Cluster Profile
Balakati Brass industries

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Promoting Energy Efficiency in SMEs
SAMEEEKSHA

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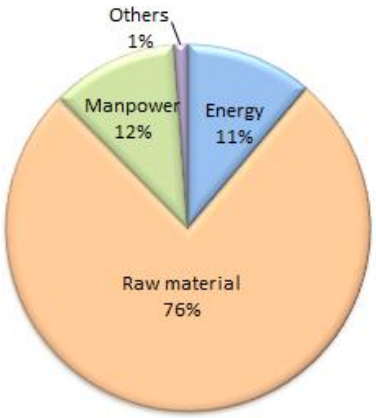
Balakati brass industries

Overview of cluster

Balakoti is located at about 20 kilometers from Bhubaneswar city in Odisha. The cluster is spread in villages such as Balakati, Bainchua, Hirapur and Rathijema. The brass units are essentially artisan based industries, which are traditionally involved in making brass articles for more than one hundred years. The units are traditional and are involved in brass making as an art. The size of the units may be termed tiny and located in small spaces within residential areas of the villages. Over the years, the cluster continued to produce similar types of products and there was no innovation or product diversification. These issues have led to either closure of the units or operation for a few days in a year.

Balakati brass cluster in Odisha
Source: Google Maps

The raw material is brass metal which is generally supplied by middlemen or who involved in the business of brass products. The artisan units produce different products based on orders. The artisan units generally get a fixed amount e.g. Rs 300 per kg of product from middlemen for converting raw material into final product. This would essentially cover costs towards energy, manpower and others. The raw material constitutes 76% of total production costs and energy accounts for about 11% of costs. The cluster provides direct employment to about 1000 people.



Breakup of production cost

Product types and production capacities

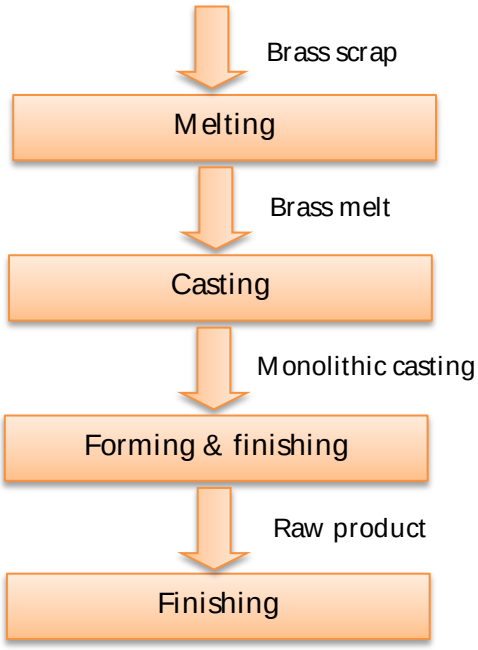
Balakati brass cluster is involved in production of brass plates (small and medium), cups (small and medium), temple bells and other handicraft brass products. The units produce mainly monolithic castings. Based on weights of these castings, they are made into different products of different sizes. There are close to 100 artisan based brass units in the cluster; however these units are operated intermittently based on market demands. On an average, close to 10 units are operating in the cluster on a continuous basis and each unit undertakes melting for about 50 days in a year; other associated operations such as shaping & forming and finishing are undertaken subsequently. The total estimated production from the cluster is 141 tonne, considering the units are in operation for a smaller timespan in a year. The estimated annual turnover of the cluster is Rs 9.8 crore.

Production of brass articles from the cluster

Category (based on crucible capacity)	Number of existing industries	Number of operating industries	Production (tonne/year)	Turnover (Rs crore/year)
25 kg capacity	50	8	60	4.2
34 kg capacity	30	5	51	3.5
50 kg capacity	20	2	30	2.1
Total	**100**	**15**	**141**	**9.8**

Production process

The production process of brass products involves melting of raw materials, casting in moulds, shaping & forming and finishing operations. The major steps involved in the production are explained below. The process flow diagram of a typical processing plant is shown in figure.



Production process

i) Melting

The raw materials i.e. brass scarps are directly supplied by middlemen who would provide generally good quality raw materials and sorting out of any foreign material may not be required at the unit level. Brass scarps are added in a melting crucible. Different capacities of crucibles used in the cluster include 25 kg, 34 kg and 50 kg. Generally, a crucible can effectively be used for about 25 heats or melting after which it is generally replaced with a new crucible procured from local market.

The brass scarp is melting in pit type coal fired furnaces. Although the melting point of brass is about 900-940 ^{O}C, it was reported in the cluster that melting being carried out at about 1100-1200 ^{O}C, which is very high. However, the units have not been equipped with any instrumentation for temperature measurements. Fluxing agent is added and slag is removed from top and the melt is ready for pouring.

Raw material (brass scarp)

Brass melting furnace

ii) Casting

The moulds used in the units are clay based small cups. The moulds are kept in a row and the inner portion is coated with spent lube oil procured from local market. The brass melt is taken out manually from the furnace using a small ladle and poured into moulds. The melt solidifies and takes the shape of the mould.

Brass castings

iii) Forming and shaping

The monolithic castings are base materials for production of all types of brass articles produced in Balakoti cluster. The forming and shaping operations are carried out in subsequent days after melting operation. The castings produced in moulds are subjected to forming and shaping processes. This activity is accomplished through skilled workers who generally work a number of units in the cluster. Charcoal is used for heating the castings while subjected to forming and shaping operation. The temperature requirement for this process is about 350-400 ^{O}C. This is a cold-working process and Based on the weight, the castings are formed into different products such as plates, cups, bells, etc. meeting the requirements of customers.

Formed & shaped articles

iv) Finishing operations

The articles formed in previous steps would require finishing and polishing. This process is done manually. The formed article is mounted to a rotating shaft using wax fixed at its back. The article is manually adjusted for its centre alignment so that there is no wobbling. The finishing and polishing operation is carried out manually to provide shining to the product.

Finishing operation

Technologies employed

i) Melting furnace

The technology or main equipment used in the cluster is melting furnace. The melting furnace used across the cluster is essentially a pit type furnace. Crucibles of three different capacities viz. 25 kg, 34 kg and 50 kg are commonly used in the cluster. The furnaces are coal fired, which are generally filled surrounding the crucible at the initial firing of the furnace. Combustion air is supplied through an electric operated blower of about 0.25 hp capacity. The blower is operated intermittently based on furnace requirements. The crucibles, ladles and moulds procured from local market. The life of crucible is close to 25 heats and moulds are used for about one year. The furnace is the main energy consuming equipment in an artisan based brass units.

Coal fired pit furnace

Energy scenario in the cluster

The cluster uses coal, charcoal and electricity for the production process. Both coal and charcoal are procured from local market. Electricity is used to operate combustion air blower which is used intermittently based on melting requirements and for finishing operations. The details of energy sources and tariffs are shown in table.

Prices of major energy sources

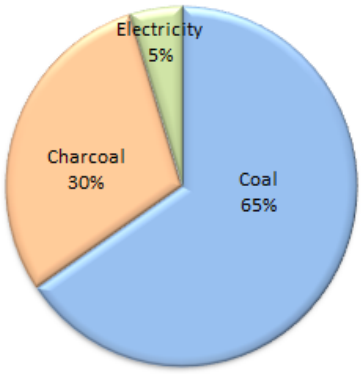
Energy type	Source	Price (Rs)
Coal	Local market	9000 per tonne
Charcoal	Local market	18000 per tonne
Electricity	Central Electricity Supply Utility of Odisha	5.60 per kWh

Energy consumption

A major share of energy is consumed in melting operation in the form of coal. The energy consumption level is dependent on type of furnace used, maintenance of key operating parameters and operating practices.

i) Unit level consumption

Coal accounts for about 60-65% of total energy consumption in a brass unit followed by charcoal. Electricity accounts for only 5% of total energy consumption – for combustion air blower and finishing operations. The average specific energy consumption (SEC) of brass units in Balakati cluster is about 60 MJ/ kg brass product. The major energy consumption area is melting. Other operations such as forming & shaping and finishing involve less energy but are quite labour intensive. The estimated unit level energy consumption break-up of different categories of brass units are shown in the figure.



Energy share at unit level

Typical energy consumption of brass units

Category (based on crucible capacity)	Coal (tpy)	Charcoal (tpy)	Electricity (kWh/year)	Total energy (toe/year)	Annual energy bill (million INR)
25 kg capacity	12	12	6300	10.7	0.4
34 kg capacity	18	15	8400	15.1	0.5
50 kg capacity	27	22	12300	22.2	0.7

ii) Cluster level consumption

The cluster level energy consumption is estimated based on energy consumption of processing plants in different category. The total annual energy consumption of Balakati brass industry cluster is estimated to be 206 tonnes of oil equivalent (toe). The equivalent carbon emissions from the cluster are about 1285 tonne of CO_2. The overall energy bill of cluster is estimated to be Rs 6.7 million.

Energy consumption of Balakati brass cluster (2015-16)

Energy type	Annual consumption	Equivalent energy (toe)	GHG emissions (tonne CO_2 per year)	Annual energy bill (million INR)
Coal	239 tonne	131	540	2.2
Charcoal	215 tonne	65	631	3.8
Electricity	117,000 kWh	10	115	0.7
	Total	**206**	**1285**	**6.7**

Energy saving opportunities and potential

Some of the major energy saving options in Balakati brass industries are discussed below.

i) Energy efficient melting furnace

The SEC level of melting furnace used in the cluster was observed to be very high. One of the major reasons for higher SEC level may be attributed to poor furnace design. Traditionally, the furnace design has not undergone any changes since beginning. The cluster uses quite outdated technology for melting. Other factors for poor energy performance include non-recovery of waste heat in flue gases and non-maintenance of operating parameters. There is a need to develop and demonstrate energy efficient melting furnace that would meet the requirements of furnaces operating in Balakati cluster. The envisaged energy saving with energy efficient furnaces used for melting is about 20-30%.

ii) Best operating practices

Use of instrumentation

Melting is the major energy consuming process and none of the units in the cluster monitor the temperature of melt in the furnaces. Use of melt at higher temperatures than requirements would lead to additional energy consumption. Temperature indicator must become an integral component of furnace system.

Proper ventilation

The hot gases from furnaces are let out inside the furnace room and there are no chimney arrangements. Use of chimney and exhaust fans would help in improving work place environment to a large extent.

Major stakeholders

The major stakeholders of the Balakati brass cluster include Balakati Kansa Pital Hastasilpa Unnayana Sanga and MSME-DI (Cuttack).

Cluster development activities

There were few skill upgradation programs undertaken in the past. However, at present there are no major developmental activities being undertaken in the cluster.

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

Schweizerische Eidgenossenschaft
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Swiss Agency for Development and Cooperation 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

Promoting Energy Efficiency in SMEs
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