DETAILED PROJECT REPORT
ON
RICE HUSK GASIFIER FOR
MELTING AND REHEATING PROCESS
(60 KG CAPACITY)
(BHUBANESHWAR BRASS CLUSTER)

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RICE HUSK GASIFIER FOR MELTING AND REHEATING PROCESS (60 KG)

BHUBANESWAR BRASS CLUSTER

BEE, 2010

Detailed Project Report on Rice Husk Gasifier for Melting and Reheating Process (60 kg)

Brass SME Cluster, Bhubaneswar, Orissa (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: ***BUB/BRS/RHG/05***

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See-Tech Solution Pvt. Ltd.

Nagpur

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BEE	Bureau of Energy Efficiency
MoMSME	Ministry of Micro Small and Medium Enterprises
DPR	Detailed Project Report
GHG	Green House Gases
CDM	Clean Development Mechanism
CO_2	Carbon Dio-oxide
DSCR	Debt Service Coverage Ratio
NPV	Net Present Value
IRR	Internal Rate of Return
ROI	Return on Investment
WHR	Waste Heat Recovery
SIDBI	Small Industries Development Bank of India

EXECUTIVE SUMMARY

SEE-Tech Solution Pvt. Ltd. has executed BEE-SME program in Bhubaneshwar Brass Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Bhubaneshwar cluster is one of the brass clusters in India; accordingly this cluster was chosen for energy efficiency improvements by implementing energy efficient measures / technologies, so as to facilitate maximum replication in other brass clusters in India.

The main energy forms used in these cluster units are Hard Coke and Charcoal. Hard Coke is used in the melting furnace and Charcoal is used in the reheating furnace. In brass units, about 15 % of energy is consumed in melting furnace and 84 % is consumed in reheating furnace of total energy consumption cost.

Project implementation will lead to reduction in energy consumption cost in Melting and Reheating Furnace due to huge difference in the cost of rice husk and the presently used fuels as Hard Coke and charcoal in this cluster. One brass unit (main unit) will implement this technology and provide their facility on rental basis to another 2 brass units to recover the investment made for the proposed technology faster and to make the proposed project feasible.

Project implementation i.e. Rice Husk Gasifier for Melting and Reheating Furnace of 60 kg capacity in 3 units of the cluster of same production capacity will lead to saving about 21,600 kg hard coke and 25,920 kg charcoal per year. But the other brass units who will use the facility on rental basis will share 50% of their savings in hard coke consumption and charcoal consumption with the main unit as a rental charges.

This DPR highlights the details of the study conducted for assessing the potential for installation of rice husk gasifier for melting and reheating furnace, possible energy saving and its monetary benefit, availability of the technologies/design, local service providers, technical features & proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, sensitivity analysis in different scenarios and schedule of project Implementation.

This bankable DPR also found eligible for subsidy scheme of MoMSME for “Technology and Quality Upgradation Support to Micro, Small and Medium Enterprises” under “National Manufacturing and Competitiveness Programme”. The key indicators of the DPR including the Project cost, debt equity ratio, monetary benefit and other necessary parameters are given in table below:

S.No	Particular	Unit	Value
1	Project cost	₹ (in Lakh)	10.13
2	Monetary benefit for main unit	₹ (in Lakh)	4.86
3	Debit equity ratio	Ratio	3:1
4	Simple payback period	years	2.08
5	NPV	₹ (in Lakh)	7.28
6	IRR	% age	29.77
7	ROI	% age	26.06
8	DSCR	ratio	1.93
9	Process down time	Days	8
10	CO_2 reduction	MT/year	133

The projected profitability and cash flow statements indicate that the project implementation will be financially viable and technically feasible.

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 25 selected SMEs clusters. Bhubaneshwar Brass Cluster is one of them. The BEE's SME Programme intends to enhance the energy efficiency awareness by funding/subsidizing need based studies in SME clusters and giving energy conservation recommendations. For addressing the specific problems of these SMEs and enhancing energy efficiency in the clusters, BEE will be focusing on energy efficiency, energy conservation and technology up gradation through studies and pilot projects in these SMEs clusters.

***Major activities in the BEE -SME program are furnished below*:**

Activity 1: Energy Use and Technology Audit

The energy use technology studies would provide information on technology status, best operating practices, gaps in skills and knowledge on energy conservation opportunities, energy saving potential and new energy efficient technologies, etc for each of the sub sector in SMEs.

Activity 2: Capacity Building of Stake Holders in Cluster on Energy Efficiency

In most of the cases SME entrepreneurs are dependent on the locally available technologies, service providers for various reasons. To address this issue BEE has also undertaken capacity building of local service providers and entrepreneurs/ managers of SMEs on energy efficiency improvement in their units as well as clusters. The local service providers will be trained in order to be able to provide the local services in setting of energy efficiency projects in the clusters

Activity 3: Implementation of Energy Efficiency Measures

To implement the technology up gradation projects in clusters, BEE has proposed to prepare the technology based detailed project reports (DPRs) for a minimum of five technologies in three capacities for each technology.

Activity 4: Facilitation of Innovative Financing Mechanisms for Implementation of Energy Efficiency Projects

The objective of this activity is to facilitate the uptake of energy efficiency measures through innovative financing mechanisms without creating market distortion.

1 INTRODUCTION

1.1 Brief Introduction about Cluster

Bhubaneshwar brass cluster is a household & age old business which is slowly diminishing and is restricted to certain tribes / communities. In short, they are artisians. These units are in operation since 35-40 years. Since it is low value business and family run the business wherein all the family members are engaged hence very few avail the bank facilities, that too Gramin Bank. The general turnover of the brass units is approximately ₹ 3 Lakh to ₹ 7 Lakh.

In this cluster, brass units are located in 4 different villages named as Balakati, Pratap Sasan and Rathijema - these three villages are adjacent to each other at a distance of about 22 km from the old city of Bhubaneshwar while the fourth village Bainchua is around 8 km from the old city of Bhubaneshwar. This cluster is traditional and community based, can also be called as "Kutir-Udyog". Manufacturing activity in this cluster takes place at the backyard of the unit owner's house.

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. The brass units have not registered under any; these units are identified by the names of the fore-fathers.

As there is neither association nor any organized form of the units, which are in this business, there is no one to hear their issues / problems and the brass units are gradually dying.

All these units are running in a single shift and there is no usage of any technology, neither any equipment which consumes energy to a greater extent is being used. The equipment which is being is used only for polishing of the end product.

Majority of the cluster units are of integrated type, where the raw material is processed in-house to the final product. Table 1.1 shows the total energy consumption scenario at Bhubaneshwar Brass cluster.

Table 1.1 Details of Annual Energy Consumption Scenario at Bhubaneshwar Brass Cluster

S. No	*Fuel used*	*Unit*	*Value*	*%age Contribution in Equivalent Energy Terms*
1	Electricity	kWh/year	15670	0.37
2	Hard Coke	MT/year	310	35.3
3	Charcoal	MT/year	359	64.4

Classification of Units

The brass units can be categorized into three types which are based on product manufacture.

S. No	Category	Products
1	A	Thali
2	B	Ghara, Lota, Diya, Bela etc
3	C	Handicrafts

Products Manufactured

Different types of products manufactured and their percentage share in Bhubaneshwar Brass cluster are as shown in Table 1.2 below:

Table 1.2 Product Manufactured

S. No	Type of Product	Category	%age Share	Units (No.).
1	Thali	A	54	65
2	Different varieties of brass articles like Lota, Bati, Bela, diya etc.	B	38	45
3	Handicrafts	C	8	10
Total (No.)[1]				120

[1] *– Out of total 200 brass units only 120 brass units are in operation.*

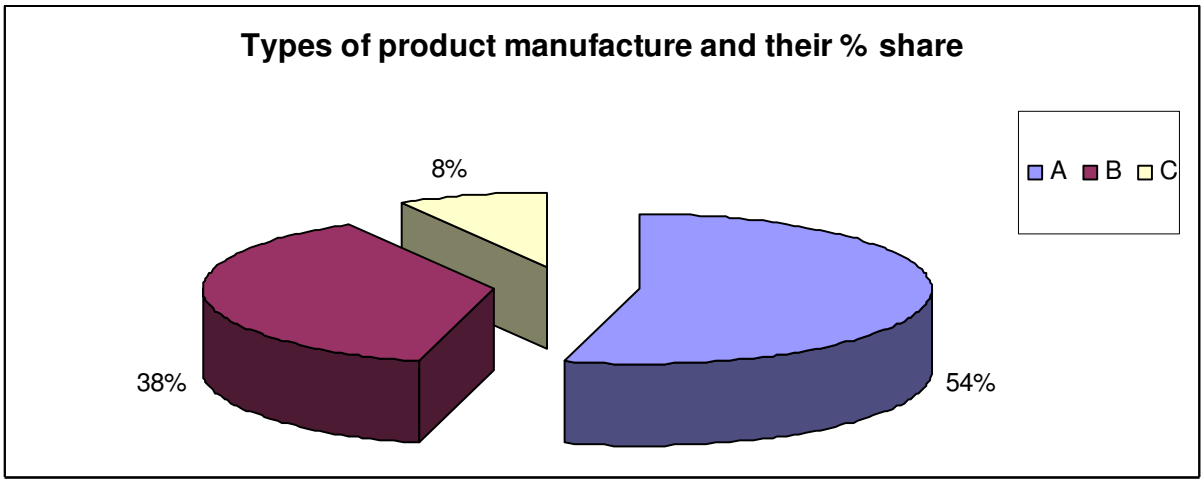
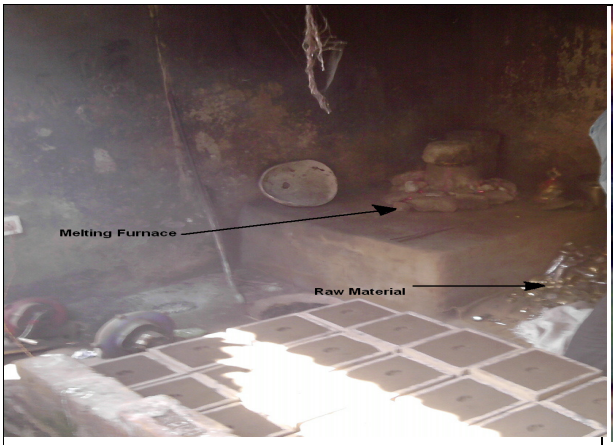


Figure 1.1: Different types products manufactured and their % share



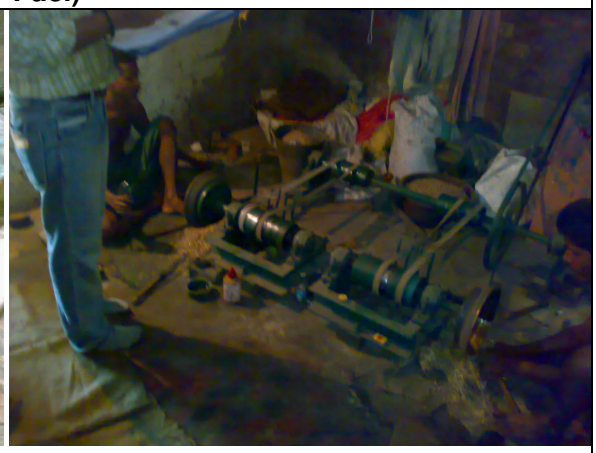
Raw Material Storage

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

Figure 1.2: Photographs of Bhubaneshwar Brass Cluster

Production Process

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

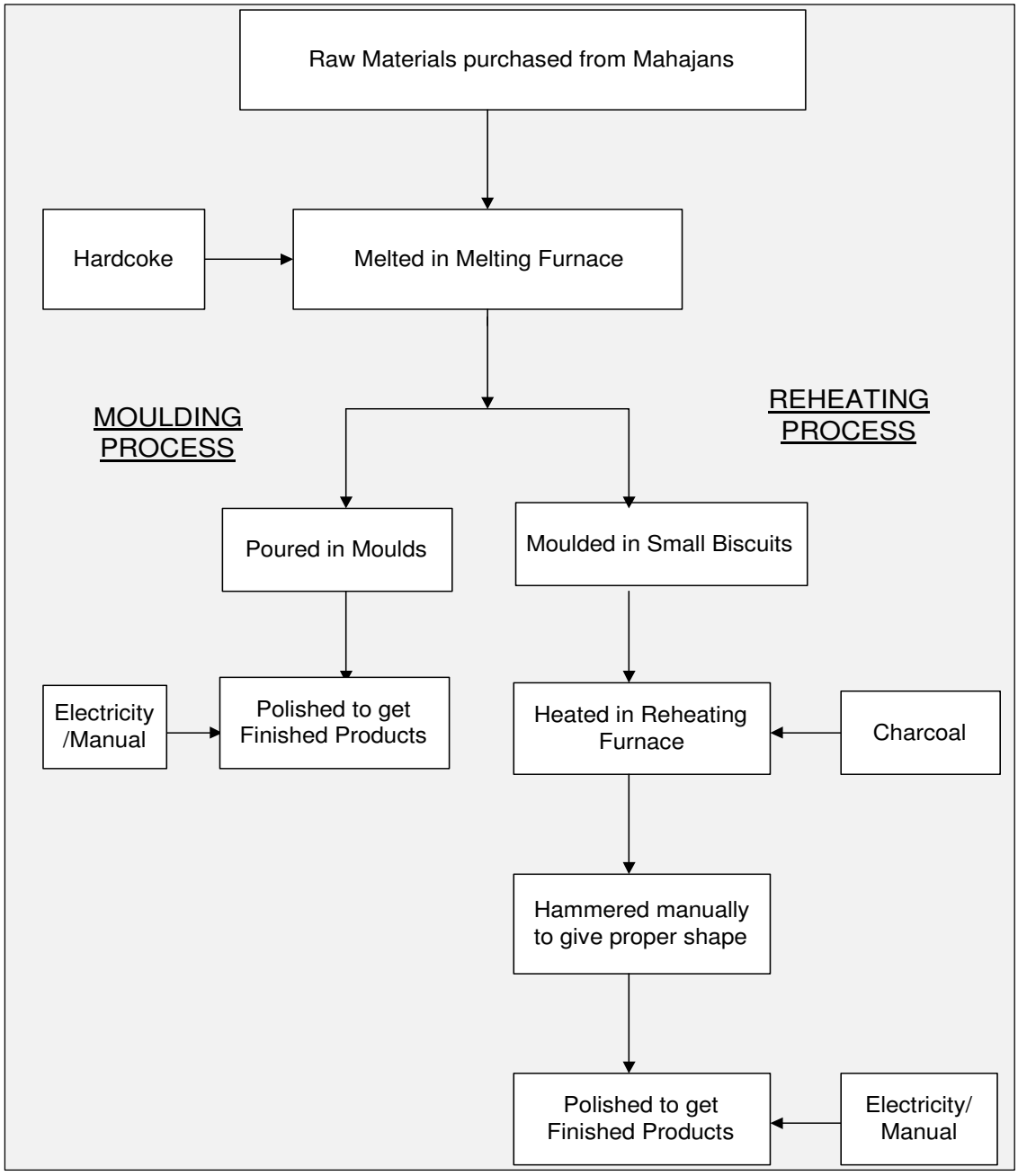


Figure 1.3 Process Flow Diagram of manufacturing of Brass Units

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 Mahajans (Raw material supplier). Fuel used in melting furnace is Hardcoke; and the fuel used in reheating furnace is Charcoal. Hardcoke and Charcoal is obtained from local source at a comparatively much higher cost than available in the market.

Melting:

The melting furnace is a unique and important requirement in the processing of manufacture of 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 melting furnace is prepared by the unit owners as per their traditional process. Melting furnace heats the raw material to a temperature of about 950^{o}C. At this temperature, raw material melts. Furnace 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. The source of thermal energy used for melting is Hard Coke. The melting process is a batch process; it takes time around 5 to 6 hours depending upon quantity of raw material under processing. Around 2 to 4 batches 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.

Re - Heating:

The Reheating furnace is an open furnace build up on ground as per their 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 a reheating furnace. Temperature of about 800^{o}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 simultaneously heating and beating.

Beating:

The heated billet from the reheating furnace is taken out through pincers at a temperature of about 800^{o}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 beated 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 uniformly thickness 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.

1.2 Energy Performance in Existing Situation

1.2.1 Average Production

Annual production in typical unit in Bhubaneshwar brass cluster is given in Table 1.3 below:

Table 1.3 Annual production from a typical brass units

S. No	Type of Brass Unit	Production (Kg/year)	
	Scale of Unit	Minimum	Maximum
1	A	1920	4836
2	B	1728	6144
3	C	360	7680

1.2.2 Energy Consumption

Energy consumption (both electrical and thermal) in a typical brass unit for different types of product categories is given in Table 1.4 below:

Table 1.4 Annual Energy Consumption

Type of Brass Unit	*Electricity (KWh per year)*		*Hard Coke (Kg per year)*		*Charcoal (Kg per year)*	
Scale of Unit	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
A	0	378	1920	6240	3840	5760
B	0	492	1200	4200	1920	5760
C	404	893	4320	6720	0	0

Note: *Minimum Electricity Consumption in most of the brass units is zero because they are operating the blowers and the polishing machines manually.*

1.2.3 Specific Energy Consumption

Specific energy consumption both electrical and thermal energy per kg of product for different types of brass products manufacturing units is given in Table 1.5 below.

Table 1.5 Specific Energy Consumption in Different Brass Units

Type of Brass Unit	*Electricity (kWh/kg of Production)*		*Hard Coke (kg/kg of Production)*		*Charcoal (kWh/kg of Production)*	
Scale of Unit	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
A	0	0.12	0.56	1.79	0.8	1.78
B	0	0.15	0.23	1.4	0.8	1.67
C	0.10	1.12	0.88	2	0	0

Note: *Minimum Electricity Consumption in most of the brass units is zero because they are operating the blowers and the polishing machines manually.*

1.3 Proposed Equipment

1.3.1 Description of Equipment

In this brass cluster, thermal energy is consumed in the melting and reheating furnaces. Hard coke is used as a fuel in melting furnace and charcoal is used in reheating furnace.

Melting Furnace is utilized for the melting of raw material i.e. Copper and Zinc, scrap vessels of Brass. Melting furnace is manufactured by the unit owners on their own as per their traditional method. In this furnace, temperature of around 950^{o}C is maintained. At this temperature, raw material melts. Furnace 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.

The Reheating furnace is an open furnace build up on ground for reheating of the moulded material in order to give the moulds a specific shape and size. The furnace is built by just digging a hole of about 30-50 cm wide and 30-90 cm deep. Reheating furnace is also manufactured by the unit owners on their own as per their traditional method. The moulded material is formed by pouring the melted brass material from the melting furnace in suitable moulds. The brass biscuits obtained after moulding are reheated and hammered to give the proper shape for final finishing. The biscuits moulds are reheated in a Reheating furnace at a temperature of about 800℃.

Melting and reheating both are batch processes; it takes time around 5 to 6 hours per batch depending upon quantity of raw material under processing. Around 2 to 3 batches are carried out in a week depending on the capacity of unit. The efficiency of the melting and reheating furnaces in this cluster was observed less than 5 % in all the brass units. Hard coke and charcoal is available in this cluster at much higher rate. Substitute for this fuels by lower cost fuels will results in huge quantum of savings in fuel cost in furnaces.

1.3.2 Role in Process

Melting furnace is used for melting of the raw material so as to form the brass products of desired shapes by pouring the melted raw material in the desired shape moulds.

In order to give the biscuit moulds a specific shape and size, the moulded material are reheated in a reheating furnace and hammered. Hammering process of the reheated mould requires more skill to give the proper shape to form the desired shape final product. The process of providing the shape to the reheated mould also depends on the reheating process of the biscuit mould which can be achieve by reheating the biscuit moulds at a required temperature with a proper heating cycle time.

1.4 Benchmarking for Existing Specific Energy Consumption

Energy consumption in furnaces would depend on the following mentioned parameters

- Type of fuel used and its calorific value
- Quantity of material
- Temperature maintained in the furnace
- Operational and maintenance practices

1.4.1 Operating Parameters

Operating parameters including the fuel and electricity consumption in the brass unit considered in this DPR in order to estimate the feasibility study of the proposed project is given Table 1.6 below:

Table 1.6 Operating Parameters in a Brass unit

S. No.	Particulars	Unit	Value
1	Capacity of Reheating Furnace	kg	60
2	Capacity of Melting Furnace	kg	60
3	Electricity Consumption	kWh/year	430
4	Hard Coke Consumption in melting furnace	kg/year	7200
5	Charcoal Consumption in reheating furnace	kg/year	8640
6	Production of a unit	kg/year	8640
7	Reheating Furnace Temperature	^{o}C	800
8	Melting Furnace Temperature	^{o}C	950
9	Cost of Hard Coke	₹/ kg	8.5
10	Cost of Charcoal	₹/ kg	22.5
11	Cost of Hard coke consumption	₹/ year	61,200
12	Cost of Charcoal consumption	₹/ year	1,94,400

1.4.2 Operating Efficiency Analysis

Detailed Operating Efficiencies analysis of the melting and reheating furnaces along with their specific fuel consumption is given in Annexure – 1.

1.4.3 Specific Energy Consumption

Specific electrical and thermal energy consumption in a brass unit is given in Table 1.7 below:

Table 1.7 Specific Energy Consumption in a Brass unit

S.No	Particulars	Unit	Value
1	Electricity consumption	kWh/kg	0.049
2	Hard Coke consumption	kg/kg	0.83
3	Charcoal Consumption	kg/kg	1.0
4	Hard Coke consumption	₹/ kg	7.08
5	Charcoal Consumption	₹/ kg	22.5

1.5 Barriers in Adoption of Equipment

1.5.1 Technological Barrier

- Lack of awareness on the use of alternative fuel options due to unavailability of new Technologies in this cluster.
- Lack of Technical Expertise on development of technology that can be employed for the use of agro based fuel which is abundantly available in this cluster.
- No awareness or information about the new Energy Efficient Technologies available in the market.
- Basic educational level in this cluster is very poor. Most of the unit owners are themselves workers. The cluster is more of traditional handicraft than SME industrial cluster.
- The unit owners do not have industrial culture/mindset even of MSME level.
- Actual working days per week is maximum 2 or 3 and that too one shift on that day.

1.5.2 Financial Barrier

- Implementation of the proposed project requires an investment of about ₹ 10.08 Lakh which is a significant investment as far as this cluster is concern.
- The unit owners are crafts-man work on labor rates work and earn for day to day living; their financial condition is very poor.
- Due to bare minimum margins, the unit owners are not able to make and investment.

- Due to less operating hours and seasonal dependency, payback period for implementation of the project increases if a single unit plans to implement the energy conservation projects.
- The unit owners in the cluster do not have any banking experience; they hardly have anything to offer as collateral security.

1.5.3 Skilled Manpower

All the skills are limited to Crafts men's skills. Other than this there are no skills.

1.5.4 Other Barriers

- All the operations depend on Mahajans (Persons who are providing the raw material to the unit owners for converting to finished products. The unit owners are paid for labor charges for conversion. The margin for unit owners is very low). They have to operate their units based on orders from Mahajan.
- There are some associations (Samiti's) of these craftsmen; however policies or activities in these associations have not been able to raise their living/business.

2 PROPOSED EQUIPMENT

2.1 Detailed Description of Equipment

2.1.1 Description of Equipment

Here, we propose to use the rice husk as a fuel in melting and reheating furnaces. This can be possible by installation of the rice husk fired Gasifier. Switching from the fossil fuel to the agro – based fuel i.e. rice husk will give a huge quantum of saving in terms of rupees in the melting and reheating processes because the fossil fuels at Bhubaneshwar brass cluster to the brass unit owners is available at a very higher cost. In a Gasifier, producer gas is generated by partial combustion of rice husk which is then used as a fuel in the furnaces.

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 and reheating process.

Implementation of this project also requires the redesign of producer gas fired which is generated from Gasifier melting and reheating furnaces with waste heat recovery system. Gasifier achieves efficiency of about 75 % and the gas fired furnaces achieves efficiency of about 25 %. Hence the overall efficiency that can be achieved is 19 %. Preheating of combustion air also contributes in the saving additional to the saving that can be achieved due to fuel cost difference.

2.1.2 Equipment Specification

A detailed engineering drawing of the rice husk fired Gasifier, Gas fired melting and reheating furnaces with waste heat recovery system, specifications of the other accessories required along with their dimensions is given in Annexure-4.

2.1.3 Suitability over Existing Equipment

Implementation of this proposed project will require the installation of Gasifier along with the redesign of melting and reheating furnaces. The redesign of the furnaces will includes the design of new structure for furnace along with burner assembly and the waste heat recovery system i.e. recuperator, proper insulation and refractory of the furnace, blower of very small capacity and adjustment of stoichiometric air to fuel ratio. Details are given in Annexure-4.

This project implementation is suitable because of the following reasons

1. Rice husk is available in plenty at this cluster at a very lower cost.
2. It will reduce the energy consumption cost in melting and reheating process.
3. It will increase the efficiency of the furnaces.

4. It will also reduce the flue gas losses due to installation of waste heat recovery system (i.e. Recuperator) for combustion air preheating.
5. It will reduce the specific fuel consumption in the furnace.
6. It will reduce the GHG emissions.

2.1.4 Superiority over Existing Equipment

Implementation of this project will involve the use of renewable fuel thereby replacement of fossil fuel. Proposed fuel is easily available at Bhubaneshwar brass cluster as the most of the persons including the unit owners belongs to the farming background involving in cultivation of rice. Installation of this project will require the redesign of the gas fired melting and reheating furnaces. Preheating of combustion air by the flue gases through installation of recuperator in melting and reheating furnaces leads to reduction in fuel consumption. This project improves the technology in the brass unit and also proposed the proper instrumentation helps in reducing the operating energy consumption cost and improves the quality of the product by maintaining proper temperature in the furnaces.

2.1.5 Availability of Equipment

Reheating and melting furnaces required in the brass unit is of very small capacity of about 60 kg. These furnaces have to manufacture with the help of local fabricators according to the detailed engineering drawing of the reheating furnace which is provided by Technical Expert. Local fabricators are easily available at this cluster. A Rice husk fired Gasifiers supplier is also easily available.

2.1.6 Source of Equipment

In Bhubaneshwar brass cluster, melting and reheating furnaces are manufactured by their own traditional method which is highly inefficient. The proposed technologies of agro based fuel are already in operation for melting and reheating processes in other industries through Gasification.

2.1.7 Terms and Conditions in Sales of Equipment

Performance guarantee of one year will be provided by the vendor.

2.1.8 Process down Time during Implementation

Implementation of the proposed project is a completely new separate setup. This project will require a maximum shutdown period of 8 days for completion of the connection of all three equipments and instrumentation and trial.

2.2 Life Cycle Assessment

Life cycle assessment of the proposed equipment is about 15 years. Maintenance or replacement of the refractories will be required on a periodic basis i.e. after every 5 years.

2.3 Suitable Unit for Implementation of Proposed Equipment

For estimation of saving potential in operating energy cost consumption in melting and reheating processes, brass unit having a production capacity of about 60 kg per batch is considered.

3 ECONOMIC BENEFITS FROM PROPOSED EQUIPMENT

3.1 Technical Benefits

3.1.1 Fuel Saving

Implementation of this proposed project will save all the hard coke consumption in melting furnace and charcoal consumption in reheating furnace due to use of Rice Husk Fired Gasifier. Total hard coke and charcoal saving would be 21,600 kg and 25,920 kg per year respectively.

3.1.2 Electricity Saving

Implementation of this project will lead to increase in electricity consumption due to use of electrical blowers by replacing the present hand driven blowers. The cost of electricity consumption will be ₹ 18,357 per year @ ₹ 2.3/kWh.

3.1.3 Improvement in Product Quality

Product quality will be the same as in the present condition. However, this project will reduce the excess heating of the raw material due to installation of proper monitoring system thus saving in fuel consumption.

3.1.4 Reduction in Other Losses

This project will reduces the flue gas losses of the melting and reheating furnaces thereby utilization of flue gas (waste heat) for combustion air preheating due to installation of recuperator.

3.2 Monetary Benefits

Total monetary benefit after implementation of this system in main unit and providing this system on rental basis for use to another 2 brass units would be ₹ 4,86,237/- per year. Details of monetary saving calculation are given at Annexure 3.

3.3 Social Benefits

3.3.1 Improvement in Working Environment in the Plant

This project results in reduction in the surrounding temperature around the furnaces. In the proposed equipment, melting and reheating process is carried out in a closed enclosure and the proper insulation will be provided due to which it will reduce the heat loss from the surface of the furnace. Thus it will reduce the temperature of the room thereby providing the comfortable atmosphere to work for the workers. Due to installation of the proper designed system, it will also reduces the accidents which may happen due to manual handling as presently used practice. Also helps to keep the clean environment around the furnace. This project also generates the revenue for the farmers due to sell of rice husk to the brass unit owners.

3.3.2 Improvement in Workers Skill

This project creates the awareness among the workers about the use of new technologies available for use of agro based fuel. Use of proper monitoring system provides the guidelines to the workers for the proper operation of the equipment in order to get the good quality final product in a lesser cycle time. They also learn about the new technologies employed in the furnace which helps in reduction in energy consumption cost in the furnaces. Also inspire the brass units to adopt the new energy efficient technologies for other operations in brass unit.

3.4 Environmental Benefits

3.4.1 Reduction in GHG Emission

Implementation of this proposed project for melting and reheating process results in replacement of fossil fuel by the agro based fuel. Total GHG emission reduction would be 133 tCO_2 per year.

4 IMPLEMENTATION OF PROPOSED EQUIPMENT

4.1 Cost of Equipment Implementation

4.1.1 Equipments Cost

Cost of the proposed project is about ₹ 9.12 Lakh which includes the design and fabrication of the Gasifier, melting and reheating furnaces along with their all other accessories like waste heat recovery system, burner, blower, insulation and refractory etc.

Parameters	Unit	Value
Cost of Gasifier	₹	3,60,000
Cost of PG fired melting furnace includes the cost of Furnace structure, burner, Recuperator, Blower etc.	₹	1,30,000
Cost of PG fired reheating furnace includes the cost of Furnace structure, burner, Recuperator, Blower etc.	₹	1,55,000
Service charges	₹	1,50,000
Vat	₹	80,625
Transportation Cost	₹	36,281
Total Capital Cost	**₹ in lakh**	**9.12**

4.1.2 Erection & Commissioning and other Miscellaneous Cost

Erection & commissioning cost is ₹ 0.36 Lakh which includes the piping, instrumentation, labour work etc and ₹ 0.645 Lakh as miscellaneous cost.

Table 4.1 Details of Proposed Equipment Installation Cost

S. No	*Particular*	*Unit*	*Cost*
1	Equipment Cost	₹ (in Lakh)	9.12
2	Erection & commissioning cost	₹ (in Lakh)	0.36
3	Misc. Cost	₹ (in Lakh)	0.64
4	Total Cost	₹ (in Lakh)	10.13

4.2 Arrangements of Funds

4.2.1 Entrepreneur's Contribution

Entrepreneur will contribute 25% of the total project cost which is ₹ 2.53/- Lakh.

4.2.2 Loan Amount

Remaining 75 % cost of the proposed project will be funded by the bank which is ₹ 7.60/- Lakh.

4.2.3 Terms & Conditions of Loan

The Interest rate is considered at 10% which is SIDBI's rate of interest for energy efficient projects. The loan tenure is 5 years from the date of first disbursement of loan.

4.3 Financial Indicators

4.3.1 Cash Flow Analysis

Profitability and cash flow statements have been worked out for a period of 8 years. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below.

The project is expected to achieve monitory savings of ₹ 4.86/- Lakh per annum.

- The Repair and Maintenance cost is estimated at 5% of cost of total project cost with 3% increase in every year as escalations.
- Interest on term loan is estimated at 10 %.
- Depreciation is provided as per the rates provided in the companies Act.

Based on the above assumptions, profitability and cash flow statements have been prepared and calculated in Annexure-5.

4.3.2 Simple Payback Period

The total project cost of the proposed equipment is ₹ 10.13/- Lakh and monetary savings is ₹ 4.86/- Lakh hence, the simple payback period works out to be 2.08 years.

4.3.3 Net Present Value (NPV)

The Net present value of the project investment at 10 % works out to be ₹ 7.28/- Lakh

4.3.4 Internal Rate of Return (IRR)

The after tax Internal Rate of Return of the project works out to be 29.77 %. Thus the project is financially viable.

4.3.5 Return on Investment (ROI)

The average return on investment of the project activity works out at 26.06%.

Table 4.2 Financial Indicators of Proposed Equipment

S. No.	Particular	Unit	Value
1	Simple payback period	Years	2.08
2	NPV	₹ (in Lakh)	7.28
3	IRR	%age	29.77
4	ROI	%age	26.06
5	DSCR	Ratio	1.93

4.4 Sensitivity Analysis in Realistic, Pessimistic and Optimistic Scenarios

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different situations like when there is an increase in energy cost savings or decrease in energy cost savings due to variation in the fuel consumption. For the purpose of sensitive analysis, following scenarios have been considered.

- Optimistic scenario (Decrease in rice husk consumption by 5%, decrease in electricity consumption by 5%.)
- Pessimistic Scenario (Increase in rice husk consumption by 5%, Increase in electricity consumption by 5%

In each scenario, other inputs are assumed as a constant. The financial indicators in each of the above situation are indicated along with standard indicators

Table 4.3 Sensitivity Analysis

Scenario	IRR(% age)	NPV	ROI(% age)	DSCR
Optimistic	29.89	7.33	26.07	1.94
Realistic	29.77	7.28	26.06	1.93
Pessimistic	29.65	7.23	26.04	1.93

4.5 Procurement and Implementation Schedule

Total procurement and implementation schedules required for implementation of proposed equipment is estimated at 12 weeks and details are given in Annexure 6.

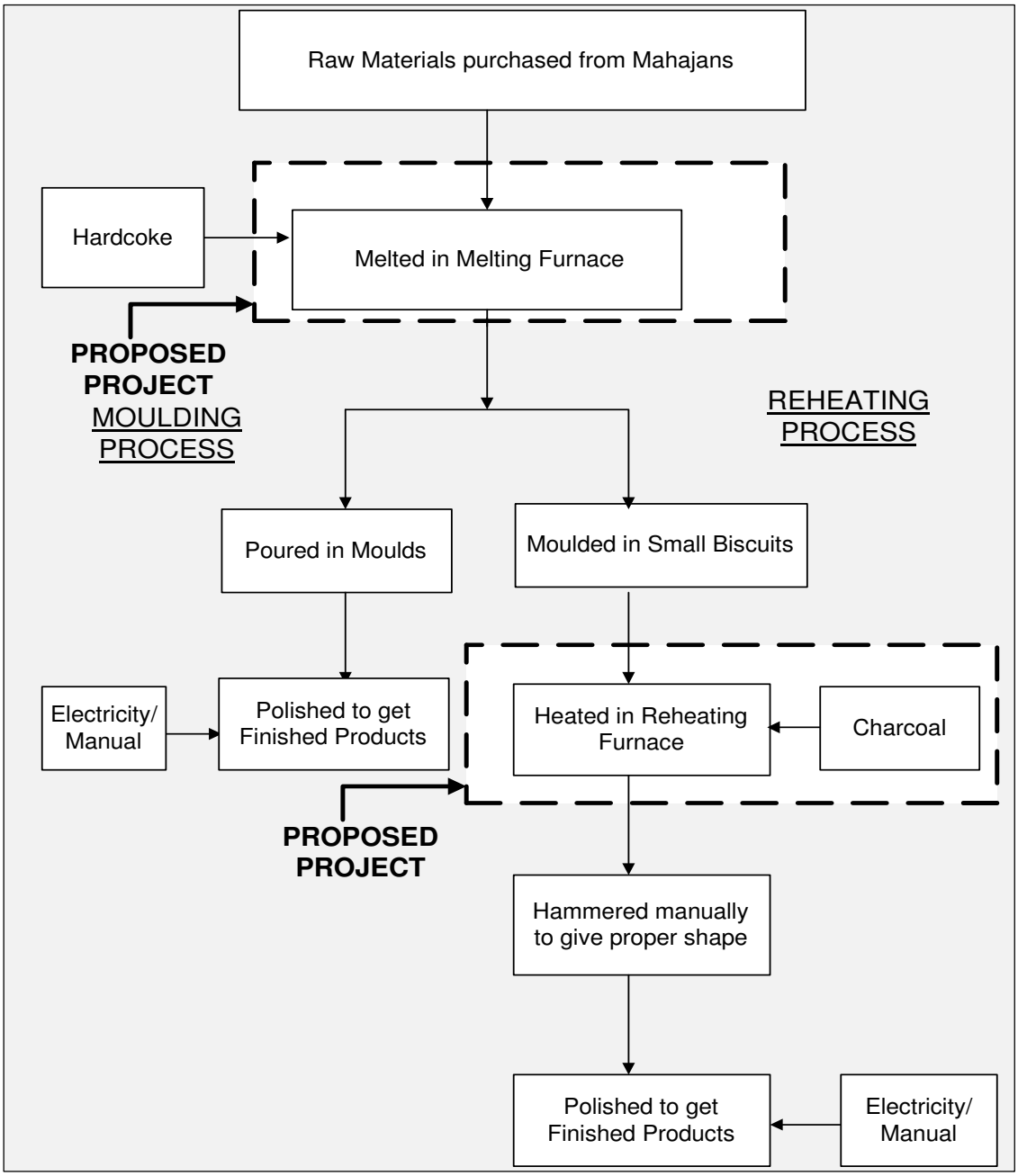
Annexure

Annexure -1: Energy Audit Data Used for Baseline Establishment

Baseline for implementation of the proposed project can be considered as the specific fuel consumption and cost per unit of production in the melting and reheating furnaces which depends on the efficiency of the furnace.

S.No.	*Particulars*	*Unit*	*Value*
1	Quantity of production per batch	kg	60
2	Melting Furnace temperature	^{o}C	950
3	Reheating Furnace temperature	^{o}C	800
4	Ambient Temperature	^{o}C	35
5	Specific heat of Brass	kcal/kg ^{o}C	0.112
6	Calorific value of Hard Coke	kcal/kg	4500
7	Calorific value of Charcoal	kcal/kg	6500
8	Quantity of Hard Coke per batch	kg	25
9	Quantity of charcoal per batch	kg	40
10	Efficiency of the Melting furnace	%age	3.91
11	Efficiency of the Reheating furnace	%age	1.32
12	Cost of Hard Coke	₹/kg	8.5
13	Cost of Charcoal	₹/kg	22.5
14	Specific fuel consumption in melting furnace	kg of Hard Coke/ kg of Production	0.83
15	Specific fuel consumption in reheating furnace	kg of Charcoal/ kg of Production	1.0
16	Specific Fuel consumption cost in melting furnace	₹/ kg	7.08
17	Specific Fuel consumption cost in reheating furnace	₹/ kg	22.5

Annexure -2: Process Flow Diagram



Annexure -3: Detailed Technology Assessment Report

Calculations of Rice Husk Consumption in Melting and Reheating Furnaces

Sr.	Particulars	Rice Husk Gasification for 60 Kg Melting Furnace
1	Hard Coke Consumption, Kg/year	7200
2	Calorific Value of Hard Coke, Kcal/Kg	4500
3	Calorific Value of Rice Husk, Kcal/Kg	2500
4	Gasifier Efficiency, %	75
5	Equivalent Rice husk consumption in Gasifier for Melting operation, Kg/year	= (7200 * 4500) / (0.75 * 2500) = 17280
6	Efficiency of existing melting furnace, %	3.91
7	Efficiency of proposed producer gas fired melting furnace, %	25
8	Rice Husk Consumption required for melting Process, Kg/year	= 17280 * (3.91/25) = 2703

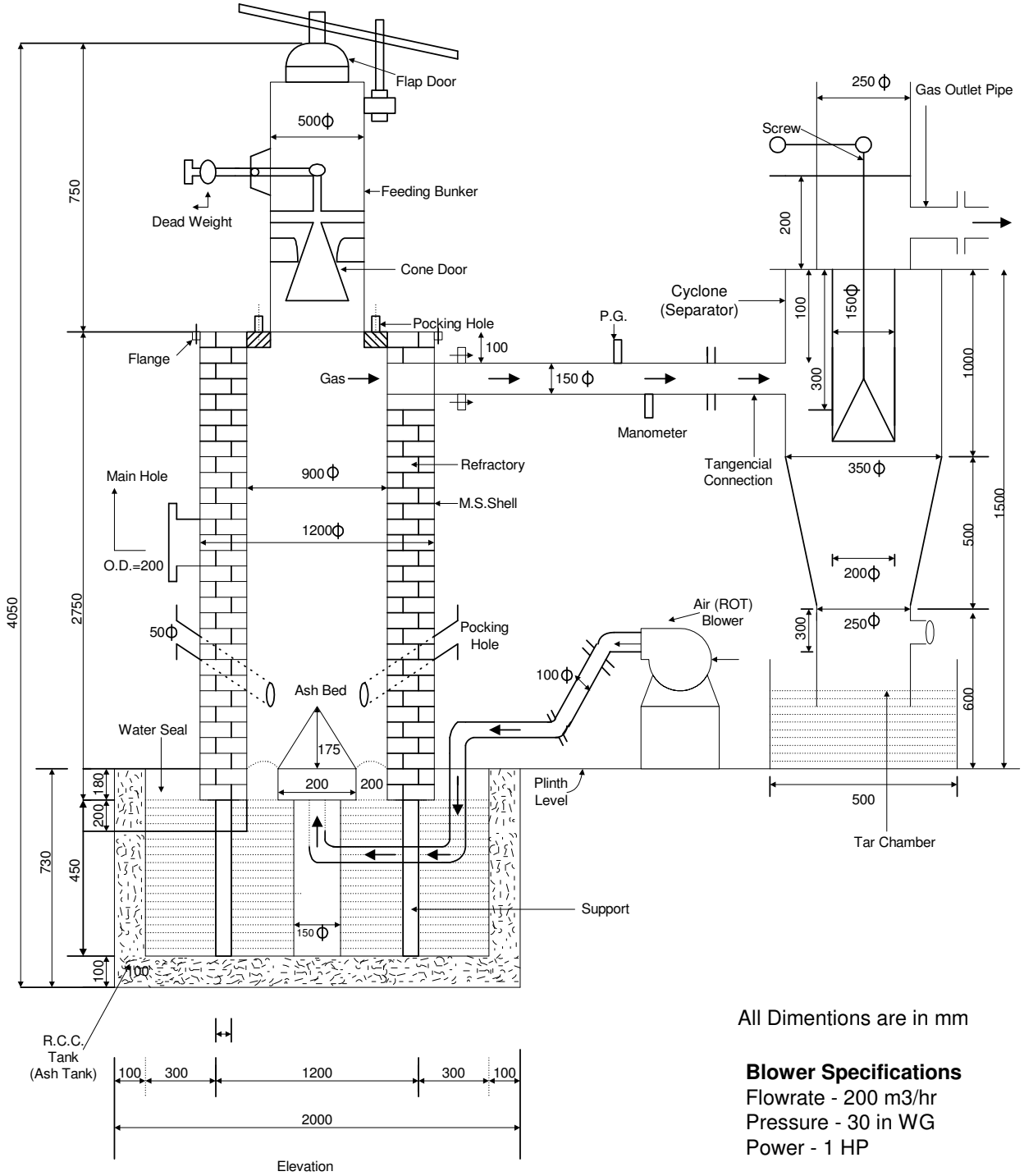
Sr.	Particulars	Rice Husk Gasification for 60 Kg Reheating Furnace
1	Charcoal Consumption, Kg/year	8640
2	Calorific Value of Charcoal, Kcal/Kg	6500
3	Calorific Value of Rice Husk, Kcal/Kg	2500
4	Gasifier Efficiency, %	75
5	Equivalent Rice husk consumption in Gasifier for Reheating operation, Kg/year	= (8640 * 6500) / (0.75 * 2500) = 29952
6	Efficiency of existing reheating furnace, %	1.32
7	Efficiency of proposed producer gas fired reheating furnace, %	25
8	Rice Husk Consumption for required reheating Process, Kg/year	= 29952 *(1.32/25) = 1581

S. N.	Particular	Unit	Melting Furnace		Reheating Furnace	
			Present Situation	Proposed Situation	Present Situation	Proposed Situation
1	Type of fuel	--	Hard Coke	Rice Husk (In Gasifier)	Charcoal	Rice Husk (In Gasifier)
2	Quantity of fuel consumption in main unit	kg/year	7200	2703	8640	1581
3	Quantity of fuel consumption by the other 2 units	kg/year	14400	5405	17280	3163
4	Quantity of fuel savings will be shared by the other 2 units with the main unit	kg/year	7200		8640	
3	Cost of fuel	₹/kg	8.5	1.5	22.5	1.5
4	Furnace temperature	°C	950	950	800	800
5	Furnace efficiency	% age	3.91%	25%	1.32%	25%
6	Gasifier Efficiency	% age	75.00%			
7	Annual operational hours	Hours	576	1728	864	2592
8	Cost of fuel consumption in furnaces in main unit	₹/year	61200	4054	194400	2372
9	Monetary saving due to fuel change in main unit	₹/year		57,146		1,92,028
10	Monetary saving to main unit due to rent facility	₹/year		61,200		1,94,400
11	Monetary saving o main unit	₹/year		1,18,346		3,86,428
10	Rated Blower Power	kW		0.75		0.75
11	Rated Blower power of Gasifier	kW				0.75
12	Electricity Consumption	kWh/year				8060
13	Cost of Electricity	₹/KWh				2.3
14	Electricity cost	₹/year				18537
15	Net monetary savings	₹/year				4,86,237
16	Total investment	₹ (In lakh)				10.13

Annexure -4: Engineering drawing of the Proposed Equipment

GEN. LAYOUT FOR GASIFIER

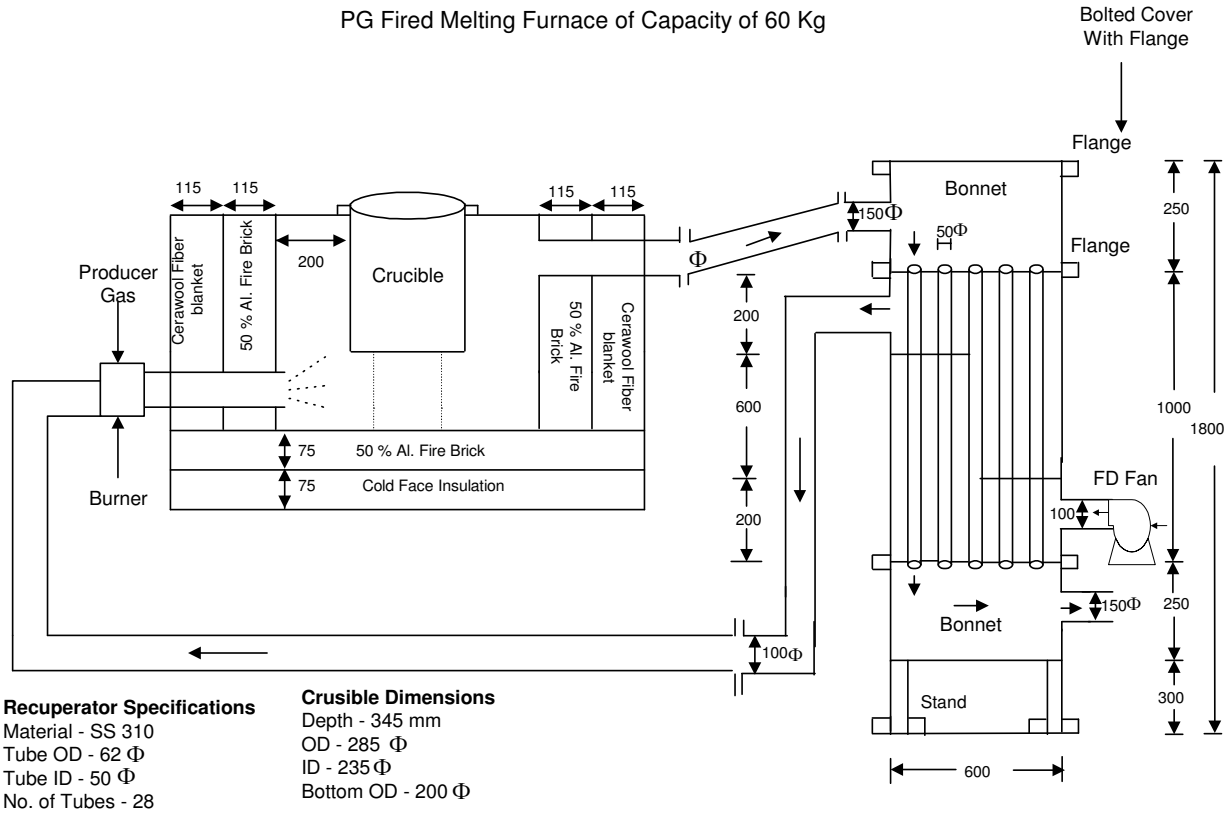
(60 kg)



All Dimentions are in mm

Blower Specifications
Flowrate - 200 m3/hr
Pressure - 30 in WG
Power - 1 HP

PG Fired Melting Furnace of Capacity of 60 Kg



Recuperator Specifications
Material - SS 310
Tube OD - 62 Φ
Tube ID - 50 Φ
No. of Tubes - 28
Pitch - 105 mm

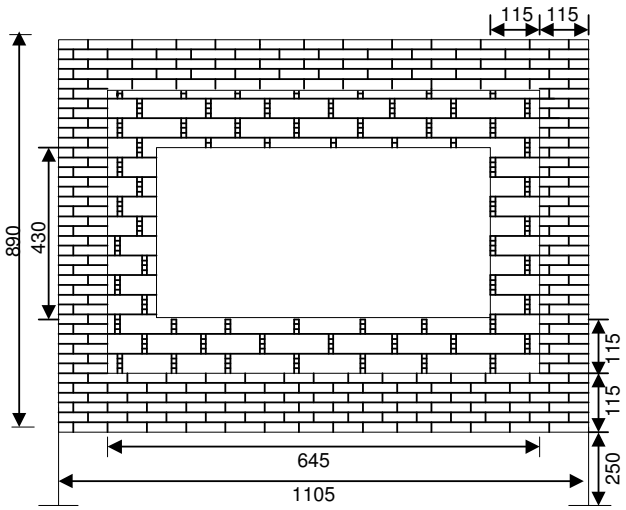
Blower Specifications
Flowrate - 200 m3/hr
Pressure - 30 in WG
Power - 1 HP

Crusible Dimensions
Depth - 345 mm
OD - 285 Φ
ID - 235 Φ
Bottom OD - 200 Φ

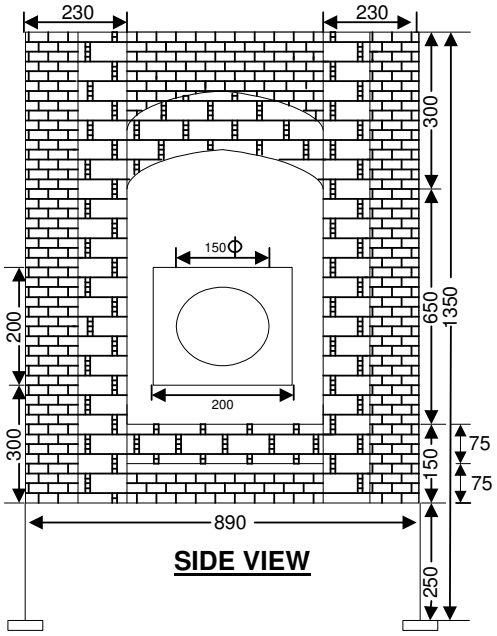
Drawing is not to Scale

All Dimentions are in mm

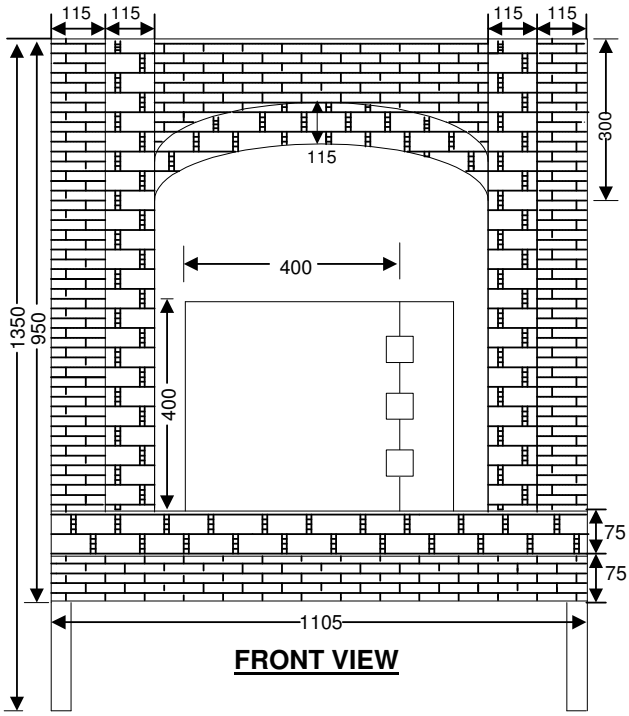
60 KG REHEATING FURNACE



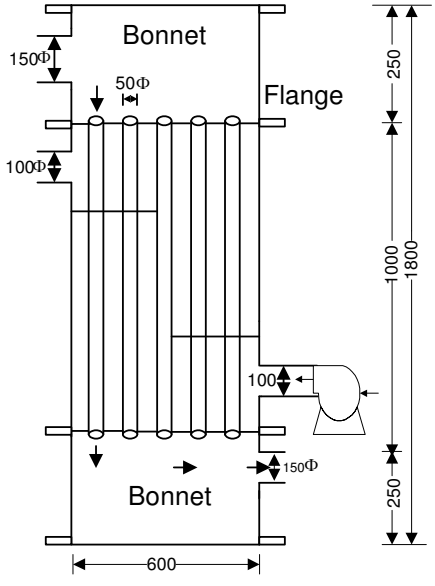
TOP VIEW



SIDE VIEW



FRONT VIEW



Blower Specifications
Flowrate-100m3/hr
Pressure-30 in WG
Power-0.5 HP

Recuperator Specifications
Material-SS310
Tube OD-62Φ
Tube ID-50Φ
No. Of Tubes-19
Pitch-105mm

Drawing is not to scale,
All dimension are in mm

COLD FACE INSULATION

50% ALUMINA FIRE BRICK

Annexure -5: Detailed Financial Analysis

Name of the Technology	***Melting Furnace***		
Rated Capacity	***60 Kg***		
Details	***Unit***	***Value***	***Basis***
Installed Capacity	kg	60	
No of working days	Days	-	
No of Shifts per day	Shifts	-	(Assumed)
Proposed Investment			
Plant & Machinery	₹ (in lakh)	9.12	
Erection & Commissioning	₹ (in lakh)	0.36	
Investment without IDC	₹ (in lakh)	9.48	
Misc. Cost	₹ (in lakh)	0.65	
Total Investment	₹ (in lakh)	10.13	
Financing pattern			
Own Funds (Equity)	₹ (in lakh)	2.53	Feasibility Study
Loan Funds (Term Loan)	₹ (in lakh)	7.60	Feasibility Study
Loan Tenure	years	5.00	Assumed
Moratorium Period	Months	6.00	Assumed
Repayment Period	Months	66.00	Assumed
Interest Rate	%age	10.00%	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	5.00	Feasibility Study
Annual Escalation	%age	3.00	Feasibility Study
Estimation of Revenue			
Hard Coke consumption(Melting furnace)	kg/Year	7200	
Cost	₹ /kg	8.5	
Charcoal consumption(Re-heating furnace)	kg/Year	8640	
Cost	₹ /kg	22.5	
Rice Husk consumption(Melting furnace)	kg/Year	2703	
Cost	₹ / kg	1.5	
Rice Husk consumption(Re-heating furnace)	kg/Year	1581	
Cost	₹ / kg	1.5	
Electricity consumption	kWh/Year	8060	
Cost of electricity	₹./ kWh	2.3	
Other Savings(Rental savings)	₹	2.56	
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

Estimation of Interest on Term Loan

(₹ in lakh)

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	7.60	0.60	7.00	0.88
2	7.00	1.20	5.80	0.64
3	5.80	1.44	4.36	0.51
4	4.36	1.68	2.68	0.36
5	2.68	1.80	0.88	0.19
		7.60		

WDV Depreciation

Particulars / years	1	2
Plant and Machinery		
Cost	10.13	2.03
Depreciation	8.10	1.62
WDV	2.03	0.41

Projected Profitability

Particulars / Years	1	2	3	4	5	6	7	8
Revenue through Savings								
Fuel savings	4.86	4.86	4.86	4.86	4.86	4.86	4.86	4.86
Total Revenue (A)	4.86	4.86	4.86	4.86	4.86	4.86	4.86	4.86
Expenses								
O & M Expenses	0.51	0.52	0.54	0.55	0.57	0.59	0.60	0.62
Total Expenses (B)	0.51	0.52	0.54	0.55	0.57	0.59	0.60	0.62
PBDIT (A)-(B)	4.36	4.34	4.33	4.31	4.29	4.28	4.26	4.24
Interest	0.88	0.64	0.51	0.36	0.19	0.03	0.00	0.00
PBDT	3.48	3.70	3.81	3.95	4.11	4.25	4.26	4.24
Depreciation	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
PBT	2.94	3.16	3.28	3.42	3.57	3.71	3.72	3.70
Income tax	0.00	0.71	1.30	1.34	1.40	1.44	1.45	1.44
Profit after tax (PAT)	2.94	2.46	1.98	2.07	2.18	2.27	2.28	2.26

Computation of Tax ***₹ (In lakh)***

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	2.94	3.16	3.28	3.42	3.57	3.71	3.72	3.70
Add: Book depreciation	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Less: WDV depreciation	8.10	1.62	-	-	-	-	-	-
Taxable profit	(4.62)	2.08	3.81	3.95	4.11	4.25	4.26	4.24
Income Tax	-	0.71	1.30	1.34	1.40	1.44	1.45	1.44

Projected Balance Sheet ***₹ (In lakh)***

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
Reserves & Surplus (E)	2.94	5.40	7.38	9.45	11.63	13.90	16.18	18.44
Term Loans (F)	7.00	5.80	4.36	2.68	0.88	0.00	0.00	0.00
Total Liabilities D)+(E)+(F)	12.47	13.73	14.27	14.66	15.04	16.43	18.70	20.97

Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	10.13	10.13	10.13	10.13	10.13	10.13	10.13	10.13
Less: Accm. Depreciation	0.53	1.07	1.60	2.14	2.67	3.21	3.74	4.28
Net Fixed Assets	9.59	9.06	8.52	7.99	7.45	6.92	6.39	5.85
Cash & Bank Balance	2.88	4.67	5.75	6.67	7.58	9.51	12.32	15.12
TOTAL ASSETS	12.47	13.73	14.27	14.66	15.04	16.43	18.70	20.97
Net Worth	5.48	7.93	9.91	11.99	14.16	16.43	18.71	20.97
Dept equity ratio	2.76	2.29	1.72	1.06	0.35	0.00	0.00	0.00

Projected Cash Flow: ***₹ (In lakh)***

Particulars / Years	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Sources									
Share Capital	2.53	-	-	-	-	-	-	-	-
Term Loan	7.60								
Profit After tax		2.94	2.46	1.98	2.07	2.18	2.27	2.28	2.26
Depreciation		0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Total Sources	10.13	3.48	2.99	2.52	2.61	2.71	2.80	2.81	2.80
Application									
Capital Expenditure	10.13								
Repayment of Loan	-	0.60	1.20	1.44	1.68	1.80	0.88	-	-
Total Application	10.13	0.60	1.20	1.44	1.68	1.80	0.88	-	-
Net Surplus	-	2.88	1.79	1.08	0.93	0.91	1.92	2.81	2.80
Add: Opening Balance	-	-	2.88	4.67	5.75	6.67	7.58	9.51	12.32
Closing Balance	-	2.88	4.67	5.75	6.67	7.58	9.51	12.32	15.12

Calculation of Internal Rate of Return

₹ (In lakh)

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Profit after Tax		2.94	2.46	1.98	2.07	2.18	2.27	2.28	2.26
Depreciation		0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Interest on Term Loan		0.88	0.64	0.51	0.36	0.19	0.03	-	-
Salvage/Realizable value					-	-	-	-	-
Cash outflow	(10.13)	-	-	-	-	-	-	-	-
Net Cash flow	(10.13)	4.36	3.64	3.03	2.97	2.90	2.83	2.81	2.80
IRR	29.77%								

NPV	7.28

Break Even Point

₹ (In lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.38	0.39	0.40	0.42	0.43	0.44	3.38	0.47
Sub Total (G)	0.38	0.39	0.40	0.42	0.43	0.44	3.38	0.47
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.13	0.13	0.13	0.14	0.14	0.15	1.13	0.16
Interest on Term Loan	0.88	0.64	0.51	0.36	0.19	0.03	2.61	0.00
Depreciation *(H)*	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Sub Total (I)	1.54	1.31	1.18	1.03	0.86	0.71	4.27	0.69
Sales (J)	4.86	4.86	4.86	4.86	4.86	4.86	38.90	4.86
Contribution (K)	4.48	4.47	4.46	4.45	4.43	4.42	35.52	4.40
Break Even Point (L= G/I)	34.30%	29.30%	26.53%	23.21%	19.47%	16.00%	12.01%	15.71%
Cash Break Even {(I)-(H)}	22.37%	17.34%	14.54%	11.19%	7.41%	3.91%	10.51%	3.54%
BREAK EVEN SALES (J)*(L)	1.67	1.42	1.29	1.13	0.95	0.78	4.67	0.76

Return on Investment

₹ (In lakh)

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Net Profit Before Taxes	2.94	3.16	3.28	3.42	3.57	3.71	3.72	3.70	27.51
Net Worth	5.48	7.93	9.91	11.99	14.16	16.43	18.71	20.97	105.58
									26.06%

Debt Service Coverage Ratio

₹ (In lakh)

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*Total*
Cash Inflow											
Profit after Tax	2.94	2.46	1.98	2.07	2.18	2.27	2.28	2.26	13.90	2.94	2.46
Depreciation	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	3.21	0.53	0.53
Interest on Term Loan	0.88	0.64	0.51	0.36	0.19	0.03	0.00	0.00	2.61	0.88	0.64
TOTAL (M)	4.36	3.64	3.03	2.97	2.90	2.83	2.81	2.80	19.71	4.36	3.64

Debt

Interest on Term Loan	0.88	0.64	0.51	0.36	0.19	0.03	0.00	0.00	2.61	0.88	0.64
Repayment of Term Loan	0.60	1.20	1.44	1.68	1.80	0.88	0.00	0.00	7.60	0.60	1.20
TOTAL (N)	1.48	1.84	1.95	2.04	1.99	0.91	0.00	0.00	10.21	1.48	1.84
Average DSCR (M/N)	1.93										

Annexure -6: Details of Procurement and Implementation

S. No.	Activities	Weeks											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Design												
2	Civil Construction												
3	Procurement of Raw Material												
4	Fabrication												
5	Refractory Lining												
6	Insulation												
7	Erection and Commissioning												
8	Testing												
9	8 days breakdown												

Annexure -7: Details of Technology Service Providers

S. No.	Technology	Name of Service Provider	Address	Contact Person and No.
1	Technical Expert	Yajna Fuel Services	B – 15, Dattaviahar Co – OperativeHousing Society, Ground Floor, Shivaji Nagar, B – Cabin,Thane (W) – 400602	Mr. Mukund Gharpure - 09969410594, 022 - 25424983
2	Fabricator	Standard Engineering Works	474/475, Palasuni, Rasulgarh , Bhubaneshwar – 751010	Harhpal Rajput - 093382224660
3	Fabricator	Biraja Steel Industries	Plot. No. 172, Sector A Zone A, Mancheswar Industrial Estate	Gaurang Mahalik - 09938677782
4	Technical Expert and Fabricator	Shri Sadguru Dev Engg. Services	A/4, New Veena Vihar, Datta Mandir Road, Dhanukar Wadi, Kandivali, Mumbai - 67	Mr. Ravi Patel - 09969378982

Annexure -8: Quotations for Proposed Technology

Yajna
FUEL SERVICES

Work Centre.: B-15, Dattavihar co-op Hsg.So., Gr. Floor, Shivaji Nagar, B- Cabin,
Thane (W) 400602. Tel.: 022- 2538 4681, Tel/Fax.: 2542 4983
e-mail.: yajnafuel@vsnl.net web site.: www.yajnafuelindia.com

To,
M/s.See-Tech Solution Pvt Ltd.
11/5, MIDC, Info Tech Park,
Near VRCE Telephone Exchange,
South Ambazari Road,
Nagpur – 440 022

Kind Attention: - Mr. Milind Chittawar

Subject: Budgetary offer for Gasifiers and PG fired Melting and Reheating Furnaces for different capacities

Dear Sir,

We thank you for your enquiry. Based on the discussions & data furnished by you, we are pleased to submit offer for the mentioned subject, as follows: -

1) Annexure I: Scope of Supply.
2) Annexure II: Quotation, Payment Terms & Exclusions

We hope you will find the details & information submitted in order and in line with your requirement. However if you have any quarries (Technical/Commercial), kindly feel free to call on us.

We assure you of our best services & hope to hear a favorable reply soon.

Thanking you,
Yours Faithfully,

For YAJNA FUEL SERVICES.

(Dr. M.G. Gharpure)

ANNEXURE I

Scope of work:

1. Preparation of site plan for furnace and Gasifier installation, estimation of Storage space, Chimney connection, firing orientation, Ducting to Chimney
2. Fabrication of furnace and Gasifier, Refractory lining, Insulation lining, etc
4. Commissioning.
5. Performance testing and Economic Evaluation.

ANNEXURE II

PROJECT ESTIMATION FOR GASIFIER OF DIFFERENT CAPACITIES

Sr. No.	Description	Total cost (Rs.)
1	Rice husk fired Gasifier of Capacity of about 30 Kg • Gasifier main reactor with water jacket, provisions for air entry & gas outlet, etc. • Blower for delivering gasification air • Cyclone separator for separation of course particles from gas • Gas flaring arrangement to be used during start-up of the gasifier • Calorific value of gas – 1100 to 1200 Kcal/Nm3 • Gas Composition – CO: 10 - 20 %, H2:10 – 20%, CH4: 3 – 8 %, CO2: 7 -12 %, N2: 40 – 50 %	Rs. 2,45,000/-
2	Rice husk fired Gasifier of Capacity of about 60 Kg • Gasifier main reactor with water jacket, provisions for air entry & gas outlet, etc. • Blower for delivering gasification air • Cyclone separator for separation of course particles from gas • Gas flaring arrangement to be used during start-up of the gasifier • Calorific value of gas – 1100 to 1200 Kcal/Nm3 • Gas Composition – CO: 10 - 20 %, H2:10 – 20%, CH4: 3 – 8 %, CO2: 7 -12 %, N2: 40 – 50 %	Rs. 3,60,000/-
3	Rice husk fired Gasifier of Capacity of about 100 Kg • Gasifier main reactor with water jacket, provisions for air entry & gas outlet, etc. • Blower for delivering gasification air • Cyclone separator for separation of course particles from gas • Gas flaring arrangement to be used during start-up of the gasifier • Calorific value of gas – 1100 to 1200 Kcal/Nm3 • Gas Composition – CO: 10 - 20 %, H2:10 – 20%, CH4: 3 – 8 %, CO2: 7 -12 %, N2: 40 – 50 %	Rs. 5,80,000/-

Sr. No.	Description	Total cost (Rs.)
4	Rice husk fired Gasifier of Capacity of about 250 Kg • Gasifier main reactor with water jacket, provisions for air entry & gas outlet, etc. • Blower for delivering gasification air • Cyclone separator for separation of course particles from gas • Gas flaring arrangement to be used during start-up of the gasifier • Calorific value of gas – 1100 to 1200 Kcal/Nm3 • Gas Composition – CO: 10 - 20 %, H2:10 – 20%, CH4: 3 – 8 %, CO2: 7 -12 %, N2: 40 – 50 %	Rs. 11,00,000/-
5	Rice husk fired Gasifier of Capacity of about 500 Kg • Gasifier main reactor with water jacket, provisions for air entry & gas outlet, etc. • Blower for delivering gasification air • Cyclone separator for separation of course particles from gas • Gas flaring arrangement to be used during start-up of the gasifier • Calorific value of gas – 1100 to 1200 Kcal/Nm3 • Gas Composition – CO: 10 - 20 %, H2:10 – 20%, CH4: 3 – 8 %, CO2: 7 -12 %, N2: 40 – 50 %	Rs. 15,00,000/-

PROJECT ESTIMATION FOR PG FIRED MELTING FURNACES OF DIFFERENT CAPACITIES

Sr. No.	Description	Total cost (Rs.)
1	Melting furnace with crucible type Producer Gas fired of capacity of about 30 Kg • Melting Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 90,000/-
2	Melting furnace with crucible type Producer Gas fired of capacity of about 60 Kg • Melting Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 1,30,000/-
3	Melting furnace with crucible type Producer Gas fired of capacity of about 100 Kg • Melting Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 1,50,000/-
4	Melting furnace with crucible type Producer Gas fired of capacity of about 250 Kg • Melting Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 2,60,000/-
5	Melting furnace with crucible type Producer Gas fired of capacity of about 500 Kg • Melting Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 5,50,000/-

PROJECT ESTIMATION FOR PG FIRED REHEATING FURNACES OF DIFFERENT CAPACITIES

Sr. No.	Description	Total cost (Rs.)
1	Reheating furnace Producer Gas fired of capacity of about 30 Kg • Reheating Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 1,20,000/-
2	Reheating furnace Producer Gas fired of capacity of about 60 Kg • Reheating Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 1,55,000/-
3	Reheating furnace Producer Gas fired of capacity of about 100 Kg • Reheating Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 2,00,000/-
4	Reheating furnace Producer Gas fired of capacity of about 250 Kg • Reheating Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 3,60,000/-
5	Reheating furnace Producer Gas fired of capacity of about 500 Kg • Reheating Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 6,45,000/-

PROJECT ESTIMATION FOR SOLID FUEL FIRED MELTING AND REHEATING FURNACES

Sr. No.	Description	Total cost (Rs.)
1	Reheating furnace Charcoal fired of capacity of about 500 Kg • Reheating Furnace Fabrication plus refractory works • Recuperator, Burner • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 6,40,000/-
2	Melting furnace with crucible type Hard Coke fired of capacity of about 500 Kg • Melting Furnace Fabrication plus refractory works • Recuperator • FD fan • Piping + ducts + insulation with aluminum cladding	Rs. 5,40,000/-

Payment Terms

20 % advance along with work order
30 % after providing the layout for furnace installation and start for fabrication
30 % after completion of fabrication
20 % after erection and commissioning

Exclusion: (Buyer's Scope)

1. Any damage to living or nonliving object.
2. Welding facility at site
3. Water required for castable.
4. Transportation/Freight.
5. Any instrumentation and control other than supplied with the furnace.
6. Start up fuel expense.
7. Expenses required for aesthetic.
8. Civil work & Electrical connections to all motors.
9. Any other item not included in scope of work.
10. Unloading/shifting of equipment at site.
11. Responsibility of any theft of material at site.

Bureau of Energy Efficiency (BEE)
(Ministry of Power, Government of India)
4th Floor, Sewa Bhawan, R. K. Puram, New Delhi – 110066
Ph.: +91 – 11 – 26179699 (5 Lines), Fax: +91 – 11 – 26178352
Websites: www.bee-india.nic.in, www.energymanagertraining.com

SEE-Tech Solutions Pvt. Ltd
11/5, MIDC, Infotech Park,
Near VRCE Telephone Exchange,
South Ambazari Road,
Nagpur – 440022
Website: www.letsconserve.org

India SME Technology Services Ltd
DFC Building, Plot No.37-38,
D-Block, Pankha Road,
Institutional Area, Janakpuri, New Delhi-110058
Tel: +91-11-28525534, Fax: +91-11-28525535
Website: www.techsmall.com