Outdoor Air Pollution

The Problem

With an average annual production of 200 billion bricks per annum, India is the second largest producer of bricks in the world, after China. India's share is nearly 14 percent of the global brick production. Over the last 40 years brick production has increased by more than 8 times, due to growing demand from the housing and infrastructure sectors. Around 35 million tonnes of coal is consumed in the sector and is the third largest consumer of coal in the economy after thermal power, iron and steel. Brick is also a major contributor to environmental pollution as it depends heavily on natural resources, like soil (e.g. top fertile alluvial soil in the Indo-Gangetic plains), and coal. The average estimated CO2 emission from the sector is more than 60 million tonnes.

The predominant technology that is used for brick manufacturing in India is Fixed Chimney Bull's Trench Kiln (FBTK). This accounts for nearly 70 percent of the total brick produced in the country. However, other technologies that find application include Clamp Kilns, which produce bricks in batches where operation might be happening at relatively smaller scales, and are widely used in the peninsular region, contributing to about 25 percent of the total brick production.

The state of Andhra Pradesh is one of the key brick producing states in South India. The brick kilns in AP are located in six major districts which includes Krishna, Guntur, Vizianagaram, Srikakulam, Kurnool, and Ananthpur. Clamp kilns are predominant technology for producing bricks in the state. The stacked raw bricks are irregularly fired with different fuels in between them. Since kilns are randomly designed, and are open, it leads to improper burning of the fuel as well as loss of heat thus making some bricks being over burnt and some unburnt leading to wastages.

Based on the estimates of the global burden of disease methodology, AP recorded more than 34,000 deaths due to exposure to PM 2.5. Further, an estimated around 1500 deaths have been attributed due to brick kilns in the state. There are variations in the average yearly concentration across six districts. For example, the highest average annual concentration has been observed in Krishna district (nearly110 µg/m3), while the lowest average annual concentration has been observed in Vizianagram (nearly 72 µg/m3). The economic and social benefit-cost assessment undertaken in this study looks at two options of cleaner kiln technologies in the state of Andhra Pradesh. The two options involve improvement of existing Clamp Kilns and FCBTK to the Zig-Zag Kilns, and Vertical Shaft Brick Kilns (VSBK) technology.

Solutions

Interventions	BCR	Benefits (INR crores)	Costs (INR crores)
Improved Zig-Zag Kiln	7.40	18,473	2,496
Vertical Shaft Brick Kiln Technologies (VSBK)	6.83	26,224	3,840

Total costs and total benefits discounted at 5%

The full paper by economist **Souvik Bhattacharjya** Fellow Centre for Resource Efficiency and Governance The Energy and Resources Institute (TERI) is available on www.appriorities.com/environment-and-climate-change

Improved Zig-Zag Kiln

The Problem

Coal is the main source of energy for brick kilns. The use of large quantities of coal and petcoke in brick kilns contributes significantly to emissions of carbon dioxide (CO2), and particulate matter (PM). It is estimated that, around 35 million tonnes of coal is consumed in the sector and is eventually the third largest consumer of coal in the economy after thermal power, iron and steel.

Emissions largely arise from inefficient combustion of large quantities of coal, petcoke and agri-residues that are used in brick kilns which has serious health and mortality implications. The average estimated CO2 emission from the sector is more than 60 million tonnes.

The Solution

Clamp kilns and/or FCKs can be converted to Improved Zig-Zag Kilns at low costs in the lowlands at the same site. This can be accomplished in less than half a year. The production capacity is the same or higher compared to the Clamp kilns and/or FCKs.

Zig-Zag brick manufacturing leads to 22 percent lower CO2 emission than Clamp kiln/Down draught kiln brick manufacturing process.

Costs

It is estimated that the cost of the proposed intervention is approx. Rs. 2,496 crores.

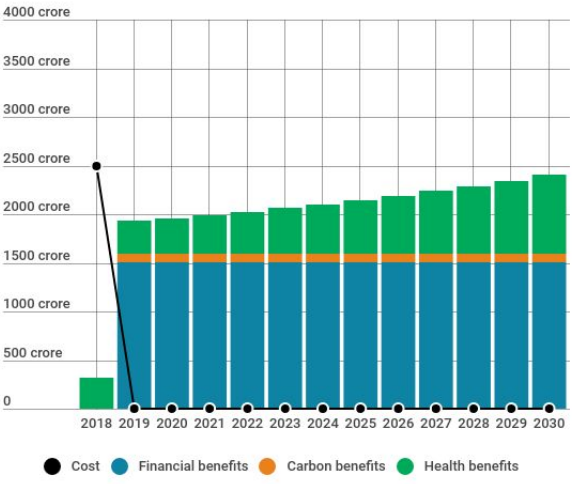
Benefits

The financial benefits for Zig-Zag technology has been estimated for a period of 12 years (till 2030). It has been found that the production of class I bricks can increase from 50 percent to 80 percent in case of Zig-Zag technologies.

The total incremental financial benefits are Rs 12,673 crores till 2030, at 5% discount rates. Further, With Zig-Zag technology, an estimated 7,552 deaths can be avoided (between 2019 and 2030), thereby improving quality of life. This leads to saving of 629 deaths per annum.

This intervention would lead to total benefits worth Rs. 18,473 crores at 5% discount rates.

Benefits and costs for implementing improved Zig-Zag Kiln technology



Costs and benefits in crore rupees from author's estimates.

Vertical Shaft Brick Kiln Technologies (VSBK)

The Problem

Clamp kilns are predominant technology for producing bricks in AP. As the kilns are randomly designed, and are open, it leads to improper burning of the fuel as well as loss of heat thus making some bricks being over burnt and some unburnt leading to wastages. Approx. 1500 deaths have been attributed due to brick kilns in the state.

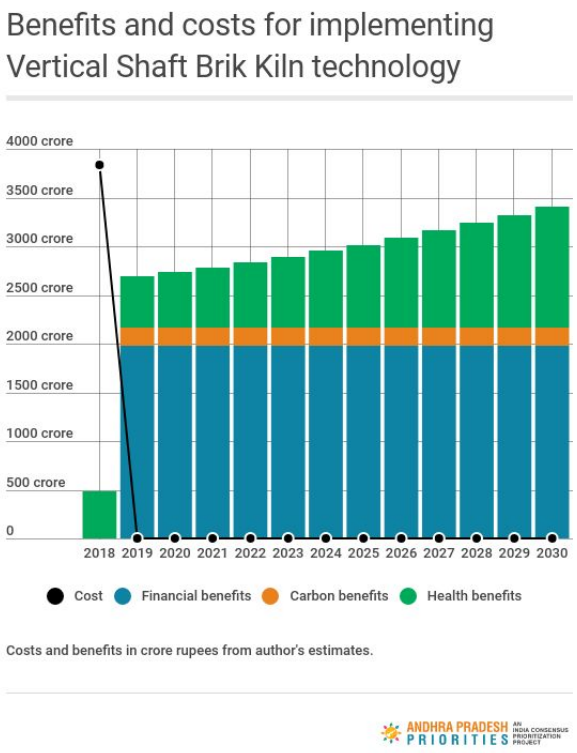
The Solution

The VSBK technology uses hot exhaust gases for the gradual preheating of the unfired bricks in a continuous process, thus reducing energy consumption and CO2 emissions compared to the more commonly used clamp kilns.

The VSBK makes clay brick an even more sustainable building option by reducing the embodied energy of an average clay brick, at least by half.

Costs

The total cost of this intervention is estimated to be approx. Rs. 3,840 crores.



Benefits

The private financial benefits for VSBK technology has been estimated for a period of 12 years (till 2030). While the number of class 1 bricks in Zig-Zag technology is approximately 80 percent, the share further increases to 90 percent in VSBK.

Use of VSBK can lead to an incremental financial benefit of Rs. 16,725 crores at 5% discount rates. Retrofitting with a VSBK technology is estimated to reduce CO2 by 3.8 million tonnes.

The avoided CO2 costs have been estimated to be Rs 2,260 crores at 5% discount rates. In the presence of VSBK technology, an estimated 11528 deaths can be avoided, thereby improving quality of life between 2019 and 2030. This is equivalent to 961 deaths saved per annum.

The total benefits due to conversion to VSBK technology is Rs. 26,224 crores at 5% discount rates.