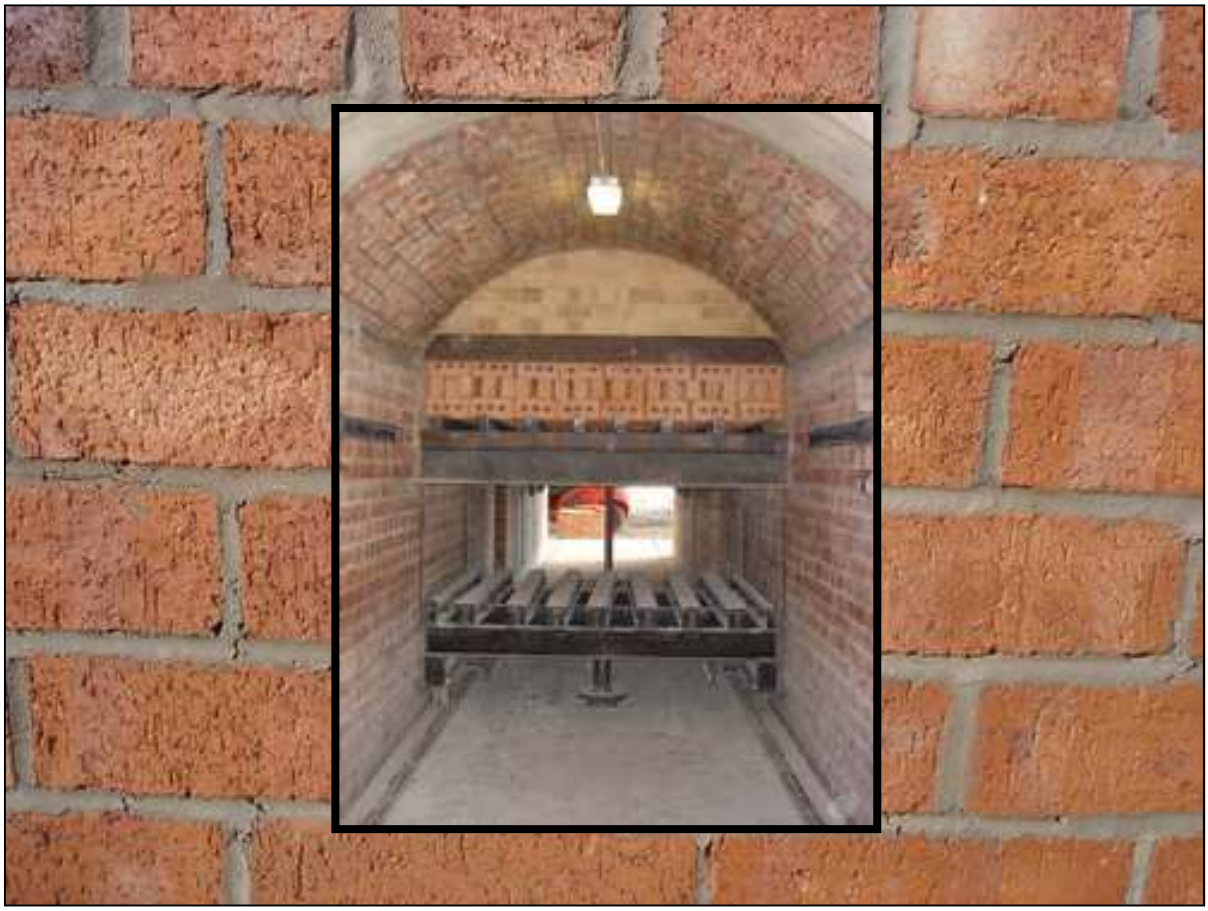
projekt consult

Beratung in Entwicklungsländern GmbH

Evaluation of the SA-VSBK

Dr. Michael Priester
Dr. Llewellyn Lewis
Eckhard Rimpel



Pretoria, Johannesburg, Bad Vilbel
November 2012

Laerchenstrasse 12
61118 Bad Vilbel, Germany
Telefon: +49-6101-5097-0
Telefax: +49-6101-509729
e-mail: info@projekt-consult.de
www.projekt-consult.de

Managing Director: Dipl.-Volkswirt Bernd Benthin
HRB Frankfurt am Main 73468, USt-IdNr. DE114201238
Bank account: Frankfurter Sparkasse
BLZ 500 502 01, Account-Nr. 58-99 00 37
IBAN: DE 04 5005 0201 0058 9900 37
SWIFT-BIC.: HELADEF1822

Content

Executive summary **4**

1 Introduction **7**
1.1 Objectives and issues 7
1.2 Methodology 8

2 Framework conditions **9**
2.1 The brick sector as part of the broader industry 9
2.2 The building material and brick markets 9
2.3 Implications of the brick market for the project 13
2.4 Emission right trade and leverage from European right to CERs 15

3 Critical issues dating back to the project planning stage **17**

4 Review of the current situation of the project **18**
4.1 Sustainability, dissemination and replication 18
4.1.1 Caring Production 18
4.1.2 Enabling Environment review 19
4.1.3 Technology Dissemination review with a focus on replication 20
4.1.4 Key factors influencing the VSBK dissemination process 21
4.2 Relevance to Context and Technology 25
4.3 Summary of the findings 26
4.3.1 Strengths 26
4.3.2 Challenges 27
4.3.3 Red flags 27

5 Recommendations for the future intervention **28**
5.1 Roll out of VSBK 29
5.2 Policy and enabling environment 30
5.3 Support of sustainable brick making 33
5.4 Communication 34
5.5 Project management 35
5.6 Political dialogue 35
5.7 Issues to phase out 35
5.8 Stakeholders to be addressed 35

6 DAC-criteria **37**
6.1 Programmatic Thrust 37
6.2 Effectivity and effectiveness 37
6.3 Sustainability and long term success factors 38
6.3.1 Success factor 1 – Strategy 38
6.3.2 Success factor 2 – Cooperation 39
6.3.3 Success factor 3 – Steering structure 39
6.3.4 Success factor 4 – Processes 39
6.3.5 Success factor 5 – Learning and Innovation 40

7 List of Annexes: **40**

LIST OF ABBREVIATIONS

€	Euro
ABSA	
ABT	Alternative Building Technologies
AFD	Agence Francaise de Developpement
BE	Brick Equivalent
BEE	Black Economic Empowerment
BMI-BRSCU	BMI Building Research Strategy Consulting Unit cc
BTK	Bull Trench Kiln
CBA	Clay Brick Association
CDM	Clean Development Mechanism
CER	Carbon Emission Rights
Cermalab	materials testing and materials sector training laboratory for the ceramics industry
CIDB	Construction Industry Development Board
CMA	Concrete Manufacturers Association
CSIR	Council for Scientific and Industrial Research
DAC	Organisation for Economic Co-operation and Development
DEA	Department of Environmental Affairs
DHS	Department of Human Settlements
DTI	Department of Trade and Industry
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EMP	Environmental management plan
EMPA	Material Science and Research Institute of the ETH
EP	Entrepreneur
GHG	Green house gases
GPCC	Global Programme on Climate Change
HQ	head quarter
IDC	Industrial Development Corporation
IPAP	Industrial Policy Action Plan
MBA	Master Builders Association
NEF	National Empowerment Fund
NGO	Non Governmental organization
NHBRC	National Home Builders Registration Council
OSH	Occupational Safety and Health
PMSC	Proyecto Minería Sin Contaminación
PMU	Project Management Unit
PoA	Programme of Activity
PSC	project steering committee
R	Rand
RDP	Reconstruction and Development Programme
RSA	Republic of South Africa
SA	South Africa
SABS	South Africa Bureau of Standards
SANS	South Africa National Standard
SC	Swisscontact
SDC	Swiss Agency for Development and Cooperation
SKAT	Swiss Resource Centre and Consultancy for Development
SSP	support service provider
T	ton
ToR	Terms of Reference
TR	thousand Rand
VSBK	Vertical Shaft Brick Kiln
ZAR	South African Rand

Executive summary

The present report summarises the results of an external evaluation of the SA-VSBK project. According to the ToR, the mission has two main goals: a **Mid-term/end phase review** and the provision of **recommendations for a second phase**. The mission team was composed of Dr. Michael Priester (team leader), Dr. Llewellyn Lewis (South African Building sector expert) and Eckhard Rimpel (brick production and CDM expert). The mission to SA took place between September 23rd and October 6th, 2012, followed by a workshop held between November 5th and 7th. The report builds upon an auto-evaluation, interviews, field visits, workshop results and the review of documents.

The **second chapter** summarizes the **market for building materials in general and the clay brick in particular**. This concludes that the clay versus cement products have roughly a half-half share, which is expected to remain like this in the future, if no detrimental legal-administrative procedures induce changes.

The market for stock bricks is 1.6 Billion Brick Equivalents (BE) per annum, of which 80% are still produced in clamps. Only considering operations which require less than 35 VSBK shafts to fully convert clamp production by VSBK production and certain potential within the non CBA-associated brick makers the potential for VSBK in RSA is around 600 shafts.

The CER trade, which had been seen as a key element to facilitate funding and to support the industrial conversion process was established within the first industrial PoA, but severely suffered from the price decay for CER´s (from around 12 €/t at the start of the **CDM component** to below 1 €/t currently).

The **third chapter** outlines critical issues that date back to the **project planning**. Lack of consideration of potential non-technical/economical barriers for investment in new technologies (feasibility study and risk assessment), unrealistic estimation of the market development, an unforeseeable downturn of the global economy and national building sector contributed to defined targets which were irrealistic and non-achievable. The unilateral focus on cooperation with the private sector further added to the difficulties to establish an enabling environment for the conversion of the brick industry.

The **fourth chapter** summarizes the findings with respect to the **current project implementation status**. It can be stated that the **key strength** are that the SA-VSBK has established relation of confidence with all relevant key stakeholders from private sector (all doors are open), that the technology transfer had been successful and is practically concluded, the support service provision is fully commercialized, the evolution of SA-VSBK kiln design (initially by South-South cooperation, then taken over by private SA know-how) has added enormous developments to the global state of the art and knowledge on the technology and last but not least that the first pilot kiln is running and performing extremely well, producing high quality bricks and competitively with respect to economic, social and environmental performance. This is acknowledged by both the public as well as the private actors.

In view of the low numbers of VSBK shafts running in RSA after over 3 years of project implementation (6 shafts at one pilot enterprise), a thorough **analysis of driving forces and barriers** for the investment in this technology has been performed:

The **driving factors** are manifold (commercial, socio-cultural, technical, environmental & climate change related). Many of them are only recently fully understood, after monitoring the well performing kiln operation at Langkloof. This leads to a new potential for the marketing of the VSBK focusing on the technology as a positive business solution. Either alone or in combination, the commercial drivers increase the likelihood and potential size of profit, so helping brick producers achieve greater financial gain and independence.

Equally there are many **barriers to investment**. Aspects may be grouped in different fields, such as enabling environment, financial & economic, market, socio-economic, technological and finally geografical factors. A uni-dimensional reduction to access to finance –as it has been made with project planning- is not realistic. To stimulate more investment the situation calls for an extended addressing of market issues, the administrative framework and adverse perceptions.

In discussion the **lack of finance** is mentioned as the key problem: nevertheless, this does not mean the simple access to a credit line. The third party financing is linked for the investor with a lot of risks he is not willing to take in the current circumstances. Most of these barriers are perceptions which may be overcome by a targeted communication based on reliable and proven data from the first pilot plant. Thereby a special highlight on the hard business case facts is seen as a convincing approach.

As **main challenges** the team identified the establishment of a critical mass of VSBK in RSA to trigger auto-development of the technology, the creation of the required political and enabling environment and support for the greening of the brick (or building material) sector in order to motivate EPs to invest, to overcome resistance against VSBK in parts of the private and public sector and to generate ownership within the sector organisations to anchor the technology and the approach to green the brick industry in view of sustainable impacts of the SDC funded project.

Immediate attention should be given to the following aspects: Address the intellectual property right issues (which lies with private and commercial SSPs) and outline a roadmap with a clear definition of roles, mandates and responsibilities for each actor mutually agreed with all relevant partners, initiate a policy dialogue, prepare for an institutionalization including the definition of and cooperation with a partner to anchor the technology and develop a concept for sustainability and an exit strategy.

The **fifth chapter** deals with **recommendations for the future intervention**. The guiding principles for the outline of a new phase were defined the identified need to broaden the scope of the project (from unilateral focus on VSBK towards unbiased support of EE brick production in order to align with Government and CBA), to broaden the portfolio of partners (including the public sector in order to moderate processes that may lead to a more supportive environment for greening the sector), to focus on support instead of regulation and to support SA led further development of the technology.

This leads to proposal with a **three-tier approach**: 1. Roll-out of VSBK, 2. Policy and enabling environment and 3. Support of sustainable brick making in general. This shall be complimented by an own component for cross-sectoral communication and a political dialogue on protocol level in order to advocate for Governmental commitment or even financial contributions. The project is advised to phase out the CDM related activities as long as the CER prices are as low and to establish a NGO to host the technology.

With such an outline the project evolves further: it **changes its role** from a technology transfer and technological driving force to a facilitator and supporter of private sector driven development. Whithout doubt SDC and the implementers can build upon experiences in Vietnam, Southamerican Andean countries and Central Africa. The role of SDC should be seen in its traditional strengths: the promotion and moderation of multi-stakeholder processes for development. The conversion of the brick industry replacing clamp kilns by VSBK, and thereby contributing to the national climate change goals, is a complex process where individual enterprises face high administrative and entrepreneurial burdens. The project can make a difference by providing paved roads, and reducing barriers not only for single enterprises but for the entire brick making community. And this shall apply to aspects such as licensing, financing, engineering, construction and optimizing operational performance. This evolution of the approach would initiates the following changes:

1. **From supply driven to demand oriented** project content, structure and management in order optimize outlook for sustainability by:
    - New 3rd component (technologically unbiased) in order to align with CBA and Govt. policies

- Project Steering Committee with participation of Government, Association and EP´s
- Participatory planning

2. Address the **privatization of technology services** adequately in order to maintain focus and impact by:
    - Solution of intellectual property right issue ensuring that the project has a product to roll out
    - Stringent definition of roles of actors
3. Identify and address **barriers for investment** in VSBK in order to achieve critical mass of VSBK by:
    - Study of barriers and success factors by SA partners in SDC brick projects
    - Policy dialogue as a means to discuss and overcome barriers
    - More specific communication campaign
4. Strengthen **partner intervention** in order to generate ownership:
    - SA driven technology development
    - Stronger aligning with CBA and Government authorities

With respect to sustainability the report highlights that the following success factors are addressed:

Success factor 1 – **Strategy**

- Define and communicate objectives on impact level
- Strengthen alignment with national strategies

Success factor 2 – **Cooperation**

- Strengthen synergies with other SDC CC projects and add political dialogue
- Strengthen the establishment of networks on partner side (from and with CBA as the key driver in the sector and a loose network of excellence of commercial SSPs)

Success factor 3 – **Steering structure**

- Establish PSC
- Develop operational planning and monitoring

Success factor 4 – **Processes**

- Enlarge partner portfolio to public sector
- Initiate processes on provincial level
- Support optimization of administrative procedures (i.e. EIA)

Success factor 5 – **Learning and Innovation**

- Bring capacity building from individuals to a higher level (organizations, networks, public authorities)
- Strengthen the training component

1 Introduction

The authors have been invited by SDC, Berne to perform an external evaluation of the SA-VSBK project. A brief project description as well as the TOR is given in the annex.

1.1 Objectives and issues

According to the ToR, the mission has two main goals:

1. **Mid-term/end phase review**: assess the performance of the project analyzing the changes in the context since project planning, achieved results and draw out lessons learnt
2. **Recommendations for second phase**: based on the results of the review, recommendations and delimitations for key areas for project intervention in a possible second phase and what are the elements where the second phase should be focusing more to achieve a sustainable implementation of the VSBK in South Africa and a transition to a low carbon clay brick sector.

Based on the ToR provided with the invitation to tender, it is evident that one of the greatest challenges has been found in supporting successfully the dissemination of the VSBK technology within the brick sector. This despite a broad spectrum of advantages covering environmental, social, economic and other fields. The evaluation mission will therefore focus mainly on the following issues:

- Identification of the perception of key stakeholders regarding the VSBK technology and its specific advantages (from an entrepreneurial as well as an administrative point of view). These perceptions shall be used as leverage for further dissemination of the technology in the upcoming second phase.
- In addition, it seems important to identify barriers and success factors for dissemination of VSBK technology in the South African brick sector. These factors can be of social, economic, legal, administrative, organisational or other nature. They do invariably influence the decision taking on process changes more prominently than technological issues. In order to outline a path towards dissemination distinction should be made between voluntary and obligatory changes of technology, especially in view of sustainable processes. Even though a legal administrative pressure towards VSBK technology could be established, it is envisaged to assess opportunities for voluntary application of this technology and setting the market frame work accordingly.
- Evaluation with respect to the DAC criteria (relevance, efficiency, effectiveness, sustainability, etc.).

With respect to the outline of an envisaged second project phase the basis for a strategic positioning of the project shall be identified and assessed: In the view of the project as initiator and moderator of change towards caring / responsible brickmaking and greening of the brick industry the activities to outline the future phase will include a scenario for the development of the building material market in SA for the mid term future, a survey of the demands of the brick sector for support, assistance and advice in view of the desired greening of the brick industry as well as the perspectives of brick producers towards other options for industrialization of the brick production, such as Hoffman or tunnel kilns. The mission will further identify options for accelerating the technological changes, i.e. setting the enabling environment including the access to finance, stimulating direct investment and knowledge transfer by foreign VSBK brick entrepreneurs, etc.

Issues	concerns
Adoption of VSBK, scaling up	• Possible rate of adoption as a function of market and EP perspectives, alternatives to VSBK • evaluation of adequacy of business model (open source)
Business Environment	• Evaluation of Policy developments impacting brick production • Existing incentive schemes, suitability and ease of access

	• CDM and green credit lines
Green Economy trends	• Assess likelihood of impact of Green Economy on building sector • Will this increase demand for VSBK?
Scope for growth	• Scaling-up potential in RSA • Towards informal sector in RSA • Expansion into Southern Africa (with, without VSBK)
Local anchoring of technology	• Robustness of local knowledge pool for assuring dissemination of technology • Transfer functions of PMU to local organisations
Synergies	• With SDC Energy Efficient Building approach, other ongoing public and private sector funded projects
Project set-up	• Efficiency and impact

1.2 Methodology

The consultants applied the following methodological elements:

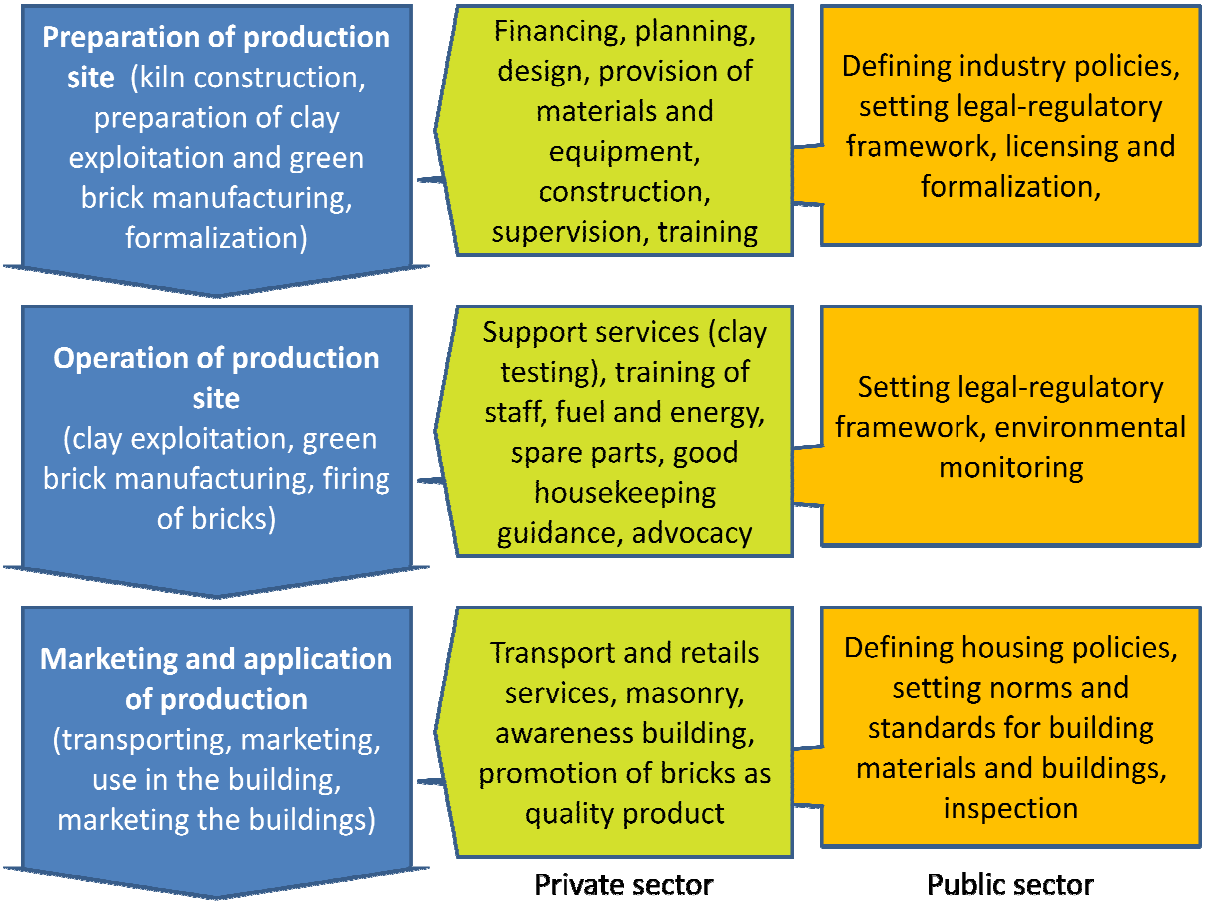
- Initiating a brief auto-evaluation process. In this process around 25 key stakeholders were selected to respond to 4 short questions. The result guided the evaluation mission and gave first hints on the key challenges of the project and a second phase
- Becoming familiar with the brick producers sector, the VSBK Project and SDC through reviewing existing documents relevant to the ToR (Desk study).
- Consulting with the SA-VSBK Project management and the VSBK project responsible in SDC (HQs and Coof).
- Interviewing the responsible of SC and SKAT at HQ via telephone
- Conducting field visits to VSBK entrepreneurs, builders, Clay Brick Association to Port Elizabeth, Jeffrey's Bay and Cape Town
- Interviewing provincial and national offices of DEA, financial entities (IDC, ABSA), CDM stakeholders.
- Consulting all relevant stakeholders, holding meetings and interviews.
- Discussing the major findings with selected key stakeholder in a half day workshop in Pretoria

2 Framework conditions

2.1 The brick sector as part of the broader industry

To understand the complexity of the brick sector and its different levels and interrelations the following illustration is given, which follows the logic of up-stream, side-stream and down-stream linkages as outlined by the African Mining Vision. The upstream linkages are those required before the brick manufacturing operation, namely the construction of the brick factory with all its elements. The side-stream linkages are those required to maintain operation, while the down-stream linkages relate to the marketing and demand side. The illustration further highlights the interrelations with both the private as well as the public sector. It is important to understand that the target level of the GPCC is on the mid level (GHG reduction during operation), while the SA-VSBK intervenes on the upper level (provision of EE kiln technology). The preparedness of the EPs to invest is determined by the down-stream level. This highlights the challenges to target and focus the intervention without diluting the resources.

Upstream, sidestream and downstream linkages of brick production



2.2 The building material and brick markets

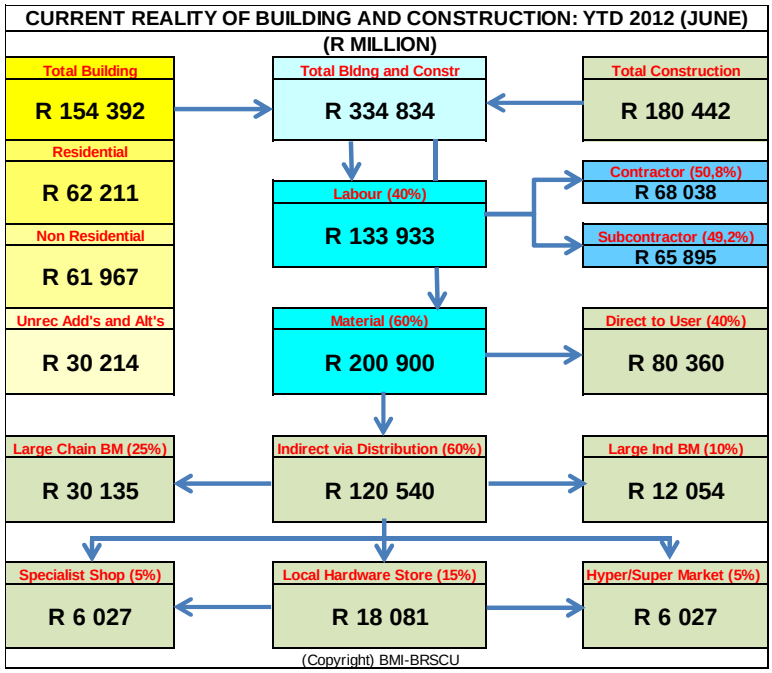
The present chapter summarizes the general situation of the building and clay brick markets. For full details please refer to the annexes 3 and 4.

The Building and Construction Industry is a large system of some R334-Billion with a Building Materials market of about R200-Billion, which is distributed to a dispersed building market via the various retail chains and the individual and franchised independent distributors.

The MAJOR BUILDING PRODUCT GROUPS constitute about R90 Billion (50%) of the total of R194 Billion annual Building Materials market.

It can be noted that WALLING is one of the largest product segment of the major building products, which comprises some 54% of the R200 Billion of major building product groups and between them, represent very important segments of the South African building industry.

Companies that operate in these environments are part of very large and relatively stable systems with a momentum of their own. The risks inherent in large markets are clearly less than in smaller and more cyclically sensitive markets. The South African Building and Construction Industries are also characterised by relatively few large players in each of the major product segments which also reduces the operating risk of these companies and of course of investors in these companies.

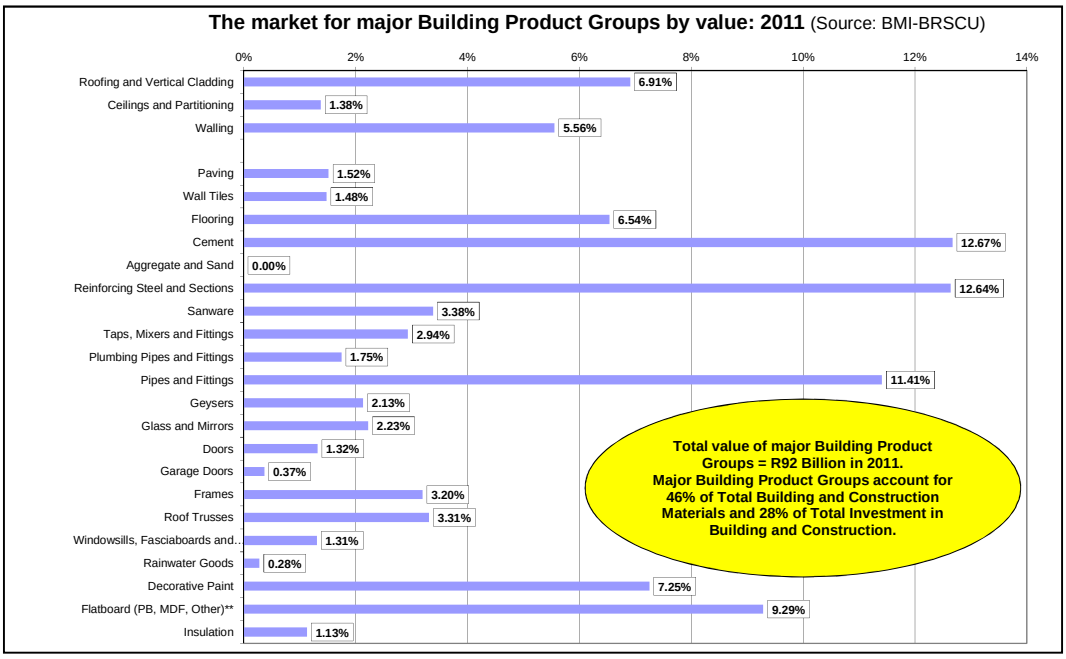


The value of building materials used in 2011 was about R201 Billion in a total investment of about R335 Billion. It is estimated that the market for the major building product groups, represents about R92 Billion or 28% of the total investment in building and construction, and 46% of Total building and construction materials. Most of the building materials required by the industry are manufactured locally. Luxury products do get imported as well as commodity type products from countries with large production capacities and low costs. This is particularly prevalent from China and Eastern European and Latin American countries.

The main stakeholders operating in the major building product groups would also be the major participants in the building materials manufacturing process. In this regard it is interesting to note the major stakeholders in manufacturing by product segment and percentage of sales by value:

Reinforcing Steel and Sections	11,23%
Cement	13,12%
Flatboard (Particleboard, MDF, Other)	8,25%
Walling (including paving)	**8,61%**
Decorative Paint	6,45%
Aggregate And Sand	8,24%
Flooring	5,81%
Roofing and Vertical Cladding	4,86%
Sanware	3,01%
Roof Trusses	2,94%
Window and Door Frames	2,84%

Glass and Mirrors	1,98%
Plumbing Pipes and Fittings	1,55%
Doors	1,98%
Geysers	1,90%
Taps and Mixers	1,84%



It is evident that Walling is the fourth most important Building Product Group. The industry is large and has momentum and critical mass and organizations operating in the major building product sectors have the comfort that the market is large and will grow in tandem with the Building Industry in total.

The manufacturing sector is dominated by a few large players. This of course affects the opportunities for investment as far as equity ownership is concerned. Currently the capacity of most Building materials manufacturers is under utilised. Many of the manufacturers have excess capacity and have put expansion plans on hold.

The Clay Brick Industry consists of some 140 - 150 factories from which production and sales statistics have been obtained.

According to At Coetzee, Executive Director of the CBA, the 14 large brick companies have about 40 factories between them and the CBA members probably represent some 85% of total production capacity and sales turnover in the industry.

Recently the CBA surveyed the total clay brick producers known to them to try and determine a verifiable figure for clay brick production capacity and sales volumes.

The current total clay brick production is running at about 65% of capacity. The split in production between NFP and Other is 67% to 33%.

Staffing is currently at some 84% of full employment.

Total Sales averages 221 696 488 Brick Equivalents (BE) per month with NFP comprising some 63% and other 37%.

If this monthly figure is extrapolated to annual sales (multiplied by 11,3) an annual figure of 2,5 Billion Clay Brick sales is arrived at. The CBA estimate that the survey probably represents the majority of total Clay Brick manufacturers (including non CBA members) and the total estimated Clay Brick market of some 2,5 Billion Brick Equivalents (BE) appears to be a good estimate.
It is estimated that the total brick and masonry market in 2011 amounted to 4,9-billion brick equivalents at an estimated value of R5,1-billion.

This market estimate is based, firstly on the survey by the CBA into the market for Clay Bricks and information obtained from the Concrete Masonry Association (CMA) on the market for Concrete Masonry products. Secondly, these estimates for the total market size is linked to and derived from total building activity in the residential and non-residential sectors.

In the case of the residential sector, the number of brick equivalents per unit and m2 is estimated and in the case of the non-residential sector, the number of brick equivalents per sq.m. of non-residential building activity. A user index is assumed in each of the segments for both the residential and non-residential sectors and market share percentages are also assumed for the main product segments, i.e. clay face brick, concrete face brick or block, clay stock brick or block and concrete stock brick or block and panels.

It is evident that the estimates of brick equivalents per unit and per sq.m. and the user index are subject to manipulation. Another segment which is subject to manipulation is the unrecorded additions and alterations segment in both the residential and non-residential sectors.

The market size derived in this manner is then confirmed in discussions with the major players in the brick/concrete masonry industry, i.e. the Clay Brick Association (CBA), the Concrete Masonry Association, the Cement and Concrete Institute and major manufacturers in both the clay brick- and the cement brick/block industries. The input from the CBA was shown in the earlier paragraph.

The Concrete Masonry Association (CMA) does not have a good estimate of the total brick/concrete masonry market. According to them, there is a 50:50 split between clay- and concrete brick/block. The Cement and Concrete Institute holds the view that there has been a trend away from clay stock bricks towards cement stock bricks/blocks in the last number of years.

Taking into account the various views expressed, BMI-BRSCU estimates the market at some 4,923-billion brick equivalents per annum, with the split between clay stock bricks and cement stock bricks/blocks at just more than 70:30 in favour of cement bricks/blocks. Clay face brick still dominates the face market with face blocks only holding a very small share of a specialised market segment.

2011 DEMAND FOR BRICKS/CONCRETE MASONRY BY PRODUCT				
Material	**BE*Million**	**Percent**	**R Million**	**Percent**
- Clay Face	835	16.96%	1494	29.22%
- Concrete Face	180	3.66%	316	6.18%
- Clay Stock	1654	33.60%	1689	33.02%
- Concrete Stock	1947	39.54%	1396	27.29%
- Panels	307	6.23%	220	4.30%
TOTAL	**4923**	**100.00%**	**5115**	**100.00%**

Concrete Stock bricks/Blocks represent the major competitor to Clay Stock bricks/Blocks and currently command 54% market share by volume, compared to the 46% of Clay Stock bricks/Blocks. By value, Clay Stock bricks/Blocks represents 55% of the total Stock brick/Block market and Concrete

Stock brick/Block just less than 45%. Concrete Stock brick/Block has taken market share from Clay, particularly within the last five to eight years. The main driver of this successful market penetration by Concrete Stock bricks/Blocks has been because of the smaller scale of Capex requirement to set up a Concrete Plant, and the greater flexibility and mobility of Concrete Plants. The aggressive marketing and promotional campaigns of Concrete Manufacturers also plays an important role. Moreover the Concrete Masonry Association has the support of their own members as well as the Cement and Concrete Producers because of the common objective to promote the use of Cement and Concrete products to end-users. The Clay Brick Association in contrast has only the support of some of the manufacturers, albeit the most important players. Finally there is another aspect: a drive particularly by ABSA/Barclays Bank in support of Department of Human Settlements (DHS) to promote the adoption of n such as building panels and Light Steel Frame Construction. This further weakens the position of clay bricks in the market.

Although the assumption in this report is that the relative market shares of Clay and Concrete Stock bricks/Blocks will remain the same to the year 2020, it is clear that the aggressive expansion by the Concrete Brick and Block Manufacturers, will of itself, create more competitive pressure on Clay Stock bricks/Blocks and if the past history is anything to go by, the market share of Clay Stocks could be further eroded.

This will apply particularly to the residential sector, whilst the market shares in the non-residential sector may well remain fairly constant over the scenario period.

A major building company compared both materials, which underlined the fact that both materials have specific advantages, which keep their market position.

Clay brick	Cement brick
• Thermal properties better • Mass (sound transmission properties) better • Better quality (50 Mpa vs 7 Mpa in the case of concrete) • Easier transport • Excellent stock brick backing material if facade is with face bricks • Image as quality building material	• Cheaper • Production process much faster and more flexible. Less Working Capital tied up in stock • Uniformity higher • Can be manufactured with fly ash (very economic) but more unstable with regard to drying shrinkage and wetting expansion • Versatility • Allows production in mobile factories • Very little administrative burden

It is expected that the split of Clay Stock brick/Block between the residential and the non-residential sector will change from 60%: 40% in 2009 to 63%: 37% by 2020 under the Lower Middle Road Soyuz Scenario.

2.3 Implications of the brick market for the project

Based on the a.m. numbers the potential for newly constructed VSBK shafts can be established as follows:

The **market for stock bricks** in 2011 was 1,6 Billion Brick Equivalents (BE) per annum. The capacity of a single shaft is 6000 per day X 7 days X 49 weeks = 2 056 000 per annum.

Within the national stock brick production it is estimated that **80% are fired in clamps**.

It is generally assumed (hearsay from leading industry stakeholders) that VSBK conversion is only suitable for Manufacturers producing up to 4 million BE per month or 48 Million per annum (24

shafts) whilst it is estimated that up to 35 shafts would be theoretically operationally feasible. It is estimated that 24 shafts would cover the production requirement of **80 % of these clamp kilns** in SA.

The use of higher technology kilns (Hoffmann kilns and tunnel kilns) are – due to cost considerations - mostly limited to face bricks and special products like hollow blocks (i.e. by Corobrick, other companies using some old Corobrick stock brick kilns and Julian de la Hunt). Zig-Zag-Kilns are currently not operating in RSA. Only about 20 % of stock bricks are produced with these kilns.

If the penetration could be 10% market share (of 80% of the clay stock brick market) in 3 years, this would translate into just above 70 VSBK shafts, taking into consideration the growing overall demand for stock bricks due the picking up of the building sector. The market development will see a rise in demand, derived from a Lower Middle Road Outlook to 2020, which may be estimated at 14.19% from 2012 to 2015 and 43.63% by 2020.

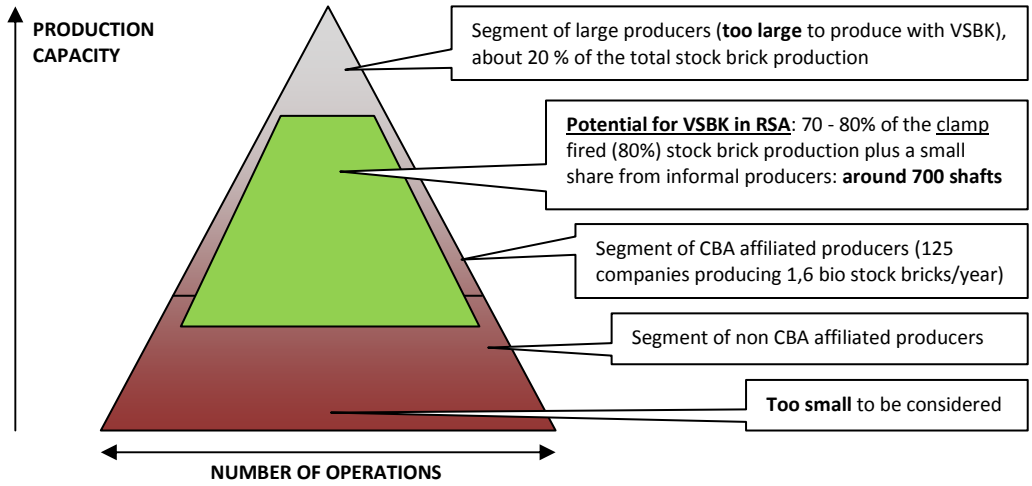
If the total market share could be above 70% of the clay stock brick market by 2020 this would translate a theoretic potential of close to 650 VSBK shafts.

In addition the potential within the non CBA - organized brick sector (informal operators, riverbed operations) should be considered. Even though a thorough analysis had not yet been performed it is estimated that the large amount of these operations (several hundreds in Eastern Cape alone, see below) the potential may be significant (as the Nepal experience underlines, see below) and may be estimated as additional 10% of the above mentioned potential in the industrialized sector.

This amounts to a total potential of around and above 700 VSBK in total RSA.

Annex 8 gives a scenario for the potential development of the stock brick market and the potential VSBK market penetration. Please note that this market potential scenario is just a scenario based on and derived from the Lower Middle Road Scenarios for the Building Industry on one hand and on percentage estimations of potential market share leading to potential market size on the other hand. This potential will remain just that, until it is converted to actual sales through dynamic market efforts and subject to all the risks inherent in the market, the economy, the policy and enabling environment etc. both globally and locally.

The following graph illustrates the different field of the potential:



Please note that this does not translate directly into demand and market for VSBK!!!

It is submitted that the VSBK investment should be judged on a mix of considerations:

1. The commercial viability as well as the carbon credits arising out of an environmentally friendly production process;
2. The social and promotional value attached to the successful use of the VSBK technology which could serve as a model for the Clamp Kiln Clay Brick producers – who in the longer term will be compelled to convert to some form of environmentally friendly production process;
3. The potential for BEE participation and the transfer of technical and managerial skills;
4. Participation in a large and economically important building industry and the Affordable Housing market with the connotations of social contribution to a politically important sector;
5. Thus for a relatively small investment a "foot in the door" will be achieved in a very important market sector (one of the four major building product groups);
6. The Clay Stock brick (clamp kiln) market is also characterized by second and third generation family ownership, which by its nature loses the appetite and incentive to grow and to invest in new technology. Therefore it is an industry ripe for consolidation, regeneration and growth through acquisition.

2.4 Emission right trade and leverage from European right to CERs

For the trade of emissions rights for CO_2 there are two different systems:

- The European system for the brick industry foresees that the brick producers get a budget of emission rights (EUA) allocated in Germany by DEHSt (Deutsche Emissions Handels-Stelle; Department of the Environmental Authority) or in other European countries by other national authorities. The amount of emission rights allocated is in relation to the baseline, which takes into account the historic emissions. The allocation reduces annually by a certain factor. Additional emission rights have to be purchased by auctions; surplus emission right may be sold via the same auction. Due to the reduction factor the market price should be rising, thereby creating a financial incentive to invest in energy efficient technologies. Especially in the brick industry it is difficult to comply with the regulations because the CO_2 emissions derive not only from fuel, but also from the used clay, which may contain a high amount of $CaCO_3$ (Calcium carbonate; lime). Despite the gradual reduction of emission right volumes the prices have reduced from around 25 €/t CO_2 (in 2008) to today 7,86 €/t CO_2 [1]. The development since 2010 is given below.

- The UN established system for Carbon Emission Rights (CER). Hereby approved projects of investment in energy efficient technology, generally financed by external funding, can generate CERs according to the reduction of CO_2 emissions. These CER can be traded and partly repay investment costs. The prices for CER have reduced from more than 12 €/t CO_2 to currently just below 1 €/t CO_2. Please see the price development below:

[1] See http://www.eex.com/en/

European industry can swap EUAs by CERs thereby leveraging due to the price difference (currently 7,86 : 0,95 €/t CO_2. Nevertheless the north-south trade of emission rights in the brick industry has never reached a significant volume. Difficulties arose from the unpredictable market developments and the high transaction costs.

3 Critical issues dating back to the project planning stage

Generally the evaluation is based upon a target-performance comparison. In this case the targets set as product of the project planning stage have to be considered unrealistic. The following reasons have led to an over-ambitious and impractical definition of goals[2] for the current project phase:

- Lack of consideration of potential non-technical/economical barriers for investment in new technologies (access to finance study and risk assessment). This is even more incomprehensible, as in most of the Asian projects the dissemination of the VSBK technology, which is from a purely technical and economic perspective very convincing and viable, has been hampered by similar barriers. The full understanding of the drivers and hindering factors have yet to be fully understood.
- Unrealistic estimation of the market development. The socio-economic features of the SA brick making sector have not been sufficiently considered in the vision for the market development.
- Unforeseeable downturn of the global economy and national building sector which seriously affected the clay brick market in the industry. This led to over-capacity, large stocks and resistance to investments in new technology.
- Unilateral cooperation with the private sector which proved to be insufficient to set the required incentivizing framework for the greening of the industry.
- The CDM intervention had been planned and included in the project concept just before the drop of CER prices which negatively affected the cost-benefit relation of co-funding through the CDM PoA.

Taking the original planning as basis for the evaluation would lead to an unfair result.

[2] See TOR in the annex for the relevant phase goals.

4 Review of the current situation of the project

4.1 Sustainability, dissemination and replication

The main issue of SA-VSBK track is to create a critical mass of functioning VSBK as successful working examples together with an accessible and sustainable technology supply chain. Therefore, the evaluation team reviewed and identified areas of success and relevant shortcomings of the "VSBK Project" in respect to its goals and objectives set in the first Phase and challenges for a next phase

4.1.1 Caring Production

The technology transfer had worked well in the first phase of the project. This includes the study tour of SA brick makers to Nepal and India and the technical support by SKAT and the global pool during the design phase for the first kiln. This was the basis for the kiln construction in Jeffrey´s Bay. Thereby the SA-VSBK has helped to transform the brick industry. Nevertheless the SA brick makers criticized the fact that they were not granted access to the Vietnamese VSBK designs and sites. According to their understanding these seem to be the most advanced (already using hydraulic unloading devices, complex exhaust systems, etc. and are as well as the SA factories embedded in industrialized green brick preparations using mechanized extruders etc.).

Based upon the Indian and Nepali design the SA designers and experts developed a design that included a number of new design elements: the hydraulic unloading system facilitating the manipulation of bricks at the bottom end of the shaft, a cement foundation, the reinforced cement structure for the kiln construction, the forced draft system, the back to back configuration of the shaft, a mechanized lifting system and others.

Currently the further development is purely SA based and private sector driven by commercial service providers (designers, structural engineers, air flow experts, refractory brick suppliers etc.). These quote that there is no need of further input from the global pool at this stage of the development, but they would like to have an exchange with Vietnamese brick factories and designers.

Due to the development of the design features and the commercial partners in the project the intellectual property rights has become an issue. Initially the project planned for an open source technology, even though this term is not clearly defined. Currently the situation is as follows:

Holder of intellectual property	Mark 1	Mark 2	Mark 3	Mark 4
	Built at Langkloof (first 6 shafts)	Revised Mark 1 design based upon experience from building first 6 shafts	To be built (12 to 18 shafts) at Langkloof as extension of the existing kilns	Further design of the kiln engineer
SDC	**Concept design, Construction design**	**Concept design (disputed[3])**	**none**	**none**
Commercial service provider[4]		**Concept design (disputed), Construction design**	**Concept design, Construction design**	**Concept design, Construction design**

[3] SA-VSBK has paid for 3D concept sketches on the kiln design for further discussion and review by the international expert team, which carry the Rowe Engineering copyright logo. The contract and General Terms and Conditions which may be more specific on intellectual property, have not been analyzed.
[4] Jez Rowe Engineering

The Mark 1 and 2 designs have proven technically fully viable during the past 12 months of operation. Nevertheless they are rather expensive (around R750,000 per shaft or 75,000 €[5]) and overdesigned[6]. Accordingly the value of these products for dissemination is reduced, both in SA as well as outside the country, even though the kiln produced excellent performance.

With the new design of Mark 3 (which was completely developed without intervention, funding or any other formal relation to the SA-VSBK) a number of important improvements have been added to the kilns (which have not been tested); these include: lighter shafts, optimized (multi-escape) flue gas system, lighter support structures, and modular construction, optimized bar system at the unloading site. With these changes the price per shaft as per current quotations for the materials has been reduced to about R500,000 (around 50,000€) including mechanical equipment, roofing, engineering.

Currently the SA-VSBK is designed to a state where the EP´s expect first operational performance indicators from Mark 3. The construction shall start shortly at Langkloof. First experiences shall be available mid 2013. Further reviews and amendments of the design seem unnecessary at this moment.

The time lines to be considered for the investment of new EP´s are relatively long. The next kiln at a new EP might not be in operation for a period of 18 months. This is due to the fact that the EP´s are still waiting for operational results of the next 12 kiln at Langkloof with the advanced design and at reduced kiln costs. The finalization of the financial engineering will take at least 3 months, the construction of the kiln the same. The lead time of a new kiln at a different site and host EP is estimated to be 9-12 months.

The VSBK solution can be considered a vehicle for social and structural change as it turns an essentially open-air, primitive and unhealthy work environment into a professional factory operation with cleaner technology, a healthier environment, with proven energy efficiency and cost saving in production and stock management, whilst saving approximately 9% in labour. The labour conditions improve notably along this process; they now include year round employment, better OSH situation and less physical work.

With respect to the question, if the VSBK technology responds to the demand of the market: There is Government pressure on the Industry to transform through a raft of legislation (Energy Efficiency in Building: SANS 204, SANS 10400 AX) by the DEA, DTI and the SABS (National Building Regulations). The Industry is well aware that they have to convert to more energy efficient and environmentally friendly production.

The adoption of VSBK technology did strengthen the position of the brick producer: Anecdotal evidence from a Developer in Jeffreys Bay, Eastern Cape, testifies to the superiority of the VSBK brick to Clamp Kiln equivalents. It has also opened up new markets as far afield as Port Elizabeth with the largest Face Brick manufacturer purchasing a large percentage of Langkloof production for redistribution in PE.

4.1.2 Enabling Environment review

The focus for the establishment of an enabling environment was on the private sector partners, especially from the funding; banks, financial engineering as well as the PoA for CDM. The public sector has not been addressed systematically. The initially envisaged PSC had not been established, resulting in more opportunistic and ad hoc relations with governmental authorities. An initiative to

[5] Including mechanical equipment and roofing structure

[6] Initially it has been designed with a pay load of over 100 t of green bricks on the upper platform (as in Nepal, where final drying takes place there). The actual net load in Langkloof is always inferior to 20 t.

get governmental support from DEA for the VSBK as officially recognized “green” clay brick firing technology had been declined by the authorities who do not want to favour one technology.

Even though the CDM PoA is close to being fully established in the private sector the brick makers do not see this as a viable co-funding opportunity: still considerable entry costs, the high administrative burden and requirements and consequently delays in the investment project as well as the insecure future of the CER trade system at all and the CER prices in particular are areas of concern. The lower limit for viability is around 10 to 20 shafts, the upper limit established by the PoA for eligibility is 30 shafts.

Raising awareness of the VSBK to the different target groups requires a combination of advertising, public relations and direct representation to sell the benefits of VSBK products. The resources now exist in a proven technology, proven production processes, energy and cost savings and proven in-the-wall performance. There are alliances with Swiss Contact, SDC, AFD, the Banks, Clay Brick Association (CBA) to build upon and reinforce the need to of influence the Policy and Legislative Environment (DEA, SABS, DTI etc).

How sustainable / favourable is the access to existing green credit lines? SDC is the only supplier of finance which presents a huge barrier. SA Banks don’t understand finance requirements of the Clay brick Manufacturers. According to Langkloof CEO Nico Blake a short-term loan cannot work. Investors require a 7-9 months payment holiday. Barclays PLC (Jeff Lawrence) more amenable. Could there be other forms of investment finance or fiscal incentives? Efforts were initiated (by Kevin Fruin) with IDC, IDT, DEA, DBSA etc to motivate a recapitalization process of the Industry, but yet without success. It may be that the timing was premature and the reception may be more positive under current environmental and Legislative pressure.

The SDC grant for the first pilot EPs had certainly motivated Langkloof. However the support grant may not be sufficient enough incentive under the current Industry conditions and outlook which has led to a wait-and-see risk adverse mind-set. The project is advised to bundle all supportive measures (advisory services, independent broker for SSP services, lobbying with banks and on policy level with government, grant component, communication) into an incentivating package.

4.1.3 Technology Dissemination review with a focus on replication

The cooperation with CBA, which would have been the most natural recipient and anchor for the technology and know-how, has been difficult in the beginning. The CBA has a delicate political situation to deal with and has to be very diplomatic. The largest brick producer (Corobrik) has 14 Factories and is the main funder of CBA. They are not totally convinced that VSBK is the best solution, advocating Zig Zag or Hoffman Kilns as preferred alternatives. Meanwhile the situation has gradually changed due to the operational experiences of Langkloof with the VSBK and with the assistance of the visionary and supportive Executive Director of the CBA, who is himself convinced of the VSBK as required innovation for the brick sector in SA. Therefore now CBA is very supportive of promoting energy efficient production and advocates the VSBK as one solution. Nevertheless within the CBA the VSBK is still a sensitive issue and it is unfortunately premature for a formal partnership between the project and CBA. However the existing networks as well as the advocacy power of the Executive Director are increasingly used for the benefits of the project.

The CBA is an important ally to motivate more entrepreneurs to adopt cleaner brick production technologies and have sensitized its members to the inevitability of change or demise. The message has been well received and has been supported by SC and SDC and of course Legislation. There is now a successful plant and with the further investment by Langkloof this will reinforce the message of economic viability.

The project has based its dissemination approach on a commercial strategy. The initially envisaged NGO Section 21 has never been established due to resistance from both commercial Support Service Providers (SSPs) and CBA. Therefore the strategy evolved into a market driven approach with SSPs as recipients and providers of knowledge. The main SSPs are:

- Jez Rowe from Rowe Group for kiln design and engineering
- Cermalab, Pieter Du Toit for clay testing, ceramic testing and training services
- Cool nrg, Kevin Fruin as representative of the CME CDM
- Standard Bank as funding partner and representative of the CME CDM
- JJ Oosthuysen for funding and financial engineering
- DIAL, Dion Marais for environmental monitoring and air emissions measurements
- Jacqui Duarte from Trademark Communications for communication
- Jean Lopez from Cape Refractory Industries for refractory lining of kilns
- Commercial banks for funding, partly funded by international donors such as AFD (seed capital to Banks and Grants up to 7% of Investment)

Some of these SSPs have linked up with further local know-how, such as air flow and structural engineers etc. Based on the interviews performed during the mission the evaluation team could confirm the high level of expertise, knowledge and commitment amongst these SSPs. In SA it is the private sector that drives the further development (i.e. designs and construction for future kilns). Therefore the approach seems justified and adequate.

The project is maintaining a fluent dialogue with all these SSPs and uses them efficiently, even though the role of the project has evolved: from a technology transfer and technological driving force to a facilitator and supporter of private sector driven development. On the other hand the project is still the nucleus of the network and relations are initiated mostly by the project. An own and independent network of SSP has not yet evolved.

Obtaining the critical mass (5-10% of VSBK shaft potential or 40-80 shafts and another 3 or 4 entrepreneurs adopting VSBK in the next phase), as well as obtaining the momentum required for future expansion or dissemination of the VSBK technology at national level is just a question of time and urgency. The pressure will increase from Government and all the major players are convinced there has to be conversion to cleaner technology. All required resources are in place and with potential candidates waiting and watching (Apollo Bricks, Western Cape and Gauteng), Ocon Bricks (with some component of BEE) and at least 3 or 4 other very interested candidates. The 20% penetration could be achieved with 3 years.

As already outlined in chapter 4.1.1 the South-South transfer has worked very well in the beginning (study tour, mutual engineering sessions, fire master's training etc.). Without the technology transfer the kiln at Langkloof would not been erected and performing so well. Later the optimism has dampened due to the process been overlaid by different approaches, differences in the cultural outset and competitions with respect to intellectual rights and commercial agendas. This led to a situation where currently little may be expected from further technology transfer between the "Global Pool" and the SA-VSBK.

4.1.4 Key factors influencing the VSBK dissemination process

The factors which determine the transition of technology towards greener production in VSBK can be broadly organised into the drivers, i.e. what makes it desirable, and the barriers and success factors, i.e. what makes it possible, or not.

4.1.4.1 Drivers for investments in VSBK

The principal drivers for investments in VSBK are as follows.

4.1.4.1.1 Commercial

- **FASTER PRODUCTION means FASTER RETURNS**: Industrialised 24/7 brick production is faster; from 6-10 weeks in clamps from the stacked green brick to the marketable product to 48 h in a VSBK. This minimizes the bound working capital. In the case of the first pilot kiln the material in stock (in green bricks, bricks in the firing process, as well as fired bricks) turned over from around 230 days with clamp operation to below 100 days with VSBK. Therefore the inventory stock turnover developed from 1,6 to 3,7 times per year!
- **HIGHER SALES PRICE due to BETTER PRODUCT QUALITY**: The experiences from the pilot operation show that the high and uniform brick quality from VSBK production leads to retail prices about 20% above the clamp kiln fired brick prices.
- **ACCESS TO NEW MARKET SEGMENTS**: The VSBK fired bricks are –due the energy efficiency of the production process- considered a green building material. Even though the awareness for green building is only just growing there is the probability that these specific demands can only be served by highly energy efficient producers.
- **BETTER PRODUCT QUALITY results in LARGER VIABLE MARKETING PERIMETER**: The higher retail price allows a regionally more extended demand. In the case of the pilot operation the feasible transport distance increased by around 30%. The first VSBK operation immediately faced demands from Port Elizabeth, about 100 km from the production site.
- **LOWER FUEL COSTS**: Due to the high energy efficiency the VSBK reduce the fuel costs by 40-50%. Especially in those areas, where long transport distances from the coal production to the brick production occur these savings are enormous. The current energy consumption is in the pilot VSBK is down to 0,88 MJ/kg
- **LESS PRODUCTION COST AND EFFORT**: The new production process greatly reduces the transport and physical effort for the same outcome so making the work less costly (reduced costs for fuel, tyres, wear of machinery and electricity) and less of a physical strain.
- **IMPROVED RECOVERY**: Production in a VSBK also increases the yield as losses are reduced from 8-18% (according to the climatic situation) in the clamps to less than 2% in VSBK[7].
- **INDEPENDENCE FROM CLIMATE CONDITIONS**: The operation of a VSBK under a roof allows the year round production and reduces influences of the weather on the production process. The pilot operation operated continuously for the last twelve months since inauguration. Clamp operations are very sensitive with respect to rain and have to be stopped in the wet season.
- **BUILDING UP ASSETS**: The VSBK represents a new fixed asset in the balance sheet of the brick producer, while clamps are a low cost technology only requiring a large amount of low quality fired bricks for the coverage of the green bricks.
- **SLOW BUILD OF PRODUCTION**: The VSBK allows to be build shaft by shaft or batch wise thereby reducing the initial investment costs.

4.1.4.1.2 Socio-cultural

- **DIGNITY AND HIGHER SOCIAL STATUS**: Industrialised operations have better access to investors, banks and government authorities, and even skilled and experienced labourers.
- **UPGRADE OF SKILLS AMONGST THE LABOUR FORCE:** The more industrialised production of the bricks in VSBK requires labourers skilled in the manipulation of electric, mechanical and hydraulic machinery, the application of a given and strict time schedule as well as very strict working procedures, this at a 24/7 basis. Furthermore the operation requires skilled supervisors. These requirements together with the training translate into professional development.
- **YEAR ROUND INCOME:** The independence from the climatic situation allows a permanent employment of the labour force, beneficial for both the company as well as for the workers.
- **REDUCED HEALTH RISKS**: The working environment changes towards less exposure to dust, wind and weather conditions.
- **BETTER WORKING CONDITIONS:** The VSBK technology greatly reduces the physical work required.

[7] In the last month the number went down to 1,2%

4.1.4.1.3 Technical

- **ABILITY TO CONTROL AND ADJUST FIRING PROCESS:** The VSBK allows constant monitoring of the firing regime and its adjustment; a feature that is a huge advantage compared to the clamp kiln firing.
- **ABILITY TO ADJUST PRODUCTION:** The VSBK as firing technology in larger operation allows adjusting the production by putting certain shafts out of service. The production of the competing tunnel kiln can be reduced to not less than 80% of nominal capacity.

4.1.4.1.4 Environmental

- **REDUCED EMISSIONS**: Due to the energy efficiency of the VSBK the productions leads to reduced emissions of GHG and other pollutants, such as dust, SO2 etc.. Thereby the technology will meet future stricter standards of environmental performance.
- **HIGHER RECOVERY FROM THE RESOURCES**: The reduced losses of fired bricks due to breakage lead to a better recovery from the clay resources.

The driving factors are as well manifold (commercial, socio-cultural, technical, environmental & climate change related). Many of them are only recently fully understood, after monitoring the well performing kiln operation at Langkloof. This leads to a new potential for the marketing of the VSBK focusing on the technology as a positive business solution.

Either alone or in combination, the commercial drivers increase the likelihood and potential size of profit, so helping brick producers achieve greater financial gain and independence.

With so much to gain, the key questions then are what are the barriers which prevent brick makers from industrialising the firing process? And what are the factors which ensure success when someone does attempt to mechanise?

4.1.4.2 Key Barriers to the dissemination of VSBK

Whilst there are indeed technical reasons why the investment in VSBK is sometimes not regarded beneficial, other factors can be even more important. These might be due to the existence or non-existence of certain political, legal, financial, cultural, or other conditions.

4.1.4.2.1 Enabling environment

- Lack of favourable a Government **policy framework** for the greening of the building material or brick making sector
- The **political order** in the country and the brick producing regions influences the outlook for success of mechanisation projects
- The lack of **disincentives to stop using the old technology.** There is a view that Clamp Kiln operations in South Africa have developed technically and cannot be compared with counterparts in other developing countries, e.g. India. Better firing technology has evolved as well as lower emissions and pollution. According to CBA some Clamp operators are so smart, they can match VSBK. A Clamp Kiln also provides a diversity of products which a VSBK cannot, i.e. a variety of colours through managing oxygen feed, paving bricks, Quantum and Gem Bricks, as well as a high quality and cheap product. A Clamp Committee has been established in CBA to investigate and promote better firing technology and emission control, with an obvious view to prolong Clamp operations as long as possible – or permanently.
- The **administrative requirements for formalisation and licensing** potentially pose traps for the technological conversion process. In many systems there are numerous incentives for miners to remain informal. Getting a mining license, an EIA, an EMP an Aerial Emission License can be enormously time consuming (mining license 5 years, EIA 3-12 months) and expensive (EIA: R50,000-130,000; mining license up to R500,000).
- The existing **administrative procedures do not allow a slow phasing in of VSBK**: the Aireal Emission License for a VSBK production does not allow continuing operating clamp kilns and replacing the production stepwise. This forces the EPs to plan for VSBK for the full production capacity, hence requiring high investment capital while from a technological point of view the shaft-wise installation would be feasible and reduce barriers for funding.
- The **capacity and will of local or national authorities to enforce the law** influences the potential for formalization and greening the industry by affecting the investment climate. Pragmatic attitude to the brick sector seeking to meet Governments objectives with respect to health, safety, employment and environment and climate change through constructive engagement with formal and informal brick producers is needed rather than establishing excessively complex administrative barriers and penalisation only.

4.1.4.2.2 Financial, economic

- The **amount of initial investment in a low margin industry**. Perceived up-front capital outlay to convert to VSBK (under the present difficult economic circumstances, smaller operators probably don't have the cash to convert). The costs for constructing the VSBK are currently quite high at about R700 000 per shaft (which can be reduced to R500,000) and for and small-medium sized entrepreneurs to realise full production capacity they would need a multitude of shafts.
- **Access to finance** is a key determinant for the possibility of industrialisation. Although government has committed itself to reduce carbon emissions, support to industry or private sector efforts have been quite minimal or if available, the process to access the government funds is very tedious. White entrepreneurs face additional barriers that are based on the BEE charters of banks requiring them to hand out loan preferentially to black entrepreneurs. A few private banks offer favourable loans through their green fund (refinanced mostly by international donor agencies such as KfW, AFD), though not easily accessible. The envisaged co-funding under the PoA / CDM turned out to be less attractive than initially envisaged: the low CER prices after the massive price drop (see above) as well as the initial cost to join the PoA and the demanding administrative procedures pose additional barriers and lead to neutral or negative cost-benefit perception by the entrepreneurs.
- The **capacity of the brick maker businesses to raise the required debt finance** from financial institutions is another limiting factor. The balance sheets of clamp kiln productions are not sound enough to produce sufficient collateral, even though large amounts of money are bound in stocks (one third in green bricks, one third in clamps and one third in fired product). The lack of other assets amounts to this situation.
- The **lack of economic incentives** (tax reduction for those who use the VSBK technology, recapitalization funds etc.)
- **Access to existing support measures** may be a determinant for investment: Existing programmes to support the transition, such as the SA-VSBK, have already established relationships of trust with the entrepreneurs and may draw on their local experience as well as on their networks.
- The **perception of having a long payback period** hinders EPs to embrace this technology, especially considering the normally huge production capacities of brick plants. Due to additional effects these payback periods have actually turned out to be much shorter than envisaged and perceived by entrepreneurs: the minimized losses, the savings in overall expenditure in the entire process due to streamlined production and lower transport requirements, the activation of bound capital, the faster turnover of stocks are reasons, which have not yet been fully communicated and understood by potential investors.

4.1.4.2.3 Market

- The **global financial crisis** has negatively affected the construction sector in general and the brick sector in particular. The **demand for bricks** is still reduced. In this un-certain situation of the market entrepreneurs lost interest for investment into new production facilities.
- **Lacking knowledge of the market** and **lacking understandings of the dynamics of the market** for their products hinder the entrepreneurs to identify the right moment for investment.
- Also the **perceived advantages of Clamps to VSBK in producing a variety of products and large sizes**. The development of VSBK must focus on more versatility and products, e.g. maxi bricks and hollow tiles.

4.1.4.2.4 Socio-economic factors

- The **role of brick making within the individual or household livelihood strategy**: Most of the brick factories in SA are operated by the 3rd or 4th generation of brick makers. Frequently the younger generation is not interested in taking over the operation. These succession problems lead to a consolidation of the sector and to a negligence of the factory. Only few operators have understood the signs of the times and see the modernization of the factories as mean to create assets for future take overs.
- The **image of VSBK has been adversely affected** by a series of reasons: the technology is not new in the Nepal sense, but it is new to South Africa. In addition it is not invented here (instead it still has a development country image: technology for the poor). This reduces acceptance and acknowledgement of the technology. In addition the "VSBK" (steel shaft) installed prior to the project (promoted by Anton de Jager) have –if running at all- not performed in an energy efficient and technically viable manner. Thirdly one pilot entrepreneur envisaged to invest in VSBK has been known of having installed a zig-zag-kiln. Even though this is not a kiln and only an intermediate change of operation, it had a negative influence on the image of the VSBK. All this amounts to a situation where the people that by their very nature resist change and are consequently very suspicious of this "new" technology, resist to decide on investment.
- Until recently there has **not been a successful show case** of the technology in the country. Only with the pilot operation at Langkloof brick factory there is one. Nevertheless most entrepreneurs are expecting operational results of the second batch of kilns, which will be built shortly and with a new design. Brick makers in general have not yet developed trust in this technology are very conservative and they have the attitude of 'wait and see if it works'.
- Financial institutions viewed this technology with suspicion as they **do not understand it** and it is not part of the localised production landscape. They will therefore view this as high risk and opt not to finance the construction of these kilns.

- **Neither the CBA nor the SA Governmental authorities have actively supported this technology**: The first due to resistance of the biggest player (who is not producing stock bricks, but sees a potential discrediting of his technology) and the latter due to an approach avoiding technological bias.
- **The dependency on significant number of skilled labour** is seen a threat for entrepreneurs, especially in times of labour unrest in SA. The VSBK operations are not substantially reducing the amount of labour (only about 9%). While Langkloof had up to 180, partly seasonal staff, this went down with the VSBK to 160, but on a 24/7/365 basis. In addition the required skills are much higher. Developing the skills is difficult as there are only few training providers. But Cermalab (ex CSIR) is a training resource and Langkloof are agreeable to allow their site as a practical training venue.
- The 24/7 operation **requires people with willingness to work at night time**. This has been a major obstacle for VSBK implementation in some Asian countries (Pakistan, India etc.).

4.1.4.2.5 Technological factors

- The **production capacity** of VSBK is rather low and not in line with the needs of the SA formal brick producers: a single shaft of the size as currently installed in SA would have a daily production of between 5,000 and 6,000 bricks per day. The larger clamp brick operations produce up to 1 Mio. bricks per day. They would need more than 100 shafts to match their capacity needs. Organizing this is seen as a major challenge.
- The production of bricks in VSBK requires a stationary production while clamp kiln operations may be producing in a mobile manner.
- The VSBK still has the image of producing only a **limited diversity of products** (stock and semi-face bricks). This may hamper the adaptation to future new demands on the market, i.e. for face bricks, maxis, hollow blocks etc.
- **Access to appropriate technology and services** is paramount: proximity of engineering, manufacture, supply, maintenance and support services, the quality of the equipment, and the adaptation of the technology to regional conditions and traditional practices determine the acceptance by the entrepreneurs. His is given in SA after the first phase of the project.
- **Competing other technologies** may be seen as more beneficial: Where BTK work well (with respect to the ground properties) their substitution by VSBK has proven to be rather difficult.

4.1.4.2.6 Geographical factors

The **geological, climatic and hydraulic characteristics** of the deposit and the factory site influence the viability of modernisation with VSBK. These factors cannot be influenced by a project. The clay properties, the groundwater table, as well as the climatic situation during rainy and dry seasons are all enormously important in determining the optimal clay preparation, green brick manufacturing and firing process. Very slow drying clay and one with low mechanical strength in the green brick may limit the viability of VSBK (which requires minimum strength due to high stack of green bricks above the firing zone). A moist ground (i.e. as encountered in the brick production sites in Vietnam in the river deltas and the so-called informal river-bed operators in SA) may prohibit the firing in earth bound structures (clamps) or kilns (BTK) to ascending moisture in the firing ware. This favours technologies with kilns where the product has no direct contact with the ground (VSBK, tunnel kiln).

The above analysis has shown that there are many barriers to investment. Aspects may be grouped in different fields, such as enabling environment, financial & economic, market, socio-economic, technological and finally geografical factors.

A uni-dimensional reduction to access to finance is not realistic. To stimulate more investment the situation calls for an extended addressing of market issues, the administrative framework and adverse perceptions.

In discussion the lack of finance is mentioned as <u>the</u> key problem: nevertheless, this does not mean the simple access to a credit line. The third party financing is linked for the investor with a lot of risks he is not willing to take in the current circumstances. Most of these barriers are perceptions which may be overcome by a targeted communication based on reliable and proven data from the first pilot plant. Thereby a special highlight on the hard business case facts is seen as a convincing approach.

4.2 Relevance to Context and Technology

The introduction and desired dissemination of the VSBK technology can be seen as a **necessary** but not sufficient answer for the brick and building sector to respond to South Africa's obligations towards fulfilling the Kyoto Protocol. It notably reduces GHG emissions and coal dust pollution from the brick production. Nevertheless this is only one aspect in the value chain of clay bricks. The

following table shows the further potentially required interventions, as these have been implemented in industrialized countries:

	Introduction of EE in the firing of clay bricks	Integrated EE in the brick making process	Introduction of energy efficient clay bricks
Example interventions	Introduction of VSBK	Good housekeeping from clay mining to brick sales	Hollow blocks
Estimated reduction of GHG emissions per volume unit of commercial product	50-60% (including consideration of the reduced breakage)	Additional 10-15%[8]	Additional 50% reduction
Reasons for the savings	Reduction in fuel (internal and external)	Higher energy efficiency in green brick drying, Reduction in transport, energy requirement for green brick production etc.	Reduction in clay and fuel resources, reduction in transport, reduced effort in manipulation on building site, optimized insulation.
Status	Currently implemented	Proposed as component in second phase	Currently the market is not ready for this intervention.

While the application of a holistic approach to the brick production would be possible within the project the firing of hollow blocks is not possible with VSBK. Instead these products require a tunnel kiln for firing. Under the circumstances given in SA the intervention as implemented by the project is both relevant as well as important for the greening of the building material industry.

The SA-VSBK project requires systematic communication to spread the economic, environmental and social successes generated with the implementation and operation of the first pilot kiln. This is addressed in the proposals for the next phase.

The Legal framework for the sector is in place but is onerous. There needs to be an effort for example to streamline Mining Licence applications and the EIA requirements. Many stakeholders have mentioned the expense and time involved as an obstacle (which doesn't apply to Concrete Brick Manufacturing). Moreover Concrete Brick plants are more mobile and require low start-up costs. According to Ocon CEO, Albert Weber, a plant producing 2 million bricks per month can be installed for R5 million. The Legislation is compelling and the Industry is well aware of the increasing pressure. The lack of experience i.e. on the methods to monitor clamps environmentally leaves an administrative vacuum, which does not support the transition towards cleaner technologies. The Industry needs to be closer to the relevant Government Departments (DEA, DMR, IDT, SABS, CSIR, SABS) as well as the influential Associations (CBA, MBA etc)

4.3 Summary of the findings

4.3.1 Strengths

The project has made a great progress especially with respect to the technology transfer. The key achievements are:

- The SA-VSBK has established relation of confidence with all relevant key stakeholders from private sector (all doors are open),
- The technology transfer had been successful and is practically concluded,
- The support service provision is fully commercialized,

[8] According to experiences from projects in the brick sector from Germany. Numbers may be higher in areas where the drying process is very inefficient.

- The evolution of SA-VSBK kiln design (initially by South-South cooperation, then taken over by private SA know-how) has added enormous developments to the global state of the art and knowledge on the technology,
- The first pilot kiln is running and performing extremely well, producing high quality bricks and competitively with respect to economic, social and environmental performance. This is acknowledged by both the public as well as the private actors.

Further important achievements include the development of an operational manual for VSBK (concluded), the development of a financial engineering system, the new kiln designs (Mark 3 and 4) as well as the PoA for CDM, which is amongst the first industrial PoAs worldwide.

4.3.2 Challenges

On the other hand the project is still facing major challenges with respect to the roll-out of the technology and the required enabling environment. The key tasks for a future focus derive from the following needs:

- To establish a critical mass of VSBK in RSA to trigger auto-development of the technology[9],
- To create the required political and enabling environment and support for the greening of the brick (or building material) sector in order to motivate EPs to invest,
- To overcome resistance against VSBK in parts of the private and public sector and
- To generate ownership within the sector organisations to anchor the technology and the approach to green the brick industry in view of sustainable impacts of the SDC funded project.

4.3.3 Red flags

In view of the fact that the project is still operating without formal partnerships and based on the above analysis the following issues should be resolved immediately:

- Address the intellectual property right issues (operational guidance, kiln design, access to pilot kiln) and outline a roadmap with a clear definition of roles, mandates and responsibilities for each actor mutually agreed with all relevant partners (SDC, implementers SC and SKAT, design company and other SSP´s),
- Initiate a policy dialogue,
- Prepare for an institutionalization including the definition of and cooperation with a partner to anchor the technology
- Develop a concept for sustainability and an exit strategy.

The implications of <u>intellectual property rights for key products being with commercial SSP</u> are a key for the future of the project. It does not only apply to the question of the South African VSBK being open source or not, it also affects access to and branding of technology, dissemination (roll-out) of technology as well as use of technology in other countries and creates risks for the project with respect to having an own product to disseminate (SDC brand or Rowe brand). Without an immediate definition of the implications of the commercialization approach for the project and an agreement on this solution between the key involved parties it does not make sense to plan a new project phase[10].

[9] the commissioning of the additional 18 VSBK shafts by Langkloof will go a long way to establishing the required critical mass

[10] Currently SA-VSBK has no right to brand Mark 2, Mark 3 or even Mark 4, the last 2 being the only commercially interesting designs, as SA-VSBK products. So, what shall SA-VSBK disseminate?? The clear and mutual definition of roles for the presence and the future has to go hand in hand with the solution of the property right issue.

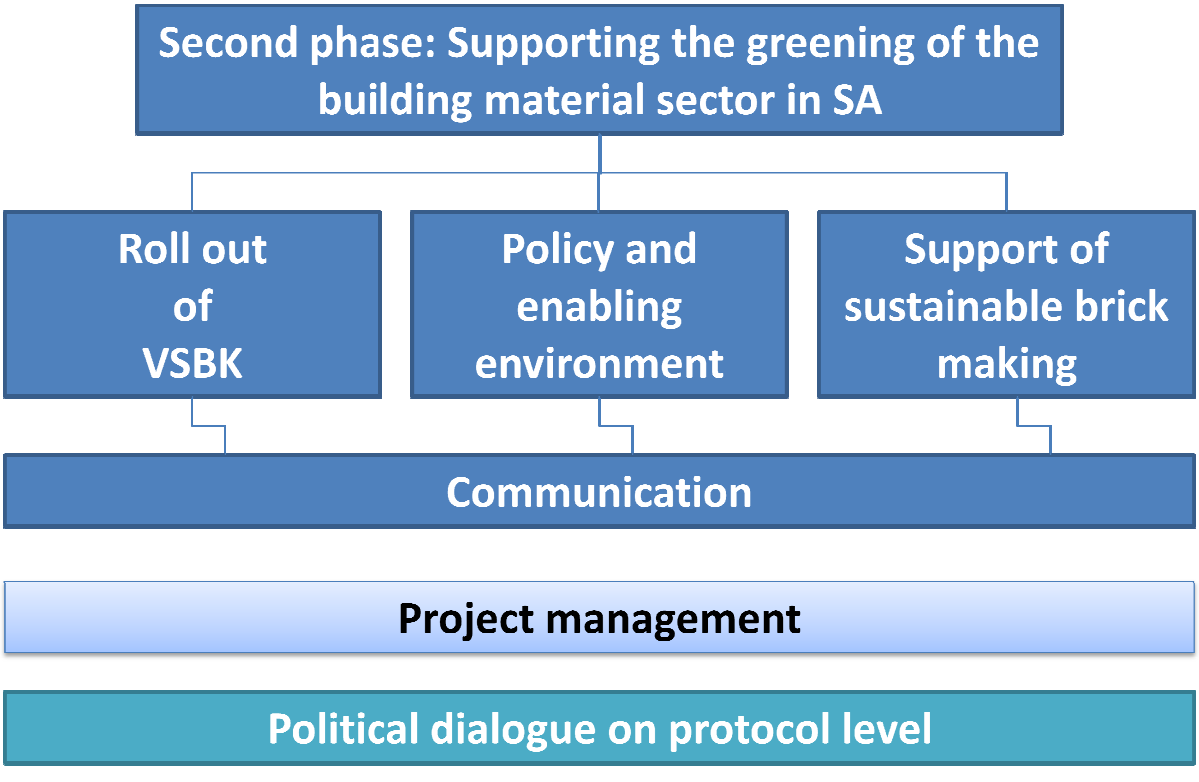
5 Recommendations for the future intervention

For the outline of a new project phase the mission team applied the following underlying principles that derived from the analytical part of the evaluation:

1. The mission recommends broadening the scope of the project. This means an evolution from unilateral focus on VSBK towards unbiased support of EE brick production. This does not mean to discontinue VSBK intervention, but to add a component of broader intervention to generate a buy in of important stakeholders. This is required in order to align with Government and CBA, both crucial partners pivotal for the dissemination of VSBK and the anchoring of the project results on the long run in view of the desired sustainability.
2. The mission then sees the need to follow an approach broadening the portfolio of partners. This shall include the public sector in order to moderate processes that may lead to a more supportive environment for greening the sector. This shall lead to an effective push-pull scenario for the greening of the brick industry.
3. In order to maintain the relation of confidence with the key stakeholders from the private sector the new phase shall explicitly focus on generating support for greening the industry instead of regulation traditional and ineffective technology and processes.
4. The project shall use all opportunities to generate SA leadership and ownership, including for instance the further development of the technology.

These considerations lead to an evolution of the existing SA-VSBK project into a second phase with an amended and adapted approach, not to a completely new project. Thereby SA-VSBK shall build upon the achieved technical and non-technical results of the first phase, the existing relations and network of partners and upon key elements of the provision of advisory services. Certain continuity is seen as a basis for success in the second phase.

Based on these considerations the mission proposes a general outline as visualized in the below illustration. Please see more detailed version in annex 5.



The following chapters will detail the individual elements.

5.1 Roll out of VSBK

This component shall be a continuation of the 3rd component of the first phase (technology dissemination) and incorporate required continuance of elements from the 1st component of the first phase (caring production). The mission proposes the following core elements:

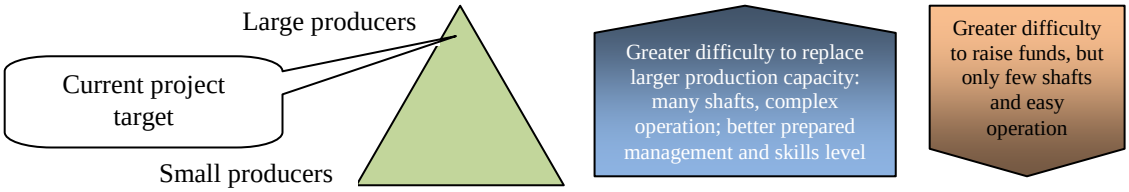
- **Establish a master design for the SA-VSBK kiln**
  - Retrofit operational experience to master design and perform peer review
  - Solve the property rights issue with Rowe Group on the MK3 and 4 design and establish rules for the access to the technology

In a workshop in Pretoria on October 3rd this issue of intellectual property was discussed. According to this stakeholder dialogue the initially envisaged "open source" or free access to the technology is not the case in VSBK, neither from the "Global pool" partners in Asia nor in SA (open access is only provided by SKAT, which could apply for the unimproved SA version). It more applies to broader principles of VSBK construction and operation. In order to pay for development in design and to ensure quality and high standard the user may pay for engineering and supervision, while the following principles shall be applied: Commercial delivery, promotion of only the latest and most advanced development, utilization of established resources, provision of support and facilitation by the project as well as project supported performance monitoring. The holder of the intellectual property expressed his preparedness to negotiate with SDC in order to agree upon shared property right i.e. for the application of the technology inside and outside Southern Africa. The negotiation should lead to a clear understanding of the implications of a commercial service provision within a international cooperation (especially given the fact that currently there is only one pilot EP and only one SSP for each specific service), a clear definition of rules for the access to the technology, as well as a definition of the roles, mandates and obligations of each party and the procedures for interaction and information.

In this respect it may be promising to foresee a role for the Global pool as a risk management tool, i.e. for third party assessments.

  - Develop low cost VSBK design for small producers (1 or 2 shaft)

Until now the SA-VSBK has only focused on large brick producers, while the lower end of the pyramid has been virtually neglected.



  - Make Vietnamese experience available and organize technological exchange
- **Promote investment in VSBK amongst new EP´s and identify new target groups**
  - Optimize information on VSBK to EP´s
  - Make investment package for further pilot kilns more attractive
  - Map informal brick production by river-bed operators et al and assess VSBK as a tool for formalization

The Nepalese experience underlines the need to assess and potentially address the informal sector. While the Nepalese project focused over many years on the substitution of the BTK (larger operation), and this with rather restricted success, they recently discovered that there is a

considerable demand for VSBK amongst the small scattered brick producers in the hills. The potential in SA is large. While the CBA only groups the formal enterprises, amounting to about 123 (Executive Director of CBA) countrywide, alone in the Eastern Cape province there are 200 or even 500 informal brick makers (according to Greg Scott of EDA and Pieter Du Toit of Cermalab). As the investment in a VSBK requires certain security of tenure the industrialization of these target groups could be a viable tool for its formalization and a socially important intervention.

- **Optimize image of VSBK**
  - Assess opportunities for VSBK for face bricks , maxis and hollow ware
  - Assist enterprises in optimization and operation of existing VSBK (steel shaft etc.)
- **Negotiate access to VSBK by Cermalab for training purposes**
- **Support VSBK brick builder / CBA in participation in 3rd ABSA green building competition**

The periodically organized green building competitions are seen as an excellent ground to present VSBK bricks as a green building material. In the past clay brick was not admitted to these venues due to lacking supply with energy efficient production techniques. This has changed with the introduction of VSBK.

5.2 Policy and enabling environment

This component shall continue and build upon the second component of the first phase. It shall be amended by an action line related to a policy dialogue. This dialogue shall help to remove administrative barriers and red tape (i.e. in the field of EIA procedures), develop a pull scenario for sustainable/responsible products and production, which means supporting the establishment of an incentive system or facilitating the easier access to finance. At the same time the project will help the sector to reach international and national sustainability (social, environmental, ecological) targets. In addition this element shall contribute to levelling the playing field for clay brick producers in the competition with other building material industries and discuss and address identified barriers.

- **Study barriers and success factors for the greening of the brick production** in general (in South America) and VSBK in particular (in Vietnam, Nepal, India)

The mission proposes to perform in all the countries with past or ongoing brick and VSBK projects a study on the barriers and success factors for the dissemination of VSBK and green production processes. This study should be performed by an interdisciplinary group of public and private stakeholders from the SA brick sector (DEA, communication, design, environmental monitoring, financial and funding issues) and look into the entire bandwidth of issues (as presented in the above analysis of drivers and barriers). This will create a generic understanding of the issues and dynamics for SDC and the projects and will generate a thorough background for the outline of the SA roll-out and policy dialogue components. It will further bring study tours to a higher level.

- **Establish a policy dialogue**, EE in brick making forum, participate in EE Forum under Dept of Energy etc.

The establishment of governmental support services or the removal of administrative barriers for the brick sector is a politically sensitive issue and requires careful advocacy and generation of political will and backing.

The policy dialogue is recommended on three complimentary levels:

1. On the protocol level a political dialogue, especially during the establishment of the new project phase. Ideally this should lead to a memorandum of understanding on partner contributions, i.e. a recapitalization fund for the greening of the brick industry provided by the SA government (see below).

2. An interaction with the government on the level of the GPCC and the SDC´s climate change mitigation programme in South Africa, i.e. by participation at the Energy Efficiency forum established under the DoE.
3. A policy dialogue of the SA-VSBK with public authorities and depatments at national and provincial levels

Therefore the SA-VSBK project is recommended to moderate **multi-stakeholder platforms with public institutions** in order to interchange opinions and develop an agreement or even policy elements for an enabling environment for the greening of the brick (or building material) industry in SA. These platforms can be organized in combination with the PSC or an advisory board or committee.

The list of potential key topics is long and diverse:

- Life cycle assessment and Energy efficiency benchmarking for building materials
- Barriers and success factors for green brick production
- General issues and priorities for greening the brick production.It has been repeatedly mentioned by interview partners that a national strategy for the greening of the building material sector is still missing. This could break down the general terms of the IPAP II, which addresses the greening of industrial technologies in general.
- The CO_2 reduction goals within the Vision 2020 targets
- The informal brick production as a challenge for the government and the society
- Skills needed and skills development for the greening of the brick industry
- Financing of the transition, the process as buisiness case for banks, recapitalizaion of the brick sector
- Administrative burden and barriers for the greening of the brick industry

For the generation of political support, there are generally 2 options: the development of a supporting policy or the establishment of a legal regulatory framework. The following table discusses both options and concludes that the policy option would be the most favourable.

Options for political support

Policy approach	Legal approach
SA-VSBK in alliance with CBA seeking political support by moderating a multi-stakeholder platform to achieve a vision for the future and an agreement on the general approach to actively support the process, i.e. on a pilot basis	SA-VSBK in alliance with CBA seeking legal support for the VSBK by related laws and regulations and advising authorities on the respective stipulations.
Preferred and proposed option due to the fact that the VSBK is still innovative and the approach allows to gradually build confidence between public and private stakeholders.	**Option not proposed due to lengthy legislative process and potential contradictions with political considerations, institutional mandates and pertinent legal stipulations. In addition a regulatory approach may jeopardize the relation of confidence with the EPs.**

The project is highly advised to follow a promotional approach without intervening in the regulation of the sector.

- **Develop a step-by-step guide for enterprises on the upgrading process to VSBK**

A guide as a cook book for investors guiding on each step, the authorities to address, the SSPs, the required forms and information to provide etc, considering the business plan, financial engineering, EIA, EMP, Atmospheric Emission License, contracting of design, building contractor, support services. Such a guide should contain master contracts with SSPs and contractors. It could be electronically or as printed matter. It would greatly help EPs not to get lost during the process. Most of the inputs are already available; they only need to be documented in a systematic manner.

- **Lobby for the establishment of a generic EIA system** for the conversion of clamp brick production to VSBK.

The EIA approval process is still lengthy and costly. A simplified system grouping the different but similar operations and projects (from clamp to VSBK) should be treated with a kind of type approval similar to the PoA for CDM in order to reduce administrative barriers (blanket application = all presenting at the same time and are treated at national level[11] or cluster application = entry at different moments possible) should be discussed and lobbied for.

- **Identify options for funding and identify incentives**

The avaliability of funds for the modernization of the firing process will remain one determining factor for the roll-out. From the evalution team´s point of view there is still need and opportunity for enlarging the bandwidth of funding sourcing and aligning them to the specific needs of the brick industrial sector (i.e. with respect to payback and grace periods). The following table shows the differnt funding options and their status with respect to exploitation for the brick sector:

Funding instrument	Status in SA-VSBK
Commercial banks	Currently exploited and key part of the financial engineering. Nevertheless the banks still lack full understanding of the brick frining transformation process as a profitable business case for them. Further advice based upon the Langkloof data is recommended.
CDM	Currently established with the PoA, but not sufficiently attractive due to low CER prices and unclear future of the certificate market.
Green funds, NEF	Not exploited yet: they need to be contacted and funding of VSBK advocated for with CC, environmental and social arguments
Recapitalization	Not exploited yet: SDC is advised to lobby for partner contributions i.e. in form of a recapitalization fund for VSBK (or greening the brick production) similar to the funds established for the modernization of the taxi fleet.
Private equity, crowd funding, BEE	Not exploited yet: the SA-VSBK is recommended to assess options for these funding instruments in the light of the relatively low interest levels for private investors in the current banking environment

The availibility of funds shall be complemented by instruments to lower the initial investment and streching of the conversion process to build up capacities as well as economic assets allowing a slow phasing in of VSBK (policy dialogue with government authorities required).
In addition instruments for the evaluation of stocks (which are enormous in the case of clamp operations) and using them as collateral may ease the problems in funding.
Any intervention requires a strategic marketing of investment in VSBK as business case as well for banks and financial service providers.

- **Training of consultants in financial engineering and with funding tools and formats**
- **Advise EP´s with respect to loan applications** and pave the way with banks, financial institutions, private equity, green funds and CDM
- **Expose VSBK technology to provincial officers** and create awareness of green solutions

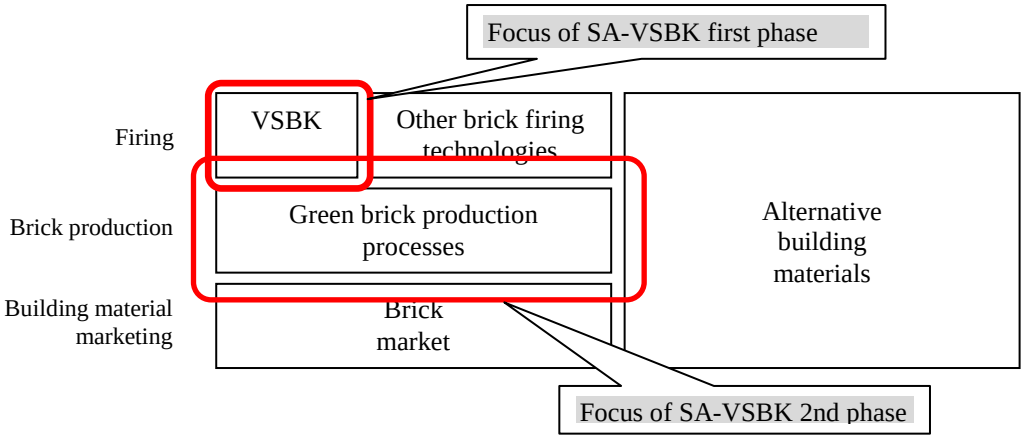
Another issue discussed was the proposal to train building inspectors from NHBRC and other certifying bodies in order to raise awareness on green clay bricks. As being rather far from the original project goal and as SDC is doing this within anther SA project, this recommendation is now omitted. Interchange of experiences with the other project is suggested.

[11] A guiding eample could be the ECO+ approach, developed for blanket administration of artisanal gold mining operations in Ecuador within the framework of the SDC funded PMSC

5.3 Support of sustainable brick making

As earlier stated this component shall serve as an entry card to Government and CBA and shall embed VSBK in a broader view on brick making technologies in SA.

Thereby the project is advised to extend its scope as follows:



In the following part the individual recommendations are presented and discussed:

- **Broaden the knowledge base and inform about bricks as quality building material**
  - Support Life Cycle Assessment for bricks / fired clay products together with CBA;
  - Translate production performance in product properties (embodied energy and carbon footprint) and into the walling structure
  - Establish benchmarks for EE in brick making in RSA

Performing a LCA is already in discussion between SA-VSBK and CBA. Cooperation with EMPA Switzerland and the University of Pretoria is already envisaged. This shall develop a broader view on different brickmaking processes and establish corridors for the footprint of the product, the product as well as the walling structure build with the bricks. It is expected that this product will be used as a tool for both the authorities as well as the CBA and its members.

It is in addition recommended to extend the LCA to a holistic assessment integrating social and environmental aspects.

- **Provide training to stakeholders in brick production and application**
  - Develop and disseminate other operational manuals
  - Prepare and provide training courses (training of fire masters and supervisors)
  - Promote good housekeeping in all types of brick production (clamp kilns, zig-zag, Hoffmann, tunnel kilns and VSBK)
  - Include academic institutions as partners (in order to prepare the next generation of brick experts)

Training of staff is has been mentioned a key issue in order be able to effectively operate new technology. The large number of shafts for the bigger brick operations, the continuous operation, the higher required skills and the sensitive fine-tuning opportunities of the process (firing curve, temperature, external fuel addition etc.) require well trained staff at operational and supervisory level. The project had already developed the operational manual for VSBK which is used by Langkloof and Cermalab for training purposes. This should target not only on VSBK and not exclusively at the firing process, but include the entire brick making process. Minimization of losses, optimization of firing curve, drying and green brick preparation, OSH, quality control, cash flow improvement, automation, masonry, etc. have been mentioned by the interviewed stakeholders. Good housekeeping as a mean to optimize the entire process with respect to all performance levels adds to

this. An example for a good housekeeping guide, developed in the Vietnam project for tunnel kiln operators elaborated by E. Rimpel from the German Brick and Tile Research Institute may serve as an example (annex 6) and highlight that this goes far beyond ISO 14000 practice.

- **Assess and assist other energy saving brickmaking technologies**
- **Strengthen and support professional service providers to the brick sector**
- **Address BEE for brick makers; identify viable solutions**

Black Economic Empowerment (BEE) is a programme launched by the South African government to redress the inequalities of Apartheid by giving previously disadvantaged groups (black Africans, Coloureds, Indians and some Chinese) of South African citizens' economic privileges previously not available to them[12]. It has been enacted 2003 and is a key element that needs special attention. The access to loans from banks is conditional or preferential according to compliance with BEE scores. These scores relate to the following seven different elements: Ownership, Management Control, Employment Equity, Skills Development, Preferential Procurement, Enterprise Development and Socio- Economic Development. The mostly white owned EP´s are facing challenges to meet these standards. This has negative consequences on the access to funding: Government funding schemes are funding BEE compliant projects only, the commercial banking sector is following financial sector charters, which prioritise BEE compliant projects and private equity is looking for larger projects only. Brick makers expressed their concern and identified support in this aspect as a potential component of the future SA-VSBK project phase. It is proposed that the project moderates a platform for the exchange of identified and successful solutions and approaches and contribute to advocacy for these solutions within the brick making sector.

- **Monitor developments in the sector and inform industry accordingly**

The developments of the brick sector are regionally different and early signs can give important hints to brick makers to be competitive within the market. The project could assist the sector with constantly channelling the information to EPs.

5.4 Communication

Communication turned out to be crucial and a cross-sectoral issue. A need is seen to evolve from the more opportunity driven and ad-hoc communication to a systematic strategy:

- **Establish a systematic communication strategy and implement** (target group specific and addressing environmental, climate change, economic and social benefits accordingly)

The communication needs to address the different target group specifically:

While for the private sector (brick enterpreneurs, banks, SSPs) the business case should play the driving role, the government, donors and the public should be addressed with the higher aggregated goals (impact level) of the project, especially related to the optimization of labor conditions, job creation in down-stream sectors, skills development, BEE, reduced emission levels i.e. for suspended particulate matter and better compliance with national CO_2 reduction goals.

[12] "It is an integrated and coherent political process. It is located within the context of the country's nation transformation programme, namely the RDP (Reconstruction and Development Programme). It is aimed at change the imbalances of the past by seeking to substantially transfer and confer ownership, management and control of South Africa's financial and economic resources to the majority of the citizens. It seeks to ensure broader and meaningful participation in the economy by black people to achieve sustainable development and prosperity." — *BEE Commission Report, pg. 2*

Experiences with the project team composition with the specific skills and strenghts suggest that the communication should be implemented by a communication specialist. This would rather call for a separate project component than for a cross-cutting issue being embedded and integrated into the three thematic axes. The current set-up where Jaqui Duarte is acting as communication expert is promising for the future, as she is parallelly working as communication expert for CBA. This coincidence allows to closely link both programs.

5.5 Project management

The mission recommends the project management to specifically address the following issues:

- Perform yearly operational planning with clear allocation of resources , accountability and targets
- Establish a project steering committee or advisory committee in order to pave the ground for a multi-stakeholder network and for the policy dialogue
- Establish model contract for further pilot kilns with clear property right arrangements and regulations on the use and access to products and supported pilot schemes based upon the experiences from the first phase.

5.6 Political dialogue

In order to complement the implementation of the project and generate a more prominent impact it would be beneficial to establish prior to the implementation of the next phase a political dialogue on protocol level between the Swiss Embassy and relevant Ministries & Authorities on South African side. This with the objective to generate political commitment, national ownership and financial partner contributions to support the greening of the building material industry

5.7 Issues to phase out

The mission team considers the following issues as redundant for the activity portfolio of the project:

- The technology transfer is practically finished and not required any more. The SA partners are sufficiently qualified to further develop the technology
- The CDM intervention will be fully commercial and operational after the acceptance of the PoA by the CDM system. This is currently under way. The project will include the PoA and CER trade as an element in the financial engineering for new pilot projects and the technology roll-out.
- The Section 21 NGO as host for the technology had not proven viable.

5.8 Stakeholders to be addressed

The mission recommends extending the cooperation and coordination with the most important stakeholders (the most significant ones are marked in bold). According to the interviews these are:

Governmental
DEA at national and regional levels
Department of Energy
Department of Mineral Resources (DMR)
Department of Labour
Department of Trade and Industry; Economic Development Department
Department of Human Settlements (DHS)
Department of Public Works (DPW)
SABS (South African Bureau of Standards)
SANEDI (South African National Energy Development Institute)
Local Governments
Industrial Development Corporation (IDC)
National Empowerment Fund (NEF)

Green funds
Jobs Fund
Associations, etc.
Clay Brick Association (CBA)
National Home Builders Registration Council (NHBRC)
Construction Industry Development Board (CIDB)
Concrete Manufacturers Association (CMA)
Green Building Council (GBC)
Master Builders Association (MBA)
Agrément Board
Private commercial stakeholders
Brick Making EP´s
Service Providers (Jez Rowe, etc.)
Construction Material Suppliers (Refractories, Steel, Hydraulics, etc.)
Brick Manufacturing Equipment providers (mills, mixers, extruders…..)
Coal providers
Contractors in the brick making
Construction Companies
Architects
Banks (ABSA, NEDBANK, STANDARD)
Cool nrg
Others
Cermalab
Council for Scientific and Industrial Research (CSIR)
Media
Academic Institutions
CDM Africa
KFW, AFD
SDC
International support and consultancy

With respect to the engagement with these key stakeholders the mission recommends the following changes on the operational level:

1. **From supply driven to demand oriented** project content, structure and management in order optimize outlook for sustainability:
    - New 3rd component (technologically unbiased) in order to align with key stakeholder that are currently not directly addressed: CBA and Government
    - Project Steering Committee with participation of Government, Association and EP´s
    - Participatory planning to create a platform for the stakeholders to engage in the project and develop ownership
2. Address the **privatization of technology services** adequately in order to maintain focus and impact:
    - Solution of intellectual property right issue ensuring a stringent division of roles and mandates with clearly defined interfaces between all stakeholders, especially project, EP´s and, SSP´s
3. Strengthen **partner intervention** in order to generate ownership:
    - Participation in a study on barriers and success factors in other SDC funded brick and VSBK projects
    - SA driven technology development

6 DAC-criteria

6.1 Programmatic Thrust

The project is fully in line with South African and Swiss programs and policies.

On the Swiss side the within the framework of the GPCC the new project is fully aligned with the SA Energy Efficiency building program. It now addresses all the 3 strategic levels:

1. Policy Framework (standards, monitoring),
2. Capacity Building and
3. Implementation of projects (research, knowledge, skills development to demonstrate energy efficiency, cleaner clay bricks, energy efficient equipment, waste).

On the SA side the project is in line and guided by the national building standards, such as SANS 10400XA issued 19th of November 2011 as well as with the DTI Industrial Policy Action Plan II (IPAP II) on the localization of green technology as issued in 2009 and with the Vision 2020 CO_2 emission reduction targets.

6.2 Effectivity and effectiveness

Effectivity and effectiveness are both hampered by the impacts of the global financial crisis and its impact on the building material market and construction industry in South Africa. This had a detrimental effect on the availability of entrepreneurs for investments in VSBK. While initially 5 parallel investment projects had been planned, only one had been realized and this after long delays due to difficult negotiation procedures for the funding (including the CDM component) and the financial support by the project (contract negotiations). In consequence, this lead to slow budget spending and a prolongation of the project phase with the respective budget remains. The following diagram visualizes the allocation of funds to the 6 defined outcomes. Please note that the mentioned percentage is only indicative since the parts 1 (services headquarter), 2 (local office of contractor), part 3A (long term experts), and part 3C have not been considered in this cost allocation.

The main budget was allocated to the technology transfer, which had high interaction costs due to study tours and short term consultancies coming from India, Nepal and Switzerland. The budget allocated to technology transfer had been spent effectively as the technology transfer has been successfully concluded and an absolute top class kiln established in South Africa. At the same time it has to be stated, that the technology transfer was instrumental in establishing a fully commercial support service provision, an achievement which is without comparison in the other SDC funded VSBK or brick projects. In all the other projects, it took considerably more time and effort to establish commercial systems which are the basis for sustainability.

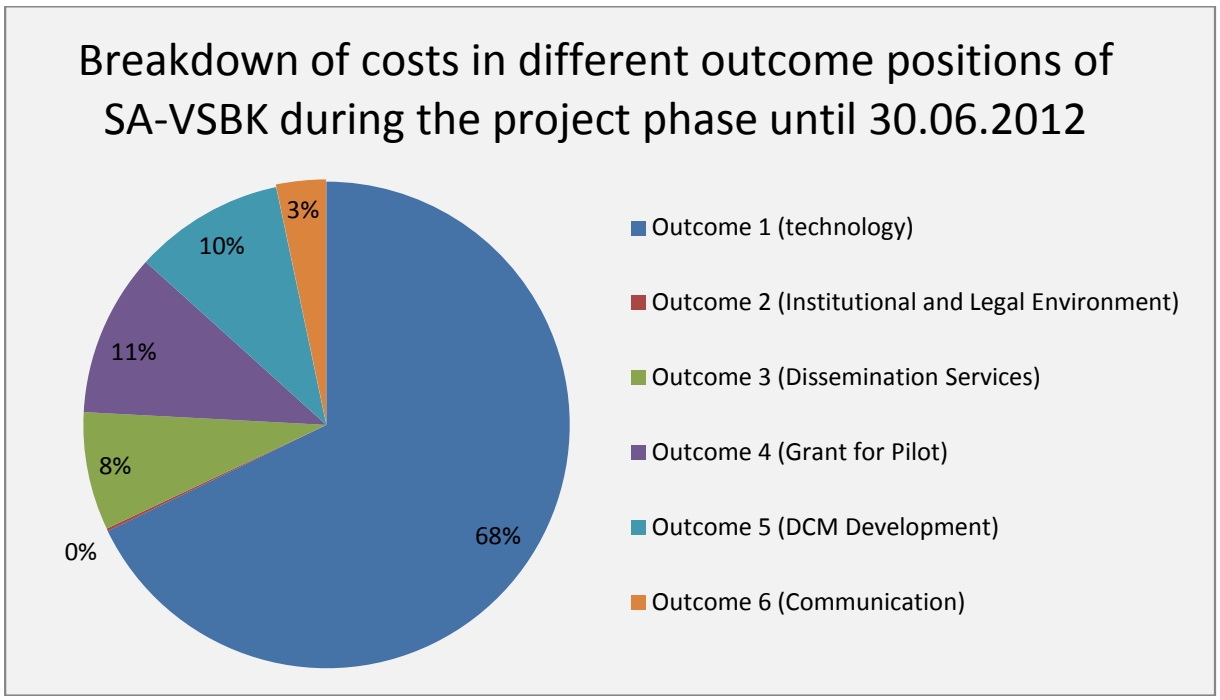
Allocation to the outcome 2 (institutional and legal environment) fall short due to limited engagement with important stakeholders (public sector).

Under the outcome 3 (dissemination services) the following key activities have been paid for: Outcome 3 includes local consultant costs and related travelling. This was mainly Kevin Fruin who did a number of presentations at regional CBA meetings as well as numerous individual visits to entrepreneurs interested in VSBK and the PoA. Until September 2011 also communication costs were charged to this account, as the project did not have a separate communication budget. This was only approved in November 2011 and additional budget was provided. A major expense was incurred during the launching of the VSBK for which fact sheets and other promotional material was prepared. Coordination with media and preparation of press releases is included in this budget position.

As only one pilot has been implemented, the original budget for 3 grants has not been used.

The second largest contribution went into the development of the CDM system, which is currently close to conclusion with the official registration of the PoA under the UN system. As this is the first industrial PoA worldwide, this expense can be judged fully justified even though the unforeseeable decline in CER prices lead to a reduced demand for co-funding under the CDM system.

Costs under the outcome 6 (communication) relate to participation in different national and international conventions such as COP17 as well as the preparation of the documentary (video).



The encountered slow dynamic of the sector under the current framework conditions rather suggests to consider a four-year phase instead of opting for a shorter but more intense intervention.

6.3 Sustainability and long term success factors

In the current phase the situation with respect to sustainability is sensitive due a number of reasons: a supply driven approach, a rather low level of participation, a very technical focus of the project and its partners as well as an institutional structure that is centred in and on the project staff (individual rather than institutional relation, linkages from the project to individual SSP, EPs etc. instead of building up and supporting networks).

The outlook for sustainability shall be created following the guidance of the “Capacity works” approach developed by the German GIZ. The system identified 5 clusters of success factors which have shown to be critical for long term sustainability and success: namely strategy, cooperation, steering structure, processes and learning and innovation. The following chapter summarizes recommendation on the strategic and managerial level according to these 5 success factors:

6.3.1 Success factor 1 – Strategy

Define and communicate objectives on impact level

So far the project has been perceived as a purely technological project, even though it is embedded in the GPCC. The project is strongly advised to underlay all activities with their relavance for the achievement of the higher aggregated goals and communicate the objectives as well as the achievements on impact level.

Strengthen alignment with national strategies
In line with the above stated the SA-VSBK had faced difficulties to partner with governmental organisations and CBA. The strong technological bias on the VSBK was a hinderance. The proposal addresses this shortcoming and proposes stronger emphasis on the higher aggregated goals and alignment with national strategies (IPAP II, climate change mitigation targets, BEE, employment policies). The reflection on the relevance (see above) underlines that the general project approach is in line with these strategies, but on an operational level this has be stronger aligned and the harmony with national strategies communicated.

6.3.2 Success factor 2 – Cooperation

Strengthen synergies with other SDC CC projects and add political dialogue
The SA-VSBK has so far operated in certain isolation. This creates the opportunities to tap a larger potential of synergies and alignments with other projects under the SDC GPCC in general and the SDC cliamte change mitigation programme in South Africa in particular. Promising interfaces have been identified for instance with the components 2b Capacity: skills and training (in the training of green building inspectors), 2a Capacity: research (with respect to EE in buildings) as well as with the components 1 at policy level. In addition the potential of coordination with the seco funded Cleaner Production Center shall be explored.

Strengthen the establishment of networks on partner side
In order to achieve sustainable impact the SA-VSBK is advised to strengthen ties and networks on two different levels:

1. The commercial services shall be anchored in a loose network of excellence of SSP. This network shall be strengthened in its functioning and supported with external know-how, for which the project acts as an independent broker.
2. The non-commercial products of the project shall be planned, implemented, supervised and used in close coordination and cooperation with CBA, who shall stepwise develop ownership, take over and generate leadership in the greening of the brick industry based upon the results of the project.

6.3.3 Success factor 3 – Steering structure

Establish PSC
As earlier stated the planned PSC had not been established: this with serious consequences for the relations to the public sector. In view of the sustainability the establishment of multi-stakeholder steering structures is essential. Whether this should be realized in form of a PSC or an advisory board or committee should be left for decision of the project, i.e. contingent on partner commitment achieved during the preparation of the new phase.

Develop operational planning and monitoring
As well the establishment of project management tools such as yearly operational planning with targets, milestones, indicators, budgets allocated, clearly defined responsibilities, a pragmatic M&E system shall provide for better transparency for the partners and sustainability.

6.3.4 Success factor 4 – Processes

Enlarge partner portfolio to public sector
The public sector in its normative and control, but as well in its promoting functions is a key to long term success of the project, which is as well targeting on meeting goals for the CC mitigation.

Initiate processes on provincial level
While in SA the public sector at national level is highly politicized it is recommended to start tri-partite processes (incl. public, private and civil society) at the provincial level. Uptake by national authorities generally works well, if successes have been produced at local level.

Support optimization of administrative procedures (i.e. EIA)
Heavy administrative burden is hampering the development of the brick sector and is causing competitive disadvantages for the brick producer, who requires mining licenses, EIA, AEL etc. Easing that burden will contribute to an accelerated transformation of the brick industry.

6.3.5 Success factor 5 – Learning and Innovation

Bring capacity building from individuals to a higher level (organizations, networks, public authorities)
The project is recommended to transform from current individualized and personal relations to institution-centered and network-based relations.

Strengthen the training component
In view of the current state of the brick producing sector (family businesses in the 3rd or 4th generation without dynamics for change) the future of the sector will depend on skilled EP´s and key staff, even more as the necessary changes in equipment and processes requires higher professionalized and skilled staff. While a lack of training supply has to be stated there is a role for the project to establish the required structures and intellectual resources.

7 List of Annexes:

Annex 1: TOR
Annex 2: Agenda of the mission
Annex 3: Current and future building activity in South Africa 2011-2020
Annex 4: Walling Market 2011-2020
Annex 5: Draft outline of the future phase
Annex 6: Good housekeeping guide for tunnel kilns (example from Vietnam)
Annex 7: Photo documentation of the mission
Annex 8: Scenario for the potential development of the stock brick market and the potential VSBK market penetration