SMALL AND MEDIUM ENTERPRISES: ENERGY EFFICIENCY KNOWLEDGE SHARING

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SAMEEEKSHA NEWSLETTER

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Inside...

Promoting Energy Efficiency in SMEs

SAMEEEKSHA

VISION

SAMEEEKSHA envisages a robust and competitive SME sector built on strong foundations of knowledge and capabilities in the development, application, and promotion of energy-efficient and environment-friendly technologies.

Bureau of Energy Efficiency

SHAKTI SUSTAINABLE ENERGY FOUNDATION

The Energy and Resources Institute

A PLATFORM FOR PROMOTING ENERGY EFFICIENCY IN SMEs

IN THIS ISSUE...

The theme of this issue is the BEE initiative titled 'Energy and resource mapping of MSME clusters in India', under which partner-agencies have undertaken studies on major energy intensive MSME sub-sectors, identified options for energy efficiency (EE) and resource efficiency in each sub-sector, and outlined policy-level strategies that could help bring about large-scale improvements in EE and resources utilization throughout the concerned sub-sectors as well as reductions in carbon emissions on a national level.

The first article describes the mapping study undertaken by TERI on the MSME segment of the refractory industry. The article presents an overview of the Indian refractory industry, summarizes EE and resource-efficient technological options that have been identified for adoption by MSME refractory units, and outlines a few broad strategies that could, upon implementation, help in scaling up the adoption of these identified options.

The second article in this issue captures the gist of an interactive workshop organized by BEE and TERI on December 11th, 2021 to present and discuss the outcomes of the mapping exercises that have been carried out by various partner-agencies under the BEE project in the foundry, forging, steel rerolling, paper, pharmaceuticals, brick, and glass & refractory sub-sectors.

The issue concludes with a summary of the salient points from the 20th SAMEEEKSHA meeting held (online) on 17th December 2021.

SAMEEEKSHA Secretariat

ENERGY AND RESOURCE MAPPING STUDY OF REFRACTORY INDUSTRY

The refractory industry is one of the energy intensive MSME sub-sectors in which TERI has conducted an energy and resource mapping study and identified energy efficiency (EE) options under the BEE project 'Energy and resource mapping of MSME clusters in India'. This article presents an overview of the Indian refractory industry, and also summarizes some of the key EE options that have been identified for adoption by refractory units.

Overview of refractory industry

The Indian refractory industry comprises large-scale plants as well as MSMEs located in clusters in different parts of the country. The important MSME refractory clusters include:

- Eastern zone – Asansol and Raniganj (West Bengal); Chirkunda, Ranchi and Ramgarh (Jharkhand)
- Central zone – Katni (Madhya Pradesh)
- Western zone – Rajkot (Gujarat);Bhilwara (Rajasthan)
- Southern zone - East West Godavari (Andhra Pradesh); Virudhachalam (Tamil Nadu)

The total annual production of the refractory industry was estimated at 0.84 million tonnes during FY 2019–20, of which over half (57%) came from refractory clusters in the eastern zone.The iron & steel industry is the principal end-user of refractories, accounting for around 75% of the market (figure 1).

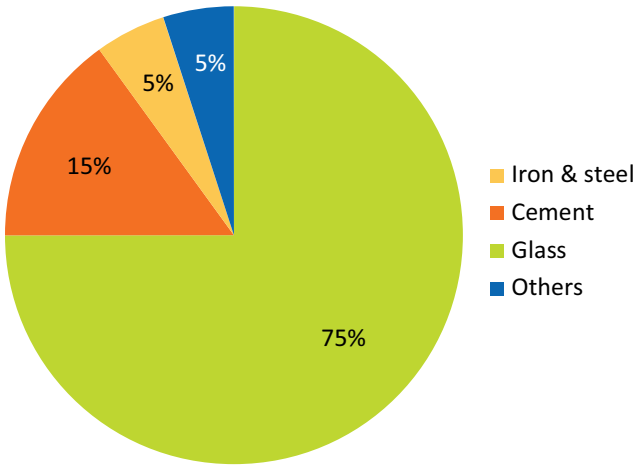

Figure 1. End-users of refractories by industry sub-sector

TERI's work with refractory industry

TERI has been engaged with the refractory industry since 2015–16, when surveys were conducted and cluster profiles prepared on the Asansol, Chirkunda, Ranchi and Virudhachalam refractory clusters under the TERI–SDC Partnership Program. This experience provided a glimpse of the sheer scale and spread of the Indian refractory industry and the huge potential it offered for EE improvements.

During the 14th SAMEEEKSHA platform meeting in Kolkata in August 2018, members of the Indian Refractory Manufacturers Association (IRMA) underlined the need to promote EE firing technologies among refractory clusters in the eastern zone. TERI followed up on this opportunity by holding a workshop in Chirkunda (Jharkhand) in May 2019, which saw participation by a large number of refractory entrepreneurs and other stakeholders from the eastern zone including industry associations, MSME-Development Institutes (Dhanbad and Kolkata), District Industries Centre (W. Burdwan), technical experts from the Central Glass and Ceramics Research Institute (CGCRI), Kolkata, and researchers from the Ceramic Engineering Department of University of Kolkata and Maulana Abul Kalam Azad University, Kolkata. The event provided TERI with deeper insights into the specific needs and challenges of the refractory units/clusters in the eastern zone. Also in 2018–19, TERI conducted studies and walk-through energy audits in the Chirkunda and Ranchi refractory clusters to assess the potential for introducing EE and renewable energy (RE) options under the UNDP–GEF project titled 'Market Transformation and Removal of Barriers for Effective Implementation of the State-Level Climate Change Action Plans'.

The ongoing energy and resource mapping exercise initiated by BEE thus marks a logical and important step towards scaling up EE throughout the Indian refractory industry.

Technology

The manufacture of refractory products involves two distinct process steps: (1) raw material preparation and moulding, and (2) firing of the moulded products.

The equipment used in preparation and moulding include jaw crushers (crushing), ball mills (grinding), mullers (mixing), friction presses and hydraulic presses (pressing/moulding). Drying of the moulded 'green' products is usually carried out naturally, in large open sheds.

For firing the green products, a majority of MSME refractory units (about 71%) use downdraft (DD) kilns which are batch-type kilns with firing cycles ranging from 10 to 12 days. Figure 2 shows a typical DD kiln. About 23% of refractory units use tunnel kilns for firing (figure 3); these are continuous-type kilns, in which the residence time of refractory products ranges from 20–28 hours. DD kilns account for almost 50% of total refractory production in India, while tunnel kilns account for about 40%. Other types of kilns such as chamber kilns and rotary kilns account for the remaining 10% of total refractory production (figure 4).

Figure 2. Downdraft kiln

Figure 3. Tunnel kiln

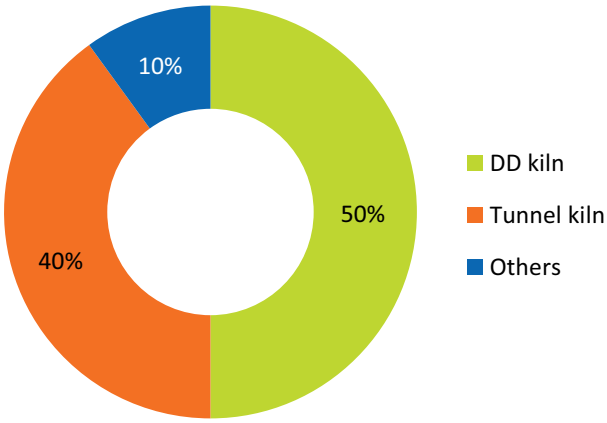

Figure 4. Technology-wise production shares

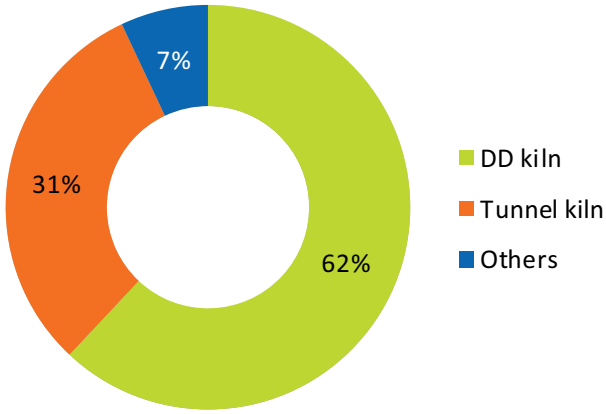

Figure 5. Energy consumption shares by kiln type

Energy consumption

DD kilns account for about 62% of total energy consumption, tunnel kilns 31%, and other kilns about 7% (figure 5).The total annual energy consumption of MSME refractory clusters in India is estimated at 105,446 tonnes of oil equivalent (toe), of which almost 99% (104,364 toe) is in the form of thermal energy for process heating in kilns.The primary fuels used are coal in DD kilns and petroleum coke (petcoke) in tunnel kilns. Electricity accounts for barely 1% of total energy consumption, and is used to drive various machinery/ equipment in raw material preparation and moulding.

Options for energy efficiency

A number of EE and resource-efficient options have been identified for DD kilns as well as tunnel kilns, with attractive payback periods on investments as shown in table 1. DD kiln-based units can also achieve significant savings in energy consumption by switching over to tunnel kiln technology. The energy performance of tunnel kiln units can be enhanced by switching over from solid fuel to gaseous fuel, provided that natural gas (NG) is available at cluster level at prices comparable to the existing fuel prices.

Table 1.Summary of energy efficiency and resource-efficiency options identified for refractory units

EE option	Energy saving (toe/year)	Monetary saving (Rs lakh/year)	Investments (Rs lakh)	Simple payback (years)	CO_2 reductions (t/year)
DD kilns					
Enhancing insulation of crowns and doors	2654	412	243	0.6	10676
Kiln monitoring & control tool	5490	851	284	0.3	22087
Installing waste heat recovery system	1268	197	473	2.4	5103
Tunnel kilns					
Enhancing insulation	1954	410	80	0.2	7934
Low thermal mass cars	1341	281	300	1.1	5443
Switchover from solid fuel to gaseous fuel	15334	185	915	5.0	5971
Cross-cutting technology					
EE motors	38	29	95	3.3	363
Resource-efficiency options					
Productivity enhancement in DD kilns	(-) 466	460	985	2.1	(-) 4439
Installation of material feeding conveyor system	196	903	1129	1.2	1867

Strategies to scale up energy efficiency

Based on its studies and stakeholder consultations in the Indian refractory industry, TERI has identified a number of strategies that could, upon implementation, help overcome the existing barriers and pave the way for large-scale improvements in EE as well as resource-efficiency among refractory clusters across the country. A few key strategies are summarized below.

- **Establish an Energy Management Cell (EMC) at cluster level**. The EMC will facilitate the adoption of EE technologies/equipment in individual refractory units through a self-sustaining model, and ensure that each cluster achieves a benchmark EE level at minimum cost. It can provide hand-holding support to individual refractory units in terms of identifying and implementing Energy Conservation Technologies and best operating practices.
- **Establish a Technology Upgradation Fund (TUF)**. The TUF will help in establishing technology and product development centres as well as skill development facilities in major refractory clusters; and it can provide support to refractory units for the adoption of new products as well as for upgrading workforce skillsets.
- **Establish Common Facility Centres (CFC) in select clusters**. The CFC can meet the common requirements of all units in the cluster: for instance, providing access to testing of raw material, marketing support, and so on.
- **Develop new industrial zones**. These new industrial zones will provide necessary infrastructure for smooth and efficient refractory production, including green fuel supply systems.

INTERACTIVE WORKSHOP ON OUTCOMES OF ENERGY AND RESOURCE MAPPING OF MSME CLUSTERS

BEE and TERI organized an interactive workshop in New Delhi on 11th December 2021 under the aegis of SAMEEEKSHA to share and discuss the outcomes of the on-going BEE initiative titled 'Energy and resource mapping of MSME clusters in India'. The physical event was attended by around 45 participants including officials from BEE, industry association representatives and entrepreneurs from MSME clusters across the country, technology experts, and representatives of the partner-agencies implementing the project—namely, PwC India; ICF; NPC; ENZEN & GKSPL; and TERI. In addition, about 35 participants attended the event online.

Mr Milind Deore, Director, BEE, summarized the interventions by BEE in the MSME sector which have so far covered about 120 MSME clusters in 30 sub-sectors. However, the sheer size and spread of the Indian MSME sector still leave enormous, hitherto-untapped scope for scaling up energy efficiency (EE). It is in this context that BEE initiated the energy and resource mapping project in nine energy intensive sub-sectors, with the aim of preparing a policy roadmap for each sub-sector that will help bring about large-scale improvements in EE and resources utilization as well as reductions in carbon emissions on a national level.

Mr Girish Sethi, Senior Director, TERI, underlined that long-term engagement with MSMEs at the cluster level—in particular, building and strengthening the capacities of cluster-level agencies such as local service providers—is needed for ensuring the sustained uptake of EE measures; this aspect must be taken into consideration while drawing up action plans for implementation of the roadmaps prepared under the mapping project. He cited a recent study by TERI which indicates that 75–80% of overall energy consumed by industry sector is thermal energy. This implies that even with advancements in generation and supply of electricity from renewable energy (RE) sources, the industrial sector will continue to depend on fossil fuels such as gas, oil and coal—particularly for high-temperature processes in industries such as glass, refractories, foundry, forging, etc. The need, therefore, is to develop electricity-based solutions for various industrial processes, and promote these solutions through appropriately framed policies.

Mr P Shyam Sunder, Joint Director, BEE, provided a brief overview of the mapping project including its design and approach, key activities, and the way forward. The partner-agencies have prepared policy road-maps for scaling up EE in each sub-sector at the national level. As the next step forward, enabling policies will be framed to address the following important aspects as brought out by the studies and sub-sectorial road-maps:

- Providing technical and financial support to MSMEs for demonstration, implementation, and replication of feasible EE measures
- Strengthening the knowledge and capacities of MSME personnel as well as key cluster-level entities
- Finalizing and implementing BEE's innovative 'Perform, Achieve and Earn' (PAE) scheme that will incentivize MSMEs to increase their energy efficiencies and reduce their carbon emissions.

A discussion followed on the project outcomes, moderated by Mr Milind Deore. Detailed presentations were made by partner-agencies on their respective sub-sectorial studies and roadmaps in order to facilitate the discussions.

- Foundry; Forging (Mr Jayakrishnan Nair, PwC)
- Steel rerolling; Paper (Mr Rudhi Pradhan, ICF)
- Pharmaceuticals (Mr Jitendra Srivastava, NPC)
- Brick (Mr Thanumoorthi & Mr Sonal Kumar, ENZEN & GKSPL)
- Glass & Refractory; Chemicals (Mr Pawan Kumar Tiwari, TERI)

Among the industry representatives who contributed to the discussions were Mr Devendra Jain Chairman, Institute of Indian Foundrymen (IIF), Indore Chapter; Mr Vikas Bajaj, Association of Indian Forging Industry (AIFI); Mr Anand Bhargava, CEO, All India Steel Rerollers Association (AISRA); Mr Bipin Thapliyal, Secretary General, Indian Agro & Recycled Paper Mills Association (IARPMA); and Mr Om Vir Singh Bhati and Mr Brij Mohan Gupta, All India Brick & Tile Manufacturers Federation (AIBTMF). Key policy recommendations for improved energy and resource efficiencies are tabulated below. A few salient points from the discussions are summarized thereafter.

Key policy recommendations for improved energy and resource efficiencies	
All sub-sectors	• Develop innovative business models for disseminating EE technologies (e.g. ESCO) • Establish Energy Management Centres (EMCs) and Common Facility Centres (CFCs) at cluster level to enable energy and resource-efficient production at unit level • Set up solar parks in clusters to meet motive loads • Identify competent LSPs at cluster level and strengthen their capacities through training programs • Develop EE assessment tool for financial institutions • Implement market-based financing mechanisms for EE like emissions trading, carbon pricing
Foundry & Forging	• Promote adoption of EETs such as: o Induction billet heater with IGBT controls and IoT o Electricity based heat treatment /annealing / normalization furnaces o Continuous forging and heat treatment • Work with National Institute of Advanced Manufacturing Technology for hands-on training courses in foundry and forging • Work with IIF's Centre of Excellence and Automotive Research Association of India (ARAI)'s Forging Division for soft skills training
Steel rerolling	• Enhance steel scrap recycling • Promote the adoption of direct rolling technology, which can entirely eliminate thermal energy use in steel rerolling • Introduce diploma courses in steel rerolling in the curricula of engineering colleges and technical training institutes
Paper	• Increase the usage of micro-turbines (cogeneration) • Promote the use of biofuels • Incentivize switch from fossil fuel-based boilers to electric boilers • Promote the use of plastic waste-to-energy boilers ('co-processing'), which are already being used in Vapi cluster
Pharmaceuticals	• Promote adoption of EETs such as: o Screw/ scroll compressor with VFD in HVAC-chillers o Energy efficient pumps with IE-3 motors and inbuilt VFD o Retrofits of boilers and thermic fluid heaters with systems for mechanized fuel feeding, combustion control, and waste heat recovery o Energy efficient boilers with fluidized bed combustion (FBC) technology • Work with professional bodies like Indian Society of Heating, Refrigerating and Air Conditioning Engineers (ISHRAE) to develop customized skilling programs for workforce
Brick	• Promote adoption of EETs such as: o Zig-zag technology to replace clamp kilns and Bull's trench kilns (BTKs) o Fuel switch (coal to gaseous fuels) o Use of internal fuel o improved fuel feeding practices (e.g. coal crushers, automatic coal feeding) o reducing surface heat losses (e.g., double-wall insulated feed-hole covers) • Promote manufacture and usage of EE products such as perforated bricks, hollow blocks, etc.

Glass & Refractory	• Glass: o Container glass—automation and control systems in tank furnace; electrification of annealing lehrs o Glass bangles—electrification of reheating furnaces; waste heat recovery systems; improved pot arching (for pot furnace units) o Blown and toughened glass— electrification of annealing lehrs; centralized LPG distribution system for glass blowing • Refractory o Switchover from downdraft kiln to tunnel kiln o Low thermal mass cars in tunnel kiln o Waste heat recovery system o Improved insulation o Kiln monitoring and control systems

Salient points

- Significant energy saving potential exists in all sub-sectors. Implementation of the identified EE options will yield significant reductions in energy consumption and carbon emissions as projected for 10 years (i.e. 2030–31) against 'business-as-usual' (BAU) scenarios. For instance, the energy savings against BAU in 2030–31 are projected at 17% for foundry; 22% for forging; and 29% for steel rerolling. Furthermore, the identified EE options offer attractive payback periods on investments.
- Promote energy management systems at cluster level. An ecosystem for energy monitoring has to be created among MSMEs through widespread implementation of energy management systems such as ISO 50001 and Internet-of Things (IoT)-based monitoring technologies. As individual MSMEs generally lack the capacities and motivation to adopt such systems, they should be supported and implemented at the cluster level by experts.
- Increase natural gas availability, promote its usage. The availability of NG for industries should be increased and its usage promoted. This would encourage industries to switch from high-carbon fuels like coal to NG—for instance, in the steel rerolling sub-sector, where coal-fired reheating furnaces account for about 70% of total energy consumption and where NG-fired options are already available.
- Rationalize gas prices. At present, NG price varies greatly—between regions and states, and in some cases even between districts within a state (e.g., Punjab). Furthermore, the gas prices keep changing. These uncertainties in gas costs severely affect the operations and competitiveness of units. Gas should be made available at a fixed and uniform price for industries across the country.

In his concluding remarks, Mr Abhay Bakre, Director General, BEE expressed his satisfaction that much progress has been made since 2010 in improving energy and resource efficiency in the MSME sector—in terms of awareness generation, assessment of needs, as well as finding solutions—thanks to the efforts of various implementing agencies working in close cooperation with industry partners. He underlined the need for a clear plan to achieve EE targets by 2030. To facilitate this challenging task, BEE is preparing a scheme for financing EE improvements in the MSME sector.

20TH MEETING OF SAMEEEKSHA

The 20th meeting of SAMEEEKSHA platform was held (online) on 17th December 2021. The meeting was attended by nearly 50 participants including officials from BEE; government departments such as Andhra Pradesh State Energy Conservation Mission (APSECM) and Office of the Textiles Commissioner, Mumbai; representatives of MSME associations; and entrepreneurs representing different textile industry clusters across the country.

Welcoming the participants, **Mr Girish Sethi**, Senior Director, TERI said that the meeting would focus on the findings of the study conducted by TERI to facilitate energy efficiency (EE) improvements in the MSME segment in the textile industry under a project initiated by International Energy Agency (IEA) in partnership with BEE. **Dr Sachin Kumar**, Associate Director - Energy Efficiency, SSEF, noted that the SAMEEEKSHA platform has steadily grown in strength and coverage over the years: in terms of hosting useful knowledge resources on its website, to facilitating the greater participation of and more effective interactions with entrepreneurs and other cluster-level stakeholders. **Dr Vibha Dhawan**, Director General, TERI, underlined that MSMEs form the bedrock of Indian entrepreneurship and hence need to be nurtured, adding that promoting EE among MSMEs will not only improve their competitiveness but be critical for meeting India's de-carbonization goals as announced by the Prime Minister during COP-26. **Mr Abhay Bakre**, Director-General, BEE said that the time has come to focus on bringing about large-scale EE improvements across MSME sub-sectors through nationwide initiatives such as the ongoing BEE-supported energy and resource mapping project in nine energy intensive MSME sub-sectors.

Mr Prosanto Pal, Associate Director, TERI made a presentation on 'BEE-IEA-TERI study on SME textile sector'. A panel discussion followed, moderated by **Mr Milind Deore**, Director, BEE and focusing on opportunities and policies to promote EE in the textile industry. The panel comprised **Mr Danda Prasad**, Chairman, AP Spinning Mills Association; **Mr Sanjeev Arora**, Reliance Industries Ltd., Textile Division, Ahmedabad; **Mr B K Sahoo**, Asst. Commissioner, Office of the Textiles Commissioner, Mumbai; **Mr A Chandra Sekhara Reddy**, CEO, APSECM; **Mr Hugo Salamanca**, IEA; and **Mr Ajitesh Upadhyay**, Sector Expert, BEE. Some of the key points from the presentation and discussions are listed below.

Key points

- The textile industry consumes an estimated at 10.35 million tonnes of oil equivalent (Mtoe) each year, of which 53% is thermal energy and 47% is electricity. MSMEs comprise a sizeable proportion of the textile industry, accounting for almost 95% of total cloth production. Energy accounts for 15–20% of total production cost, underlining the potential and scope for improving EE.
- The project has identified EE opportunities in all three major segments of the textile industry, namely, spinning, weaving, and wet processing (dyeing). Large-scale adoption of these EE measures could bring about energy savings of 8% in spinning, 5% in weaving, and 10% in wet processing.
- Major barriers to the adoption of EE technological options include the absence of indigenous manufacturers of EE machines, and the lack of trained machine operators.
- TERI and IEA have developed and recommended an integrated policy package for scaling up EE among MSME textile units, with actionable elements along three parallel tracks:
  - Regulation (e.g., expansion of PAT scheme, adoption of EE motors via ESCO-model)
  - Information (e.g., deep-dive EE programs, training operators/technicians on EE looms)
  - Financial incentives (concessional loans for EE technologies)

ABOUT **SAMEEEKSHA**

SAMEEEKSHA is a collaborative platform aimed at pooling the knowledge and synergizing the efforts of various organizations and institutions—Indian and international, public and private—that are working towards the common goal of facilitating the development of the Small and Medium Enterprise (SME) sector in India, through the promotion and adoption of clean, energy-efficient technologies and practices.

SAMEEEKSHA provides a unique forum where industry may interface with funding agencies, research and development (R&D) institutions, technology development specialists, government bodies, training institutes, and academia to facilitate this process.

For more details, please contact

Secretary – SAMEEEKSHA
Industrial Energy Efficiency Division
TERI, Darbari Seth Block
IHC Complex, Lodhi Road,
New Delhi - 110 003, India
Tel: (+91 11) 2468 2100
Fax: (+91 11) 2468 2144, 2468 2145
Email: sameeeksha@teri.res.in
Website: http://sameeeksha.org