



CASE STUDY

Fly Ash Bricks: Brick production using fly-ash from thermal power plants in India

Background Information

As the second most populated country in the world, urbanization in India is taking place at a high rate. As a result, the country is dealing with a great housing shortage. Twenty-five per cent of the population do not have dwellings of their own, accounting for a shortage of almost sixty million units. Hence, building constructions play a vital role to meet such demand. However, in India construction of building is responsible for approximately twenty two per cent of the national emissions, with the main culprits being the production of bricks and cement apart from the construction processes itself.

The housing shortage situation has forced India to increase the bricks and cement production. The procedure of conventional brick production involves topsoil removal from fertile land at the end of every growing season. The consequences of the activities are releasing a large amount of carbon, degrading the soil, and also threatening the farmers from losing their fertile land.

These challenging issues are being addressed in India by an inspiring green business initiative, spearheaded by Development Alternatives (DA), a research Non-Governmental Organization (NGO) and social enterprise hybrid. This new approach for brick production uses fly ash, a by-product from thermal power plants, instead of topsoil removal from a fertile productive land.

Three hundred million tonnes of fly ash are produced a year in India, causing severe respiratory problems to Indian population. Furthermore, power plant operators face significant costs for disposal of fly ash. Alternative brick production and sale of bricks with low carbon content creates a mutual win-win situation for both power plant operators, as it helps cutting down costs related to ash waste disposal, and local communities, as less environmental damage occurs. The fly-ash brick requires relatively simple technologies for production, is inexpensive, and overall more resilient than traditional bricks.

Approach, Delivery, & Challenges

This GREEN-WIN India case study aims at creating a low carbon economy that can contribute to alleviate the poverty by increasing job availability and reducing environmental impacts at the same time.



A low-tech solution with multiple benefit

Fly ash brick offers a simple low-tech solution to make a more sustainable and eco-friendly bricks (Figure 1). The technology has been developed by TARA Machines, a social enterprise that is part of a wider NGO group – Development Alternatives. Compared to standard brick production, fly ash bricks provide several advantages, as:

1. being more sustainable and reducing impact to the environment;
2. having uniform colour like cement, which reduces plastering requirement;
3. being lighter in weight, dense composition, and durable.



Figure 1. Fly ash bricks production process

This simple and low-tech technology introduced by TARA Machines is basically a press machine to produce fly ash bricks. Generally, the machine consists of a raw material mixing chamber, mixture conveyor, moulds for the brick, a hydraulic system, and electronic control panel. The operational of the fly ash brick machine is simple. The first step is to mix all of the materials (Figure 2), consisting of sixty-two per cent of fly ash, twenty-five per cent of quarry dust, eight per cent of hydrated lime, and five per cent of gypsum. All materials are mixed together with water to achieve the desired mixture consistency. After mixing, the conveyor will transport the mixture into the moulds to have it pressed by the machine and make it compact. The last step in the process is to let them dry under the sun and water-cure the bricks for seven to fourteen days.

With this machine, the workers could produce the bricks faster and easier. One machine can produce up to 1450 fly ash bricks per hour depending on the type. In addition to environmental benefits, various social benefits are also associated with the commissioning of new fly ash units, as the establishment of new units creates new employment opportunities.

Spread the awareness of the sustainable infrastructure development

The use of fly ash brick offers an opportunity for a productive use of waste, while preventing air emission and creating jobs for the local community. DA has been working in several states of the country towards the development of fly-ash brick industry, including Bihar, Odisha, Madhya Pradesh, Maharashtra, Orissa, Delhi, Jharkhand, Chhattisgarh and Haryana. According to DA's recent report, the state of Bihar produces approximately eighteen billion traditional bricks per year using approximately six thousand kilns (Maity and Chandran, 2016) produced from Fixed Chimney Kilns (FCKs), which are resource- and energy-intensive, as the predominant technology in the state.



Figure 2. Fly ash bricks mixture

It is extremely important that initiatives are taken towards promoting cleaner brick production technologies and waste management. The government of Bihar has adopted cleaner construction technologies to move towards becoming a low carbon economy. In partnership with DA, the Bihar State Pollution Control Board has organised several workshops to spread awareness and encouraged the production and usage of fly ash bricks across the State. Also, through DA, TARA Machines has been involved in policy decisions at the government level in the states of Orissa and Bihar. This has helped the company understand the shift taking place towards green technology, leading to a growing market and increased engagement with the State. In the case of Orissa, forward thinking policy decisions taken by the Government have fostered a demand for eco-friendly building materials. The company has also received support from an order mandating all government buildings within a 100 km radius of a power station to use fly ash bricks

Challenges

Besides the positive environmental impacts, the entrepreneurs raised several concerns regarding issues that hamper the operation of current units, such as:

- 1) **Low demand:** a negative and false mindset is prevalent among the consumers regarding the poor quality of fly ash bricks, mainly due to lack of knowledge about the new technology and product; and
- 2) **Financial constraints:** many brick-kiln entrepreneurs lack adequate financial knowledge and the ability to prepare business plans, including the documentation needed to apply for a loan.

The current market share of fly ash bricks has decreased drastically due to the lack of demand. The scenario is likely to be reversed if a ban is imposed on the existing fixed chimney kilns which impact adversely the environment and public health. This could lead to acquiring sixty percent of today's clay brick market share. The increased production will have a positive impact on the environment and economy if rigorous implementation of pro-fly ash policies is in place

Benefits, Lesson Learned, and Outcomes

Contributions to Sustainable Development Goals

The case study approach and activities are highly linked with the Sustainable Development Goals (SDG). As fly ash brick enterprises have increased from twenty-five in 2014 to hundred twenty-nine in 2016, it indicates that more entrepreneurs have become aware of the impact of climate change and have chosen to contribute to a low carbon economy. Shifting the brick material from topsoil to fly ash waste from thermal



plants, reduces the GHG emissions that lead to climate change (SDG 13) and pollution, helping to ensure healthy lives (SDG 3). Besides, various social benefits are also associated with the commissioning of new fly ash units. The establishment of new units, in fact, creates new employment opportunities, contributing to poverty eradication (SDG 1). Furthermore, it also promotes inclusive and sustainable industrialization (SDG 9) that will significantly raise industry's share of employment and gross domestic product (SDG 8).

Lesson learnt and next steps

This GREEN-WIN India case study is working with the local community to create a regional value chain and communal wealth by upcycling waste material, while also building and maintaining good relationships with all stakeholders such as entrepreneurs, government officials, and private sectors, which is the key to the success of the project.

Governmental and political support is also needed to ensure an enabling regulatory environment. For example, currently the Government of Bihar has taken steps to accelerate the adoption of green brick production technologies in the State. Bihar will need over 7500 million bricks over the next five years just to meet the rural housing gap of 1.1 million dwellings per year. Potential savings of 2.8 million tonnes of carbon dioxide (CO₂) emissions are possible while creating livelihoods for 0.35 million people by introducing cleaner production systems.

In order to capitalise on this potential, the Bihar government has formed an inter-departmental task force. The major areas that the Task Force will be looking at:

- 1) increasing awareness among entrepreneurs through workshops and seminars;
- 2) facilitating policy support for large scale adoption by providing incentives to green technology enterprises;
- 3) facilitating increased and easy finance support for small entrepreneurs through banks and other financial institutions for the uptake of green technologies; and
- 4) accelerating service delivery through capacity building of technology providers.

Information

J.D. Tabara, jdtabara_greenwin@sustainability.eu

Manisha Mishra, Development Alternatives, mmishra@devalt.org

Emily Benson, Green Economy Coalition, emily.benson@greeneconomycoalition.org

Project information

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Contact

Jochen Hinkel (project coordinator), Global Climate Forum (GCF), Germany, hinkel@globalclimateforum.org

www.green-win-project.eu



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