# Clean Technologies for Improving Environment, Quality, Health and Safety in Small and Informal Sector.

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## Introduction

Small industry sector in India comprises of 3.12 million units, employing 17 million persons and contributing towards 40% of the industrial production[1]. It also contributes to around 65% of the total industrial pollution load in the country[2]. Apart from the registered small-scale units, several lakhs of firms exists in the "informal sector"[3]. The two sectors can be addressed together as Small and Informal Sector (SIS). The issues of environment protection, quality of products and health and safety of workers are very closely interlinked in SIS. Apart from being the major industrial polluters, the industries in the SIS are also characterized by poor working conditions and high degree of occupational hazards faced by the workers.

In recent years growing awareness on environment pollution in SIS has led to efforts to control pollution. Conventional command and control approach based on environmental regulations and relocation of industrial clusters has been attempted. Studies have shown that compliance to adhere to environment norms remains poor in the SIS firms[2]. The enforcement of regulations and relocation of industries are difficult tasks, due to large number of geographically dispersed units involved as well as the social and political dimensions associated with closure or relocation. Other reasons for poor compliance include (i) lack of off- the shelf technological solutions; (ii) lack of awareness in the industries; (iii) fear of reduced profits etc. ISO-14001 certification is almost negligible in the small-scale sector. A study during 1999-2000 reported that all the 25 small and medium (SME) units certified to ISO-14001 belonged to the category of medium-sized enterprise[4]. The study also identified lack of awareness, lack of management commitment, prohibitive cost of certification etc. as the main reasons for low ISO- 14001 certification level in SME sector.

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[1] News item in "The Hindu Business Line, Tuesday, July 10,2001

[2] Article in "Down to Earth", issue dated July 31,2001.

[3] "Informal sector" firms – low technology micro-entreprises operating outisde the purview of the state. Blackman A and Bannister G J . Community Pressure and clean technologies in the informal sector: An econometric analysis of the adoption of Propane by traditional brickmakers in Cd. Juarez, Mexico; Resources for the Future. December 1996.

[4] Nyati K P. ISO 14001 in India – Boon or Blackmail. Confederation of Indian Industries. 1999.

Given this background it is clear that pollution control in SIS is a challenging task, in which conventional command and control regulation may not be an effective tool. An alternative approach based on clean technologies[3] – new technologies that mitigate environmental impacts without significantly raising production costs, could be more effective. It is hoped that the clean technologies would create a win-win situation for all the stakeholders and SIS firms would adopt such technologies voluntarily or with minimal external support.

**TERI Projects in SIS**

TERI initiated work in 1994 on the development and promotion of energy efficient clean technologies in selected energy intensive SIS industries[5]. The main objective of the intervention is to utilize efficient technologies for reducing air pollution and for improving working conditions. The industries covered are brick kilns, silk reeling, small-scale glass industry and iron foundries. The programme has resulted in development/ adaptation of following technologies:

- Vertical Shaft Brick Kiln (VSBK).
- Natural gas fired pot furnace for glass industry.
- Natural gas fired muffle furnace for glass industry.
- Biomass gasifier based silk reeling oven.
- Divided blast cupola with pollution control system for iron foundries
- Biomass gasifier based silk dying system.

The development, demonstration and fine-tuning of the technologies required a time period of 3 to 5 years. In all the cases, energy savings of the order of 30– 60 % were achieved under field conditions. In case of brick and foundry sector -- for which emission norms exist -- the emissions were found to be much below the most stringent emission norms. In the case of brick kilns and glass furnaces substantial reduction in heat exposure to workers was achieved. In all the cases, air pollution in the working environment was reduced, resulting in better and safe working conditions for the workers. Another important result in all the cases was reduction in wastage, improvement in product quality, reduction in processing time -- all leading to better productivity and better selling price for the product.

[5] Most of the TERI activities were a part of energy and environment programme of Swiss agency for Development and Cooperation (SDC). For reference refer to various TERI project reports on these projects.

In all the cases the capital cost of the improved technologies is higher compared to the traditional technologies, despite this fact, in several cases e.g. muffle furnace for glass industry and VSBK (in parts of central and western India), a good demand for the new technologies have been created. The industries for which, environmental regulations exist, enforcement of these regulations has helped in creating demand for clean technologies. TERI and other partner organisations are presently in the process of transferring the technical know-how to local technology providers. The local technology providers would provide the technology to the end-users. In the case of silk reeling oven, dissemination approach based on soft loans and capital subsidy is being attempted.

**Suggested Approach**

The experience from the work carried by TERI, and other institutions elsewhere, shows that an approach based only on conventional command and control regulation will not work for environmental management in SIS. A comprehensive approach for environment management in SIS can consist of:

- Development and demonstration of appropriate clean technological solutions in collaboration with industry thereby utilising the available traditional know-how;
- Formation of a technology provider network for making available the developed technological solutions to the end users;
- Creating awareness among the owners about the environmental concerns and available solutions;
- Training workers in the new technologies and creating awareness among them regarding the health risks involved with existing technologies;
- Facilitating credit for SIS firms for the adoption of clean technologies;
- Mobilising community pressure on the polluting industries to adopt clean technologies;
- Formulation of realistic and practicable emission regulations and improving the implementation by the strengthening of regulatory agencies (e.g. pollution control boards)

## Case study: Vertical Shaft Brick Kiln (VSBK)

A case study of Vertical Shaft Brick Kiln (VSBK) technology illustrates that in general the introduction of energy efficient technologies results in reduction in pollution, improvement in quality and improvement in working conditions.

Brick remains one of the most important building materials in India. Brick making is a traditional industry, generally confined to rural and peri-urban areas. Notably, the Indian brick industry, which is second largest producer in the world, has more than 100,000 operating units, producing about 140 billion bricks annually. The industry has an annual turnover in excess of Rs 120 billion. It is one of the largest employment generating industries, employing around 6-8 million workers.

The conventional practice of firing clay bricks in rural country clamps and Bull's Trench Kilns (BTK) consume huge quantities of energy in terms of coal, firewood and other fuels. The brick industry in India is estimated to consume around 24 million tons of coal and several million tons of biomass fuels. Brick kilns are also notorious as highly polluting establishments, affecting not just the flora and fauna, but also posing severe threats to workers health. Higher energy costs and inability of the industry to meet the environment standards has caused serious concerns on the survival and well-being of the industry.

VSBK technology was developed in China where it is a popular kiln for small-scale production of bricks. As a part of an action research project on brick kilns, VSBK technology was transferred and adapted under Indian conditions. Today, five Indian institutions including TERI posses the technical know-how and around 15 kilns (almost all under private ownership and constructed without subsidy) are operating in the country. The technology has got firmly established in the Bundelkhand region and Mahrashtra. Large-scale dissemination of the technology through local technology providers is being planned in the coming years. The main reasons for VSBK emerging as a viable brick firing alternative in these regions are:

- Energy savings of the order of 50-60% compared to traditional clamps.
- Increase in production volumes
- Better product quality and increase in the percentage of saleable fired bricks (from around 70-80% in clamps to about 90% in VSBK).

In addition, the SPM concentration in stack emissions from VSBKs ranged from 50-250 mg/$Nm^3$, which is a substantial reduction in comparison to 500 - 1000 mg/$Nm^3$ for traditional BTKs. Significant reduction in the thermal exposure and fugitive emissions makes this kiln much better in terms of workers health and safety. The process of formulation of environment norms for VSBK by the Central Pollution Control Board (CPCB) is in progress.