Environmental Regulations and the Indian Brick Industry

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Introduction

Brick making is a traditional but important industry in India and other developing countries. Based on the limited information available on the brick industry in India, it is estimated that more than 100,000 kilns produce about 80 to 100 billion bricks per year.

Brick kilns can be classified into three categories based on production capacity: small (<1 million bricks/year), medium (1–2.5 million bricks/year) and large (>2.5 million bricks/year). Small kilns are known as clamp kilns and are located mainly in rural areas. Medium and large kilns are of Bull's trench kiln (BTK) type and are generally located near urban and more densely populated rural areas.

Brick making is a highly energy intensive process, with a specific energy consumption of 1.2 to 1.75 MJ/kg of fired bricks for Bull's trench kilns, and 1.5–3.0 MJ/kg of fired bricks for clamp kilns. Coal is the major fuel used for firing bricks; it is estimated that the brick industry consumes about 15 million tons of coal annually.

Low efficiency in brick firing practices leads to high levels of PIC (product of incomplete combustion) emissions. In addition to these emissions from combustion, the life cycle of brick making involves significant fugitive emissions. In India, after the introduction of Bull's trench kilns in the late 19th century, there was no significant improvement in brick firing practices until the mid-1990s. In 1996, the Government of India set emissions standards for brick kilns. These regulations have brought about some technological improvement in a section of the brick industry (mainly in large brick making units). In addition to reductions in emissions, the regulations have resulted in some fuel savings.

This article discusses the impact of environmental regulations on the brick industry in India, and highlights the existing barriers to large-scale dissemination of and improvements in brick firing technology.

Table 1. Emission standards and chimney height regulations for fixed chimney kilns

Kiln capacity	Maximum concentration of particulate matter (mg/Nm^3)	Minimum stack height (m)
Less than 15,000 bricks per day (less than 4.5 m trench width)	1000	22
15,000–30,000 bricks per day (4.5–7.0 m trench width)	750	27 with gravity settling chamber
More than 30,000 bricks per day (more than 7.0 m trench width)	750	30 with gravity settling chamber

Source: Government of India, 1996.

Emissions and Environmental Regulations for Brick Kilns

Brick kiln emissions consist of mainly coal fines, dust particles, organic matter, and small amounts of gases associated with acid deposition, such as SO_2, NO_x, H_2S, and CO. Typical suspended particulate matter emissions from stacks in Bull's trench kilns during coal feeding varies from 1000 to 2500 mg/Nm^3. Carbon dioxide emissions from the burning of 15 million tons of coal per year by the brick industry are estimated at 6.7 million tons.

On April 2, 1996, the Ministry of Environment and Forest, Government of India, set stack emission standards for brick kilns (Table 1). The regulations also stipulated an immediate ban on the erection of new moving chimney Bull's trench kilns, and the closure of all existing moving chimney Bull's trench kilns by June 30, 2000.

Impact of Regulations on the Brick Industry

The ban on moving chimney Bull's trench kilns necessitated either a conversion of moving chimney kilns to fixed chimney kilns, or adoption of new technologies such as zigzag firing or Vertical Shaft Brick Kiln (VSBK). As a result, various improved fixed chimney kiln designs with gravity settling chambers were developed in the public and private sector. By the end of the 1998 brick making season, about 7000 moving chimney kilns had converted to fixed chimney kilns. However, the kiln conversions have been restricted mainly to large brick kilns in the states of Punjab, Haryana, and Uttar Pradesh. Reduction in suspended particulate matter concentration by 50 to 75%, and in energy consumption by 10%, were observed in fixed chimney kilns (with gravity settling chambers) compared to moving chimney kilns.

Conversion to fixed chimney technology is not feasible for small kilns as it is for large kilns. Thus, to meet the environmental regulations, new technologies must be considered. One such technology is Vertical Shaft Brick Kiln (VSBK) technology. This technology is very popular in China. Based on its high potential, it was introduced in India by the Swiss agency for Development and Cooperation (SDC). Pilot demonstrations have shown that the technology can be suitably modified to work under the conditions present in India. Energy savings on the order of 30–60% compared to existing firing practices, along with significant reductions in particulate emissions, were observed during pilot demonstrations. The large-scale dissemination of the technology is expected to begin in July 2000.

A comparison of the three main technologies for firing bricks is provided in Table 2.

Barriers to Dissemination of Efficient Technologies

To date, the adoption of improved technologies has been restricted to large kilns located in specific geographical regions of the country. According to recent estimates by the industry association, about 60–75% (around 25,000 units) of large and medium

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Table 2. Technical options for brick firing

Technology	Production capacity	Initial investment (US $)	Availability	Emissions (mg/Nm³)	Specific energy consumption (MJ/kg of fired brick)
Fixed chimney with gravity settling chamber	*Large*	15,000–30,000	Commercially available	< 400	1.1–1.5
Forced draught zigzag fired kiln	*Large*	20,000–50,000	Commercially available	< 1000	0.8–1.2
Vertical Shaft Brick Kiln	*Small & Medium*	10,000–20,000	Ready for dissemination	< 150	0.8–1.0

scale enterprises will be unable to meet the deadline of June 30, 2000 for adoption of new technologies. The process of adoption of new technology has not even started in small units. The major barriers to the dissemination of efficient technologies among small and medium scale enterprises are described below.

Lack of Awareness

Awareness among brick kiln owners regarding the various technology options that can be used to improve performance of kilns remains poor. The brick industry in India is not well organized, and channels for information dissemination and exchange, such as newsletters, industry journals, seminars, and conferences, are not available. Brick industry associations at the local, state, and national levels are the only existing institutions through which information can be communicated to individual brick kiln owners. However, a majority of the brick industry associations do not have the capacity to carry out this task. Thus there is a need for outside intervention for information dissemination.

Limited Technological Options

There is a large variation in terms of production capacity, raw materials, and climatic conditions, among brick enterprises in the country. New appropriate technologies that meet the needs of all sections of the brick industry are required. At present, the development or import of efficient brick-making technologies is severely restricted, mainly due to a lack of resources (finances and professional expertise).

Lack of Financing for Small Brick-Making Operations

The majority of small brick making enterprises do not have sufficient financial resources to upgrade their technologies. These enterprises are not able to access loans from financial institutions due to the small financial size of the project and a lack of familiarity with the brick industry on the part of bankers.

Shortage of Technology Intermediaries for Large-Scale Diffusion of Technologies

Only a small group of technology providers exists in this sector. These are either small private firms or government institutions. They have limited capacity in terms of reaching out to the large number of kilns scattered across the country. Technology intermediaries (promoters) are needed to commercially popularize the improved technologies among users.

Lack of Appreciation of Process Innovations

Environmental regulations for brick kilns focus on an 'end-of-pipe' approach rather than 'pollution reduction at source' by increasing the energy-efficiency. Reducing pollution at the source by improving kiln operation has received little attention. Studies carried out by the Tata Energy Research Institute (TERI) show that improvement in kiln operation can result in a large reduction in emissions and up to a 20% reduction in energy consumption in fixed chimney kilns. Further information can be found in Report on action research project on brick kilns, September 1999, TERI Report No. 98 IE 41. Some information is also available from the Tata Energy Research Institute's website: www.teriin.org.

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