



Case Studies on Cleaner Brick Production

Case Study No.3

Production of Bricks through Hybrid Hoffman Kiln (HHK)

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1 Introduction

1.1 Background

In several of the developing countries, fired-clay bricks are the prevalent building materials and are still produced through traditional technologies and practices. Some of these practices have adverse impacts on the environment. Various studies have established that improvements in technology and practices can reduce fuel consumption and pollutants emissions (including black carbon) significantly. Climate and Clean Air Coalition (CCAC) is a collective effort of governments of some of the countries along with United Nations Environment Programme (UNEP) towards mitigation of the impacts of short-lived climate pollutants and address the climate change. The CCAC Brick Production Initiative is aimed at substantial mitigation of emissions of black carbon and other pollutants from brick kilns through employing a range of technology and policy approaches. International Centre for Integrated Mountain Development (ICIMOD), is coordinating CCAC-BPI activities in South Asia.

The reduction in emissions can be achieved through shifting to efficient brick kiln technologies as well as through production of resource efficient products such as perforated/hollow bricks or flyash-clay bricks (utilizing flyash, an industrial waste, in brick making). The objective of these case studies is to showcase the examples of brick manufacturing enterprises who have adopted these measures to improve efficiency and reduce emissions. In this endeavour, case studies on four brick manufacturing enterprises operating in South Asia region have been developed. These case studies are focused on:

1. Production of perforated bricks;
2. Production of bricks through Natural Draft Zigzag Kiln;
3. Production of bricks through Hybrid Hoffman Kiln (HHK);
4. Utilisation of flyash in brick making.

This case study is focused on an enterprise producing bricks through Hybrid Hoffman Kiln (HHK) in Bangladesh.

1.2 Introduction to Hybrid Hoffman Kiln (HHK)

Hybrid Hoffman Kiln (HHK) technology is developed and widely used in China. It is a modified version of Hoffman kiln technology which was developed in Germany in mid-19th century. In the Hybrid Hoffman Kiln, hot flue gases exiting from the kiln is directed to pass through the drying

tunnel to utilize the heat in drying of green bricks. Also the green bricks produced by mixing powdered fuel with clay (internal fuel). These features, combined together, lead to lower energy consumption and reduction of air pollution.

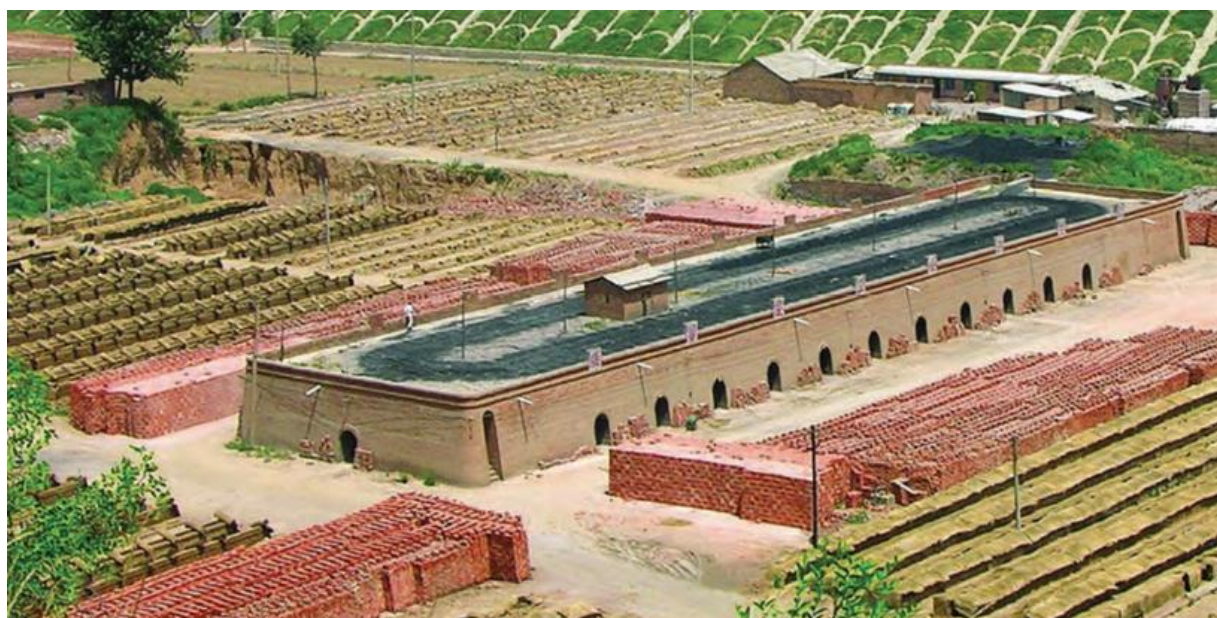


Figure 1: A view of a Hybrid Hoffman Kiln¹

1.3 Brief description of the enterprise²

Name of the company/enterprise	Universal Bricks Ltd.
Location	Dhamrai, Dhaka, Bangladesh
Operating since	2006
Installed production capacity	50,000 bricks per day
Estimated annual production capacity	16.5 million bricks (assuming 330 working days/year)
Operational season	Round the year
Type of products	Solid bricks
Type of fuel	Coal
Method of fuel usage	Around 75% of the fuel required for firing the bricks, is used as internal fuel by mixing it with clay before moulding of green bricks. Rest of the fuel is fed into the kiln from the feedholes provided on the top of the

¹ Photo Credit: The compendium of Case Studies from the GEF Climate Change Portfolio: Transfer of Environmentally Sound Technologies.

² Khan, A.H. (2008) "Energy and Stack Emission Monitoring In Hybrid Hoffmann Kiln (HHK) Type Universal Kiln", World Bank, Dhaka, available at: http://www.ecobrick.in/resource_data/KBAS100078.pdf

	kiln.
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2 Production process³

The schematic of the brick manufacturing process in a Hybrid Hoffman Kiln is shown in the picture below:

³ *Ibid.*

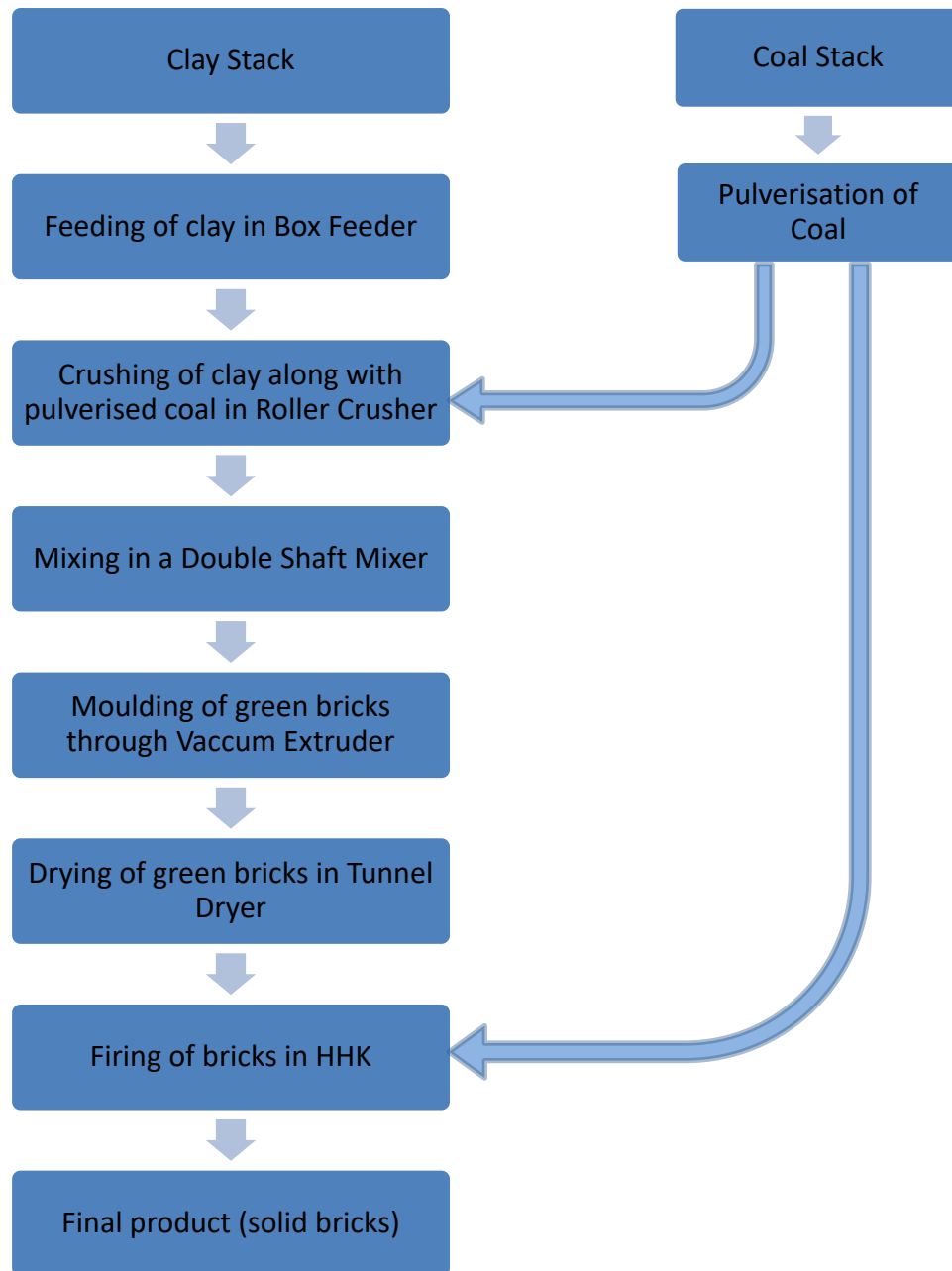


Figure 2: Schematic of brick production process at the Hybrid Hoffman Kiln

The steps involved in the brick manufacturing process in the Hybrid Hoffman Kiln along with the photographs⁴ is described below:

⁴ All the photographs used in this table for describing the steps involved in the production process are not of this particular enterprise. These photographs are taken from different HHK plants and are used here as representative photograph of the various steps of the production process.

Clay and pulverized coal is poured onto the conveyor belt through the respective box feeders (red box for coal and green box for clay in the photograph). The conveyor belt transport the clay and coal mix to the roller crusher.



A view of the extrusion system. In the extrusion process, clay and coal is mixed and then the raw-mix is extruded to produce green bricks.



The drying system consists of small parallel tunnels in which green bricks loaded on carts and the hot air are passed in counter current flow for drying of the bricks. Hot flue gases exiting from the kiln is utilized in drying of the bricks.



Dried bricks come out of the drying tunnels from the opposite end of the tunnels.




The chimney of the dryer is located at the brick entry end of the drying tunnel through which the hot gases including the flue gases from the kiln exit into the atmosphere. The chimney is 20 feet high, 42 feet long and 6 feet wide.



The extruded bricks are loaded in the kiln for firing.



<p>Fuel is fed through the feed holes provided at the top of the kiln.</p>	
<p>After firing and cooling, the finished product is unloaded from the kiln in small trolleys.</p>	

3 Main Features and Benefits of Hybrid Hoffman Kiln

Main Features⁵:	
Production capacity	50,000 bricks per day
Estimated annual production	16.5 million bricks (assuming 330 working days/year)
Land occupied by the kiln	~ 5000 square meters
Capacity of the dryer	72,000 bricks per day
Capital cost of kiln technology (excluding cost of land and buildings)	600,000 – 650,000 USD (estimated for the year 2009)

⁵ Khan, A.H. (2008) “Energy and Stack Emission Monitoring In Hybrid Hoffmann Kiln (HHK) Type Universal Kiln”, World Bank, Dhaka, available at: http://www.ecobrick.in/resource_data/KBAS100078.pdf

Weight of green bricks	4.0 kg		
Weight of dried bricks	3.25 kg		
Weight of fired bricks	3.0 kg/brick		
Firing temperature	950-1050 °C		
Specific Energy Consumption	1.2 MJ per kg of fired bricks		
SPM emission	20.3 mg/Nm ³ (range was 15.8 – 26.9)		
	0.879 kg per 1,000 bricks		
Advantages⁶: (Performance of HHK as compared to other prevalent kiln technologies in Bangladesh)			
Type of Kiln	Coal Consumption (ton coal/100,000 brick)	SPM emission (mg/Nm ³)	CO ₂ emission (ton CO ₂ /100,000 brick)
Fixed Chimney Kiln (FCK)	20-22	1,000	50
Improved Fixed Chimney Kiln (IFCK)	16-18	< 500	40
Zigzag Kiln	16-18	270-300	40
Hybrid Hoffman Kiln (HHK)	12-14	20.3	30

4 Conclusions

- Hybrid Hoffman Kilns are more energy efficient and less polluting as compared to the other prevalent kiln technologies in Bangladesh.
- The capital investment in case of HHK is substantially higher mainly because of higher production capacity, mechanized operation and tunnel drying system.

⁶ World Bank Report on 'Introducing Energy-efficient Clean Technologies in the Brick Sector of Bangladesh', 2011 available at:
<https://openknowledge.worldbank.org/bitstream/handle/10986/2797/601550ESW0P1110e00201100Color0FINAL.pdf>