



A PLATFORM FOR PROMOTING ENERGY EFFICIENCY IN SMEs

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Editorial

The importance of Indian foundry industry is well established. According to a recent survey, India is the 3rd largest producer of castings in the world, producing over 9 million MT of various grades of castings. Most of the foundries in India exist in the MSME sector and are backbone of important industrial sub-sectors such as automobiles, railways, machine tools, defence, textile, cement, power machinery and so on.

Kolhapur in Maharashtra boasts of being one of the biggest foundry MSME clusters in India with concentration of around 400 units manufacturing a range of hi-quality ferrous (iron) castings. Majority of the foundry units in Kolhapur cater to the automotive sector, supplying castings for engines, clutch housing, gears, etc. to major OEMs such as Ashok Leyland, Eicher, Hyundai, Maruti, Mahindra, Tata. Additionally, castings are also supplied to other industrial sub-sectors such as valves, pump-sets, compressors, sugar and textile. The total production of the Kolhapur foundry industry is estimated to be 600,000 tonnes per annum, which is about 8% of India's total casting production.

The Kolhapur foundry cluster has been well supported with many Governments/bi-lateral/ multi-lateral agencies targeting their interventions in the cluster. A major project is being executed by TERI with support from World Bank-GEF/SIDBI to improve the energy performance of foundry units. The project aims to identify energy conservation options/technologies in about 120 units and facilitate their implementation in over 80 units in the cluster. Additionally, with an aim to improve the productivity of the foundry units, Japanese experts from IGES with support from JICA initiated small group activities such as 5S, Kaizan, BOPs in selected units in the cluster. The objective of the Kaizan activity was to improve energy efficiency in the induction melting furnaces. Capacity building programs on BOPs in induction furnaces were also conducted in the cluster under this project which was coordinated by TERI. A Kaizan manual highlighting BOPs in induction melting has also been prepared and disseminated in the cluster. Moreover, IIF (Kolhapur Chapter) and local industry associations are also undertaking various developmental projects in the cluster.

Kolhapur cluster is highly energy intensive and offers immense scope for energy conservation through adoption of best available technologies/ operating practices. It is important to generate awareness about these through platforms such as SAMEEEKSHA.

I wish to thank TERI, IGES and WB-GEF/SIDBI who are making all round efforts to make Kolhapur foundry units more energy efficient and competitive.

Surjit Pawar
Chairman, IIF – Kolhapur Chapter

CLUSTER PROFILE

KOLHAPUR FOUNDRY CLUSTER

Background

Foundries manufacture various types of metal castings. The castings are used in different industries such as automobiles, railways, pumps, compressors and valves, diesel engines, cement, textile machinery, sanitary pipes and fittings, power generation, construction, etc. The Indian foundry industry produces over 9 million tonnes of castings annually, accounting for about 8–9% of global castings production. There are around 4500 foundry units dispersed across various geographical clusters in the country; about 3600 units (80%) are small-scale, 675 (15%) medium-scale, and 225 (5%) large-scale.

One of the biggest and most important foundry clusters is located in Kolhapur (Maharashtra). Kolhapur was traditionally an agro-based economy. The steady increase in sugarcane cultivation and jaggery manufacture in the region, coupled with progressive industrialization in the latter half of the 20th century, resulted in an increasing use of oil engines and agricultural machinery and a demand for locally available castings. This led to the emergence of the foundry industry in Kolhapur in the 1960s. Today, there are around 300 foundries in the Kolhapur cluster. The total annual production of the Kolhapur foundry cluster is estimated at 600,000 tonnes, which represents about 7–8% of India’s total casting production. According to industry estimates, the Kolhapur foundry cluster provides direct employment to over 40,000 people and indirect employment to nearly 100,000 people.

Almost all the Kolhapur foundry units fall under the MSME category as defined by the Ministry of MSME in terms of total investment in plant and machinery. The units may also be categorized as small, medium and large on the basis of annual production (table).

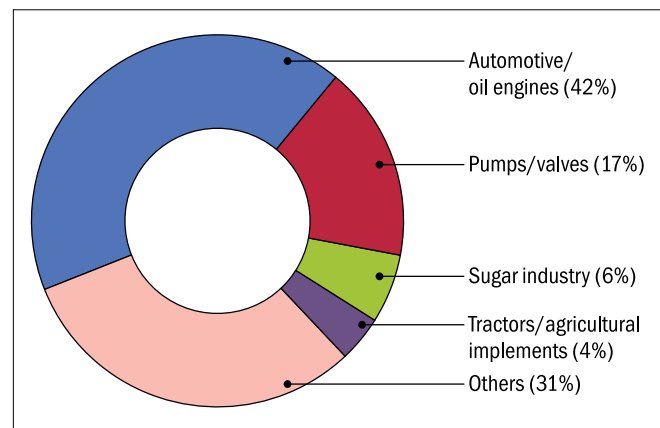
Profile of foundry units in Kolhapur cluster		
Unit size	Annual production (tpa*)	No. of units
Small	Up to 1000	195
Medium	1001–10,000	75
Large	Above 10,000	30
	Total	300

*tonnes per annum



Finished castings

The Kolhapur foundry units primarily manufacture ferrous (iron) castings, comprising spheroidal graphite (SG) iron as well as grey-iron castings. A majority of the foundry units cater to the automotive sector, supplying castings for engines, clutch housing, gears, etc. for automobile giants like Ashok Leyland, Eicher, Hyundai, Maruti, M&M, and Tata. Castings are also manufactured for other industrial sectors like pumps/valves, sugar, textiles, etc. Almost 30% of the cluster production is exported.



End-use distribution of castings produced by Kolhapur foundry cluster

The major industries associations in the cluster are:

- Kolhapur Engineering Association (KEA)—the apex cluster organization, with over 500 members from industries including foundries, automotive, sugar, textile, engineering, agricultural implements, etc.

- Institute of Indian Foundrymen (IIF)—Kolhapur Chapter. It has about 275 members comprising foundry units as well as consultants, LSPs and equipment suppliers. IIF Kolhapur provides support to the local foundry units in different areas such as technology, raw materials, labour, training programs, workshops, trade fair visits, information dissemination, etc.
- Gokul Shirgaon Manufacturers Association (GOSHIMA)
- Shirolu Manufacturers Association of Kolhapur (SMAK)
- Manufacturers Association of Kagal Hatkanangale (MAKH)
- Ichalakaranji Engineering Association

Other important cluster-level stakeholders include:

- MSME testing lab, which offers a range of physical and chemical testing facilities
- Government Polytechnic, which offers a certificate course in foundry technology for workers/fresh graduates in collaboration with IIF, Kolhapur
- District Industries Centre (DIC)
- Financial institutions—there are about 20 banks operating in the cluster. They provide units with financial assistance for expansion and upgrading of infrastructure.

Cluster development initiative

The Kolhapur foundry units, in partnership with KEA and other industry associations, have formed a Special Purpose Vehicle titled 'Kolhapur Foundry and Engineering Cluster' and obtained government approval for a project to provide quality infrastructure in the Kolhapur cluster under the Industrial Infrastructure Upgradation Scheme of the Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry. The project, currently under way, will:

- Set up two sand reclamation facilities, in Gokul Shirgaon and in Shirolu
- Establish a Common Facility Centre (CFC) for testing, CAD/CAM training and electronic library
- Improve general infrastructure like roads and water supply

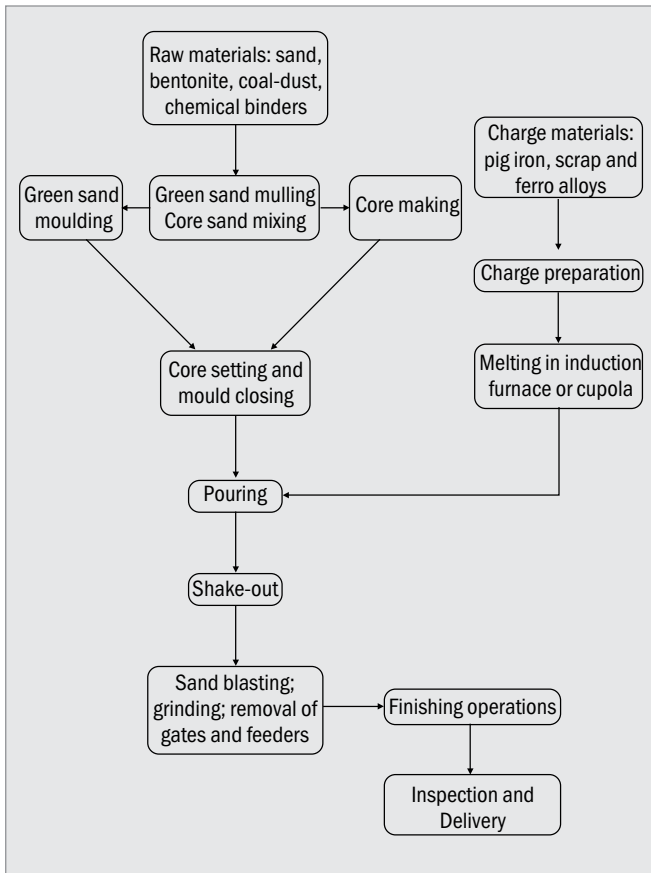


Induction furnace

Technology status and energy use

The main technology in a foundry is the melting furnace system. The melting furnace may either be coke-fired (cupola) or powered by electricity (induction furnace). Iron-containing materials are heated in the furnace to produce molten metal, which is drawn off and poured into moulds to make castings. There are three broad components in the foundry process:

1. *Preparation of moulds and charge material.* Fresh sand is mixed with bentonite (a kind of absorbent clay) and other additives in 'sand mullers' to prepare green sand, which is then processed in 'shell moulding machines' to make the mould casings (shells) for the castings. Cores for the moulds (which give the castings their interior shape) are made by mixing sand with binders, water and other ingredients in 'intensive mixers'. Simultaneously, the charge materials comprising metal scrap, pig iron, and other alloys are loaded in the furnace for melting. The ratio between raw materials depends on final casting properties.
2. *Melting.* The charge is melted in the furnace, and the molten metal is poured into the sand moulds using a ladle (manual, automatic, or semi-automatic). The moulds are allowed to cool and harden to allow the metal to take the shape of the moulds.
3. *Finishing stage.* The metal castings are removed from the moulds and cleaned, using 'shot blasting machines' and 'knock-out' machines to remove the sand and cores. The castings are machined if required, tested and packed for dispatch. The sand from the moulds is either disposed of or treated in a sand reclamation plant for reuse.



Process Flow Chart

The induction furnace entails a higher energy cost per tonne of molten metal than the coke-based cupola, but offers advantages like faster start-up, lower manpower requirement, and reduced emissions. Also, the induction furnace is a better option for producing SG iron castings, which are increasingly in demand. Hence, about 70% of the Kolhapur foundry units (210 units) are using



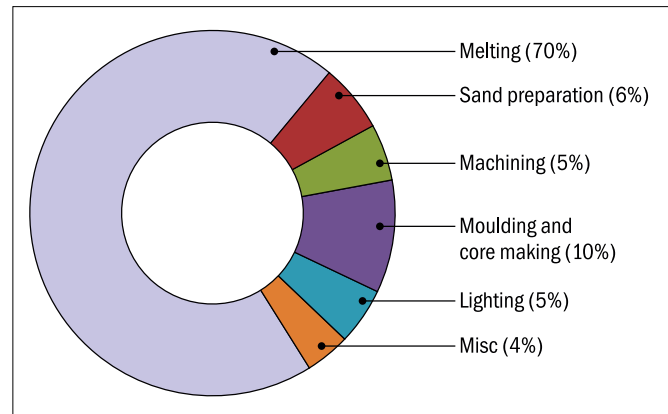
Metal pouring

induction furnaces, with only about 30% (90 units) using coke-based cupolas. Some units also practice ‘duplexing’, i.e., the cupola is used for basic melting, and the induction furnace is used for refining the properties of the molten metal.

The main raw materials used in the Kolhapur foundries are pig iron and scrap, sand and bentonite, which are sourced from different parts of the country. Coke for the cupola furnaces is usually imported.

Energy use

The Kolhapur foundry units consume two main forms of energy: coke and electricity. Coke is used for cupola furnaces. Electricity is used for the induction furnaces, and also to operate the various machines for sand mixing, mould preparation and finishing. The melting process accounts for most of the energy consumption (above 70%) in a foundry unit. Moulding, core making, and sand preparation are also significant consumers of electrical energy (see figure).



Utility-wise energy consumption in a foundry unit

The specific energy consumption (SEC) of induction furnace-based foundries ranges between 1000–1200 kWh per tonne of good castings. In cupola-based foundries, the average coke to melt ratio (i.e. the amount of coke consumed per tonne of metal charged) ranges between 1:8 and 1:9. Overall, the cluster consumes around 166,000 tonnes of oil equivalent (toe) annually.

Annual energy consumption in Kolhapur foundry cluster

Energy source	Annual consumption	toe*
Electricity	1185 million kWh	101,910
Coke	128,111 tonnes	65,000
Total		166,910

* toe—tonnes of oil equivalent

Options for energy saving

Considering the high share of energy in the total production costs, and in the backdrop of rising energy costs, there is an urgent need to improve the energy efficiency of foundry units in the Kolhapur cluster. TERI has conducted a number of walk-through and detailed energy audits in the cluster. These studies suggest

that there is significant scope for energy efficiency improvement in induction furnaces and other process technologies such as sand mixing, pneumatic grinding, machining, and sand reclamation. There is also scope for energy savings in cross-cutting technologies such as compressors, pumps, motors, etc. The main energy conservation measures carrying potential for replication are summarized below:

Key energy conservation options in Kolhapur cluster		
No.	Energy conservation option	Energy saving potential
Melting furnace		
1	Replacement of inefficient induction furnace	High
2	Replacement of convention cupola with DBC cupola	High
3	Optimization of burner of diesel fired Aluminum furnace	Medium
4	Automation in metal pouring system	Medium
5	Lid mechanism for induction furnace crucible	Medium
6	Melting optimization in induction furnace	Low
7	Utilization tum/shot blast for foundry return	Low
Cooling water circuit		
1	Replacement of inefficient pump with energy efficient one	High
2	Replacement of cooling tower fan blades (aluminum) with FRP blades	Low
Compressed air system		
1	Replacement of fixed speed air compressor with variable speed air compressor	High
2	Down-sizing of air compressor	High
3	Retrofitting of air compressor with VFD	Medium
4	Reducing pressure drop by resizing the pipe lines	Medium
5	Optimizing pressure setting of air compressor	Medium
6	Arresting compressed air leakage	Medium
Others		
1	Replacement of inefficient transformer with low loss transformer	Medium
2	Down-sizing of sand mixture drive motor	Medium
3	Replacement of inefficient sand mixer with semi-automatic sand mixer	Medium

Compiled by TERI based upon its ongoing activities under the World Bank–GEF–SIDBI project titled ‘Financing Energy Efficiency at MSMEs’

WORKSHOP ON FINANCING OF ENERGY EFFICIENT TECHNOLOGY FOR MSMEs

Energy efficiency and finance for EETs are high on the political agenda and a number of initiatives such as energy audits, awareness campaigns and capacity building programs have been undertaken in this domain. However, MSMEs are slow in taking action on the proposals made through such initiatives, due to insufficient understanding of the issues involved and low trust levels. A first round of stakeholder consultations suggests that the presentation of best practices by MSMEs would help overcome these barriers and convince other entrepreneurs, who have already been exposed to energy efficiency awareness campaigns, to adopt EETs.

In this backdrop, the Ministry of MSME and GIZ organized a workshop on 'Financing Energy Efficient Technology for MSMEs – Opportunities and Challenges' in New Delhi on 3rd March 2014. The participants included representatives from leading Government organizations, financial institutions, industry, implementing agencies and donors. The aim was to motivate MSMEs to adopt EETs by showcasing best practices already undertaken in the MSME sector, and by providing information on relevant subsidies, loan schemes and training opportunities. The workshop also aimed to provide a networking platform for the stakeholders comprising MSMEs, bankers, chartered accountants, energy auditors and consultants.

The Ministry of MSME presented details of the Technology and Quality Upgradation Support to

MSMEs (TEQUP) scheme. The main objective of the scheme is to motivate MSMEs to upgrade their manufacturing processes by adopting EETs, thereby reducing production costs and greenhouse gas emissions. TEQUP provides support, by way of grants and subsidies, for capacity building of MSME clusters on EETs; preparation of DPRs; implementation of EET projects; and product certification.

The presentations and discussions at the event helped demonstrate that EET projects are an effective business model for MSMEs as well as for banks. Considering the fact that the banks are directly impacted by profitability, EET projects enable them to mitigate their portfolio risk and seize new business opportunities. The workshop underlined the importance of undertaking, continuing and intensifying the following activities:

- Collaboration and coordination of energy efficiency interventions among MSMEs.
- More effective use of platforms such as SAMEEEKSHA to share information about best practices and outcomes of interventions.
- Collection of project-related data across all stakeholders working on energy efficiency interventions
- Preparation of benchmarking documents for interventions such as awareness building among MSMEs, energy audits, and capacity building of bankers by the Ministry of MSME.



Contributed by GIZ



CHANGING PARADIGMS OF CLUSTER DEVELOPMENT: LEARNING FROM GLOBAL EXPERIENCES

The Foundation for MSME Clusters (FMC), along with UNIDO, CII and TCI Network, organized a two-day international conference on ‘Changing Paradigms of Cluster Development: Learning from Global Experiences’ between February 20–22, 2014 in New Delhi. The conference was supported by the EU, GIZ, Indian Institute of Corporate Affairs (IICA), Inter-American Development Bank (IDB), SIDBI and Embassy of Switzerland, New Delhi. Around 210 participants from over 100 institutions and 24 countries, comprising policy makers, eminent academicians, cluster practitioners, researchers and independent consultants participated in the conference. The Conference was inaugurated by Shri Madhav Lal, Secretary, Ministry of MSME.

Speaking on the sustainability agenda, Mr Mukesh Gulati, Executive Director, FMC said that “*Economies of change in the short term are the main driver for addressing sustainable development in MSMEs*.” He opined that change in practices among MSMEs is a bigger factor of change than changes in equipment and technology. Mr Daniel Ziegerer, Director of Cooperation, Embassy of Switzerland further emphasized this point, and suggested the need to shift from a technology-driven approach to a systematic approach in implementation of projects on sustainability in MSMEs. He also emphasized the need for setting up partner-networks and capacity building of the partner agencies and other stakeholders; innovative strategies; co-financing; and sharing of experiences in order to make implementations more

effective. Mr Guillaume Massard, Scientific Director of Sofies SA, suggested the setting up of eco-industrial parks as a long-term solution for addressing the issues of sustainability in MSMEs. He also elaborated on the need for park management structure for proper functioning of the industrial parks. Mr Florian Beranek, Chief Technical Advisor, UNIDO, Vietnam, suggested that steps should be taken to provide MSMEs with customized management tools like ‘reap26’ (a CSR-based management and reporting tool developed by UNIDO) that is in line with the ISO 26000 standards for responsible, sustainable and successful functioning of MSMEs.

The conference also dealt in detail with issues like innovation, structural challenges and market-led inclusive development that need to be addressed during the process of cluster development. It was suggested that local networks of producers should be created and linked to global value chains, and that policies for cluster development should take advantage of the natural network or pockets of trust that exist in clusters, for smoothening forward as well as backward linkages. The India Backbone Implementation Network (IBIN) system created by the Planning Commission should be utilized to remove bottlenecks in implementation of cluster development policies. The participants voiced the need for a service unit to operate as the knowledge backbone through information collation, research and coordination, etc. A small network of institutions with knowledge in the area of cluster development could be



Contributed by FMC

DSDS 2014 – THEMATIC SESSION ON PROMOTING ENERGY EFFICIENCY IN MSMEs

A Thematic Session on ‘Promoting Energy Efficiency in MSMEs’ was held in New Delhi on 7th February, 2014 during the 14th Delhi Sustainable Development Summit (DSDS, 6–8 February 2014). The session was chaired by Dr Ajay Mathur, Director General, BEE. Mr Daniel Ziegerer, Director of Cooperation, Embassy of Switzerland delivered the welcome address in which he underlined the importance of promoting energy efficiency in India’s MSME sector, which has been at the core of SDC’s agenda in India. Mr Suvendhu of Ernst & Young (E&Y) made a background presentation that highlighted the financial, technology and policy gaps in promoting energy efficiency in the MSME sector, based on a rapid study conducted by E&Y. He pointed to the need for wider dissemination of energy efficient technologies (EETs), and for bankers to be trained in evaluating energy efficiency projects.

Dr Ajay Mathur, BEE, noted that the MSME sector occupies a special place for innovation, job employment and exports. Adequate service mechanisms have to be established around demonstration projects, to facilitate their large-scale replication. Dr Veena Joshi, Senior Advisor (Energy), Embassy of Switzerland stressed the need to address ‘information failures’ in order to effectively implement energy efficiency programs in the MSME sector. It is essential to establish accurate baselines, for which standard templates must be developed. She suggested a ‘bottom-up’ approach under which all institutions related to the MSME sector should be mapped at the cluster, state and national levels, in order to help aggregation of data at the national level. BEE should consider putting in place an energy conservation code for the MSME sector, similar to that set up for the building sector.



Mr Hideaki Domichi, Senior Vice President, JICA, pointed out that Japan has made considerable reductions in energy consumption in its industrial sector due to the continuous introduction of dedicated programs. The JICA lines of credit to SIDBI have effectively been used for granting loans at reduced interest to over 6000 MSMEs for adopting energy efficient technologies (EETs). A list of EETs is available as a reference point for bankers to assess EE projects. Prof. Hironori Hamanaka, Institute for Global Environmental Strategies (IGES), outlined an ongoing technology transfer project titled ‘Research Partnership for Application of Low Carbon Technology for Sustainable Development’, being jointly implemented by TERI and IGES with JICA’s support to promote clean/energy efficient technologies in the Indian SME sector. By deploying a strategy that directly involves businesses on both supply and demand sides (i.e., Japanese technology supplier and Indian SME respectively) along with capacity building support, the project has successfully demonstrated Japanese EETs such as electric heat pump (EHP) in two dairy units (Amul in Anand and MILKFED in Chandigarh), and gas heat pump (GHP) in two foundries in the Rajkot engineering cluster. These EET demonstration projects have brought about 30%–40% energy savings compared to the baseline figures.

Dr Pradeep Monga, Director, Energy & Climate Change Branch, UNIDO highlighted UNIDO’s focus on benchmarking, promoting energy management systems and following a systems optimization approach in its efforts to promote energy efficiency in the MSME sector. He pointed out that the impact of energy



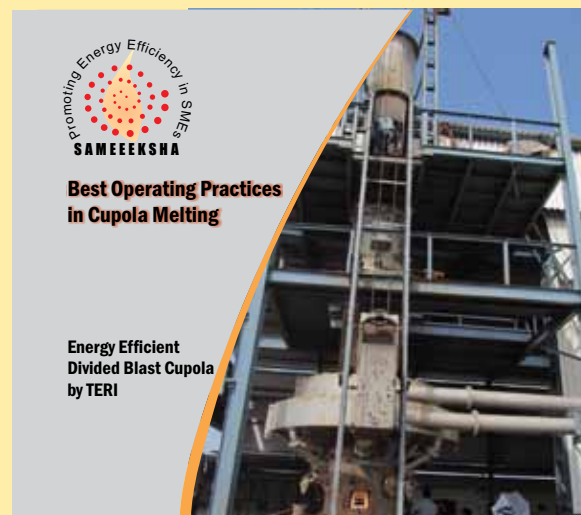
conservation measures could be increased if there is convergence between energy efficiency and renewable energy options. Mr Jean-Yves Grosclaude, Director of Strategy, AfD, provided a financial institution's perspective on the issue of promoting EETs in the MSME sector. AfD has provided lines of credit to SIDBI to facilitate cheap loans to SMEs for adopting EETs. He endorsed a cluster-based approach to implement energy efficiency programs in the MSME sector, and pointed out the need to establish guarantee mechanisms for banks to encourage lending to micro enterprises.

Prepared by TERI

Mr Girish Sethi, Director, TERI noted that to formulate effective programs for promoting energy efficiency in the MSME sector, MSMEs can be categorized into two broad categories: old/traditional sectors and new/advanced sectors. Large opportunities exist in 'traditional' units for energy efficiency improvements. The Research, Development, Demonstration and Dissemination (RDD&D) approach should be followed to implement EETs in MSME clusters, with emphasis on competency pooling and the establishment of local supply chains for wider dissemination of the EETs.

SHORT FILM ON BEST OPERATING PRACTICES IN CUPOLA MELTING

TERI with support from Climate Change and Development Division of Embassy of Switzerland has successfully demonstrated and disseminated the energy efficient divided blast cupola (DBC) for metal melting in the small-scale foundry industry in India. For efficient operation of the DBC, it is essential to follow best operating practices (BOPs). In order to disseminate information on these BOPs, a short film has been prepared that succinctly captures the BOPs in cupola melting. The film has been prepared with support from Renewable Energy and Energy Efficiency Partnership (REEEP). It highlights some of the basic BOPs that must be followed by foundry operators and supervisors to achieve optimal results. The CD containing this short film can be ordered from the SAMEEEKSHA Secretariat.



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.

ABOUT TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI is deeply committed to every aspect of sustainable development. From providing environment friendly solutions to rural energy problems to tackling issues of global climate change across many continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local and national level strategies to suggesting global solutions to critical energy and environmental issues.

With staff of over 900 employees drawn from diverse disciplines, the institute's work is supported by ministries and departments of the government, various bilateral and multilateral organizations, and corporations of repute.

VISION OF SAMEEEKSHA

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.

FOR MORE DETAILS, PLEASE CONTACT

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