

MANUAL ON ENERGY CONSERVATION MEASURES IN BRASS CLUSTER, BHUBANESHWAR



Bureau of Energy Efficiency (BEE)

Ministry of Power, Government of India

Prepared By

SEE - Tech Solutions Pvt. Ltd.





MANUAL ON ENERGY CONSERVATION MEASURES IN BRASS CLUSTER, BHUBANESHWAR

**Based on findings of BEE's SME Program for
Bhubaneswar Brass Cluster**

Sponsored by

**Bureau of Energy Efficiency (BEE),
Ministry of Power, Government of India, New Delhi
www.bee.nic.in**

Executing Agency

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June, 2010



BEE

The mission of Bureau of Energy Efficiency (BEE) is to develop policy and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act (EC Act), 2001 with the primary objective of reducing energy intensity of the Indian economy. This will be achieved with active participation of all stakeholders, resulting in accelerated and sustained adoption of energy efficiency in all sectors. The setting up of Bureau of Energy Efficiency (BEE) provides a legal framework for energy efficiency initiatives in the country.

Bureau of Energy Efficiency (BEE) is implementing a program (BEE's SME Program) to improve the energy performance in 25 selected SME clusters. The objective of the program is to accelerate the adoption of EE technologies and practices in the chosen SME clusters through knowledge sharing, capacity building and development of innovative financing mechanisms. Further information is available at www.bee-india.nic.in

SEE-Tech Solutions Pvt. Ltd.

SEE-Tech Solutions is a consulting & performance contracting firm for energy cost minimization. Its mission statement is "*Conserve our essential companion – Energy & Environment*", serving since 1993, it has completed more than 500 energy conservation assignments. It has contributed uniquely to this field by developing and implementing knowledge based software solutions: *See-UtiSave & See-ThermiSave*, which are being used by many Energy Auditors & Energy Managers. SEE-Tech Solutions is currently developing REEC (Regional Energy Efficiency Centre) with assistance from USAID in its ECO-III project, where in 150 energy conservation measures will be demonstrated for hands on capacity building in Energy Efficiency & Renewable Energy in industries & buildings. In this REEC, requirements of SMEs are duly addressed. Further information is available at www.letsconserve.org

SEE-Tech Solutions is Executing Agency for BEE's SME project in Bhubaneswar Brass Cluster.

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Acknowledgement

SEE - Tech Solutions Pvt. Ltd is thankful to Bureau of Energy Efficiency (BEE), Ministry of Power and Government of India for entrusting us the assignment of study of Technology gap assessment at Brass Industries Located at Bhubaneshwar, Orissa.

We also thankful to the Bhubaneshwar Brass association for their support and co-operation during energy use and technology audit study.

We are also thankful to all the plant in charges and all workers of the SME units for their support during the Energy Use and Technology Audit studies.

We also acknowledge the complete team of Brass industries at Bhubaneshwar for their help, co-ordination and cooperation in providing plant operating data, other technical details, views and discussions over Energy Audit observations.

We take this opportunity to express our appreciation for the support provided by various SME owners, LSP's and various equipment suppliers for their active involvement and their valuable inputs in making the program successful and in completion of the cluster manual.



Milind Chittawar, CEO & MD
SEE-Tech Solutions Pvt. Ltd



Foreword

SMEs have played a very significant role in Indian Economy, be it % of GDP, export and employment. However on technology and production cost front there is substantial potential for improvement through energy cost reduction and corresponding GHG emission reduction.

In BEE's SME Program 25 SME clusters have been identified for implementation of the program. Bhubaneswar Brass Cluster is one of them. There are more than 200 units. Bhubaneswar brass unit owners are the traditional artisans. This business is transferred from father to his son. Units which are in operation are 30 - 40 years old. They totally depend on Mahajans for raw material and fuel purchase. Technical awareness on the energy efficiency technologies is very poor. All units operate only in one shift.

Under this program total 30 Energy Audits are carried out in various brass units at Bhubaneswar which includes the units engaged in manufacturing of Thali, Ghara, Lota, Bela, Diya and other artificial handicrafts like Sinhasan, Ghanti, Mandir etc. The study has focused on identifying technology gaps and techno-economically feasible projects to reduce energy cost as well as corresponding GHG emissions. The study has also identified application of renewable energy in brass unit. For implementing the technologies, appropriate vendors/suppliers have been identified and pursued to serve Bhubaneswar Cluster. Local Service Providers (LSPs) have also been identified and developed.

This manual serves as a reference document for the units in Bhubaneswar cluster covering brief information on BEE's SME Program, Cluster level scenario at Bhubaneswar, Summary of Energy Audit findings and Technology assessment, Environmental benefits from identified technologies, Details of energy saving technologies, their saving potential, List of Technology providers, List of LSPs and several other related information so that the SME units can use this manual to understand process wise energy cost in brass components manufacturing, compare their energy consumption with the benchmark and identify suitable technologies and their suppliers to reduce their energy consumption and thereby energy cost.

The next step in the project involves developing DPRs (Detail Project Reports) for the identified technologies which will be used by the units for availing finance. SIDBI already has scheme for financing Energy Efficiency projects in SMEs. These DPRs will increase number of projects financed by banks. CDM PINs are also being developed to facilitate CDM projects arising from these identified technologies.

We urge SME units in Bhubaneswar Cluster to take advantage of these projects, refer to the manual, interact with LSPs, Technology suppliers and forth coming DPRs in detail and implement the projects to reduce the energy cost.



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1.0 ABOUT BEE'S SME PROGRAM

1.1 Project Objectives

Bureau of Energy Efficiency (BEE) is implementing a program (BEE's SME Program) to improve the energy performance in 25 selected SME clusters. Brass Cluster at Bhubaneswar is one of them. Objective of the program is to accelerate the adoption of energy efficient technologies and practices in the chosen SME clusters through technology gap studies, energy audits, benchmarking, knowledge sharing, capacity building at local level and development of readily usable DPRs to facilitate financing of energy efficient projects.

1.2 Expected Project Outcome

Under this BEE SME Program, following outcome is envisaged for Bhubaneswar Cluster:

Activity 1: Energy Use and Technology Analysis

This activity has developed information based on the status of Bhubaneswar Brass Cluster, identification and detailing of all possible energy efficiency measures, their techno-economic feasibility, overall potential to impact energy and environmental scenario. Energy use and status for adaptation of technology in order to improve energy performance of the units in the cluster have been studied and analyzed. 15 technologies/energy conservation measures have been identified preparation for DPR (Detail Project Report). This stage is completed and findings for the same are presented in this manual.

Activity 2: Capacity Building of LSPs and SMEs

This activity is started, LSPs have been identified and capacity creation among local service providers/technology providers is in progress which is helping the LSPs to undertake implementation of the identified energy efficiency measures. The LSPs will be trained in order to be able to provide the local services in the setting of energy efficiency projects in the clusters.

Activity 3: Implementation of energy Efficiency Measures

Scope of this activity is to facilitate the implementation of energy efficiency measures in Bhubaneswar cluster through development of ready to use DPRs to facilitate bank financing. Development of 15 DPRs is in progress.

Activity 4: Facilitation of Innovative Financing Mechanism

The objective of this activity is to facilitate the uptake of energy efficiency measures through innovative financing mechanisms without creating market distortion; efforts are in progress to develop such mechanisms.

1.3 Project Duration

Complete project duration is about 2.5 years. Project started in July 2009. Most of the activities will be completed by December 2010. This project will be completed latest by June 2011.



1.4 Identified Clusters under the Program

There are 25 clusters identified under the BEE SME Program, these are as follows:

Table No. 1: List of Identified Clusters under BEE SME Program

Sr.	Name of Cluster/Sector	Product	Number of Units Surveyed
1	Jamnagar (Brass)	Brass	846
2	Warangal (Rice Milling)	Rice Milling	115
3	Surat (Textiles)	Textiles	415
4	Pali (Textiles)	Textiles	357
5	Morbi (Ceramics)	Ceramics	442
6	Ahmedabad (Chemical Industries)	Process Industries	395
7	Solapur (Textiles)	Textiles	175
8	Alwar	Oil Milling	65
9	Bangalore	Machine Tools	54
10	Batala, Jalandhar & Ludhiana	Foundry	431
11	Bhimavarm	Ice Making	28
12	Bhubaneshwar	Brass	33
13	E & W Godavari	Refractories	44
14	Ganjam	Rice Milling	205
15	Gujarat	Dairy	22
16	Howrah	Galvanizing	57
17	Jagadhri	Brass & Aluminium	91
18	Jodhpur	Limestone	78
19	Jorhat	Tea	60
20	Kochi	Sea Food Processing	35
21	Muzaffarnagar	Paper	18
22	Orissa	Sponge Iron	45
23	Vapi	Chemicals & Dyes	180
24	Varanasi	Brick	122
25	Vellore	Rice Milling	49

2.0 CLUSTER SCENARIO

2.1 Overview of SME Cluster

2.1.1 Cluster Background

Brass units are located in 4 villages near by Bhubaneshwar (Balakati, Pratap Sasan and Rathijema - these three locations are adjacent to each other and about 22 Kms from the old city of Bhubaneshwar, while Bainchua is around 8 Kms from the old city of Bhubaneshwar) This cluster is very traditional and community based, can be called as “Kutir-Udyog”, They live in the same house and at its backyard manufacturing activity takes place.

There are approximately 200 brass units in this cluster which are engaged in manufacturing of brass articles like Thali, Goddess Idol, Aasan, Bati, Bela, Ghara, Lota, Diya and others. There is no firm name to these units; these are identified by the names of their fore-fathers.

2.1.2 Products Manufactured

Brass units located at Bhubaneshwar are engaged in manufacturing of different types of following products

- Thali (Plate or Tray)
- Kansa or Bela (Cup)
- Small Gina or Small Bati (Small Cup)
- Maan
- Katia
- Ghara
- Bati
- Others include different types of handicrafts like Ghanti, Mandir, Asan etc

2.1.3 Classification of Units

Units are involved in manufacturing of different types of products. The units can be broadly classified according to the types of products

- a. Units involved in manufacturing of one product i.e Thali only
- b. Units involved in manufacturing of different types of products like Ghara, Lota, Diya, Bela etc
- c. Some of units are engaged in manufacturing of handicrafts only

It was realized that the units are too small. Electric equipments in each unit are a few; mainly there are one or two table fans, CFLs, Sodium Lamps, air blower and polish machine. Many of the units use manual blowers and manual polish machine and shifted from electrical ones. Very few of them are using the electrical blowers which have a very small capacity motor.

It was also found that the “Chulas” in each unit were operated on an average of about 2 to 3 times in a week. Each time the melting processes take around 5 to 6 hours and 45 to 50 kgs of Hard Coke.



Figure No. 1: Photographs for Overview of Bhubaneswar Brass Cluster



Raw Material Storage



Melting Furnace



Biscuits formation from molten Brass



Re- heating Furnace (Charcoal is used as Fuel)



Hand Driven Polishing and Finishing Machine



Motor Driven Polishing and Finishing Machine



2.1.4 Production Capacity (In Kg or Pieces per Year) Detail

Average annual production in a typical brass unit for different types of product category is as follows:

Table No. 2: Annual Production of Brass Products in a Typical Brass unit

Sr.	Type of Unit	Production in a Typical Unit
1	Thali	1920 to 4836 Kg/year
2	Different products like lota, Bati, Bela etc in a single unit	1728 to 6144 Kg/year
2	Other like handicrafts	360 to 7680 Kg/year

2.1.5 Energy Consumption Profile & Availability

At the cluster level, Energy consumption profile & availability of various energy sources is as follows:

Table No. 3: Energy Consumption Scenario at the Bhubaneshwar Brass Cluster

Sr.	Type of Fuel	*Quantity used/ annum	Unit	GJ/ annum	%	Availability
1	Electricity	15670	Kwh/annum	56	0.37 %	Available in required quantity
2	Hardcoke	310	Tonnes/year	5336	35.3 %	Available in required quantity but at higher cost
3	Charcoal	359	Tonnes/ year	9763	64.42 %	Available in required quantity but at higher cost
	Total			15155	100.00 %	

2.1.6 Raw Materials Used

Raw Materials are mainly used as a mixture of zinc and copper. Most of the units bring old brass scrap as a raw material for manufacturing new articles.

All the raw materials were taken from some particular "Mahajan". There are about 10 Mahajans in that area. These Mahajans give them the raw materials without any price but with a condition that the finished product should be sold to them only. After selling the finish goods to the Mahajans the manufacturer receive only the amount left after all the deductions.

2.2 Energy Situation in the cluster

2.2.1 Types of Fuels Used and Prices

Details of different types of fuels used in Bhubaneshwar Brass cluster along with their price and calorific value are as follows:

Table No. 4: Types of Fuel Used and Prices*

Sr.	Type of Energy	Price of Fuel, Energy	Calorific Value
1	Electricity	Rs. 2.30 per kWh	-
2	Charcoal	Rs. 22.5 per Kg	6,500 Kcal/Kg
3	Hard coke	Rs. 8.5 per Kg	4,500 Kcal/Kg

* Reference period is October 2009 to December 2009

2.2.2 Fuels and Electricity Consumption

Average thermal fuel and electricity consumption in a typical brass unit considering the minimum and maximum capacity brass units are as given below

Table No. 5: Fuel and Electricity Consumption

Sr. No.	Type of unit according to the type of Product Manufacturing	Nos. of units are in operation	Electricity Consumption, KWh/year	Hard Coke Consumption, Kg/year	Charcoal Consumption, Kg/year
1	Thali	65	102	2400	3450
2	Different products like Lota, Bela, Bati, Diya	45	112	2250	3000
3	Handicrafts like Mandir, Asan, Snake etc	10	400	5250	0
4	Applications		To drive polish, buffer, drill, cutting motors & Lighting	Fuel for Melting furnace.	Fuel for Heating furnace.

2.2.3 Specific Energy Consumption (In Appropriate Unit)

Based on the data provided by the units in the cluster Specific Energy Consumption for thermal and electrical energy have been calculated, which are as follows.

Table No. 6: Specific Energy Consumption Range in Brass Units in Bhubaneshwar

Sr. No.	Type of unit according to the type of Product Manufacturing	Electricity Consumption, KWh/Kg of Product	Hard Coke Consumption, Kg/Kg of Product	Charcoal Consumption, Kg/Kg of Product
1	Thali	0 to 0.12	0.56 to 1.79	0.8 to 1.78
2	Different products	0 to 0.15	0.23 to 1.4	0.8 to 1.67

Sr. No.	Type of unit according to the type of Product Manufacturing	Electricity Consumption, KWh/Kg of Product	Hard Coke Consumption, Kg/Kg of Product	Charcoal Consumption, Kg/Kg of Product
	like Lota, Bela, Bati, Diya			
3	Handicrafts like Mandir, Asan, Snake etc	0.10 to 1.12	0.88 to 2	0

2.3 Manufacturing process/technology overview in a typical unit

2.3.1 Process Technology

Manufacturing process and technology that are in use in Bhubaneswar Brass Cluster are as follows.

Production Process :

Process flow diagram for different types of brass products is shown in item 2.3.2.

Raw Materials:

The raw material for production of brass articles are Copper and Zinc and sometimes scrap vessels of Brass or Copper and Zinc, both the materials are locally sourced or obtained from Mahajan. Fuel used for melting furnace is Hardcoke; also fuel used for heating furnace is Charcoal. Hardcoke and Charcoal are obtained from local source.

Melting:

The melting furnace is unique and important requirement in the process of manufacturing brass metal products. The Melting Furnace or Chulla is utilized for the melting of raw material i.e. Copper and Zinc, scrap vessels of Brass. This Chulla is prepared by the unit owners as per their traditional process. This melting furnace heats the raw material to a temperature of about 950 °C. At this temperature, raw material melts. It is about 40-70 cms wide and 15-60 cm deep. Basic metals are kept inside the crucible and process of heating is carried on. The source of thermal energy for melting is Hard Coke. The melting process is batch process; it takes time around 5 to 6 hours depending upon quantity of raw material under processing. Around 2-4 batches are carried out in a week depending on the capacity of unit.

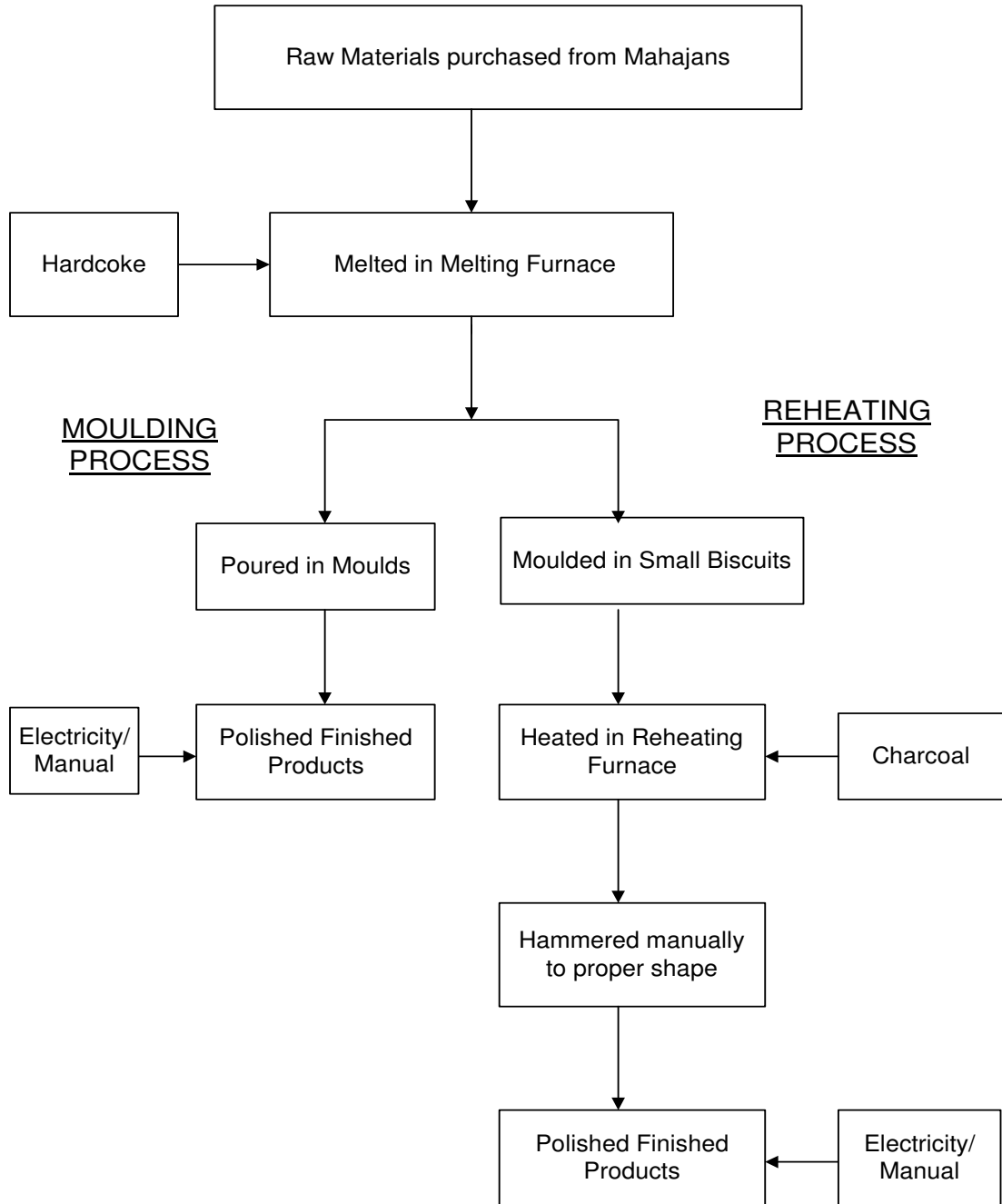
Moulding & Casting:

The molten brass obtained from melting furnace is poured in suitable moulds i.e. Achhu for casting or moulding. The Achhu is prepared in different sizes shapes like thali, lota, bati, bela, ghara, diya etc keeping in view the quantity of the melted alloy is to be poured in it for different products. A small Koi called Dhal Koi is used for transporting the melted alloy from the Koi to pour into Achhu which is previously sterilized with Mobil oil. The molten alloy is allowed to remain sometime inside the Achhu to be cold. During the process of cooling, Tashu (rice head) is used after pouring the molten alloy. The rice head makes processing of cooling slow of the alloy. This cooled alloy is called Ghati. The



moulds of lota, ghara, diya are available so molten material can be easily transformed into these shapes.

Figure No. 2: Process Flow Diagram of Brass Articles



Heating:

The Reheating furnace is an open furnace build up on ground as per the traditional procedure. The furnace is built by just digging a hole of about 30-50 cm wide and 30-90 cm deep. Charcoal is used as a fuel in heating furnace. Temperature of about 800 °C is maintained inside the furnace.

Since in order to give the moulds a specific shape and size the moulded material are reheated in a Reheating Furnace and hammered, the moulded material are formed after moulding of melted raw material from the melting furnace. This process requires more skill to give the ingot proper shape and size. For this different size of hammers, pincers, pathara (stone anvil), iron anvil etc. are required. This beating process also requires simultaneous heating and beating.

Beating:

The heated billet from the reheating furnace is taken out through pincers at a temperature of about 800 °C and is then hammered in a sequential and known fashion. In case of formation of Thali and other products, the beating is carried out from left to right on the heated billet by a group of hammer men. The heating & beating is a simultaneous process in order to bring it to a desired shape. The process is carried out by holding the moulded material by craftsmen over stone anvil and is beaten by the hammer men to form concave size. Next step is to increase the height of the product beyond its circumferential base. Under this process, a hammer man takes the leading part in hammering of the product. The products formed by this technique are like thali, ghara, diya etc.

Scrapping:

After the process of beating the product scrapping is carried out by the artisans where if any portion of the body of the product unusually thick enough is removed. Thus scrapping is carried out for ensuring a uniform thickness of the product and smoothness of product wherever required.

Polishing:

The finished products after molding or manual finishing are polished for shining look and smoother surface. Machine used for polishing is either hand driven or electrically powered. This motor is connected to the main polishing part via pairs of flat belts. The finished products after polishing are sold to Mahajans.



2.4 Current Policies and Initiatives of Local Bodies

There were 4 to 5 small associations (society), each consisting of 50 members; but now many of them have been closed. Details of associations are as follows

1. Bhagwati LFMICS Society, Assigharsahi - Mr. Babaji Sahoo - Secretary
2. Bainchua Brass and Bel Metal Co - operative Society - Mr. Lingraj Sahoo - Preseident
3. Brajmohanji Brass and Bel Metal Association - Mr. Gopal Charan Sahoo - President
4. Kshetramani Brass and Bel Metal Association - Mr. Janardan Sahoo - President

MSME Development Institute, Cuttack, a field office of MSME Development Organization under the Ministry of MSME (Micro, Small & Medium Enterprise), Government of India, was established at Cuttack as branch office in the year 1956

The raw material is sourced from the following sources.

The primary aim of this institute is to promote and develop small scale industries in the state of Orissa by rendering escorts services. The main activities of this Institute is to render techno-economic and managerial consultancy in the field of chemical, mechanical, metallurgy, leather, electrical, electronics, hosiery, Glass & Ceramics, Industrial Management, Economics and Statistics, etc. to the existing as well as prospective entrepreneurs including training facilities under Entrepreneurship Development Programme (EDP), Management Development Programme (MDP) & Industrial Motivational Campaigns. The other important activities of this Institute are District Industrial Potentiality Survey, NSIC Registration, Joint Capacity Assessment, Ancillary Development, Export Promotion, Revival of Sick SSI units, Conducting Seminars/ Workshops and Awareness Programmes on different themes like pollution control, Energy conservation, ISO-9000/TQM, ODS, preparing various reports including status of the industry.

• Assistance/ Consultancy to prospective Entrepreneurs:

Under this activity, the following services are being rendered to the entrepreneurs to set up their units.

- ✓ Motivation through Campaigns & training through EDP/MDP
- ✓ Selection of Product and location
- ✓ Selection of machinery and technology.
- ✓ Marketing/ financial assistance
- ✓ Preparation of Detail Project Reports
- ✓ Assistance in coordination with District Industries Centre (DICs) & other agencies.

• Assistance/Consultancy rendered to existing Units:

Technology up-gradation and use of improved manufacturing technologies/ Design/ Process.

- ✓ Improvement in tooling
- ✓ Quality improvement & product development
- ✓ Consultancy for diversification.



- ✓ Consultancy for managerial/ marketing/ financial related matters.
 - ✓ NSIC registration to participate in the Government Store Purchase Programme.
 - ✓ Technical assistance on plant & machinery including lay out.
1. **Micro & Small Enterprises Cluster Development Programme (MSE-CDP)** - DC(MSME) launched MSE-CDP for holistic development of selected MSEs clusters through value chain and supply chain management on co-operative basis.
 2. **Scheme for Capacity Building** - Scheme for capacity building, strengthening of database and advocacy by industry/ enterprise associations, as envisaged in the promotional package for Micro and Small Enterprises (MSEs).
 3. **Credit Linked Capital Subsidy Scheme for Technology Upgradation** - The Scheme was launched in October, 2000 and revised w.e.f. 29.09.2005. The revised scheme aims at facilitating Technology Upgradation of Micro and Small Enterprises by providing 15% capital subsidy (12% prior to 2005) on institutional finance availed by them for induction of well established and improved technology in approved sub-sectors/products. The admissible capital subsidy under the revised scheme is calculated with reference to purchase price of Plant and Machinery. Maximum limit of eligible loan for calculation of subsidy under the revised scheme is also been raised from Rs. 40 lakhs to Rs. 100 lakh w.e.f. 29-09.2005
 4. **Assistance to Entrepreneurship Development Institutes** - For strengthening training infrastructure in EDIs, assistance upto 50% or Rs. 50 lakhs whichever is less - for State Governments.
 5. **Scheme of Micro Finance Programme** - Creating self employment opportunities is one way of attacking poverty and solving the problems of unemployment.

Table No. 7: Details of Raw Material Suppliers at Bhubaneswar Brass Cluster

Sr.	Name of Company	Address	Name of person with contact details
1	Madanmohan Traders	Rathijema, Tirisighar, Khurda	Mr. Ugrasen Sahoo 9337528045
2	Ambica Traders	Uttara Chhak, Kausalyaganga.	Mr. S. Mahanta
3	Tareni Traders	Uttara Chhak, Kausalvaganga	Mr. Sudershan Sahoo 933729674
4	Bhagwati Traders	Uttara Chahak	Mr. B. Mahanta
5	Bhairathi Metal Store	Utara Chhack, Khurda	Mr. Bhagirathi Maharana 0674 - 2465429

2.5 Issues Related To Energy Usage and Conservation and Barrier in Technology Up-Gradation

2.5.1 Energy Availability

Bhubaneshwar brass cluster uses energy in the form of electricity, Hardcoke and Charcoal. Electrical energy is provided by Orissa Electricity Regulatory Commission. Electrical energy is mainly used for lighting and polishing purposes. Some of the brass units are not using electricity for any type of operation in their unit. All the equipments are hand driven. Very few units are using the electrical blowers for furnaces and electrical motors for polishing machines. Otherwise in most of the units electricity is used only for lighting. Very little amount of electrical energy is used as compared to the thermal energy obtained from Charcoal or Hardcoke.

For lighting purpose electrical energy requirement varies from 12 to 157 KWh/year and for polishing it varies from 136 to 753 KWh/year. Electricity is also used for blowers in furnaces; its value varies from 15 to 172 KWh/year. Thermal energy is used in the form of Charcoal and Hard coke. Charcoal is used in heating furnace and the hard coke is used in melting furnace.

Hard coke and charcoal are available at Bhubaneshwar brass cluster at a very higher rate than as compared to available in the market.

2.5.2 Technological Issues

Overall technical understanding on brass articles manufacturing at Bhubaneshwar brass cluster is very poor. They are using all the traditional and old technologies.

There is lack of knowledge on the energy efficiency improvement in the furnaces. The furnaces used are the traditional ones. The efficiencies of these furnaces are found very low i.e less than 5 %.

Lack of technical expertise available at this cluster. All the equipments they are using are tailor made as per traditional means. This business is one type of family business and the same tradition is followed as given and taught by their fore fathers.

2.5.3 Financial Issues

As discussed, production of the unit is dependent on the decision of Mahajans. Also the cost of fuel is very high. Because of this reasons, total turnover and profit to the units is very low. Due to this, they are not able to grow and focus on new technologies as they are not having the funds for investment and they don't having the raw material to run their unit on a continuous basis.

Availing finance is a major issue. Due to low production capacity, single unit are not able to implement the energy efficiency improvement projects and it is economically also not feasible. If 3 to 4 units combine and install the energy efficient furnaces or rice husk fired Gasifier then the payback period of these projects reduces. Initial demonstration of the suggested technologies helps the units to understand and eliminate their fund availability problems.



2.5.4 Manpower Related Issues

These articles production techniques are passing from one generation to another generation. All artisans are very trained and efficient in preparation of utensils but they lack knowledge of available new technologies. From technical point of view, they require specialized training about the efficient technologies. Also the capacity building of local service providers may help in successful implementation of the projects.

2.5.5 Technology & Service Providers Related issues

There is no issue of service provider at Bhubaneshwar Brass Cluster. The units are run by their family members as per the traditional practices.



3.0 ENERGY AUDIT AND TECHNOLOGY ASSESSMENT

3.1 Methodology Adopted For

3.1.1 Energy Use and Technical Study

3.1.1.1 Pre-Energy Audit Activities

Methodology adopted for pre - energy audit activities is as follows:

1. Based on the situation analysis data provided by BEE on Bhubaneswar Brass cluster, the activities were evolved and planed accordingly. Three to four brass units were visited and observed in detail to get deeper understanding of the energy issues in the unit before starting the work.
2. Visit the president office of brass cluster and take their feedback and views.
3. Based on the visit, identify energy consuming equipments and analyze ongoing technologies and start identifying gaps at the cluster level.
4. Prepare the data collection and equipment measurement format for the energy audit and its field measurements
5. Prepare a list of 30 units to be audited taking care that all types are included.

Allocation of one person from our team to work full time to convince the unit owners/persons to get ready for conducting the energy audit.

Get involve one local person i.e auto driver as an intermediate for local language translation wherever required.

3.1.1.2 Preliminary Energy Study

Number of preliminary energy audit studies was done in 21 brass units

Methodology adopted for Preliminary Energy Audit study is as follows:

1. Collection of the past electrical and thermal energy consumption data wherever available
2. Establishment of the energy consumption scenario at the unit
3. Establishment of the benchmarks for specific energy consumption of typical equipments wherever possible
4. Study of major energy consuming equipments at the unit
5. Modification of previous formats for data collection and measurements and finalize them for detail energy audit study.

3.1.1.3 Detailed Energy Study

Detailed energy audit study was carried in 9 brass units

Methodology adopted for Detail Energy Audit study is as follows:

1. Detail observations on the equipments in terms of their functions, energy requirements
2. Electrical measurements on the electrical equipments by Load Analyzer which includes the measurement of Voltage, Current, kW, PF on the motors if applicable.



3. Thermal measurements which include the temperature measurement by thermocouple and thermal imager, air velocity measurement by anemometer wherever applicable on melting and reheating furnace
4. Arriving at energy balance and Specific Energy Consumption at unit level
5. Carrying out all the required measurements to quantify specific energy consumption for each of the equipment
6. Identification of alternative lower energy consumption or lower energy cost option to deliver same process function
7. Analyze saving potential and investments required accordingly prioritize the measures and identify 15 technologies for preparation of DPR

Technical audit involves the following:

- In technical audit the technologies and processes used and equipment details are to be studied.
- Compare the specific energy consumption of equipments of brass units.
- The capacity utilization to the total capacity installed is to be studied.
- Study the availability of new technologies and local service providers at Bhubaneswar.

3.2 Observations Made During the Energy Use and Technology Studies Carried Out In the Cluster

3.2.1 Manufacturing Process and Technology/Equipments Employed

The manufacturing processes followed in all types of industries are same as covered in item 2.3.1 List of the major equipments employed is as follows:

1. Melting furnace
2. Heating Furnace
3. Polishing & Finishing Machine

3.2.3 Capacity Utilization Factor

Capacity utilization factor at the unit level and at the equipment level is described below:

Plant Level:

1. The brass cluster units operate seasonally depending upon the demand in the market and the quantity of raw materials available.
2. These units generally operate for 5-6 months in a year.
3. Annual production of these brass units varies from 1920-7680 kg.
4. Majority of the product manufactured in various units is only Thali.
5. Batch production is observed in these units. Maintenance of the chullas or Furnaces is carried out on a weekly basis.
6. Melting and Reheating furnaces used in this units operates in batches.
7. Melting furnace operates for out 4 to 5 batches per month depending upon the need of the market.
8. The batches for reheating furnace vary from 4 to 5 batches per month. This follows the operation of melting furnace.



Equipment Level:

1. Melting furnace even though operates for 4 to 5 batches per month but whenever it operates it will operate at this full load capacity
2. Similar to melting furnace, reheating furnace also operate at its full capacity.

3.2.4 Housekeeping Practices

During our energy use and technology audit, following housekeeping practices were observed.

1. Proper weekly maintenance of the melting furnace is carried out regularly.
2. Similar maintenance of the reheating furnaces is carried out regularly.
3. Cleaning practices of working place are properly followed.

3.2.5 Availability of Data and Information

Energy consumption data for month is available approximately and the production data is available as per the batches carried out in a furnace.

3.2.6 Any Other Relevant Aspect

This cluster needs financial support for implementation of the identified energy saving projects.

3.3 Technology Gap Analysis

This step was started with gathering energy efficient technologies available and is prevalent world wide in brass unit.

3.3.1 Technology Gap Analysis and Process Up-Gradation

Latest technologies available and the best practices that should be followed in brass units to reduce the energy consumption are as follows:

A. Raw Material Processing

1. Purchase of the right materials, it will save the energy and costs that would otherwise have to be incurred to treat them in the unit
2. Usage of scrap brass utensils reduces the raw material cost.
3. Fuel stored should be kept properly in a dry and clean place to prevent from contamination.

B. Melting Furnace

The Melting Furnace or Chulla is utilized for the melting of raw material i.e. Copper and Zinc, scrap vessels of Brass. Melting of brass is carried out in a traditional Chulla or Melting furnace at a temperature of about 950°C. Fuel used for melting of brass is hard coke. This Chulla is prepared by the unit owners itself as per their traditional process. It is about 40-70 cm wide and 15-60 cm deep. Basic metals are kept inside the crucible and process of heating is carried on.

Pictorial view of the melting furnace found at Bhubaneswar brass cluster units is shown below



Figure No. 4: Pictorial view of the proposed new redesigned melting furnace



ii. Rice Husk Gasification for Melting Process

The redesigned furnace with installation of rice husk fired Gasifier is another technique to reduce the melting process energy cost. During our audit, it was observed that the fuels are purchased by the units at a very high cost. In order to minimize the overall production energy cost, this project is most suitable.

We have found that rice husk is easily available at this cluster as most of the unit owners belong to farming background and are also engaged in rice cultivation. Therefore the rice husk is available at a very cheaper rate at this cluster and it can be easily used as a fuel for melting process.

To use rice husk as a fuel for melting process, we have to design a Gasifier for combustion of this fuel. In Gasifier, producer (CO) gas is generated by partial combustion of rice husk. This producer gas is then sent for combustion in the melting furnace as a source for providing heat. It also requires the new redesigned melting furnace along with waste heat utilization of flue gas of furnace for combustion air preheating.

This reduces the cost of fuel in melting furnace as rice husk is available at a very cheaper rate and also the efficiency of the new designed furnace will be high due to use of gaseous fuel (producer gas) as compared to the use of solid fuel in this furnace. Gasifier achieves efficiency of about 75 % and the gas fired melting furnace achieves efficiency of about 25 %. Hence the overall efficiency that can be achieved is 19 %.

Pictorial view of Rice Husk Gasifier is shown below



Figure No. 5: Pictorial view of the proposed Rice Husk Fired Gasifier



C. Reheating Furnace

The brass biscuits obtained after moulding are reheated and hammered to give the proper shape for final finishing. The biscuits are reheated in a Reheating furnace at a temperature of about 800°C. The fuel used in a reheating furnace is Charcoal. Products obtained after reheating are hammered and polished to get the required surface finish. The working on this furnace is a batch process depending on the seasonal demand or availability of raw materials. The furnace is built by just digging a hole of about 30-50 cm wide and 30-90 cm deep.

Pictorial view of the reheating furnace found at Bhubaneswar brass cluster units is shown below



Figure No. 6: Pictorial view of the existing reheating furnace at this cluster



Like melting furnace, specific fuel consumption in reheating furnaces is found very high as compared to the theoretical requirement. It means that reheating furnace is also highly inefficient. The working of the furnace is dependent on the season and availability of raw materials. The reheating process is batch process; it takes time around 4 to 5 hours. Like melting process, around 2-4 batches carried out in a week of reheating furnace depending on the capacity of unit.

Similar to melting furnace technologies, following mentioned technologies for reheating process helps in reducing the energy cost in melting furnaces. These projects payback period reduces if 3 to 4 units combine and install these projects i.e. the same case as in case of melting furnace already mentioned above.

i. Redesigning of Reheating Furnace with recuperator

The redesigned reheating furnace will consist of furnace with recuperator where the high temperature of exhaust gas will be utilized for preheating of combustion air which will contribute to increase in efficiency of furnace. Also proper design of reheating furnace with waste heat recovery system increases the efficiency of the furnace. The traditional furnaces specific fuel consumption is found very high as compare to the requirement. Therefore a redesigned reheating furnace with recuperator will improve the efficiency of furnace thereby resulting in decrease of specific fuel consumption. It will also lead to efficient fuel utilization. Efficiency of upto 15 % can be achieved by this new design furnace.

Pictorial view of this type of furnace is shown below



Figure No. 7: Pictorial view of the proposed new redesigned reheating furnace



ii. Rice Husk Gasification for Reheating Process

One common Gasifier can be utilized for both the melting and reheating furnaces. Capacity of Gasifier should be selected by considering all these factors. Similar to the melting process by rice husk gasification, reheating process is also possible. As the charcoal is available at the cluster at very high price as compare to the market prices this project results in huge quantity of savings in rupees in energy consumption in reheating furnace.

For this project, as common Gasifier can be utilized then we can only redesign and install a new gas fired reheating furnace. In this case also, overall efficiency which can be achieved will be 19%.

D. Polishing Machine

Polishing is the last process step in the brass unit. Various types of process can be carried out in polishing section like finishing, drilling, buffer machine etc. Most of the units use manual operation for polishing of products. Very few of them are using electrical driven motors and they are also of very small capacity. Following projects help in energy saving in case of electrical driven motors but these projects' payback period is very high due to less energy savings because the working hours of operation of polishing machines are very less i.e 4 to 5 hours in a week.

Some tips to reduce the energy consumption in polishing section:-

- 1) Usage of energy efficient motors for the polishing section. The efficiency of an electric motor can only be improved through a reduction in motor losses. Improvement in the design, materials, and construction has resulted in efficiency gains of 2 to 6 % which translates into a 25% reduction in losses.
- 2) Use of thyristor based speed controller by directly mounting of motor results in saving in 15% saving in electricity consumption.
- 3) Use of solar energy for running of polishing motors eliminates the operating cost.



3.4 Energy Conservation Measures Identified

3.4.1 Proposals for Energy Conservation & Technology Up-Gradation

3.4.1.1 Proposal Description Including Technology/Product Specifications, Benefits of Implementation, Cost of Implementation, Monetary Savings, Simple Payback Period and Issues/Barrier in Implementation for Each Proposal

Based on the findings of technology gap analysis & energy audits various energy conservation measures are identified as given below:

1. For Melting Furnace

A. Saving in hard coke consumption in Melting furnace by redesigning the new melting furnace with recuperator.

Project Description and Benefits:

Melting furnace is in a form of open fire place furnace or Chulla. The fuel used in melting furnace in the brass cluster unit is hard coke. Melting furnace section consumes about 1200-6720 kg/year depending on amount of raw material used for processing. Here we propose to redesign a furnace with waste heat utilization for combustion by air preheating. It improves the efficiency of the furnace. *Here we have done the calculations by combining 3 brass units.*

Approximate One Time Investment: It varies from Rs. 70,000 to Rs.90,000 depending upon their production capacity.

Annual Savings: It varies from Rs 50,000 per year to Rs 52,000 per year depending on the size of unit and amount of fuel consumption.

Simple payback period: Approximately 1 year

Calculation of energy saving potential by Installation of Redesigned Melting furnace with Recuperator

Note: We consider a group of 3 brass units. Below are the saving calculations done for implementation of this project by 3 brass units jointly.

1. Hard coke consumption	= 9000 Kg/year
2. Efficiency of existing melting furnace	= 4.91 %
3. Efficiency of proposed melting furnace	= 15 %
4. Saving in Hard coke consumption due to Efficiency improvement	= 6094 Kg/year
5. Cost of Hard coke	= Rs. 8.5/Kg
6. Saving in Hard coke consumption in Rs.	= Rs. 51,469
5. Electricity consumption of blower	= 0.25 KWh/year
6. Cost of electricity	= Rs. 2.30/KWh
7. Electricity consumption in Rs.	= Rs. 165/year
6. Total Saving in Rs.	= Rs. 51,304 /year
7. Approximate investment	= Rs. 70,000
8. Payback period	= 1 year



Issues/Barrier in implementation: There are no technological barriers in implementation of this project. The issue is only availability of fund. This can be solved by installing this project by a group of 3 to 4 units.

B. Saving in rupees by using rice husk gasification for Melting process and redesigning the furnace for same.

Project Description and Benefit:

Hard coke is used as a fuel in melting furnace. At Bhubaneswar brass cluster, cost of hard coke is available at higher cost than the market price. Rice husk is available at very cheaper rate. Therefore, use of rice husk as a fuel reduces the energy consumption cost in melting furnace. *Here we have done the calculations by combining 3 brass units.*

Approximate One Time Investment: This investment cost is considered as a combined cost with the reheating furnace cost, as common Gasifier is used for both the reheating and melting furnaces, therefore combine investment for the rice husk gasification process for both the melting and reheating varies from Rs. 3,20,000 to Rs. 3,30,000 depending on the capacity of the units.

Annual Savings: Therefore, the savings for melting furnaces varies from Rs 40,000 per year to Rs 80,000 per year depending on the size of unit and amount of fuel consumption.

Simple payback period: Approximately 1 year considering the combine investment and saving for melting and reheating furnaces.

Calculation of energy saving potential by Installation of Rice Husk Gasifier with Redesigned Melting furnace for the same leading to Reduction in Fuel Requirement.

Note: We consider a group of 3 brass units. Below the saving calculations is done for implementation of this project by 3 brass units jointly.

1. Hardcoke consumption	= 9000 Kg/year
2. Calorific value of Hardcoke	= 4500 Kcal/Kg
3. Cost of Hardcoke	= Rs. 8.5/Kg
4. Cost of Hardcoke in Melting Furnace	= Rs. 76500 /year
5. Calorific value of rice husk	= 2500 Kcal/Kg
6. Cost of rice husk	= Rs. 1.5/Kg
7. Equivalent rice husk consumption for melting	= 21600 Kg/year
8. Efficiency of Gasifier	= 75 %
9. Efficiency of new design gas fired furnace	= 25%
10. Overall efficiency of melting process	= 19%
11. Actual rice husk consumption for melting due to Improved efficiency	= 5581 Kg/year
11. Cost of rice husk consumption	= Rs.8371 /year
12. Electricity consumption in proposed Gasifier blower	= 0.25 KW
13. Electricity consumption of Gasifier blower	= 72 KWh/year
14. Electricity consumption in proposed furnace blower	= 0.25 KW
15. Electricity consumption of furnace blower	= 72 KWh/year
16. Total electricity consumption	= 144 KWh/year
17. Cost of Electricity	= Rs. 2.30 /KWh



18. Electricity consumption	= Rs.331 /year
19. Saving in Rs.	= Rs. 67,798 /year
20. Total investment (including gasifier, furnace, recuperator etc)	= considered in point 2 B investment as combine Gasifier is installed for reheating and melting process

Issues/Barrier in implementation: There are no technological barriers in implementation of this project. The issue only is the availability of fund. This can be solved by installing this project by a group of 3 to 4 units.

2. For Reheating Furnace

A. Saving in charcoal consumption in Reheating furnace by redesigning the new Reheating furnace with recuperator

Project Description and Benefits:

The fuel used in Reheating furnace in the brass cluster unit is charcoal. Reheating furnace section consumes about 1920-5760 kg/year depending on amount of raw material use for processing. Here we propose to redesign a furnace with waste heat utilization for combustion by air preheating. It improves the efficiency of the furnace. **Here we have done the calculations by combining 3 brass units**

Approximate One Time Investment: It varies from Rs. 1,20,000 to Rs.1,60,000 depending upon their production capacity.

Annual Savings: It varies from Rs 1,65,000 per year to Rs 2,59,000 per year depending on the size of unit and amount of fuel consumption.

Simple payback period: Less than 1 year

Calculation of energy saving potential by Installation of Redesigned Reheating furnace with Recuperator

Note: We consider a group of 3 brass units. Below the saving calculations is done for implementation of this project by 3 brass units jointly.

1. Charcoal consumption in Reheating Furnace	= 12,000 Kg/year
2. Efficiency of existing reheating furnace	= 1.75 %
3. Efficiency of proposed reheating furnace	= 15 %
4. Saving in Charcoal consumption due to Efficiency improvement	= 7380 Kg/year
5. Cost of Charcoal	= Rs. 22.5/Kg
6. Saving in Charcoal consumption in Rs.	= Rs. 1,65,274/year
5. Electricity consumption of blower	= 72 KWh/year
6. Cost of electricity	= Rs. 2.30/KWh
7. Electricity consumption in Rs.	= Rs. 165/year
6. Total Saving in Rs.	= Rs. 1,65,109/year
7. Approximate investment	= Rs. 1,20,000
8. Payback period	= 0.7 year



Issues/Barrier in implementation: There are no technological barriers in implementation of this project. The issue only is the availability of fund. This can be solved by installing this project by a group of 3 to 4 units.

B. Saving in rupees by using rice husk gasification for Reheating process and redesigning the furnace for same.

Project Description and Benefits:

Charcoal is used as a fuel in reheating furnace. At Bhubaneshwar brass cluster, hard coke is available at higher cost than the market price. Rice husk is available at very cheaper rate. Therefore, use of rice husk as a fuel reduces the energy consumption cost in reheating furnace. *Here we have done the calculations by combining 3 brass units*

Approximate One Time Investment: This investment cost is considered combine with the reheating furnace cost as common Gasifier is used for both the reheating and melting furnaces, therefore combine investment for the rice husk gasification process for both the melting and reheating will varies from Rs. 3,20,000 to Rs. 3,30,000 depending on the capacity of the units.

Annual Savings: Therefore, the savings reheating furnaces varies from Rs 2,50,000 per year to Rs 3,50,000 per year depending on the size of unit and amount of fuel consumption.

Simple payback period: Approximately 1 year considering the combine investment and saving for melting and reheating furnaces.

Calculation of energy saving potential by Installation of Rice Husk Gasifier with Redesigned Reheating Furnace for the same leading to Reduction in Fuel Requirement.

1. Charcoal consumption	= 12000 Kg/year
2. Calorific value of Charcoal	= 6500 Kcal/Kg
3. Cost of Charcoal	= Rs. 22.5/Kg
4. Cost of Charcoal in Reheating Furnace	= Rs. 2,70,000 /year
5. Calorific value of rice husk	= 2500 Kcal/Kg
6. Cost of rice husk	= Rs. 1.5/Kg
7. Equivalent rice husk consumption for reheating	= 41600 Kg/year
8. Efficiency of Gasifier	= 75%
9. Efficiency of new design gas fired furnace	= 25%
10. Overall efficiency of reheating process	= 19%
11. Actual rice husk consumption for melting due to Improved efficiency	= 3831 Kg/year
12. Cost of rice husk consumption	= Rs. 5476 /year
13. Electricity consumption in proposed furnace blower	= 0.25 KW
14. Electricity consumption of furnace blower	= 72 KWh/year
15. Cost of Electricity	= Rs. 2.30 /KWh
16. Electricity consumption	= Rs.331 /year
17. Saving in Rs.	= Rs.2,65,838 /year
18. Total saving (both hard coke and charcoal)	= Rs. 3,33,636/year
19. Total investment (including Gasifier, Melting and reheating furnace)	= Rs. 3,40,000
22. Payback Period	= 1 year



Issues/Barrier in implementation: There are no technological barriers in implementation of this project. The issue only is the availability of fund. This can be solved by installing this project by a group of 3 to 4 units.

3. Other Utilities

A. Saving in electricity consumption by use of energy efficient motor and blower for melting furnace

Project Description and Benefit: Decrease in loading on motor, decreases the efficiency of motor thereby resulting in more electricity consumption. Replacement of the conventional existing motors by energy efficient motors results in saving of electricity consumption of blower motor. Energy efficient motors even at low loading, operates at high efficiency as compared to the conventional motors. Also the use of energy efficient blowers also reduces the electricity consumption.

Approximate One Time Investment: Rs. 2500 for one unit only.

Annual Savings: Savings achieved only in one unit is very less because of low operating hours of a single unit. If 5 to 8 units combine and use a common furnace by adjusting their operation hours alternatively, (since each unit operates 1 to 2 batches per week and working in between 6:00 AM to 1:00 PM (one shift only)) then the savings achieved is about Rs. 200 to Rs.400 per year.

Calculation of energy saving potential by Replacement of Existing Motors by Energy Efficient Motors of Blowers Resulting in Saving of Electricity Consumption in Melting Section.

1. Electricity consumption of furnace blower	= 0.24 KW
2. Combine efficiency of existing blower and motor	= 42 %
3. Combine efficiency of proposed blower and motor	= 50 %
4. Electricity consumption of furnace blower	= 69 KWh/year
5. Saving in electricity after replacement	= 41 KWh/year
6. Cost of electricity	= Rs. 2.3/KWh
7. Saving in electricity by considering 5 unit's use common alternatively	= 205 KWh/year
8. Saving in electricity consumption in Rs.	= Rs. 472/year
9. Total investment required	= Rs.2500
10. Payback period, years	= 5

Issues/Barrier in implementation: Savings achieved is less as compared to the investment because of less operating hours.

B. Installation of energy efficient motors to drive the Polishing Section.

Project Description and Benefit: Loading of polishing motors was found less. At low loading, the efficiency of motor will decrease thereby resulting in more electricity consumption. Replacement of the conventional existing motors by energy efficient motors



results in saving in electricity consumption. Energy efficient motors even at low loading, operates at high efficiency as compared to the conventional motors.

Approximate One Time Investment: Rs. 3500 for a single brass unit.

Annual Savings: Savings achieved only in one unit is very less because of low operating hours of a single unit. If 10 to 12 units combine and use a common motor for polishing operation by adjusting their operation hours alternatively, (since each unit operates polishing machine only 4 -5 hours per week and working in between 6:00 AM to 1:00 PM (one shift only)) then the savings achieved is about Rs. 600 to Rs.800 per year.

Calculation of energy saving potential by Replacement of Existing Motors by Energy Efficient Motors Resulting in Saving in Electricity Consumption in Polishing Section.

1. Electricity consumption of polishing section	= 1.12 KW
2. Efficiency of existing motor	= 65 %
3. Efficiency of proposed motor	= 70 %
4. Electricity consumption of polishing section	= 227 KWh/year
5. Saving in electricity after replacement	= 25 KWh/year
6. Cost of electricity	= Rs. 2.3/KWh
7. Saving in electricity by considering 12 unit's use common alternatively	= 300 KWh/year
8. Saving in electricity consumption in Rs.	= Rs. 690/year
9. Total investment required	= Rs. 3500
10. Payback period, years	= 5

Issues/Barrier in implementation: Savings achieved is less as compared to the investment because of less operating hours.

C. Saving in electricity consumption by directly mounting the motor of polishing section by installing thyristor based speed control

Project Description and Benefits: It was observed that the motor is connected to the polishing machine through a belt. It increases the electricity consumption due to efficiency loss in transmission, friction etc. If we directly couple the motor to the machine and installing a thyristor based speed controller, it reduces the electricity consumption in polishing section by about 15%.

Approximate One Time Investment: Rs. 500 for a single unit.

Annual Savings: Savings achieved only in one unit is very less because of low operating hours of a single unit. If 4 to 5 units combine and use a common motor for polishing operation by adjusting their operation hours alternatively, (since each unit operates polishing machine only 4 -5 hours per week and working in between 6:00 AM to 1:00 PM (one shift only)) then the savings achieved is about Rs. 350 to Rs.450 per year



Calculation of energy saving potential by Installation of Thyristor based speed control resulting in saving of Electricity Consumption by Directly Mounting the Motor of Polishing Section.

1. Electricity consumption of polishing section	= 227 KWh/year
2. Saving in electricity consumption	= 15%
3. Saving in electricity after project implementation	= 34 KWh/year
4. Cost of electricity	= Rs. 2.3/KWh
3. Saving in electricity by considering 5 unit's use common alternatively	= 170 KWh/year
5. Saving in electricity consumption in Rs.	= Rs. 391
6. Total investment required	= Rs. 500
7. Payback Period, years	= 1.2

Issues/Barrier in implementation: Savings achieved is less as compared to the investment because of less operating hours if a single unit implement.

D. Saving in electricity consumption by use of solar energy to drive the motor of polishing section and blowers of melting and reheating furnaces

Project Description and Benefits: Motors of polishing section and the blowers of furnaces used are of very small capacity. Use of solar energy to drive these motors is easily possible. It does not require any operating cost. One solar system can be alternatively used for all the applications.

Approximate One Time Investment: Rs. 1,20,000

Annual Savings: Annual savings achieved is very less about Rs. 800 to Rs.1000 per year because of less numbers of operating hours.

Issues/Barrier in implementation: Savings achieved is less as compared to the investment because of less operating hours if a single unit implement.

E. Savings by replacement of existing lighting by energy efficient lighting

Project Description and Benefits: After polishing section, lightning load is another energy consuming load, as most of the furnaces are hand driven. Most of the units are using bulb which is not efficient as savings are concerned so they are to be replaced by CFL.

Approximate One Time Investment: Varies from Rs. 200 to Rs. 400

Annual Savings: Varies from Rs. 80 to Rs. 200 /year

Simple Payback Period: 3 years

Calculation of energy saving potential by Replacement by Energy Efficient Lighting

1. Original Wattage	= 60 Watt
2. Wattage after replacement	= 22 Watt
3. Saving in Wattage	= 60 – 22 = 38 Watt



4. Nos. in operation	= 1
5. Hrs in operation	= 768 hrs/year
6. Saving in electricity consumption	= 29 Kwh/ year
7. Cost of electricity	= Rs. 2.3 /KWh
8. Annual saving in term of Rs	= Rs 67 /year
9. Approximate Cost of all Change over (Investment)	= Rs 200
10. Pay back period	= 3

3.4.2 Availability of Technology in Local/National/International Market

Extensive survey has been carried out to identify availability of technology/ product in local/national /international market. Scenario and the opportunities are explained to them those who were not aware about the Bhubaneswar Cluster. Thereafter only those who have shown interest to serve Bhubaneswar Cluster are included in the following lists. Details of the local service providers are given in section 3.4.3.

3.4.3 Availability of Local Service Providers Who Can Take Up the Proposals

LSPs who can take up above mentioned proposals are as follows:

Table No. 8: Details of the Vendors for Supplying the Identified Technologies

Sr.	Technology	Name of Service Provider	Address	Contact Person and No.
1.	Solar System	Kalinga Kommercials	23, Shubham market, Ram mandir, Square Janpath, Bhubaneswar - 751001	Sanjay Dhawan - 09937007399
2.	Furnace and Gasifier Fabricator	Standard Engineering Works	474/475, Palasuni, Rasulgarh , Bhubaneswar - 751010	Harhpal Rajput - 093382224660
3.	Furnace and Gasifier Fabricator	Biraja Steel Industries	Plot. No. 172, Sector A Zone A, Mancheswar Industrial Estate	Gaurang Mahalik - 09938677782

Table No. 9: Details of the Identified Technical Experts to Assist For Implementation of Above Identified Projects in Brass Unit

Sr.	Technology	Name of Service Provider	Address	Contact person and No.
1.	Technical Expert to provide the guidance or design for implementation of identified projects	Yajna Fuel Services	B – 15, Dattaviahar Co – Operative Housing Society, Ground Floor, Shivaji Nagar, B – Cabin, Thane (W) – 400602	Mr. Mukund Gharpure - 09969410594, 022 - 25424983

3.5 Identification of technologies/equipments for DPR preparation

3.5.1 Justification for Technologies Identified for DPR Preparation

Sr.No.	List of Technologies For DPR Preparation	Justification for Selection of Technologies
For the units involved in manufacturing the one product only i.e. Thali		
1.	Redesigning of Melting furnace with waste heat recovery system	This technology increases the efficiency of the melting furnace thereby decreasing the fuel consumption cost.
2.	Use of rice husk gasification for Melting process and redesigning the furnace for same	It reduces the energy consumption cost in melting furnace by use of available fuel i.e rice husk at cheaper rate.
3.	Redesigning of Reheating furnace with waste heat recovery system	This technology increases the efficiency of the reheating furnace thereby decreasing the fuel consumption cost.
4.	Use of rice husk gasification for Reheating process and redesigning the furnace for same	It reduces the energy consumption cost in reheating furnace by use of available fuel i.e rice husk at cheaper rate.
For the units involved in manufacturing the several products in a single unit		
5.	Redesigning of Melting furnace with waste heat recovery system	This technology increases the efficiency of the melting furnace thereby decreasing the fuel consumption cost.
6.	Use of rice husk gasification for Melting process and redesigning the furnace for same	It reduces the energy consumption cost in melting furnace by use of available fuel i.e rice husk at cheaper rate.
7.	Redesigning of Reheating furnace with waste heat recovery system	This technology increases the efficiency of the reheating furnace thereby decreasing the fuel consumption cost.
8.	Use of rice husk gasification for Reheating process and redesigning the furnace for same	It reduces the energy consumption cost in reheating furnace by use of available fuel i.e rice husk at cheaper rate.



3.6 ENVIRONMENTAL BENEFITS

Sr.	List of technologies for DPR Preparation	Environmental Benefits (reduction in GHG emission TCO ₂ /year)	Reduction in NO _x , SO _x ,
For the units involved in manufacturing the one product only i.e. Thali			
1.	Redesigning of Melting furnace with waste heat recovery system	133	Nominal
2.	Use of rice husk gasification for Melting process and redesigning the furnace for same	174	Nominal
3.	Redesigning of Reheating furnace with waste heat recovery system	NA	Nominal
4.	Use of rice husk gasification for Reheating process and redesigning the furnace for same	NA	Nominal
For the units involved in manufacturing the several products in a single unit			
5.	Redesigning of Melting furnace with waste heat recovery system	200	Nominal
6.	Use of rice husk gasification for Melting process and redesigning the furnace for same	265	Nominal
7.	Redesigning of Reheating furnace with waste heat recovery system	NA	Nominal
8.	Use of rice husk gasification for Reheating process and redesigning the furnace for same	NA	Nominal

Note: These all technologies do not result into any reduction in waste generation.



4.0 CONCLUSION

4.1 Summary of Findings

4.1.1 All Energy Saving Proposals/Measures Identified For the Cluster

Sr.	Identified Saving Measures
For the units involved in manufacturing the one product only i.e. Thali	
1.	Redesigning of Melting furnace with waste heat recovery system
2.	Use of rice husk gasification for Melting process and redesigning the furnace for same
3.	Redesigning of Reheating furnace with waste heat recovery system
4.	Use of rice husk gasification for Reheating process and redesigning the furnace for same
For the units involved in manufacturing the several products in a single unit	
5.	Redesigning of Melting furnace with waste heat recovery system
6.	Use of rice husk gasification for Melting process and redesigning the furnace for same
7.	Redesigning of Reheating furnace with waste heat recovery system
8.	Use of rice husk gasification for Reheating process and redesigning the furnace for same

4.1.2 Technology Gap Assessment for All Energy Saving Proposals/ Measures Identified For the Cluster

Sr.	Present practice/ technology	Improved practice/ technology
1	Conventional existing motors of blowers (both melting and reheating)	Replacement of existing motors with energy efficient motors in melting section
2	Conventional existing motors of polishing section	Replacement of existing motors with energy efficient motors in polishing section
3	Existing Chulla (both melting and reheating) with low efficiency	Replacement of existing Chulla with redesigned melting and reheating furnace resulting in efficient use of fuel
4	No preheating of air entering into furnace or Chulla	Preheating of air by using waste heat of flue gases through recuperator
5	Use of fuels like hard coke and charcoal available at high cost	Installation of rice husk Gasifier for generation of fuel for furnace at a cheap rate.

4.1.3 Techno-Economics for all Energy Saving Proposals

Sr.	Identified Saving Measures	Savings per year in for a single project for a group of 3 units, Kg/year	Savings per year in for a single project for a group of 3 units, Rs./year	No. of groups of 3 units may adopt the technology	Savings in Rs.	Investment in Rs.	Payback Period, years
For the units involved in manufacturing the one product only i.e. Thali							
1	Redesigning of Melting furnace with waste heat recovery system	6055	51,469	12	6,34,784	9,10,000	1
2	Use of rice husk gasification for Melting process and redesigning the furnace for same		65,000	13	8,45,000	Considered under the point 4 as common Gasifier is used for both	-
3	Redesigning of Reheating furnace with waste heat recovery system	7346	1,65,274	10	16,52,740	12,00,000	Less than a year
4	Use of rice husk gasification for Reheating process and redesigning the furnace for same		2,63,738	11	29,01,118	38,40,000	1
For the units involved in manufacturing the several products in a single unit							
5	Redesigning of Melting furnace with waste heat recovery system	5900	50,153	7	3,51,071	6,30,000	2
6	Use of rice husk gasification for Melting process and redesigning the furnace for same		67,000	8	5,36,000	Considered under the point 8 as common Gasifier is used for both	-
7	Redesigning of Reheating furnace with waste heat recovery system	11513	2,59,037	7	18,13,259	11,34,000	Less than a year

Sr.	Identified Saving Measures	Savings per year in for a single project for a group of 3 units, Kg/year	Savings per year in for a single project for a group of 3 units, Rs./year	No. of groups of 3 units may adopt the technology	Savings in Rs.	Investment in Rs.	Payback Period, years
8	Use of rice husk gasification for Reheating process and redesigning the furnace for same		2,69,994	8	21,59,952	26,40,000	1
Others							
9	Use of energy efficient lighting	29	67	40	2668	8000	3
	Total		11,91,732		1,08,96,592	1,03,62,000	1

Note - Combine approx. savings, investment and payback period for both the melting and reheating furnaces as discussed for a group of 3 units

4.1.4 Barriers in Implementation of Identified Energy Saving Proposals

Following are the barriers in implementation of identified energy saving proposals:

1. On discussion with the plant person during the audit, many of them agreed with the possible saving measures but they do not have fund to invest.
2. Due to non continuous operation of the units, savings achieved is less as compared to the investment.
3. Some of the projects such as Redesigning of Melting Furnace require technological issues which need to be taken care through proper training so as to facilitate such project implementation

4.1.5 Short Listed Technology/Products for DPRs

Following are the short-listed technologies for preparation of DPRs:

A. For the units involved in manufacturing the one product only i.e. Thali

1. Redesigning of Melting furnace with waste heat recovery system
2. Use of rice husk gasification for Melting process and redesigning the furnace for same
3. Redesigning of Reheating furnace with waste heat recovery system
4. Use of rice husk gasification for Reheating process and redesigning the furnace for same

B. For the units involved in manufacturing the several products in a single unit

5. Redesigning of Melting furnace with waste heat recovery system
6. Use of rice husk gasification for Melting process and redesigning the furnace for same
7. Redesigning of Reheating furnace with waste heat recovery system
8. Use of rice husk gasification for Reheating process and redesigning the furnace for same

4.2 Summary of Level of Awareness on Energy Efficiency and Energy Efficient Products in the Cluster

Level of awareness on energy efficiency at Bhubaneswar brass cluster is very poor. All units are using the old traditional methods like chulla. Efficiency of the furnaces is found very poor. Even they are getting the fuel at higher cost then also they are not concern about the efficiency of the furnaces. As most of the brass units are using manual operation in their units by eliminating the electricity requirement. But few units use the old conventional inefficient electrical motors. They are not having knowledge on energy efficient products.



5.0 IMPLEMENTATION OF SMALL GROUP ACTIVITIES

Why is Small Group Activities important?

Small Group Activities (SGA) are activities by group of employees at operator level. They aim to solve problems that occur at the place taken care of by each employee and put emphasis on participation and team work. Factories can apply small group activities to many kinds of work along with normal work or other measures that are already underway. The burden on employees will not increase because of small group activities. They not only bring benefits to factories but also increase the knowledge and ability in performing jobs of employees, improve communication among employees, increase creativity, and make it possible to express their own proposal with less hesitation. As a result, employees will start to think “This is our problem.” This SGA can be applied to Energy Conservation, too, with successful results, as shown in Figure 8.

How is Small Group Activities related to Energy Conservation?

An excellent example of organizational structure that promotes energy management emphasizing participation is that they form overlapping small groups as in figure 14. The feature of this structure is that a small group for energy management is distributed to various sections as in figure 15, which is a recipe for success of Total Energy Management (TEM) and makes various communications and management of activities more efficient and effective.

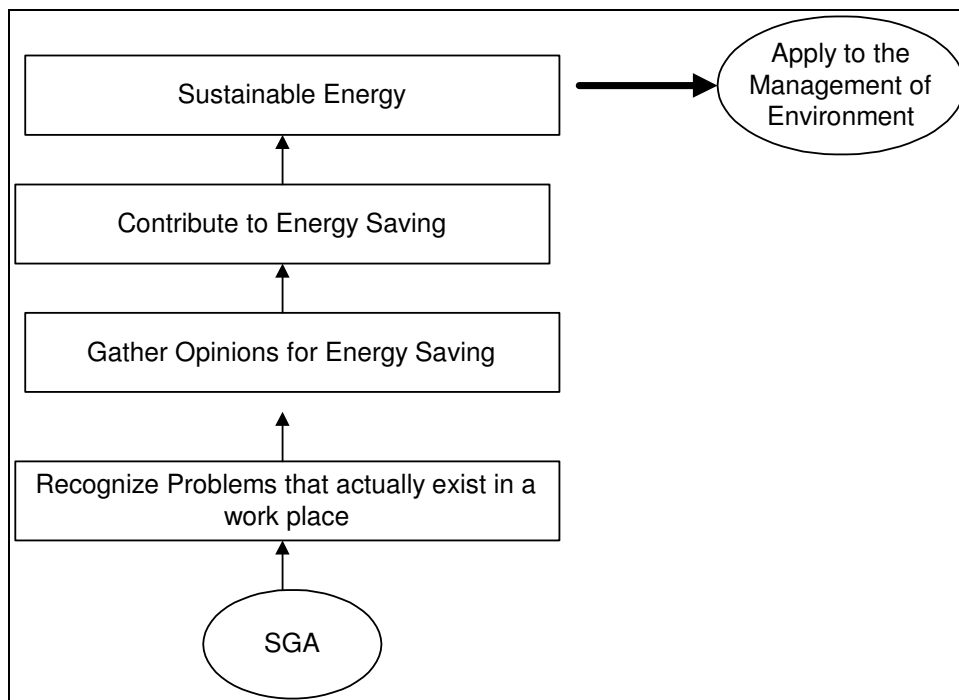


Figure No. 8: Relationship of SGA and energy saving

Small group activities for TEM are the activities in which employees of all levels in production or management, starting from the top to the bottom, participate in order to reduce loss related to their own job by improving their job. In order for the activities to succeed, management of all levels must provide support in necessary training and equipment, communication of policies, and the setting of problems to solve.

Small group activities for TEM can be divided into 4 or 5 levels depending on the scale of the organization. This division is in order to emphasize the fact that everyone must

improve in their job under the responsibility to each other. It also enables us to make improvement without overlapping. The following example shows utilizing the existing job-related organization as much as possible, as already mentioned in Part 2, 2."Strategy for Improving the Efficiency of Energy Usage further", Step 2 Proper EC Organization including Assignment of Energy Manager.

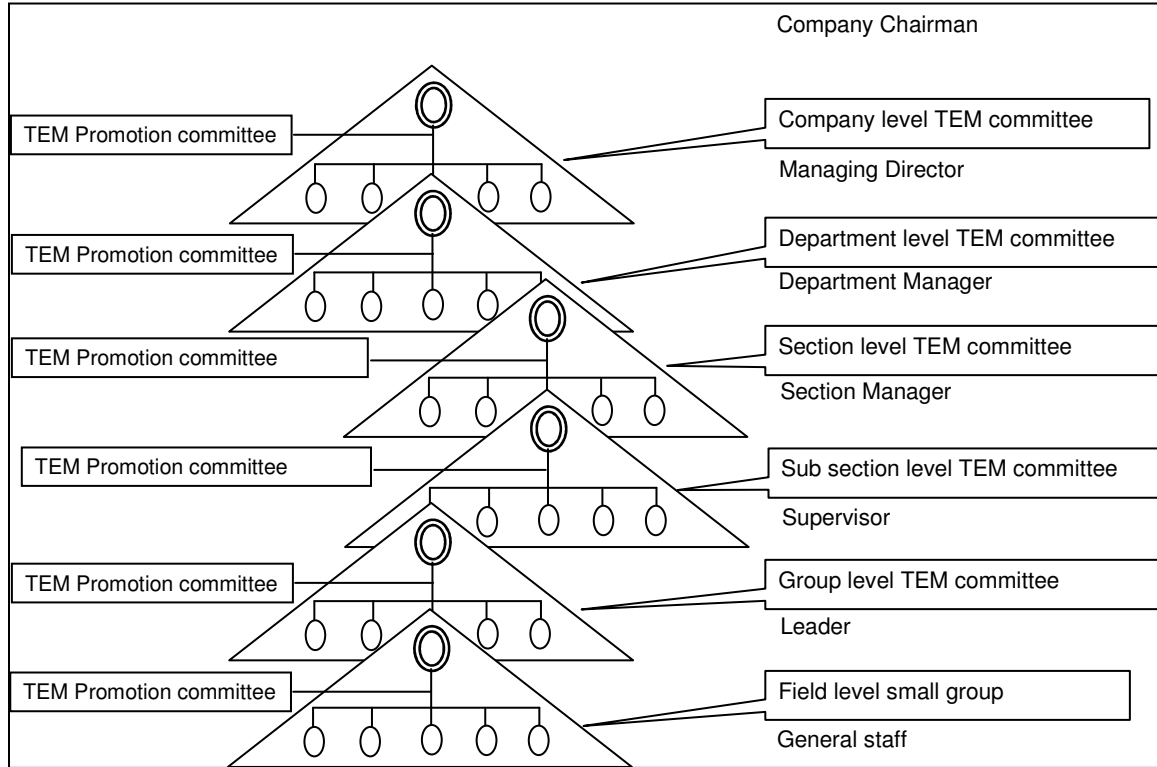


Figure No. 9: Example of Organizational Structure with Overlapping

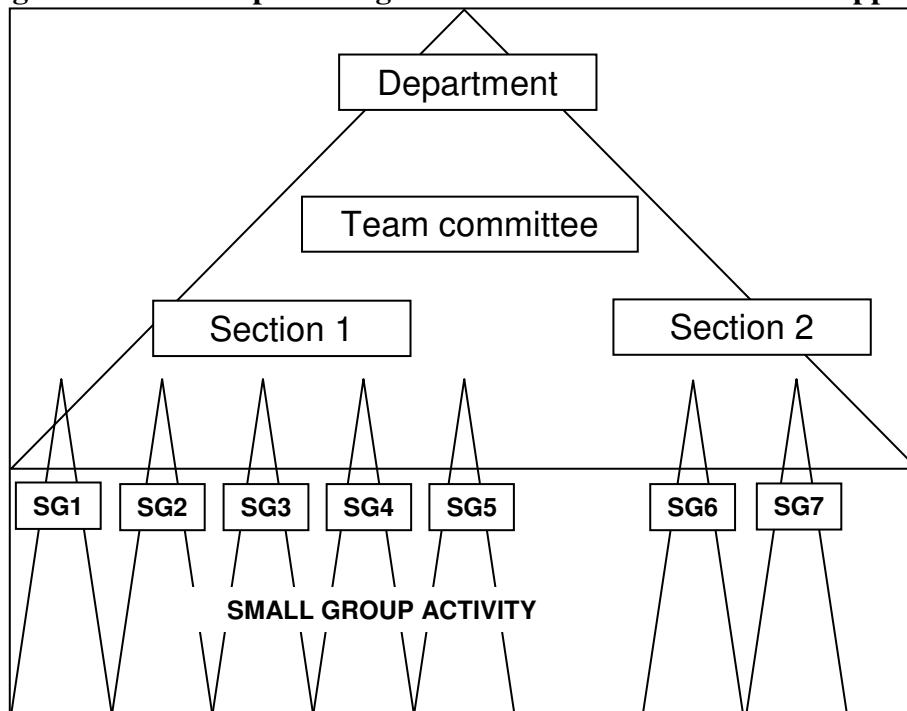


Figure No. 10: Positioning of SGA in Main Job Structure

(1) Executives level

- Define the policy and target for Total Energy Management
- Follow-up and manage activities to make sure that activities are implemented according to the policy
- Consider opinions and suggestions from the promotion office
- Consider reports from promotion committee from various levels

(2) Level of Total Energy Management promotion office

- Make sure that whole activities are done in the correct direction, without delay and smoothly
- Find a suitable method that makes it possible to implement activities continuously and without slowdown
- Listen to opinions and suggestions from small groups to use for improving
- Provide advice for Total Energy Management to various groups
- Persons in charge of the office must be those with good personal relationship, friendly, and with spirit of good service

(3) Medium level

- Define the policies of each department that are consistent with the policy of the Total Energy Management and the target of the company
- Define numerical targets to sub-groups apart from the target of the company as a whole
- Follow-up the progress in order to provide to sub-groups
- Report the progress along with suggestions and opinions to upper level committee periodically

(4) Workers/Operators level

- Implement small group activities with various themes and achieve target
- Report progress and problems encountered during implementation to upper level committee periodically
- Ask for support, suggestions, and opinions from upper level committee

(5) Responsibility of Energy Conservation committee

- Gather and analyze information on costs related to energy every month
- Analyze and solve problems related to energy
- Find a method for energy conservation
- Prepare energy conservation plan
- Follow-up the result of implementing the plan
- Perform activities such as public relationship for encouraging employees to participate
- Offer training to small group in each department



3. Steps of Small Group Activities for Energy Conservation

Small group activities for Energy Conservation can be done by using “10 Stages for Success”, based on “PDCA Management Cycle”, as shown below and also in Figure No. 11:

- Plan: Make an efficient plan in order to improve operation
- Do: Implement according to the plan
- Check: Check if implementation was according to the plan
- Act: Judge what to improve, what to learn and what to do from what we have checked

Please note that these stages are substantially the same as “Key Steps” explained earlier, but put more stress on utilization of SGA. So readers could read and use either methods up to their preference.

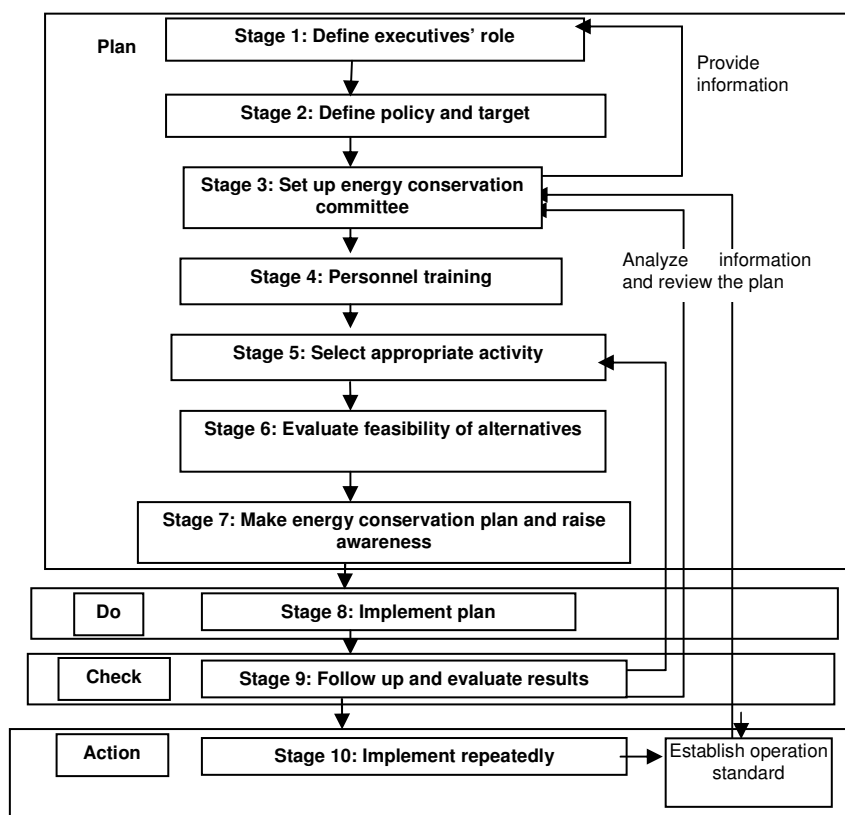


Figure No. 11: 10 Stages for Success

Stage 1: Define Executive's Role

In promoting small group activities, support must be provided such as basic environmental support. Therefore, executives must provide follow up support to employees of their companies.

- Establish a special unit that provides support to small group activities
- Prepare a system for managing small group activities in the company
- Prepare annual plan for small group activities
- Prepare a venue for meeting, consultation, advice or suggestion
- Establish a system for giving rewards to high achieving employees

- Establish a reporting system starting from informing what to do until reporting of the results
- Establish a fair system for evaluating results
- Establish a system for providing support and training to employees

Stage 2: Define Policy and Target

- Executives must announce a policy of supporting small group activities.
- Energy conservation committee must act as an advisor in order to set a numerical target that is consistent with total energy management (TEM) policy and the target of the organization. Specific targets must be set for each group.

We can see that responsibilities in stages 1 and 2 are mainly those of executives and committee. Responsibility of employees will become clearer from stage 3 and afterwards.

Stage 3: Set up Energy Conservation Committee

The principle of small group activities (SGA) is to divide into groups based on the scope of responsibility. The size of the group will depend on the size of organization. However, size of the group should not be too large. Usually a size of 5 to 10 persons is considered appropriate. It is important to define responsibilities clearly so that every member of the group can have their responsibility and participate in the activities.

Stage 4: Personnel Training

This stage will help employees to have more knowledge and understanding, have new ideas, and have more belief in their own responsibility.

Stage 5: Select Appropriate Activity

In doing small group activities, each member must be able to think, express their own ideas, and make decisions based on reality and by investigating electrical equipment, machines, and office equipment that exist in the area of their responsibility. Items to consider include size, number, where to use, situation of usage, current situation, and the number of hours usage per day.

By this we can evaluate the current situation of energy usage. Also by judging if there are more machines than needed, we can choose suitable activities and real problems for the organization.

Stage 6: Evaluate feasibility of alternatives (Analyze problems and decide on the measures and activities in each point)

Each group will gather ideas on the reasons for the problems, obstacles, and how to solve problems in order to decide on the problems, measures, and importance of activities and thus evaluate on the feasibility of activities to do based on advice from department manager. Basically, the following activities are not suitable for small group activities.

- Highly technical issues
- Issues that require a long time or many people to implement

We have identified the following problems through small group activities.

- Issues on material quality or production that influence energy usage
- Behavior on energy usage



- Efficiency of machines or equipment that uses energy
- Awareness toward environment and energy usage
- Safety costs for energy conservation

Stage 7: Make Energy Conservation Plan and Raise Awareness

Each group must prepare its activity plan. Generally, implementation for small group activities takes 6 months to 1 year. Activities to be implemented should correspond to the objectives of each group. Besides, it might help to listen to opinions of all organizations in order to receive support from all other organizations.

Stage 8: Implement Plan

Implement according to the plan of each group.

Stage 9: Follow Up and Evaluate Results

After implementing the plan, each member of small groups will follow up and evaluate the result by analyzing result, search for strong and weak points of activities, find a way to improve the activities and report on general achievement.

Stage 10: Implement Repeatedly

Energy conservation is an activity that must be implemented repeatedly. Therefore, it is necessary to implement each activity repeated and make improvement to each activity. If we are satisfied with the results, by achieving the objectives of activities, we should provide rewards in order to give motivation for continuing the small group activities and implement creative activities.

Dos and Don'ts in Energy Conservation

1. Don't Emphasize the mistakes in the past. It is better to talk about the present.
2. Don't Be worried about the theory or principles. Don't spend too much time in discussion or analysis of problems in meeting rooms.
3. Don't Think that an activity can be done perfectly from the beginning. It is necessary to do the job continuously by having experiences and judging by ourselves.
4. Do Start with an activity that requires small amount of investment.
5. Do Raise awareness so that all employees understand the necessity and importance of energy conservation and participate in it.
6. Do Start the activity now without postponing to tomorrow.

Tools that are Used Often for Small Group Activities for Energy Conservation

5S means 5 basic activities that are needed in order to keep order in working space by emphasizing increasing efficiency and improving working environment of the workers. It consists of Seiri (Arrangement), Seiton (Orderliness), Seiso (Cleaning), Seiketsu (Cleanness), and Shitsuke (Discipline).

QCC (Quality control circle) means controlling quality through group activities. For this, it is necessary to work hand in hand and achieve objective quality or customers' request. With this, we can find weak points, find the cause of problems, gather ideas for problem solving and systematically prepare quality and thus, solve problems such as material loss, production costs, working hours, or productivity. This is also a very useful tool to tackle with Energy Conservation problem. So many factories or institutions are encouraged to utilize this tool.



Annexure-1: Equipment Assessment Summary

Performance analysis method of the existing equipments which are taken as baseline for saving calculations are as follows

Performance Evaluation of Melting Furnace or Chulla

Performance of melting furnace is evaluated by calculating the direct efficiency of the furnace.

Input data for Performance Evaluation of melting Furnace

Sr. No.	Details	Unit	Furnace
1	Quantity of raw material feed per batch	Kg	100
2	Melting temperature of Brass	oC	950
3	Ambient Temperature	oC	35
4	Specific heat of Brass	Kcal/Kg oC	0.112
5	Latent heat of fusion of Brass	Kcal/Kg	44
6	Calorific value of hard coke	Kcal/kg	4500
7	Quantity of hard coke per batch	Kg	70

Direct Efficiency of Melting Furnace

$$\begin{aligned} \text{Heat required for melting} &= m (cp \times \Delta T + \lambda) \\ &= 100 \times (0.112 \times (950 - 35) + 44) \\ &= 14648 \text{ Kcal/batch} \end{aligned}$$

$$\begin{aligned} \text{Actual heat supplied} &= mf \times \text{Calorific value of hard coke} \\ &= 70 \times 4500 \\ &= 315000 \text{ Kcal/batch} \end{aligned}$$

$$\begin{aligned} \text{Direct Efficiency} &= \frac{\text{Heat required for Melting}}{\text{Actual Heat Supplied}} \\ &= 4.65\% \end{aligned}$$

Performance Evaluation of Reheating Furnace

Performance of reheating furnace is evaluated by calculating the direct efficiency of the furnace.



Input data for Performance Evaluation of Reheating Furnace

Sr. No.	Details	Units	Reheating Furnace
1	Quantity of raw material feed per batch	kg	95
2	Heating furnace temperature	oC	800
3	Ambient Temperature	oC	35
4	Specific heat of Brass	Kcal/Kg oC	0.112
5	Calorific value of Charcoal	Kcal/Kg	6500
6	Quantity of fuel feed per batch	Kg	50

Direct Efficiency of Reheating Furnace

$$\begin{aligned}
 \text{Heat required for reheating} &= m \text{ cp } \times \Delta T \\
 &= 95 \times 0.112 \times (800 - 35) \\
 &= 8139.6 \text{ Kcal/batch}
 \end{aligned}$$

$$\begin{aligned}
 \text{Actual heat supplied} &= mf \times \text{Calorific value of charcoal} \\
 &= 50 \times 6500 \\
 &= 325000 \text{ Kcal/batch}
 \end{aligned}$$

$$\begin{aligned}
 \text{Direct Efficiency} &= \frac{\text{Heat required for Reheating}}{\text{Actual Heat Supplied}} \\
 &= 2.5\%
 \end{aligned}$$



Annexure–2: Details of Technologies/Services Providers for the Cluster

Details of the vendors for supply of the identified technologies

Sr.	Technology	Name of Service Provider	Contact Person and No.	Details of vendor
1.	Solar System	Kalinga Commercials	Sanjay Dhawan - 09937007399	They are one of the well known suppliers of solar PV system at Bhubaneshwar. This vendor has installed solar PV system for the similar installations in most places at Bhubaneshwar. They are providing the solar system working for about 4 hours per day for this cluster. The cost includes all the other costs like battery, electrical wiring system etc. along with PV
2.	Furnace and Gasifier Fabricator	Standard Engineering Works	Harhpal Rajput - 093382224660	Standard Engineering Works is one of the experts in fabrication of furnaces according to the design provided to them.
3.	Furnace and Gasifier Fabricator	Biraja Steel Industries	Gaurang Mahalik - 09938677782	Biraja steel industries also engaged in fabrication work of furnaces.

Details of the identified technical experts to assist for implementation of above identified projects in brass unit

Sr.	Technology	Name of Service Provider	Contact Person and No.	Details of vendors
1.	Technical Expert to provide the guidance or design for implementation of identified projects	Yajna Fuel Services	Mr. Mukund Gharpure - 09969410594, 022 - 25424983	Yajna fuel services working in this field from last 25 years. They already implemented more than 20 similar types of projects. Also provide consultancy in designing of various types of equipments.

Annexure–2: Financial Schemes Available with Local Banks for Improving Energy Efficiency in the Cluster

There are 2 to 3 banks at Bhubaneswar providing loans to the required brass unit owners. As such there is no such scheme specially for improving the energy efficiency in the cluster.

Government Fiscal Incentives for MSME Sectors

The Ministry of Micro, Small and Medium Enterprises (MoMSME) provides support to activities in MSME units. The schemes that are feasible for the brass unit are given below.

1. Credit Linked Capital Subsidy Scheme (CLCSS)

Under this scheme, the Ministry of MSME is providing subsidy to upgrade technology (Machinery/Plant equipments). Subsidy limit per unit is Rs. 15 lacs or 15% of investment in eligible Machinery/ Plant equipments whichever is lower. For more details of the scheme visit www.laghu-udyog.com/schemes/sccredit.htm

2. Credit Guarantee Fund Trust for MSE

This scheme will cover both term loan and working capital facility upto Rs.100 lacs. Under this scheme, loan will be sanctioned without any collateral security or third party guarantee. For more details of the scheme visit www.cgtmse.in

3. Market Development Assistance Scheme

To encourage MEME entrepreneurs to tap overseas market potential and represent India in the overseas market, Government of India is reimbursing 75% of air fare by economy class and 50% space rental charges of stalls for exhibition of their products in the overseas trade fairs/ exhibitions. For more details of the scheme visit www.fisme.org.in/MDA%20FAQ.doc

4. Quality Up-Gradation/Environment Management Scheme

Under this scheme charges would be reimbursed for acquiring ISO - 9000/ISO - 14001/HACCP certifications to the extent of 75% of the expenditure (maximum to Rs. 75,000/- in each case). For more details of the various schemes visit <http://msme.gov.in/>

5. SIDBI Financing Scheme for Energy saving project in MSME Sector

To improve the energy efficiency levels in various MSME sectors, SIDBI is providing loans to eligible projects under JICA line of credit at a nominal rate of interest of 9.5 - 10% p.a. For more details of the list of eligible projects under this line of credit visit: www.sidbi.in

SIDBI Financing Scheme for Energy Saving Projects in MSME Sector under JICA Line of Credit

The Japan International Cooperation Agency (JICA) has extended a line of credit to SIDBI for financing Energy Saving projects in Micro, Small and Medium Enterprises (MEMEs). This project is expected to encourage MSME units to undertake energy saving investments



in plant and machinery to reduce energy consumption, enhance energy efficiency, reduce CO2 emissions, and improve the profitability of units in the long run.

Eligible Sub projects/ Energy Saving Equipment List under JICA Line of Credit

- Acquisition (including lease and rental) of energy saving equipments, including installing, remodeling and upgrading of those existing
- Replacement of obsolete equipments and/or introduction of additional equipments which would improve performance.
- Equipments/Machinery that meet energy performance standards/ Acts
- Introduction of equipments that utilize alternative energy sources such as natural gas, renewable energy etc., instead of fossil fuels such as oil and coal etc.
- Clean Development Mechanism (CDM) projects at cluster level that involve change in process and technologies as a whole, duly supported by technical consultancy, will be eligible for coverage.

Eligible Criteria for Units (Direct Assistance)

- Existing units should have satisfactory track record of past performance and sound financial record
- Projects will be screened as per Energy Saving list, which is available on the SIDBI website
- Units should have minimum investment grade rating of SIDBI
- Projects which may result in negative environmental and social impacts are also not eligible under this scheme.

Parameter	Norms
Minimum assistance	Rs. 10 lakh
Minimum promoters contribution	25 % for existing units; 33 % for new units
Interest rate	The project expenditure eligible for coverage under the line will carry the following rate of interest Fixed rate: 9.5 to 10.5 per annum based on rating Floating rate: 9.75 to 10.5 % per annum based on rating
Upfront fee	Non - refundable upfront fee of 1 % of sanctioned loan plus applicable service tax
Repayment period	Need based. Normally the repayment period does not extend beyond seven years. However, a longer repayment period of more than seven years can be considered under the line, if necessary.



Annexure-3: Name and Addresses of Units in the Cluster (Audited)

Sr. No.	Name of Unit	Type of Product	Address of unit
1	Gunandi Barik	Lota, Thali, Ghara, Diya	Charimaniya, Rathejima, Bhuwaneshwar
2	Kaloo Sahoo	Brass Bela, Katia, Bati	Asigharsahi, Bhuwaneshwar
3	Ramchandra Sahoo	Lota, Bela	Aigarhsahi, rathijama, Bhuwaneshwar
4	Anamchandra Sahoo	Thali	Bainchua, Khurda
5	Sridhar Sahoo 1	Thali	Assigharsahi, Bhuwaneshwar
6	Basudev Sahoo	Bela, Bati, khatia	Assigharsahi, Bhuwaneshwar
7	Bhagwan Sahoo	Ghara, Thali	Assigharsahi, Bhuwaneshwar
8	Kanhu Sahoo	Bati, Bela	Assigharsahi, Bhuwaneshwar
9	Bansidhar Sahoo	Ghara, Maan, Glass	Assigharsahi, Bhuwaneshwar
10	Shankar Sahoo	Thali, lota, Bati	Charimani, Bhuwaneshwar
11	Guranga Sahoo	Ghara, Khund	Assigharsahi, Bhuwaneshwar
12	Jaykrishna Sahoo	Thali	Charimani, Bhuwaneshwar
13	Raghunath Bansidhar Sahoo	Singhasan	Charimani, Bhuwaneshwar
14	Raghunath Dijabar Sahoo	Snake	Charimani, Bhuwaneshwar
15	Rabindra Sahoo	Thali	Trishigharsahi, Bhuwaneshwar
16	Vishwananth Sahoo	Thali	Charimani, Bhuwaneshwar
17	Neero Maharana	Thali	Assigharsahi, Bhuwaneshwar
18	Purnachandra Sahoo	Thali	Trishigharsahi, Bhuwaneshwar
19	Ashok Sahoo	Thali	Assigharsahi, Bhuwaneshwar
20	Dhadu Sahoo	Thali	Trishigharsahi, Bhuwaneshwar
21	Basudev Sahoo	Thali	Bainchua, Bhuwaneshwar
22	Dhaneswar Sahoo	Thali	Bainchua, Bhuwaneshwar
23	Sridhar Sahoo 2	Thali	Bainchua, Bhuwaneshwar
24	Jagbandhu Sahoo	Thali	Bainchua, Bhuwaneshwar
25	Lakhindra Sahoo	Thali	Bainchua, Bhuwaneshwar



Bureau of Energy Efficiency (BEE)

(Ministry of Power, Government of India)

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