



Bureau of Energy Efficiency



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Market Transformation towards Energy Efficiency in Brick Sector

a strategic blueprint, from
vision to mission



Prepared for
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Feedback is welcome and may be directed to Manu Maudgal (manu.maudgal@giz.de) and Milind Deore (mdeore@beenet.in)

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01

PROLOGUE

💧💧 *Earth provides enough to satisfy every man's needs, but not every man's greed.*”

M K Gandhi



01 | PROLOGUE

Energy efficient modernization entails mechanization of brick manufacturing process AND shift in product from dense solid brick to lower density (e.g. perforated, hollow) bricks and/or diversified brick.

Under the BEE's strategy, brick manufacturers who adopt energy-efficient manufacturing shall be awarded a new BEE accredited mark called "Energy Efficient Enterprise (E3)" mark. The adoption of E3 mark shall be wholly voluntary by Industry.

Market awareness for the E3 mark shall be generated by BEE to encourage sourcing bricks from manufacturing units who have been awarded the E3 mark.

Overall the market transformation strategy is expected to reduce - energy, clay, water use and reduces wastes per unit production.

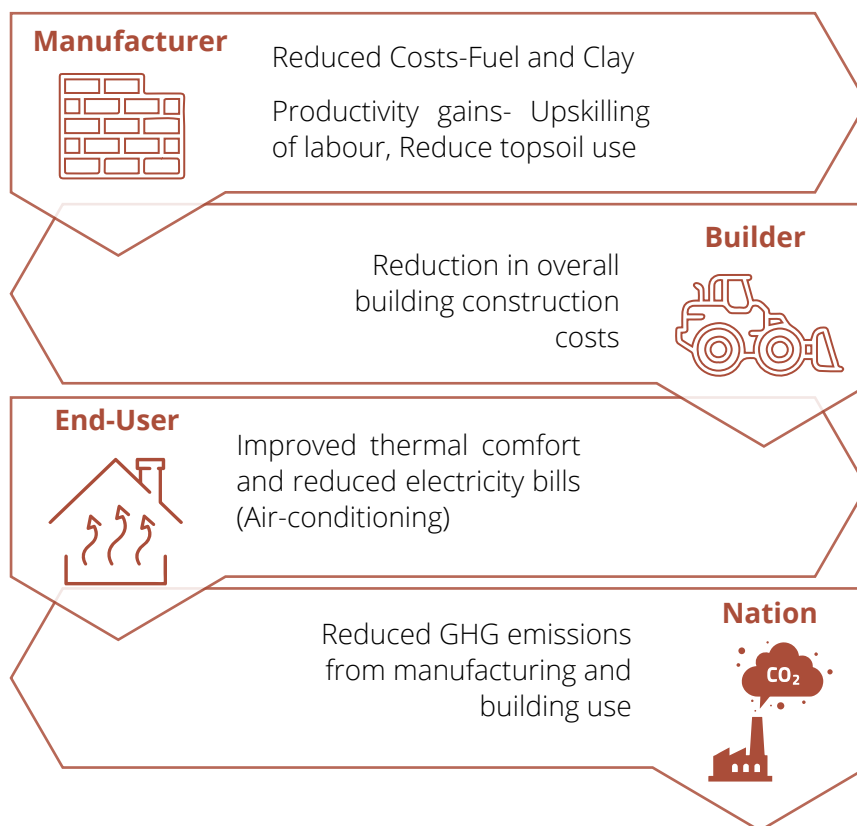
The traditional red clay brick is a time-tested walling material of choice and an important raw material for the construction industry. India is the world's second-largest producer of bricks and this demand is expected to multiply three to four times over the next 20 years. The sector contributes nearly 0.7% to the country's GDP, offers seasonal employment generation to over 10 million workers and has strong influence on other economic sectors such as transportation and construction.

Bricks have been produced since ancient times (dating back to 6000 B.C) by mixing ground clay with water, forming bricks into desired shape and size, drying them and then firing them (at around 1100 °C) to impart durability and weathering resistance.

The clay depending on its mineral content, geological occurrence yields bricks of varying density, strength, water absorption, and thermal conductivity.

This conventional method of brick manufacturing carries environmental consequences represented by the emissions of greenhouse gases (GHG), due to fuel firing in the brick kilns, which contributes to climate change and raises concerns on the extraction of clay and the removal of topsoil. Newer man-made materials have emerged which emphasize on either aesthetics, maintenance, time/effort of construction, etc. The focus on short run incentives e.g. cost savings; often overlook aspects like thermal comfort or the 'long-run sustainability like end-of-life issues' of the new technology.

Over the last decade, innovations in the use of clay bricks have been noted, leading to reduced resource use (energy and clay). The innovated clay product (typically perforated and hollow clay bricks and blocks) have lower densities, consume less clay/energy in manufacturing, have lower thermal conductivity values, and can also be produced in larger size format. These attributes bring-in several benefits along the construction value chain.

Figure 1: Market Transformation Benefits

Brick consumers are mainly government agencies, real estate developers, individuals constructing residential buildings, and contractors for road construction, etc. Given this spread in the user base, the sector is slow to change. For example, in India the share of new type of clay bricks is currently less than 0.5%¹ (of the market share); majority bricks being the solid clay brick. Even though, twenty to forty percent of the manufacturing cost of a brick is due to energy, a variety of barriers dis-incentivize modernization in this sector, (inter-alia):

Buildings already account for more than 30 percent of electricity use, with rapid urbanization expected in the coming decade has implications for national energy security (as electricity is largely generated in coal-fired power plants) and greenhouse gas emissions.

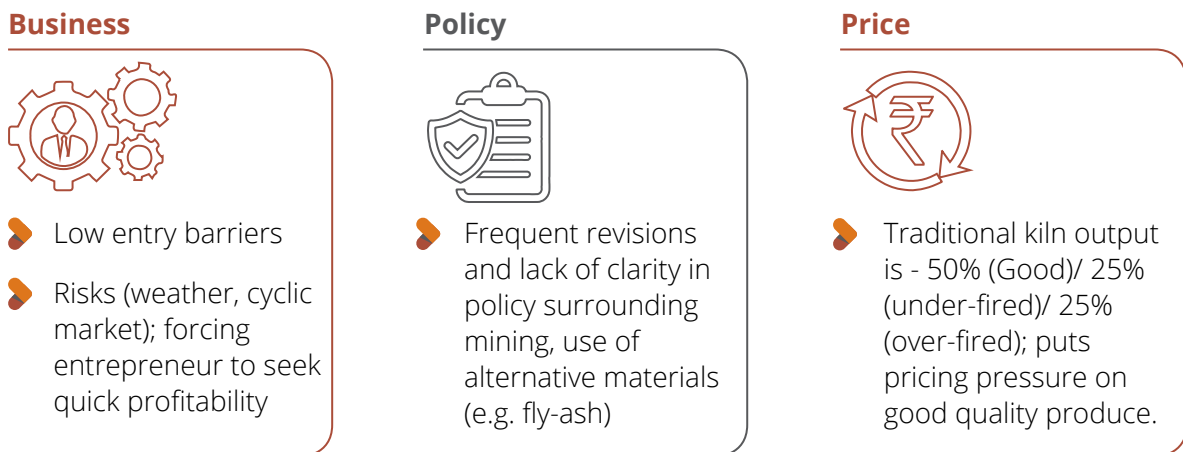
A technological makeover of the traditional solid bricks to porous and hollow products would offer both energy and raw material efficiency, with the potential to put India on a more sustainable pathway in infrastructure development. Perforated and hollow products allow for the use of clay other than topsoil, which can thus be preserved.

In India, the Bureau of Energy Efficiency is the nodal agency to assist Government in developing policies and strategies with a thrust on self-regulation and market principles, under the overall framework of the Energy Conservation Act, 2001 with the primary objective of reducing the energy intensity of the Indian economy.

¹Policy Roadmap for Promoting Resource Efficient Bricks in India (GKSPL 2017), the annual production of perforated and hollow bricks was around 0.2 billion bricks/year. If enterprises producing perforated and hollow products, produce other products as well, the maximum total production from such units is not more than 1 billion bricks per year (~ 0.5 % of the total production).

Given the sizable opportunity in pre-empting the consequences of the business as usual scenario (which is continued manufacture and sales of solid bricks) and considering that much of the growth in building stock is yet to occur, the Bureau of Energy Efficiency (BEE) seeks to accelerate the shift in the brick manufacturing sector towards energy efficiency through voluntary adoption of improved production technologies and encouraging the production of porous/hollow clay products in India.

Figure 2: Market Transformation Barriers



Buildings already account for more than 30 percent of electricity use, with rapid urbanization expected in the coming decade has implications for national energy security (as electricity is largely generated in coal-fired power plants) and greenhouse gas emissions.

A technological makeover of the traditional solid bricks to porous and hollow products would offer both energy and raw material efficiency, with the potential to put India on a more sustainable pathway in infrastructure development. Perforated and hollow products also allow for the use of clay other than topsoil, which can thus be preserved.

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The BEE proposes a two-step strategy to activate the market transition:

1. Brick manufacturers who adopt energy-efficient manufacturing shall be awarded a new BEE accredited mark called "Energy Efficient Enterprise (E3)" mark, and
2. Market awareness for the E3 mark shall be generated by BEE to encourage customers to source bricks from manufacturing units who have been awarded the E3 mark.

The adoption of E3 mark shall be wholly voluntary by Industry . Energy-efficient transformation in brick making through BEEs active steering is expected to enable the brick sector and indeed India to lock itself into an energy-efficient and sustainable infrastructure.

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is an International Cooperation enterprise for sustainable development which operates worldwide, on a public benefit basis. GIZ is fully owned by the German Federal Government and implements development programs in partner countries to achieve the German development policy objectives.

The Federal Republic of Germany and the Federal Republic of India have, under the Indo German Technical Cooperation, agreed to jointly promote the “Indo-German Energy Programme” (IGEN) with the aim to promote energy efficiency/conservation in energy consumption to use energy more efficiently and in turn improve the environment and aid climate protection.

The GIZ works closely with the Bureau of Energy Efficiency (BEE) to promote energy efficiency and the execution of policy backed national and state-level programs. The BEE with support from GIZ has developed the market transformation strategy to enhance the demand towards energy efficient brick manufacturing.

M/s Greentech Knowledge Solutions Pvt Ltd (GKSPL) had been retained by GIZ to support the strategy development and the development of this document. To accomplish the assignment, two methods were used: (i) desk review of relevant documents, reports, and data and other available information, and (ii) interaction with stakeholders (brick industry, government, and bank and non-bank financial institutions, etc). Feedback received through these stakeholder consultations was considered to shape the brick market transformation strategy.







02

BRICK SECTOR
OVERVIEW

👉👉 *Connecting with nature means to connect with ourselves. If we do so we nurture a better planet* 🗨️🗨️

Narendra Modi



02 | BRICK SECTOR OVERVIEW

Burnt clay brick is a time-tested walling material of choice in India. Newer man-made materials have emerged which emphasize on either aesthetics, maintenance, time/effort of construction, etc. The focus on short run perverse incentives e.g. cost savings; often overlook aspects like thermal comfort or the 'long-run sustainability like end-of-life issues' of the new technology.

Traditional solid brick manufacturers through a technological makeover can morph to 'Energy-efficient bricks' viz. porous and hollow products, which offer energy and raw material efficiency both during production and use.

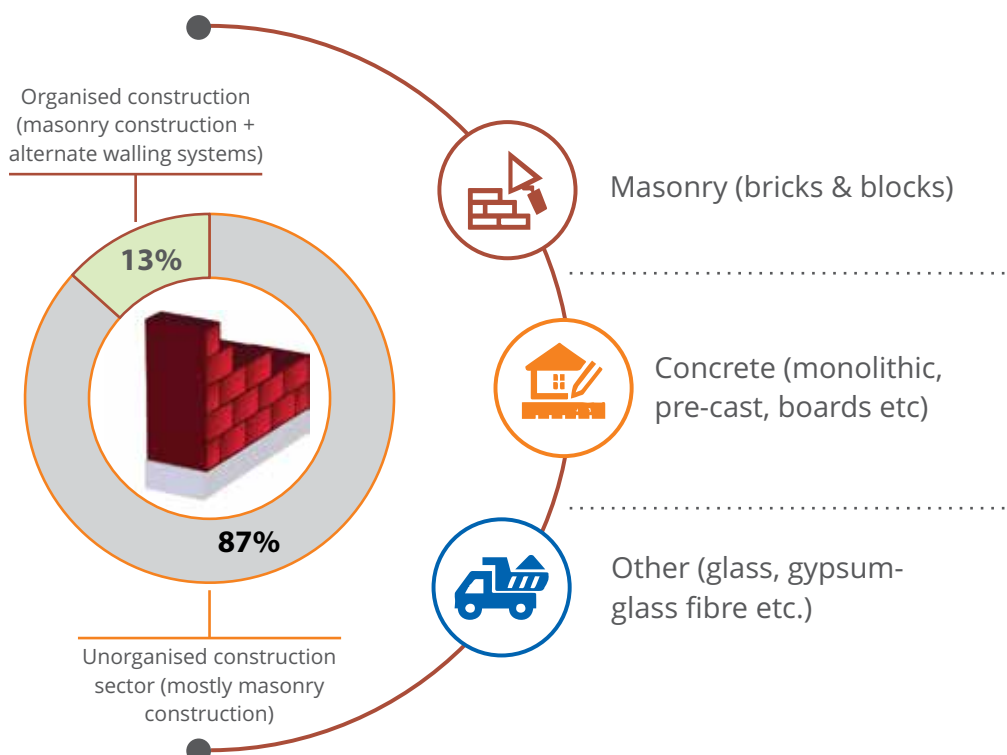
India has an opportunity to choose 'Energy-efficient bricks' as a more environmentally sustainable pathway in infrastructure development.

Active steering shall enable India to lock itself into an energy efficient and sustainable infrastructure.

A building brick or block, in the context of this document, is defined as a building material in the form of a rectangular unit which is primarily used to make walls of buildings using masonry construction techniques. The other applications of bricks and blocks are in the construction of pavements, boundary walls, canals, drains, and other elements.

The largest application of building bricks and blocks is for the construction of walls. Apart from brick masonry construction, a variety of other materials and construction techniques exist for the construction of walls (Figure 3).

Figure 3: Technologies for the construction of walls



In India, the organized real estate sector is estimated to construct around 0.1 billion m²/ year, which is a small segment (~13%) of the total annual building construction² in India. The organized construction sector makes use of both brick masonry as well as alternate walling technologies.

Construction carried out by the unorganized sector which includes construction done by local masons, civil contractors, small builders as well as self-construction is estimated at around 0.65 billion m²/year³ (~ 87%) making it the main mode of construction in the country (Figure 3). Within the unorganized sector, brick masonry construction is the most popular method for the construction of walls.

In the coming decades, while the percentage shares of both the organized real estate sector as well as alternative technologies for wall construction are likely to increase, that of bricks and blocks-based masonry construction is also expected to increase to retain the Lions share in wall construction.

2.1 Types of bricks and Market demand

The brick manufacturing sector contributes 0.7% of India's GDP and employs one of the nation's largest workforce after agriculture. It is also one of the largest (coal) energy users and source of GHG emissions from India.

India is the world's second-largest producer of bricks, with an annual production of around 250–300 billion bricks⁴ (440–530 million m³) per annum^{5,6}. Given the large projected increase in the building stock in India, the demand for bricks is expected to multiply by 3-4 times in next 20 years and reach 750-1000 billion brick/year.

There are various types of bricks being produced, the main being solid burnt clay bricks, fly ash bricks (with cement), fly ash bricks (with lime and gypsum), solid and hollow concrete blocks, and aerated autoclaved concrete (AAC) blocks. Around 85% of the bricks produced are burnt clay bricks and the remaining 15% are non-fired bricks (AAC blocks, flyash bricks, concrete blocks, etc.). Perforated and hollow clay brick products comprise less than 0.5%

Based on the experiences in Europe, and Asian countries like China⁷ and Vietnam, despite introduction of non-fired bricks, the burnt-clay brick industry is likely to retain a market share of 60%-80% in the future. Projections suggest that raw material availability in the future for

²Bain & Company, Residential real estate in India http://www.naredco.in/notification/pdfs/FINAL_India_Real_Estate_Digest_ALL_pages.pdf accessed on 01 June 2017.

³The total built-up area in India is estimated to be around 15 billion m² by NITI Aayog (IESS, 2047). If we take an annual growth rate of a 5% increase in the building built-up area, the annual addition in the built-up area will be 0.75 billion m²/year. The organized real estate constructs around 0.1 billion m²/year, thus the remaining 0.65 billion m²/year is assumed to be constructed by the unorganized construction sector.

⁴Standard size of brick is taken as 230 mm x 110 mm x 70 mm, which is the most prevalent brick size in the country.

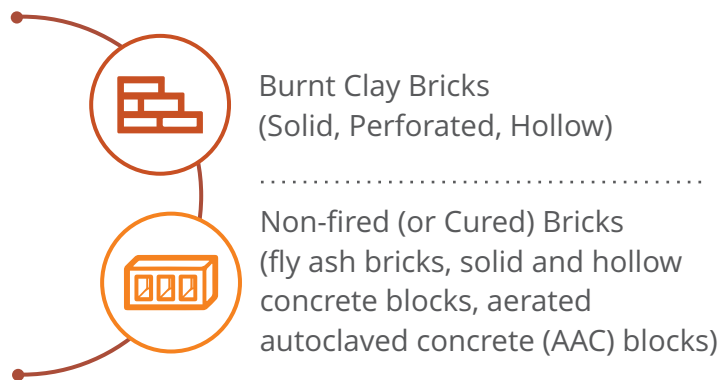
⁵Bricks are mainly used for the construction of different types of walls and it may be more useful if the annual production is expressed in terms of volume of walling material produced.

⁶It is to be noted that there is a lack of officially validated data on both the manufacturing side as well as on the consumption side i.e. on the building construction. The majority of the brick production takes place in small manufacturing units belonging to the unorganized sector. Thus, most of the numbers used in this paper are taken from estimates available in reports prepared by non-government organizations working in the brick sector such as The Energy and Resources Institute (TERI), Centre for Science and Environment & Greentech Knowledge Solutions.

⁷Data sourced from The Fired Brick Industry in China. Presentation made by Xiaolin Yu at Second Policy & Advocacy Network (PAN) Asia Workshop, 20-21 June 2019, Organized by ICIMOD, Climate & Clean Air Coalition & UNEP

alternate products like Autoclaved Aerated Concrete (AAC) blocks, flyash bricks, etc. would not be enough to meet the brick demand of the country. Given the global experience and raw material trends, it is thus prudent to assess that the burnt-clay brick will continue to command significant market share even in the future.

Figure 4: Types of bricks



2.2 Opportunities for energy savings

Energy Use in Manufacturing

Burnt clay brick (the traditional red brick) making accounts for significant energy consumption, wherein nearly twenty to forty percent of a brick's cost of manufacture is due to energy.

Solid burnt clay bricks are manufactured in small manufacturing units belonging to the unorganized/informal sector. The estimated number of such manufacturing units range from 1,50,000 to 2,80,000. Most of the brick production (around 75% of the total bricks produced) is accounted by 50,000 - 60,000 relatively bigger units based on arch-less moving-fire continuous kiln technologies (fixed chimney bull's trench kiln technology and zig-zag kiln technology), with a typical production capacity of 30-70 lakh bricks/year/enterprise. A few medium/large scale enterprises are also in operation, involved in the production of mostly perforated and hollow burnt clay bricks⁸. Coal and biomass fuels are used for firing bricks and the annual consumption is estimated at around 30-35 million tons of coal and 10 million tons of biomass fuels.

The average⁹ specific energy of manufacturing burnt clay bricks ranges from 1300 – 3200 MJ/m³ based on factors such as:

- ▶ Type of brick kiln technology employed (viz. the Specific Energy Consumption (SEC) of the kiln technology) and

⁸The pictorial brick manufacturing process and solid brick alternate options are shown in Annexure-V.

⁹The “average specific energy” term encapsulates the range of average SEC of different “brick product-production process” combinations. For example, SEC of “solid brick-clamp kiln” combination varies between 2400 to 4000, and the average SEC would be 3200 (Refer row 1 of Table 1).

Lessons from China

China started modernizing the fired clay brick industry since 1990. Even today, the fired clay brick continues to hold the largest market share and the current production is estimated at over 1000 billion bricks/ year.

Over 25 years, three clear transformation trends have emerged:

Consolidation of brick manufacturing — large scale (1200 tpd sizes) in about 4000 units. Earlier this was around 100-200 tpd in 150,000 plus kilns. The kilns are also located close to raw material supply chain in the hinterland.

Shift to modern technologies like Tunnel and Rotary Tunnel kiln working all around the year.

Clay remains the main raw material constituting 85% of the brick market. However, instead of depending on clay from agriculture fields, new sources of clay have been identified and instead of solid brick now the product mix has larger share of perforated and hollow bricks.

- Brick material density (mainly depends on the type of final product – solid/perforated/hollow)

Table 1: Indicative Average Specific Manufacturing Energy (MJ/m³, by Product/Process)

Type of Brick Product	Indicative Average Specific Manufacturing Energy (MJ/m ³)	Process & Assumption
Solid burnt clay brick – Clamp kiln	3200 MJ/m ³	Mostly manual clay preparation and moulding; sun drying; Fired in clamp/downdraught kiln; Specific Energy Consumption 1.5 – 2.5 MJ/kg, Average SEC – 2.0 MJ/kg; Average brick density of 1600 kg/m ³ .
Solid burnt clay brick - FCBTK	2100 MJ/m ³	Mostly manual clay preparation and moulding; sun drying; Fired in FCBTK; Specific Energy Consumption of 1.1 – 1.5 MJ/kg of fired brick, Average SEC 1.3 MJ/kg; Average brick density of 1600 kg/m ³ .
Solid burnt clay brick – Zigzag kiln	1800 MJ/m ³	Mostly manual clay preparation and moulding; sun drying; Fired in Zigzag kiln; Specific Energy Consumption of 0.95-1.3 MJ/kg, Average SEC – 1.125 MJ/kg; Average brick density of 1600 kg/m ³ .
Burnt perforated clay brick – Zigzag kiln (around 25% perforation)	1600 MJ/m ³	Semi-mechanized clay preparation; extrusion; shed/sun-drying; Fired in a Zigzag kiln; Specific Energy Consumption of 1.0-1.35 MJ/kg, Average SEC – 1.175 MJ/kg; Average brick density of 1350 kg/m ³
Burnt hollow clay block – Tunnel kiln (around 60% perforation)	1300 MJ/m ³	Mechanized clay preparation, extrusion, followed by artificial drying; Fired in a Tunnel kiln; Specific Manufacturing Energy Consumption of around 1.6 MJ/kg of fired brick; Average brick density of 800 kg/m ³ .

Source: GKSPL, 2017: Roadmap for Resource Efficient Bricks

In recent years, the burnt clay brick production has seen some improvements in energy efficiency due to the implementation of pollution control board directives to reduce air pollution from brick kilns through a shift to Zigzag kiln technology from FCBTK technology. It is to be noted that despite a change in the brick kiln technology, the type of brick product produced has not changed and remains the solid burnt clay brick.

There will be a significant improvement in energy efficiency if the kiln technology is further upgraded to, say, tunnel kilns, as well as there is a shift from solid bricks to hollow/perforated bricks. Even Zigzag kilns with a change in product will yield substantial energy efficiency gains.

Thus, the key to energy efficiency in the Brick manufacturing sector is to encourage a comprehensive shift rather than incremental changes.

Although nearly twenty to forty percent of cost of brick manufacture is due to energy, comprehensive energy efficiency improvements¹⁰ and technology modernization (apart from incremental improvements¹¹ due to tightening emissions standards¹²), have not found much traction in India due to a variety of factors apart from, (inter-alia):

Historical: traditional Brick making has low entry barriers and large risks (weather, cyclic market); thus, entrepreneurs seek (quick) profitability by extracting savings from labour, machinery, customers and regulation compliance. The uncertainties in the sector are aptly captured in the Hindi proverb *bhatta baith gaya!*

Policy Stability: frequent revisions and lack of clarity in policy surrounding mining, use of alternative materials (e.g. fly-ash) discourage brick kiln owners to invest in new technology.

Perception overhang: Brick output quality mix from traditional kilns is - 50% (Good)/25% (under-fired)/25% (over-fired). This puts pressure on the pricing of good bricks and in the past encouraged dumping of the low-quality product through bulk public and private construction projects. The low-quality product coupled with non-compliance with regulations has dimmed the entire sector perception, especially amongst policymaking circles.

Brick price: Brick owner recover costs of technology risk, fuel choice, marketing, financing, etc through end-product price which ranges from Rs 1.5 to 3 per kg solid brick to Rs 2.5 to 5 per kg Hollow Blocks. Price of product varies across regions like North-West India is low whereas, in Bengal, North East states and parts of South India better pricing and profitability encourages brick makers to consider technology upgradation.

¹⁰Comprehensive energy efficiency improvements focus on modernization of all steps in brick manufacturing process AND shift in product from dense solid to lower density (e.g. perforated, hollow) bricks and/or diversified brick and tile production. It is characterized by the use of machinery for clay-mixing and brick forming (e.g. extrusion), use of artificial dryers and efficient/modern kilns (e.g. zigzag, tunnel kiln). The brick manufacturing enterprise transforms from "traditional informal enterprise" to "organized formal enterprise" and significant improvements in working conditions. Typically, 30-50% reductions in SEC (MJ/m³ of brick) are possible when perforated and hollow products are produced.



¹¹Incremental energy efficiency improvements mean energy efficiency improvements due to incremental improvements in traditional brick kilns e.g. retrofitting fixed chimney BTK to zigzag kiln. There is no change in the final product (solid brick), and no significant change in the brick manufacturing process, nature of enterprise and working conditions. Typically, 15-20% reductions are possible in SEC through incremental improvements like retrofitting FCBTKs to Zigzag kilns.

¹²Two incremental energy efficiency improvements in the brick industry have happened due to the implementation of emissions standards to control air pollution emissions. This includes, shift from movable chimney to Fixed Chimney Bull's Trench Kiln (FCBTK) technology in the late 1990s and the ongoing shift from FCBTK to Zigzag kiln. In both cases (if done correctly), the shift results in 15-20% reduction in specific energy consumption.

Overall, end-product brick price to the consumer does not encourage investments to bring in comprehensive energy efficiency technology in the sector. The price arbitrage from bricks manufactured using traditional kilns and those using modern technology creates a perception of lack of affordability, which is reflected by the less than 0.5 market share of burnt clay brick units manufacturing perforated/ hollow bricks in India.

Energy Efficiency- The Opportunity

Introducing comprehensive energy efficiency in brick making will not only reduce energy use, but it would also result in reductions in raw material use.

Manufacturing of burnt clay bricks: The average specific energy of manufacturing burnt clay bricks ranges from 1300 – 3200 MJ/m³. The energy consumption for the manufacturing of bricks can be reduced by following two broad paths:

1. Kiln Efficiency Improvements: Changeover from the traditional kilns like clamp and Fixed Chimney Bull Trench Kiln (FCBTK) to Zigzag and other efficient brick kilns (e.g. Tunnel kiln) for the firing of burnt clay bricks.
2. Shift to Alternative Clay Bricks: Changeover from solid burnt clay bricks to lighter¹³ burnt clay products (porous, perforated or hollow bricks/blocks). At present, there are just a few enterprises involved in the production of perforated and hollow burnt clay bricks.

Operational Energy of Buildings: The Bureau of Energy Efficiency has come out with two building energy conservation codes – Energy Conservation Building Code, 2017 for commercial buildings and Eco-Niwas Samhita (Part 1), 2018 for residential buildings. Both codes aim at reducing heat transmission from the building envelope to reduce the operational energy required for cooling or heating of the building. The choice of brick impacts the thermal transmission value of the outer walls of a building. **Usually, the lighter clay brick products (porous or hollow bricks/blocks) also have lower thermal conductivity values.** The use of bricks having lower thermal conductivity for construction of the outer wall helps in energy savings in the operational life of the building and thus can support meeting the requirements of the energy conservation building codes.

As per a 2017 Indo German Energy Forum (IGEF) report conducted by TERI on behalf of BEE, burnt clay brick manufacturing has been identified with the second-largest potential for energy efficiency amongst the industrial sector in India with savings of around 2 mtoe by 2031 and 4 mtoe by 2041¹⁴. Therefore, a national initiative must be launched to transform clay brick production in the country and to realise the sectors energy-saving potential.

Market driven sectoral transformations have been successfully tried out in a diversity of sectors in India to scale up energy efficiency.

Modernization of brick manufacturing is a low hanging energy efficiency fruit, which has recently started through conversions to zig-zag / tunnel kilns albeit with low momentum. This momentum needs to be accelerated to enhance the supply and bring in affordability through economy of scale.

¹³Lighter products (porous and hollow products) have lower specific manufacturing energy (MJ/m³). Usually, these bricks (because of porosity or presence of air gaps) also have lower thermal conductivity values which help in lowering the operational energy of the building.

¹⁴The largest is the iron and steel sub-sector (about 27 mtoe by 2031 itself and 45 mtoe by 2041)

2.3 Barriers to adoption of energy-efficiency in brick sector

Supply Side Barriers

- a) Lack of appropriate technology package at an affordable price, and technical support:

The burnt clay brick production involves several processes, the main being clay preparation, shaping/ moulding, drying, firing, and material handling. Shift to zigzag kiln brings-in improvement only in the firing process and others remain the same.

Shift to the production of perforated and hollow brick products to achieve larger energy efficiency targets will require upgradation in all aspects of the brick-making processes including choice of raw material, degree of mechanization and production capacity.

Apart from a few, most of the technology vendors are based abroad. Investment required in procurement from turnkey suppliers (European / Chinese) abroad is very high. Moreover, the entrepreneur faces difficulties in deciding the best fit technology for his plant for a specific product-mix, and then integrating the procured machinery from different vendors, including any indigenous common machinery, for results.

Standardization of appropriate technology packages may bring in economy of scale and thus affordable technology pricing. Besides, with limited technical capabilities, the manufacturing enterprises may also require technical support in the selection of technologies and dissemination of operational best practices.

- b) Lack of access to finance for technology upgradation

Brick manufacturing enterprises are mostly financed wholly by the entrepreneur or through informal arrangements as the majority of them are informal producers with no fixed assets. Thus, the business seldom has a credit history.

Technology modernization is also expensive. A traditional (manual labour intensive) brick kiln based on FCBTK would cost around INR 5 million to commission. A modern tunnel kiln would easily take around INR 70 million. Add to this investment required for mechanization of value chain activities and the investment stretches to around INR 120 million.

Table 2: Comparative cost of kiln technologies

Cost of establishing a new FCBTK kiln	INR 5 million
Cost of establishing a new Zigzag kiln	INR 5 million
Cost of upgrading an existing FCBTK to Zigzag kiln	INR 2 million
Cost of establishing a new Tunnel kiln	INR 70 -120 million

To finance heavy Capex, a financier would seek commensurate collateral in place of credit history which is difficult to obtain. Very few entrepreneurs venture to extend such collateral.

Further, there are no government incentives or financial products to attract energy efficient technology investments.



Given this context, viable project financing models do not exist. Thus, overall there is a lack of formal finance in upgradation of the enterprises.

c) Limited or lack of assured market demand for energy efficient bricks

The market demand is dominated by solid burnt clay bricks, especially in the unorganized construction sector. The perforated and hollow bricks are being used in very limited regions. This limited or lack of market demand hinders the manufacturing enterprises to invest. It is also seen as a risk by the financiers in financing the manufacturing enterprises.

A perceived sustained shift of customer preference towards such energy efficient products shall enable serious adoption of energy efficiency by brick manufacturers.

d) Uncertainty in the environment and mining policies / Creation of Perverse incentives

Lack of clarity and certainty in policy surrounding mining, use of alternative raw materials (e.g. fly-ash) pose uncertainty to the future of clay brick industry and discourages brick kiln owners to invest in new technology. For example, a draft amendment to the fly ash notification issued by MoEFCC vide notification dated 25 Feb 2019 proposed shift of all the clay brick manufacturing units to fly ash brick manufacturing, without analyzing the reasons for the slow progress in the implementation of previous fly ash regulation in the brick sector during last 20 years.

Demand Side Barriers

a) Higher product cost (Issue of Affordability):

Solid burnt clay bricks are priced significantly less than the perforated/ hollow bricks. The lower price is explained by the

- 🔸 lower capital requirement and manual labour

- the informal nature of the burnt clay brick manufacturing
- intense competition among burnt clay brick manufacturing enterprises and
- negligible marketing expenses since the product is well entrenched in the market

On the other hand, the bricks manufactured through energy efficient processes (e.g. perforated and hollow burnt clay blocks) are mostly manufactured in

- the formal sector with a higher cost of compliance with regulations related to environment, labour, etc.
- capital intensive to bring in economy of scale
- marketing of product

A market assessment study on perforated and hollow burnt clay bricks¹⁵, found that one of the reasons for the higher price of the product in North India was small production capacity (thus low economy of scale), low plant utilization factor coupled with the higher expenditure on the marketing of the product. Builders also perceive the product as being expensive to their projects or cite lack of masonry skills for use. However, this is not universally true as experience from Bengaluru market shows that the use of lighter and bigger hollow blocks for constructing apartments, results in lower cost of overall project construction due to savings in reinforcement (steel, cement) and faster construction¹⁶.

b) Lack of awareness among end-users and limited availability:

While the solid burnt clay bricks are produced across the country, the production of other types of bricks is usually confined to a few regions. For example, the hollow burnt clay blocks are produced mainly in the area around Bengaluru and Kerala.

The awareness about the energy efficient manufacturing of bricks and its benefits especially to end-user is low. Moreover, products like hollow burnt clay blocks are yet to be included in the Schedule of Rate (SoR) with state PWDs which hinders their use in government construction.

c) Perceived lack of standards/Assurance:

Construction is a traditional and risk-averse business. The builders, individual homeowners, contractors and masons are hesitant to adopt a new product or a construction technique. The process of adoption of any new brick product is slow. There are no widely used Marks/ labels or rating systems which inform the end-user about the energy-environment performance of the bricks used.

¹⁵GKSPL (2016). Market Assessment for Burnt Clay Resource Efficient Bricks (REBs). UNDP-GEF project on Energy Efficiency Improvements in Indian Brick Industry.

¹⁶Refer section of this document where the estimated savings are of the order of 1 to 1.5% of a project's capex outlay.







03

BRICK SECTOR MARKET TRANSFORMATION

“ It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change ”

Charles Darwin



03 | BRICK SECTOR MARKET TRANSFORMATION

3.1 The Bureau for Energy Efficiency

The Government of India set up Bureau of Energy Efficiency (BEE) on 1st March 2002 under the provisions of the Energy Conservation Act, 2001. The mandate of the Bureau of Energy Efficiency is to assist in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001 with the primary objective of reducing energy intensity of the Indian economy.

As highlighted earlier the Indo German Energy Forum (IGEF) came out with a report on the study by TERI which identified burnt clay brick manufacturing as having the second-largest potential for energy efficiency amongst the industrial sector in India with savings of around 2 mtoe by 2031 and 4 mtoe by 2041¹⁷. This energy-saving would be enough for lighting up of around 23 million households by 2031 and around 47 million households by 2041¹⁸.

Given the large potential for energy efficiency in clay brick manufacturing, the BEE is proposing a market transformation initiative for this sector, under which the end-customer market shift takes place towards bricks sourced from manufacturing units adopting lower specific energy for manufacturing and product innovation (viz. perforated and hollow bricks).

3.2 Brick Sector: Market Transformation Strategy

The BEE, under the Energy Conservation Act, 2001 has the function and powers to:

13-e: take all measures necessary to create awareness and disseminate information on efficient use of energy and its conservation.

13-j: Formulate and facilitate implementation of pilot projects and demonstration projects for promotion of efficient use of energy and its conservation.

13-k: Promote use of energy efficient processes, equipment, devices and systems.

In line with its powers the BEE proposes to launch a voluntary initiative for the brick sector.

The market transformation strategy, on one hand, focuses on lowering the specific manufacturing energy through improvements in production technologies and promoting the production of energy efficient bricks¹⁹ (supply side measures), and on the other hand, creating market demand for such manufactured bricks (demand-side measures).

The proposed strategy is dual-pronged. Firstly, it is proposed to develop a voluntary BEE accredited symbol/mark to convey the adoption of energy efficient manufacturing and develop the award process for "Energy Efficient Enterprise (E3)" symbol/mark to such manufacturers. Secondly,

¹⁷The largest is the iron and steel sub-sector (about 27 mtoe by 2031 and 45 mtoe by 2041)

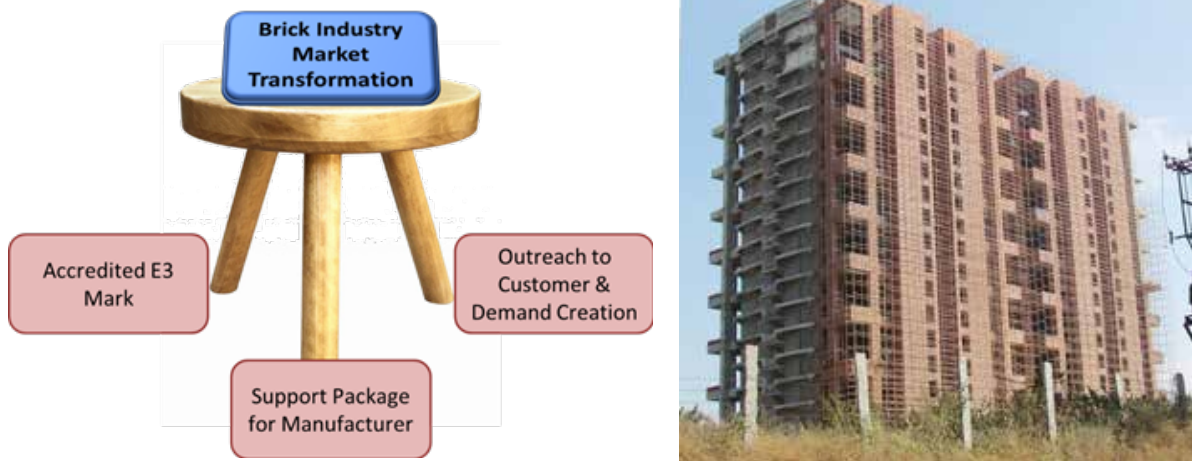
¹⁸Assumption: 7 LED lights per household (20 W each and each used for 5 hours/day) and 4 Fans per household (50 W each and each used for 10 hours/day) i.e. a minimum connected load of 340 W per household.

¹⁹Energy efficient bricks are those bricks that have lower specific manufacturing energy, i.e. those bricks which are manufactured using energy efficient technologies and processes. Additionally, these bricks, because of low density, have better insulation properties and saves energy for the home buyer or end user in air conditioning.

it is proposed to develop market demand (by E3 mark) in the eyes of the customer to source bricks from manufacturing units who manufacture energy efficiently.

The core of the strategy is depicted in Figure 5 below:

Figure 5: Proposed Strategy



The BEE accredited symbol shall be awarded to those brick manufacturers who meet the BEE proposed methodology to estimate the process SEC threshold²⁰. The Manufacturer SEC is calculated based on deemed specific manufacturing energy for different production processes (MJ/kg) and the product density (kg/m³). A manufacturer will be awarded “E3” mark if the weighted average specific manufacturing energy of the manufacturing plant is below a certain threshold value. To begin with, it is proposed that the threshold value should be kept at 25%²¹ lower than the national baseline for specific manufacturing energy of clay bricks. This threshold shall be reviewed and revised every (say) two years.

The proposed supply side interventions are:

- Energy Efficient Enterprise (E3) Mark for manufacturers with energy efficient brick production
- Support package to manufacturers to facilitate a shift to E3 marked enterprises
 - Development of standard & affordable technology packages
 - Institutional capacity building and training
 - Catalysing green finance²² (including for institutional customers as well)

²⁰Refer Section 2.3 for the Deemed SEC approach and criteria.

²¹Threshold has been set to ensure that the E3 mark is aspirational for those undertaking upgradations to zigzag kilns; possibly with additional process / product modifications.

²²Green finance refers to financial investments flowing into sustainable development projects and initiatives, environmental products, and policies that encourage the development of a more sustainable economy. Green finance includes climate finance but is not limited to it, as it could support a wider range of other environmental objectives, such as industrial pollution control, water sanitation or biodiversity protection. <https://www.thegef.org/sites/default/files/events/Intro%20to%20Green%20Finance.pdf>

The supply side interventions will be supplemented by simultaneous actions on the demand-side such as:

- Increasing demand of Energy Efficient bricks by large institutional players such as government or private builders.
- Launching a targeted outreach and communication campaign for builders, architects, and other demand influencers.

The deemed energy-saving approach proposed for estimating energy efficiency savings to manufacturer and end-user of the E3 bricks would be useful to mobilise green finance towards sector modernization and builders/ developers sourcing bricks from E3 marked manufacturers.

Figure 6: Proposed dual market strategy



The implementation of this proposed approach will require active involvement and concerted efforts of a wide range of stakeholders including various government ministries/departments. Therefore, to achieve the goal of this market transformation initiative, it is proposed to launch a “Brick Industry Mission” spearheaded by the Bureau of Energy Efficiency.

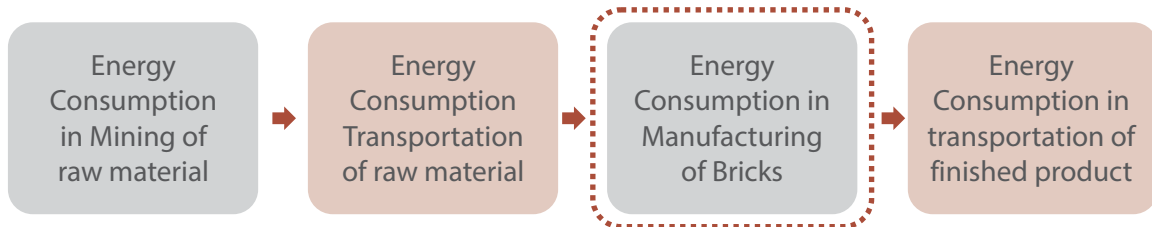
3.3 Concept of “Deemed Specific Manufacturing Energy”

Specific Manufacturing Energy

For this document, the Specific Manufacturing Energy of a brick product includes energy consumption in the manufacturing of bricks in the manufacturing plant i.e. within plant gates. The energy consumed in the mining of raw materials and transportation of raw materials and finished products is not included.

Figure 7 below shows the various stages and energy consumption involved in the entire production process of a brick product and the boundary considered for estimation of Specific Manufacturing Energy.

Figure 7: Specific Energy for Manufacturing boundary (Red dotted lines)



'Gate to Gate' manufacturer boundary: Includes energy used in brick forming, extrusion, drying, firing, plant & machinery but not the energy for mining of raw materials and transportation of finished product

Estimation of Deemed Specific Manufacturing Values (MJ/m³)

In the case of burnt clay products, the specific manufacturing energy includes fuel used in the kiln, fuel used in the drying of bricks, and electricity/diesel used in the operation of the brick manufacturing plant.

Specific manufacturing energy (MJ/m³) will depend upon two parameters:

- (i) deemed specific manufacturing energy for different production processes (MJ/kg). It will depend upon the type of production process and the kiln technology being used for manufacturing of bricks. Deemed values for different production processes and kiln technology are provided in Table 3.
- (ii) the product density (kg/m³). It will depend upon the type of brick product. The product density can be measured easily. There are standard processes for taking samples for measurement (IS 5454: 1976), and for measuring the density (ASTM C20 for bricks; and IS 2185 for blocks). The standards are common for both solid and perforated/ hollow bricks and blocks.

The deemed specific manufacturing energy (MJ/m³) for a brick product can be estimated by multiplication of the two parameters explained above.

It should be noted that for the estimation of specific manufacturing energy (MJ/m³), only the product density needs to be measured. For data on specific energy consumption in the manufacturing process, deemed values (as provided in Table 3) will be considered.

Indicative specific energy consumption in manufacturing²³ of burnt clay bricks for different production processes and kiln technologies are provided in Table 3.



²³Indicative values based on data available through sample energy audits and plant data made available by individual manufacturers.

Table 3: Indicative specific energy consumption in manufacturing

Production Process & Kiln Technology	Average Indicative Specific energy consumption in manufacturing (MJ/kg)
Mostly manual clay preparation and moulding; sun drying; Fired in clamp/downdraught kiln; Specific Energy Consumption 1.5 -2.5 MJ/kg	2.0
Mostly manual clay preparation and moulding; sun drying; Fired in FCBTK; Specific Energy Consumption of 1.1 -1.5 MJ/kg of fired brick	1.3
Mostly manual clay preparation and moulding; sun drying; Fired in Zigzag kiln; Specific Energy Consumption of 0.95 -1.30 MJ/kg;	1.125
Semi-mechanized clay preparation; extrusion/ soft mud moulding; shed/sun-drying; Fired in a Zigzag kiln. Specific Energy Consumption of 1.0-1.35 MJ/kg	1.175
Mechanized clay preparation, extrusion, followed by artificial drying; Fired in a Tunnel kiln. Specific Energy Consumption of around 1.6 MJ/kg of fired brick	1.6

Source: GKSP, 2017: Roadmap for Resource Efficient Bricks. The data of specific manufacturing energy provided in the above table is based on monitoring of brick kilns done by various agencies like TERI, GKSP, PSCST, etc. The data is available in the public domain in the form of reports, research papers and presentations.

The densities for some of the brick product samples are provided in Table 4²⁴.

Table 4: indicative densities for some of the brick products

Type of brick product	Indicative density (kg/m ³)
Solid burnt clay brick	1600
Perforated burnt clay brick(around 25% perforation)	1350
Hollow burnt clay block (around 60% perforation)	800



²⁴These values are indicative and are provided for illustration purpose only. There can be variations in densities depending upon the type of clay and production process. The densities of brick products need to be measured while the estimation of specific manufacturing energy.

3.4 “Energy Efficient Enterprise (E3)” mark

International Experience - Energy based Industry Mark

Experience is available on energy-based mark certification for 18 industry sectors (brick industry is not one of them) from the Energy Star certification in USA and Canada.

The ENERGY STAR provides Energy Performance Indicators (EPIs) to benchmark industrial plant energy performance.

The EPIs are external, industry-specific benchmarking tools that score a plant's energy performance and compare it to that of similar plants in its industry within the U.S and Canada. EPIs are developed using annual plant energy (includes all fuels) and production data for a specific manufacturing industry.

Manufacturing plants with an EPI score of 75 or more can earn the ENERGY STAR certification and display the ENERGY STAR.

Source: <https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/measure-track-and-benchmark/energy-star-energy>

E3 mark shall be awarded to an enterprise based on specific manufacturing energy parameter.

The Specific Manufacturing Energy is calculated in MJ/m³, as the bricks are to be finally used for the construction of walls. Specific manufacturing energy will be computed based on deemed specific manufacturing energy for different production processes (MJ/kg) and the product density (kg/m³).

A manufacturer will be awarded “E3” mark if the weighted average specific manufacturing energy of the manufacturing plant is below a certain threshold value.

It is proposed that this threshold value should be kept at 25% lower than the national baseline for the specific manufacturing energy of clay bricks.

This detailed explanation now follows.

Criteria for awarding “E3” Mark

Currently, the national baseline of specific manufacturing energy of burnt clay bricks and blocks is estimated to be around 2350 MJ/m³.

The threshold value for the award of “E3” mark is proposed to be kept at 1750 MJ/m³ which is 25% lower than the current baseline²⁵.

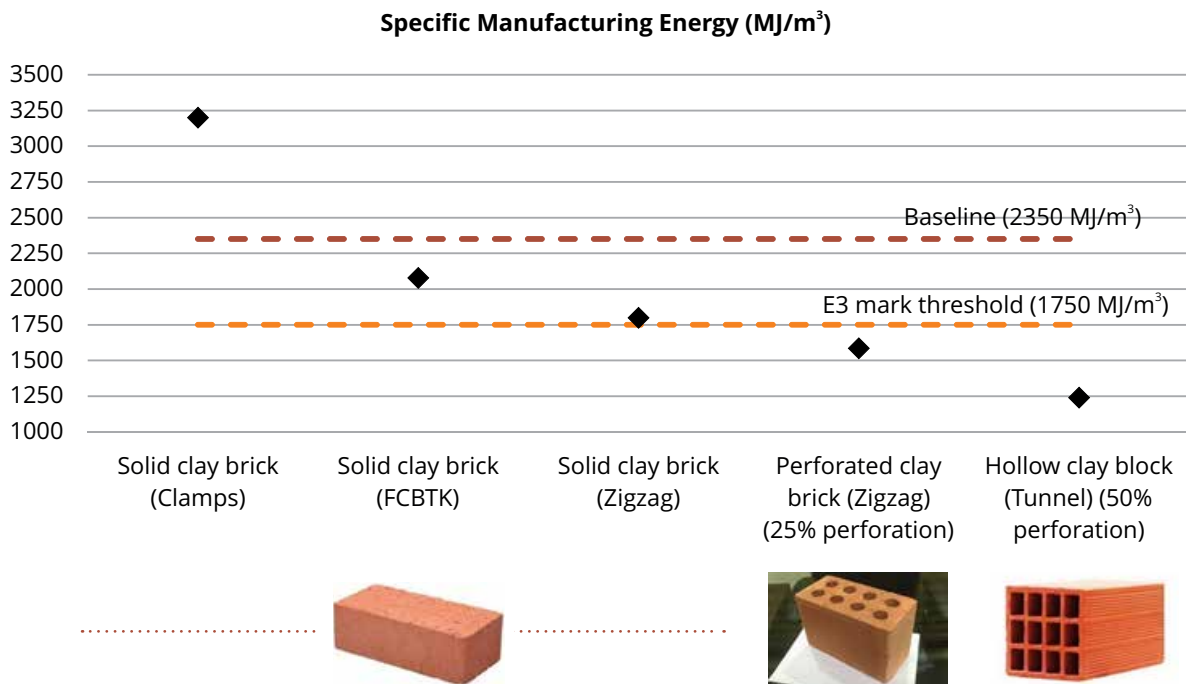
That means an enterprise will be awarded “E3” mark if the specific manufacturing energy of its manufacturing plant is lower than the threshold i.e. 1750 MJ/m³. The methodology of estimation of baseline is provided in Annexure-II.

If an enterprise is manufacturing more than one product, then for the award of “E3” mark, the weighted average specific manufacturing energy of its entire product range should be less than the threshold.

The specific manufacturing energy for various products and the proposed threshold for E3 Mark is represented in Figure 8.

²⁵It is proposed that the national baseline will be updated periodically every 2 years; thereby the threshold for the award of the E3 mark will also get updated regularly.

Figure 8: Specific Manufacturing Energy Baseline & E3 Mark Threshold for various products



MRV Methodology based on Deemed Specific Manufacturing Values

It will not be required to do a complete energy audit of the manufacturing unit at the time of award of E3 mark or for estimation of energy savings.

The Measurement, Reporting and Verification (MRV) methodology for the award of "E3" mark will be based on deemed values of specific manufacturing energy of various manufacturing technologies and processes as specified in Table 3. The estimation of energy efficiency savings will also be based on the deemed values.

The detailed process for award of "E3" mark is explained in Annexure-I.

3.5 Thrust Areas

The objective of this initiative to promote Energy Efficiency in the manufacturing of Bricks, through comprehensive technology and product change.

The thrust areas under the initiative and their brief overview are discussed below. The detailed action plan for these thrust areas for the first year is provided in section 4.

Thrust Area-1: Development of Brick Industry Mission

Develop Brick Industry Mission in consultation with the key stakeholders, key government ministries and agencies and get their inputs and buy-in for the programme. The mission document will lay the guidelines for implementation of the initiative.

Thrust Area-2: Branding of manufacturers producing energy efficient bricks through “E3” mark

The E3 marking accreditation process is proposed to be established by a national agency viz. the BEE. This E3 marking will result in enhanced visibility of the brick manufacturing enterprise in the eyes of consumers looking for their products. A simple and robust process will be adopted for the award of E3 marking.

Thrust Area-3: Comprehensive support package to manufacturers to facilitate the shift to E3 enterprises

The key activities under this may include (inter-alia):

- Development of standard & affordable technology packages customised to Indian industry requirements
- Institutional capacity building and training
 - Deployment of simulation software to assist industry in plant design and operation
 - Knowledge exchange through exposure visit of Indian entrepreneurs to countries like China and Vietnam
 - Assistance in the creation of an ecosystem of technology providers, suppliers, test labs
- Catalysing green finance and incentive

Thrust Area-4: Creation of market demand for E3 mark sourced bricks

The key activities under this may include (inter-alia):

- Increasing demand for E3 mark sourced bricks by large institutional players through getting them included in the schedule of rates, developing standard procurement guidelines, and where possible through aggregated / bulk procurement
- Launching a communication and capacity building campaign targeted at builders, architects, contractors and home buyers for the uptake of E3 mark bricks.







04

IMPLEMENTATION
ARRANGEMENT

 *Openness brings progress while seclusion leads to backwardness* 

Xi Jinping



04 | IMPLEMENTATION ARRANGEMENT

The initiative is proposed to be spearheaded by the BEE and implemented in two phases:

Phase-1: Initiation Phase

The initiation phase will be around 12-month duration. During this phase, the strategy will be implemented and tested in two selected regions. This phase will be focused upon establishing the mechanism for the award of E3 mark, developing the standard technology packages, developing communication and outreach materials targeted at various stakeholders such as manufacturers, consumers, financing agencies and relevant government stakeholders, and mobilization and exposure of the potential manufacturers, technology providers and key consumers. The institutional framework and the implementation procedures will also be established during this phase.

The potential regions for implementation during the initiation phase can be

1. Region-1: Bengaluru - Chennai - Coimbatore - Madurai (South India)
2. Region-2: Delhi NCR – Chandigarh - Varanasi (North India)

These locations are proposed for the pilot mainly because of the following reasons:

- Setting up a new E3 manufacturing plant would itself take around 2-3 years. At these proposed locations, the manufacturing capacity required to produce energy efficient bricks already exists. This will ensure the availability of energy efficient bricks in the market from the beginning and help in expediting the implementation and testing of the concept.
- There is also initial level awareness about the benefits of the use of energy efficient bricks among the users at these pilot locations.

The outcomes from this phase will be crucial to laying the foundation for scaling up implementation nationwide before undertaking the national launch of the Brick Industry Mission.

Phase-2: National Brick Industry Mission

The National Brick Industry Mission is proposed for the 4-year duration (say) 2020 till 2024. Under the mission, major clay brick manufacturing clusters in the country are expected to be covered. Detailed action plan for the National Brick Mission will be developed during the Initiation Phase.

4.1 Stakeholders, Roles and Responsibilities

Table 5: Stakeholders, Roles and Responsibilities

S. No.	Stakeholder	Role	Responsibilities
1	Bureau of Energy Efficiency	<ul style="list-style-type: none"> Ownership of the programme and overall supervision of its implementation. 	<ul style="list-style-type: none"> Develop and own the National Brick Mission Establishing mechanism for E3 enterprise marking, ensuring its credibility, and empanelment of relevant agencies for this purpose Up-dation of baseline & threshold for E3 mark Keep data on pilots/ dashboard updated Advertisement, communication and outreach Convening of Stakeholder Consultations
2	Government ministries/ departments/ agencies in the building sector & environment (MoHUA, MoEFCC, BMTPC, CPWD, PWD, NBCC, TCPO, BIS etc.)	<ul style="list-style-type: none"> Promote EE bricks through adoption and regulation and help in market creation. 	<ul style="list-style-type: none"> Utilisation of E3 mark sourced bricks in construction projects supported/ implemented by them Facilitate modifications in building and environment regulations/ incentives to incorporate E3 sourced bricks Integration of E3 bricks in the Pradhan Mantri Awas Yojana
3	GIZ	<ul style="list-style-type: none"> Assist BEE in the implementation of the programme. 	<ul style="list-style-type: none"> Coordinate implementation with the Technical Support Agency Provide strategic advice and technical support to BEE Any other in consultation with the BEE
4	Empanelled/ Accredited Agencies for awarding E3 mark	<ul style="list-style-type: none"> E3 mark to manufacturers 	<ul style="list-style-type: none"> To analyse and validate information received from manufacturers and recommend the award of E3 mark following BEE laid down criteria and process
5	Green Financing Agencies (IFC, KfW, etc.) and MSME focussed banks (RBL, Yes Bank, Bandhan Bank, etc)	<ul style="list-style-type: none"> Make green finance available for E3 manufacturers (and institutional builders) 	<ul style="list-style-type: none"> To recognise the E3 mark for gaining eligibility for green finance To develop specific financing products

S. No.	Stakeholder	Role	Responsibilities
6	Brick producers and their associations	– Shift toward E3 enterprises	– Motivate members to adopt E3 mark
7	Builders and their associations (CREDAI, NAREDCO, etc)	– Help in creation of the market for energy efficient bricks	– To use energy efficient bricks in their projects and procure from E3 enterprises
8	Homebuyers	– Create demand	– To demand construction made from E3 marked bricks for better energy and environmental performance during ownership.
9	Local Facilitators (e.g.: Smart city, CREDAI and IIA local chapters, urban local bodies, etc.)	– Facilitate demand creation for energy efficient bricks	– As local demand influencers expected to aid in demand creation for energy efficient bricks

A Technical Support Agency (TSA) will be engaged to provide technical support to BEE during the implementation of the programme. Suggested scope of work for the TSA are provided in Annexure-IV.

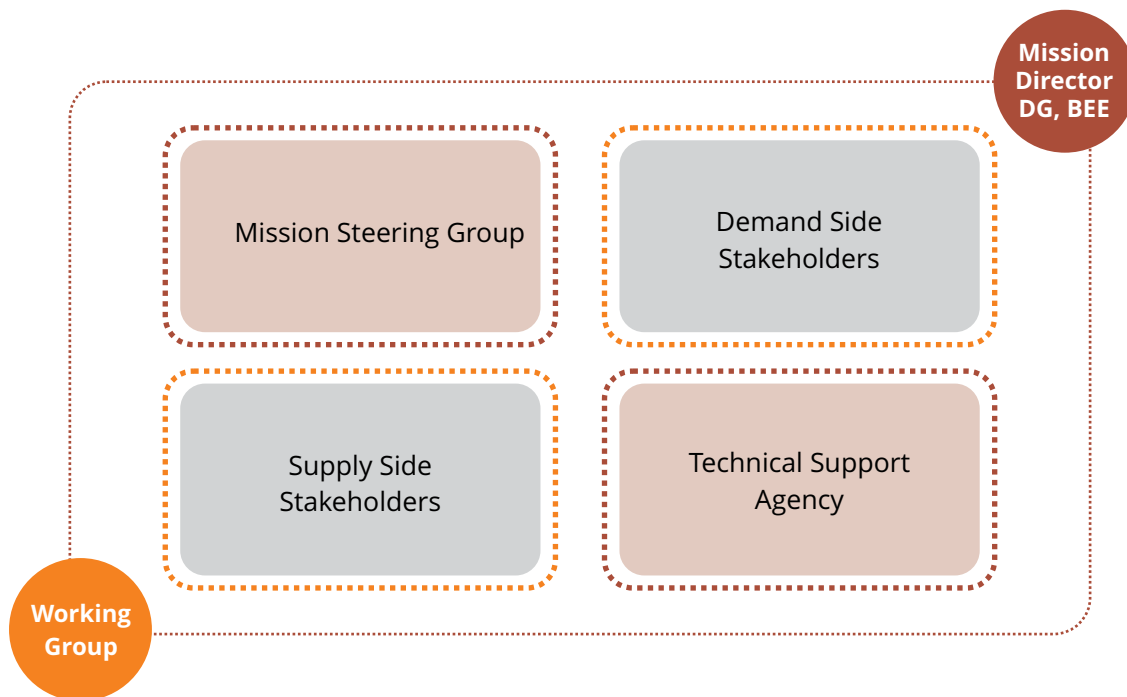
4.2 Institutional framework for implementation

The initiation phase will be mainly implemented by the BEE. The relevant government ministries or agencies such as Ministry of Environment Forest and Climate Change (MoEFCC), Ministry of Housing and Urban Affairs (MoHUA), Building Materials and Technology Promotion Council (BMTPC) will be important partners in the proposed initiative. These stakeholders will be engaged during initiation phase and will be part of the Mission Steering Group for implementation of the National Brick Mission. To facilitate communication with these key stakeholders and get their buy-in for the programme, a policy maker's meet will be organised at the beginning of the Initiation phase.



The institutional arrangement for the implementation of the National Brick Mission is presented in Figure 9.

Figure 9: Institutional Map under the Mission



Mission Steering Group (MSG)

- ▶ Apex committee to review / guide all tasks
- ▶ ~10-15 member: MoP, BEE, GIZ, CPWD, EESL, Association (Brick, Builder), MoEF, MoUD, MSME, CPCB, BMPTC, SDAs, Smart Cities, CSE, Financiers etc

Mission Steering Group (MSG)

- ▶ Guide and Review tasks document development and Review Stakeholder inputs related to Mission development
- ▶ Mission development
- ▶ Pilot thrust areas (SEC baseline data, Procurement guidelines, Technology modules, Accreditation Process, Symbol, Agreements etc).
- ▶ ~10 Multi-institutional membership: BEE, GIZ, Brick manufacturer, Builder, PWD, SDA, Technology, Financiers, SPCB, ULB, CEPT etc.





05

ACTION PLAN FOR
INITIATION PHASE

💧💧 *Genius is in the idea. Impact, however, comes from action* 💧💧

Simon Sinek



05 | ACTION PLAN FOR INITIATION PHASE

The activities planned to be undertaken under different thrust areas under the initiation phase and the action plan are discussed below. As a first step, a Technical Support Agency (TSA) will be hired to support in the implementation of the initiation phase, and the two regions for the pilot will be finalised.

Activity-0: Hiring of Technical Support Agency & Finalization of the two regions for implementation of Initiation Phase (Month 0)

A Technical Support Agency (TSA) is proposed to provide technical and implementation support to BEE (refer Annexure-IV). The two regions will be finalized for implementation of the initiation phase and testing of the strategy.

Primary responsibility: GIZ & BEE

Indicator: TSA hired, and Two pilot locations finalized

Timeline: Month 0

5.1 Thrust Area-1: Development of Brick Industry Mission

Key Activities & Responsibilities:

1. Organization of Policy Maker's Meet (Month 1)

To initiate communication with the key government ministries and agencies and get their inputs and buy-in for the programme, a policy maker's meet will be organized at the beginning of the Initiation phase. These along with other stakeholders shall be invited to be part of the mission steering group for implementation of the National Brick Industry Mission.

Responsibility: TSA with support from GIZ & BEE

2. Preparation of draft National Brick Industry Mission Document (Month 1-3)

The draft National Brick Mission document will be prepared. The inputs received from the policy makers meet and other stakeholder consultations organized under other thrust areas will also be incorporated in the mission document.

Responsibility: TSA

3. Stakeholder consultation on the draft National Brick Industry Mission Document (Month 4)

A consultation will be organized to gather inputs and suggestions from the stakeholders on the draft brick mission document.

Responsibility: TSA with support from GIZ & BEE

4. Final National Brick Industry Mission Document (Month 4-6)

Based on the inputs, the National Brick Industry Mission document will be finalized. The Brick Mission Operational Plan (maybe in the form of an annexure to the mission document or as a separate document) will also be prepared. The learnings and impacts gained from implementation of the initiation phase will also be incorporated in the brick mission document.

Responsibility: TSA

Performance Indicators and Timeline:

Performance Indicator	Timeline						
	M1	M2	M3	M4	M5	M6	M 7-12
Draft national brick industry mission document							
Stakeholder consultation							
Final brick mission document and Operational plan							

5.2 Thrust Area-2: E3 Mark to energy-efficient brick manufacturers

Key Activities & Responsibilities:

1. Preparation of tender documents for empanelment of agencies who shall award the E3 mark (Month 1)

BEE to empanel agencies via an Open Tender Process wherein two or more agencies are identified to offer the E3 mark in pilot regions. TSA shall prepare a tender document to empanel agencies who shall award the E3 mark.

Responsibility: TSA in consultation with GIZ & BEE

2. Development of the process for award of E3 Mark (Month 1)

TSA will prepare a document detailing the process to be followed for awarding E3 mark to manufacturing enterprises. This will include application formats, application review and data verification process, guidelines for the use of the E3 mark, design of E3 mark, etc. The document will be reviewed and approved by BEE.

Responsibility: TSA in consultation with GIZ & BEE

3. Empanelment of agencies for the award of E3 mark to manufacturers (Month 1-3)

BEE to empanel agencies via an Open Tender Process wherein two or more agencies are identified to offer the E3 mark in pilot regions. The potential labelling agencies include green building rating agencies (e.g. GRIHA, GBCI, IGBC, etc.), Industry facing bodies (NPC, CII, FICCI, PHDCCI, etc.) as well as inspection testing and certification bodies (e.g. TUV, UL, etc.). TSA would provide technical assistance in evaluating the applications for empanelment.

Responsibility: BEE with support from TSA & GIZ

4. Finalization of the baseline deemed MRV protocol and the E3 marking scheme (Month 2)

Specify (deemed) manufacturing energy values for different types of brick products and production processes, lay down national baseline of specific manufacturing energy (refer Annexure 1) and establish E3 mark award process. One review roundtable will be organized in each of the two regions, involving selected representatives of brick producers, brick buyers and local government. The baseline, E3 enterprise marking scheme and MRV protocol based on deemed values will be presented and finalized.

Responsibility: TSA with support from GIZ & BEE

5. Launch Event/ Stakeholder Workshop – I (Month 3)

A launch event or stakeholder workshop (proposed in Delhi) will be organised in which the initiation phase of the brick market transformation initiative will be launched. The event will bring together all concerned ministries, departments, national builders and brick industry associations, technology providers, labelling agencies, etc. TSA will assist BEE and GIZ in designing and organising the launch event.

Responsibility: GIZ & BEE with support from TSA

6. Communication and Outreach with manufacturers (Month 3-6)

The communication and outreach materials will be developed to enable outreach to the manufacturers and encourage them to upgrade towards E3 marked enterprise. The associations of manufacturers will also be engaged.

Responsibility: TSA in consultation with GIZ & BEE

7. Process of E3 marking of manufacturers (Month 4-12)

The TSA, empanelled labelling agency and local facilitators (e.g. SDA) will mobilise the brick manufacturers to shift to E3 enterprises and apply for E3 Mark. For a conventional brick manufacturing enterprise, it may take around 1-3 years to upgrade to E3 enterprise. Therefore, in the beginning, the enterprises already manufacturing energy efficient bricks will be mobilised for E3 marking. The gain the E3 mark, the E3 enterprises will sign an agreement or MoU with BEE ensuring production and supply of energy efficient bricks in certain minimum production quantity. This activity will start in month 4 and will be continued through the entire duration of the initiation phase. However, by the end of month 6, there should be at least one signed agreement (like Memorandum of Understanding (MoU)) with one E3 mark manufacturer and one User.

Responsibility: TSA and Empanelled Agency with support from GIZ & BEE

8. Dashboard (Month 3-6)

A dashboard linked to the BEE website will be created. It will give key data on the programme (energy efficient brick sales, deemed energy savings, CO2 reductions, etc). It will provide information on energy efficient bricks, host digital formats for brick manufacturers to apply for E3 marking, and will have a map showing updated geotagged locations of the E3 manufacturing locations.

Responsibility: TSA with support from GIZ & BEE

Performance Indicators and Timeline:

Performance Indicator	Timeline						
	M1	M2	M3	M4	M5	M6	M 7-12
Tender document for empanelment of labelling agencies	█						
Documents on E3 mark award process, application formats, application review and data verification process, and guidelines for the use of mark	█						
Design of E3 mark/logo			█				
Empanelment of at least one agency for the award of E3 mark			█				
Roundtable in two pilot locations to finalize the baseline, deemed MRV protocol and the E3 marking scheme		█					
E3 marking scheme launch event/ Stakeholder workshop-I		█					
Communication and outreach materials targeted at manufacturers developed			█			█	
At least one manufacturer with E3 Mark and MoU with BEE			█			█	
Dashboard linked to BEE website						█	

5.3 Thrust Area-3: Comprehensive support package to manufacturers to facilitate the shift to E3 enterprises

Key Activities & Responsibilities:

1. Development of standard & affordable technology packages customized to Indian industry requirements (Month 6-12)

TSA with support of BEE shall consult select manufacturers (India) and technology providers (India & abroad) to develop affordable technology package(s) as per Indian requirements. There may be 2-3 technology packages depending upon the desired product mix and production capacities (e.g. 100 ton per day, 200 ton per day, etc.).

Responsibility: TSA with support from GIZ & BEE

2. Institutional capacity building and training (Month 6-12)

A supportive ecosystem involving technology providers, test labs, technical services and other professional bodies to assist the manufacturing industry in this transformation. TSA with support of BEE shall mobilize potential test labs, technology providers and other professional bodies to create this support ecosystem. TSA will identify training and capacity

building needs of these bodies and will develop training modules and arrange for their training. Expert agencies from other countries (e.g. TCKI, Netherlands) will be engaged to impart training to the Indian professionals. TSA may also identify appropriate simulation software for plant design and operation and assist the industry in its use.

Responsibility: TSA with support from GIZ & BEE

3. Exposure visit of brick manufacturers, builders and policymakers to China (Month 5-6)

The clay brick industry of China has progressed substantially towards production and use of resource-efficient bricks over past the 30 years. An exposure visit to China will help in gaining understanding and learnings from their initiatives and it will also motivate the manufacturers for the transition. An exposure visit, of a delegation of key E3 manufacturers and E3 user builders along with BEE and GIZ, over a week time would serve to showcase learnings of manufacturing best practice, technology R&D institution, diversity of building application types etc.

Responsibility: TSA with support from GIZ & BEE

4. Engaging Green Financing Institutions (Month 6-12)

A pro-active engagement will be carried out with the International green financing institutions (kFW, IFC, etc), national financing institutions (SIDBI, etc.) and MSME focussed banks and NBFCs (RBL bank, Bandhan bank, Yes bank, etc.) to get them interested in the programme and offer financing to brick manufacturer who are upgrading to E3 enterprises.

Responsibility: TSA with support from GIZ & BEE

Performance Indicators and Timeline:

Performance Indicator	Timeline							
	M1	M2	M3	M4	M5	M6	M7-12	
Standard technology packages developed								
Training program for potential test labs, technology providers and other professional bodies on plant design, operation, maintenance, and raw material and product testing such as making use of simulation software, International expertise								
Exposure visit of brick manufacturers, builders and policy makers to China								
Financing of at least one manufacturer for upgradation to E3 enterprise								

5.4 Thrust Area-4: Creation of market demand for E3 mark sourced bricks

Key Activities & Responsibilities:

1. Launching a communication and outreach campaign targeted at builders, architects, contractors and home buyers for uptake of E3 mark bricks (Month 4-12)

Communication and outreach materials will be developed for consumers focusing on the benefits of using energy efficient bricks. The energy efficient bricks from the E3 enterprises are likely to become available in the market by the 5th month. It is proposed that one roundtable in each pilot location will be organized, to mobilize the targeted consumers to source bricks from E3 enterprises. Apart from key builders, market for E3 brick manufacturers will also be developed among individuals constructing their own houses and small builders. The potential consumers will be encouraged to sign an agreement or MoU with the E3 brick manufacturing enterprises or BEE for sourcing bricks for use in their projects. This activity will start in month 4 and will be continued through the entire duration of initiation phase. However, by the end of month 6, there should be at least one signed agreement/ MoU. Promotional activities may include, organisation of events for consumers, participation in exhibitions and multimedia advertisements will also be supported under this initiative.

Responsibility: TSA in consultation with GIZ & BEE

2. Increasing demand for Energy Efficient bricks by large institutional players through getting them included in the schedule of rates, developing standard procurement guidelines, and where possible through aggregated / bulk procurement (Month 4-12)

Model procurement guidelines will be prepared to aid builders/aggregators in the procurement of energy efficient bricks. TSA will also provide technical support for the inclusion of energy efficient bricks in the schedule of rates of the local government/PWD.

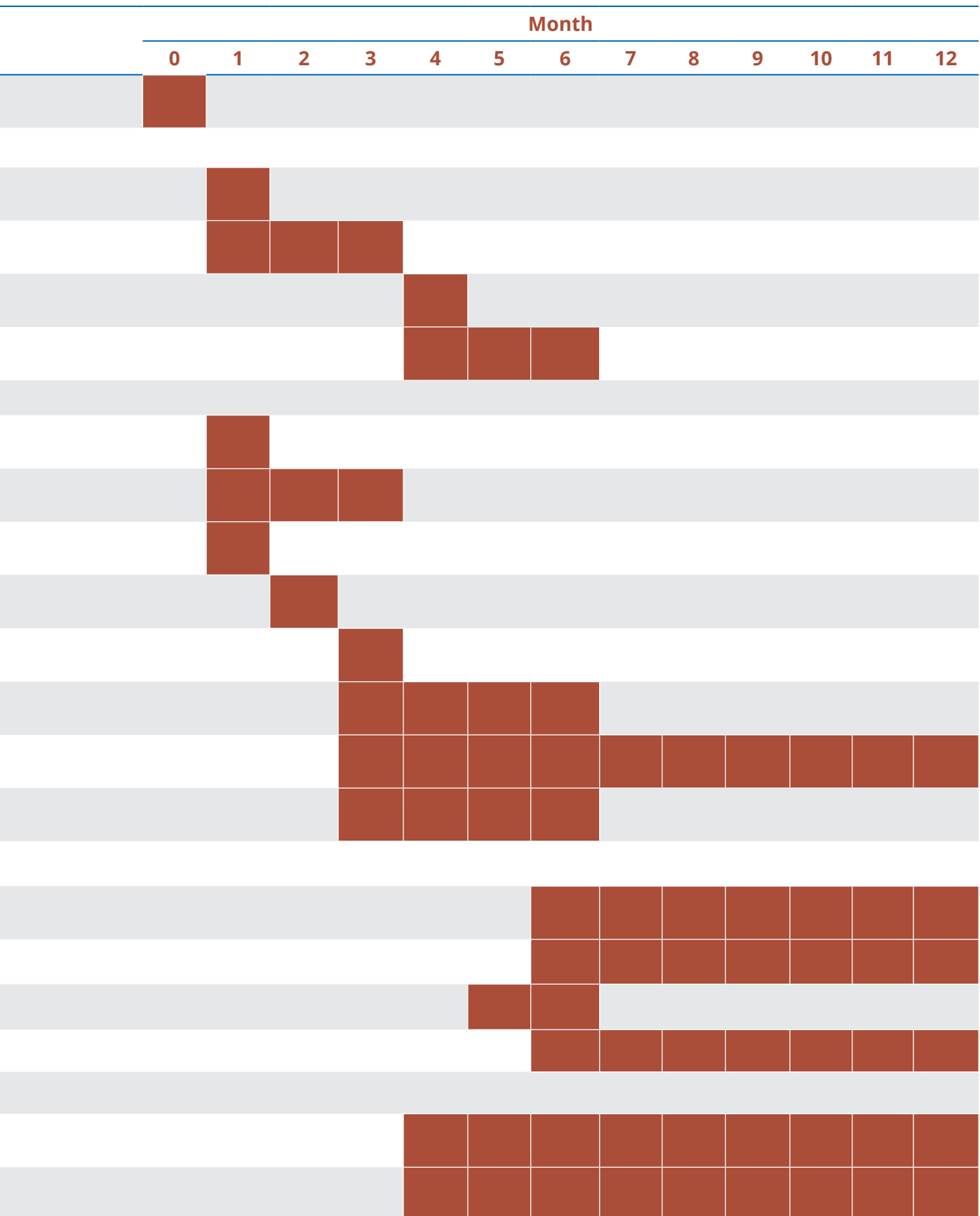
Responsibility: TSA in consultation with GIZ & BEE

Performance Indicators and Timeline:

Performance Indicator	Timeline						
	M1	M2	M3	M4	M5	M6	M7-12
Communication and outreach materials targeted at consumers developed							
At least MoU/agreement with one consumer for use of E3 Mark bricks							
Procurement guidelines for E3 bricks developed							
Inclusion of E3 bricks in SoR in pilot regions							

Table 6: Work-Plan for the Initiation Phase

Activities	Primary Responsibility
Hiring of Technical Support Agency	BEE, GIZ
Thrust Area-1:	
Policy Maker's Meet	BEE, GIZ, TSA
Draft national brick mission document	TSA
Stakeholder consultation of draft brick mission	TSA
Finalization of national brick mission and operational plan	TSA
Thrust Area-2:	
Tender document for empanelment of E3 marking agency	TSA, GIZ, BEE
Empanelment of E3 marking Agencies	BEE, GIZ
Development of process of award of label	TSA, GIZ, BEE
Finalisation of baseline, deemed MRV, E3 marking scheme	TSA, GIZ, BEE
Launch event E3 marking scheme (Stakeholder Workshop -I)	BEE, GIZ, TSA
Communication and Outreach with manufacturers	TSA, BEE, GIZ
E3 marking of manufacturers	Empaneled Agencies
Dashboard	TSA
Thrust Area-3:	
Development of standard technology packages	TSA
Institutional capacity building and training	TSA
Exposure visit to China	TSA, BEE, GIZ
Engaging Green Financing Institutions	BEE, GIZ, TSA
Thrust Area-4:	
Communication and outreach campaign with builders and demand influencers	TSA, BEE, GIZ
Procurement guidelines, Inclusion in SoR and other demand creation activities	TSA, BEE, GIZ







06

IMPACTS

💧💧 *Small gestures can have a big impact. Create where it matters.* ””

Anonymous



06 | IMPACTS

6.1 Energy savings and GHG avoided as compared to BAU

The savings in energy consumption and reduction in GHG emission as compared to the BAU scenario are plotted below:

Figure 10: Energy savings as compared to BAU²⁶

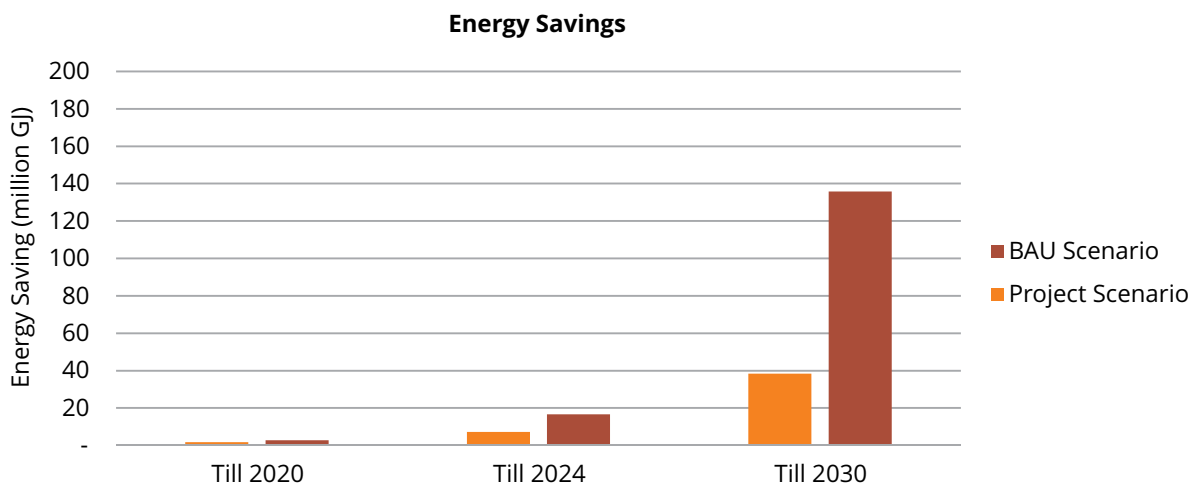
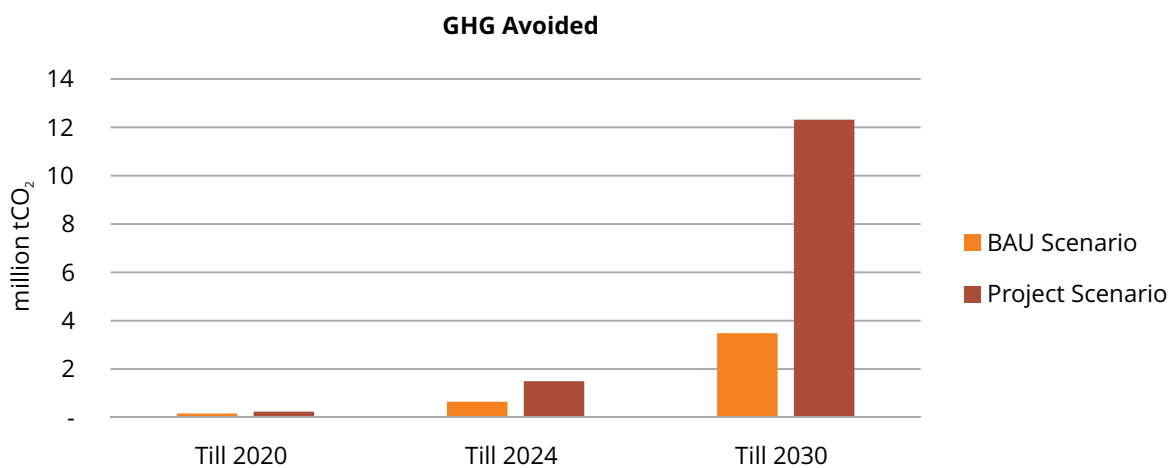


Figure 11: GHG avoided as compared to BAU



6.2 Benefits along the value chain

The savings in energy consumption and reduction in GHG emission as compared to the BAU scenario are plotted below:

Table 7: Estimated built-up area constructed using E3 bricks in BAU and Project scenario

Time line	Total built-up area constructed using E3 mark sourced bricks (million m ²)	
	BAU	Project Scenario
2019-20 (1 year)	1	1
2020-24 (4 years)	13	35
2024-30 (6 years)	50	205

Brick manufacturing is the second highest coal consumer after steel industry in India. Around 2% coal is imported, the rest being sourced domestically.

Official statistics club coal consumption in brick sector under 'Others', as brick units largely purchase through local intermediaries or spot markets.

The sector accounts for nearly 5% of raw coal consumption in India (30-35 million tonnes per annum). Of this around 10-15% is imported coal (e.g. USA, Indonesia). This consumption is more than Cement, Paper, Textile, Sponge Iron, fertilizer & Chemicals put together!

The choice of coal depends on landed coal price and local availability, for example kilns in Punjab, South India (with no local mines) may choose imported coal over domestic coals, whereas those in Bihar will not.

Despite price sensitivity, brick units pay nearly 3 to 4 times (Rs 6000 – 11000 per tonne coal) when compared to power plants. The Calorific value of coal used ranges from 4000-6000 kcal per kg.

Fuels with high Sulphur content (2-4%), and lower costs per calorie, may also be used (Pet Coke) etc.

Source http://www.mospi.gov.in/sites/default/files/publication_reports/Energy%20Statistics%202019-final.pdf

In addition to saving energy during brick production, the BEE initiative of transitioning towards E3 marked enterprises will carry benefits for all stakeholders along the value chain. The E3 sourced clay products (perforated and hollow clay blocks) would have lower densities, consume less clay in manufacturing, have lower thermal conductivity values, and would enable production of larger sized bricks. These attributes bring-in several benefits as highlighted below:

Brick Manufacturer:

- Reduction in fuel consumption and clay consumption, and hence in production cost
- Reduction in transaction costs associated with technology selection due to standardized technology packages and know-how

Builders/Consumers:

- Reduction in building construction cost
 - Lower structural cost because of lighter products
 - Reduction in cost of labour and mortar because of larger size format

Homeowner:

- Reduction in electricity bills (where building is air-conditioned) or Improvement in thermal comfort because of lower thermal conductivities.

Country-level:

- Creation/ preservation of jobs
- Reduction in resource use (fuel and clay) in brick manufacturing. Perforated and hollow products allow for the use of clays other than topsoil, which can be preserved.
- Reduction in operational energy of buildings and electricity consumption
- Reduction in GHG emission associated with brick manufacturing as well as building operation.

6.2.1 Case Example: Estimated benefits for a sample residential building

To estimate the benefits, an example of a residential building tower as below is considered:

No. of storey	= 7
No. of flats per storey	= 8
Type of flats	= 2 BHK (100 m ² size each, ~ 1080 sq ft)
Total no. of flats in the tower	= 56
Baseline	Construction of walls using solid burnt clay bricks
Project case	Construction of walls using hollow burnt clay blocks

Figure 12: A sample residential tower and flat layout (for representation purpose only)



The estimated benefits for various stakeholders along the value chain is provided in Table 8 below:

Table 8: Estimated benefits along the value chain

Parameter	Apartment level (100 m ²)	Tower level (8x7=56 flats)	Primary Beneficiary
Savings in manufacturing energy (MJ)	43,050	24,10,800	Manufacturer
Savings in electricity consumption (kWh/year)	1,246	69,776	Homeowner
Reduction in weight of building walls (ton)	37	2,100	Builder
Reduction in overall construction cost (% of total construction cost of building) ²⁷		1% - 1.5%	Builder
Net savings in energy (ton of Coal eq.)	29	1,614	Country
GHG avoided (tCO ₂)	55	3,056	Country
Additional Benefits			
40%-70% reduction in raw material (clay and fuel) consumption. Reduction / elimination in use of topsoil in brick making.			Country
Significant reduction in air pollution during manufacturing of bricks			Country

The deemed savings methodology for estimation of (deemed) energy savings based for this case example is provided in Annexure-III.



²⁷With use of hollow clay blocks instead of solid clay bricks, there is an estimated saving of Rs 15-25 per square feet in the construction cost of the building mainly because of (i) reduction in load of building and hence reduced steel consumption, (ii) reduction in mortar consumption and (iii) faster construction reducing the labour cost. Reference: Excerpts of the talk given by Mr Siddhant Sivaraman of Living Walls, in the awareness workshop for architects on resource-efficient bricks organised at Bengaluru on 04 December 2015 under UNDP-GEF-MoEFCC project on "Energy Efficiency Improvements in Indian Brick Industry".





07

BUDGET

“ too much attention is paid to the cost of doing something. One should worry more about the cost of not doing it. ”

Philip Kotler



07 | BUDGET

The proposed market transformation strategy advocating the design and dissemination of the E3 mark would require consistent collaborative work on the part of the BEE and its affiliates to ensure the on-going integrity of the E3 mark with brick manufacturers and brick customers.

Apart from investing to support the technical development and maintenance of the E3 mark, significant support would be required to generate customer awareness for E3 mark.

A better understanding of the necessary budget heads is expected during the initiation phase planned in two key brick markets. An initial rough estimate is however provided in Table below:

Table 9: Rough budget estimates for rolling out the Market Transformation approach

S. No.	Head of Expenditure	Amount (INR)		
		Initiation Phase (12 months, till 2020)	National Brick Mission (4 year, till 2024)	Saturation Phase ²⁸ (6 year, till 2030)
1	Technical Support Agency (Professional Fee and Travel)	100 lakhs	600 lakhs	300 lakhs
2	Dashboard (development and maintenance)	10 lakhs	30 lakhs	30 lakhs
3	Events & Outreach (Stakeholder workshops, Exposure visits, Local events, Advertisements, Participation in exhibitions, Social media outreach etc.)	150 lakhs	200 lakhs	300 lakhs
4	Development of Capacity building initiatives (Technology, Finance, Skill, financial Incentives etc.)	--	To be estimated post Pilot	To be estimated post Pilot
Total		260 lakhs	830 lakhs	630 lakhs

Note: The above are estimates. The actual costs would depend on the scope of the works put up for public bidding by BEE or its affiliates.

²⁸In this document the duration of proposed Brick Industry Mission is till 2024. However, the estimates of impacts and budget has been made for the period 2024-2030 on a pro-rata basis. This will help in making decision on extending the mission beyond 2024 till 2030..







08

ANNEXURE



A letter to the future

Ok is the first Icelandic glacier to lose its status as a glacier. In the next 200 years all our glaciers are expected to follow the same path. This monument is to acknowledge that we know what is happening and what needs to be done. Only you know if we did it. ””

Memorial plaque Okjökull glacier Iceland

ANNEXURE-I: THE AWARD OF “E3” BRAND MARK TO MANUFACTURERS

1. Empanelment of labelling agencies (E3 mark agencies) for awarding E3 mark

To be Established

- BEE empanelment procedure for brand award agency
- Tender for empanelment brand award agency

Through public procurement the BEE will invite applications to empanel agencies (two or more for initiation phase) which will collect information from the manufacturers, verify data and award E3 mark based on the criteria laid down by BEE. The E3 mark will be awarded for two years.

A standard cost/fee for the labelling agencies will also be fixed, through the tender, by the BEE which the manufacturer will directly pay to the empanelled agency.

To be Established

- Manufacturer Branding Form and Online Process
- Dashboard of Pilot phase outcomes

The interested manufacturers will submit the E3 marking application form along with the required data in the prescribed format to the empanelled agency. A digitized application process shall be explored.

3. Due diligence by E3 mark agency

The empanelled agency will verify the data provided by the manufacturers and assign deemed specific manufacturing energy values to the manufacturers.

To be Established

- E3 Mark design and guidelines for its use

4. Award of E3 Mark

Post evaluating the application made in previous step, the empanelled E3 marking agency shall consider awarding E3 mark to the manufacturer. This mark will be awarded

for two years. The list of E3 manufacturers will be displayed on the web-portal/dashboard and will be updated quarterly.

To be Established

- Surveillance Agency Procedures
- Tender document to appoint Surveillance Agency

5. Surveillance: Audit of E3 Mark Agencies

A certification body will be hired by the BEE which will do random sample audits of the E3 manufacturers to verify their eligibility for the mark and the due diligence process followed by the E3 mark agencies. A penalty will be

levied on the E3 mark agencies in case of any discrepancy. The defaulting E3 manufacturer shall be black-listed from the E3 programme.

ANNEXURE-II: METHODOLOGY FOR SPECIFIC MANUFACTURING ENERGY BASELINE

The baseline of specific manufacturing energy will depend upon two parameters:

- i. The average specific manufacturing energy of each brick product - production technology combination and
- ii. Market share of each brick product - production technology combination

The methodology for estimation of baseline of specific manufacturing energy is provided in Table 10 below:

Table 10: Estimation of baseline of specific manufacturing energy

S. No.	Type of Brick Product & Production Technology	Average SEC of production Technology (MJ/kg)	Initiation Phase (12 months, till 2020)	Average Specific Manufacturing Energy (MJ/m ³) [A]	Estimated Market Share (%) [B]
1	Solid burnt clay brick – Clamp Kiln	2.0	1600	3200	25.0 %
2	Solid burnt clay brick - FCBTK	1.3	1600	2100	64.9 %
3	Solid burnt clay brick – Zigzag Kiln	1.125	1600	1800	10.0 %
4	Burnt perforated clay brick (around 25% perforation) – Zigzag Kiln	1.175	1350	1600	0.02 %
5	Burnt hollow clay block (around 60% perforation) – Tunnel Kiln	1.6	800	1300	0.08 %

$$\text{National Baseline} = \sum (A_i \times B_i) = 2344 = 2350 \text{ MJ/m}^3 \text{ (approx.)}$$

Source: GKSP, 2017: Roadmap for Resource Efficient Bricks

ANNEXURE-III: METHODOLOGY FOR ESTIMATION OF ENERGY SAVINGS BASED ON DEEMED VALUES

Conceptually the energy saving due to sourcing from E3 marked brick manufacturers of a building wall has two components:

- Energy savings because of saving in manufacturing energy of the total volume of bricks consumed in the construction of the building walls
- Savings in operational energy of the building during depending upon the thermal conductivity of the walling material.

Defining Baseline

- For estimating energy savings, the national baseline for specific manufacturing energy and U-value will be defined. Over time the baseline would be updated using secondary data sources or especially commissioned surveys. The methodology of estimation of baseline is provided in Annexure-II.

The methodology is now demonstrated for a sample residential flat of 100 m² floor area. The estimation of energy savings has been done for use of hollow clay blocks as against the current baseline.

Manufacturing Energy of Bricks consumed in construction of the Building:

This will depend upon the total volume of the bricks consumed in building construction and the specific manufacturing of the brick used.

For residential houses/flats, on an average, 0.41 cubic meter of brick material per square meter of the floor area is generally consumed in the construction of the walls of the flat²⁹.

Thus, knowing the specific manufacturing energy of the brick/block to be used in the construction of the building, the baseline specific manufacturing energy, and the floor area of the building, the savings in manufacturing energy can be estimated.



²⁹GKSPL, 2017, Roadmap for Promoting Resource Efficient Bricks in India: A 2032 Strategy. (Assumption: Outer wall thickness – 200 mm and Inner wall thickness – 100 mm)

An illustration of the estimation of the manufacturing energy is provided in the table below:

Table 11: Illustration to estimate savings in manufacturing energy of a sample flat (100 m²)

Parameter	Unit	Current National Baseline	Hollow Clay Block
Specific Manufacturing Energy [A]	MJ/m ³	2,350	1,300
Volume of brick material per square meter floor area [B]	m ³ /m ² floor area	0.41	0.41
Manufacturing Energy of brick material consumed in the building per square meter floor area [C = A x B]	MJ/m ² floor area	963.50	533.00
Floor area of the building (assumed) [D]	m ²	100	100
Total Manufacturing Energy of brick material consumed in the building [E = C x D]	MJ	96,350.0	53,300.0
Savings in manufacturing energy as compared to baseline	MJ		43,050.0

Operational Energy of the Building:

The choice of wall construction brick material will have impact on the cooling energy requirement (or heating energy requirement in case of cold climates) and thus on the overall operational energy consumption of the building.

The Bureau of Energy Efficiency has recently launched "Eco Niwas Samhita 2018 (Part-1: Building Envelope)", which is the energy conservation building code for residential buildings³⁰. As per this code, the energy simulations of buildings establish a correlation between the RETV and the cooling energy requirement of building.

With the help of the correlations in the code, the Residential Envelope Transmittance Value (RETV) for a wall assembly can be calculated. Higher the RETV value, higher will be the cooling/heating energy requirement of the building.

For a typical wall assembly, constructed using different brick types, RETV values have been calculated. Following assumptions were taken while calculating the RETV:

- Wall assembly: 15 mm outside plaster + 200 mm thick wall made up of brick/block + 10 mm inside plaster
- Window to Wall Ratio (WWR): 15%
- Window overhang: 300 mm
- Glazing type: Single glazing

³⁰<https://www.beeindia.gov.in/latest-news/eco-niwas-samhita-2018-part-i-building-envelope-book-film-tool>

Thus, knowing the RETV and the climatic zone in which the building is located, the cooling energy requirement can be calculated.

The results of the calculation for some of the brick types are provided below:

Table 12: Results of calculation for cooling energy requirement of buildings

Climatic Zone	Brick Type	RETV	Annual Cooling Energy Performance Index (EPI) in kWh/m ² .year	
			Air conditioned	Non-air conditioned
'Hot & Dry' or 'Composite' Climate	Current National Baseline (k=0.8 W/m-K)	19.42	58.03	0
	Hollow Clay Block	14.70	45.57	0
'Warm & Humid' Climate	Current National Baseline (k=0.8 W/m-K)	16.96	61.77	0
	Hollow Clay Block	12.96	49.37	0

Table 11 provides an annual cooling energy requirement of the building per square meter of the floor area for different brick types. For an assumed lifetime of the building, total energy saving in operational energy during the lifetime of the building can be calculated.

An important point to note under the proposed deemed MRV is that the savings in operational energy of building take place when the construction of outer walls is carried out using the chosen brick type and the building is air-conditioned.

If the building is not air conditioned, then there will not be any saving in operational energy. Nevertheless, the choice of brick type for the construction of outer wall will have an impact on the thermal comfort of building occupants.

The estimation of savings in the operational energy of a sample air-conditioned flat of 100 m² floor area located in composite climate is now tabulated.

Table 13: Estimation of saving in cooling energy requirement of a sample flat located in composite climate

Parameter	Unit	Current National Baseline	Hollow Clay Block
Annual cooling electricity requirement per square meter floor area [A]	kWh/m ² .year	58.03	45.57
Savings in cooling electricity requirement per square meter floor area [B]	kWh/m ² .year	---	12.46
Floor area of the flat (assumed) [C]	m ²	100	100
Total cooling electricity requirement of the flat [D = A x C]	kWh/year	5,803	4,557
Savings in cooling energy as compared to the national baseline	kWh/year	--	1246
Monetary saving in electricity bills (assuming electricity cost = Rs 5/Kwh)	Rs/year		6230



ANNEXURE-IV: SUGGESTED SCOPE OF THE TECHNICAL SUPPORT AGENCY (TSA) DURING THE PILOT PHASE

To provide technical support as well as implementation support during the initiation phase, a technical support agency will be hired with the scope of work as:

1. Thrust Area-1: Development of Brick Industry Mission
 - ▶ Assist in organizing the Policy Maker's Meet
 - ▶ Preparation of draft National Brick Mission document
 - ▶ Organization of stakeholder consultation to gather inputs on the draft national brick mission
 - ▶ Finalization of the National Brick Industry Mission and its Operational Plan
2. Thrust Area-2: E3 marking of manufacturers producing energy efficient bricks through E3 mark
 - ▶ Preparation of tender document for empanelment of agencies who will award E3 mark to manufacturers
 - ▶ Finalization of the process to be followed for awarding E3 mark to manufacturing enterprises. This will include application formats, application review and data verification process, guidelines for the use of mark, design of mark, etc.
 - ▶ Assist in evaluation of applications and empanelment of labelling agencies
 - ▶ Finalization of baseline, deemed MRV and the E3 marking scheme
 - ▶ Assist in organizing the launch event of the E3 marking scheme
 - ▶ Development of communication and outreach materials targeted at bricks manufacturers
 - ▶ Assistance in outreach and mobilization of manufacturers for E3 marking
 - ▶ Co-ordinate with the empanelled labelling agencies in the E3 marking process
 - ▶ Development of a dashboard linked to the BEE website
3. Thrust Area-3: Comprehensive support package to manufacturers to facilitate the shift to E3 enterprises
 - ▶ Development of standard technology packages as per Indian requirements
 - ▶ Mobilization of technology providers, test labs, technical service providers and other professionals in India to facilitate their involvement in the brick sector transformation
 - ▶ Identifying training needs and organizing training program for the above-mentioned professions by expert international agencies

- Assist in organizing an exposure visit of Indian delegation (selected manufacturers, builders, policy makers, etc.) to China
 - Assist in engaging green finance institutions
4. Thrust Area-4: Creation of market demand for energy efficient bricks
- Development of communication and outreach materials targeted at builders and demand influencers
 - Assistance to in outreach and Mobilisation of builders and other demand influencers, and awareness campaigns
 - Preparation of procurement guidelines for large institutional consumers
 - Providing technical support for inclusion of E3 bricks in SoR of various government agencies.
5. Additional responsibilities of the TSA
- Keep track of implementation and impacts, and up-dation of the dashboard
 - Estimation of energy and CO² savings through pilot initiatives
 - Assistance in organising various events and workshops planned under this initiative
 - Any other set of activities in line with the overall mandate.



ANNEXURE-V: BRICK MANUFACTURING PROCESS AND POTENTIAL E3 MARK SOURCED BRICKS

Brick manufacturing process:

The typical brick manufacturing process involves following key stages. Conventionally all the processes are done manually, however, use of various machines, particularly for clay preparation and material handling, are increasingly being used.

Table 13: Brick manufacturing process

Step-1: Clay Preparation



Step-2: Shaping or Moulding



Step-3: Drying



Step-4: Firing of bricks



Material Handling



Potential E3 mark sourced bricks and blocks:

Perforated Bricks



Perforated Bricks



9. LIST OF ABBREVIATIONS

AAC	Aerated Autoclaved Concrete
B2B	Business to Business
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
BMTPC	Building Material and Technology Promotion Council
CPWD	Central Public Works Department
CREDAI	Confederation of Real Estate Developers Association of India
CSE	Centre for Science and Environment
EC Act	Energy Conservation Act, 2001
EE	Energy Efficiency
E3	Energy Efficient Enterprise
ESCO	Energy Service Company
FAQ	Frequently Asked Questions
FCBTK	Fixed Chimney Bull Trench Kiln
GDP	Gross Domestic Product
GHG	Green House Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GKSPL	Greentech Knowledge Solutions Pvt Ltd
IFC	International Finance Corporation
IGEF	Indo German Energy Forum
IGEN	Indo German Energy Programme
MoEFCC	Ministry of Environment Forest and Climate change
MoHUA	Ministry of Housing and Urban Affairs
MoP	Ministry of Power, Govt. of India
MRV	Monitoring Reporting and Verification
MSC	Mission Steering Committee
MSME	Micro Small and Medium Enterprises
NAREDCO	National Real Estate Development Council
NBCC	National Buildings Construction Corporation
PWD	Public Works Department
SEC	Specific Manufacturing Energy of Consumption
SFC	Standing Finance Committee
SoR	Schedule of Rates
TCPO	Town & Country Planning Organisation
TERI	The Energy and Resources Institute
ToR	Terms of Reference
TSA	Technical Support Agency (viz. consultant)
WG	Mission Working Group

FEEDBACK FORMAT

Reference:

Document: Market Transformation towards Energy Efficiency in Brick Sector

Version: December 2019

Feedback may be provided as per format or emailed to
manu.maudgal@giz.de /mdeore@beenet.in

Feedback

1. How could we improve this document?

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2. Suggestions for consideration during roll out of the strategy for market transformation?

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3. A new initiative takes off through support received from passionate pioneers in respective domains. Your suggested name / organization to share E3 mark details?

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About Yourself

Name:	Email:
Organization name:	Phone:

Where would you place your organizational Interest vis-à-vis the Brick Sector

Supply Side	Customer Side	Policy / Regulator
<ul style="list-style-type: none"> • Brick Manufacturer • Brick Technology Vendor • Financier • Raw material vendor • Brick service provider (like Laboratories, Consultants) • Other (specify) 	<ul style="list-style-type: none"> • Brick Distributor • Brick Customer-Institutional • Brick Customer-Retail • Financier • Builder Service Provider (like Architect) 	<ul style="list-style-type: none"> • Central Ministry / Institution • State Department / Institution • Think tank

The Bureau of Energy Efficiency (BEE) is the nodal agency to support Government of India in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001 with the primary objective of reducing the energy intensity of the Indian economy.

The fired (red) clay Brick manufacturing sector, which supplies 85% of all bricks used in construction, consumes annually nearly 5% of all coal used in India. With scant technological innovation, the sector has a large un-tapped energy efficiency potential.

The BEE is proposing a market transformation strategy under which brick manufacturers who adopt energy-efficient manufacturing shall be awarded a “Energy Efficient Enterprise (E3)” mark. The adoption of E3 mark shall be wholly voluntary by Industry.

The market transformation strategy further seeks to encourage customers to source bricks from manufacturing units who have been awarded the E3 mark.

The BEEs active steering is expected to accelerate the adoption of improved production technologies and encourage product innovation (like porous/hollow clay products) in the brick sector, locking India into an energy- efficient and thermally comfortable infrastructure.



Bureau of Energy Efficiency



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