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Enabling Policies in The Indian Brick Sector

- Current Status and Future Trends

Development Alternatives

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Prepared by:

Development Alternatives, New Delhi, India

Supported by:

Shakti Sustainable Energy Foundation, New Delhi, India

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Executive Summary

The humble fired clay brick continues and will continue to be one of the most important building materials in India not with standing the advent of alternate building materials. The Indian brick industry is characterized by small scale, decentralized production units mainly situated in rural and peri-urban areas catering to entire construction industry of the country. With over 200,000 units operating across the country, it provides employment to more than 12 million unskilled workers. Thus it is the largest employment generator in the informal sector.

Unlike developed countries where clay brick is used to increase the aesthetic appeal of housing, in India and Asian countries it is the backbone of housing and all development activity. With increasing resource prices, in recent years, it is becoming increasingly difficult for the brick industry to sustain the high costs of energy and material resources for production. The brick industry is also one of the highest polluters in terms of particulate matter and carbon (both gaseous and solid form) amongst all the existing small scale industrial activity. In addition to the above, lack of awareness, necessary institutional structures and capacity resists the brick industry to change towards a more profitable and cleaner production system.

In the recent past, there has been growing awareness on the need to change evident from the favourable policies being introduced by the various departments of the State and Central Governments. Initiatives by the regulatory agencies have resulted in formulating the emission standards and citing criteria of brick industries. Ministry of Science and Technology has instituted programmes on improving the brick and associated industries through technology development and dissemination schemes. promotional and financial incentives have been introduced by Ministry of MSME to adopt cleaner production technologies. Despite the all the initiatives the industry has not seen change over the last century (more than 100 years). Unless a shift of mentality and attitude occurs any form of change is a distant dream despite all the international pressure of improving the global climate conditions.

There are instances of improved technologies being promoted and practiced in India developed indigenously suiting Indian traditions and social culture. Instances of fly ash technologies (using waste materials), vertical shaft brick kiln (world's most energy efficient technology), use of internal fuel (being practiced in Central India) are increasingly becoming adopted driven mainly by economic reasons.

Urgent actions are needed to fast track the change the Indian Brick industry. Risks are few but rewards are many. A coordinated policy amongst all major departments is required for the same. Thus it is proposed to set up a Mission Mode Programme by the Indian Government coordinated by the Ministry of Medium, Small and Micro Enterprises with responsibilities of formulating favourable policies, coordinating activities of various agencies to increase the effectiveness of the various schemes thereby accelerating the transformation of the Indian brick industry towards a cleaner and greener future.

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Overview

A Brick is a ceramic structural material that is made by pressing clay into blocks and firing them to the requisite hardness in a kiln. Bricks in their most primitive form were not fired but were hardened by being dried in the sun. Sun-dried bricks were utilized for many centuries and are used even today in regions with the proper climate. In India, traditional technologies are used for brick production. In general, bricks are hand moulded, sun dried and fired in a kiln. The entire process of brick making is manual and estimated to provide employment to 8 million workers. They have been one of the primary building materials known to mankind and good bricks are resistant to atmospheric action and high temperatures and are more durable than stone.

Down the ages, there have been various interesting historic and cultural references to bricks.

- **Bricks find mention in the Bible; the tower of Babel was built in burnt bricks.**
- **Bricks were predominantly used in the Indus valley civilization. In fact the civilization was first discovered when ancient bricks being used to build railway ballast came to the notice of a passing archaeologist.**
- **While the Taj Mahal was built in white marble, it had extensive scaffolding made entirely out of brick, which was pulled down after completion.**

The common fired clay brick continues to be one of the most important building materials in India. They are used as walling material in most residential and commercial buildings. They are also used for other applications, e.g. road and canal construction. India is the second largest producer of bricks in the world, and is next only to China in terms of brick production. Brick production is estimated to be growing at a rate of 4% per year.

Bricks are produced at village and rural enterprise levels. The sizes of brick units are much smaller in the rural areas. However, in peri-urban areas, the size of brick producing units is much larger, and clustering of brick making units is quite common. Regional variations are also observed in the size and scale of the brick production units. The total number of brick making units is estimated at around 150,000.

2.1 Developed Countries

Modern clay brick production process in developed countries is an optimal mechanized and automatic process, fully controlled to obtain quality products out of the process. The modern production processes are based on different brick shapes and colors. In the last 60 years a variety of factors resulted in radical changes in the European and American brick industry.

In these developed countries, rather than serving as a load-bearing structure, brick today is typically used as a veneer that is anchored or adhered to a variety of backing systems. To maximize its application in today's building environment, most brick is made differently than it was a few decades ago. For example, instead of shaping units into individual molds, over 90% of currently made brick are manufactured by an automated extrusion method. In this system, the raw material is pushed (or forced) through a die, turned into long ribbons of brick material and then cut to the desired height. Core holes are often included to help in firing and lighten the weight of brick units. Unlike the traditional practice of hand-loading brick units into periodic kilns before and after firing, most brick is now fired in **tunnel kilns** - a continuous process where the units move slowly through the kiln on rails or kiln cars and exposed to the firing.

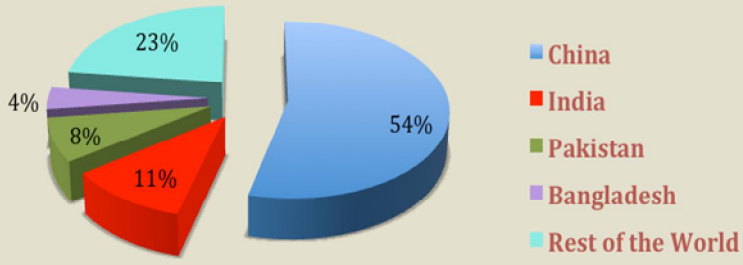
Bricks in America are made through an automated extrusion method, usually fired in a continuous kiln. However, Countless builders, designers and homeowners in America also insist on the timeless, classic appeal and "character" found in brick made by traditional manufacturing methods. Thus, many brick manufacturers make both extruded and molded brick, and some manufacturers make brick by hand. The result is that one can easily replicate a classic look by using new brick that look exactly like the brick found in America's most historic and treasured buildings, houses and streetscapes.

Additionally, manufacturers offer customers myriad color and texture options, through the increased usage of face coatings. Thus brick in developed countries optimizes on the use of resources, and differs fundamentally from developing countries in being chosen for its aesthetic appeal rather than its load bearing qualities even though these bricks are strong, dimensionally precise and easier to handle than brick manufactured in developing countries. Most brick manufacturers also follow environmentally friendly policies. For example, brick is made from local resources, which cut down the need to transport the product over long distances. In USA, Approximately 80% of brick kilns are fired with natural gas, and several facilities use fuels of bio-based materials from other industrial applications and waste products, such as methane gas and sawdust.

The overall percentage of brick production in developed nations is significant lower then in developing nations The UK produces 4 billion, the USA 8 billion and other developed countries produce approximately 11 billion as opposed to 100 billion bricks produced by China alone.

2.2 Developing Countries

Brick production wordwide is concentrated in developing nations as developed countries increasingly use materials such as steel, cement, and other materials for constructions. As can be seen from figure 1, 77 per cent of brick production is in developing nations with China dominating at 54 per cent of the total brick production worldwide.



Brick Production Worldwide
Source: Clean Air Task Force, May 2008[1]

However, this picture may soon change as China is gradually reducing its dependence on burnt clay bricks. In the country, a gradual banning of all solid clay bricks and tiles in new buildings in all municipalities, large and mid-sized cities in coastal areas, and cities in provinces where per capita farmland is less than 0.053 hectares was initiated in 2000 to ensure that no solid clay bricks would be in use by 2010[1]. In Vietnam too, a phase-wise replacement of burnt clay bricks is taking place. A decision issued by the Prime Minister in 2010, states that by 2020 alternative building materials should replace all baked building materials, including clay bricks. Also part of the decision is the use of about 15-20 million tons of industrial waste industrial (thermoelectric ash, blast furnace slag etc.) to produce building materials[2].

2.3 Under Developed Countries

Under developed nations that rely heavily on bricks, are also getting conscious of their resource inefficient technologies and bringing about gradual changes in their brick sectors. In Bangladesh of the 4500 kiln, 4000 are of the The Moving Chimney Bulls Trench Kiln (MCBTK) type. The MCBTK is known to be the most polluting kiln and the country is now making a transition to cleaner technologies such as the VSBK and the Hybrid Hoffman Kiln (HHK) technology which is the most viable kiln for the area according to UNDP, that is working on implementing a project on improving kiln efficiency in the Bangladesh brick making industry by demonstrating and promoting the HHK technology.

In May 2002, the Government of Nepal announced the discontinuation of production licenses for Bull's trench kilns (BTK) with movable chimneys. The government signed a bilateral agreement with SDC for to implement VSBK technology transfer in February 2003 to gradually modernize the brick technology in Nepal. The MCBTK type has also been banned in parts of Pakistan.

[1] **http://english.peopledaily.com.cn/200403/17/eng20040317_137777.shtml**
[2] **No. 567/QD-TTg, Hanoi, April 28, 2010 'Approving the program on development of non-baked building materials through 2020'**

In **Latin American** too, issues of resource inefficiency and environmental degradation are being addressed through the Latin American Artisanal Brick Makers Programme for Energy Efficiency to Mitigate Climate Change (EELA). The project is under way in **Argentina, Bolivia, Brazil, Colombia, Ecuador, Mexico and Peru**, sponsored by Swisscontact and national partners in each country. In the first phase, 2010-2013, research is being conducted on the status of the industry in each country, and technical improvements are being tested. A core objective is to reduce the emission of greenhouse-effect gases from the ovens, thereby curbing the industry's contribution to climate change.

The efforts are focused on improving energy efficiency, introducing alternative and less polluting fuels, improving the artisanal ovens and raising the quality of the final product. The EELA participants also hope that the governments will include their solutions when drawing up new public policies.

3.1 Status

The Indian brick industry is highly unorganized and comprised of small scale production units - with numbers in the range of over 100,000 clusters spread across rural and peri-urban areas in the country. Clay fired bricks form the backbone of the construction industry which is estimated to be at USD 70.8 billion[3]. The construction industry contributes to about 10 per cent of the Gross Domestic Product (GDP), registering an annual growth of about 9 per cent.

Burnt bricks are the most popular building material in India. As stated in UNDP's 'Green Bricks', 2009, an estimated 140 billion bricks are produced each year in order to match the annual growth in the construction sector. With 140 billion bricks a year, India is the second largest brick producer (China dominates with 54 per cent share) in the world).

In India, there are approximately 100,000 kilns (2009 estimates) and 70 per cent of the total brick produced comes from Bulls Trench type of Kilns. 140 billion bricks produced per year consume 24 million tonnes of coal and the total carbon dioxide emission from brick production is estimated at 41.6 million tonnes, which accounts for 4.5 per cent of the total greenhouse gas emissions from India[4].

During the ninth five-year plan period, the annual demand of 170 million bricks per year was estimated capable generating revenues of over US$ 4.8 billion. With the increasing housing and infrastructure needs, consumption of bricks is slated to increase even further. In order to meet this demand, currently over 150,000 units[5] provide direct employment to more than 8 million workers.

3.2 Process and Technology

The brick making sector in India has a wide geographic spread. However the basic steps in making a brick are not very different in different regions. The brick making process has not undergone too much change over the ages. In different areas, different soil types are used with respect to local situation. Combinations are made to accommodate local edaphic and climatic conditions.

Traditionally the following main steps were followed. The first step in making a brick is to procure the ingredients i.e. clay, coal, water, etc. The clay is mined and stored in the open. The next step is tempering i.e. mixing the clay with water to get the right consistency for moulding. This is mostly a manual process. The moulding of green bricks is done using wooden or metal moulds, which are then arranged in the sun to dry. After two weeks they are ready to be burnt.

[3] **Economic Times Data, Nov. 2008**
[4] **UNDP, 2009. Green Bricks. http://www.undp.org.in/sites/default/files/climate_pdf/11.pdf**
[5] **Central Pollution control Board**

The final step in the process is firing. The most common options for firing in India, Clamps, Movable Chimney Bull's Trench kiln (MCBTK) or Fixed Chimney Bull's Trench Kiln (FCBTK) are highly energy intensive. Clamps are the oldest types of kilns wherein temporary constructions are made of green bricks and fired. The bull trench (BTK) which is very popular in the northern and eastern parts of the country, is circular or elliptical in shape. Tall movable metal chimneys (MCBTK) are placed on the brick settings in the trench. There are also modifications of the BTK which have a permanent fixed chimney (FCK). In zig-zag kilns the length of the kiln gallery is increased by zig-zagging the chambers and the fire follows a zig-zag path instead of the straight path followed in a BTK. In VSBK's the air draft is vertical and bricks move while the fire is stationary. The Hybrid Hoffman like the Hoffmann kiln is a series of batch process kilns, but has modifications to reduce heat escape and waste heat recovery for drying green bricks into a tunnel.

The smaller enterprises with limited access to capital and resources use the clamps; the medium enterprises use MCBTK; and the larger enterprises use either FCBTK or HDKs. The main fuel used is coal and biomass (mostly in clamps). The production capacities and the capital investments requirements of these technologies differ and they cater to different segments of brick enterprises. Brick making is highly energy intensive process, with specific energy consumption varying from 1.2 to 1.75 MJ/kg of fired bricks for BTKs and 1.5 to 3.0 MJ/kg for clamp kilns.

Table 1 : Comparison between different kiln types[6]

Kiln type	Typical production capacity (lakh bricks / year)	Approx no. of kilns	Coal consumption (tons per lakh bricks)	Specific Energy Consumption (MJ/kg of fired product)	Average SPM Concentration in stack (mg/m^3)
BTK-fixed chimney	30-100	25000	17-24	1.1 - 1.4	500 - 1040
BTK-moving chimney	20-80	8000	18 - 28	1.2 - 1. 75	1770
High draft / down draft kiln / Zig-Zag firing	30-50	200	<18	0.8 - 1.1	270 - 370
Clamps	0.5-10	>60,000	32-71	1.2 – 4.5	Similar to MCBTK
EcoKiln	5-40	100-150	11 - 16	0.7 - 1.0	78 - 80[7]

[6] **In the case of clamps; besides coal, other biomass like cow-dung, crop residues are used taking the fuel consumption much higher than other comparable kilns.**

There are very few High Draft Kilns (HDK) and Vertical Shaft Brick Kilns. One of the major considerations in operation of HDKs is the use of forced draught which is created using electrically operated fans. In view of the highly unreliable electricity supply situation in rural areas, the issue of reliable operation remained a high concern for brick entrepreneurs. Backup supply of electricity with captive sources is not financially viable. The entrepreneurs who earlier opted for this technology have already closed down their HDK plants.

[7] **Kiln monitored by DA. Source: Lakshmikantan et al [1999]**

4.1. Sector

The Indian Brick Sector is varied and complex. Due to its inherent nature of working, there are various sectors directly or indirectly associated with the brick sector. A detailed list of the same is given below, these are elaborated in Chapter 5.

1. Industrial Policies
    a. Improving productivity of enterprises in the unorganized sector.
    b. Technology and quality upgradation support to MSME's
    c. Rajiv Gandhi Udyami Mitra Yojna
    d. Prime Minister's Employment Generation Programme
    e. State Industrial Promotion Policies

2. Environmental Policies
    a. Climate Change Action Plan
    b. Emission standards for various brick technologies
    c. Citing criteria for setting up brick production
    d. No Objection Certificate
    e. Use of fly ash for clay brick production

3. Production Policies
    a. E-auction of coal through IT systems
    b. Soil mining rules and guidelines

4. Technology Policies
    a. Indian Standards for bricks, technologies, processes.
    b. Performance Appraisal Certificate Scheme
    c. Technology Upgradation Support by DSIR
    d. Technology development support by DST

5. Finance Policies
    a. Credit Link Capital Subsidy Scheme for Technology Upgradation
    b. Credit Guarantee Fund Scheme for Micro and Small Enterprises

6. Market Policies
    a. National Housing Policy
    b. National Building Code
    c. Energy Conservation Building Code

d. Indian Green Building Council Green Homes
e. Green Rating for Integrated Habitat Assessment
f. Public procurement guidelines for State and Central work
g. Indira Awas Yojana
h. Preferential procurement from MSME's

7. Labour Policies

No definite labour policies specifically related to the brick sector has been found.

4.2. Department

The various Ministries/Departments which are associated with the above policies are given below:

1. Policy making (Central/Federal subject)

1.1. Supreme Court of India
Guidelines on various policies for the brick sector based on PIL filed in the Green Bench of the Honourable Court.

1.2. Ministry of Science and Technology
Support science and technology entrepreneurship development for promotion of knowledge based technology, accelerating the development and commercialization of indigenous technology or adapting imported technology to wider domestic application, promotion and popularization of science based technologies in states.

1.3. Ministry of Micro Small and Medium Enterprises
Facilitating the promotion, development and enhancing the competiveness of micro, small and medium enterprises.

1.4. Ministry of New and Renewable Energy
Formulation of green building rating, codes specifying use of energy efficient building materials e.g. fly ash bricks in buildings.

1.5. Ministry of Rural Development
Policies and programmes to alleviate rural poverty based on increasing productive employment opportunities. The major thrust areas are poverty alleviation, employment generation, infrastructure development focussing on providing basic housing needs.

1.6. Ministry of Steel
Policies and programmes to utilize use of industrial waste materials

1.7. Ministry of Coal
Formulating coal pricing and procurement policies and preferential allotment of coal

1.8. Ministry of Power
Policies and programmes for utilization of pulverized coal ash from thermal power plants in brick making.

1.9. Ministry of Labour
Policies for provision of minimum wages, human rights, prevention of child labour and safety and welfare of workers.

1.10. Bureau of Indian Standards
Provides product quality certification and development of technical standards

1.11. Central Pollution Control Board
Advice the Central Government on any matter related to water and air pollution. Plan, execute, technical assistance and guidance to State Boards for prevention of air pollution.

2. Implementation (State subject)

2.1. Department of Mining
Formulation of mining guidelines, cess and royalty, collection of annual royalty and compliance.

2.2. State Pollution Control Board
To advice, implement National guidelines on air pollution control. To monitor, regulate polluting industries and ensure compliance. Formulate state specific rules and guidelines. Provide NOC to establish and operate for micro and small industries.

2.3. Directorate of Industries
Promote and facilitate growth of small scale industries. Administers various promotional policies of State Govt. through provision of incentives, subsidies and concessions.

2.4. District Industries Centre
Prepare viable project reports, promote small scale industries for employment generation, EDP training and grant PRC to prospective entrepreneurs

2.5. Khadi Village Industries Board
Granting of subsidies to enterprises based on PMREGP programme as approved by the Directorate of Industries.

2.6. District Collectorate
Granting of mining license to enterprises.

2.7. Banks
Grant and issue finance to eligible enterprises.

3. Implementation (Autonomous Bodies)

3.1. Small Industries Development Bank of India
3.2. National Bank for Agriculture and Rural Development
3.3. Bureau of Energy Efficiency
3.4. Building Materials Technology Promotion Council
3.5. The Housing and Urban Development Corporation Ltd.
3.6. Central Public Works Department
3.7. State Public Works Department

Enabling Policies in The Indian Brick Sector

The brick sector falls under the Micro, Small and Medium Enterprise (MSME) category. It is an unorganized sector, with units scattered all across the country. The sector falls under the jurisdiction of the Ministry Of Micro, Small and Medium Enterprises at the centre. At the state level, the sector is under the Directorate of Industries (Department of Industries). Schemes and policies relevant to the brick sector that are currently in place are detailed below:

5.1. Industrial Policies

5.1.1. Improving productivity of enterprises in the unorganised sector

The **National Manufacturing Competitiveness Council (NMCC)** was set up by the Government in 2004, an interdisciplinary and autonomous body at the highest level to serve as a policy forum for credible and coherent policy initiatives in manufacturing sector. The Council is expected to energize and sustain the growth of manufacturing industries in the Country and also help in implementation of strategy. The council has finalized a five-year National Manufacturing Competitiveness Programme (NMCP) that was accepted by the government and announced for implementation in the Budget of 2006-07. This programme was directed at improving competitiveness at the firm level rather than a sector or industry level and based on the idea that MSMEs need to build abilities to acquire, develop or assimilate new technology, reduce cost of production, enhance productivity, practice total quality management (TQM) and improve customer service. The NMCP is the direct responsibility of the state governments, though supported by the centre in terms of setting the framework and ensuring uniformity.

Appropriate technologies in the MSME sector continue to remain a focus area as can be seen from the plans envisaged in the upcoming 12th Five Year Plan. At the national level, it is expected that a **technology upgradation fund** of Rs. 2500 Crore will be created within the plan for the MSME sector to acquire and upgrade technology.

5.1.2. Technology and quality upgradation support to MSME's

Ten Schemes were drawn up under the National Manufacturing Competitiveness Programme (NMCP) of which one of the most relavant for the clean upgradation of the brick sector is the Technology and Quality Upgradation Support to MSMEs (TEQUP) which has provisions for

- Capacity building of MSME Clusters for Energy Efficiency/Clean Development Interventions and other technologies mandated as per the global standards
- Implementation of Energy Efficient Technologies (EET) in MSME sector/units
- Setting up of Carbon Credit Aggregation Centres (CCA) for introducing and popularising clean development mechanism (CDM) in MSME clusters

- Encouraging MSMEs to acquire product certification/ licences from National/International bodies and adopt other technologies mandated as per the global standards.

5.1.3. Rajiv Gandhi Udyami Mitra Yojna (RGUMY)

The The RGUMY is a scheme for promotion and handholding of MSMEs. Part of the 11th FYPs objective is to support MSMEs by handholding first generation entrepreneurs who have successfully completed an Entrepreneurship Development Program (EDP), Skill development Programme (SDP), or an entrepreneurship cum skill development programme (ESDP) of at least two weeks duration, or have undergone vocational training from Industrial Training Institutes.

5.1.4.Prime Minister' Employment Generaton Programme (PMEGP)

The PMEGP was launched in 2008 and is a credit linked subsidy programme for generation of employment opportunities through establishment of micro enterprises in rural and urban areas. The upper limit of the cost of project that could be set up in the manufacturing sector is Rs. 25 Lakh. At the state level schemes will be implemented through State Directorates of Khadi and Village Industries Commissions and Boards, State and District Industries centres (DICs) in rural areas and in urban areas, the scheme will be implemented by the DICs. By 2011-2012, the scheme aims to generate an estimated 37.38 lakh jobs and the total outlay for subsidy under the PMEGP is. 4485 crore. This scheme caters to VSBK and flyash units.

5.1.5.State industrial Promotion Policies

Every State in India has a Industrial Promotion Policy that outlines the priority sectors for industrial development and the initiatives of the state to boost these industrial sectors, by providing subsidies and incentives in these sectors. Here details relevant to the brick sector from two State industrial policies are highlighted.

Bihar Industrial Incentives Policy (2011)	Orissa Industrial Policy Resolution (2007)
Bricks units are not eligible for subsidy except for mechanised units engaged in manufacturing refractory bricks and bricks from fly ash, red earth, raw industrial waste material which can qualify for incentives. The older Industries Incentive Policy 2006 of Bihar excluded **all** Brick Manufacturing units from any incentives.	Brick-making units (except units making refractory bricks and those making bricks from flyash, red mud and similar industrial waste), though not eligible for fiscal incentives as industrial units are eligible for investment facilitation, allotment of land under normal rules, recommendations to financial institutions for term loans and working capital & recommendation for power. This is a progressive change from the policy of 2001 where brick manufacturing units were excluded from all incentives and facilitation.

5.2. Environmental Policies

5.2.1. Climate Change Action Plan

Keeping in line with the rising emphasis on climate change related concerns nationally and internationally, the National Action Plan on Climate Change (NAPCC), was introduced in 2008 and outlines the existing and future policies and programs addressing climate mitigation and adaptation. Two out of eight missions could be relavant to the brick sector - The **National Mission for Sustainable Habitat** which aims to make habitat sustainable through improvements in energy efficiency in buildings among other measures. The Recycling of material and Urban Waste Management will be another area of focus. However building materials are not part of their focus. The **National Mission on Energy Efficiency** has initiatives to promote energy efficiency through market based mechanisms and fiscal instruments in energy intensive industries. Based on the National Action Plan, individual States are preparing State Action Plans for Climate Chanage to set priorities to tackle climate change.

5.2.2. Emission standards for various brick technologies

With growing environmental consciousness at all levels of society, the pollution caused by the brick industry is under the scrutiny of environmentalists and the government. The Government of India took a step towards controlling environmental (air) pollution from brick kilns by issuing a notification on emission standards for brick kilns in April 1996. The standard laid by the Government also provides regulations on 'stack height' corresponding to kiln capacity in order to control emissions.

Table 2: Emission Standards for Brick Kilns in India

Size	Kiln Capacity	Stack Height	Maximum limit of SPM (mg/Nm^3)
Small BTK	< 15,000 bricks per day (< 4.5m trench width)	Minimum stack height 22 m or induced draught fan operating with minimum draught of 50 mm W.G. with 12 m stack height	1000
Medium BTK	15,000- 30,000 bricks per day (4.5-7.0 m trench width)	Minimum stack height 27 m with gravitational settling chamber or induced draught fan operating with minimum draught of 50 mm W.G. with 15 m stack height	750
Large BTK	>30,000 bricks per day (> 7.0 m trench width)	Minimum stack height 30 m or induced draught fan operating with minimum draught of 50 mm W.G. with 17 m stack height	750
Small DDK	< 15,000 bricks per day	12 m	1200
Medium DDK	15,000- 30,000 bricks per day	15 m	1200
Large DDK	>30,000 bricks per day	18 m	1200
Small VSBK	< 15,000 bricks per day (1-3 shafts)	11 m (at least 5.5 m from loading platform)	250
Medium VSBK	15,000- 30,000 bricks per day (4-6 Shafts)	14 m (at least 7.5 m from loading platform)	250
Large VSBK	>30,000 bricks per day (>7 shafts)	16 m (at least 8.5 m from loading platform)	250

Source: Gazette Notification G.S.R.543 (E) dated 22nd July 2009

5.2.3. Siting criteria for setting up brick production

An industry or an industrial area over a period of time could cause significant damage to the surrounding environment and ecological features due to the cumulative emissions or industrial waste generated in the zone. Industries are, therefore, required to be sited, striking a balance between economic and environmental considerations. According to the Ministry of Environment and Forests (MoEF) the following factors must be recognised:

- No forest land shall be converted into non-forest activity for the sustenance of the industry (Ref. Forest Conservation Act, 1980)
- No prime agricultural land shall be converted into industrial site
- Within the acquired site the industry must locate itself at the lowest location to remain obscured from general sight.
- Land acquired shall be sufficiently large to provide space for appropriate treatment of waste water still left for treatment after maximum possible reuse and recycle. Reclaimed (treated) wastewater shall be used to raise green belt and to create water body for aesthetics, recreation and if possible, for aquaculture. The green belt shall be 1/2 km wide around the battery limit of the industry. For industry having odour problem it shall be a km wide.
- The green belt between two adjoining large scale industries shall be one km.
- Enough space should be provided for storage of solid wastes so that these could be available for possible reuse.
- Lay out and form of the industry that may come up in the area must conform to the landscape of the area without affecting the scenic features of that place.
- Associated township of the industry must be created at a space having physiographic barrier between the industry and the township.
- Each industry is required to maintain three ambient air quality measuring stations within 120 degree angle between stations.

GOVERNMENT OF ORISSA – SITING CRITERIA

The Government of Orissa, Department of Science & Technology and Environment, vide memo no ENV-I-4/87/STE/18775 dated 26/10/87 have approved the following siting criteria for Brick Kilns, Lime Kilns and Coal Briquette units.

- **Such industries should not be established on prime agricultural lands and forest lands**
- **They must be located at least ½ km away from the National and State highways high tide, lines, flood plains, villages and small settlements and 2 kms away from the out skirts of small towns and population of 50, 000 or less and 5 kms away from the out skirts of large towns of population more than 50, 000.**
- **Each unit should be at least 1 km away from another such unit.**

5.2.4. No Objection Certificate (NOC)

To prevent air, water and soil pollution arising out of industrial projects, regulations require entrepreneurs to obtain clearance from Central/State Pollution Control Boards before setting up the industry.

The **Consent to Establish** No Objection Certificate (NOC) is granted by different authorities depending upon the environmental impact of the industrial unit i.e. Red/Green category of Industrial Unit. The State Pollution Control Board is responsible for granting the NOC to brick production units. Usually, there is a separate application form, set of guidelines and other requirements for each category of unit and the brick industry falls under the red category.

The **Consent to Operate** No Objection Certificate (NOC) is in keeping with the provision of the Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control Pollution) Act, 1981. Industries falling in the Red category – such as brick producing units are required to renew their Consent to Operate certificate every year.

5.2.5. Use of Fly Ash for Clay Brick Production

With a view to protect the environment, conserve top soil and prevent the dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land a notification S.0.763 (E)[8] was published in September 1999. It restricts the excavation of top soil for manufacture of bricks and promotes the utilisation of fly ash in the manufacture of building materials and in construction activity within a specified radius of fifty kilometres from the thermal power plants. The notification was further modified in November 2008 (S.O. 2623 (E)9) such that all construction activity within 100 kms shall use only fly ash based products. Excise duty is exempted on all products using Flyash and phosphogypsum resulted in widely scattered production of flay ash and gypsum based bricks/blocks.

5.3. Production Policies

5.3.1. E Auction of Coal through IT systems

Coal distribution through e-auction was introduced under the New Coal Distribution Policy of the Government with a view to provide access to coal for such consumers who are not able to source coal through the available institutional mechanisms for reasons like seasonality of coal requirement, limited requirement of coal not warranting long term linkage etc. In the long run it is expected that e-auction may help in creating spot as well as future market of coal in the country.

Thus the e-auction scheme has been introduced subject to inter-alia the following conditions:

i. Any buyer will be entitled to buy coal under e-auction

ii. There shall not be any "Floor Price" in e-auction. However, coal companies may be allowed to fix an undisclosed Reserve Price not below the notified price

iii. Programme of e-auction should be announced well in advance and be given wide publicity to all consumers who intend to participate

[8] **http://envfor.nic.in/legis/hsm/flyash.html**
[9] **http://envfor.nic.in/legis/hsm/2623.pdf**

iv. At the beginning of the financial year, CIL shall declare a programme on sale of coal through e-auction indicating the quantity and quality of coal to be made available through auction during all the four quarters from different coal companies/ coalfields

v. In order to address the concerns of such industrial consumers who with to have an assured supply over a long period, say one year, under e-auction so as to plan their annual production etc. CIL will earmark a fixed quantity which will be provided to highest bidder/ bidders as per bidders requirement over the period of the bid

Based on the above guidelines and modalities, around 10% of estimated annual production of CIL would be initially offered under e-auction and quantity to be offered under e-auction would be reviewed from time to time by Ministry of Coal.

5.3.2. Soil Mining Rules and Guidelines

In keeping with the Mines and Minerals (Development and Regulation) Act of 1957, Clay along with stones, gravel etc. is considered a 'Minor mineral' and the various State Governments are authorized to make rules with respect to Minor Minerals. The State government has the authority for regulating the grant of mining leases in respect of minor minerals. The holder of a mining lease has to pay a royalty or dead rent, whichever is more in respect of minor minerals removed or consumed by him or by his agent, manager, employee, contractor or sub-lessee at the rate prescribed for the time being in the rules framed by the State Government in respect of minor minerals.

The Act also mentions that the State Government shall not enhance the rate of royalty or dead rent in respect of any minor mineral for more than once during any period of three years.

5.4. Technology Policies

5.4.1. Indian Standards for bricks, technologies, processes

The Bureau of Indian Standards (BIS), the National Standards Body of India has been successfully promoting and nurturing the standardization movement in the country since 1947. Over the years, a number of standards have been developed laying down requirements for classification, general quality, dimensions and physical requirements for building material. IS 1077 establishes these specifications for burnt clay building bricks. Similarly IS 3951 and IS 3952 lay down the standards for hollow clay bricks. IS 1077 does not allow for waste utilization in the bricks. IS 13757:1993 allows for fly ash utilization in burnt clay building bricks but not other industrial waste. IS:12894:1990 specifies standards for Flyash Lime bricks.

IS 2117:1991 is a guide for manufacture of hand-made common burnt clay building bricks. While IS 11650:1991 guides their manufacture by semi-mechanized process.

5.4.2. Performance Appraisal Certificate Scheme

A Performance Appraisal Certificate Scheme (PACS) is being implemented for the development and promotion of materials, products, and systems under the joint initiatives of Building Materials and Technology Promotion Council (BMPTC), Construction Industry Development Council, Bureau of Indian Standards (BIS) and other agencies. It is

intended use of new building materials, components, products, elements, construction systems and assemblies, not yet covered by the Indian Standards. A Performance Appraisal Certificate (PAC) for Vertical Shaft Brick Kiln (VSBK) technology was finalised at the first meeting of the Technical Assessment Committee (TAC) of PACS.[10]

5.4.3. Technology Upgradation Support by DSIR

The Department of Scientific & Industrial Research (DSIR) of the Ministry of Science and Technology has the mandate of strengthening the interface between industry, R&D establishments and academic institutions and providing catalytic support for development and demonstration of innovative product and process technologies, traversing the journey from proof of concept or laboratory stage to pilot stage, rendering them fit for commercialization. The Technology Promotion, Development and Utilization Programme (TPDU) of the department has the objective of Development and Demonstration of innovative need-based technologies for making the industry competitive.

5.5. Finance Policies

5.5.1. Credit Linked Capital Subsidy Scheme (CLCSS)

The Ministry of Small Scale Industries (SSI) is operating a scheme for technology up gradation of Small Scale Industries (SSI) called the Credit Linked Capital Subsidy Scheme (CLCSS). The Scheme aims at facilitating technology up gradation by providing upfront capital subsidy to SSI units, including tiny, khadi, village and coir industrial units, on institutional finance (credit) availed of by them for modernization of their production equipment (plant and machinery) and techniques. The Scheme provided for **15 per cent** capital subsidy to SSI units, including tiny units, on institutional finance availed of by them for induction of well-established and improved technology in selected sub-sectors/products approved under the Scheme. The eligible amount of subsidy was based on the actual loan amount not exceeding **Rs.40 lakh to Rs. 100 lakh.**

The eligible beneficiaries include sole Proprietorships, Partnerships, Co-operative societies, Private and Public limited companies in the SSI sector. Priority shall be given to Women entrepreneurs.

Existing SSI units registered with the State Directorate of Industries, which upgrade their existing plant and machinery with the state of the art technology, with or without expansion and new SSI units which are registered with the State Directorate of Industries and which have set up their facilities only with the appropriate eligible and proven technology duly approved by the GTAB/TSC, these type of units can be covered under this scheme.

5.5.2. Credit Guarantee Fund Scheme for Micro & Small Enterprises (CGMSE)

CGMSE provides credit guarantee cover to the collateral free credit provided to Micro & Small Enterprises by the bank. The purpose of Credit Guarantee Fund Scheme for Micro & Small Enterprises is that it provides credit guarantee comfort to banks and FIs for the credit facility extended to the eligible MSE units. And the main objective is that the lender should give importance to project viability and secure the credit facility purely on the primary security of the assets financed.

[10] **Http://mhupa.gov.in/pdf/outcome_budget/chap4-0708.pdf**

New or existing Micro and Small Enterprises availing credit facilities up to **Rs.100.00 lakh** without any collateral security and or third party guarantee are eligible for CGMSE.

The guarantee cover available under the scheme is to the extent of 75% / 80% of the sanctioned amount of the credit facility, with a maximum guarantee cap of Rs.62.50 lakh / Rs. 65 lakh. The extent of guarantee cover is 85% for micro enterprises for credit up to Rs.5 lakh. The extent of guarantee cover is 80%(i) Micro and Small Enterprises operated and/or owned by women; and (ii) all credits/loans in the North East Region. In case of default, Trust settles the claim up to 75% (or 80%) of the amount in default of the credit facility extended by the lending institution. Lock in period of 18 months from either the date of last disbursement or date of payment of guarantee fee whichever is later, for invoking the claim under the scheme.

5.6. Market Policies

5.6.1. National Housing Policy

A National Housing and Habitat Policy (NHP) was evolved in 1988 based primarily on the Global Shelter Strategy adopted by the United Nations in November, 1988. The long term goal of the NHP was to eradicate homelessness, improve the housing conditions of the inadequately housed and provide a minimum level of basic services and amenities to all. Since then there have been two updated versions formulated in 1998 and 2007. In 1998, the original policy underwent a thorough review to address the issues of sustainable development, infrastructure and for strong public private partnership for better shelter delivery.

The policy also recognized the unsustainable consumption of natural resources like land, water, soil, energy, forests and minerals in construction. Hence it advocated sustainable development of housing and settlements to provide a healthy environment by advocating the increased use of renewable energy sources; renewable and innovative material use like fly ash, red mud etc.; efficient technologies requiring less energy and material among others. It also looked upon the construction sector for sustainable generation of employment and subsequent capacity building of the workers.

The revised National Housing Policy of 2007, in view of increased urbanisation and increased urban poor, reiterated the sustainability concerns of its predecessor. It also recognised that the Development of sustainable habitat is closely related to the adoption of '*the Regional Planning approach*' while preparing Master Plans of towns/ cities, District Plans and Regional/Sub-Regional Plans. It also advocates the observance of the National Building Code of 2005.

5.6.2. National Building Code

The latest version of the National Building Code was released in 2005. The original was prepared in 1970 and revised in 1983. In this latest version, aspects of energy conservation and sustainable development have been consistently dealt with in various parts and sections through appropriate design, usage and practices with regard to building materials, construction technologies, and building and plumbing services. The document focuses on energy efficiency in aspects such as Use of pozzolana (such as fly-ash, rice husk ash, meta-kaoline, silica fume, ground granulated blast furnace slag, etc.) in concrete production. A new chapter (Part 11) is being added to the National Building Code 2005 titled 'Approach to Sustainability' to provide required guidance with respect to all relevant aspects involved during planning, design, construction, operation & maintenance

of buildings. It looks at the life cycle concerns of building material advocates the use of low carbon sustainable alternatives.

5.6.3. Energy Conservation Building Code

The Bureau of Energy Efficiency (BEE) has introduced a voluntary code for energy efficiency; The Energy Conservation Building Code (ECBC) 2006 has an aim to reduce energy consumption from 25 per cent to 40 per cent , yielding annual saving of about 1.7 billion units[11]. There is however no mention of building material and embodied energy concerns in this code. It looks purely at operating energy of a building. Similarly, the Ministry of New and Renewable Energy Sources (MN&RE) has initiated several programs focusing on utilization of renewable energy sources in buildings.

5.6.4. Indian Green Building Council Green Homes

Indian Green Building Council (IGBC) Green Homes is the first rating programme developed in India, exclusively for the residential sector. It was envisioned in 1997 and was finally launched in 2008. The criteria encourage construction of homes which are sustainable over the life cycle of the building. The programme covers methodologies to cover diverse climatic zones and changing lifestyles. Under the Material Component it looks at aspects of Reduce, reuse, recycle, use of Local materials and Waste management.

5.6.5. Green Rating for Integrated Habitat Assessment

TERI (The Energy & Resource Institute) developed the **GRIHA** (Green Rating for Integrated Habitat Assessment) rating system keeping in mind Indian conditions in 2006. It is a voluntary rating system for new commercial, residential and institutional buildings to facilitate design, construction, operation and evaluation of environment friendly buildings. It takes into account the National Building Code 2005, the Energy Conservation Building Code 2007 and other IS codes, local bye-laws, other local standards and laws. MNRE is promoting this through a combination of financial and promotional incentives, and other support measures[12]. It has certain specific material considerations that include

- Utilization of fly ash in the building structure.
- Use low-energy material in the interiors.
- Reduce volume, weight, and time of construction by adopting an efficient technology (e.g. pre-cast systems, ready-mix concrete, etc.).

5.6.6. Public Procurement Guidelines for State and Central Work

Articles 298 and 299 of the Indian Constitution form the foundation for public sector procurement. The Indian Contract Act (1872) and Sales of Goods Act (1930) provide the legislative basis. Specifically, the General Financial Rules (2005) and the Delegation of Financial Powers Rules provide the operational framework, and the Directorate-General Supplies and Disposals (DGS&D) Manual provides the procurement model for other Central and State Government bodies, as also public sector undertakings (PSUs). Additionally, PSUs are limited companies and are bound by the provisions of the Companies Act. Only the two states of Karnataka and Andhra Pradesh have pronounced public procurement policies.

The rules and policy pronouncements focus on transparency in the procurement process, from standard setting and tendering to payments. Preference is accorded to a select

[11] **www.energymanagertraining.com/ECBC/27May2007/PIB_27May2007.pdf**
[12] **Issued vide sanction No. 3 / 5 / 2008-UICA (SE) dated 5th February, 2009**

group of goods and products from registered cottage or small scale industries which have considerably reduced in number over the past few years. There is no specific mention of environmental criteria in any of these and, consequently purchases are made from the vendor offering the lowest price for a given specification/ standard and delivery schedule.

Bricks fall in the raw materials category and only public sector manufacturing units such as the Public Works Department and Indian Railways procure raw materials. The value of works taken up by the CPWD in 2008-2009 was approximately Rs. 70 billion and the procurement bill of the Indian Railways was Rs. 280 billion (Apart from manufacturing of locomotives, tracks etc the railways also grant contracts for construction of buildings and bridges). Ensuring that procurement made by these two units take environmental considerations into account could have a massive impact on GHG emissions of the country.

The CPWD and State PWDs consider only those for contracts who register with them. The PWD has a schedule of rates with the basic rate of materials in which Clamp Bricks, Bulls Trench Kiln (K.B.) Bricks and Fly Ash bricks are included.

5.6.7. Indira Awas Yojna

The Indira Awas Yojna is a flagship scheme of the Ministry of Rural Development (MoRD) to provide financial assistance to the BPL households in rural areas for construction of a dwelling unit in all states of India, This scheme has significantly increased the demand for building materials in rural areas. Currently there are no procurement specifications or established layouts and the beneficiary is free to conduct their house as they please within the financial assistance provided - Rs.35,000/- per unit for the plain areas & Rs.38,500/- for the hilly/difficult areas. However, under the guidelines of the IAY, the District Rural Development Agency (DRDA) is required to give information on environmentally friendly, innovative and disaster resistant technologies[13].

5.6.8. Preferential procurement for MSME's

A policy has been formulated by MSME, awaiting Cabinet approval, to ensure that 20 per cent of the procurement by the different Ministries/ PSUs is made from MSME sector mandatorily. Challenge here would be to upscale the technical capabilities of MSMEs to meet quality standards and delivery schedules[14]. The MSME share of estimated annual procurements, worth over Rs 1,70,000 crore, is now a mere 5 per cent, or Rs 8,500 crore. It is expected if the government accepts the recommendation, MSMEs can have a potential Rs 34,000 crore slice of the overall purchases, including those made by public sector companies [15]

[13] **Barbara Morton and Rajan Gandhi (2011) Green Public Procurement: Policy & Practice within EU & India**
[14] **http://msme.gov.in/MSME-Strategic-Action-Plan.pdf**
[15] **http://smetimes.tradeindia.com**

There are significant issues with the current practices in the Indian brick sector – both environmental and social that need to be addressed and constraints that arise in enabling a transforming the brick sector to a cleaner and energy efficient one as emerges from the policy mapping. These are elaborated below.

6.1 Issues

6.1.1. Associated Environmental Issues

Pollution:

The large coal consumption of the brick industry is the cause of significant air pollution in terms of carbon dioxide (CO2), carbon monoxide (CO), sulphur dioxide (SO2), nitrogen oxides (NOx) and suspended particulate matter (SPM). While the emission standard (CPCB norms) for Suspended Particulate Matter (SPM) ranges between 750 - 1000 mg/Nm^3 the actual emissions from existing brick technologies range from 600 - 1770 mg/Nm^3 which exceed the prescribed norms.

High usage of coal as a fuel also leads to considerable amount of Greenhouse Gas (GHG) emissions. Considering the average specific energy consumption is $4.5x10^{-6}$ Tj/ brick, multiplying by 18, 44,000 bricks per unit, the CO_2 emissions contributed by 100,000 brick kilns is 78 tonnes/annum. The large amounts of coal used for brick firing also leave behind **bottom ash** as residue. Some part of this bottom ash is used as an insulation material for the firing chamber, while the rest gets dispersed by wind and rain. The air pollution and bottom ash generated cause considerable health problems, especially related to respiratory health, while also causing damage to property and crops.

Lack of regulation & Lax monitoring mechanisms:

A directive was issued by the Supreme Court of India for discontinuing the movable chimney kilns and for all brick kilns to conform to new environmental norms by 30 June 2001[16]. While this signalled a move in the right direction, due to lax monitoring mechanisms such kilns continue to function and flout environmental regulations. Additionally, while kilns with higher production levels and capital have the option to changeover to fixed chimney type BTKs, the small and medium scale brick entrepreneurs are confronted with environmental regulation without having financially viable options to switch and thus continue to run polluting kilns.

[16] http://www.vsbkindia.org/vsbkhow.htm

Low Energy Efficiency:

With an average consumption of 20 tonnes of coal per 100,000 bricks, the brick sector consumes about 24 million tones of coal per year which is about 8 per cent of the total coal consumption of the country (third largest consumer after power and steel sector). In addition it also consumes several million tones of biomass fuels. The share of energy in total cost of brick production is 35-50 per cent. As new technology alternatives have demonstrated, there is a potential to considerably reduce the amount of coal used in the firing of bricks.

Suboptimal Resource Utilisation:

The brick industry competes for resources with other sectors, which poses a significant challenge to the sector. **Coal** is one such resource that is required for the power, steel and other crucial sectors and **top soil** or land which could be used for agriculture. Soil being the raw material for brick making, is consumed in huge amounts by the brick industry. According to recent estimates, top soil to the extent of 350 million tonnes is used every year for the production of clay bricks in India (DPR – PSCST, 2010)[17].

The traditional kiln unit itself occupies considerable land area and which is subjected to high temperature making it unfit for agricultural activities (after the site is abandoned). The fast depletion of arable land thus caused due to brick making is a matter of concern to India taking into consideration food security issues.

6.1.2. Associated Socio-Economic Issues

Occupational Hazards:

Traditional brick making involves crude techniques causing considerable worker drudgery. Brick workers, especially moulders are exposed to the sun for long hours. They are exposed to high concentration of dust while manual breaking of coal. There is also the risk of exposure to dust (from bottom ash spread on the kin) and open fire during manual coal feeding. The workers have to walk on hot surface (top of the furnace) while monitoring and regulating the fire. They are also exposed to high concentrations of Respirable Suspended Particulate Matter (RSPM), during monitoring and regulating the fire, as the furnace chamber is covered with ash (ash acts as insulator). This exposure is also risked during the manual mixing of fly ash and clay and due to the open dumping and storage of fly ash.

Transportation of green and red bricks is done by head load. Generally 9 to 12 bricks are carried at a time as head load. Carrying head loads on a regular basis causes health problems, especially in women. Even though the brick workers are exposed to these occupational hazards, coverage under any sort of insurance or medical facilities is not a practice that is followed.

[17] **Detailed Project Report (June 2010).Model Project Report for Setting up Energy Efficient Brick Kiln for the Production of Resource Efficient Bricks. Punjab State Council for Science & Technology.**

Seasonal Employment:

Brick production is seasonal in nature and units generally remain closed during peak summer and monsoon period. Therefore the workforce gets employment for a limited period of six months in a year. During this period, the workforce has to look for alternative options of income generation. Due to lack of any skill set, majority of the workforce has no option but to engage as labourers (generally as agricultural labourers). The other issue with this is that there is no guarantee to get employment in the same kiln in the next season; therefore this community has to undergo a job hunt twice every year.

Reimbursement Mechanism:

In the brick sector, labour is brought in through a contractor (from distant places). Since they are not on the payrolls of the kiln owner, they are not covered under the current labour laws, e.g. Minimum Wages Act. The work force is paid on basis of quantum of work and against completion of certain tasks such as moulding of 1000 bricks, transportation of 1000 green bricks etc. Operations are mostly manual and under present conditions 100 to 150 days of employment is available.

For jobs such as transportation of green bricks which are done by individuals, both males and females are paid separately and at equal rates. Brick making jobs are performed by the husband - wife couple. However, there are no separate wages for women labour for jobs such as brick moulding (which are performed together by several members of a family) and payments are made on piece rate to a family. There is no practice of systematic spending or savings.

6.2 Constraints

No Green Public Procurement Policy:

India does not yet have a green procurement policy as yet. The Ministry of Environment and Forests (MoEF) is formulating a Green Procurement Policy to be merged with the overall Indian public procurement policy[18]. In this regard, they have enlisted Confederation of Indian Industry (CII) to develop green procurement guidelines and build capacity for formulating, implementing, and enforcing the GPP at the national and state levels. MoEF will decide if the product is green or not on the basis of certain environmental as well as quality parameters. In fact, through the GPP, the MoEF also plans to create a market for green products through the policy by going through the tender route and giving the contract to the lowest bidder for each product.[19]

Low emphasis on use of Fly Ash:

While, ash based building materials have gained more acceptance and the use has increased in lieu of various notifications, its use is not rigidly imposed and hence ash bricks and blocks are still occupy only a small per cent age of the total brick/ block share. India produces about 70 million tons of coal ash per year from burning about 200

[18] **Barbara Morton and Rajan Gandhi (2011) Green Public Procurement: Policy and Practice within EU and India**
[19] **http://www.financialexpress.com/news/environment-ministry-mulls-green-public-procurement/775798/0**

million tons of coal per year for electric power generation. Coal-ash management poses a serious environmental problem for India and its use for brick making helps in the disposal of waste in a resourceful manner. It also prevents the depletion of top soil used to make conventional bricks and thus reduces the embodied energy of the building making it greener.

Building Materials neglected in National Action Plan for Climate Change:

The National Mission on Sustainable Habitat and Enhanced Energy Efficiency in the National Action Plan on Climate Change have not addressed concerns of life cycle and embodied energy of building materials which may have increased emphasis on the use of clean and energy efficient bricks.

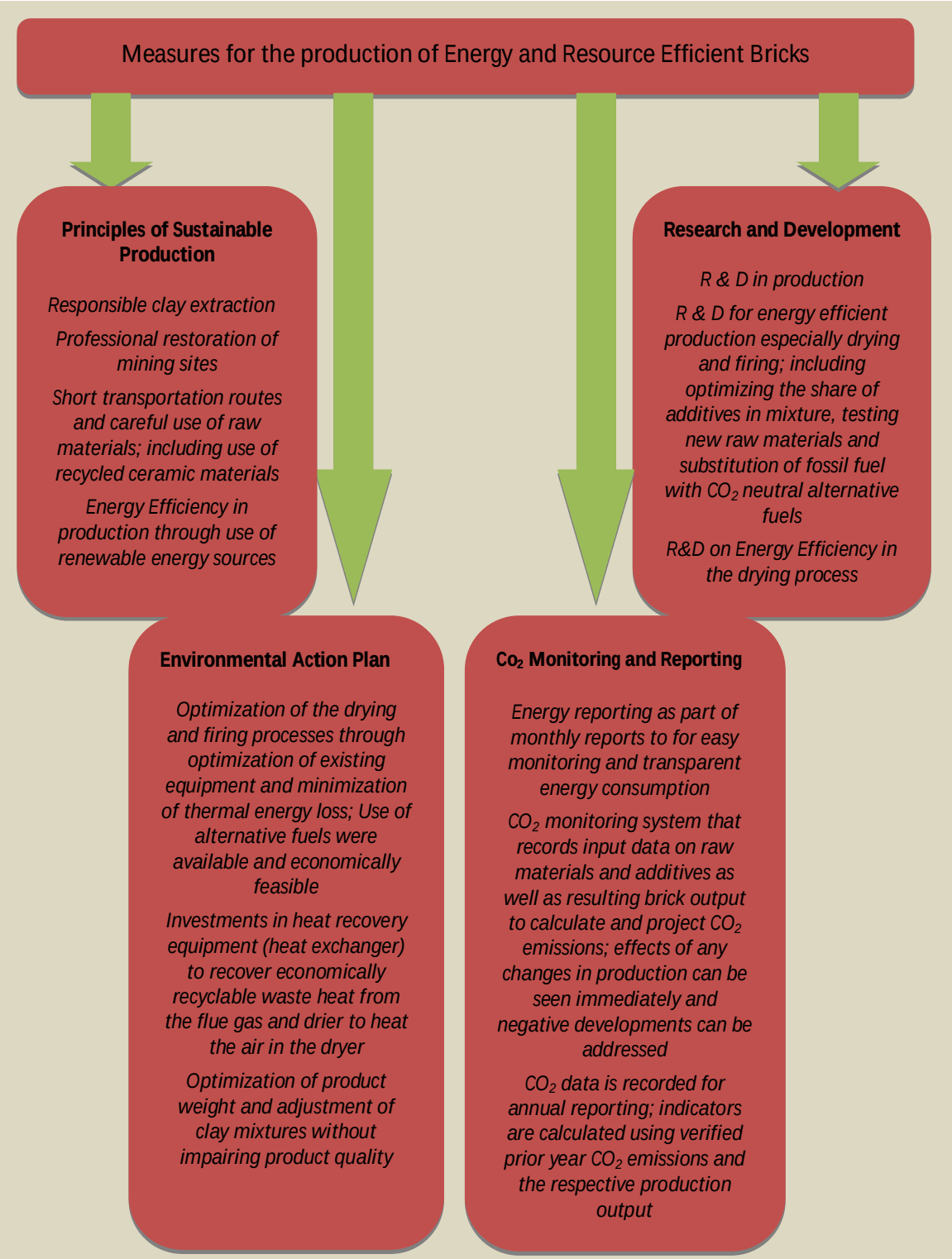
No initiative for the promotion of mechanised mixing:

Using waste in green bricks necessitates the use of mechanized mixing and hence needs mention in manufacturing standards in addition to product specifications.

There are significant differences between the brick industry in developed and developing nations. Developing nations are much more reliant on bricks as a load bearing building material and are predominantly known to have obsolete and polluting firing technologies for brick production and various social issues. On the other hand, developed nations have a highly mechanized and energy efficient process for brick making. There are constantly innovations in terms of making the process more energy efficient; examples of this include the production of hollow bricks, use of natural gas etc. Due to mechanization, the bricks are also of good quality and a standardized size and color.

7.1. Measures for Environment improvement and Energy and Resource Efficiency in Developed Countries – A Weinerberger Case Study

Weinerberger is the worlds leading manufacturer of bricks and has units all over the developed world. The company follows the operational application of economic, ecological and social criteria and its initiatives and innovations give a good picture of the environment protection measures that are taken in brick production in developed countries.



Source: Wienerberger Sustainability Report 2010

The potential of a country to switch to cleaner more energy efficient technologies is highly dependent on economy, but also on its environmental outlook that is reflected in their development strategies and policies. These are mentioned below:

7.2 Environment Friendly Policies in the Global Brick Industry

China is gradually reducing its dependence on burnt clay bricks. A gradual banning of all solid clay bricks and tiles in new buildings in all municipalities, large and mid-sized cities in coastal areas, and cities in provinces where per capita farmland is less than 0.053 hectares was initiated in 2000 to ensure that no solid clay bricks would be in use by 2010[20].

In **Vietnam**, a phase-wise replacement of burnt clay bricks is taking place. A decision issued by the Prime Minister in 2010, states that by 2020 alternative building materials should replace all baked building materials, including clay bricks. Also part of the decision is the use of about 15-20 million tons of industrial waste industrial (thermoelectric ash, blast furnace slag etc.) to produce building materials[21].

In **Bangladesh,** where the brick industry is extremely polluting and dominated by the MCBTK, the country is now making a transition to cleaner technologies such as the VSBK and the Hybrid Hoffman Kiln (HHK) technology which is the most viable kiln for the area according to UNDP, that is working on implementing a project on improving kiln efficiency in the Bangladesh brick making industry by demonstrating and promoting the HHK technology.

The Government of **Nepal** in 2002 announced the discontinuation of production licenses for Bull's trench kilns (BTK) with movable chimneys. The government signed a bilateral agreement with SDC for to implement VSBK technology transfer in February 2003 to gradually modernize the brick technology in Nepal.

In the **Latin American** countries of **Argentina, Bolivia, Brazil, Colombia, Ecuador, Mexico and Peru**, issues of resource inefficiency and environmental degradation are being addressed through the Latin American Artisanal Brickmakers Programme for Energy Efficiency to Mitigate Climate Change (EELA). The project is under way in sponsored by Swisscontact and national partners in each country. In the first phase, 2010-2013, research is being conducted on the status of the industry in each country, and technical improvements are being tested. A core objective is to reduce the emission of greenhouse-effect gases from the ovens, thereby curbing the industry's contribution to climate change.

The efforts are focused on improving energy efficiency, introducing alternative and less polluting fuels, improving the artisanal ovens and raising the quality of the final product.

7.3 Policies towards Sustainable Resource Use Around The Globe:

Certain countries are proactively looking at resource efficiency and sustainable development through their policy frameworks.

The **German** National Strategy for Sustainable Development (NSSD) has strategic, mostly quantitative, trend objectives and a set of 21 indicators grouped under different headings that

[20] **http://english.peopledaily.com.cn/200403/17/eng20040317_137777.shtml**
[21] **No. 567/QD-TTg, Hanoi, April 28, 2010 'Approving the program on development of non-baked building materials through 2020'**

factor in resource conservation, energy productivity and resource productivity. The goal is to double energy productivity and resource productivity by the year 2020.

The 2008 **South African** National Framework for Sustainable Development (NFSD) proposed five relevant strategies: enhancing systems for integrated planning and implementation; sustaining ecosystems and using resources sustainably; investing in sustainable economic development and infrastructure; creating sustainable human settlements; and responding appropriately to emerging human development, economic and environmental challenges. The South African scientific community considers resource depletion as an urgent priority for water and soil.

In 2007 the **Japanese** government adopted a policy that committed Japan to becoming a 'Sustainable Society', which it proposes to build through comprehensive measures integrating the three aspects of such a society, specifically, a Low Carbon Society, a Sound Material-Cycle Society and a Society in Harmony with Nature. This decision both consolidates a long period of sectoral policy development and sets the stage for integrated planning in the future. Material Flow Accounts (MFA) have become an integral feature of Japanese environmental policy, identifying the whole system of material flows in the national economy and providing itemized overviews for such flows.

8.1 Short Term Measures

8.1.1 Preferential Policy Regime

There are various policy tools in the country being regulated and implemented by different departments that can positively influence the uptake of clean and resource efficient technology as can be seen from the chapter on Enabling Policies, however these require mainstreaming in planning processes at all levels and rigorous implementation and enforcement. The involvement of civil society in this area needs to be strengthened, as very few institutions are working on ensuring that social and environment conditions in this sector improve.

8.1.2 Improved Access to Finance

The adoption of eco friendly brick making technologies has the potential to create entrepreneurs as well as livelihoods. This requires improved access to finance for new entrepreneurs as well as existing entrepreneurs for bringing about improvements in existing technology as well as the uptake of new technology. Access to finance in the form of subsidies, performance incentives and 'one-window' loan systems needs to be enhanced. Financial instruments such as leasing finance also need to be better explored.

8.1.3 Enhanced Service Delivery

Availability of easy access to commercial service providers is a key factor that is considered by those thinking of investing in a new production technology. Successful deployment of new brick-making technologies cannot occur without a reliable service delivery mechanism in place that assures the entrepreneur that required technical support will be available at all stages of installation to commissioning. Only then are newer brick-making technologies likely to gain the foothold that is required from which its larger-scale adoption can become a self-sustaining process. Currently the country has negligible commercial service providers that promote environmentally friendly brick-making technologies.

8.1.4 Green Rating Systems

The establishment of a Green Rating System and incentives for individuals and organisations that adhere to such a system is crucial for promoting clean and resource efficient technologies. Green rating systems that consider embodied energy can go a long way in reducing carbon emissions while at the same time raising awareness of consumers and increasing demand for eco building materials.

8.2 Long Term Measures

8.2.1 Green Procurement Policy

A significant boost for the demand of eco-bricks can come from ensuring that they are included in the public procurement policy of the country. The 'Schedule of Rates' document used for procurement by the State Public Works Department or Building Construction Department needs to have a preferential regime for eco-bricks and eco building material suppliers. Once such materials are used favourably in government buildings, they can set a precedent for citizens.

8.2.2 Use of Industrial Waste

Industrial waste having a calorific value of over 1000 KCal/kg can be used as internal fuel for brick making. Examples include sponge iron waste, boiler ash, sugar industry waste, burnt rice husk ash, textile sludge etc. Using industrial waste in brick making at an extensive scale will require certain prerequisites. A stringent policy regime that makes it mandatory to use industrial waste where it is abundant and Research and Development initiatives to test the most viable industrial waste that can be used in an area and in what quantities to ensure that quality of bricks is maintained. This is a necessary step in the long run to reduce pressure on resources such as coal and soil.

8.3.3 Mainstreaming Resource Efficiency and Green Growth

Resource depletion is being treated as a priority in several countries of the world. India too needs to mainstream resource efficiency and green growth in its policies rather then taking it up as sporadic initiatives. This will encompass several of the policy initiatives mentioned in this chapter – such as ensuring resources are recycled through use of industrial waste, having a green procurement policy, having a green rating system that ensures that life cycle of products - resource extraction, manufacture, distribution, use, disposal and recycling – is considered. This preferential regime needs to be mainstreamed to ensure sustainable development in the nation.

Way Forward

It is well established that the brick sector is the backbone of the infrastructure industry of India. The unique characterization is its decentralized small scale production activity providing large scale employment and income generation opportunities – a characterization of the SME industry.

Considering the fabric of the brick industry, there is a large scope for improvement in terms of resource efficiency, especially looking at the energy consumption. Top soil usage is also a concern for the future. It is apparent that with rising national and international concerns on the environment there will be increasing pressure on the Indian brick sector to improve. To catalyze and sustain the process policy will play a crucial role.

Thus the following way forward is suggested:

- "Status of Indian Brick Sector" report for understanding the current situation in terms of technologies being followed, improved practices, resource consumption.
- Identification of a nodal Ministry of the Government of India to understand, and coordinate the improvement of the brick sector, suggest measures of improvement and monitor the same.
- Enhancing capacities of policy makers and government at regional, state and national scale on the status and need for change.
- Introduction of a national programme for improvement of the brick sector in the mission mode. This can be in the form of a "National Programme on Brick Sector Efficiency Improvement".

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