Preliminary Study Report on Varanasi Brick Kiln Cluster

From field visit during the period of 3rd May to 5th May and with inputs from EESL

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United Nations Industrial Development Organisation

Promoting Market Transformation for Energy Efficiency in MSMEs

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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1 BACKGROUND

The project on Market Transformation of Energy Efficiency in MSMEs focuses on improving energy efficiency in the MSME industrial sector of India via demonstration of promising technology as well as an innovative financial model through continued capacity building, information dissemination, and establishment of standard operating procedures for implementing energy efficiency (EE) investment projects. The major stakeholders in this project are UNIDO, MoMSME, EESL, BEE & SIDBI.

10 MSME clusters are selected for implementing under the project. The 10 clusters are as follows:

SN	Cluster	Location (State)
1.	Textiles	Surat (Gujarat)
2.	Chemical	Ankleshwar (Gujarat)
3.	Tea	Jorhat (Assam)
4	Galvanizing and Wire drawing	Howrah (West Bengal)
5.	Paper	Muzaffarnagar (Uttar Pradesh)
6.	Forging	Batala, Jalandhar and Ludhiana (Punjab)
7.	Textiles	Varanasi (Uttar Pradesh)
8.	Sponge Iron	Sundargarh (Odisha)
9.	Rice	Vellore (Andhra Pradesh)
10.	Ceramic	East and West Godavari (Andhra Pradesh)

2 CLUSTER PROFILE

2.1 Varanasi Brick Kiln Cluster

There are approximately 226 (Two hundred and twenty-six) brick kilns in operation within the greater Varanasi district. The kilns are majorly located in clusters in the following areas of the district: • Haruhua • Munari • Sarnath • Rameshwar • Sindhora Road • Badagaon • Rohania Presently the brick market is highly competitive due to imbalance in demand and supply, late onset of spring weather and scattered rainfall are the two major factors responsible for this. The late onset of spring has led to the currently functioning brick kilns to be operating at loss. This is due to the over consumption of coal in order to keep the brick kiln operating at capacity; With a number of units yet to start operations in February/ March 2010. The local market cost of 1st class bricks is in the range of Rs 3.8 – 4.2 per brick.

2.2 Kick-off meeting

A joint team of officials of Office of DC-MSME, UNIDO, Office of GM (DIC) Varanasi and EESL visited the cluster during 04th to 05th June 2018 to brief the project to the industries association members and understand the current scenario of cluster. A Cluster Level Interaction was done with the industry association on 04th June 2018 in the presence of President, Int Nirmata Parisad, Varanasi. It was followed by the visit to few units to understand the current scenario of the cluster **(Few photo graphs attached as Annexure A)**. In Varanasi brick cluster, there were around 425 units, however due to environmental issues, around 300 units has been declared as defaulter by Government of Uttar Pradesh and closed the operation. These brick kilns may be classified into following clusters within the district:

- Haruhua
- Sarnath
- Sindhora Road
- Rohania
- Munari
- Rameshwar
- Badagaon

The Average production size of the Kiln per cycle in all units is 6 Lakhs Bricks/Cycle. The average cycle time is 28 to 30 days for normal kilns and 20 to 22 days is for Zig-Zag Kilns. The average coal consumption for producing one-lakh bricks is between 18 to 20 Tons of Coal depending upon the quality of coal for normal kilns and 13 to 14 Tons for Zig-Zag kilns

3 MANUFACTURING PROCESS AND PRODUCTS

3.1 Raw Material

The basic raw materials used for making bricks are; clay, sand and water. Due to the location of brick kilns around the vicinity of the Ganges valley the entire cluster has an abundance of good quality clay possessing near ideal chemical and physical properties. The soil is very suitable and create minimal to negligible difficulties while sun drying or while firing of burnt clay bricks.

3.2 Main Product of the Cluster

The two main product types manufactured in the Varanasi cluster are Bricks and Half Bricks. There is just one standalone unit which produces tiles/ perforated bricks in combination with bricks.

3.3 Fuel Used:

Coal is the main source of energy used in brick making. Very few units within the cluster are also using sawdust / wood in conjunction with coal for the firing of bricks. However, the energy usage of these fuel sources is negligible as compared to the overall consumption of coal in the operation and energy usage of the kiln.

Many of the units use a combination of different coal types depending upon availability and market price fluctuations.

3.4 Process Flow

The brick manufacturing process in a typical unit is centered around the Bull Trench Kiln (BTK) and the associated processes supplementing the firing and cooling within the BTK. The Bull Trench Kiln is the popular choice of brick manufacturing unit in the Varanasi cluster. It is an oval/circular shaped brick kiln with its chimney usually in the middle. The trench is connected to the chimney by means of evenly spaced chambers along the trench. A schematic of a BTK is shown below.

3.4.1 Clay Winning and Soil preparation

Clay is usually dug from the local vicinity of the brick kiln. The clay is then processed as to be free from gravel, lime and other bio wastes/ matter. This soil once excavated is then watered and left over a period of 8 – 12 hours for weathering and processing. After aging the moistened soil is kneaded/ pugged as required.

3.4.2 Moulding / Brick formation

The Plastic clay after been through the previous process is then moulded into the required brick shape and size with its makers mark using a metal/ wooden / PVC mould.

3.4.3 Brick Drying

Once the clay has been formed into the pre required green brick shape, it is then left out in the sun to dry and reduce its moisture content. Fast drying on extremely hot days may lead to creation of cracks in the green brick which is undesirable. Therefore to minimize crack creation and quick moisture loss, the drying process takes place over a period of 8 -12 days with the bricks left out in the Sun. The bricks are usually laid out in stacks with a horizontal vertical alignment as to maximize usage of space and Sun light.

3.4.4 Firing and cooling

The firing and cooling is done in the bull trench kiln (BTK). Relative to combustion zone within the kiln, the trench can be divided into cooling, firing and pre heating zones.

3.4.5 Brick Extraction

The extraction of bricks takes place in the beyond the cooling zone of the brick kiln. As the brick firing and cooling is a continuous process the brick discharge takes place daily in tandem with the position of the firing/cooling of the lines.

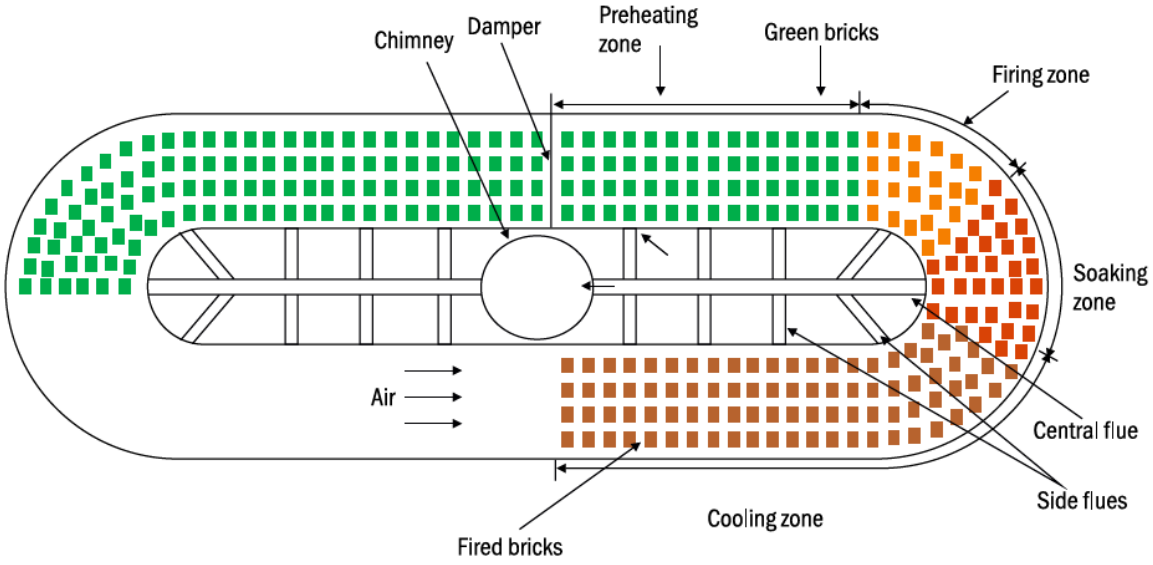
4 FIELD STUDY

Following representative industries Visited were visited in consultation with the local industrial association by the joint team of DI MSME office, EESL and UNIDO during the period of 04/06/2018 to 05/06/2018:

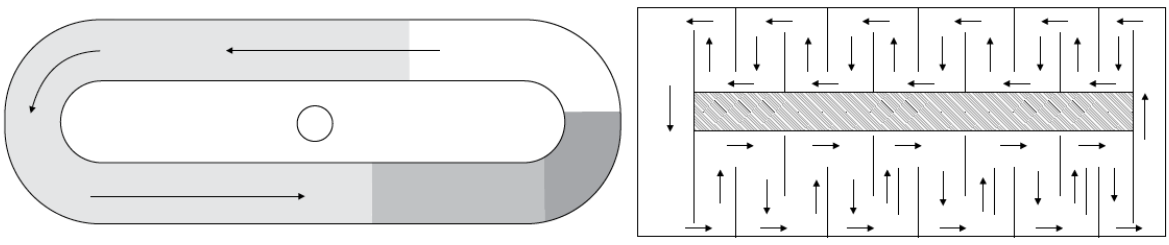
4.1 Prospective Technologies

4.1.1 Zigzag firing technology

The pattern of setting the green bricks in a kiln determines the travel path of the fire (and therefore, hot air) through the kiln.



In a conventional BTK, the bricks are set in linear pattern and the path of fire/hot air too is linear. If the bricks are set in a zigzag pattern, the travel path of the fire/hot air is prolonged.



Path of fire/hot air through (a) conventional kiln (b) zig-zag kiln

This increases the exposure of the green bricks to heat, reducing fuel consumption and improving the overall thermal efficiency of the kiln. Zigzag kilns are typically shorter (in trench size and overall kiln length) and have longer combustion zones than the conventional, straight firing kilns.

4.1.2 Modern technology Tunnel kiln (Clay brick making production line)

A tunnel kiln is a type of continuous kiln that is typically open on both ends and heated c entrally. Bricks, carried by the kiln cart, pass through the kiln in an uninterrupted fashion, allowing large volumes to be processed without shutting off the kiln between batches. Although tunnel kilns are generally more expensive to build than Hoffman kilns they are more economical to run and lend themselves to high degrees of automatic control. It is essential that tunnel kilns are run on, a continuous basis for ideally several years at a time between shutdowns.

4.2 Saving Potential:

Estimated Savings by replacing remaining units with Zig Zag Technology:

Sl.	Particulars	Units	Value
1	No of Units operating after Environmental Clearance	Nos	125
2	No of Units already replaced with Zig-Zag Kiln	Nos	60
3	Remaining units with Normal Kiln	Nos	65
4	Estimated annual Coal Consumption of Normal Kiln	Tons	63180
5	Estimated annual Coal Consumption of Zig-Zag Kiln	Tons	45630
6	Estimated saving of Coal Consumption after replacing normal Kiln with Zig-Zag Kiln per Annum	Tons	17550
7	Average Cost of Coal per Ton	Rs.	10000
8	Monetised Savings	Rs.Cr	**17.55**
9	Investment for Replacing Normal with Zig-Zag Kiln for 65 Units (Rs.20 Lakhs/Unit)	Rs.Cr.	**13**
10	Payback Period	Months	**9**
11	Estimated Savings	MTOE	**10530**
12	Estimated CO2 Emission Reduction	Lakh TCO2	**1.04**

4.3 Barrier in Technology Upgradation:

a. **Financial Issues-** The greater part of the entrepreneurs in the brick community cite lack of financial support and access to credit from financial institutions. Due to the current technology of the brick manufacturing process; i.e. its dependence on weather conditions, constant relocations and its modulus operandi, financial institutions are hesitant to offer a line of credit to interested and progressive kiln owners.

b. **Shortage of Trained Manpower -** Varanasi brick cluster faces shortage of trained manpower at every level. There is a void of competent consultants and qualified masons for planning & supervision of kiln improvements and kiln construction/renovations respectively. The current state of process technology is such that there are no formal training options available to the managers and coal feers.

c. Lack of Research and Development - There is a definitive void in development and existing facilities for Research and Development in this sector. Institutes in the past have been integral in facilitating technology transfers and improvement in the brick manufacturing cluster all over India, However there is need for continuous Research and Development associated processes (Green brick moulding) other than the thermal firing/cooling to encounter the problems whenever they may arise.

5 CONCLUSION:

The brick kilns are struggling to survive due to not so favorable business eco-system. There are good number illegal brick kiln units who either does not have a proper consent to consent to operate or a consent which have not been satisfactory to the regulatory requirement. The state has identified number of such units to take appropriate actions. The grievances of the genuine units are that the units who does not have legal consent to operate are spoiling the business environment and as such the genuine brick kilns are facing hurdles to survive.

On the technology front almost 75 units has already adopted the zig-zag kilns and the same is not a standardized technology which can be aggregated. Further the clay and firebrick which is used to build the kiln does not give the edge to consider this as a concrete technology. The only other substantial technological option is the tunnel kilns which has not been proven for the coal as feed and higher investment requirement stipulates to even consider for piloting. However, a detail feasibility only can give the proper direction in this regard.

6 PHOTOGRAPHs: