven to be technically feasible. However, the capital investment requirements and operational sophistication have created a perception among brick manufactures that the technology is risky. These issues have raised significant barriers preventing the technology from penetrating into the market. In order to make the technology feasible for the small and medium enterprises and increase its attractiveness, TARA is providing technology know-how as well as operational and logistical support to the brick entrepreneurs.

Each VSBK plant qualifies as a small scale CDM project as per the definition of small scale CDM projects contained in Appendix B to the simplified modalities and procedures for small scale CDM projects. In order to reduce the transaction cost and to maximise the returns to the entrepreneurs, a bundling approach is being followed in compliance with the rules prescribed by the Executive Board

The project promotes a technology that is superior in terms of resource conservation and reduced environmental pollution compared to the prevalent technologies. The environmental and social benefits of the project are further enhanced by a specific community benefit program that is implemented in order to meet the requirements of the Community Development Carbon Fund (CDCF) of the World Bank. The project thus contributes to sustainable development.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India	Technology and Action for Rural Advancement (TARA), on behalf of individual entrepreneurs	No
Government of Italy	The Community Development Carbon Fund (CDCF)	Yes
State of the Netherlands	The Community Development Carbon Fund (CDCF)	Yes
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Technology and Action for Rural Advancement (TARA): TARA is the business arm of the Development Alternatives Group. It produces, packages and markets technology and business innovations that create sustainable livelihood opportunities on a large scale in India. TARA will provide the technological and operational support to the individual entrepreneurs implementing the VSBK plants. TARA represents the individual entrepreneurs and is responsible for undertaking the carbon transaction as an intermediary.

The Community Development Carbon Fund (CDCF): Trust fund maintained and operated by the World Bank in its capacity as trustee of the CDCF on behalf of the public and private participants. CDCF will purchase the emission reductions generated by the project from TARA and will supervise the implementation of the community benefit program.

The official contact for the CDM project activity is the CDCF of the World Bank.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

India

A.4.1.2. Region/State/Province etc.:

The states of Bihar, Madhya Pradesh and Orissa

A.4.1.3. City/Town/Community etc:

The clusters and cities in which the project activities are implemented are as follows.

States	City/Clusters	No. of Plants fill in
Madhya Pradesh	Hoshnagabad	1
	Jabalpur	1
Bihar	Supaul	1
Orissa	Puri	1
	Koraput	1
	Rayagada	1
	Nayagarh	1
	Dhenkenal	1
	Balasore	1
	Kendrapara	1
	Jagatsinghpur	1
	Rourkela	2
	Jharsugura	3
Total No. of Plants		16

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

Brick making in India is usually a clustered activity, with several brick units existing in a cluster. The clusters are characterised by access to easy availability of soil and coal and proximity to the large brick markets such as the urban centers. These clusters usually run into several kilometres of radius around the urban and peri-urban areas. One of the unique characteristics of these clusters is the smoky environment. VSBKs set up in these clusters stand out distinct due to their design and operational procedures and have a unique identification. The plants included in the proposed project are identified by their location within a specific cluster in a state.

The exact location of the individual VSBK plants included in this project are provided as attachment in Annex III.

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The project activity falls under the **Type II : Energy efficiency improvement projects, and category II.D : Energy efficiency and fuel switching measures for industrial facilities as** described in the Appendix B to the simplified M&P for small-scale CDM project activities. The project however deals only with energy efficiency measures, not fuel switching, for industrial facilities.

A brick manufacturing facility has primarily two key processes i) producing green bricks (clay bricks before firing are called 'green bricks'), and ii) sintering/firing of the green bricks. The sintering process requires thermal energy inputs and inefficient technologies are used at present. As part of the project activity, energy efficient measures in form of VSBK will be introduced for the brick sintering process. Given that the amount of energy consumed per production of one unit of fired clay brick using VSBK is lower compared to the present technologies, the introduction of VSBK will lead to substantial energy savings in the brick manufacturing facilities. Type II, and category II.D. is therefore appropriate for the project activities. Further description of the technology is provided in the following paragraph.

The total amount of energy saving by the project is estimated as the difference in the thermal energy consumption of the VSBK technology and that of the technology that otherwise would have been used to manufacture burnt clay bricks.

The VSBK technology will require a thermal energy input of about 0.84 Mega Joules/kg-brick compared to 2.0 Mega Joules/kg-brick that is presently required in the baseline technology. The aggregated energy saving by the 16 plants in the project is estimated to be about 26.14 GWh_{th} per year, assuming a unit production capacity of 18,44,000 bricks per year (= 5,071,000 kg bricks per year) per kiln and energy savings of 1.634 GWh per kiln. This is within 60 GWh_{th}, i.e. the threshold for saving in thermal energy inputs for small scale projects falling into II.D category.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

The project is expected to achieve GHG emission reductions of approximately 81360 tonnes of CO_2 equivalent in 10 years from operation of 16 VSBK plants at different locations.

Years	Annual Estimation of Emission Reductions (tonnes CO_2 E)
2008	8136
2009	8136
2010	8136
2011	8136
2012	8136
2013	8136
2014	8136
2015	8136
2016	8136
2017	8136
Total estimated reductions (tonnes CO_2E)	81360
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes CO_2E)	8136

A.4.4. Public funding of the small-scale project activity:

No public funding from Parties included in Annex I is being received by this project

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

This is not a debundled large-scale project activity as defined in appendix C to the simplified M&P for the small-scale CDM activities. There are no other project activities registered or applying for registration as small-scale CDM project with the same project participants and in the same project category and technology/measure. The VSBK plants included in the project are owned by different entrepreneurs. Further, the VSBK plants included in this project are not located within a radius of 1 km from each other. Thus the project is not a debundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Version 11 of AMS-II.D : Energy efficiency and fuel switching measures for industrial facilities

B.2 Justification of the choice of the project category:

The project category applied to this project activity is as follows:

- TYPEII - Energy Efficiency Improvement projects
- Category: II.D. Energy efficiency and fuel switching measures for industrial facilities.

The approved methodology AMS-II.D states that activities involving efficiency measures for specific industrial processes (such as steel furnaces, paper drying, tobacco curing etc.) fall into the II.D category. It also states that the measures may replace existing equipment or be installed at new facilities. The project deals with energy efficiency measures in brick manufacturing, which is an industrial activity, and the measures are implemented at new brick making units.

Brick manufacturing is an industrial activity and thermal energy input is required for brick sintering. The conventional sintering technologies require higher thermal energy input. This project introduces energy efficient kilns for sintering of bricks, which reduces the thermal energy input in the brick firing facilities and thereby reduces CO_2 emissions. The project promotes a specific energy efficiency measure in the form of VSBK to reduce the requirement of thermal energy inputs for firing an equivalent amount of bricks (when compared to the present sintering technologies).

The energy efficiency measure is introduced at 16 new brick production facilities. With a production capacity of 18,44,000 bricks per plant per year (= 5071000 kg-bricks/plant/year), the energy savings achieved at individual site is estimated to be about 1.634 GWh_{th} . This saving is within the threshold of 60 GWh_{th} per year applicable to this category of activities as defined in AMS II.D. The activity proposed at each site thus meets all the conditions to use the methodology provided in AMS II.D. Furthermore, since the aggregate energy saving from 16 sites is estimated to be 26.14 GWh_{th} per year, which is within the threshold of 60GWh_{th} per year, the conditions for bundling the activities at 16 sites are also met.

B.3. Description of the project boundary:

AMS II.D. defines the project boundary as the physical and geographical site of the industrial facility, processes and equipment that are affected by the project activity. In case of the project, the technology adopted will be operationalised inside the kiln premises. The affected process is the brick firing process of a brick making plant. The VSBK plant will be installed within the brick kiln premises. The project boundary is thus defined as the physical, geographical area of each of the 16 brick production facilities where VSBK is installed.

The sources of anthropogenic GHGs within the project boundary include

- Emissions of CO_2 from fuel consumption during the sintering process

The sources of anthropogenic GHGs outside the project boundary include

- CO_2 emissions associated with the transport of raw material and finished product
- CO_2 emissions associated with the transport of fuel

The emissions occurring outside the project boundary are ignored in the approved methodology as they occur both in the baseline as well as in the project. The amount of transport of raw materials such as soil, sand and water etc., are unaffected by the project, as there are no changes to the process of making green bricks. VSBK being an energy efficient technology, the requirement of fuel in case of the project is lower compared to the baseline. Therefore, emissions due to transport of fuel in the project is lower compared to the baseline. However in order to achieve conservative estimates, the lower GHG emissions associated with transport of lower quantity of fuel required in the project is not considered.

B.4. Description of baseline and its development:

Baseline Scenario:

As per AMS II.D. "the energy baseline consists of the energy use of the existing equipment that is replaced in the case of retrofit measures and of the facility that would otherwise be built in the case of a new facility".

Since the project activity sets up new brick making facilities, the energy use of the brick making facilities that would otherwise have been built and operated in the absence of VSBK plant is considered to represent the energy baseline. The brick making facilities that would otherwise have been built in the clusters, where project interventions are made, are those using the clamp technology. The energy consumption of the clamps is therefore considered the baseline energy consumption. Further justifications for assuming clamps to be the baseline option are provided below. This is done by, first, identifying all potential options for brick making in India and, second, by narrowing down the options that are most likely to be operating in the clusters where project interventions are made.

Possible Options for brick making in India

The possible options for brick making in India include the following technologies.

- Clamps
- Movable Chimney Bull Trench kiln (MCBTK)
- Fixed Chimney Bull Trench Kiln (FCBTK)
- High Draft Kilns (HDK)
- Vertical Shaft Brick Kiln (i.e. the project option)

A brief description about each of the technologies mentioned above is provided in Annex-4. The production capacities and the capital investments requirements of these technologies differ and they cater to different segments of brick enterprises. The smaller enterprises with limited access to capital and resources use the clamps; the medium enterprises use MCBTK; and the larger enterprises use either FCBTK or HDKs. Table 4 below summarizes the number of brick making plants in India per technologies and production capacities. HDKs are very limited in number (only 20) as they have not been widely accepted by brick entrepreneurs. One of the major considerations in operation of HDKs is the use of forced draught which is created using electrically operated fans. In view of the highly unreliable electricity supply situation in rural areas, the issue of reliable operation remained a high concern for brick entrepreneurs. Backup supply of electricity with captive sources is not financially viable. The entrepreneurs who earlier opted for this technology have already closed down their HDK plants. Therefore, HDK can be ruled out as a realistic baseline option. Similarly, the number of plants using VSBK is also extremely limited and the technology faces several barriers, as described in section B.3. VSBK is therefore not considered a baseline option. This leaves Clamps, MCBTK and FCBTK as the only plausible baseline options.

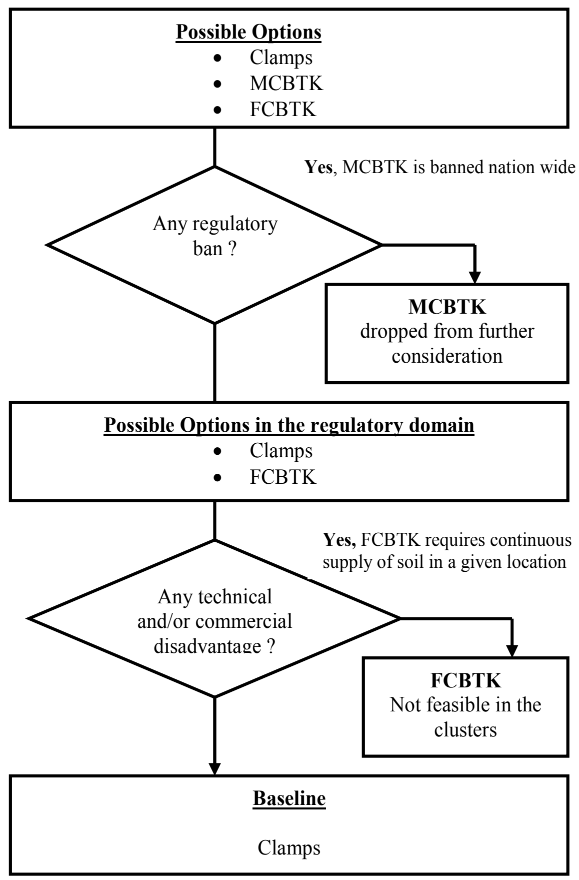
Regulatory interventions in the form of stricter emission standards and non-approval of new MCBTKs have been made since 1990's in order to control the increasing pollution from the brick industry (http://www.cpcb.nic.in/standard8.htm). The regulatory intervention has been further strengthened with a Supreme Court ruling, which has banned the use of MCBTK nationwide.

Table 4: Brick Kilns in India[1]

[1]*Source : Central Pollution Control Board, New Delhi - A document prepared in March, 2004 in the context of developing Emission Standards, Stack Height Regulation and Citing criteria for the Brick Kilns*

Kiln type	Typical Production Capacity Range *(100,000 bricks / year)*	Approximate number of kilns
Fixed Chimney Bull Trench Kiln (FCBTK)	30-100	25,000
Movable Chimney Bull Trench kiln (MCBTK)	20-80	8,000
High Draft Kilns (HDK)	30-50	20
Clamps (Firing/down draft kiln)	0.5-10	> 60,000
Vertical Shaft Brick Kiln	5-40	30

Although both clamps and MCBTKs are considered to be highly polluting, regulations have so far been directed only towards the MCBTKs. The main reasons for not bringing the Clamps under the purview of the regulation appear to be the difficulty in enforcement due to their large number and their relatively shorter life in a given location and prolific use of clamps by traditional brick making communities. Further, the clamps are seen as a very important avenue of livelihoods for rural brick making communities and agencies such as the Khadi Village Industries Boards at the state levels continue to finance setting up of clamps. Based on this it is reasonable to conclude that Clamps will continue to operate and proliferate in the future as they are unaffected by regulation. The existing MCBTKs, however, will gradually disappear.



The brick producing regions in India are categorised into two major zones based on the nature of soil availability: i) Indo-Gangetic plains, and ii) Peninsular and Coastal India. The Supreme Court ruling has already had a measurable impact in the Indo-gangetic region, where a majority of enterprises using MCBTK have shifted to FCBTKs. The number of FCBTKs reported in Table 4 is mostly confined to the Indo-Gangetic region. The Indo-Gangetic region has good availability of soil due to continuous soil replenishment in the Ganga flood plain, which is required to support larger production volumes possible in FCBTK. It should be noted that besides the capital investment, cost of fuel and availability of adequate amount of soil within the kiln's command area are the two most important factors determining the commercial viability of larger plants such as the FCBTK. FCBTK is feasible for plants with larger production capacities and hence suitable for areas with adequate availability of soil. One of the prime reasons for non implementation of the Supreme Court order in other parts of the country has been the limited availability of soil in these areas that can support change over to larger production plants such as FCBTKs. The brick manufacturers in these areas are therefore reluctant to making investment in FCBTKs. As a result the peninsular and coastal India region is still dominated by Clamps and MCBTKs. While the presently operating MCBTKs are expected to continue for some time, Clamps will continue to be the most preferred option for brick manufacturing in these regions, in the absence of any alternative technology for smaller capacity plants that are suitable for regions, where soil

replenishment is generally low. Clamps also have a very low entry barrier as investments are needed mostly in the working capital and no permissions are needed certainly for their operation in rural areas.
In conclusion, Clamps are therefore considered the most plausible technology option in the baseline scenario for brick making in the clusters of peninsular and coastal India where the project activities are implemented.

Energy baseline

This project reduces thermal energy inputs into the brick production activity. Based on the methodology, category II.D. "Energy efficiency and fuel switching measures for industrial facilities", the energy baseline of this project activity is the thermal energy consumption by the technology that would have otherwise been used to manufacture bricks in those clusters where the project interventions are made.

The energy consumption of the clamps is considered as the baseline energy consumption. The energy consumption of Clamps is reported to be 2.0 MJ/kg-brick[2]. The "annual output of each VSBK plant" (kg-bricks/year) is multiplied with the above "specific energy consumption" (of Clamps) to arrive at the annual energy consumption in the baseline scenario.

Emission baseline

The baseline emission is estimated by multiplying the "energy use" with the emission factor of the energy source. The source of energy for firing bricks in the geographical clusters where the project activities are located is predominantly bituminous coal. Therefore the IPCC default value of 25.8 tC/TJ has been considered for the carbon emission factor. Further justification for using coal as the baseline energy source is provided below.

Coal is the main source of energy used for firing bricks in India. The next choice of fuel is biomass, including fuel wood. In one of the studies undertaken by the FAO[3] the use of fuel wood in the entire brick industry in the country is reported to be only 300,000 tons/year, while the use of coal is reported to be about 14,000,000 tons/year. Thus use of fuel wood represents a very tiny fraction (much less than 2% in terms of energy inputs) of the total energy requirement of the brick industry in all of India. Since the values reported in the FAO report does not distinguish between the renewable biomass and nonrenewable biomass, the actual fraction of renewable biomass (with zero emissions) is likely to be lower. It is also difficult to undertake ex-post monitoring of the actual usage of biomass in the clamps operated by brick manufacturers. As the clamp owners do not benefit from the project, there is little incentive for them to measure and record data pertaining to their fuel use. Feeding rate of fuel is often decided visually through experience of the fire masters rather than through measurements. In the absence of systematic and scientific monitoring over a reasonable period of time sufficient to account for seasonal variations in fuels etc. (which will be cost prohibitive), the level of uncertainty associated with the data could be very high. It is therefore proposed to fix the biomass usage in baseline conservatively at 5% of the total energy input, for all the areas included in the project, which is higher than the national average figure of less than 2% reported in the FAO report. In light of the above assumptions, the baseline emissions are adjusted appropriately by multiplying with a "biomass adjustment factor" (0.95 = 1- 0.05). The baseline emission is thus expected to be conservative.

The total emissions from the baseline scenario will be 14584 tonnes of CO_2 equivalent per annum for the 16 plants included in the project (assuming a standard production rate of 1,844,000 bricks per year per kiln).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

[2] Source: Page 2 (20) of TERI 2000CR 41. This figure is also consistent with lowest reported figure from Table 3.1 of document GCP/RAS/131/NET, Field Document 35 published by FAO.

[3] Source: FAO Field Document No. 35, "Regional Wood Energy Development Programme in Asia", GCP/RAS/154/NET.

A small-scale CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below the level that would occur in the absence of the registered project activity and if the project activity is facing one or more barriers as defined in Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activities.

The analysis below documents the existence of several issues which make the VSBK technology appear most unattractive to brick manufacturers. Given these high barriers, in the absence of the project activity it is expected that brick manufacturers will continue to use the clamp technology, even though it requires a significant input of thermal energy for brick burning. The project activity would therefore result in lower CO_2 emissions compared to the level of CO_2 emissions that would occur if an equivalent amount of burnt clay bricks were to be manufactured using the clamp technology. The project activity should therefore be considered additional.

As already mentioned, VSBK is a new technology and it has so far hardly penetrated the India market at all. Out of more than 100,000 brick kilns operating in the country, only around 30 kilns use VSBK technology [4]. The number is negligible considering the fact that introduction VSBK in the country started in the year 1995.

Technological Barrier: As a new technology requiring some operational sophistication, kiln owners are very hesitant to adopt the VSBK technology. Brick manufacturers find that the technical skills needed to provide troubleshooting and meet maintenance needs are currently lacking, creating a barrier that is preventing the adoption of the VSBK technology. Further, the conventional brick industry relies on relatively unskilled labour, whereas VSBKs are more mechanized and involve an organised production process. The operation of VSBK plants thus requires skilled manpower, which is currently unavailable in the country. Consequently, given that the industry capacity to absorb the VSBK technology is very low, kiln owners are very hesitant towards the VSBK technology.

Investment Barrier: The commonly used clamp technology only requires a limited amount of working capital and capital investment. For instance, a brick unit using the clamp technology with an annual production capacity of 1.8 million bricks requires a capital investment of US$ 5,000. In contrast, the capital investment associated with a VSBK unit with an equivalent production capacity is about US$ 20,000, i.e. a cost increase of around 400%. Profitability in the brick business largely depends on the sales volume as the profit margin per brick is low. Given limited capital resources, the manufacturers generally prefer to increase production capacity by setting up a new plant in a new location over investing in cleaner and efficient technologies. The appreciation of energy saving and related savings in the operational cost continues to be low among the brick manufacturers. Given this reality, the brick manufacturers are unlikely to investing in the more costly VSBK technology.

Besides the willingness of the entrepreneurs, a key barrier is also raising the required finances for making the investments. Most of the investments are made using credit made available by the banks. However, there is no certainty of getting the required loan sanctions from the banks and even in those cases where loans are sanctioned, it may take upto a year before the credit is disbursed. In the meantime, a number of entrepreneurs lose interest in the business proposition and sometimes even decide to not pursue it further.

Barriers due to prevailing practices: Technology diffusion is a very slow process taking several decades in the brick industry sector. For example, the first plant with fixed chimney BTK technology in the brick industry in India was constructed in 1961, but it took almost 20 years before the technology gained the acceptance of the industry.[5] The actual diffusion of fixed chimney started in early 1980s and picked up only after announcements of emission standards in 1996. The diffusion of fixed chimney kilns has however been restricted mainly to parts of north-west India. The generally observed slow rate of diffusion of

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[4] *Source: Central Pollution Control Board, New Delhi – A document prepared in March, 2004 in the context of developing Emission Standards, Stack Height Regulation and Citing criteria for the Brick Kilns*

[5] Source : Indian Bricks and Tiles Manufacturers' Association, www. brickindia.com

of technology in the brick industry is mainly attributed to the following factors:

- conservative nature of the industry;
- absence of scientific innovation and a general lack of requisite technical and managerial capability to handle new technology;
- lack of in-house R&D;
- poor information dissemination in the industry;
- lack of government support for technology development and dissemination, and
- poor access to institutional finance.

From the above discussions, it can be concluded that the prevailing practices would continue in the absence of the proposed project activity and that the project should be considered additional.

Institutional and regulatory barrier: The few VSBK entrepreneurs today represent a tiny fraction of the total brick industry. The conventional part of the brick industry has several regional and national level associations which represent the brick entrepreneurs and carry out policy dialogues with the state and national Governments. Such associations fight for the interests of the industry and try to protect the industry from any adverse policy implications, viz. imposition of higher taxes, imposition of stricter technical standards, etc. Entrepreneurs feel safer and more comfortable with the backing up of their associations. At present there is no such formal platform for the VSBK entrepreneurs, as their number is very limited.

Unlike the clamps, VSBK entrepreneurs require prior approvals from the respective State Pollution Control Boards to set up VSBK plants. The process of obtaining approvals is an extremely tedious and time taking job and at times also requires bribes to be paid. Entrepreneurs perceive this as a disadvantage and extra hassle to be overcome.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline Emissions

The emissions E_b from the baseline activity are calculated as follows:

$$E_b = \sum_{x=1}^{14} E_{bx}$$

Where E_{bx} = Baseline emissions per year corresponding to the xth Kiln

$$E_{bx} = (1 - PER_{biomass}) \bullet SEC_{CK} \bullet TP_x \bullet CEF \bullet CC$$

where,

$PER_{biomass}$	=	biomass correction factor for the baseline = 0.05
SEC_{CK}	=	Specific energy consumption in Clamps (MJ/kg-brick)
TP_X	=	Total brick production per year in Xth kiln (kg-bricks/year)
CEF	=	Carbon Emission Factor for fuel used (bituminous coal)
	=	25.8 tC/TJ (IPCC default value for India)
CC	=	Carbon to CO_2 conversion factor

The emissions in the baseline scenario are 145840 tonnes of CO_2 equivalent over 10 years for the 16 VSBK plants included in the project.

The project emissions are to be calculated as follows:

Total Emissions, E_p, by operations of 16 VSBK plants are given by

$$E_p = \sum_{x=1}^{14} E_{Px}$$

Where, E_{px} = Project emissions per year from operation of x^{th} plant,. X ranges from 1 to 16

$$E_{px} = SEC_x \bullet TP_x \bullet CEF \bullet CC$$

where, SEC_x = Specific Energy Consumption in kiln X (MJ/kg-brick)
TP_X = Total brick production per year in kiln X (kg-bricks/year)
CEF = IPCC default Carbon Emission Factor for fuel used
= 25.8 tC/TJ
CC = Carbon to CO_2 conversion factor

From the monitored data the specific energy consumption for the individual kilns is estimated using the following formulae.

$$SECx = TCx \bullet CVx / TPx$$

Where, TC_x = Total coal consumption per year for Kiln X , and
CV_x = Calorific value of coal used in x^{th} Kiln

$$TCx = \sum_{d=1}^{dx} C_{dx}$$

Where, C_{dx} = daily coal consumption in Kiln X

$$TP_x = \sum_{d=1}^{dx} P_{dx} \bullet M_x$$

Where
P_{dx} = the daily production of bricks in Kiln X (bricks/day)
dx = total no. of production days for Kiln X in a year
M_x = Weight of the bricks in kiln X (kg/brick)

Leakage

This is not applicable for this project.

Emission Reductions

Emission reduction achieved by each VSBK plant is calculated by using the formula

$ER_x = Eb_x – Ep_x$

Total emission reduction achieved by all the plants is thus calculates as

$$ER = \sum_{x=1}^{n} Eb_x - Ep_x$$ Where**,** n = number of plants included in the project =16

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	Specific energy consumption in Clamps
Data unit:	(10^{-6}Tj/kg-brick)
Description:	This value is the key determining factor influencing the use of fuel and hence the emisisons
Source of data used:	Page 2 (20) of TERI 2000CR 41.
Value applied:	2.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is obtained from the most extensive and scientifically rigorous studies on energy use in brick industry in India. This figure is also consistent with lowest reported figure from Table 3.1 of document GCP/RAS/131/NET, Field Document 35 published by FAO.
Any comment:	

Data / Parameter:	Biomass correction factor for the baseline
Data unit:	
Description:	Although coal is the main source of energy used for firing bricks in India, the next choice of fuel is biomass, including fuel wood. Since this is an energy input, it needs to be accounted for in calculations of baseline emissions based of production of kg-bricks
Source of data used:	FAO Field Document No. 35, "Regional Wood Energy Development Programme in Asia", GCP/RAS/154/NET
Value applied:	0.05
Justification of the choice of data or description of measurement methods and procedures actually applied :	In one of the studies undertaken by the FAO[6] the use of fuel wood in the entire brick industry in the country is reported to be only 300,000 tons/year, while the use of coal is reported to be about 14,000,000 tons/year. Thus use of fuel wood represents a very tiny fraction (much less than 2% in terms of energy inputs) of the total energy requirement of the brick industry in all of India. As the clamp owners do not benefit from the project, there is little incentive for them to measure and record data pertaining to their fuel use. In the absence of systematic and scientific monitoring over a reasonable period of time sufficient to account for seasonal variations in fuels etc. (which will be cost prohibitive), the level of uncertainty associated with the data could be very high. It is therefore proposed to fix the biomass usage in baseline conservatively at 5% of the total energy input, for all the areas included in the project, which is higher than the national average figure of less than 2% reported in the FAO report. In light of the above assumptions, the baseline emissions are adjusted appropriately by multiplying with a "biomass adjustment factor" (0.95 = 1-0.05).
Any comment:	

Data / Parameter:	Carbon Emission Factor for fuel used
Data unit:	tC/TJ
Description:	Coal being the main source of fuel, burning of it emits carbon and the unit specifies the tones of carbon per terajoule of energy produced by burning.
Source of data used:	IPCC default value of Indian bituminous coal

[6] Source: FAO Field Document No. 35, "Regional Wood Energy Development Programme in Asia", GCP/RAS/154/NET.

Value applied:	25.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	In one of the studies undertaken by the FAO[7] the use of fuel wood in the entire brick industry in the country is reported to be only 300,000 tons/year, while the use of coal is reported to be about 14,000,000 tons/year. Thus use of fuel wood represents a very tiny fraction (much less than 2% in terms of energy inputs) of the total energy requirement of the brick industry in all of India. As the clamp owners do not benefit from the project, there is little incentive for them to measure and record data pertaining to their fuel use. In the absence of systematic and scientific monitoring over a reasonable period of time sufficient to account for seasonal variations in fuels etc. (which will be cost prohibitive), the level of uncertainty associated with the data could be very high. It is therefore proposed to fix the biomass usage in baseline conservatively at 5% of the total energy input, for all the areas included in the project, which is higher than the national average figure of less than 2% reported in the FAO report. In light of the above assumptions, the baseline emissions are adjusted appropriately by multiplying with a "biomass adjustment factor" (0.95 = 1-0.05).
Any comment:	

Data / Parameter:	Carbon to CO_2 conversion factor
Data unit:	
Description:	This value converts the tonnes of carbon emitted into carbon-di-oxide
Source of data used:	IPCC default value
Value applied:	3.667
Justification of the choice of data or description of measurement methods and procedures actually applied :	Being IPCC default value, it can be considered as the most standard way of conversion.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

[7] Source: FAO Field Document No. 35, "Regional Wood Energy Development Programme in Asia", GCP/RAS/154/NET.

Sl. No. Plant No.	Plant IDs	Data to be Monitored			Estimated Values				
		Annual Brick Production[8]	Annual Coal Consumption	Coal Calorific value	Specific Energy Consumption	Energy Savings	Baseline CO_2 Emissions	Project CO_2 emissions	Emission Reductions
		A (Kg-bricks/Year)	B (Kg/Year)	C (Kcal/Kg)	D[9] (TJ/kg-bricks)	E[10] GWh_{th}/Year	F[11] tCO_2/Year	G[12] tCO_2/Year	H = F-G tCO_2/Year
1	IV-MP-HOSH-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
2	IV-MP-JABA-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
3	IV-BR-SUPA-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
4	IV-OR-PURI-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
5	IV-OR-KOR-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
6	IV-OR-RAY-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
7	IV-OR-NAY-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
8	IV-OR-DHE-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
9	IV-OR-BAL-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
10	IV-OR-KEN-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
11	IV-OR-JAGA-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
12	IV-OR-ROUR-	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5

[8] The figures represent the brick production with full capacity utilization of the plants

[9] $D = (B*C/A)*4.1868*10^{-9}$

[10] $E = ((A*2.0*10^{-6}) - (A*D))/3.6$

[11] $F=(1-0.05)*A*2.0*10^{-6} * 25.8*3.667$

[12] $G=A*D*25.8*3.667$

	01								
13	IV-OR-ROUR-02	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
14	IV-OR-JHAR-01	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
15	IV-OR-JHAR-02	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
16	IV-OR-JHAR-03	5071000	2.54E+05	4000	0.84E-06	1.634	911.5	403.0	508.5
Total		81136000				26.14	14584	6448	8136

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2008	6448	14584	Not Applicable	8136
2009	6448	14584	Not Applicable	8136
2010	6448	14584	Not Applicable	8136
2011	6448	14584	Not Applicable	8136
2012	6448	14584	Not Applicable	8136
2013	6448	14584	Not Applicable	8136
2014	6448	14584	Not Applicable	8136
2015	6448	14584	Not Applicable	8136
2016	6448	14584	Not Applicable	8136
2017	6448	14584	Not Applicable	8136

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	Total Brick Production
Data unit:	Bricks per day
Description:	This is the total number of bricks produced by a VSBK on an operating day
Source of data to be used:	Daily Production Report prepared at each VSBK unit
Value of data	8000
Description of measurement methods and procedures to be applied:	In a VSBK unit, bricks are fired in batches with the number of bricks in each batch specified within a range. The bricks fired and produced each day will be recorded in the Daily Production Report by the VSBK entrepreneur or his designated staff.
QA/QC procedures to be applied:	A consolidated monthly report will be sent by each entrepreneur to TARA' who will match the actual figures to the installed capacity as well as cross-check it. Based on the design (batch height and shaft size) of the kiln, TARA already has the reference points for the optimum number of bricks to be produced per day and based on this it will be able to cross check the quality of the data recorded in the Daily Production Report Since TARA has a complete understanding of the production to coal and internal fuel consumption ratio based on the site conditions, soil etc., it will be able to do a thorough quality control of the data
Any comment:	For the purpose of ex-ante calculation of emission reductions (Section B.6.3), an annual brick production of 18,44,000 bricks per year has been used, considering the capacity utilisation that is largely feasible.

B.7.1 Data and parameters monitored:	
Data / Parameter:	Average Weight of the Bricks
Data unit:	Kilograms per brick
Description:	This is the average weight of a brick produced by each VSBK unit.
Source of data to be used:	Monthly consolidated report prepared by each VSBK unit
Value of data	2.75
Description of measurement methods and procedures to be applied:	Every month 50 fired bricks will be weighed to calculate the average weight of the brick. These bricks will be taken on a sample basis and weighed on a weighing machine using standard weights. A standard mean of the weights of these 50 bricks will be considered as the average weight of the bricks
QA/QC procedures to be applied:	Based on the reference points that are established at time of kiln commissioning by TARA, reference points for brick weight will be established. In addition, from time to time, TARA personnel will personally monitor the weighing process and record their observations
Any comment:	

B.7.1 Data and parameters monitored:	
Data / Parameter:	Total Coal Consumption
Data unit:	Coal Consumption per day (kilograms /day)
Description:	This is the total volume of coal used by a VSBK on an operating day. This value will be used in calculation in the Specific Energy Consumption
Source of data to be used:	Daily Production Report prepared at each VSBK unit
Value of data	1101.95 kilograms per day for 8000 bricks
Description of measurement methods and procedures to be applied:	In a VSBK unit, bricks are fired in batches with the number of bricks in each batch specified within a range. Based on the number of batches, coal is issued for use. The coal issued and used each day will be recorded in the Daily Production Report by the VSBK entrepreneur or his designated staff.
QA/QC procedures to be applied:	To obtain optimum performance, the VSBK technology has a specified range of coal use for each batch. If this range is not adhered to, there are breakages. Therefore, based on the information provided by the VSBK units, the TARA team will be able to assess the veracity of the figures by relating the coal consumption to the reference specific energy consumption as well as the breakage figures by the units. Since TARA has a complete understanding of the production to coal and internal fuel consumption ratio based on the site conditions, soil etc., it will be able to do a thorough quality control of the data
Any comment:	For the purpose of ex-ante calculation of emission reductions (Section B.6.3), based on annual production of 18,44,000 bricks per year and an average brick weight of 2.75 kg per brick, the annual coal consumption has been taken to be $2.54*10^5$ kilograms / year.

B.7.1 Data and parameters monitored:	
Data / Parameter:	Calorific Value of Coal
Data unit:	*Kcal/Kg*
Description:	This is the amount of energy generated by burning of a kilogram of coal
Source of data to be used:	Testing Reports of TARA

Value of data	4000
Description of measurement methods and procedures to be applied:	The calorific values will be monitored once in every six months using standard testing methods. This seems a reasonable frequency as the calorific value of the coal from the same source (coal mines) is similar and these sources are not expected to change in six months.
QA/QC procedures to be applied:	To ensure quality control, the calorific value testing will be conducted by TARA at it's full fledged testing facility.
Any comment:	

B.7.1 Data and parameters monitored:

Data / Parameter:	Specific Energy Consumption (SEC)
Data unit:	TJ/kg-bricks
Description:	This is the most critical figure in estimation of energy savings happening in the project
Source of data to be used:	Calculation by TARA using figures of VSBK units
Value of data	0.84E-06
Description of measurement methods and procedures to be applied:	The SEC will be calculated on the annual data for each plant. It will be calculated using the following formula: $SEC_x = (TC_x * CV_x / TP_X) * CF_e * 10^{-9}$ Where, SEC_x = Specific Energy Consumption in kiln X (Tj/kg-brick) TC_x = Total coal consumption per year for Kiln X , and CV_x = Calorific value of coal used in x^{th} Kiln TP_X = Total brick production per year in kiln X (kg-bricks/year) CF_e = Conversion Factor from kcal to Megajoules = 4.1868
QA/QC procedures to be applied:	To ensure quality, this will be done by statistical experts within TARA
Any comment:	

B.7.2 Description of the monitoring plan:

The data involved in the project are proposed to be monitored and recorded manually by the plant operators. The following quality control measures will be followed to increase the reliability of the data monitored.

The plant owners (entrepreneurs) for their respective plants will monitor the data on daily coal consumption, daily brick production and weight of the bricks once in a month and record the information in the plant register. Additionally, the calorific value of the coal will be monitored once in every six months. The above data will be submitted to TARA for archiving purpose. TARA, thanks to its experience and knowledge of the technology, has the capability to cross check the data reported by the entrepreneurs. In case data reported by the entrepreneurs exceed the values corresponding to the installed capacity of the plants, the values corresponding to the installed capacity will only be used for the purpose of estimation of emission reductions. In such cases, the higher value on brick production (compared to the plant capacity) reported by the entrepreneurs will be replaced by the figure corresponding to the maximum plant capacity.

In order to improve the reliability of data recorded by the plant operators, TARA will carry out audit of the plants on an annual basis. 10% of the plants are proposed to be covered under the audit. The audit will be carried out at least for 3 consecutive days, and TARA's auditors will verify the data on brick production as well as fuel consumption.

The annual coal consumption data reported by the plant operators will be cross checked against the data recorded in the purchase register of the plant and the higher value after adjusting for the closing stock at the plant will be considered against annual coal consumption.

Similarly, the annual brick production data reported by the plant operators will be cross checked against the raw materials used, especially against the annual coal consumption data (as determined above) using the typical VSBK performance data. The lowest specific consumption reported for VSBK will be considered to back calculate the brick production. The brick production figure calculated will be compared with the brick production figure reported by the entrepreneurs and the lower one will be considered for the purpose of emission reductions.

TARA will compile the information of all the plants and after cross-checking and verifying it, will estimate the energy savings emission reductions on the basis of the annual data.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date : 05 June 2008

Technology and Action for Rural Advancements (also a project participant)

Village Sultanpur, Ghitorni, Mehrauli - Gurgaon Road
New Delhi : 110 030
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E Mail : arunkumar_1948@yahoo.co.in

The entity is a project participant listed in Annex I of this document

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The project activity will start in July 2008.

C.1.2. Expected operational lifetime of the project activity:

>> 15 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

Not Applicable

C.2.1.2. Length of the first crediting period:

Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/11/2008

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>> Environmental Impact Assessment study is not required for the brick plants in India. However, a brief analysis of the positive and negative impacts of the project is provided here.

Improvement of air quality : VSBK as a technology is much less emissive while considering not only GHG emissions but also in terms of SPM, SOx, NOx etc. The fuel used in VSBK is powdered coal and due to complete burning of coal, only a small amount of ash comes out as waste particle.

The emission standards for VSBK have been published by the CPCB. Till now, primarily the standards set for Bull Trench Kilns are used. While only the best BTKs are able to achieve the standards set for their pollution levels, the emissions from VSBK constructed and operated so far are well within the prescribed limits. The stack emission levels observed for different VSBKs in various geographical zones are in the range of 80mg/Nm^3 to 250 mg/Nm^3: with an average of 170 mg/Nm^3 based on a detailed study carried out on behalf on the Central Pollution Control Board of India. These emission levels of VSBK are much less than the emission standards currently prescribed for any types of kilns. These results are in agreement with the monitoring carried out by Development Alternatives. Unquestionably, the stack emission for VSBK is considerably lower than BTK under diverse Indian conditions.

Energy efficiency : VSBK is about 30% energy efficient compared to traditional kilns by technological design. Therefore it requires less fuel. Moreover it allows use of low grade fuels such as lignite and increase in use of discarded wastes. This is good for environment resulting in better quality and higher profits.

Reasonable resource utilisation: VSBK takes less space than other kilns, hence preserving land and vegetation. The usage of soil is reduced by utilizing various industrial wastes such as fly ash, stone dust etc. The inherent property of less resource use for VSBK directly contributes to the socio-economic and environmental benefits.

Other Impacts

Although VSBK is better than other technologies, both in terms of efficiency and environmental protection, it still requires resources such as clay leading to soil degradation. The fast depletion of arable land thus caused due to brick making is a matter of grave concern in India. In addition, considerable amount of water is also used for brick production.

Another negative environmental impact is exposure of workers. They are also exposed to high concentration of respirable suspended particulate matters (RSPM), during monitoring and regulating the fire, as the furnace chamber is covered with ash, which is scattered to improve insulation of the top surface. After the Govt. notification making fly ash utilisation mandatory by law, the work force gets exposed to high concentration of RSPM while carrying out manual mixing. Soil and fly ash exposure also occurs due to open dumping and storage of fly ash.

Mitigation measures for the environmental impacts

The impacts mentioned above are common to all brick-firing technologies, much less worse in VSBK. In this particular project, several measures are being taken to mitigate these impacts. To minimise use of productive top soil, utilisation of industrial waste such as fly ash, stone dust etc. is being tested and promoted. To ensure safer operations and reductions of exposures to RSPM, efforts are ongoing to improve the burning efficiency to reduce black smoke. Arrangements are also being made for smoke control during loading by using dampers. The concern of exposure to fly ash and other industrial waste, while manual mixing, is addressed by allowing mechanical mixing.

The air pollution monitoring for VSBK at the Datia R&D site has been conducted by M/s Envirotech Centre for Research & Development, New Delhi. Following is the summary of their report:

Source Monitoring

Low concentration of SPM has been recorded in all measured vents (stack) of small and large shafts. This clearly indicating that while operation dust emission are not significant probably due to the fact that fine fly ash generated while burning of coal may be trapped within the green bricks.

Concentration of all monitored gaseous pollutants like SO_2 & NO_x HC are found low. Since there is no limits existing for emissions of these pollutants it is difficult to compare with standard values however, it can be said that the loads of these pollutants are small and shall not cause any significant damage provided proper dilution and dispersion is available in the atmosphere where these are discharged.

Work Zone Monitoring

Monitored concentration indicates that prevailing SPM in loading and unloading area is of the same order. However observed concentrations are within the permissible value of 5 mg / m3 as prescribed in factory act. Concentration of gaseous pollutants like SO_2, NO_2 & CO has been found very low indicating that fugitive emissions are not significant due to operation of VSBK.

Concluding Remarks

Over all it can be said the VSBK technology for brick production is less polluting as emissions of SPM and gaseous pollutants are insignificant in comparison to the conventional technologies and far below the prescribed limits for conventional technologies.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>> Not Applicable

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The important stakeholders are the brick entrepreneurs, brick worker community, regulatory agencies, brick manufacturers association and the general public. The primary stakeholder is the brick entrepreneur; who makes the investment in the new technology and undertakes certain amount of risk.

The TARA team has undertaken several stakeholder consultations with respect to performance and promotion of VSBK. This has primarily been done at two levels:

State Level: Policy workshops have been conducted in Jharkhand and Madhya Pradesh and involved state level authorities in various departments such as the Pollution Control Boards, Environment and Mining. These workshops served as a platform for the stakeholders to air their views on VSBK and emerging environmental issues.

District level administration and Local brick manufacturer's association: TARA has also interacted extensively with the district level administrations and wherever possible the local association of brick manufacturers in both groups and on a one-to-one basis.

E.2. Summary of the comments received:

Brick Entrepreneurs

The entrepreneurs have appreciated the positive commercial aspects of the VSBK technology, especially the short firing cycle in VSBK. Bricks in VSBK are fired within 24-30 hours compared to 21-28 days in other kilns. The entrepreneur's primary concern is the availability of skilled manpower and tighter controls of the production process. Higher capital cost of VSBK is certainly an issue and clamp owners desirous of adopting the VSBK technology would need to source bank finance for investments. One major issue for VSBK entrepreneurs is the technology fee. While they recognize the need to have continuous access to train manpower, soil testing facilities and technology support; the up front technology fee is significant and entrepreneurs feel that the technology fee should perhaps be shared by the agencies who desire imposition of clean technology.

Brick Workers Community

The brick worker community; especially the operators and fire masters have a very positive view of VSBK operations. The VSBK operators need specific skill sets and regularity of operation provides a huge amount of relief to them. Simple and selective mechanization has been appreciated particularly for hoisting the bricks and for unloading. The chimney arrangement ensures consistent operations with very little air pollution. Heat at the unloading level is a concern and the problem has been mitigated by provision of cooling chambers.

Regulatory Agencies

The primary concern of the regulatory agencies is to curb air pollution. In this context, it is universally recognized by the pollution control agencies at the central and state level that VSBK is a cleaner production technology and brick entrepreneurs should opt for this. In particular, VSBK is seen as a very good option in regions where clusters of polluting clamps and kilns exists. In this direction, the Central Pollution Control Board has taken the lead to publish new standards for VSBK which significantly lower the permissible levels for SPM. Another valuable stakeholder is the Industries Department who are responsible for policy measures that support promotion of new technology. The industry channels in Orissa have strongly supported financing of VSBK entrepreneurs who were threatened with closure. They are also supporting VSBK units in new areas where large industrial projects are being setup. The possibility of round the year operation is an attractive feature viewed by the industry representatives.

The public

The public consisting of contractors, home builders have a very positive view of the VSBK technology and products. Their first observation on visiting a VSBK site is that there is no smoke. The uniformity of the product is an added feature.

Others

The brick manufacturers associations at the state level are very positively inclined and supportive of VSBK technology provided it meets their expectations in terms of product quality. In view of pending legislation for utilization of flyash in brick production, the brick manufacturers association would like the VSBK technology promoter to broker a negotiation which allows sharing of costs for new technology and pollution related investments. The national level brick association is fully engaged with VSBK technology and their current website www.brickindia.com has numerous information articles on positive aspects of VSBK technology. One of their concerns is that VSBK should have preferential financing channels in terms of margin money and interest subsidy for aspiring entrepreneurs. Their view is that government or other agencies should bear the technology costs as VSBK is good for the society at large and full costs should not be passed on to the entrepreneurs.

E.3. Report on how due account was taken of any comments received:

Comments from stakeholders are mostly positive, except the brick entrepreneurs, who are concerned about the higher investment cost, including the technology fees and are apprehensive of the availability of continued and reliable technical support needed for successful operation of the plants. In order to keep the technology attractive, TARA is assisting the entrepreneurs to cash the carbon benefits by processing the project as a CDM project. The value of CER would be very significant in forging an agreement with entrepreneurs to adopt best practices in VSBK. In addition, TARA is undertaking Research and Development for continuous improvement in burning efficiency leading to a further reduction in emission of black smoke as well as to further simplify the operation. Regarding process for lifting of bricks, the TARA team is looking at designing a simple mechanized lifting mechanism, which is to be tested soon

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Technology and Action for Rural Advancement
Street/P.O.Box:	Village Sultanpur, Ghitorni, Mehrauli - Gurgaon Road
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Organization:	World Bank Carbon Finance Unit
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Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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Annex 5

List of VSBK plants

Plant No	State	District	Name of Enterprises	Entrepreneur Address	Plant ID
1	Madhya Pradesh	Hoshangabad	M/s Swastik Bricks	Prop Vaishali Gurde, Panchmari, Hoshangobad.	IV-MP-HOSH-01
2	Madhya Pradesh	Jabalpur	M/s Hari Vishnu Bricks Works,	Mr Ashwani Kr Gontia, Jabalpur, MP	IV-MP-JABA-01
3	Bihar	Supaul	M/s Chandrakala Bricks	Mr. Parmanand Singh, Industries, PO Ratauli, PS Pipra, Dist Supaul,	IV-BR-SUPA-01
4	Chattisgarh	Puri	M/s Subhadra Bricks	Mrs. Rashmi Ranjan Swain, Nimapara Puri	IV-OR-PURI-01
5	Chattisgarh	Koraput	M/s Shiv Shakti Industries	Kabita Nayak, W/o Mr Kailash Chandra Nayak, Jeypore, Dist. Korapui, Orissa	IV-OR-KORA-01
6	Chattisgarh	Rayagada	Jagdamba VSBK Brick Ind.	Mr B Ramesh Kumar, At Kotepeta, Via J K Pur.	IV-OR-RAYA-01
7	Chattisgarh	Nayagarh	M/s Maa Bhui Nyani Bricks	Mr. Udhab Nahak, District Nayagarh Orissa	IV-OR-NAYA-01
8	Chattisgarh	Dhenkanal	Mr. M/s Mahalaxmi Vertical Shaft Bricks	Smt. Chinmayee Baral, W/o Abani Kr Baral, A1, Borapada, PO Gahamakhunti, Dist Dhenkanal, OR	IV-OR-DHEN-01
9	Chattisgarh	Balesore	M/s Maa Tarni Bricks,	C/o Paresh KumarSamal, At Andala, P S Khaira, Dist Balesore, Orissa	IV-OR-BALE-01
10	Orissa	Kendrapara	M/s Das Entreprise,	Mr. Santanu Kr. Das, Kendrapara	III-OR-NAYA-01

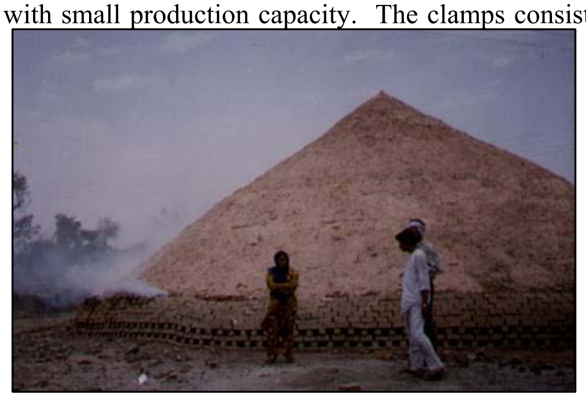
11	Orissa	Dhenkanal	M/s Mahima Brick Industries	Smt Yosobanti Lenka, W/o Satyajit Pradhan	IV-OR-JAGA-01
12	Orissa	Balesore	M/s Eureka Brick Industries.	Biswajit Parida, Rourkella	IV-OR-ROUR-01
13	Orissa	Kendrapara	M/s N P Bricks	Prasanna Kumar Acharya, Rourkella	IV-OR-ROUR-02
14	Orissa	Jagatsinghpur	M/s Leo Bricks	Mr. Dibya Kishore Sahoo,C/o Sri Chitta Ranjan Dosh, Gandhi Chowk, Jharsuguda, OR.	IV-OR-JHAR-01
15	Orissa	Rourkella	M/s M/s F & B Industries	Mrs. Pinki Patel, Gandhi Chowk, PO Gandghore, Jharsuguda, Orissa	IV-OR-JHAR-02
16	Orissa	Rourkella	M/s Pushpa Bricks,	Puspanjali Patel, Jhansuguda, Orissa	IV-OR-JHAR-03

Annex-6

Brick Production Technologies in India

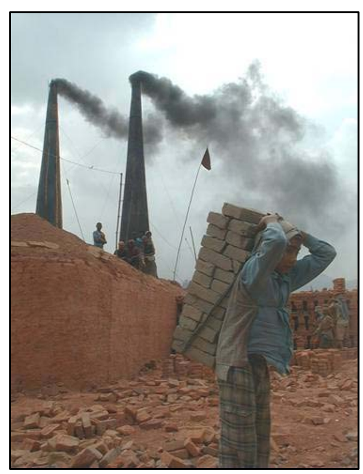
Clamps

An intermittent kiln without permanent kiln structure is commonly called a clamp. The production of capacity of clamps generally ranges from 5,000 to 50,000 bricks per firing and is categorized as a kiln with small production capacity. The clamps consist of a geometrical arrangement of bricks on the level ground. The common shapes are conical, circular and trapezoidal. The common fuel used is coal or residues of coal obtained from foundries and boilers. There is little regulation of fire and no control on firing temperatures.



Since the whole stack of bricks is exposed to the atmosphere, heat loss from the surface is excessive. The production process is highly vulnerable to external weather conditions and the production period is usually limited to 120 days per annum. The firing cycle is offer duration of 21 to 28 days and the product quality is questionable. The appearance of clamps is almost spontaneous as no clearances are required for setting up of production; especially for traditional brick communities. The entry barrier is very low as the only capital needed is working capital assisted by access to land.

Movable Chimney Bulls Trench kiln (MCBTK)



The MCBTK is a continuous kiln with the kiln structure consisting of twin trenches in the ground and a set of steel chimneys that are movable. The trench is a continuous trench wherein the bricks are stacked geometrically. The coal is fed from the top of the stacked bricks and the fire movement takes place by moving the chimneys which in turn create the draught for movement of the fire. The combustion process is fairly inefficient and a huge amount of smoke and SPM is generated and discharged through the moving chimney. The MCBTK have a production capacity of 15,000 – 25,000 bricks per day; the firing cycle to complete one round of the trench is about 21 days. The fuel consumption is highly dependent on the moisture conditions in the ground and the skills of the firemen. The MCBTK have low capital investment (largely in the steel chimneys and track arrangement). The working capital requirements are very large because of the huge investment in green bricks, fuel and contract manpower. The MCBTK have been very popular because of low capital investment and high turnover: capital ratio. The product quality is highly variable and often four qualities of brick are produced. The marketing and disposal of bricks is a major challenge for entrepreneurs. The MCBTK has been banned w.e.f. 30th June 2003 on account of its highly polluting characteristics.

Fixed Chimney Bulls Trench Kiln (FCBTK)

The Fixed Chimney Bulls Trench Kilns are larger in size compared to MCBTK. The production capacity of FCBTK ranges from 25,000 to 50,000 bricks per day. The CPCB guidelines specify a fixed chimney with a height of 30 metres and gravitational settling chamber for FCBTK of above capacity. Introduction of fixed masonry chimney, connected to the trench by flue passages and provision of dampers to control flue gases has increased the fuel efficiency of Bull's trench kilns.

The settling chamber is the simplest of all air pollution control devices. It does have a wide usefulness in its own right and can be used to separate out the larger particles in a particulate distribution generated from coal combustion in brick kilns. It is almost the cheapest device to control, operate and maintain. A large volume of chamber allows the air to flow at a low horizontal velocity, giving time for the particles to settle out. The force causing separation is that of gravity. The particulate matter i.e. dust collects and forms a layer on the bottom of the chamber. This collected dust layer must be removed periodically.

The FCBTK has the potential to produce consistent quality of bricks and colour is a strong feature of the fired bricks. The FCBTK involves a very high capital investment and an equally high working capital requirement. Because of the large scale of operations, FCBTK requires ownership of large plot of land (30,000 sq. metres) and access to vast resources of soil.

High Draught Kiln

High draught kiln developed by Central Building Research Institute (CBRI) is basically arch less, top fed, coal fired continuous kiln wherein the fire follows a zig zap path and is operated on an induced draft system. Availability of higher draught, better heat transfer between bricks and air, more efficient combustion of coal, faster drying rate of bricks in the brick preheating zone, reduction of heat losses from the kiln structure due to faster rate of fire travel makes this kiln more fuel efficient as well as less polluting.

Despite best efforts of CBRI and Building Material and Technology Promotion Council (BMTPC) over last 20 years, the HD kilns have not gained much popularity, possible due to high capital cost involved and the need for uninterrupted electricity supply. The high draught kilns installed by large brick makers have largely closed down.

VSBK

VSBK operates on the principles of effective utilization of the heat produced by the fuel. To achieve maximum utilization of the heat, a continuous chain of green bricks are loaded from top passes through a centrally located firing zone in rectangular vertical shaft, which come out as fired clay bricks from bottom. Stacking of bricks in a batch is a special feature of VSBK technology. A weighed quantity of coal is spread on each layer uniformly to fill the gaps. Fresh green bricks are shifted to the top loading platform using the ramp *(See Figure 1).* These green bricks are loaded in batches after every two hours and they are moved down slowly through firing zone located at the centre of the shaft. Each batch remains in the firing zone for nearly two hours and then slowly moves down along the shaft in a step wise unloading process after every two hours. As the procession of batches gradually passes through the shaft, the green bricks encounter pre-heating, firing and cooling zones before they reach the shaft exit.

The unloading of bricks is done from the bottom using a trolley which runs on long rails provided up to the unloading tunnel. Lifting and loading of the trolley is done using single screw mechanism. For unloading, the trolley is lifted so that the whole stack of bricks in the shaft rests on it. The stack is then lowered till the layer with openings appears through which the support bars are reinserted. On further lowering, the load of the stack is taken by the support bars except for the batch being unloaded which comes down along the trolley which finally rests on a pair of rails. Later trolley is pulled out along the rails and the bricks subsequently unloaded and sorted out for dispatch. The skill in operation is to keep firing zone in the middle of the shaft. The draught air moving up from the bottom cools the fired bricks in the cooling zone and itself gets heated and ultimately provides oxygen for coal which is burning in the firing zone. Maximum temperature in the firing zone goes up to 1000^0 C in the central firing zone. The hot gas moving upwards dry and pre-heat the green bricks in the pre-heating zone. Thus recovery of sensible heat accounts for the high energy efficiency of the VSBK technology.