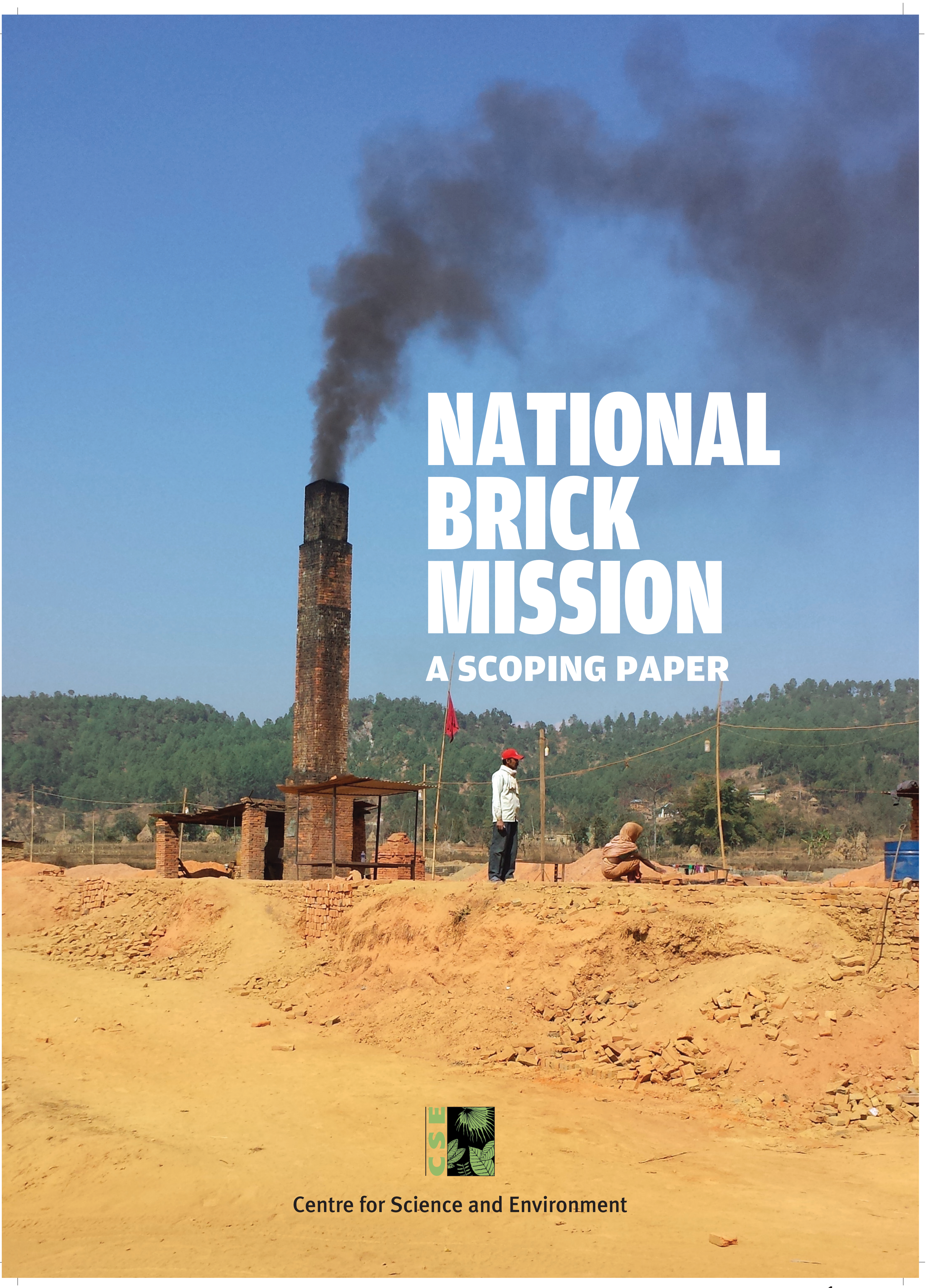
NATIONAL BRICK MISSION

A SCOPING PAPER



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Executive summary

Background

Globally, 1,500 billion bricks are produced annually. China, South Asia and Southeast Asia are the major brick producing region in the world. The region produces around 87 per cent of the total bricks produced globally. China produces almost 67 per cent of the total bricks produced globally, followed by India which produces 13 per cent of the total bricks.

The main environmental issue associated with the brick kiln sector is greenhouse gas (including black carbon) emission and particulate emission. Top soil utilisation by the sector is another important issue which needs to be addressed.

The National Brick Mission (NBM) aims to transform the Indian brick sector by facilitating large-scale adoption of technologies for cleaner fired brick production, finding alternatives to fired clay brick and:

- Reducing greenhouse gas emission, including that of black carbon
- Reducing particulate emission
- Improving energy efficiency
- Improving environmental compliance

Mission objectives

The main objective of the NBM is to transform the Indian brick sector and make it cleaner and resource-efficient.

Mission targets

The targets of NBM are to reduce:

i) GHG emissions by around 50 per cent
ii) Fuel consumption by more than 50 per cent
iii) Clay consumption by 50 per cent

Key elements of the Mission’s strategy

i) Facilitating large-scale adoption of cleaner technologies for the production of bricks
ii) Facilitating market transformation away from solid clay fired bricks towards hollow clay fired and flyash products
iii) Strengthening institutional capacities for research, delivery of technology and capacity building

Mission organisation

The Mission will be set up at both national and state levels. It will be set up as an autonomous body under the aegis of the Ministry of Urban Development (MoUD) and Ministry of Housing and Urban Poverty Alleviation (MoHUPA).

Timeframe

The implementation period of the NBM is 15 years. The first year will be spent on developing infrastructure followed by implementation of the objectives.

Resources

The total mission cost is estimated to be Rs. 7,000 crore.

1. Introduction

Brick sector is a resource intensive and highly polluting sector. It is largely unorganised and has never really come on the radar of regulatory agencies.

Bricks can be of many types. The most popular type is fired clay brick, usually red in colour, which is made from clay and then fired in a kiln. There are other types of bricks, usually classified as non-fired bricks (e.g. flyash bricks, autoclaved aerated concrete blocks, etc.) which are produced using raw materials like flyash, sand, lime, gypsum, cement, etc. It is estimated that at present, around 75 per cent of the market constitutes of fired clay bricks.

Clay fired bricks are produced in small enterprises mostly located in peri-urban and rural areas. As per the information provided by All India Brick Manufacturer Association, there are around 121,000 registered kilns operational in the country. The production processes are manual and it is estimated that more than 15 million workers are employed in the production of bricks.

Technology

A range of technologies has been adopted to produce bricks in the country. Kilns are classified on the basis of the firing mechanism adopted to bake the bricks—intermittent and continuous.

Intermittent kilns are filled with green bricks which are first heated up to the maximum temperature and then cooled before they are drawn out from the kiln. The kiln is also heated during the process. The heat trapped in the bricks and the kiln is lost during cooling, making this a fuel-inefficient technology. Clamps, scove, scotch and down-draught kilns are types of intermittent kilns.

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The search for a cleaner brick production regime is a key to reducing emissions and saving precious coal and clay


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Among all brick-making technologies, clamps are the most inefficient and most difficult to regulate

In **continuous kilns** fire is present in some part of the kiln all the time and hence the name. Continuous kilns utilise heat from the cooling bricks and combustion air to pre-heat green bricks or dry bricks before they are put into the kiln, making them more fuel efficient. They are based either on the principle of moving fire or on moving ware.

Clamps

Clamps are one of the oldest technology as well as the most basic type of kiln as no permanent kiln structure is required. It consists essentially of a pile of green bricks interspersed with combustible material. A flat dry land is chosen as a site for the construction of a clamp. Generally, layers of green bricks are piled with sloping provided at the sides for stability of the structure; the sides and top of the structure are covered with burnt bricks for insulation.

Usually there are two or more fuel beds, one below the green bricks and one or more in middle of the structure. Once the construction of the clamp is complete, the fuel bed at the bottom is ignited. Several types of fuels such as coal, coal powder, agricultural waste, and discarded tyres are used. Eyes in the clamp are holes for inflow of air. The covering of burnt bricks and ash at the top can be adjusted to control the ventilation and, hence, burning rate.

Firing takes 8-12 days. It takes another week for the bricks to cool off. The quality of bricks varies within a clamp. While the innermost bricks are the hardest and reddest, the outer bricks are under-burnt with a yellow or orange hue. Large clamps are better than smaller clamps as they provide better fuel efficiency.

Down-draught kiln (DDK)

A DDK consists of a permanent structure, including a permanent roof. Hot gases produced during the process of firing are deflected from the top of the

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DDKs are more efficient than clamps but much more expensive

kiln and re-flowed through the stacks of green bricks. Thus, the heat trapped in the gases is utilised. The floor of the kiln is perforated and linked to the chimney which is situated outside the kiln area. Warm gases rising through the height of the chimney provide sufficient draught to pull the hot gases down continuously through the stock of green bricks. The top and the sides are closed with heavy iron grates. A flash wall is built behind the grates to keep the flames off the nearby green bricks. Tie bars are installed around the structure to prevent the brickwork from deteriorating. This substantially increases the cost of construction. A small arched doorway, referred to as a "wicket", is provided as an entrance to the kiln and is bricked up temporarily during firing.

Usually, rectangular in shape circular DDKs are not unheard of. Rectangular kilns are easier to load.

Fixed chimney Bull's trench kiln (FCBTK)

An FCBTK is an improved version of MCBTK, where chimney is not movable. A fixed masonry chimney connected to the trench by flue passages and provisions of dampers to control flue gases increase the fuel efficiency of a Bull's trench kiln. The settling chamber is the simplest and cheapest of all air pollution control devices and is used to separate larger particles from smaller ones. The large volume of the chamber allows the air to flow at a low horizontal velocity, giving time for the particles to settle down. FCBTKs, therefore, produce less emissions and black carbon-containing particulate matter as compared to MCBTKs. Using a fixed chimney also increases the number of good quality bricks produced. The production capacity of an FCBTK, ranging between 25,000 and 50,000 bricks per day, is also higher than an MCBTK.

Zigzag kilns

The infrastructure of zigzag kilns is similar to FCBTKs, the only difference being that the former are always rectangular. Hot air leaving the kiln travels in a zigzag path through the stacks of green bricks, thus pre-heating them for a longer period. This makes zigzag kilns more energy efficient. The draught in these kilns can either be natural or forced. This technology reduces the consumption of coal by 20–30 per cent, and also decreases emissions, including black carbon-containing particulate matter, but needs skilled labour to operate and maintain the kiln.

This technology was introduced in India by Central Building Research Institute, Roorkee, in the early 1970s in the form of high-draught kilns, in which draught is created with the help of a fan, but gained popularity only in eastern India, especially West Bengal.

Table 1: Advantages of zigzag kiln over the FCBTKs

S. No.	FCBTKs	Zigzag kilns
1.	Specific energy consumption is in the range of 1.1–1.5 MJ/kg of fired bricks	Specific energy consumption in comparison to the FCBTKs is 20 per cent less
2.	Percentage of Class I bricks produced is between 50–60 per cent	Percentage of Class I bricks is much higher and is more than 80 per cent
3.	Range of particulate emission from FCBTKs is from 250–1,250 mg/Nm^3	Range of particulate emission from the kiln is less than 250 mg/Nm^3
4.	Black carbon emission ranges from 0.07–0.27 g/kg of fired bricks	Black carbon emission is less than 0.05 g/kg of fired bricks

Vertical shaft brick kiln (VSBK)

VSBK has a vertical shaft of rectangular or square cross-section. The shaft is located inside a rectangular brick structure. The gap between the shaft wall and outer kiln wall is filled with insulating materials—clay, flyash and rice husk. The kiln works as a counter-current heat exchanger. Heat exchange takes place between the air moving up (continuous flow) and bricks moving down (intermittent movement). Green bricks are loaded from top of the shaft with fuel placed in between them. Upward moving air heats the green bricks before they reach the firing zone. As they move down, fresh air entering from below cools them.

Two chimneys placed diagonally opposite each other puff out flue gases. In some cases, a lid is provided at the top of the shaft which can be closed to trap the heat longer and reduce the quantity of ash and other pollutants emitted.

Tunnel kiln

In case of tunnel kilns, the green bricks move horizontally in a tunnel like structure instead of moving vertically like in VSBKs. Bricks to be fired are placed on carts and passed through a long horizontal tunnel. The firing zone remains stationary near the centre of the tunnel, while the bricks and air move in opposite paths. Cold air is forced in through the end where bricks are unloaded, the cooling bricks pass their heat to the air which is then passed on to the combustion area and to the green bricks entering from the other side of


SAMEER MAITHEL

Tunnel kiln technology is considered to be the best available one

the tunnel. This is considered to be the best technology available till date for the large-scale production of bricks and is widely used in industrialised countries. The advantages of tunnel kiln technology lie in its ability to fire a variety of products, good control over the firing process, ease of mechanisation, thus reducing the labour requirement, and large production volume.

Drying of green bricks is done inside a dryer and thus the technology can be used round the year, increasing production capacity dramatically.

Table 2: Comparing different kilns on different parameters

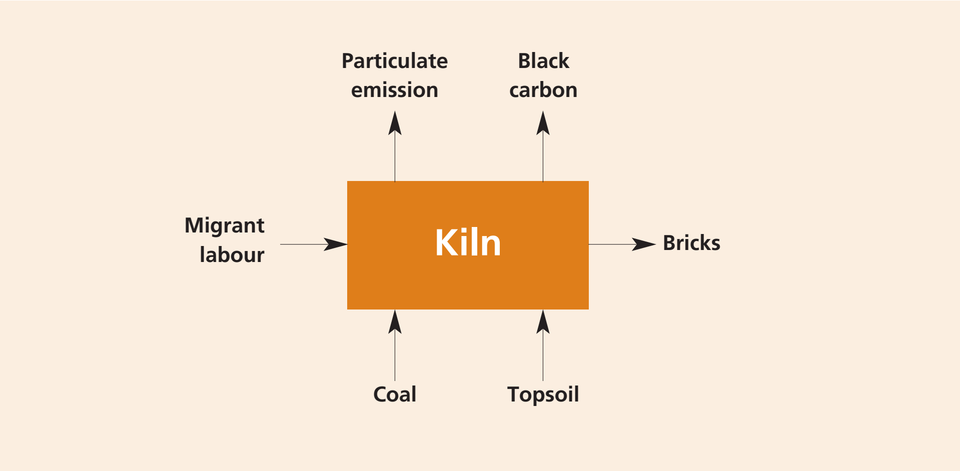
Parameters	Clamps	DDKs	FCBTKs	Zigzag (natural)	Zigzag (induced fan)	VSBKs	HHKs	Tunnel
Capital cost (USD)	NA	20,000-30,000	50,000-80,000	50,000-80,000	50,000-80,000	60,000-80,000	600,000-650,000	1,000,000
Production capacity (bricks million per year)*	0.01-0.2	0.02- 0.04	3-8	3-8	National	1.5-3	15-18	15
Specific energy (mJ/kg of fired brick)	2.10	2.97	1.30	1.06	1.03	0.8	1.20	1.4
Emission CO_2 (gm/kg fired brick)	NA	282.4	131	105	105	70.5	100	166.3
Black carbon (gm/kg fired brick)	NA	0.29	0.13	0.01	0.02	0.001	NA	0.00
PM (gm/kg fired brick)	NA	1.56	1.18	0.22	0.24	0.15	0.29	0.24
CO (gm/kg fired brick)	NA	5.78	2.0	0.29	1.62	1.84	NA	3.31
Per cent of good quality product	50	85	60	85	80	90	90	95

2. Environmental and social issues

Impact of brick production

It is estimated that in order to produce 200 billion bricks, 600 million tonnes of clay (topsoil), 35 million tonnes coal and 10 million labour days of mostly migratory workforce is needed. The result: Bricks, but also 60 per cent of total industrial emission of black carbon. This is depicted in Figure 1.

Figure 1: Input and output of a typical kiln



The main environmental concerns associated with the production of fired clay bricks are:

- Brick industry is one of the five largest industrial consumers of coal (along with steel and cement) in the country, a huge source of particulate matter emissions and one of the largest industrial emitter of greenhouse pollutants, CO_2 and black carbon.
- Recent research shows that large brick clusters exist around several Indian cities, e.g., more than 1,000 brick kilns are located in the National Capital Region and these are a significant contributor to air pollution and poor air quality in the Delhi NCR region.
- Most of the clay is obtained by excavating agriculture fields up to a depth of 2 meters, which results in loss of topsoil and land degradation.[1]

As the technology employed is relatively primitive, workforce associated with it is also high. With the advent of latest technology in China and Vietnam, efficiency of kilns increased and the workforce employed is reduced considerably. On the other hand, in countries like India and Pakistan, which are still dependent on primitive technology, kiln efficiency is on the lower side and workforce productivity is poor.

Loss of topsoil

One of the major focuses of the NBM will be to conserve topsoil. It is estimated that around 600 million tonnes of topsoil is being used by the brick sector annually. Global experience shows that clay obtained from various alternate means such as deep mining, dredging of lakes and rivers and from hilly areas can be used for making bricks. Also, the production of hollow clay bricks can reduce the amount of clay required in brick-making. A casual look at how soil is obtained for brick-making all over the country reveals that entrepreneurs

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Topsoil, a miracle of geology, is too precious to be squandered away in the production of bricks

have invested almost no time and energy in understanding how precious topsoil is—a geological miracle taking millions of years to form— and have, therefore, never looked for any alternatives. The mission will encourage cross-learning and innovation to reduce the consumption of clay by the brick sector.

Heavy dependence on coal

Clay needs to be fired to a temperature of around 1,000°C to obtain good quality bricks. A huge amount of energy is required to achieve the desired temperature. This energy is obtained by burning fossil fuels. About 50 per cent of the total cost incurred on brick making is spent on fuel. Brick sector is the third largest industrial consumer of coal after thermal power plants and iron and steel sector. The sector has no fixed source of coal procurement. Entrepreneurs procure coal from the open market. All types of domestic coal are used. In recent years, the use of coal imported from USA, South Africa and Indonesia as well as petroleum coke (a residue obtained from oil refining) has shown a sharp increase. The industry is not averse to using high ash low quality coal which increases consumption as well as emissions. Apart from coal, biomass, agricultural waste, heavy fuel oil, wood and tyres are also used in kilns as fuel.

Contribution to climate change

A visible black cloud of smoke emerging from a chimney is the archetypal image of a brick kiln. Coal feeding or charging is generally an intermittent process. In the absence of proper engineering practices, there is incomplete combustion and high amounts of air pollutants are released.

The emission profile of a sector depends upon the type of fuel being used. Coal burning releases greenhouse gases including black carbon, SO_x and particulate matter into the atmosphere. In particular, use of coal with high sulphur content (Assam and Meghalaya coal) or petroleum coke creates the problem of noxious SO_x emissions. High ash low quality coal produces more black carbon and particulate matter. Burning of biomass, agricultural waste, heavy fuel oil, wood and tyres leads to the release of contaminants and high concentration of various pollutants.

Social issues

The brick industry is considered to be the industry of the poor, employing around 10 million people directly and indirectly. Despite its gargantuan size, the brick kiln sector of India remains largely unorganised. Kiln owners and associations claim to generate large-scale employment but the condition of the workers is questionable. There has been a lot of hue and cry over the poor working and living conditions in most of the kilns and the sufferings of the workers. Workers are exposed to high levels of emissions which cause many respiratory problems. Apart from this, the nature of the work in a kiln is such that it requires extensive hard labour for a prolonged period on a continuous basis which may cause many health problems as well.

In most cases, whole families of parents and children, many a time underage, work in the same unit but only the father is treated as a worker. This is a result of the way the brick industry is organised: Each worker has to promise a certain number of bricks at the beginning of a season and fulfil that promise no matter what or he does not receive any payment at the end of the season. All risks associated with the production process are transferred to the workers. Hence, whole families get involved in fulfilling the contract.

The high cost of air pollution due to brick manufacture needs to be addressed immediately

Brick kiln entrepreneurs defend this strategy by stating that nobody is forced to accept these terms, but since the sector is not regulated by any agency, they can run their writ freely. Moreover, as labour registers are not maintained, the workers are deprived of any benefits and protection under law (such as Minimum Wages Act, 1948, Employees' Provident Funds, 1952, Employees' State Insurance Act, 1948 and Inter-state Migrant Workmen Act, 1979).

SUYESH PRAJAPATI

3. Strategy and approach

Given the considerable environmental and social impact of the brick kiln sector, it is imperative to design a strategy which can reduce clay consumption, improve energy efficiency and reduce emissions. The sector is run by entrepreneurs who do not have the knowledge, skill or financial resources to bring necessary change by themselves. It thus becomes imperative on the part of the government to adopt a comprehensive new programme to improve the environmental performance of the sector. The urgency of this need is underlined by the fact that the sector is expected to grow at a considerable pace for the next 15 years, given the urbanisation explosion in India. The demand for bricks is expected to grow by 200–300 per cent.

India is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and Government of India attaches great importance to issues related to climate change. The government recognises the urgency and importance of action that needs to be taken collectively to meet the ultimate objective of the Convention, i.e., stabilising greenhouse gas concentrations in the atmosphere at a level that prevents dangerous anthropogenic interference with world climate.

Different sectors of the Indian economy are being overhauled to address climate change. India's National Action Plan on Climate Change enshrines eight national missions that represent multipronged, long-term and integrated strategies for achieving key goals in the context of climate change. One of these missions is to enhance energy efficiency. Another is creating a sustainable habitat. "Housing for all" is one of the priorities of the government and an ambitious plan to provide affordable housing to all by 2022 is currently underway. A clean brick manufacturing process will ensure that these big leaps in infrastructure development work in synergy with the tackling of climate change.

It is therefore proposed that Indian have a National Brick Mission. The main objective of the mission will be to guide the sector in the next 15 years.

The foremost objectives of the NBM are:
1) Reducing clay consumption
2) Preparing a technology roadmap
3) Preparing an emission roadmap

Reducing clay consumption

Clay fired brick sector in India is estimated to consume as high as 600 million tonnes of clay annually. The kiln owners extract soil from a leased area and they have to pay royalty on the amount of clay being extracted to the state mining department. To save on the amount of royalty to be paid to the mining department, brick entrepreneurs never reveal the actual amount of clay they extract.

For reducing clay consumption in the brick sector change in product mix is required. In place of solid clay fired bricks, hollow or perforated bricks should be produced. Solid clay bricks should be allowed only when it is mixed with some waste such as flyash, industrial sludge, etc. There are positive examples of this in our country. Brick entrepreneurs in Maharashtra and a few in Uttar

Pradesh are mixing flyash with clay to produce bricks successfully. More such products should be encouraged and some initiative by government needs to be taken to promote utilisations of such bricks.

Considering how abatement in the demand for masonry units is improbable over the next few years, it becomes imperative to examine, on sound technological, economical and environmental grounds, alternatives to fired clay products that can partially, if not entirely, supplement the current production of fired clay bricks. Products like foamed concrete in both of its two varieties—autoclaved aerated concrete (AAC) and cellular lightweight concrete (CLC)—have found extensive use in the construction industry of developed countries. A few of these options are discussed here.

Cement concrete blocks (CCBs)

Cement concrete hollow blocks have attained importance in the modern building industry. In large-scale constructions such as apartments and commercial complexes, concrete blocks have found favour among developers primarily because of the advantages of faster construction with the larger sized blocks and also due to costs being comparable with fired clay bricks. They are a cost effective and good alternative to burnt clay bricks by virtue of their durability, fire resistance, partial resistance to sound, thermal insulation, small dead load and high speed of construction. Concrete blocks require less mortar as compared to burnt clay bricks and hence reduce the cost of wall making.

Flyash concrete blocks

Flyash can be added to some kinds of clays that are otherwise not conducive for making bricks

Flyash is a very fine residue generated during combustion of coal, constituting about 70–80 per cent of the ash, so called because it flies with the flue gases (and is captured by electrostatic precipitators). The major source of flyash is thermal power plants. Flyash is a good additive and can be added to types of clay otherwise not conducive for making bricks. Flyash brick-making has

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picked up globally in the recent past. In India, at present, there is only 2 per cent utilisation of flyash.[2]

Flyash–lime–gypsum (FaL-G) blocks
Flyash reacts with lime in the presence of moisture at ordinary temperature to form a compound possessing cementing properties. This reaction between lime and flyash results in the formation of calcium silicate hydrates (CSHs) which impart high strength to the material. In these blocks, the early strength to the material is imparted by calcium alumina-sulphate hydrates supplemented by CSHs for late-age and ultimate strength. The production of FaL-G blocks does not involve any sintering process. Blocks made by mixing lime and flyash are chemically bonded bricks.[3]

Autoclaved aerated concrete (AAC) blocks
Autoclaved products preferably contain a crystallised form of silica which helps to increase the crystallinity of the calcium silicate hydrate formed in the autoclave. The development of AAC was due to a demand for lighter weight material for construction purposes; thus, in place of normal density concrete (2,200–2,600 kg/m^3), lower density concrete of the range 500 kg/m^3 is used. The major raw materials used in the production are sand or flyash, cement, lime, aluminium powder and water. Ideal sand contains silica, SiO_2, which is one of the important components in the production of AAC. It is preferred to have 90 per cent or above SiO_2 in production of AAC but a minimum 85 per cent is required.

Construction and demolition waste reuse
There is no updated official estimate of the quantity of construction and demolition waste (C&D) being generated in India. In 2013, CSE estimated that annual C&D generation in India can be as high as 530 million tonnes annually. This waste can be recycled and used as a partial replacement for both sand and course aggregate and BIS has proposed substitution up to 25 per cent as both fine aggregate and course aggregate in plain concrete.

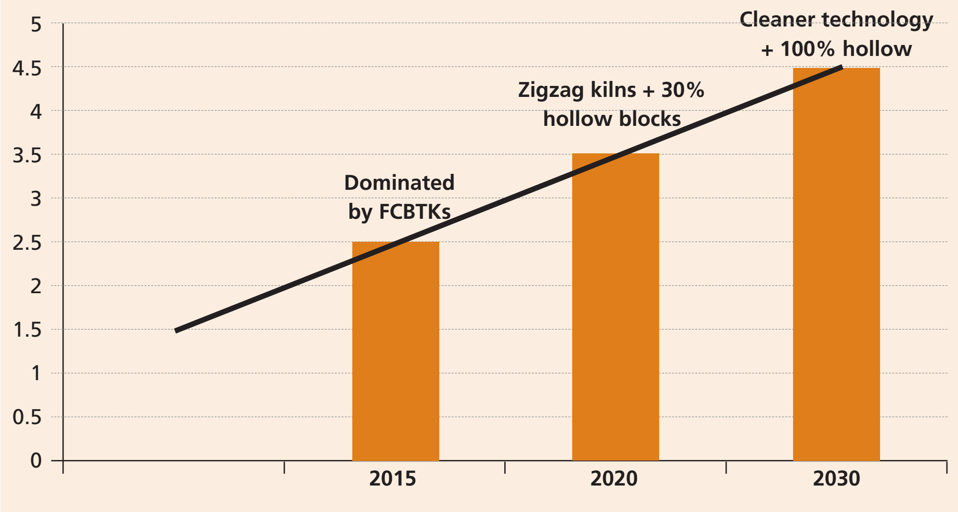
Preparing a technology roadmap

The sector moved to FCBTKs from moving chimney kilns in 1996 after notification from the then Ministry of Environment and Forests. VSBK technology was introduced soon after and emission standards were set. But this new technology did not gain popularity among brick kiln entrepreneurs for various reasons. Other technologies were also tried but could not be adopted at the national level because of financial reasons and lack of capacity to design or run. Moreover, regulatory bodies have introduced no guidelines or policy to push for change.

The sector is dominated by clamps which are difficult to regulate. In terms of popularity, clamps are followed by FCBTKs which produce a majority of the solid fired bricks in the country. The world is moving away from FCBTKs. In our neighbourhood, Bangladesh has switched away from FCBTKs to zigzag technology. Twenty years have passed since the conversion of moving chimney kilns into FCBTKs in India. The government, in particular the Ministry of Environment, Forest and Climate Change, must come up with a new technology roadmap for the sector.

Considering all the technologies discussed in the previous sections, it can be concluded that it will be imprudent to push small-scale players (using clamps) to switch to cleaner technologies. The best approach will be to switch FCBTKs

Graph 1: Roadmap for transforming brick kiln sector



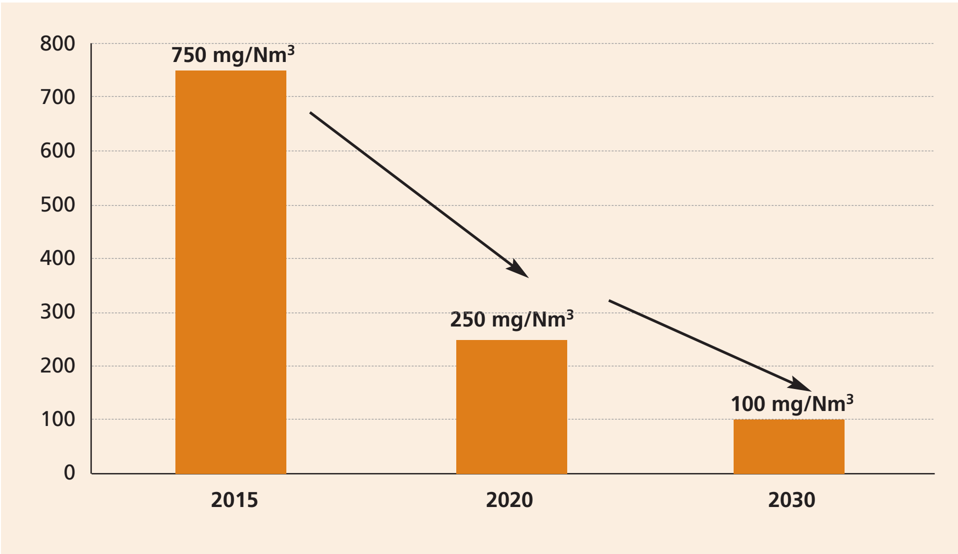
Source: *CSE*

kiln to zigzag in the next five years, and pushing them to move to cleaner technology by 2030. That cleaner technology could be the existing tunnel kiln or VSBK technology or an upgraded version of retrofitted zigzag.

Preparing an emission roadmap

It is not prudent to set emission standards for small-scale units which cannot be monitored by regulatory bodies because of their sheer number. The best option is to adopt technology-based standards. The emission standard in the country is 750 mg/Nm^3 for FCBTKs. NBM should develop emission reduction roadmap from 2016 to 2030. Particulate emissions should be less than 250 mg/Nm^3 for zigzag kilns and less than 100 mg/Nm^3 for cleaner technology.

Graph 2: Emission roadmap



Source: *CSE*

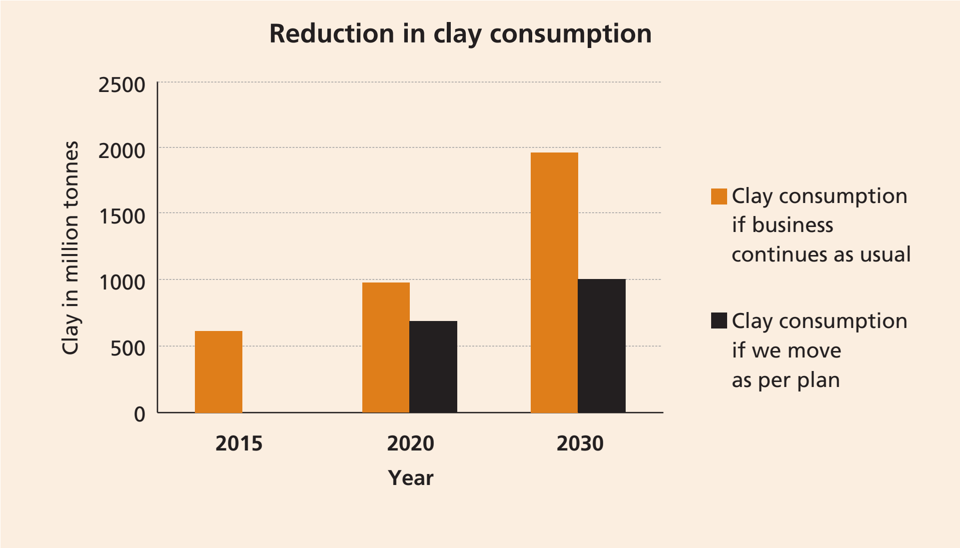
4. Expected results

The roadmap discussed in the previous chapter plans to convert all FCBTKs to zigzag and change 30 per cent of present solid bricks into hollow brick by 2020. This transformation will only be a short-term measure. Ultimately, we must plan to move to cleaner technology and 100 per cent hollow brick production by 2030. This roadmap will help achieve significant reduction in clay and coal consumption and emission of GHGs as compared to a business-as-usual level. India cannot afford a business-as-usual situation.

Reduction in clay consumption

Reduction in clay consumption will help save precious topsoil. The target is to reduce clay consumption by 25 per cent by 2020 and by 50 per cent by 2030.

Graph 3: Analysis of achievable clay saving

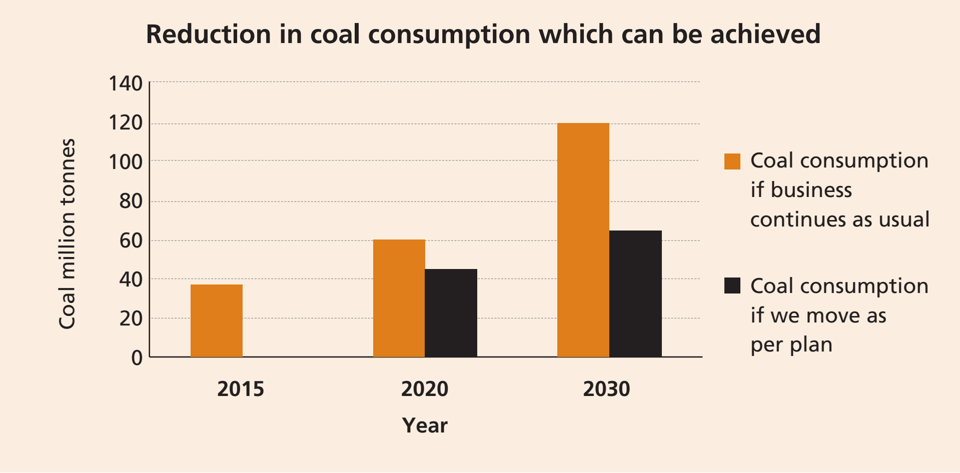


For a variety of reasons, India cannot afford a business-as-usual scenario of brick making

Reduction in coal consumption

Reduction in coal consumption will help reduce emissions as well as save depleting fossil fuels. The target is to reduce coal consumption by about a third by 2020 and about 50 per cent by 2030.

Graph 4: Proposed reduction in coal demand

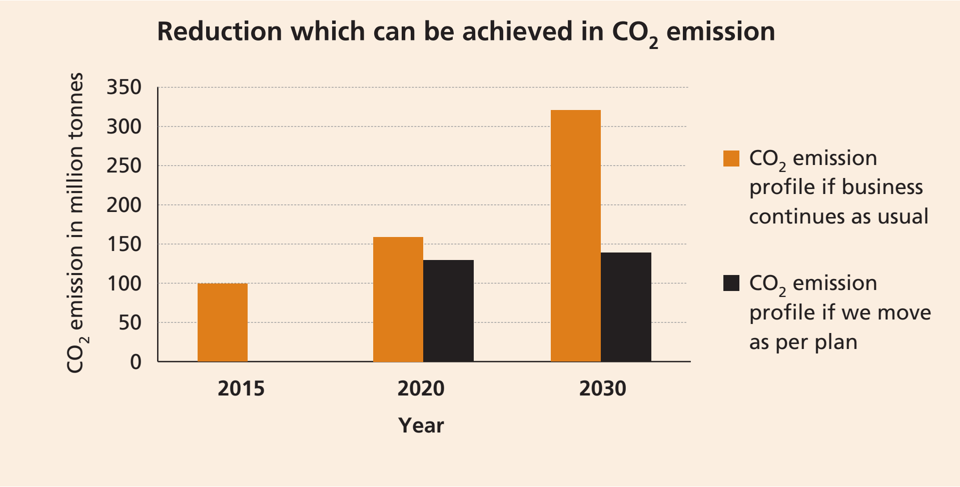


Reduction in emission profile

The sector emits not only CO_2 but other harmful materials like flyash, SO_2, NOx, CO, particulate matter, black carbon, toxic metals and volatile organic compounds.

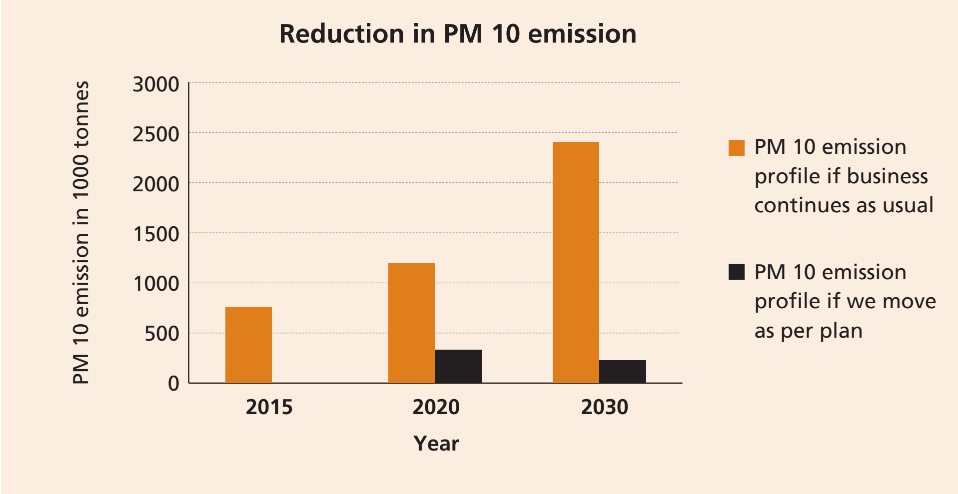
The target is to reduce CO_2 emission by 10 per cent in the next five years and by about two-thirds by 2030.

Graph 5: Proposed reduction in CO_2 emission



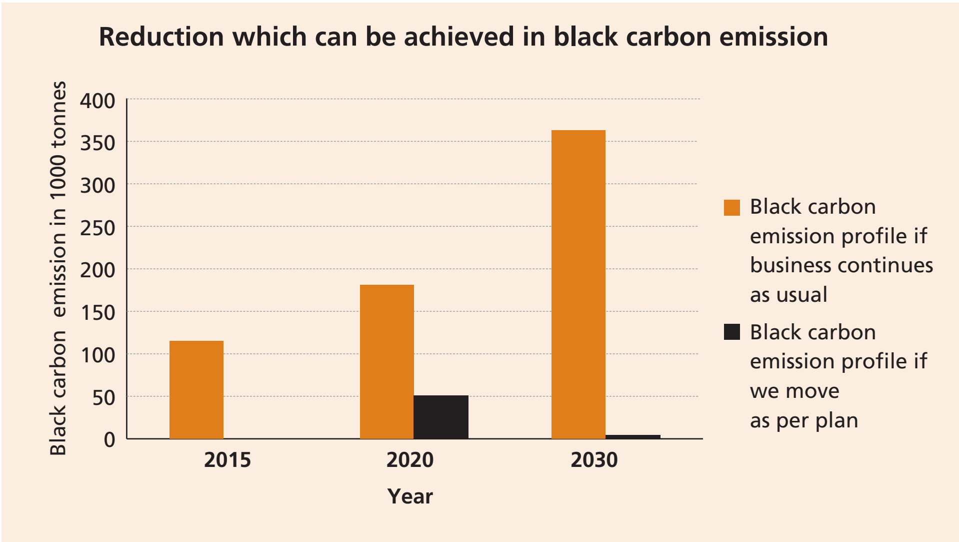
Similarly, the target for PM10 is to reduce the emission by 50 per cent in next five years make it negligible in comparison to a business-as-usual scenario by 2030.

Graph 6: Potential reduction in PM 10 emission



At present, the sector is estimated to emit around 60 per cent of the total black carbon emission from the industrial sector in the country. It can be made negligible in the next 15 years.

Graph 7: Reduction in black carbon emission profile



Source: *CSE*

5. Architecture of the National Brick Mission

In order to promote energy efficient, ecologically sustainable brick manufacturing with minimum carbon consumption, a missionary zeal is imperative. This approach shall be orchestrated by an institution comprising of political luminaries, able administrators, scientist and engineers involved in cutting-edge research and development, brick kiln manufacturers and other interested persons or groups.

Headquarters of the Mission

The headquarters of the mission directorate shall be at New Delhi.

Administrative and technical support to the authority

NBM shall be provided administrative and technical support by the Ministry of Urban Development (MoUD), which shall be the nodal ministry. The mission shall evolve an appropriate mechanism for implementation of its decision.

Structure of the Mission

The NBM shall consist of the following members:

a. Union Minister, Urban Development	Ex-officio chairperson
b. Minister of State Finance	Ex-officio member
c. Minister of State, Environment, Forest and Climate Change	Ex-officio member
d. Member, Niti Ayog	Ex-officio member
e. Minister of State, Rural Development	Ex-officio member
f. Minister of State, Housing and Poverty Alleviation	Ex-officio member
g. Minister of State, Micro, Small and Medium Enterprises	Ex-officio member
h. Executive Director, Building Materials and Promotion Council	Ex-officio member
i. Director General, Bureau of Energy Efficiency	Ex-officio member
j. State Minister of Urban Development, Uttar Pradesh	Ex-officio member
k. State Minister of Urban Development, Bihar	Ex-officio member
l. State Minister of Urban Development, West Bengal	Ex-officio member
m. State Minister of Urban Development, Tamil Nadu	Ex-officio member
n. State Minister of Urban Development, Andhra Pradesh	Ex-officio member

o.	State Minister of Urban Development, Gujarat	Ex-officio member
p.	State Minister of Urban Development, Maharashtra	Ex-officio member
q.	Representative of R&D institutes of National importance (to be nominated by the Central government)	Member
r.	Representative of Brick Kiln Manufacturing Association	Member
s.	Secretary, Union Ministry of Urban Development	Member secretary

Provided that NBM may co-opt:

- One or more ministers as may be required from any of the states having major manufacturing units.

- One or more Union ministers as may be required as ex-officio members.

- Upto five members who are experts in the field and a representative from a non-governmental organisation.

Functions of the Mission

The mission shall discharge the following functions:

- Promote energy efficient brick manufacturing technology with due regards to techno-economic feasibility.
- Take measures necessary for planning, financing and execution of programme for cleaner technology in consultation with state governments for abatement of air pollution and minimisation of coal consumption.
- Take measures necessary for planning, financing and executing programmes for utilisation of alternate raw materials (such as flyash) instead of topsoil for brick manufacturing.
- Collect, analyse and disseminate information relating to cleaner brick manufacturing in order to protect topsoil and promote less use of carbon.
- Organise, through mass media, a comprehensive information campaign regarding cleaner brick manufacturing.
- Provide technical assistance, guidance and training to brick manufacturers on cleaner production.
- Sponsor and organise research programmes and demonstrations of various technologies for cleaner production of bricks.
- Advice Central government on environmental standards, codes and guidelines with respect to brick manufacturing.
- Allocation of special vehicles, as appropriate, for implementation of work of the NBM.
- Monitoring and review of the implementation of various programmes and activities taken up for promotion of cleaner technology.

Meetings of the Mission

The mission may regulate its own procedures for transacting its business including its meetings.

Corpus of the Mission

Corpus funds shall be provided by the Central government for implementation of NBM's projects and programmes.

Constitution of State Brick Missions

State governments may constitute their own State Brick Missions (SBMs) under the chairmanship of the State Urban Development Ministry and with such composition and functions as deemed fit for assessing and implementing clean technologies of brick-making at the state level.

Engagements of research institutes

Lack of knowledge about advancements in technology, products and efficiency has been a major challenge which the brick sector has been unable to overcome. There is an immense need for involving premier institutes of the country in research and development for the modernisation of the sector.

Research institutes will be responsible for developing efficient new technologies and products which can replace solid clay fired bricks. This work must be supported by the government, financially and otherwise.

One of the major responsibilities of these institutes will be to develop the capacity of key stakeholders like consultants, organisations and NGOs. The people trained by research institutes will have to shoulder the responsibility of spreading the knowledge and training entrepreneurs and other stakeholders.

Knowledge portal

Dissemination of information is an area in which the Indian brick sector lags behind. Officially, data is never updated. Even such basic details as the number of brick kilns in the country or the state-wise list of operational brick kilns are missing. All such information is available with consultants who have been working in this field. They have collected this information from brick kiln association of different states. Brick kilns association are themselves afraid to put the information on website as there are large numbers of kilns operating without necessary regulatory clearances. The government needs to take initiative to collect and disseminate such information.

Financial viability

Financial viability of NBM is, obviously, the most important factor for its success. Funds are needed under five subheads: Infrastructure, salary, international workshop and exposure visits, aid to technical institutes and grant to brick entrepreneurs for conversion to cleaner technology. Out of these subheads, infrastructure is a one-time investment while the others are recurring.

Two sets of budgets have to be prepared for NBM; a phase-one budget for the period 2016–20 and a phase-two budget for the period from 2021 to 2030. The first phase of the mission will be crucial for creating infrastructure for conversion from FCBTK to zigzag kilns. The budget for the second phase will be allotted after mid-term evaluation of the first phase and understanding what the new requirements of the sector are.

The total amount required for the first phase of the mission is Rs. 7,015 crore which translates into Rs. 1,403 crore a year. This money can be raised by the NBM in cooperation with brick-making entrepreneurs. Therefore, the financial liability of NBM for the government would be around Rs. 701 crore per annum.

The next challenge will be the sourcing of funds for NBM. The best available option is National Clean Energy Fund (NCEF). Created in 2011, the NCEF is meant for research and innovation projects in clean energy technologies. In order to finance the NCEF, a clean energy cess of Rs. 50 per tonne was introduced on coal produced in or imported into India. In the year 2014–15, an amount of Rs. 1,100 crore has been collected as coal cess for NCEF. As per budget estimates during 2015–16, an amount of Rs. 500 to 700 crore will be collected as coal cess.

There is no official data available on the amount of coal being consumed by the brick kiln sector in India. Rough estimates put the figure at 25–35 million tonnes a year. This effectively means that since 2010, the brick kiln sector has contributed around Rs. 1,625–2,275 crore towards National Clean Energy Fund. Not a single penny of this, however, is being spent on the sector itself.

NBM can easily be funded by NCEFduring both the phases.

Table 3: Comparing different kilns on different parameters

Year	Average consumption of coal by brick sector	Coal cess	Total cess collected (Rs million)
2010-11[1]	25-35 million tonne	Rs 50/tonne	125-175
2011-12	25-35 million tonne	Rs 50/tonne	125-175
2012-13	25-35 million tonne	Rs 50/tonne	125-175
2013-14[2]	25-35 million tonne	Rs 100/tonne	125-175
2014-15[3]	25-35 million tonne	Rs 200/tonne	500-700
2015-16*	25-35 million tonne	Rs 200/tonne	500-700
Total			**1625-2275**

Notes:

1 *http://articles.economictimes.indiatimes.com/2014-06-13/news/50564444_1_the-ncef-national-clean-energy-fund-rs-500-crore, as viewed on January 12, 2016*

2 *http://www.gktoday.in/national-clean-energy-fund-ncef/, as viewed on January 12, 2016*

3 *http://www.thehindu.com/todays-paper/tp-in-school/improper-use-of-clean-energy-fund-weakening-india-expert/article6423980.ece, as viewed on January 12, 2016*

* *Expected value*

6. Recommendations

- **Ban construction of FCBTKs** or down-draught kilns
- Utilise **National Clean Energy Fund** for technology upgradation of existing kilns in the next three-five years
- **Focus on clay alternatives.** Restrict bricks produced from agricultural soil and encourage utilisation of clay extracted by desiltation/ dredging of tanks, rivers and canals. Promote bricks made of industrial waste such as flyash and marble slurry
- **Develop state level initiatives.** Research and training institutes at the regional level will work directly with entrepreneurs to improve energy efficiency, reduce emissions and utilisation of waste to replace clay
- **Government department should institute policies** to increase official consumption of bricks made from waste.
- A **policy must be instituted for private construction to replace traditional bricks** with bricks made from alternate material, starting from cities located within 50 km of thermal power plants
- A **campaign by Ministry of Urban Development, Bureau of Energy Efficiency and Ministry of Environment, Forest and Climate Change** on the need of replacing traditional red bricks with hollow, perforated and bricks from alternate materials

References

1. In some parts of the country a part of the clay used for making clay fired bricks is harnessed by desiltation of tanks and reservoirs or from rivers, which if done properly can be considered as renewable and environment friendly.

2. *Flyash Characterization, Utilization and Government Initiative in India,* Dhadse *et al*, January 2008.

3. *Strategies for Cleaner Walling Material in India,* A report for Shakti sustainable energy foundation of 2011.

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