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Anil Agarwal Environment Training Institute

Case Study: Clamp down the Clamp Kilns

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HISTORY REVIEW

- Brick making is an ancient industry
- No change in brick making process over centuries
- Many technologies have been developed and introduced in recent years
- Clamps, the oldest & traditional technology has never been talked about
- Most polluting and energy intensive.

	Agency/ Programme	Type of Intervention	Impact
1970's	Central Building Research Institute, Government of India	**Technical**: Introduction of zig-zag firing technology and semi-mechanization process	• Successful in seeding the technologies. • No large-scale adoption.
1990's	Central Pollution Control Board/ Ministry of Environment and Forest (MoEF)	**Regulation:** Air emission regulation for brick kilns	• Large-scale shift (around 30,000 kilns) from moving chimney Bull's Trench Kiln technology to more efficient and less polluting fixed chimney Bull's Trench Kiln technology.
1995-2004	Swiss Agency for Development and Cooperation	**Technical**: Introduction of Vertical Shaft Brick Kiln (VSBK) Technology	• Successful in seeding the technology. • No large-scale adoption.

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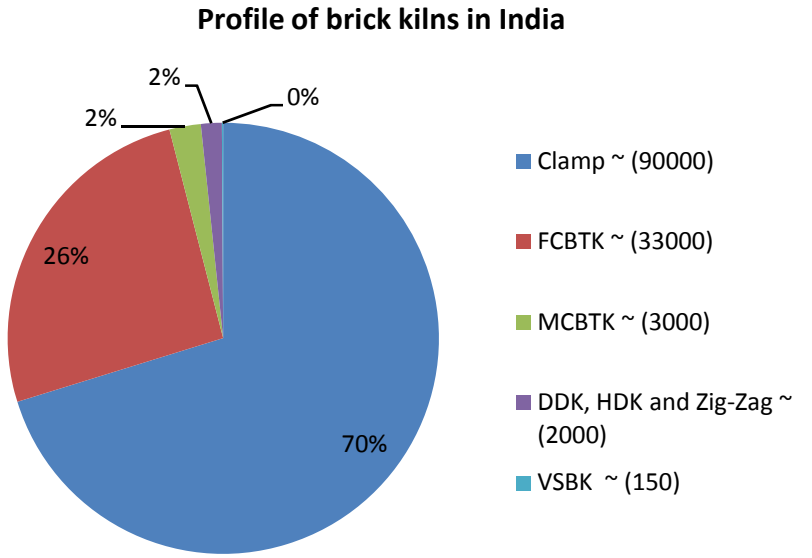
CLAMPS: INTRODUCTION

- Constitutes 70% of the total brick kilns in India
- Consists of pile of green bricks interspersed with combustible material
- Two or more fuel beds are used
- Takes 8-12 days for completion of firing
- Innermost bricks are the hardest, the outer bricks are usually under-burnt



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BRICK PREPARATION

Clay Preparation

Moulding

Drying

Sorting

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BRICK SETTING

1

A clamp does not have a permanent kiln structure. It consists essentially of an organised pile of green bricks interspersed with combustible material.

2

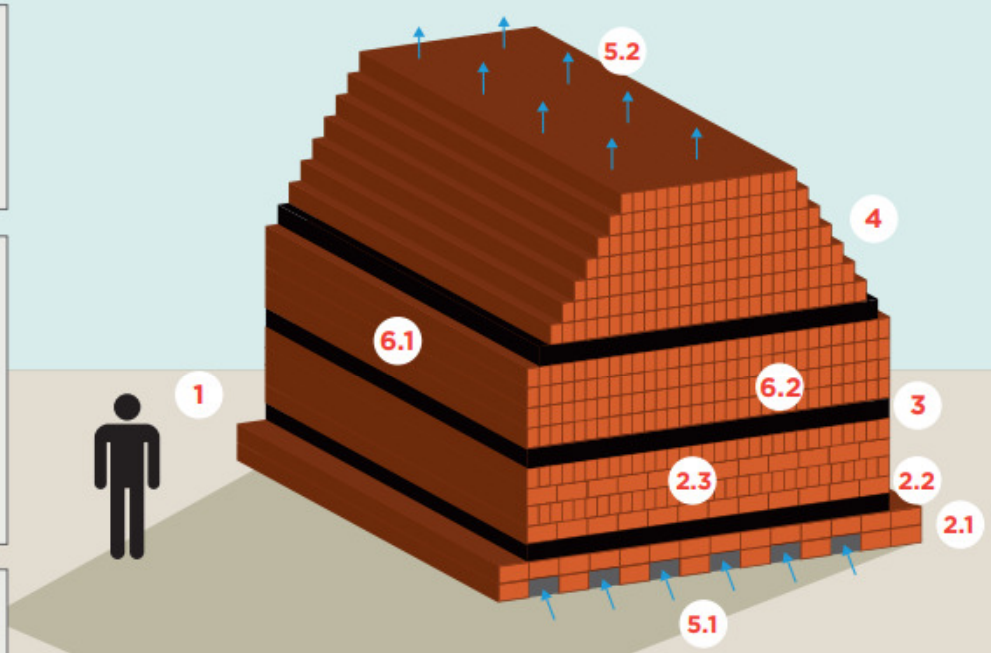
The base **(2.1)** of the clamp is first laid with fired bricks. Generally, in case of coal fired bricks, a thin layer of fuel **(2.2)** is spread over the base on which the green bricks are stacked **(2.3)**. In case of firewood fired clamps, tunnels are made through the base of the pile to feed firewood. In a rice husk fired clamp, bricks are stacked in parallel columns and the fuel is fed from the top and burned in the gaps between the brick columns. **(2.4)**

3

In bigger coal fired clamps, to attain the required firing temperature throughout the brick stacking, fuel is also added in the spacings/holes provided in the brick stacking.

4

For stability of the clamp structure, usually the upper part of the clamp has a trapezoidal shape.



2.4

Photograph of rice husk fired clamp

5

The clamps are ignited at the bottom. Air required for combustion, enters through the openings provided in the base of clamp **(5.1)**. During burning, the hot air rises up through the bricks and heats the bricks. Smoke and fumes leave from the top of the clamp **(5.2)**. In a clamp, the operator has very little control over the burning rate. The burning rate is affected by the weather particularly by the direction and speed of the wind.

6

Because of heat loss to the surroundings, bricks located on the surface are usually under-fired **(6.1)**. Also bricks located near to the fuel layer are usually over-burnt **6.2)**.

7

In case of coal fired clamps, the firing process takes around 4-5 days and then the clamp is left for cooling for 8-10 days before the bricks are taken out.

8

To reduce the heat loss from the surface of the clamps, sometimes the outer walls are plastered with mud or the base and the outer walls are permanently built with bricks. In some cases, green bricks are also stacked along the outer walls to utilise the heat from the kiln for drying of bricks.

CLAMPS: WHY AND WHY NOT

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Why people prefer

- Cheap and easy to build
- No permanent structure to install
- Mostly built next to supply of clay and fuel
- Production capacity can be varied depending upon the requirement
- Variety of fuel can be used for firing, e.g. Coal, rice husk, saw dust, coconut husk etc
- *Mostly remain unnoticed and do not figure in official records of regulatory agencies.*

What people ignore

- Large amount of heat loss from walls
- Inefficient consumption and incomplete combustion of fuel
- High emissions of particulates and GHG's
- High percentage (approx 50%) of under-burnt and over burnt bricks
- High specific energy consumption (sec)

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COMPARISON BETWEEN CLAMP AND OTHER TECHNOLOGY

Type of Kiln	SEC (mJ/kg of fired brick)	% of good quality bricks
Clamp	2.10	50
FCBTK	1.30	60
HHK	1.20	90
Zigzag (natural)	1.06	85
Zigzag (induced)	1.03	80
VSBK	0.8	90
Tunnel	1.4	95

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EMISSIONS DATA FROM CLAMPS

	Parameter	Location					
		MP	AP	TN	KA	GJ	MH
S1	SPM (µg/m^3)	210-475	218-361	215-3215	215-288	260-1480	70-900
	RSPM (µg/m^3)	84-225	185-274	158-2378	139-201	115-925	62-445
	SO_2 (µg/m^3)	5-10	6-6	6-16	6-6	6-6	4-32
	NO_2 (µg/m^3)	21-25	25-35	**49-126**	33-40	25-36	**102-201**
	CO (ppm)	ND	**0-6**	**0-28**	ND	ND	**2-10**
S2	SPM (µg/m^3)	352-799	189-363	226-3954	241-512	181-1216	60-269
	RSPM (µg/m^3)	75-418	145-210	185-2714	135-389	86-890	44-123
	SO_2 (µg/m^3)	6-9	6-6	8-17	6-6	6-6	4-9
	NO_2 (µg/m^3)	19-25	24-36	**51-123**	32-47	28-35	**65-187**
	CO (ppm)	ND	**0-10**	**0-36**	ND	ND	**4-12**
S3	SPM (µg/m^3)	120-178	83-126	154-198	255-499	215-737	56-85
	RSPM (µg/m^3)	68-126	68-93	114-155	110-331	98-365	21-58
	SO_2 (µg/m^3)	5-10	6-6	6-7	6-7	6-6	4-11
	NO_2 (µg/m^3)	15-21	24-37	39-48	35-42	28-41	**26-114**
	CO (ppm)	ND	ND	ND	ND	ND	**0-6**

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MP: Indore
AP: Patancheru
TN: Thittakudi
KA: Malur (Bangalore)
GJ: Rajkot
MH: Raigarh

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CLAMPS IN MAHARASHTRA: A CASE STUDY

- Total no of clamps in state: 7,000
- Western Maharashtra region is called the hub of clamps.
- Areas include districts of Pune, Khapoli, Ahmednagar, Solapur, Satara, Sangli, Karad, Pimpalwadi and Kolhapur.
- Consists of small, medium and large scale clamps.
- Good alluvial soil on banks of River Krishna, Warana, Koyana and Panchganga.
- Alluvial soil needs less coal for burning.
- Produces good quality bricks.
- Coal consumption in clamp in Maharashtra is 12-15 Tons/100,000 bricks out of total 16-19 Tons/100,000 bricks consumption in India.

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- Petition was transferred at NGT, Pune in 2013 against a clamp brick unit operating amidst residential area.
- After hearing all parties, NGT directed MPCB to formulate and notify emission standards rules for clamp type kilns.
- MPCB has notified new guidelines for establishment of clamp type kilns called as The Maharashtra clamp type traditional Brick kilns (Siting criteria for Establishment) Rules, 2016.

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MPCB GUIDELINE FOR CLAMP TYPE KILNS: "A HIT" OR "A MISS"

Hit: The Rules may be called as The Maharashtra clamp type traditional Brick Kilns (Siting criteria for Establishment) Rules, 2016.

Miss: The Rules are Siting guideline but do not specify about emission standards.

Hit: Clamps with batch size >50000 bricks have to adhere by the notification for brick kilns issued by MoEFCC on 22nd July, 2009 and the National Ambient Air Quality standards whereas clamps with batch size <50000 bricks needs to comply only with the National Ambient Air Quality Standards.

Miss: The said MoEFCC notification does not mention anything about the clamp type kilns. It is unclear whether the kiln owners have to comply with the BTK, DDK or VSK standards.

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Hit: Use of hazardous waste, petcoke, plastic, rubber, leather, explosive chemical, etc is prohibited.

Hit: Local agro waste residue shall be encouraged for use as internal fuel to replace coal in a phased manner.

Miss: Use of internal fuel has not made mandatory. Utilization of waste in brick making has not been mentioned.

Hit: Clamp establishment are not allowed in reserved and protected forest, national parks, world heritage sites, eco sensitive zones and residential areas.

Hit: Min. distance from national highway, state highway and human habitation (population >1000) shall be 200 mts.

Miss: The distance mentioned is very less. Does not talk about de-clustering of clamps and minimum distance to be maintained between two clamps.

Miss: The guideline misses to specify anything about the change in design or inclusion of any air emission control system in clamps.

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SURVEY BY CSE

Study area includes:

- Hinjewadi, Pune
- Khopoli
- Islampur
- Ankali- Miraj Road, District Sangli
- Pimpalwadi, Shirdi

Parameter	Hinjewadi	Khopoli	Islampur	Ankali- Miraj Road	Pimpalwadi, Shirdi
No of kilns	20-25	10-15	150	200	80
Avg no of bricks/yr	30,00,000	15,00,000	8,25,00,000	20,00,00,000	16,00,00,000
Fuel used	Coal/Wood /Furnace Oil	Coal/Rice Husk	Coal/Wood/ Baggase	Coal/Wood/ Foundry waste	Coal/Wood/ Baggase/Fly ash
Avg fuel consumption /1 lakh bricks	15-18 tons	16-18 tons (10-11 ton coal and rest rice husk)	16-18 tons	12-15 tons	9-10 tons
Rate of land lease/acre/yr	1,20,000	30,000	50,000	80,000	40,000

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OBSERVATIONS

- Use of baggase/rice husk/ coal dust/fly ash as internal fuel practiced
- Clamps operate adjacent to agricultural fields/roads
- Location of some kilns are very near to human settlements
- No clearance obtained from regulatory body
- Entrepreneurs hesitant to shift to newer technology due to:
  - Lack of understanding and clarity of different technologies in brick entrepreneurs
  - Irregular availability of raw material
  - Uncertainty of regulatory norms
  - Leased land for small duration
  - No incentives from government

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PROPOSED RECOMMENDATIONS

General:

- Multi layer fuel placement while stacking green bricks to reduce SEC
- Use of internal fuel in green brick making
- Mixing of wastes into clay while making green bricks
- Adequate distance between clamps

For Small Scale Brick Manufacturers *(Batch size: 10,000-25,000 bricks):*

- Operate if used for internal purpose only (non-commercial use)
- Temporary plastering of side walls and roofs of the clamps and the platform

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For Medium Scale brick manufacturers *(Batch size: 25,000-1,00,000 bricks)*

- Permanent or removable enclosure on three sides and top of kiln to reduce energy losses and increase efficiency of clamp.
- Channelization of exhaust gases through chimney for dispersion of emissions.
- Adequate stack height depending upon the batch size of the clamp.
- Water sprinkling and paving of internal roads to reduce emission of particulate matter around the kiln area.

For Large scale brick manufacturers *(Batch size: >1,00,000)*

- *Switch to zig-zag technology*
- *Procurement & storage of raw material in sufficient quantity for systematic functioning of kilns.*

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THANK YOU

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CLASS EXERCISE

What should be the recommendations for small, medium and large scale units?