Clay Brick Future
Presentation from M/s Keller HCW

AGM 2014
Clay Brick Association
South Africa

Agenda:
1. Brief introduction of Keller HCW
2. Brick industry in South Africa
   Products and applied technology today
3. External forces on the brick industry
4. Comparison of different alternatives
   1. Reference clamp kiln
   2. VSBK
   3. Tunnel kiln
5. Introducing new products
6. Summary and outlook
1. Brief introduction of Keller HCW
History and philosophy

- KELLER HCW, Morando and Rieter were each founded more than 100 years ago
- We build more than 1200 complete plants and many individual solutions
- We are the only combination of suppliers for turnkey plants from the quarry to packed products on the yard
- We develop economical solutions for existing and new plants by using most efficient components for body preparations, handling, drying and firing
Manufacturing range

- Machines and plants for the heavy clay industry
- From the individual machine up to the turnkey plant
- Quarry exploration – Material analysis
- Engineering of „your“ machinery or plant according to
economic and ecological aspects
- One contact person during erection and commissioning period
- Training of your staff
- After-Sales Service – 24h Hotline by the
- Automation and system technology
- Measuring and control technology

Optimization and development of your plant on site

- Handling systems
  - individual solutions – also for difficult conditions
- Grinding systems
  - for many building materials
- Handling technology
  - Innovative robot technology
- Integrated in the KELLER SERVICE NETWORK
  - 24h Service – Training – Assistance on site
Manufacturing range

• Preparation and shaping technologies
• Clay analyses in the own laboratory
• Process optimization
• Service worldwide – KELLER SERVICE NETWORK
• Shaping solutions for all kinds of products
• All Machines are equipped with automation systems of KELLER HCW

Manufacturing range

• Worldwide service for clay preparation and shaping machines - KELLER SERVICE NETWORK
• Professional spare part management
  - 24h emergency service
• Plant optimization on site
• Local service and training of your staff for optimization of productivity
• Preventive maintenance
2. Brick industry in South Africa
Products and applied technology today

Products in South Africa

- Face brick: FBS, FBX, FBA
- Stock brick: NFP, NFX, E
- Paver: PA, PB
3. External forces on the brick industry
Due to environmental issues / pollution the clamp kiln production is under threat.

The cement industry and others will take over the market for stock bricks.

The brick industry finds environmentally friendly ways of production that are accepted by the authorities.

4. Comparison of different alternatives
Details:
2.95 MJ/kg coal consumption as middle of 1.7 and 4.2 MJ/kg
Coal with 28MJ/kg

2,95 MJ/kg * 1,000,000 bricks * 3 kg/Brick /28 MJ/kg = 316,071 kg Coal

With 850 SAR / ton coal -> 850 * 316 = 268,600 SAR for coal per mio. brick

Cost for running a clamp kiln without fuel consumption and without costs for fork lift, water cart, grader etc.
Change from clamp kiln production to VSBK

What is a VSBK?

from: swisscontact.com
Capacity and investment

Capacity of one VSBK: 150,000 Bricks/month
Investment of one VSBK: 500,000 SAR

Energy consumption of different kilns

<table>
<thead>
<tr>
<th>Production Mechanism</th>
<th>Firing Energy Required (per Kg of fired brick)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel kiln</td>
<td>1.65 - 2.1 MJ/Kg</td>
</tr>
<tr>
<td>Transverse Arch kiln</td>
<td>2.0 - 4.0 MJ/Kg</td>
</tr>
<tr>
<td>Clamp kiln</td>
<td>1.7 - 4.2 MJ/Kg</td>
</tr>
<tr>
<td>VSBK Worldwide</td>
<td>0.84 - 1.1 MJ/Kg</td>
</tr>
<tr>
<td>SA-VSBK (Langkloof Bricks)</td>
<td>0.85 MJ/Kg and still improving!</td>
</tr>
</tbody>
</table>

Tunnel Kiln

today usually between 1.25 and 1.46 MJ/kg
that is 300 kcal/kg and 350 kcal/kg gross (firing only).
From that approx. 100-150 kcal/kg waste heat recovery to be used for drying.
Cost for running a VSBK

Cost for running a VSBK per Mio. bricks: 258,265 SAR
Fuel consumption: 77,400 SAR
Capital cost: 50,000 SAR
Total: 385,665 SAR

DETAILS:
Running costs estimated similar to clamp kiln production.
Fuel consumption calculated with 0.85 MJ/kg.

<table>
<thead>
<tr>
<th>Capital cost for VSBK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of VSBK's to produce 1.05 Mio. bricks / m</td>
</tr>
<tr>
<td>Investment of VSBK in SAR</td>
</tr>
<tr>
<td>Interest rate</td>
</tr>
<tr>
<td>Write off in years</td>
</tr>
<tr>
<td>Interest</td>
</tr>
<tr>
<td>Write off</td>
</tr>
<tr>
<td>SUM</td>
</tr>
<tr>
<td>per million brick</td>
</tr>
</tbody>
</table>

Pros and cons of the VSBK

**PROS**
1. Reduction in energy consumption
2. Reduction in emission
3. Improved health and safety in workplace

**CONS**
1. Investment
2. Limited product range
3. Limited achievable quality
Change from clamp kiln production to tunnel kiln

Tunnel kiln for the production of stock bricks?

Economical?
Feasible?
Tunnel kiln costs

A tunnel kiln for bricks with South African size

Capacity of 1000 to /d: ~8.2 Mio. €
Or 10 mio. bricks of 3kg per month

VSBK's for 10 Mio. b/m: 33.3 Mio SAR = 2.7 Mio. €

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Running cost for a tunnel kiln

<table>
<thead>
<tr>
<th>Cost for running tunnel kiln</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td></td>
</tr>
<tr>
<td>Investment of kiln in Euro</td>
<td>8,200,000</td>
</tr>
<tr>
<td>Investment of kiln in SAR</td>
<td>119,720,000</td>
</tr>
<tr>
<td>Factory hall and utilities</td>
<td>50,000,000</td>
</tr>
<tr>
<td>Investment</td>
<td>177,920,000</td>
</tr>
<tr>
<td>interest rate</td>
<td>8.0%</td>
</tr>
<tr>
<td>Write off in years</td>
<td>10</td>
</tr>
<tr>
<td>fuel costs per brick (1.65 MJ/kg)</td>
<td>0.15</td>
</tr>
<tr>
<td>cost per kWh in SAR</td>
<td>1</td>
</tr>
<tr>
<td>kWh per ton of fired material</td>
<td>12</td>
</tr>
<tr>
<td>capacity per annum</td>
<td>120,000,000</td>
</tr>
<tr>
<td>staff for production</td>
<td>876,000</td>
</tr>
<tr>
<td>maintenance per annum in % of investment</td>
<td>3.00%</td>
</tr>
</tbody>
</table>

running cost of kiln

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>fuel cost</td>
<td>18,032,143</td>
</tr>
<tr>
<td>electricity cost</td>
<td>4,320,000</td>
</tr>
<tr>
<td>staff</td>
<td>876,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>3,591,600</td>
</tr>
<tr>
<td>interest</td>
<td>14,233,600</td>
</tr>
<tr>
<td>write off</td>
<td>17,792,000</td>
</tr>
</tbody>
</table>

SUM: 58,845,343

per Million brick: 490,378
Comparison of running costs per million bricks

<table>
<thead>
<tr>
<th>Kiln Type</th>
<th>Cost (SAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clamp kiln</td>
<td>526,865</td>
</tr>
<tr>
<td>VSBK</td>
<td>385,665</td>
</tr>
<tr>
<td>Tunnel kiln</td>
<td>490.378</td>
</tr>
</tbody>
</table>

Pros and cons of the tunnel kiln

**PROS**

1. Reduction in energy consumption
2. Reduction in emission
3. Improved health and safety in workplace
4. All types of products
5. Highest achievable quality
6. Produce new products

**CONS**

1. Higher Investment
5. Introducing new products

Introduction of new products as exchange for stock bricks

Currently available
Introduction of new products as exchange for stock bricks

Example for a new product

Comparison of existing stock bricks and new stock bricks

<table>
<thead>
<tr>
<th>Stock brick</th>
<th>length in wall in mm</th>
<th>thickness of wall in mm</th>
<th>height in wall in mm</th>
<th>weight in kg</th>
<th>volume in dm³</th>
<th>density in kg/dm³</th>
<th>coverage weight per m²</th>
<th>weight per m² 102 mm thick wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>standard</td>
<td>222</td>
<td>102</td>
<td>73</td>
<td>3,00</td>
<td>1,65</td>
<td>1,81</td>
<td>52</td>
<td>156,0</td>
</tr>
<tr>
<td>maxi brick</td>
<td>222</td>
<td>114</td>
<td>90</td>
<td>2,50</td>
<td>2,28</td>
<td>1,10</td>
<td>35</td>
<td>87,5</td>
</tr>
<tr>
<td>New stock brick</td>
<td>300</td>
<td>122</td>
<td>250</td>
<td>7,00</td>
<td>9,15</td>
<td>0,77</td>
<td>12,8</td>
<td>89,6</td>
</tr>
</tbody>
</table>

New stock brick has:
- Lowest density
- Lowest weight
- Best insulation value
That means:

Lowest weight and density
-> lower fuel consumption
    -> lower manufacturing costs
    -> lower price per m² wall

High accuracy of product
-> less mortar
    -> faster brick laying
    -> less costs for building up walls

High insulation value
-> less costs for heating / cooling the house

Further products: Face Bricks
Further products: face brick slips and panels

Further products: blocks
Further products: roof tiles

6. Summary and outlook
• Due to environmental issues the brick production will change. It is not known when.
• Brick industry must look into alternatives for the clamp kiln production of stock bricks.
• Alternatives are VSBK’s and tunnel kilns.
• We believe that tunnel kilns with artificial dryers are the better option because of
  • Independency of climate and weather
  • Higher capacity than VSBK
  • Better quality of products
  • Any kind of stock brick/plaster brick/block can be produced.

Summary and outlook

Keller HCW is very keen in finding brick makers interested in
1. developing cost effective tunnel kilns for the production of today’s stock bricks.
2. introducing of new products in the market.
3. automating brick cutting and laying on kiln cars / dryer cars (setting machines)
Thank you and enjoy your AGM!