Cluster Profile
Saharanpur foundries





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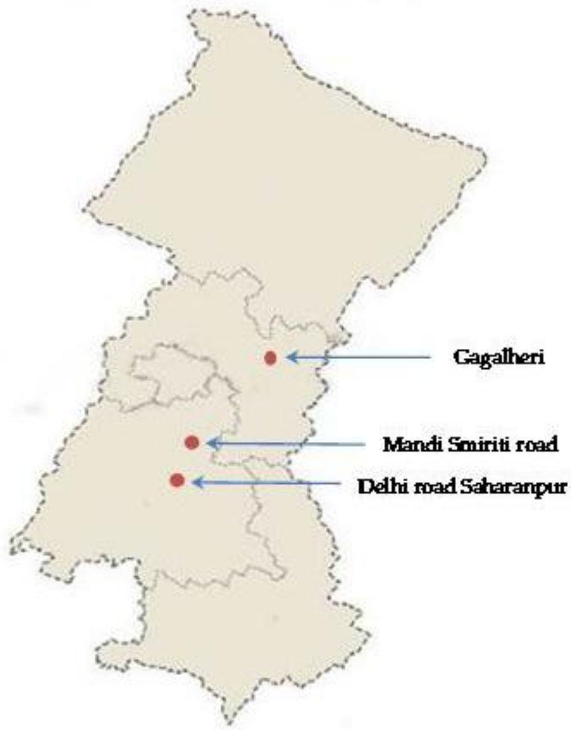
Saharanpur foundries

Overview of cluster

Saharanpur is a city in Uttar Pradesh situated between the Ganges and the Yamuna, is an important industrial cluster in India. The region is very poor in mineral resources unlike other districts in Uttar Pradesh. This has led the district to develop agro-based industries: paper, tobacco and wood-work. Wood work of Saharanpur district is world famous and is exported in many Western countries including USA, UK, Singapore, Sweden, and Kuwait. There are two large industry units located in Saharanpur, the Indian Tobacco Company (ITC Limited) and Star Paper Mills Ltd. The existing cluster of MSMEs include: wood carving cluster, hosiery industry, foundry cluster, rubber industry and straw and mill industry. Major industrial estates in Saharanpur includes Delhi road, railway road Deoband, Ambehtapeer and Titron. The Delhi road industrial estate is the oldest industrial estate of the district established over a patch of land measuring 30 acres and houses around 100 industries.

Product types and production capacities

There are about 100 foundry units exist in Saharanpur cluster. Of these only 50 foundries are currently operational. They are scattered both within and outside the city. Some of larger geographical concentration of foundry units is Delhi Road Saharanpur, Mandi samiti road industrial area and Gagalheri. A large number of small size foundries in the cluster are engaged in the production of hand pumps. Comparatively large foundries produce castings for sewing machines. Hand-pumps are also exported to Nepal and Bhutan.



Major concentrations of foundry industry in Saharanpur

Based on their production levels, foundry units can be categorised under A, B and C categories as follows:

Category A – Average production level: 100 tonnes per month
Category B – Average production level: 40 tonnes per month
Category C – Average production level: 05 tonnes per month

Majority of foundry units in Saharanpur fall in Category C. Only about 10 units fall in Category A and about 15 units fall in Category C. The total production of investment castings in the cluster is about 70 tonnes per day (about 21 thousand tonnes per annum). The industry employs nearly 1,000 direct employees. The estimated turnover of the foundry units in the cluster is approximately Rs 40 crore per annum.

Distribution of foundries

Product	Share
Hand-pump	60%
Sewing machines	25%
Paper mill machinery	10%
Others	5%

Energy scenario in the cluster

Coke and electricity are the major sources of energy for the foundries. The major raw materials used include base metals (scrap, pig iron, borings scrap and foundry returns) and alloys (ferro-silicon, ferro-manganese, etc.).

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. Hence as an alternative, Saharanpur foundries have started using a mix of Dhanbad coke (60-70%) and Gujarat coke (30-40%). Foundries face a power cut of less than four hours per day in DIC industrial estate and about 8-12 hours in other areas. There is significantly low level of awareness on energy saving measures and energy efficiency options available for foundries. It has low awareness on power factor correction and billing of electricity resulting in quite high cost of power (Rs 9.0 per kWh). The details of major energy sources and tariffs are shown in table.

Prices of major energy sources

Energy type	Remarks	Price
Coke	Low ash	Rs 18,000 - 22,000 per tonne
	High ash	Rs 11,000 - 14,000 per tonne
Electricity	HV-2	Energy charge : Rs 6.65 per kVAh Demand charge: Rs 250 per kVA per month
	LMV-6	Energy charge : Rs 6.6 per kWh Demand charge: Rs 225 per kW per month

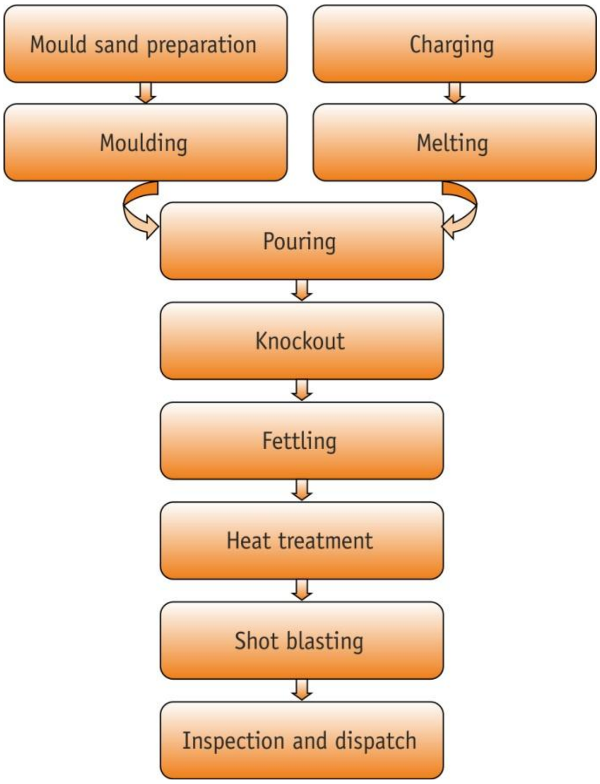
Production process

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.
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.

A process flow diagram of a typical foundry is given in the figure.



Process flow in foundry

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 tonnes per hour (tph) (internal diameter: 21 inch) to 4 tph (internal diameter: 33 inch). Majority of units are equipped with intermittent type 24 inch conventional cupola. Almost all the cupolas are of conventional type and do not have divided blast system for combustion air. The metal tapping could be intermittent or continuous based on operation of foundry. Cupolas are equipped with blower of motor rating of 15 – 30 hp. Typical well capacity of cupola is around 150 kg. Most of cupolas were over a decade old.

Cupola

(ii) Moulding and core preparation

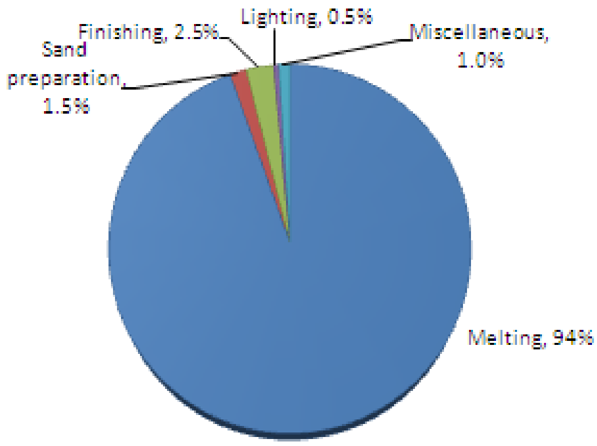
Preparation of the mould is an important process in casting industry. The mould is divided into two halves - the cope (upper half) and the drag (bottom half), which meet along a parting line. Both mould halves are contained inside a box, called a flask, which itself is divided along this parting line. 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.



Energy use break-up in a foundry

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 20-25% of the metal melted and 30-35% on good castings. Typical energy consumption of a cupola based unit is given in table.

Typical energy consumption in cupola based foundry units

Production – saleable castings (tonne/year)	Electricity (kWh/yr)	Coke (tonne)	Total energy (toe/yr)	Annual energy bill (million INR)
60	50,000	20	17	0.8
500	200,000	110	90	3.5
1000	500,000	200	180	7.5

Cluster level consumption

The total energy consumption of foundry unit in the cluster is estimated to be 3,600 tonnes of oil equivalent.

Energy consumption of the Saharanpur foundry cluster (2014-15)

Energy type	Annual consumption	Equivalent energy (toe)	Annual energy bill (million INR)
Electricity	9.3 million kWh	800	80
Thermal (Coke)	4,100 tonnes	2,800	60
	Total	**3,600**	**140**

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 existing conventional cupola with divided blast cupola

For cupola based foundries, replacement of conventionally designed cupolas with an energy efficient divided blast cupola (DBC) is the major 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%.

Divided blast cupola

(ii) Replacement of existing 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 good/best operating practices in each steps of metal melting in cupola furnace. 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) Replacement of inefficient lighting with 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 Saharanpur. The major industry associations are the following:

- *IIA (Indian Industries Association)*: Indian Industries Association (IIA) is an apex representative body of Micro, Small and Medium Enterprises (MSME). IIAs motto is to create an enabling environment for the development of MSMEs in today's ever changing and extremely competitive industrial scenario. IIAs headquarter is in Lucknow. The Saharanpur Chapter has around 22 foundries as members.
- *SIA (Saharanpur Industries Association)*: SIA is local body for industries and most of the foundries in Saharanpur area are its members. SIA deals with local issues faced by industries.

The 'District Industries Centre' (DIC), Saharanpur 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

Indian Industries Association is actively involved in cluster development activities. The major activity is along with MSME-DI, Agra for organizing Vendor Development Programmes (VDPs). They organize both National Level VDPs – cum – exhibitions and State Level VDPs. IIA also organizes monthly meeting of members where they brainstorm for possible solutions for problems faced by industries.

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