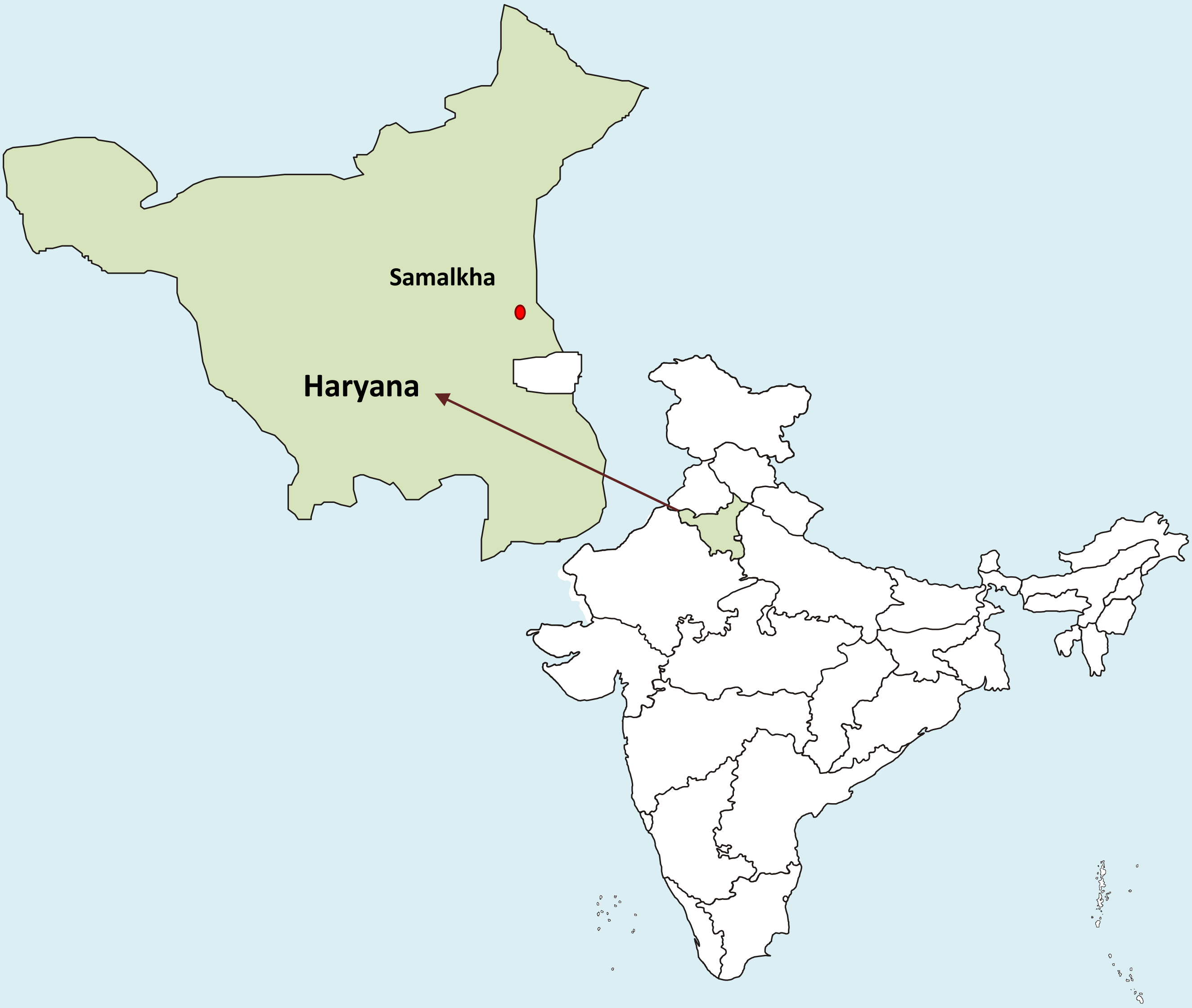
Cluster Profile
Samalkha foundries



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Promoting Energy Efficiency in SMEs
SAMEEEKSHA

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Darbari Seth Block
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India

For more information

Project Monitoring Cell
T E R I
Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi – 110 003
India

Tel. 2468 2100 or 2468 2111
E-mail pmc@teri.res.in
Fax 2468 2144 or 2468 2145
Web www.teriin.org
India +91 • Delhi (0)11

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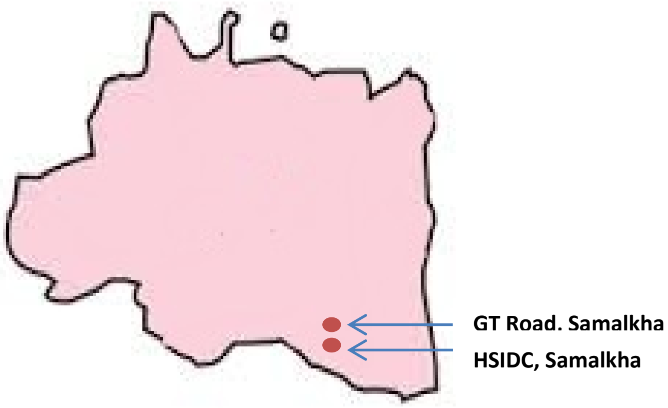
Last but not least, our sincere thanks to MSME entrepreneurs and other key stakeholders in the cluster for providing valuable data and inputs that helped in cluster analysis.

Samalkha foundries

Overview of cluster

Samalkha is a town in Panipat district of Haryana. The town is very well connected with the rail and road network. The town is about 80 km from national capital Delhi and is connected by NH-1. On its other sides it is connected with the other districts in Haryana like Sonepat, Rohtak, Jind and Karnal. Samalkha is a small town in the district of Panipat (Haryana).The town is well known for its foundry Cluster in the region. The cluster was developed in late 40s and early 50s. In 1949 a family of local traders brought Chaff Cutter business to this town. Major industrial estates in Samalkha includes HSIDC (Haryana State Industrial & Infrastructure Development Corporation Ltd) industrial estate but majority of foundries are located in and around GT Road.



Major concentrations of foundry industry in Samalkha

Product types and production capacities

There are about 50 foundry units exist in Samalkha cluster. Of these only 30 foundries are currently operational. They are scattered both within and outside the city around GT Road. Some of larger geographical concentration of foundry units is HSIDC industrial estate and GT Road. The major raw materials used include base metals (scrap, pig iron, borings scrap and foundry returns) and alloys (ferro-silicon, ferro-manganese, etc.). A large number of small size foundries in the cluster are engaged in the production of chaff cutter. The product of all the units is almost similar but it is sold with different local brand names. The capacity utilization of units is below 40%.

Based on their production levels, foundry units can be categorised under A and B categories as follows:
Category A – Average production: 50 tonne per month
Category B – Average production: 120 tonne per month

About 22 foundries are medium scale and fall under category B, these manufactures chaff cutters & cane crushers. Remaining eight foundries fall under category A; these units are engaged mainly in the production of low end automotive machinery parts such as motor casings, impellers, submersible pump parts etc. The total production of castings in the cluster is about 120 tonnes per day (about 36 thousand tonnes per annum). The industry employs nearly 2,000 direct employees. The estimated turnover of the foundry units in the cluster is approximately Rs 60 crore per annum.

Chaff cutter

Distribution of foundries

Product	Share
Chaff cutter, Kutti machine	70%
Cane crushers	15%
Valves and automotive parts	9%
Others	6%

Energy scenario in the cluster

Coke and electricity are the major sources of energy for the foundries. The growth of foundries in the cluster has been adversely affected due to the lack quality control of coke, which is purchased from Dhanbad and Gujarat. The Dhanbad coke is reported to have an ash content of 24% and Gujarat coke is 12% ash. Foundries face a power cut of less than four hours per day and average cost of electricity is about Rs 8.5 per kWh. The details of major energy sources and tariffs are shown in table.

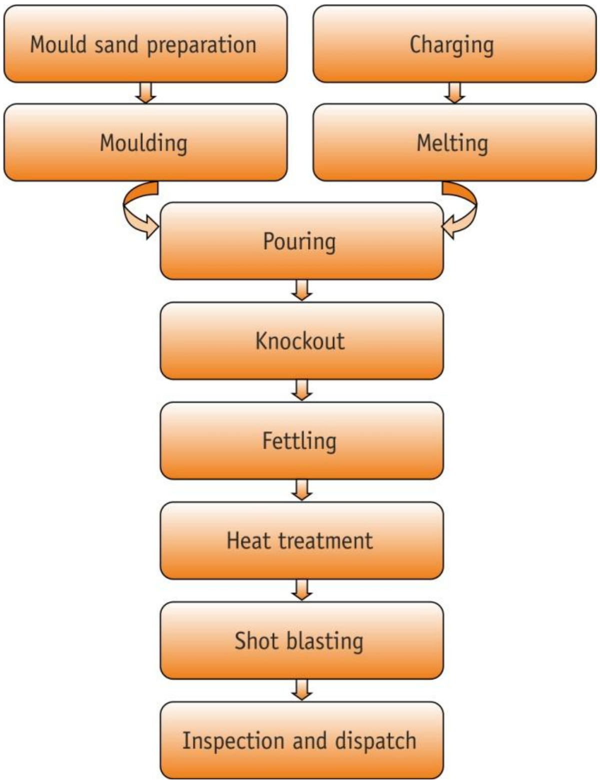
Prices of major energy sources

Raw material	Remarks	Price
Coke	Low ash High ash	Rs 18,000 - 20,000 per tonne Rs 11,000 - 13,000 per tonne
Electricity	HT	Energy charge : Rs 6.15 per kVAh Demand charge: Rs 170 per kVA per month
	LT	Energy charge : Rs 6.35 per kWh Demand charge: Rs 170 per kW per month

Production process

The major steps of process are mould sand preparation, charge preparation followed by melting, pouring, knockout and finishing. The steps are explained below.

1. **Mould sand preparation**. Fresh sand is mixed with bentonite and other additives and mixed in muller to make green sand.
2. **Moulding.** The mould sand is pressed manually on the pattern to make the mould. Then the upper and lower halves of mould are assembled together to prepare the complete mould.
3. **Charging.** The charged metallic such as pig iron, scrap, foundry returns and other alloys charged in the furnace for melting.
4. **Melting.** The metal charge is melted in either a cupola or induction furnace.
5. **Pouring.** After melting, the molten metal is transferred and poured into the moulds using ladles operated either manually or with cranes.



Process flow chart

6. **Knock-out.** The moulds are left to cool for certain time after which the castings are knocked-out from the mould either manually or using a machine.
7. **Finishing.** The finishing operation which involves removal of runners/risers, shot blasting and cleaning of castings.

Technologies employed

Some of the major foundry processes/equipment are described below.

(i) Melting furnace

The melting of raw material is done using coke in a conventional cupola. Only two foundries use electricity in an induction furnace for melting.

Cupola: Majority of the cupolas falls in the size range of 2.2 tonnes per hour (tph) (internal diameter: 24 inch) to 5.5 tph (internal diameter: 48 inch). Only three foundries operate daily. Almost all the cupolas are of conventional type and do not have divided blast system for combustion air. About 10 cupolas are divided blast type which was installed after intervention from Foundation of MSME. The metal tapping could be intermittent or continuous based on operation of foundry. Cupolas are equipped with blower of motor rating of 15 – 50 hp. Typical well capacity of cupola is around 150 kg. Most of cupolas were over a decade old.

Cupola

(ii) Moulding and core preparation

Preparation of the mould is an important process in casting industry. The mould is divided into two halves - the cope (upper half) and the drag (bottom half), which meet along a parting line. Both mould halves are contained inside a box, called a flask, which itself is divided along this parting line. The mould cavity is formed by packing sand around the pattern (which is a replica of the external shape of the casting) in each half of the flask. The sand can be packed manually, but moulding machines that use pressure or impact to pack the sand are commonly used. Cores are placed inside the moulds to create void spaces. Cores are baked in ovens which are usually electrical fired.

(iii) Sand preparation

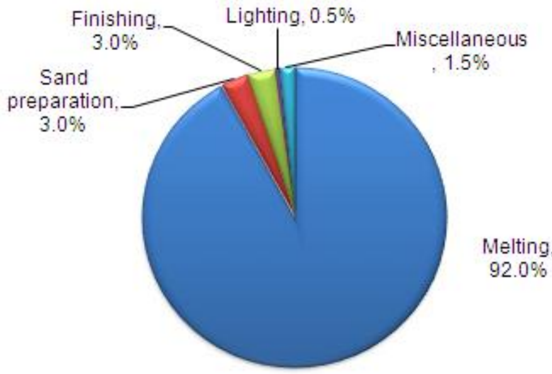
Sand preparation is done using sand mixers and sand sievers. Sand mixers have typical batch size of 100 to 250 kg. The connected load of these mixers is in the range of 10 to 15 kW. None of plant in cluster except one has a complete sand plant.

Energy consumption

Foundry uses two main forms of energy: coke and/or electricity. Melting accounts for a major share of about 90-95% in a foundry unit. The other important energy consuming areas include moulding, core, sand preparation and finishing. The share of energy usage in a typical small and medium foundry is given in the figure.

Unit level consumption

The specific energy consumption (SEC) varies considerably in a foundry depending on the type of furnace and degree of mechanisation. The average coke consumption varies between 15-20% of the metal melted and 25-30% on good castings. The coke consumption also depends on length of melt campaign; most of units have smaller campaign hence higher specific coke consumption. Typical energy consumption of a cupola based unit is given in table.



Break-up of energy use in a foundry

Typical energy consumption in cupola based foundry units

Production Saleable castings (tonne/year)	Electricity (kWh/year)	Coke (tonne)	Total energy (toe/yr)	Annual energy bill (million INR)
600	60,000	75	54	1.4
1440	150,000	180	130	3.4

Cluster level consumption

The estimation of cluster level is done on basis on energy consumption of category A and B foundry individually and figures are extrapolated. The total annual energy consumption of foundry units in the cluster is estimated to be 3,300 tonnes of oil equivalent, with coke accounting for about 90% of total energy.

Energy consumption of the Samalkha foundry cluster (2015)

Energy type	Annual consumption	Equivalent energy (toe)	Annual energy bill (million INR)
Electricity	4.1 million kWh	340	30
Thermal (Coke)	4,560 tonnes	2,960	60
	Total	**3,300**	**90**

Energy-saving opportunities and potential

Some of the major energy-saving opportunities in the foundry units in the cluster are discussed below.

(i) Replacement of conventional cupola with divided blast cupola

For cupola based foundries, replacement of conventionally designed cupolas with energy efficient "Divided Blast Cupola" (DBC) is the major

Divided blast cupola

option. The existing conventional cupolas have coke consumption of about 150-200 kg per tonne of liquid metal. With proposed energy efficient DBC the coke consumption is expected to be about 100 kg per tonne of liquid melt. The investment for a new DBC is expected to pay back within one year on account of coke saving alone. The saving can be achieved around 25-30%.

(ii) Replacement of local-make blower with proper design blower

The cupola are equipped with blower of 15-20 hp, but the blower are of local make and are not properly designed. The blower selection should be done according to inner diameter of cupola. The blower should be of proper flow rate and discharge pressure. By replacing blower with proper blower, coke saving of around 5% can be achieved.

(iii) Reduction in rejections

A large number of foundries have high rejection level (10 – 15%), which can be brought down to below 5% through improved process control. This can be achieved with no or marginal investments. As the units do not produce multiple products and the castings are limited, the rejection level can be reduced with little process improvement itself.

(iv) Best operating practices for cupola melting

Efficient operation of cupola furnace depends primarily on implementation of "Best Operating Practices" (BOP) in different steps of melting in cupolas. The foundries do not use any standard operating practices and has lot of irregularities. The units and cluster does not have any testing facility. Chemical and mechanical properties of castings are not tested. The quality of coke is also not tested. The low ash coke is supposed to be 12% ash but at times based of melting judgement, the units feel that the ash in excess of 15%. Same is the case with high ash coke. By improving operating practices in cupola a foundry can achieve about 5 – 10% coke saving.

(v) Cleaning of runner and risers before re-melting

Foundry returns i.e. runners and risers constitute a significant share of charge material. Further foundry returns will have moulding sand sticking to them (4-5% by weight). If not cleaned, this will lead to slag formation and hence higher energy consumption levels. By using shot/tumble blast, the sand be cleared from foundry returns before returned to induction furnace for re-melting. This would result in considerable energy saving and would require marginal or no investments.

(vi) Replacement of rewound motors with energy efficient motors

Rewinding of motors result in a drop in efficiency by 3-5%. It is better to replace all old motors which has undergone rewinding three times or more. The old rewound motors may be replaced with EE motors (IE3 efficiency class). This would results into significant energy savings with simple payback period of 2 to 3 years.

(vii) Use of energy efficient lighting

The foundry units were still using incandescent bulbs of 100 – 200 W for lighting. Some were using CFLs. Replacing them with induction lamp and CFL lamp can lead to energy saving of around 20–30%.

Major stakeholders

There are two major industry associations related to the foundry industry in Samalkha. The major industry associations are the following:

- *SIA (Samalkha Industries Association)*: Samalkha Industries Association (SIA) is an apex representative body of Micro, Small and Medium Enterprises (MSME). All foundries are member of SIA and it acts as apex body for organizing any event or conducting any program in the cluster. SIA deals with local issues faced by industries.
- *MSME Chamber of Commerce*: MSME chamber of commerce is the leading National premier Chamber, working for the growth of SMEs from Manufacturing and Service Sectors for the last 23 years. They are present in cluster and work for cluster development activities.
- *MSME-DI,Karnal:* MSME-DI is active in Samalkha foundry cluster, they operate from Karnal and are responsible for implement many MSME schemes in the cluster.

The 'District Industries Centre' (DIC), Samalkha provides several incentives to MSMEs like the Back Ended Interest Subsidy Scheme. Under this scheme, MSMEs can avail 3% interest subsidy (subject to a maximum of Rs 10 lakhs) on term loans loan on technology.

Cluster development activities

Samalkha Industries Association is actively involved in cluster development activities. The major activity is along with MSME-DI, Karnal for organizing Vendor Development Programmes (VDPs). Foundation of MSME has worked in the cluster extensively.

About TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI (The Energy and Resources Institute) 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. The Industrial Energy Efficiency Division of TERI works closely with both large industries and energy intensive Micro Small and Medium Enterprises (MSMEs) to improve their energy and environmental performance.

About SDC

SDC (Swiss Agency for Development and Cooperation) has been working in India since 1961. In 1991, SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC India, in collaboration with Indian institutions such as TERI, conducted a study of the small-scale industry sector in India to identify areas in which to introduce technologies that would yield greater energy savings and reduce greenhouse gas emissions. SDC strives to find ways by which the MSME sector can meet the challenges of the new era by means of improved technology, increased productivity and competitiveness, and measures aimed at improving the socio-economic conditions of the workforce.

About SAMEEEKSHA

SAMEEEKSHA (Small and Medium Enterprises: Energy Efficiency Knowledge Sharing) is a collaborative platform set up with the aim of pooling knowledge and synergizing the efforts of various organizations and institutions - Indian and international, public and private - that are working towards the development of the MSME sector in India through the promotion and adoption of clean, energy-efficient technologies and practices. The key partners are of SAMEEEKSHA platform are (1) SDC (2) Bureau of Energy Efficiency (BEE) (3) Ministry of MSME, Government of India and (4) TERI.

As part of its activities, SAMEEEKSHA collates energy consumption and related information from various energy intensive MSME sub-sectors in India. For further details about SAMEEEKSHA, visit http://www.sameeeksha.org