Cluster Profile
Malur brick kilns

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TERI team is thankful to Mr G. Parmesh (President), Malur Taluk Brick Association, Malur for providing support and information related to local brick kiln units in the cluster. TERI team is thankful to brick manufacturing units in the cluster for providing valuable data and inputs related to kiln operation in the cluster.

Malur brick kilns

Overview of cluster

Malur is one of the important brick manufacturing clusters around Bangalore. The economy of Malur is primarily dependent on business and it is famous for clay tile-and-brick industry and some small-scale industries. It is also famous for large number of Eucalyptus plantations. Malur brick making cluster and its surrounding areas are the largest hub of Down-draft kilns in the country. The product of the cluster is mainly supplied to Bangalore city.

Product types and production capacities

There are two types of brick firing technologies being used in the Malur cluster. About 600 small capacity brick manufacturing units uses 'down-draft kiln' an intermittent and inefficient method of brick firing. Whereas, large brick manufacturing units uses 'Hoffman kiln', a continuous and relatively efficient method of brick firing. There are about 20 Hoffman kilns being operated in the cluster. All the down-draft kilns uses manual green brick molding processes and produce solid bricks. The Hoffman kilns in addition to solid bricks, depending upon the market demand, also produces Resource Efficient bricks like perforated bricks and hollow blocks. Since solid bricks are the main product of the cluster, this report has used solid bricks for analysis purpose.

Down draft (DD) kiln

Green brick drying under shed

The average production capacity of a typical down-draft kiln is 35000 bricks per batch. The average duration of each batch is 8 days that includes 36 – 40 hours of firing followed by 4 – 6 days of cooling. The brick kilns are operated throughout the year. The average production capacity of a typical Hoffman kiln is 14,000 bricks per day. The average size of a brick is 9 X 4 X 3 inch weighing about 3.1 kg. The colour of a good quality brick produced is dark brown.

Energy scenario in the cluster

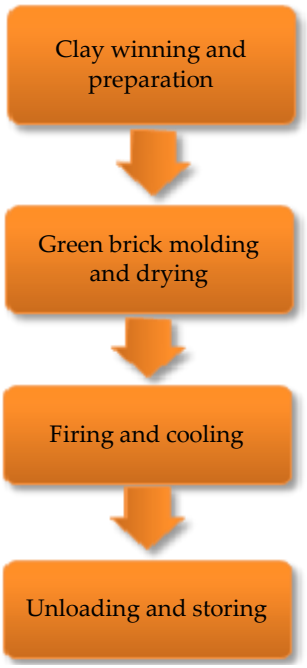
Eucalyptus twigs and firewood are generally used as fuels for firing of bricks in the cluster.

Prices of major energy sources

Energy type	Price (Rs)
Wood	2200 per tonne

Production process

Brick making in the cluster follows traditional, labour-intensive processes and practices, with minimal use of mechanization. The major steps involved in brick production process include clay excavation & preparation, moulding, drying of green bricks and firing inside the kiln. The basic raw materials used for making bricks are clay and water. Different steps involved are briefed below.



Brick production process

(1) *Clay/soil excavation and preparation*. Generally, top soil from nearby agricultural fields is excavated, which is mixed with other soil types based on requirements. Wet mixing of soil is generally done manually.

(2) *Green brick moulding*. Only solid bricks are produced in the cluster and manual moulding is practiced across the cluster. Wooden/ plastic moulds are used for making solid green bricks.

(3) *Brick drying*. The moisture present in green bricks is removed through drying process. Generally shed drying is practiced in the cluster. Green bricks are stacked under shed and upon drying they are taken for loading in the kiln.

(4) *Brick firing*. Leather hard dried bricks are loaded and stacked manually inside the kiln. The fired bricks, after cooling are taken out, classified through visual inspection and stacked for dispatch.

Technologies employed

(i) Downdraft kiln

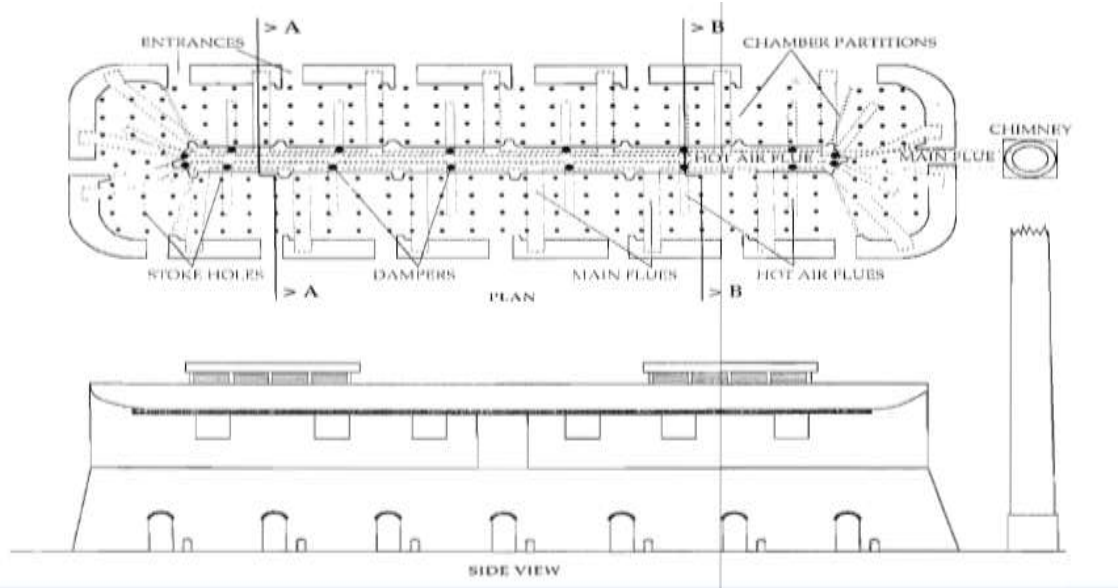
The cluster predominantly uses Down-draft kiln for firing of kilns. The production capacity of downdraft kiln varies between 20,000-40,000 bricks per batch operation. Most of the units operates with minimum of two downdraft kiln with a common chimney so that each kiln can be operated alternately. These kilns are generally constructed using clay fired bricks, with the inner layer of refractory bricks. The total time required for one cycle of loading green bricks to cooling of fired bricks is about seven days. Downdraft kiln generally have a total of 12 fireboxes with six fireboxes located on each side.


Down draft Kiln

(ii) Hoffman kiln

Another technology being used for firing of bricks in the cluster is Hoffman kiln. This type of kiln consists of series of chambers that are connected through underground radial flues to the chimney. In the arch of this barrel arched chamber, small feed-holes are provided that are used for firing of fuel (wood) into the brick setting. In the outer wall of the chamber, twelve wickets placed alternate with flues, for setting of green bricks and drawing out the

fired bricks. After the kiln is lit, it is not allowed to go out and the sequence of operation is continued.



Schematic of Hoffman kiln

Energy consumption

Wood is the major energy source in brick kilns in the cluster. Diesel is used only to provide water requirements in moulding section in the brick kiln units.

(i) Unit level consumption

Thermal energy accounts for almost 100% of energy consumption in a brick kiln. The reported wood consumption in a brick kiln is about 51 and 48 tonnes tonne per lakh brick produced in a down-draft kiln and Hoffman kiln respectively. The down draft kilns are operated throughout the year, whereas Hoffman kilns are operated for about 6 months in a year. The estimated annual energy consumption of a downdraft kiln is 287 tonnes and Hoffman kiln is 1260 tonnes. The average "Specific Energy Consumption" (SEC) of solid brick manufacturing by down draft kiln and Hoffman kiln is estimated to be about 2.76 MJ per kg fired brick and 2.59 MJ per kg fired brick respectively.

Typical energy consumption in brick kilns

Type of kiln	Production capacity	Production (lakh bricks/year)	Wood (tpy)	Annual energy bill (million INR)
Down draft	35000 bricks per batch	16	287	0.6
Hoffmann	14500 bricks per day	26	501	2.8

(ii) Cluster level consumption

The total energy consumption of Malur brick kiln cluster is estimated to be 70,606 toe. The break-up of energy consumption is given in the table.

Energy consumption of the Malur brick kiln cluster

Energy type	Annual consumption	Equivalent energy (toe)	GHG emissions	Annual energy bill (million INR)
Wood	177542 tonnes	70,606	0*	361
	Total	**70,606**	**0**	**361**

* *biomass is considered carbon neutral*

Energy saving opportunities and potential

Some of the major energy-saving opportunities in the brick kiln units in the cluster are discussed in the following section.

(i) Adoption of best available firing technology

The down draft kilns predominantly used in the cluster. Down draft kiln is an intermittent type kiln with higher SEC values as compared to continuous type kilns such as Hoffman kiln or Bull's Trench kiln (BTK). There is a potential to adopt continuous type kiln in the cluster.

(ii) Waste heat recovery through interlinking of down draft kilns

Each down draft kiln in the cluster is equipped with a chimney for discharging of flue gases. The flue gases from down draft kiln leave at quite high temperature without utilising the heat. There is a potential to interlink down draft kilns within a brick kiln unit in such a way that flue gases from the kiln under firing operation can be channelled to another down draft kiln for preheating of green bricks stacked in the adjacent kiln. This will help in effective utilisation of waste heat available in flue gases.

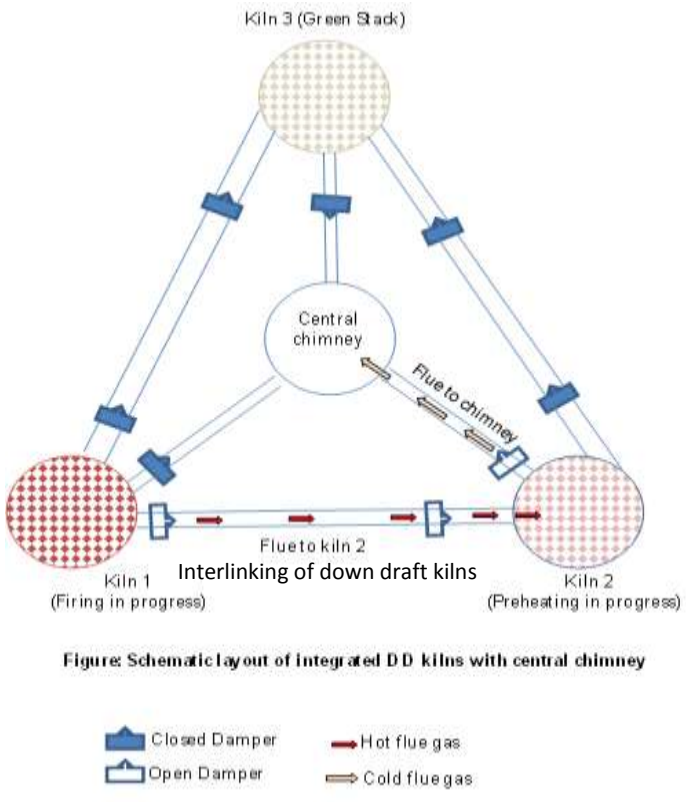
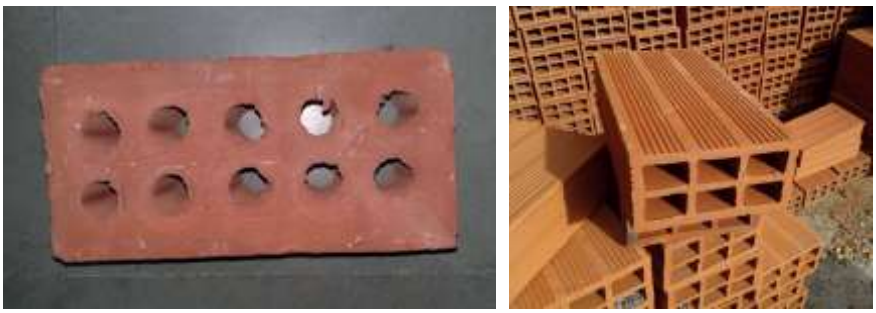


Figure: Schematic layout of integrated DD kilns with central chimney

(iii) Mechanisation/ semi-mechanisation in moulding process

Brick kilns in Malur, like many other brick making clusters are involved in production of conventional solid bricks through manual green brick molding process. With less availability of space due to increasing population and demand, a majority of the construction in cities and towns is taking place in the form of multi-storey buildings using RCC (Reinforced Concrete Cement) columns. In RCC column based buildings, bricks are increasingly being used as filler material rather than load bearing walls. The shift towards Resource Efficient Bricks (REBs) like perforated brick and hollow blocks would help in saving fuel and reducing pollution in brick production process. There is also a significant reduction in the consumption of top (agricultural) soil which is the main raw material in brick making. Increased use of REBs in building construction would also help in reducing the energy consumption of buildings due to their improved insulation properties.

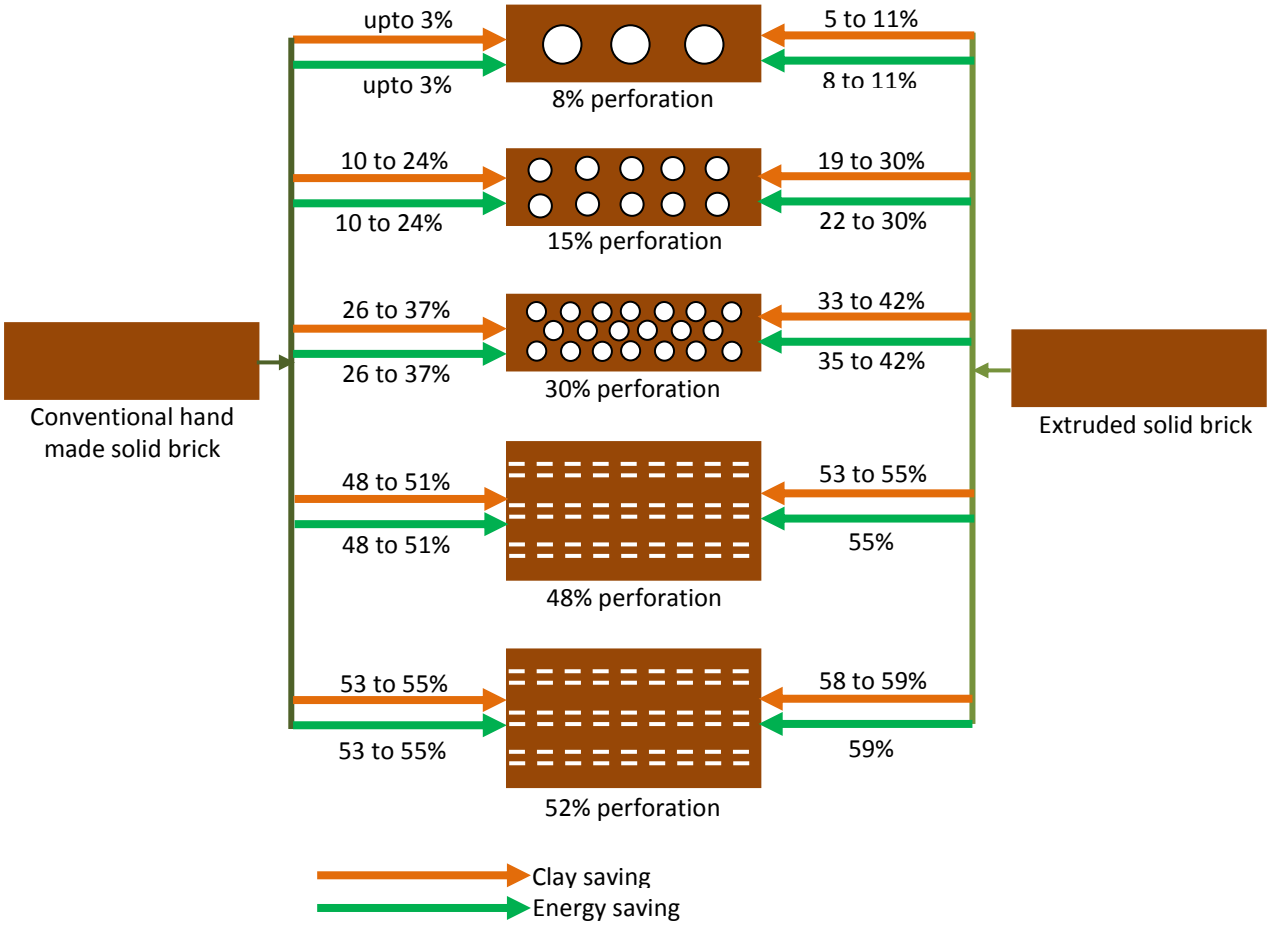


Resource efficient Bricks (REBs)

Some of the benefits of producing REBs include the following:

Resource savings

Clay and fuel (coal) are the main resources used for manufacturing REBs. The production of REBs results in substantial resource savings as compared to production of conventional/extruded solid bricks.



Resource savings by REB production

Improvement in product quality

Adoption of mechanization for preparation of raw-mix and molding process helps in proper homogenization of clay particles. The process also helps in manufacturing bricks with proper size and shape. This leads to production of better quality of green (freshly molded brick with moisture) as well as fired bricks and increased output of better quality (Class-I) bricks from the kiln.

Reduction in green brick wastage

During the brick-making season, about 20% of total green brick production of a kiln is wasted due to rain. However, with adoption of mechanization and installation of shed, the wastage of green bricks is avoided.

Flexibility in production

A mechanized brick production unit can adapt to variation in product type as per market demand which is not possible with hand-molding operation.

Reduction in plaster and mortar requirement

REBs have a uniform size and shape and can be used as such without any plaster on the surface. Hollow blocks (400 X 200 X 200 mm) are equivalent to 9 solid bricks (230 X 110 X 70 mm) and their use as walling material can help in 40–70% savings in mortar requirements.

Reduction in steel requirements

The weight of REBs is less than the equivalent size of solid bricks. For same volume of walling unit, the weight of hollow block is about 60% less than solid bricks. Therefore, use of REBs results in reduced dead load of the building and a substantial reduction in requirement of steel as reinforcement.

Reduction in energy bills of buildings

The REBs have lower heat transfer coefficient, U-values (W/m^2-k) as compared to conventional solid bricks; therefore, their use as walling material in buildings improves the insulating property and, depending upon the climatic zone, can reduce the energy bill by 1.5–6.4%.

Improved skill set of workers

The operation/maintenance of machinery/equipment will help in upgrading the skills of workers and reduce the drudgery involved in manual clay preparation and the green brick molding process.

Major stakeholders

The major stakeholder is Malur Brick Kiln Association. Other stakeholders include MSME-Development Institute (MSME-DI), Bangalore.

Cluster development activities

There were no specific cluster level activities specific to Malur brick cluster.

About TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI (The Energy and Resources Institute) is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to tackling issues of global climate change across many continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local and national level strategies to suggesting global solutions to critical energy and environmental issues. The Industrial Energy Efficiency Division of TERI works closely with both large industries and energy intensive Micro Small and Medium Enterprises (MSMEs) to improve their energy and environmental performance.

About SDC

SDC (Swiss Agency for Development and Cooperation) has been working in India since 1961. In 1991, SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC India, in collaboration with Indian institutions such as TERI, conducted a study of the small-scale industry sector in India to identify areas in which to introduce technologies that would yield greater energy savings and reduce greenhouse gas emissions. SDC strives to find ways by which the MSME sector can meet the challenges of the new era by means of improved technology, increased productivity and competitiveness, and measures aimed at improving the socio-economic conditions of the workforce.

About SAMEEEKSHA

SAMEEEKSHA (Small and Medium Enterprises: Energy Efficiency Knowledge Sharing) is a collaborative platform set up with the aim of pooling knowledge and synergizing the efforts of various organizations and institutions - Indian and international, public and private - that are working towards the development of the MSME sector in India through the promotion and adoption of clean, energy-efficient technologies and practices. The key partners are of SAMEEEKSHA platform are (1) SDC (2) Bureau of Energy Efficiency (BEE) (3) Ministry of MSME, Government of India and (4) TERI.

As part of its activities, SAMEEEKSHA collates energy consumption and related information from various energy intensive MSME sub-sectors in India. For further details about SAMEEEKSHA, visit http://www.sameeeksha.org