

Southern Asian

facing up to the material challenge

These are indeed interesting times for the brick industries of Southern Asia, but whilst demand undoubtedly remains high and is increasing pollution issues, energy consumption and the availability of suitable raw materials remain key problems to address. AC digs through the dirt

The growth in South Asian economies (India, Bangladesh, Pakistan and Nepal) and population, coupled with urbanization, has resulted in an increasing demand for residential, commercial, industrial, and public buildings as well as other physical infrastructure, resulting in a steady increase in the demand of bricks. Building construction in these countries is estimated to grow at a rate of more than 7.6 % per year between 2018 and 2025. The building stock is expected to multiply five times during this period, resulting in a very large increased demand for building materials, including the most used building material clay bricks.

On individual country basis, solid fired clay bricks are among the most widely used building materials in India, Bangladesh, Pakistan and Nepal. Collectively, these four countries account for 17 % of the global bricks output. Following China, India is the second largest manufacturer of bricks across the globe. No wonder, this very building material holds so much of importance in the Indian architecture. India alone produces over 11 percent of the bricks which are globally produced and has about 1,40,000 brick-making enterprises, who account for about 240 billion bricks per year. India's brick sector is characterized by traditional firing technologies; reliance on manual labour and low mechanization rate; dominance of small-scale brick kilns; dominance of single raw material (clay) and product (solid clay brick).

Challenges ahead

Availability of clay, especially quality clay for the production of quality heavy clay products has been a major challenge for heavy clay producers in the South Asian region for quite long. Though, clay is one of the most abundant natural mineral materials on earth. For brick manufacturing, clay must possess some specific properties and characteristics. Such clays must have plasticity, which permits them to be shaped or molded when mixed with water; they must have

sufficient wet and air-dried strength to maintain their shape after forming. Also, when subjected to appropriate temperatures, the clay particles must fuse together.

It is not unusual to see many of the heavy clay producers in these countries shifting their production units every few years by a few kilometres in order to be in the proximity of clay source. This shifting of production facilities incur huge cost burden on heavy clay producers in these countries.

The indiscriminate usage of top soil in brick making remains a serious issue in South Asian countries. For example, in India, approximately 2.2 billion cubic metre of clay/silt is utilized every year for brick making i.e. top soil of 2200 sq. km of surface land is scooped out up to a depth of 1 metre every year, leaving it infertile for future use. Given the huge population of the country and depleting agricultural yield, it would be almost impossible to source clay from agricultural fields in coming years. Though, brick producers are aware about the difficulties in coming days in sourcing the clay, but unfortunately, a lot of them have still not invested in the modern technologies, which can reduce the usage of clay significantly.

Alternate materials

Fly ash brick technology has the potential to completely eliminate carbon emissions from India's large brick-making industry which burns huge amounts of coal and emits millions of tons of carbon dioxide each year. Another significant benefit of the new technology

is that unlike clay bricks, which use valuable topsoil as raw material, the new method uses fly ash, an unwanted residue from coal-fired power plants. This fly ash is presently dumped on acres of land, damaging both the environment and the health of populations around power plants. The use of fly ash is particularly important as, with India's plans to use coal to expand power production, the generation of fly ash is set to increase while the availability of topsoil is bound to decrease.

A further advantage is that fly ash bricks can be produced in a variety of



heavy clay

strengths and sizes. This means that apart from their conventional use in building walls etc. fly ash bricks can also be used for the construction of a variety of infrastructure projects such as roads and pavements, dams and bridges.

Country	Number of brick plants	Number of bricks produced	Volume of clay used by brick industry
India	140,000	240 billion	2.2 billion cubic meters
Pakistan	42,000	65- 68 billion	580 million cubic meters
Bangladesh	7,000	28-31 billion	220 million cubic meters
Nepal	1,700	14 billion	105 million cubic meters

Given the numerous benefits of the new fly ash brick technology, the inventors are providing the technology without invoking the patent. The government of India has also issued a number of notifications encouraging its use. In addition, a World Bank project is helping to promote the new method by enabling entrepreneurs to earn carbon credit revenues to offset some of their initial costs

However, despite the number of advantages and initiatives taken by various agencies, these eco-friendly fly ash bricks are yet to gain popularity among builders and contractors in the country. This despite a 2009 notification by the ministry of environment and forests stating that only fly ash products must be used within 50 km radius of thermal power plants.

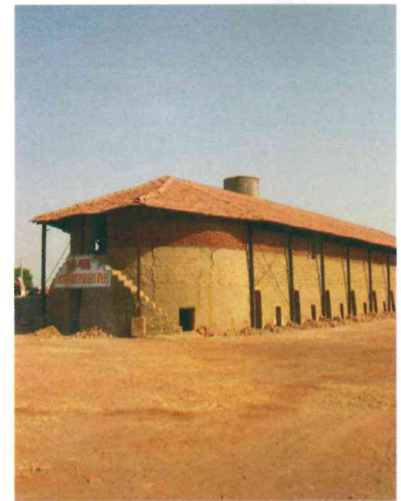
Commenting on the trend, P Venkateswara Rao, general secretary, Federation of Andhra Pradesh Fly Ash Brick Manufacturers Associations, says, "Even the state government issued a GO stating that all builders - be they private or government - should use fly ash bricks for construction. But, even many of the state government departments are not following the rule."

Vinay Kapoor, managing partner of Ambala based, Navyug Industries, which makes fly ash bricks, says, "The cost of fly ash bricks is lower than clay bricks. While each fly ash brick costs around INR 3.50-4.00, a clay brick of the same size costs around INR 5-5.50 per brick. By using fly ash bricks, builders can bring down their construction costs to a large extent. If we don't use the fly ash generated from various industries, it will only become a burden to the environment. Continuously utilizing clay bricks will lead to loss of fertile soil, which will invariably affect the food security of the country."

Elaborating on the reasons for the low usage of fly ash brick in the construction sector, realtor Mahesh Sharma of Noida based, Ashiana Homes told AC, "Most of the builders are aware of fly ash bricks, but there is a common misconception among buyers that conventional clay bricks are better. When we use fly ash bricks, buyers feel builders are compromising on quality though fly ash bricks are sturdier than clay bricks. Fly ash bricks are more cost effective due to lesser breakages than clay bricks as well as higher savings due to lower consumption of cement as lesser mortar joints involving cement are used."

Vinay Gupta, Sales Manager with Rana Infra Projects Limited, a fly ash brick producer in Gurugram says, "Basically there is a lack of awareness in this area. Certain people including developers and engineers believe that ash is a waste material which can create

health issues. But builders and developers need to understand that even fly-ash bricks are eco-friendly and will benefit them by saving time and cost. More or less is the case with pavers which are universally accepted due to their easy installation, zero water clogging, and the ability to be relocated or shifted. A proper and systematic usage will help the developer as well as the buyer in terms of cost, time, maintenance, and appearance of the project."



On account of coal based power generation, there is ample availability of fly ash in the South Asia region. For example, Coal-Based power plants consumed ~640 million tonnes of coal by the year end of 2017, which are around three fourths of the total coal used in the country. Fly ash generation, which was 188 million tonnes in 2017 and with the present momentum of the capacity addition the numbers, is expected to increase to ~225 MT by 2020.

Rules and regs

Different countries in the South Asia region has enacted legislations to curtail the use of top soil by bricks producers in their respective countries. These legislations and restrictions have made the availability of clay a great cause of concern for heavy clay product producers in many regions.

For example, In India, the Ministry of Environment and Forests of India/State Pollution Control Board in 1999 enacted a regulation that all brick-manufacturing units within a radius of 50 km from any thermal power plant should utilize fly ash, pond ash or bottom ash in optimal proportion for making bricks. The provision is expected to protect topsoil and also assist in safe disposal/utilization of fly ash. The State Pollution Control Board in 2003 has made a regulation for manufacturers of clay bricks or tiles or blocks for use in construction activities within a radius of 100 km from coal or lignite based thermal

power plants, to use at least 25% w/w of ash (fly ash, bottom ash or pond ash). In 2008, government even made mandatory provision that all construction agencies within 100km distance from coal or lignite based thermal power plant must only use fly ash based products for construction.

In September 2018, government of one of the states of India (Bihar) expressed its intention to completely ban traditional clay brick kilns in the state. According to a statement released by the state's Mines & Geology minister, Vinod Kumar Singh, "Appropriate measures are being taken to ban production of clat bricks by traditional methods. Production of bricks in such a manner is not only hazardous for public health but also responsible for enviroinmental degradation. These production units would be replaced by the units making bricks using fly ash. Notices has been served to all clay bricks producers to stop production with immediate effect."

Similarly, The Brick Manufacturing and Brick Kiln Setting Up (control) Law of Bangladesh has imposed a restriction to collect and use soil from agricultural land, hills or hillock as raw material for brick making and enforced that hollow bricks (with at least 50% empty/void) should be produced in modern brick kilns to reduce the use of clay resources as raw materials for brick production. According to the provisions of the law, brick manufacturers can only collect or use clay from dead pond, canal, swamp land, creek, river bed and fallow land with the approval of appropriate authorities.

"The irony is that the law prohibits the use of soil but does not specify which other sources to use. But the brick industry is heavily dependent on soil as the main raw material," according to Mizanur Rahman, President of Bangladesh Brick Making Owners' Association.

Unfortunately, the law has not defined the appropriate authorities and not prescribed the procedure. As a result, a number of the 7,000 brick producers in the country are still using top agricultural soil to produce the bricks in the country. Environment Courts are empowered to take any cognizance of any offence punishable under this act. However, only three Environment Courts in Dhaka, Sylhet and Chittagong have been established and functioning.

On the contrary, statistics provided by the Bangladesh's Department of Environment (DoE), which operates under the Ministry of Environment and Forests presents a different picture. According to DoE, 99% brick kilns in Comilla have adopted low-emission technologies. Meanwhile, 30% brick kilns in Chittagong, 68% in Chandpur, 93% in Feni, 91% in Brahmanbaria, 92% in Noakhali, 68% in Lakshmipur and 28% in Cox's Bazar have already adopted a modern eco-friendly technology.

According to Md Bodrul Huda, assistant director (technical) of DoE in Chittagong, "The main reason why many kiln owners are still reluctant to convert their kilns into environment-friendly ones is mainly due to financial crisis, a lack of knowledge about the modern technologies and a lack of awareness about the environment. However, the DoE is working to encourage them to adopt the environment-friendly technologies. We are taking tough measures against the errant brick kiln owners. Anyone running an illegal system will face a maximum one-year jail term or a Tk 100,000 fine or both, while all equipment will be confiscated."

According to Khondoker Neaz Rahman, a former project manager of the UNDP Green Brick Project in Bangladesh, "Currently, there are around 7,000 active brick kilns in the country and apparently, not many of these have stopped using agricultural topsoil or adopted any of the clean technologies or shifted from residential or agricultural areas. This clearly indicates that there is very little implementation of the law. The alternative materials are relatively friendlier for the environment. The government should immediately amend the law to incorporate and

A LACK OF ENVIRONMENTAL AWARENESS PERSISTS AND LEADS TO A RELUCTANCE TO UPGRADE KILNS

Closures always looming...

Of the 4,000-odd brick kilns operating in national capital regions of Uttar Pradesh and Haryana, less than one fourth have shifted on to the cleaner zig-zag technology to curb pollution levels.

"Only around 722 brick kilns have adopted the zig-zag technology to bring down their emission levels. Under the Graded Response Action Plan, notified by the Union environment ministry, only brick kilns that have adopted the zig-zag technology have been allowed to operate after June 30," said a member of the Supreme Court-appointed panel Environment Pollution (Prevention and Control) Authority.

Zig-zag technology slows down emission of smokes through the chimneys at brick kilns, allowing particulates to settle and leading to a reduction in pollution. Brick kilns fumes are potential sources of PM2.5. "Those that have not adopted the cleaner technology had to close down after June 30. EPCA would take a call on when the brick kilns can resume operations," said Sunita Narain, member of EPCA.

A section of brick kiln owners urged EPCA to not resort to sudden closures as it would lead to heavy losses. "The investment required for switchig over to zig-zag is at least Rs 10 lakh. And we are doing it on our own. So the government should not have forced us to shut shop" said one of the brick kiln owners.

Brick Wall Type	Density of material (Kg/ cubic meter)
Normal Fired clay bricks	1700- 1750
Perforated bricks	1400- 1500
Fly ash bricks	1850- 1900
Hollow concrete blocks	1350- 1400
Resource efficient bricks	694- 783

create demand for the alternative building materials in order to reduce the impacts of conventional brick-making."

Stakeholder's viewpoint

Sandeep Dave, Director Marketing - Neptune Industries Limited, a technology supplier to sanitary ware and heavy clay industry says, "The demand for fly-ash is constantly on the rise as people have realised that sustainable construction and environment-friendliness are the needs of the hour. Since fly-ash bricks are green products, they are perfect substitutes to clay bricks, which are expensive as well. Nowadays, with the advent of technology, converting fly-ash into products such as bricks and hollow core slabs is as easy as you like. All these factors put together have given a rise to the demand and resulted in a mature market. Another important factor is the price.

There are several places where there's no fly-ash but still demand exists and vice-versa. Moreover, the need for qualitative construction is also contributing wholesomely in the growth of the market."

Nilesh Bhatt, Director, Sahjanand Fly-Ash Brick Plant Pvt Ltd, says, "Nowadays 'Green Building Concepts' are very popular in our country; architects and builders are especially concentrating on environment-friendly building materials, as a result of which, there is a huge demand of fly-ash bricks across the country.

He further says, "Crucially, the success of any construction material is directly attributable to the willingness of builders and developers to adopt the same. Fly-ash bricks are undoubtedly a wonder product but it took some time before the construction fraternity embraced them. But now, trends are changing at a decent pace and renowned developers are taking the lead in this direction. India's leading builders and developers such as L&T, Godrej, JMC, Nagarjuna, Magarpatta, and Diamond Group are using fly-ash bricks in huge quantity for their projects."

Wienerberger India, a subsidiary of Austrian heavy clay giant, Wienerberger started production of heavy clay products in the country in 2009 at the state-of-the-art production facility in Kunigal, in the state of Karnataka. The facility is highly automated, engaging robots for material handling and adopts efficient use of locally available raw materials and energy to produce green & sustainable bricks for the Indian Market. With a capacity of over 150 million brick units per annum, it is one of the biggest units of its kind in Asia. The production is environmentally friendly, and runs 365 days a year irrespective of weather conditions.

According to Monnanda Appaiah, Managing Director, Wienerberger India, "Our endeavour was from the very beginning was to use an extremely resource efficient processes while delivering a product of superior quality. We developed our flagship brand - Porotherm Smart Bricks whose design allows maximum benefits with almost 60 per cent less resource usage. The raw materials that goes into the blend are sourced from clay tanks & locally available, recycled materials like rice husk, granite slurry, coal ash etc., with minimum impact to the environment making this a GREEN product, rated by the two foremost green building authorities in India, IGBC and GRIHA."

The role of technology

Technology has played a key role in the production of resource efficient bricks and blocks. Production of fly ash bricks has also become possible due to availability of appropriate technology. In coming years, widespread usage of state of the art technology and adaptation to new technology will lead to the production of resource efficient and alternate material bricks.

Manoj Kumar Pillai, Managing Director – Forest Press Machineries Limited says, "There is a considerable market for fly ash bricks in India primarily because of the fact that fly-ash is the cheapest construction material and is available in enormous quantities in the country on account of 200 thermal power plants. In a market like India there is space for everything, whether it's a product or machinery. But the word sustainability means a lot for different divisions of the society. Definitely the quality and price play a vital role. To sustain, we need to offer best quality products with affordable prices and to achieve the quality we need good technology."

Leading heavy clay technology producer from Spain, Verdes started fabricating extruders in India in early 2013 at their branch in Hosur in South India, Verdes Clay & Minerals Equipment Pvt Ltd.



During last few years, the company has supplied a number of equipments to Indian brick makers, who have improved and modernized their brick plants. During 2016 and 2017 the number of the company's customers has trebled, as compared to the years 2013, 2014 and 2015. The company's customers are spread between Gujarat and Haryana in the north and Kerala, Tamil Nadu and Karnataka in the south.

Verdes has had to adapt to the local needs by manufacturing a wide range of small machines. Indian branch of the company offers different models of extruders, grinding, mixing and dosing

machines. These equipment's are used to manufacture a variety of extruded products and standard-sized perforated bricks. Company's customers in South India have acquired state of the art technology to produce floor tiles, hollow blocks and ceiling blocks.

Government aid?

Government and concerned agencies need to promote production and application of hollow and perforated bricks on a gradual basis by creating enabling environment in their respective countries. This could be done by developing standards for hollow and perforated bricks, making preferential provisions in public procurement policies to use hollow/perforated bricks in public buildings, creating demand for hollow and perforated bricks through awareness and promotion among the consumers. Agencies should support access to finance to buy machineries for brick entrepreneurs willing to produce hollow/perforated bricks. Provide necessary trainings to brick entrepreneurs as well as masons for production and application of hollow/perforated brick.

Pakistan drives for Zig-Zag take-up

Use of Zig-Zag technology in construction and operations of kilns can minimise the effects of burning coal on environment and reduce the fuel consumption up to 30 per cent.

This was stated by Sewa Lamsal, Ambassador of Nepal in Pakistan during the inaugural ceremony of three-day training workshop on "Construction and Understanding Operations of Zig-Zag Bricks Kilns" organised by Pakistan Engineering Council (PEC) in collaboration with Ministry of Climate Change, International Centre for Integrated Mountain Development (ICIMOD) and National Energy Efficiency and Conservation Authority (NEECA).

She asked the kiln owners in Pakistan to adopt this new technology without any fear or hesitation as it gives better quality bricks and reduces coal consumption.

Engineer Khadim Hussain Bhatti, Secretary PEC welcomed the participants and highlighted the recent achievements of PEC at international and national level.

He was of the view that the introduction of environment friendly and energy efficient brick kilns is an effort in the right direction.

The traditional design of brick kilns is not only energy intensive but also put various health hazards and environmental issues, he added. With the help of modified design, up to 30 per cent reduction in fuel would save millions of dollars spent on coal import beside reduction in carbon emission up to 85 per cent thus controlling environmental degradation, he added.

He further revealed that the production of high quality bricks could be improved up to 95 per cent which is currently less than 70 per cent.

PEC shall facilitate in creating awareness about this technology through trainings, linking indigenous Research and Development organisations and pursuing policy reforms in the sector to encourage and support the kiln owners as well as the society.