

BRICK MANUFACTURING : AN OVERVIEW OF TECHNOLOGIES



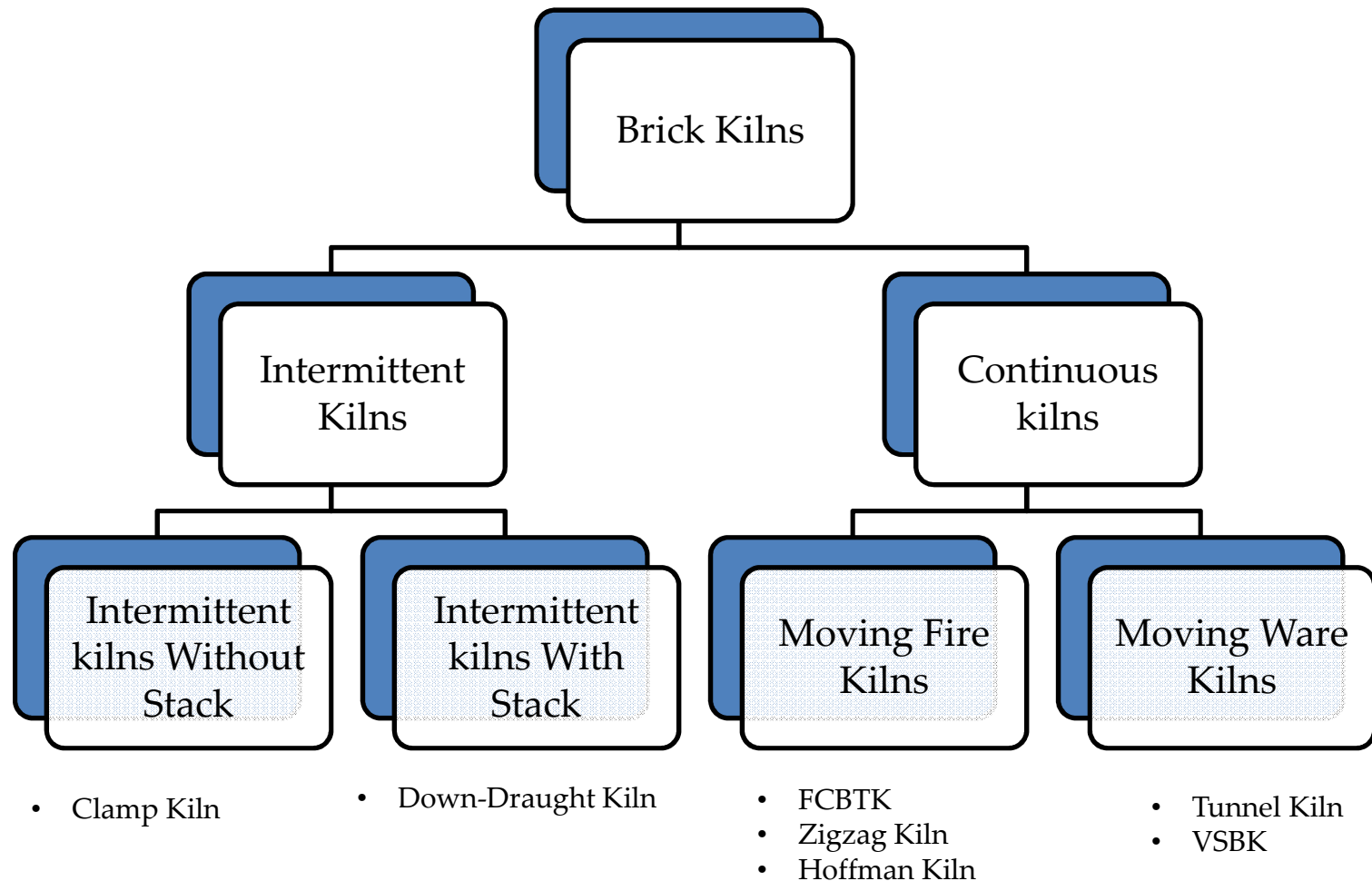
Greentech Knowledge
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FIRED-CLAY BRICKS PRODUCTION PROCESS



KILN CLASSIFICATION



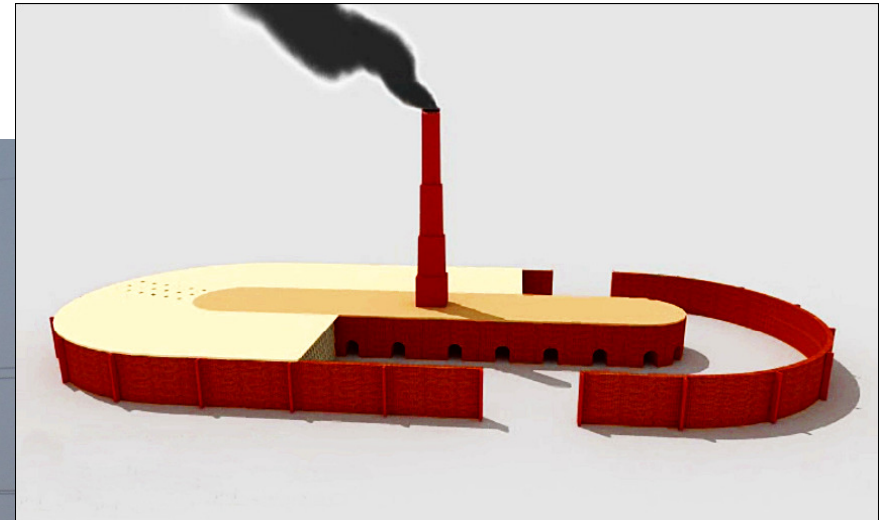
OVERVIEW OF KILNS



- Fixed Chimney Bulls Trench Kiln
- Zigzag kiln
 - Natural Draught
 - Induced Draught
- Hoffman Kiln
- Vertical Shaft Brick Kiln
- Tunnel Kiln
- Clamp Kiln
- Down-Draught kiln

FIXED CHIMNEY BULL'S TRENCH KILN (FCBTK)

- Produces 60-65% of the total brick production in India.
- ~ 40,000 FCBTK operational in India.



FIXED CHIMNEY BULLS TRENCH KILN (FCBTK) : WORKING



- Animation

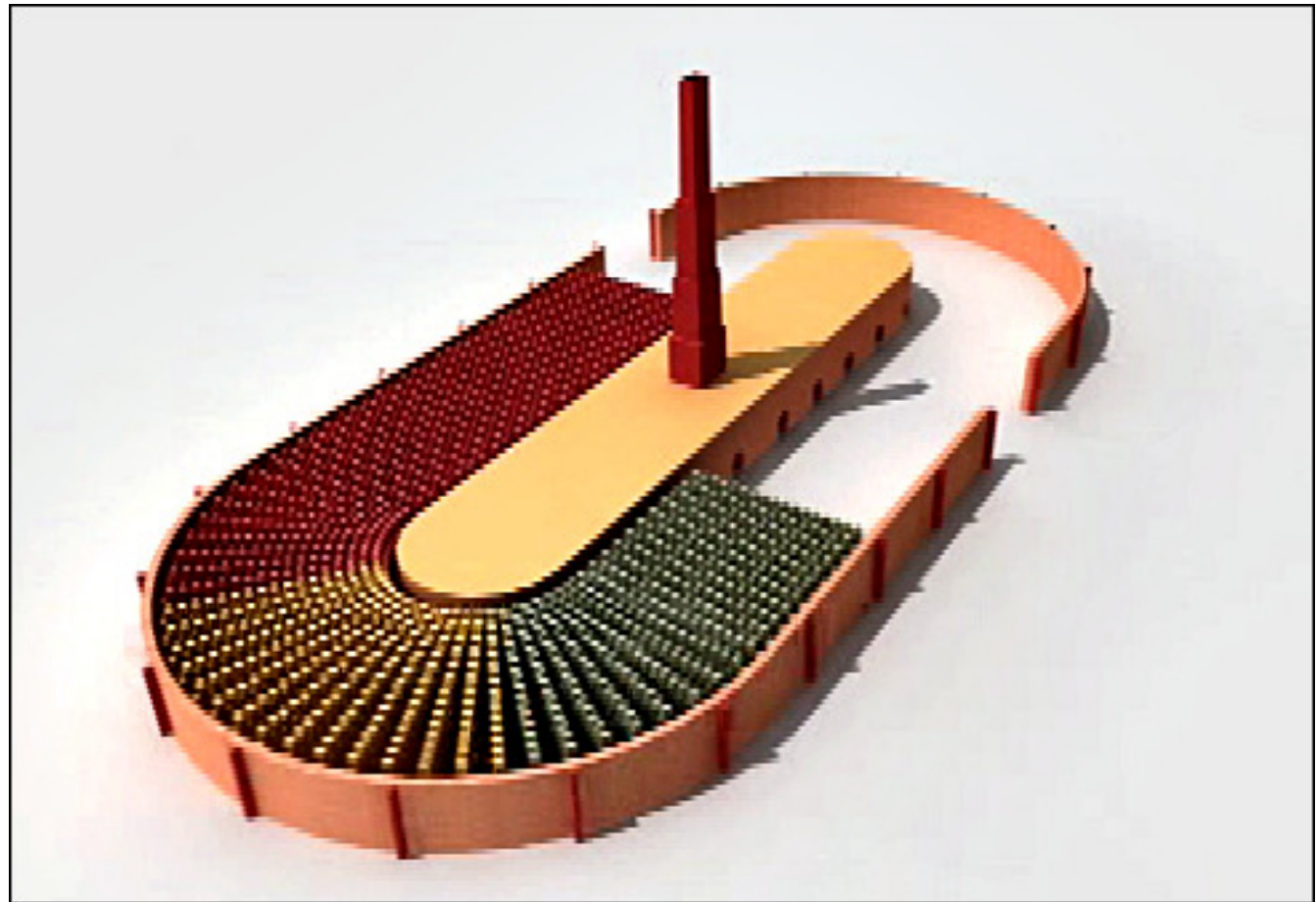
- Fire moves in closed oval circuit through the brick stacked in Trench.

- Operates under natural draught mode.

- Three zones:
 - Firing zone
 - Pre-heating zone
 - Cooling zone

- Solid fuel fed from the top intermittently.

- Column type brick setting.



FIXED CHIMNEY BULLS TRENCH KILN (FCBTK) : WORKING



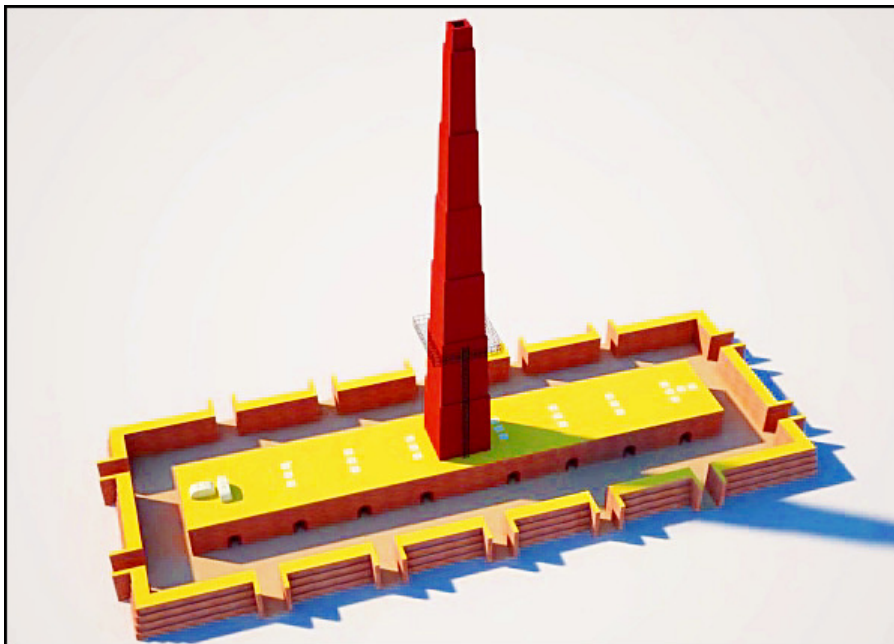
FIXED CHIMNEY BULLS TRENCH KILN (FCBTK) : MAIN FEATURES



- Production Capacity: 20,000 – 60,000 Bricks per day.
- Product Quality:
 - Class-I bricks: 50-60%
 - Underfired, over-fired or breakages: 40-50%
- Capital Investment (excluding land cost): Rs 30-50 lakh
- High emissions of PM and gaseous pollutants.

ZIGZAG KILN (NATURAL AND INDUCED DRAUGHT)

- Improved version of FCBTK.
- Central Building Research Institute (CBRI) first introduced the zigzag firing technology based during early 1970s.
- 3,000 – 4,000 kilns in India.



ZIGZAG KILN: WORKING

- Animation

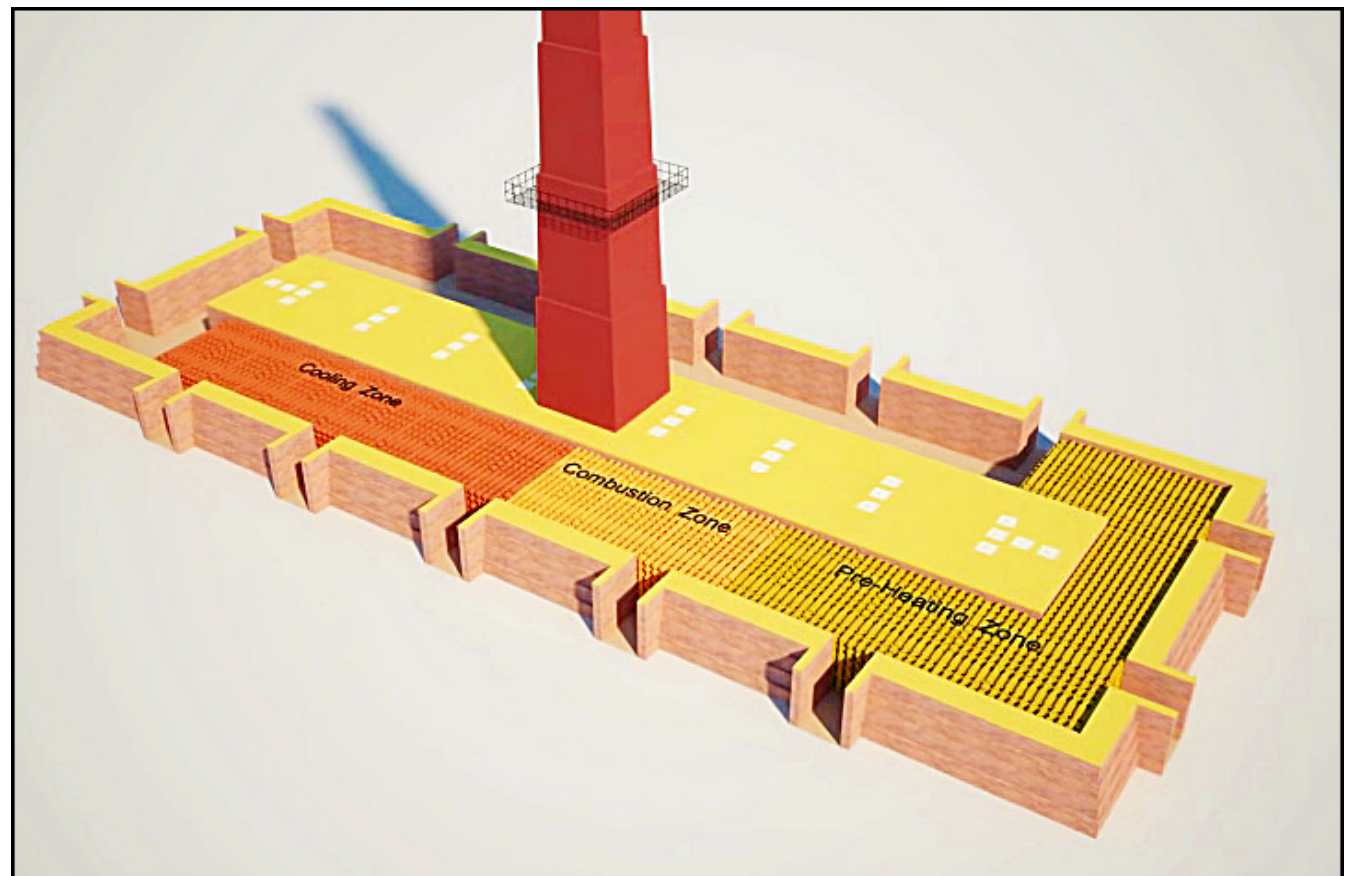
- Fire moves in closed rectangular circuit through the brick stacked in trench.

- Operates under natural or induced draught mode.

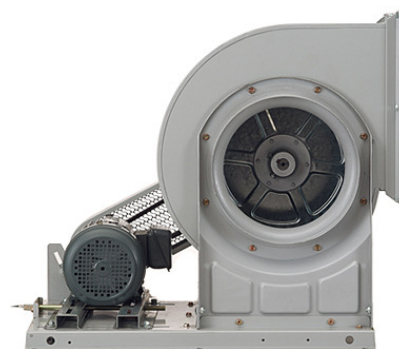
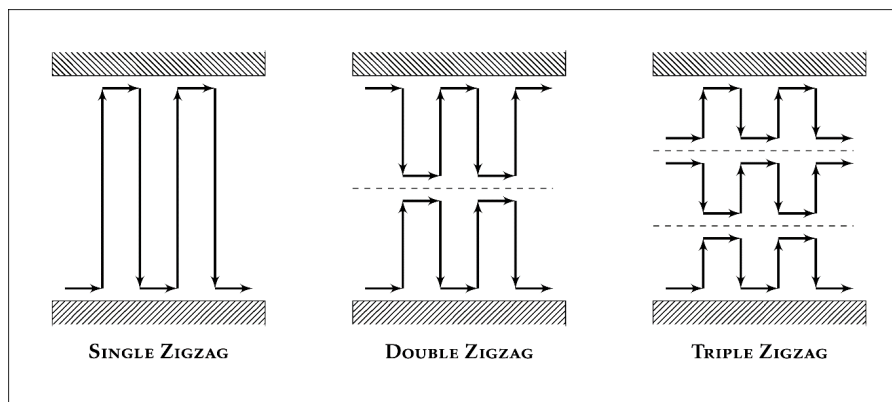
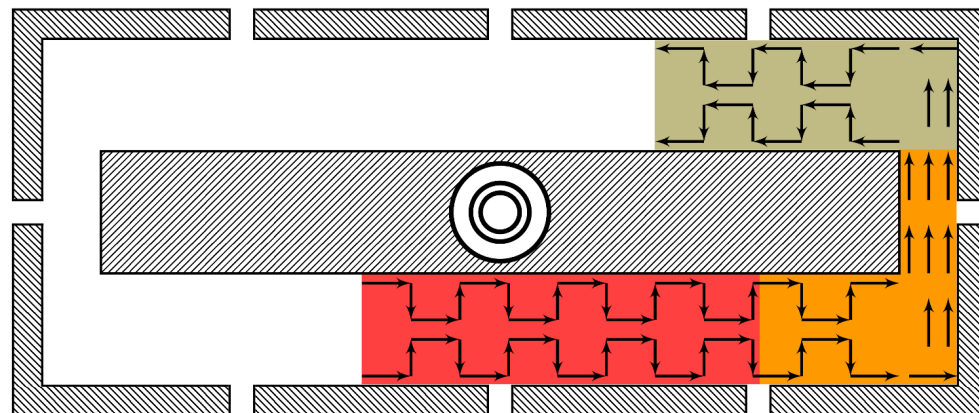
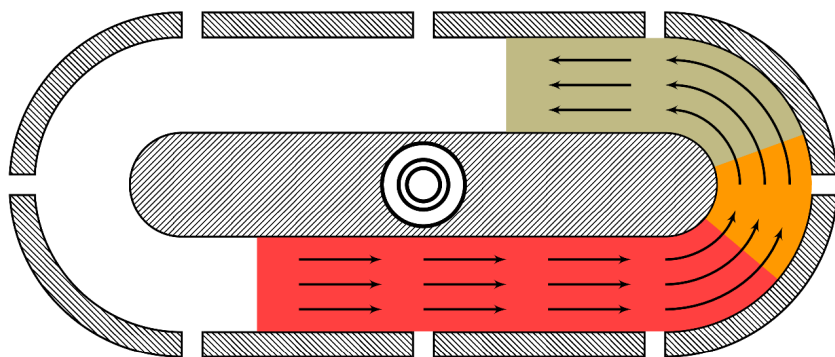
- Three zones:
 - Firing zone
 - Pre-heating zone
 - Cooling zone

- Solid fuel fed from the top continuously.

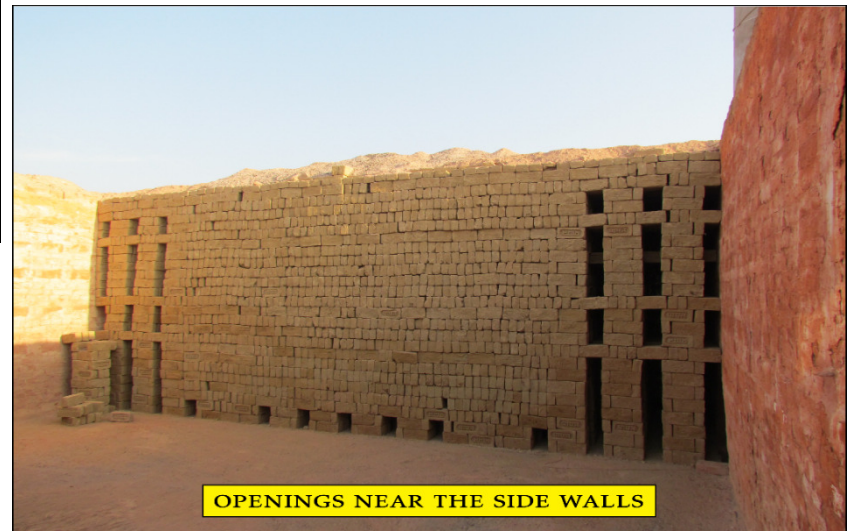
- Chamber type brick setting.



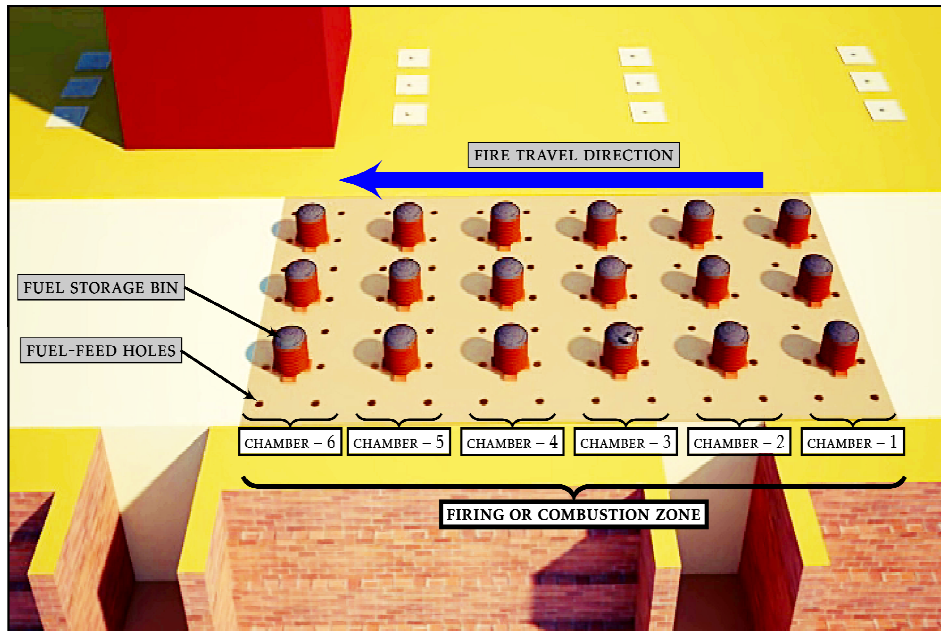
ZIGZAG KILN: WORKING



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ZIGZAG KILN: WORKING



ZIGZAG KILN: MAIN FEATURES



- Production Capacity: 20,000 – 60,000 Bricks per day.
- Up to 25% less fuel consumption compared to FCBTK.
- Product Quality:
 - Class-I bricks: 80% - 90%
 - Underfired, over-fired or breakages: 10-20%
- Capital Investment (excluding land cost): Rs 30-50 lakh
- Emits 70-80% lower PM as compared to FCBTKs.

HOFFMAN KILN

- Hoffman kiln was developed and patented by Friedrich Hoffman in Germany in the year 1858.
- In India, there are ~500 Hoffman kilns in operation.



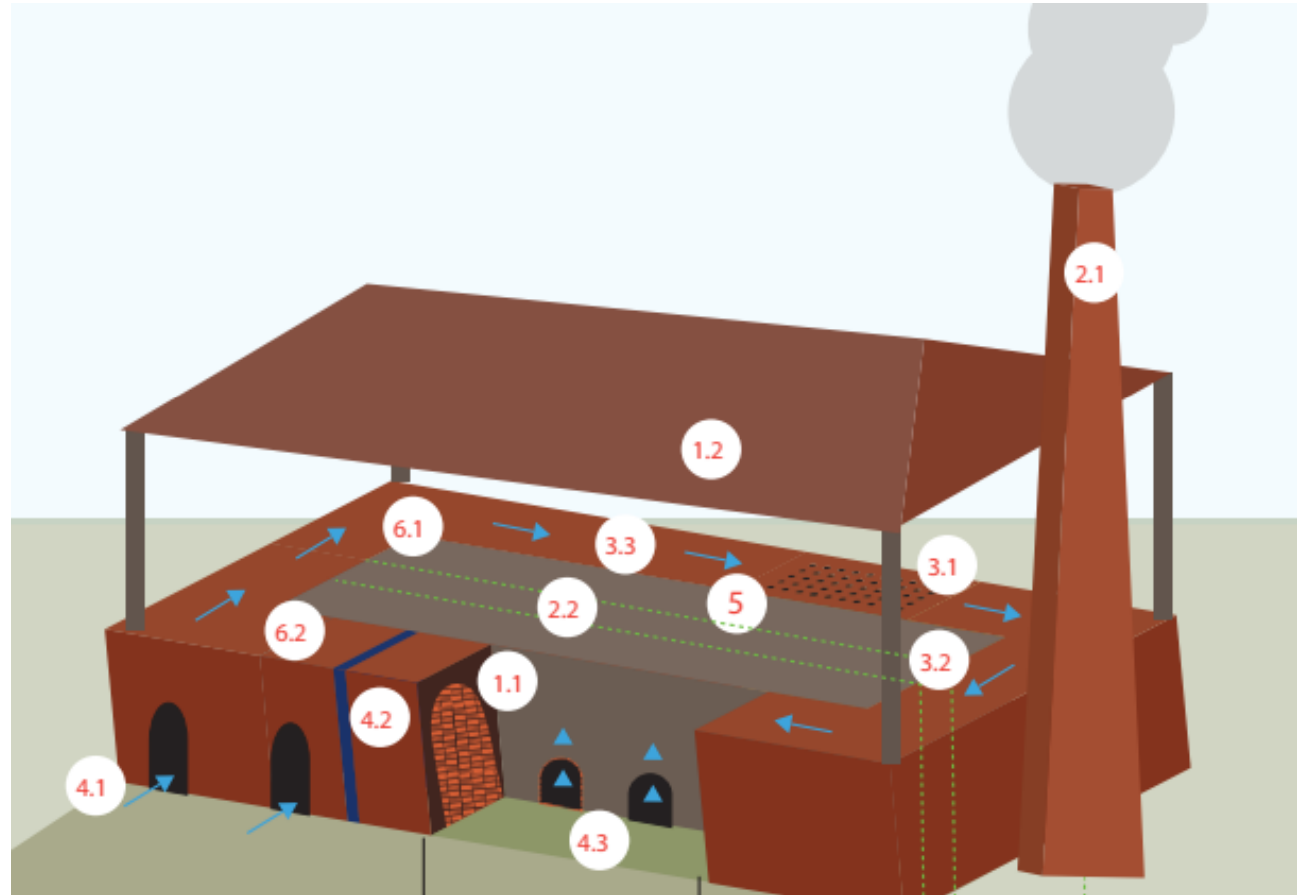
HOFFMAN KILN: WORKING

- Fire moves in closed rectangular circuit through the brick stacked in the annular space.

- Three zones:
 - Firing zone
 - Pre-heating zone
 - Cooling zone

- Operates under natural or induced draught mode.

- Solid fuel fed from the top intermittently.



HOFFMAN KILN: WORKING



HOFFMAN KILN: WORKING



HOFFMAN KILN: MAIN FEATURES



- Production Capacity: 10,000 - 20,000 bricks per day.
- The cost of setting up a Hoffman kiln is around 60 - 90 lakh.
- Can be operated all year around with a flexibility in production capacity.
- Suitable for any type of green bricks or tiles.
- Around 80% of the total bricks produced are of good quality.
- Relatively higher energy consumption because of high thermal mass.

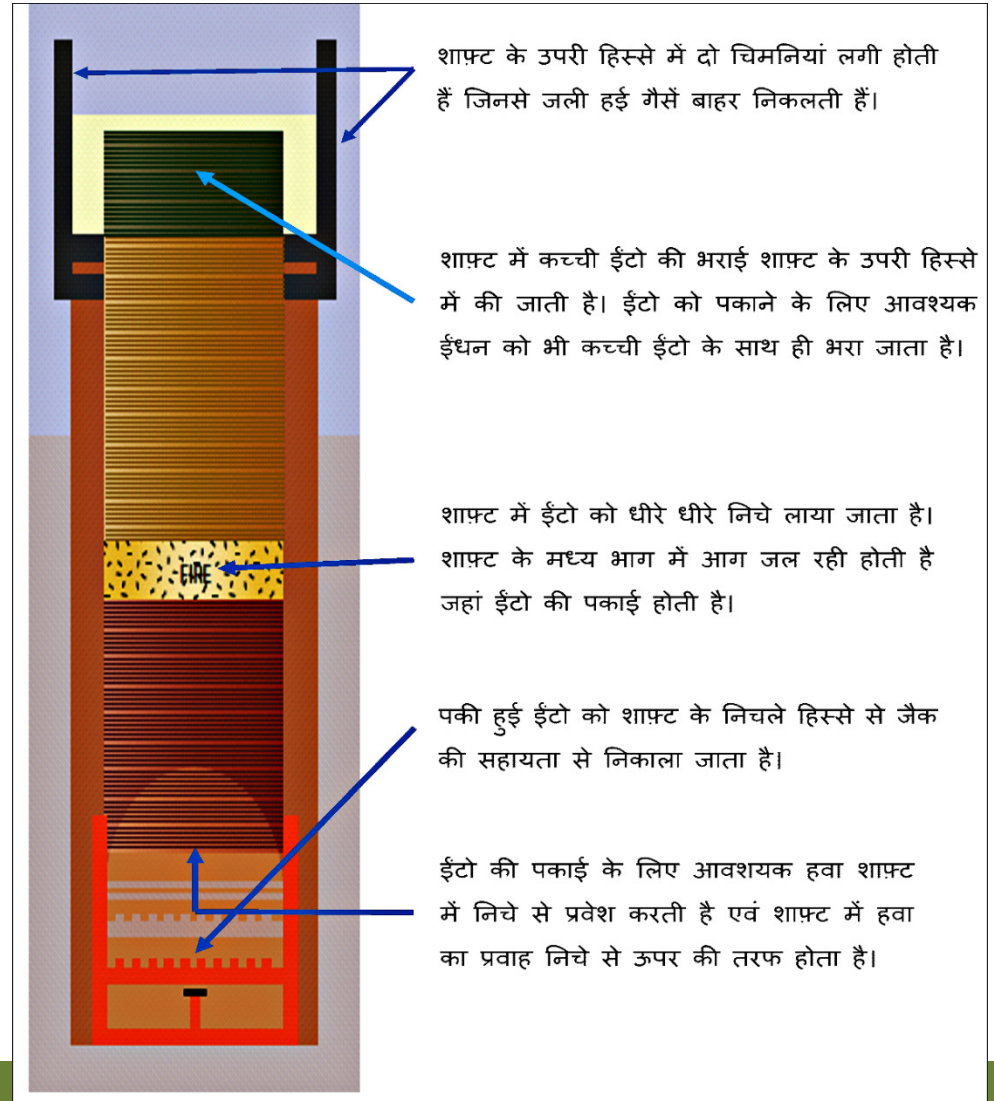
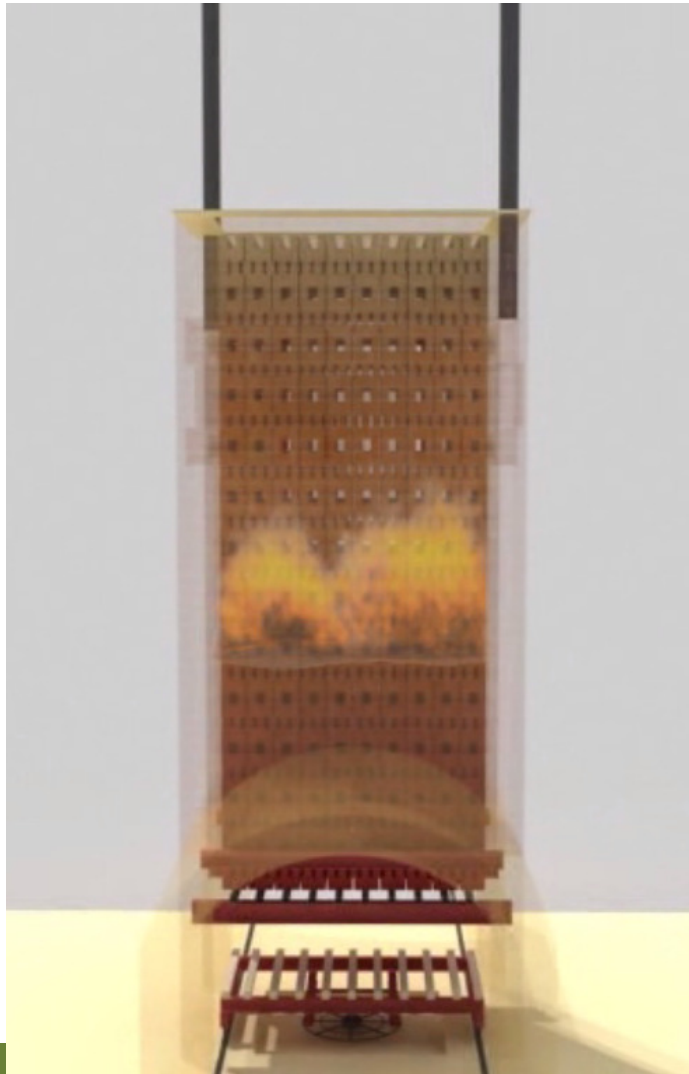
VERTICAL SHAFT BRICK KILN (VSBK)

- Developed in rural Chins during late 1960s and early 1970s.
- About 110 kilns installed in India.

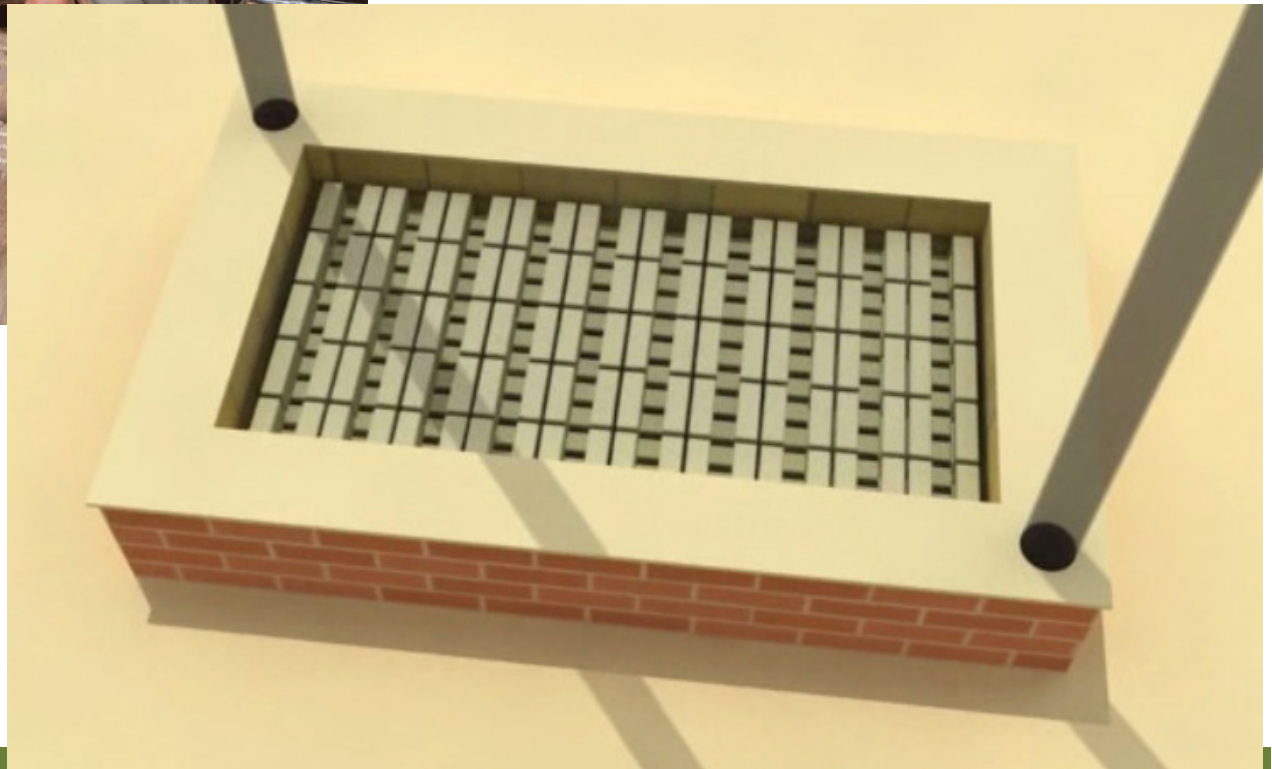


VERTICAL SHAFT BRICK KILN (VSBK): WORKING

ANIMATION

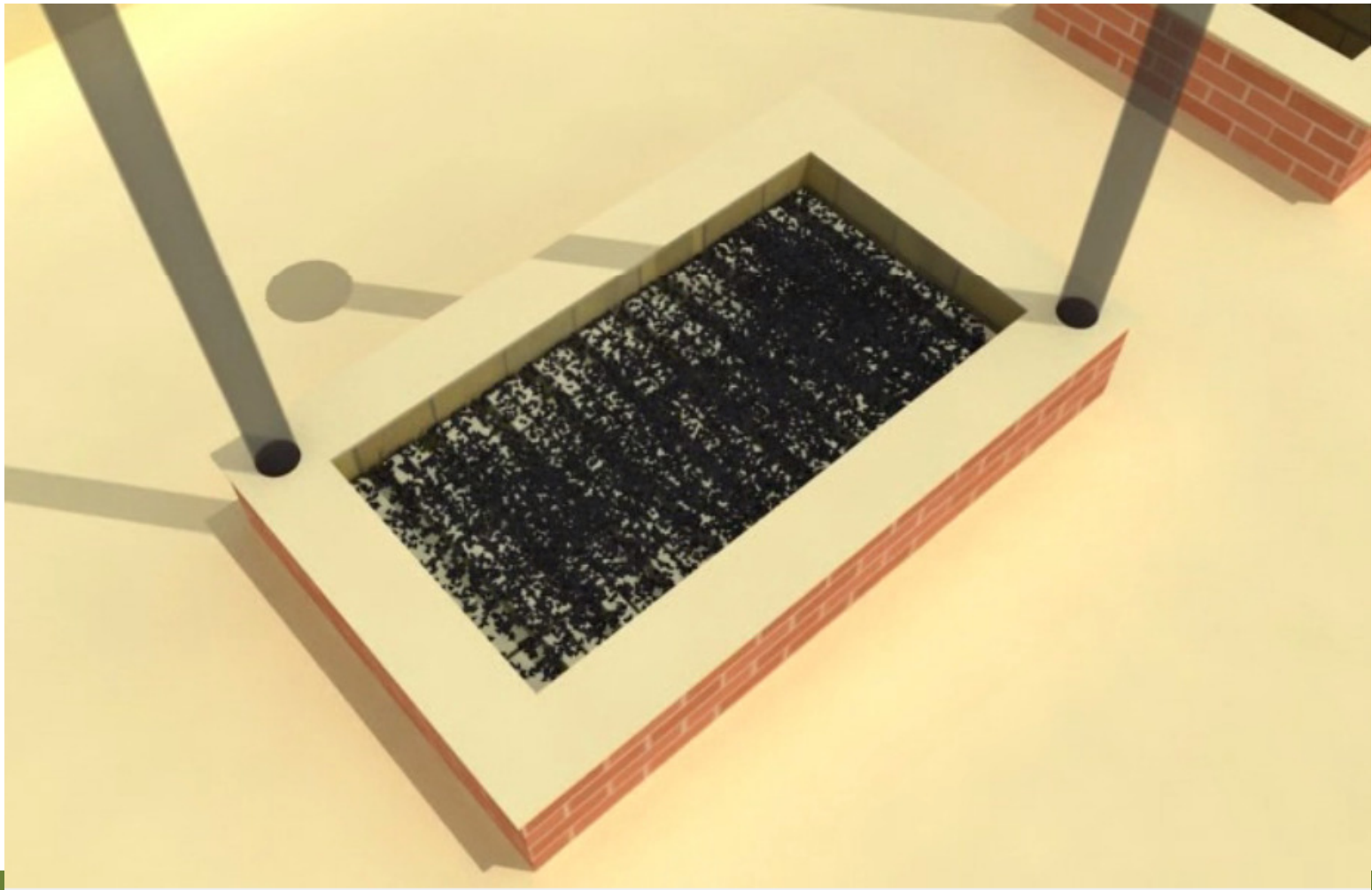


LOADING OF BRICKS



FUEL FEEDING

- Additional fuel is loaded along with the bricks from top of the shaft

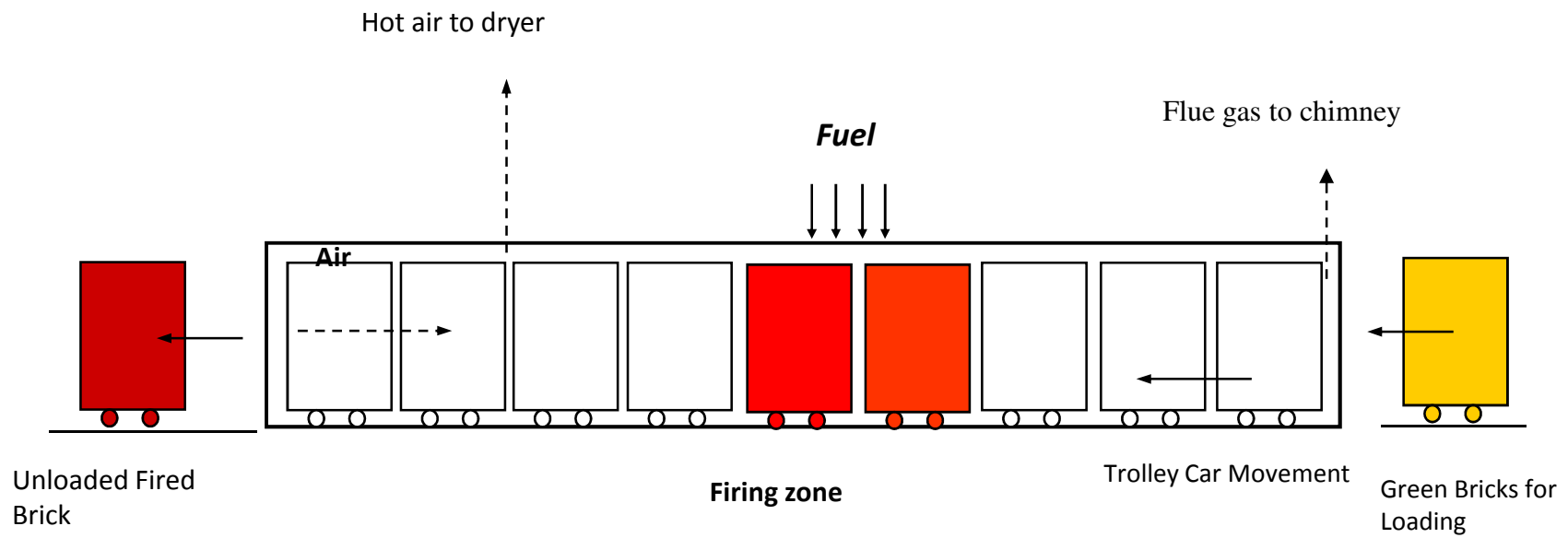


VERTICAL SHAFT BRICK KILN (VSBK): MAIN FEATURES



- Production Capacity: 5,000 – 30,000 bricks per day.
 - 4,000-5,000 bricks per day per shaft
- Consumes 30-40% less fuel as compared to FCBTK
- Requires less space area to setup as compared to other brick kilns.
- Capital Investment (excluding land cost): Rs 15-50 lakh
- Impact on product quality because of fast firing process
- Requires conveyor/lift (and electricity) for lifting of bricks to the top.
- Emits ~80% lower PM as compared to FCBTK.

TUNNEL KILN

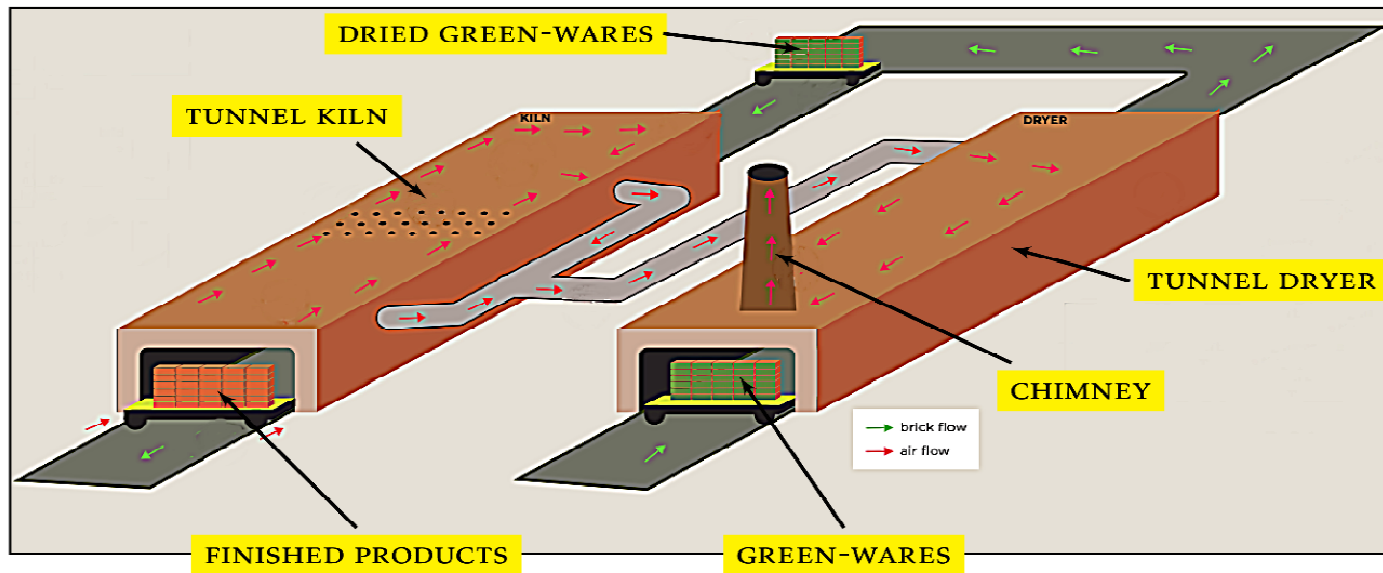


TUNNEL KILN

- Developed around mid-19th century in Germany.
- In India, there are very few (~5) tunnel brick kiln units.



TUNNEL KILN: WORKING



TUNNEL KILN: WORKING



TUNNEL KILN: MAIN FEATURES



- Production Capacity: 50,000 – 2,00,000 bricks per day.
- The cost of setting up a tunnel kiln is around Rs 4 - 10 crore.
- Can be operated all year around with a flexibility in production capacity.
- Suitable for any type of green bricks or tiles.
- Around 100% good quality (properly fired) products.
- Significantly less pollutant emission.
- Hollow blocks and any other type of bricks/block/tile can be produced

CLAMP KILN

- The clamp is the most basic type of kiln since no permanent kiln structure is built.
- It consists essentially of a pile of green bricks interspersed with combustible material.



CLAMP KILN: WORKING



Coal fired clamp

CLAMP KILN: WORKING



Wood fired clamp



Rice husk fired clamp

CLAMP KILN: MAIN FEATURES

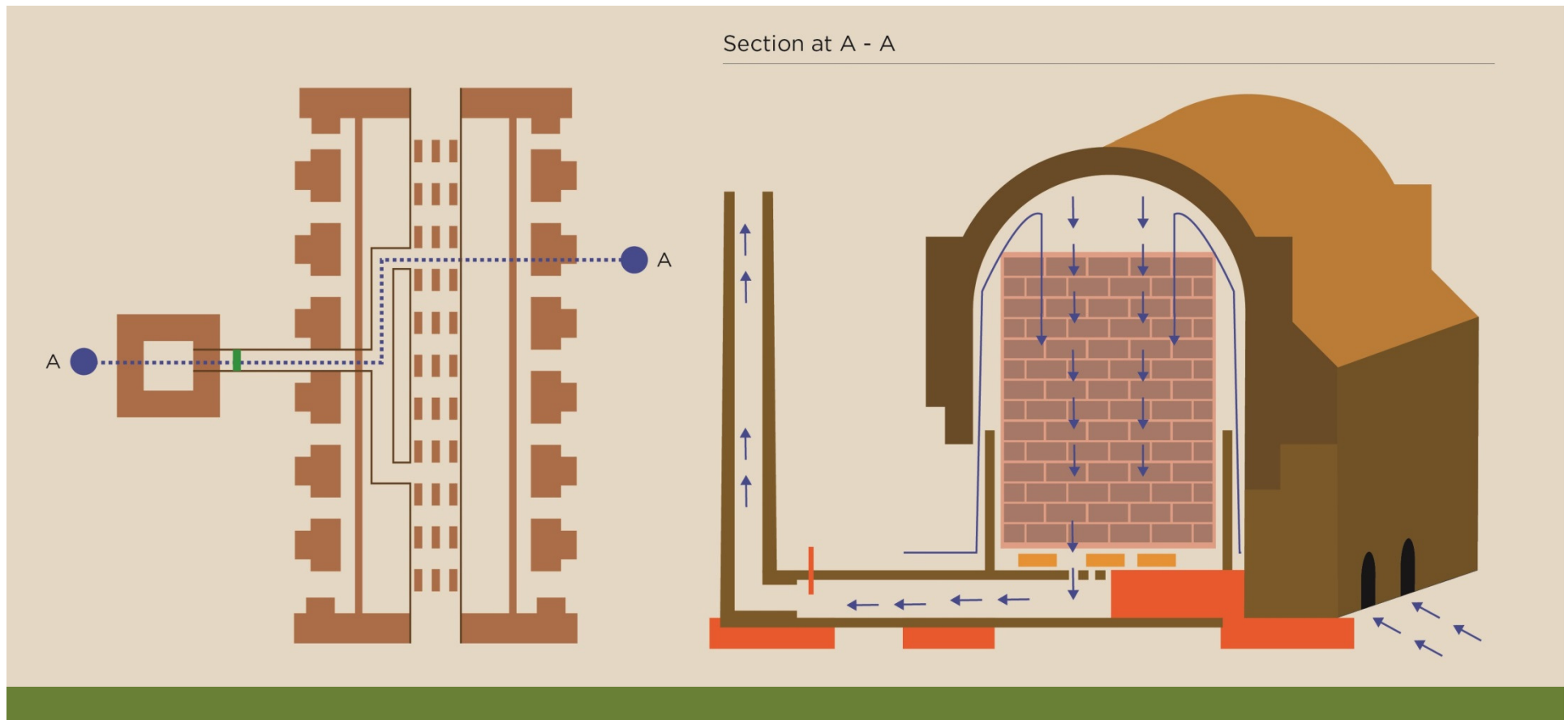


- Production Capacity: 10,000 - 200,000 bricks per batch.
- Types of Products:
 - Solid bricks
- Around 50-60% of the total bricks produced are of good quality.
- Suitable for solid fuels like coal and biomass.
- Concentration of air pollutants is very high around clamps.
- Larger clamps are relatively more energy efficient.

DOWN DRAUGHT KILNS



DOWN DRAUGHT KILNS – WORKING



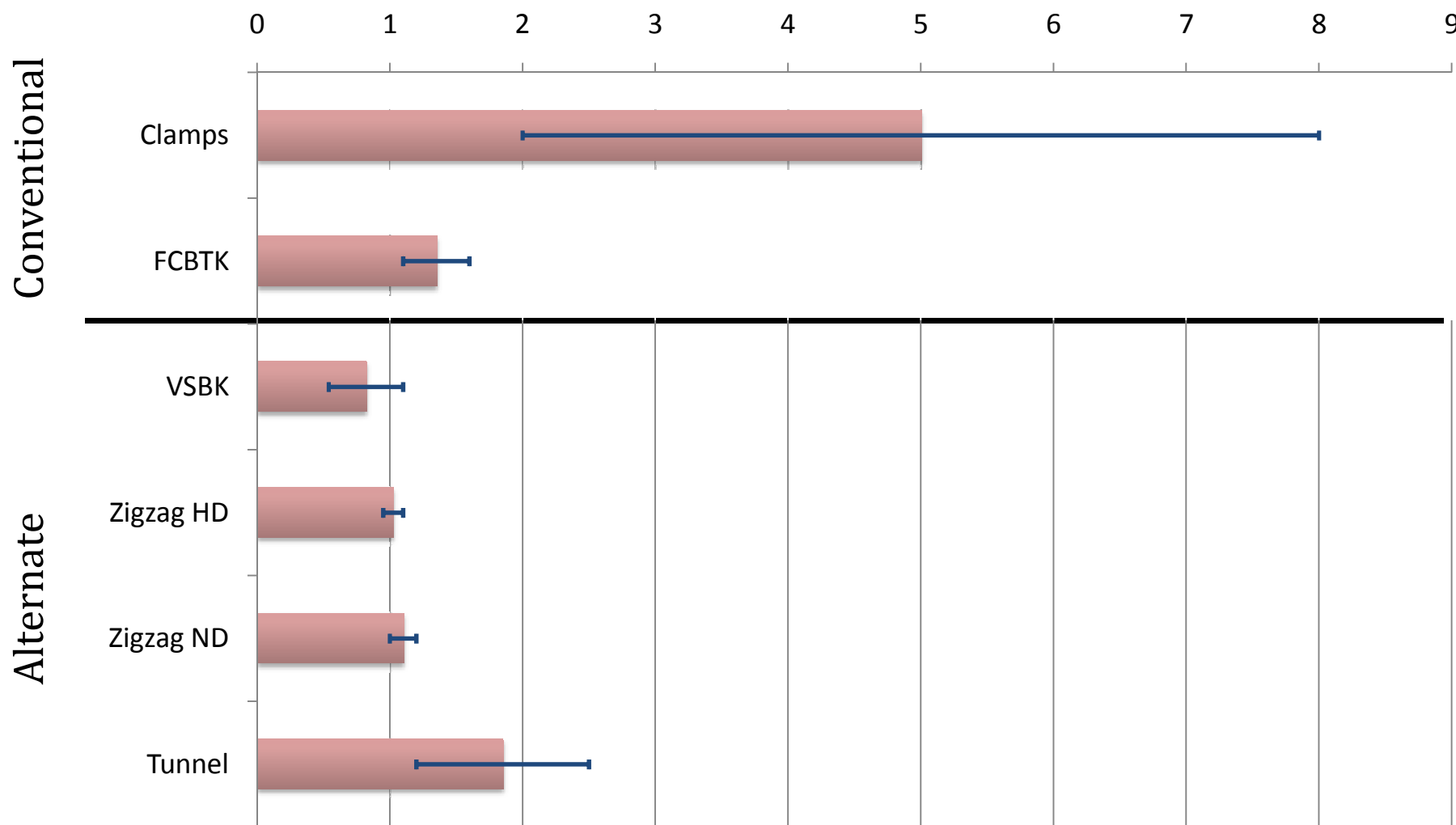
DOWN DRAUGHT KILNS



- Key aspects
 - Relatively higher investment than clamps due to permanent kiln structure
 - Suitable for small to medium scale batch production
 - Can be used for year round production
 - Capital Investment (excluding land cost): Rs 14-20 lakh
 - Production capacity: 20,000 – 40,000 bricks per batch.
 - Good quality products: 85%
 - Type of products: All types
 - Quality of fired bricks better than clamp.
 - High sensible heat losses because of higher thermal mass of the kiln
 - Relatively better and homogeneous brick quality as compared to clamps because of uniform temperature distribution

ENERGY CONSUMPTION – FIRING TECHNOLOGIES

- Specific Energy Consumption (MJ/kg fired brick)

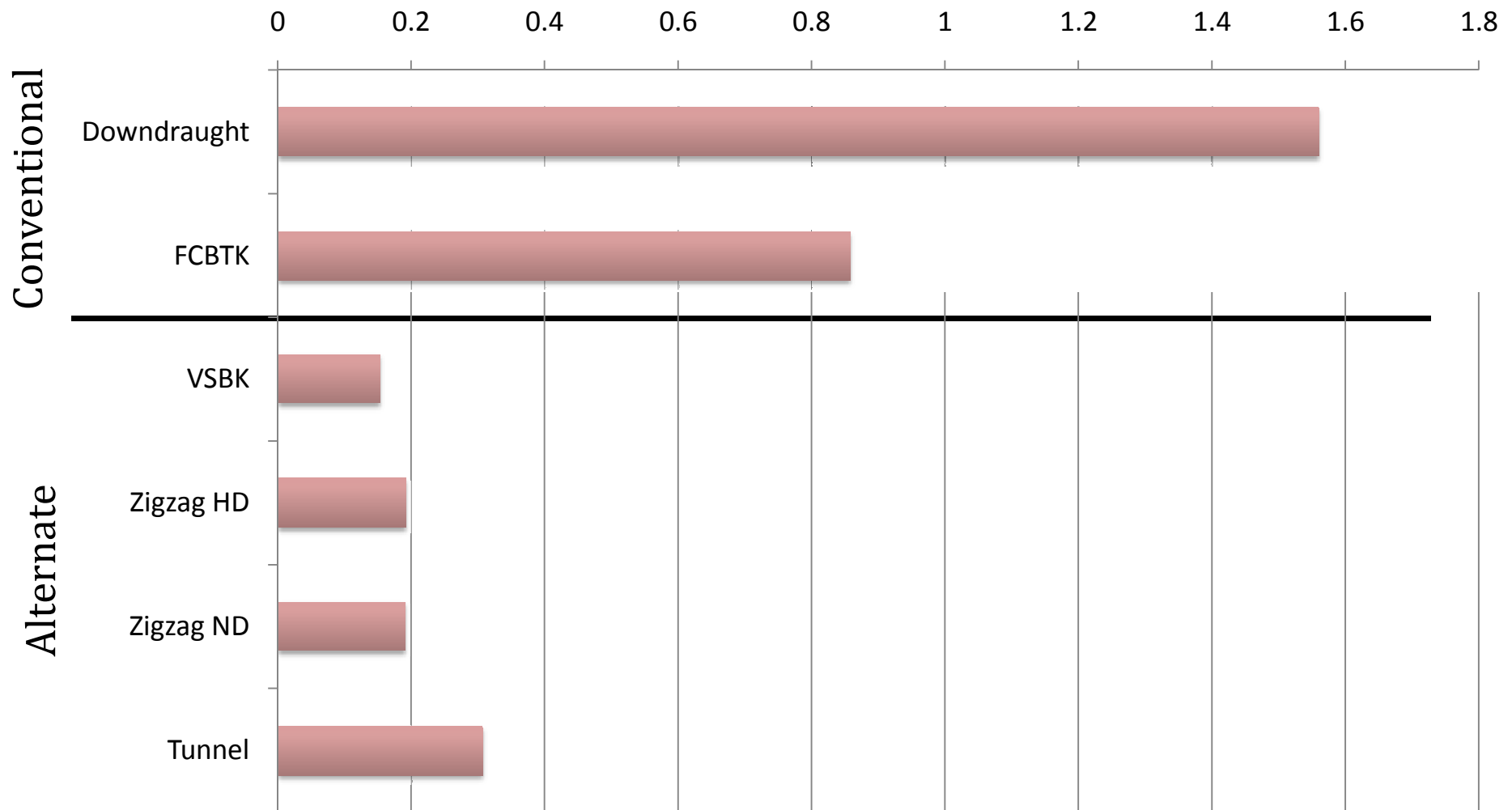


Source: Energy utilization in brick kilns, Sameer Maithel , PhD thesis, IIT Bombay,,

ENVIRONMENT PERFORMANCE



- Suspended Particulate Matter* (g/kg fired brick)



* Preliminary Results based on monitoring by GKSPL, Enzen & Entec

Comparison of Brick Kiln Technologies

	Energy Consumption	Environment Emissions	Product Quality	Economics
Best Performance	VSBK	VSBK/Tunnel	Tunnel	Zigzag
Medium Performance	Zigzag Kiln	Zigzag Kiln	Zigzag Kiln	FCBTK
Poor Performance	FCBTK	FCBTK	FCBTK/VSBK	VSBK/Tunnel

Conversion from FCBTK to Zigzag will move the industry one step ahead

THANK YOU !!!

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