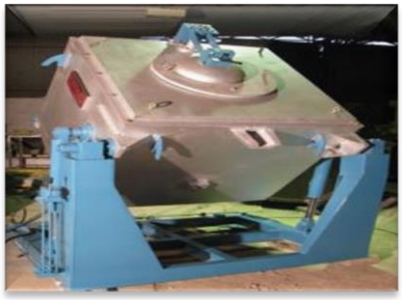
July 2018

DETAILED PROJECT REPORT
ON
REPLACEMENT OF COAL MELTING FURNACE WITH NEW EE PNG FIRED FURNACE

M/s Uma Cast–Jamnagar Brass Cluster



Submitted to
(Prepared under GEF-UNIDO-BEE Project)

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List of Abbreviations

AC	Alternate Current
ANSI	American National Standards Institute
BEE	Bureau of Energy Efficiency
DC	Direct Current
DPR	Detailed Project Report
EE	Energy Efficiency
GEF	Global Environmental Facility
IRR	Internal Rate of Return
kW	Kilo Watt
LSP	Local Service Provider
MSME	Micro and Medium Scale Industries
NPV	Net Present Value
OEM	Original Equipment Manufacturer
PGVCL	Paschim Gujarat Vij. Company Ltd
TOE	Tonnes of Oil Equivalent
UNIDO	United Nation Development Organization

ACKNOWLEDGEMENT

Confederation of Indian Industry (CII) would like to express its sincere thanks to United Nations Industrial Development Organization (UNIDO), Global Environment Facility (GEF) and Bureau of Energy Efficiency (BEE) for the role played by them in guiding and steering this prominent assignment - "Capacity Building of Local Service Providers in Jamnagar Brass Cluster"
CII would also like to give special gratitude to Jamnagar Brass Factory Owners' Association for supporting CII for carrying out this project at Jamnagar Brass Cluster and for their constant support and coordination throughout the activity.

CII is grateful to Mr. Milind Deore, Director, Bureau of Energy Efficiency, Mr. Sanjay Shrestha, Industrial Development Officer, Industrial Energy Efficiency Unit, Energy and Climate Branch, UNIDO, Mr. Suresh Kennit, National Project Coordinator, UNIDO, Mr. Niranjan Rao Deevela, National Technology Coordinator, UNIDO and Mr. Samir Patel, UNIDO, Cluster Leader, Jamnagar-Brass Cluster for their support and guidance during the project.

Last but not least we are thankful to Uma Cast, especially Mr. Anil Bhai Pansara, for showing keen interest in the implementation of this technology and providing their wholehearted support and cooperation for the preparation of this Detailed Project Report.

We would take this opportunity to express our appreciation to the Original Equipment Suppliers and Local Service Providers for their support in giving valuable inputs and ideas for the completion of the Detailed Project Report.

We would also like to mention that the valuable efforts being taken and the enthusiasm displayed towards energy conservation by the Jamnagar Brass Cluster is appreciable and admirable.

1. EXECUTIVE SUMMARY

Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, in collaboration with United Nations Industrial Development Organization (UNIDO) is executing a Global Environment Facility (GEF) funded national project "Promoting energy efficiency and renewable energy in selected MSME clusters in India". The overall aim of the project is to develop and promote a market environment for introducing energy efficiency and enhanced use of renewable energy technologies in process applications in 12 selected energy-intensive MSME clusters across 5 sectors in India (with expansion to more clusters later). This will enable improvement in the productivity and competitiveness of units, as well as reduce overall carbon emissions and improve the local environment.

Key activities involved in the project are as follows:

- **LSP MAPPING:** Detailed Mapping of LSPs in the cluster.
- **TECHNOLOGY FEASIBILITY STUDIES:** Preparation of 10 bankable DPRs.
- **TRAINING MATERIALS:** Development of 5 customized training material based on mapping
- **TRAINING PROGRAM:** Conduct 4 training programs in the cluster for the capacity building of local service providers.
- **LSP's AS LOCAL DISTRIBUTORS:** Mapping of LSPs and OEMs so that LSPs can become local dealers for major OEMs.

1.1 Brief Unit Profile

Table 1: Unit Details

Particulars	Details
Name of Plant	Uma Cast
Name(s) of the Plant Head	Mr. Anilbhai Pansara
Contact person	Mr. Anilbhai Pansara
Constitution	Private Company
MSME Classification	Small
Address:	Plot no. 669, GIDC, Phase 2, Dared, Jamnagar, Gujarat
Industry-sector	Manufacturing

1.2 Proposed EE Measure

During the plant visit it was observed that the plant was operating with old furnace coal fired melting furnace to melt the brass scrap which was operating at lower efficiency and has a lot dust pollution problem in the plant. After discussion with the plant team and technology supplier, it was proposed to replace the old furnace at Uma Cast with new energy efficient pressurized

natural gas (PNG) fired furnace. The expected reduction in specific cost is Rs. 1,243/Ton, which will lead to a saving of Rs. 3.54 lakhs per annum. The details of the proposed EE measure are given in below:

Table 2: Proposed EE Measure

Sl No	EE Measure	Annual Energy Savings, (TOE)	Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual GHG reduction (T CO_2)
1	Replacement of Coal melting furnace with new EE PNG fired furnace	3.44	3.54	8.87	51	35.03

1.3 Means of Finance

The details of means of finance for the proposed EE measure is as under:

Table 3; Project Finance

Sl. No.	Particulars	Unit	Value
I	Total Investment (Incl. of Tax)	Rs. Lakh	8.87
Ii	Means of Finance	Self / Bank Finance	Self
Iii	IRR	%	58.4
Iv	NPV at 70 % Debt	Rs. Lakh	13.9

2. INTRODUCTION ABOUT UMA CAST

2.1 Unit Profile

Uma Cast was established in 2018 and is involved in manufacturing of singe piece products such as cable glands, sanitary parts and auto components. The major energy consuming equipment in the plan was furnace. In a very short duration Uma cast has carved a niche in the industry by rapid innovation and prompt response to the market trends and as a result, today it is one of the preferred name not amongst domestic brass semis consumers list.

Table 4: Unit Profile

Particulars	Details
Name of Plant	Uma Cast
Name(s) of the Plant Head	Mr. Anilbhai Pansara
Contact person	Mr. Anilbhai Pansara
Contact Mail Id	anilpansara297@gmail.com
Contact No	+91 9376596443
Constitution	Private Company
MSME Classification	SME
No of operating hrs./day	8 hrs.
No of operating days/year	250 Days
Address:	Plot no. 669, GIDC, Phase 2, Dared, Jamnagar, Gujarat
Industry-sector	Manufacturing
Type of Products manufactured	Cable glands, sanitary parts and auto components

2.2 Production Details

The various products manufactured in Uma cast are electrical components, sanitary parts and automotive components. Last year plant had an average finished product output of 20.15 Ton per month[1]. The graph shows the month wise production of brass products at Uma cast during last six months.

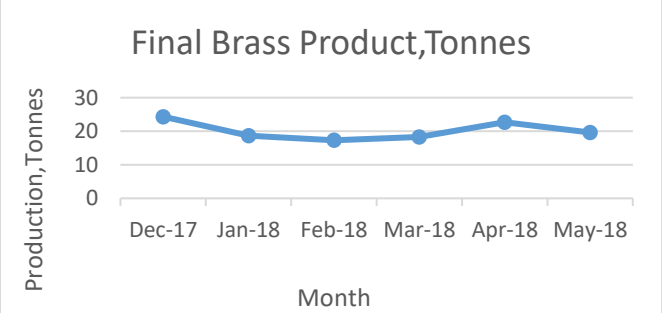


Figure 1: Production Details

[1] Finished brass goods

2.3 Typical Brass Production Flow Diagram

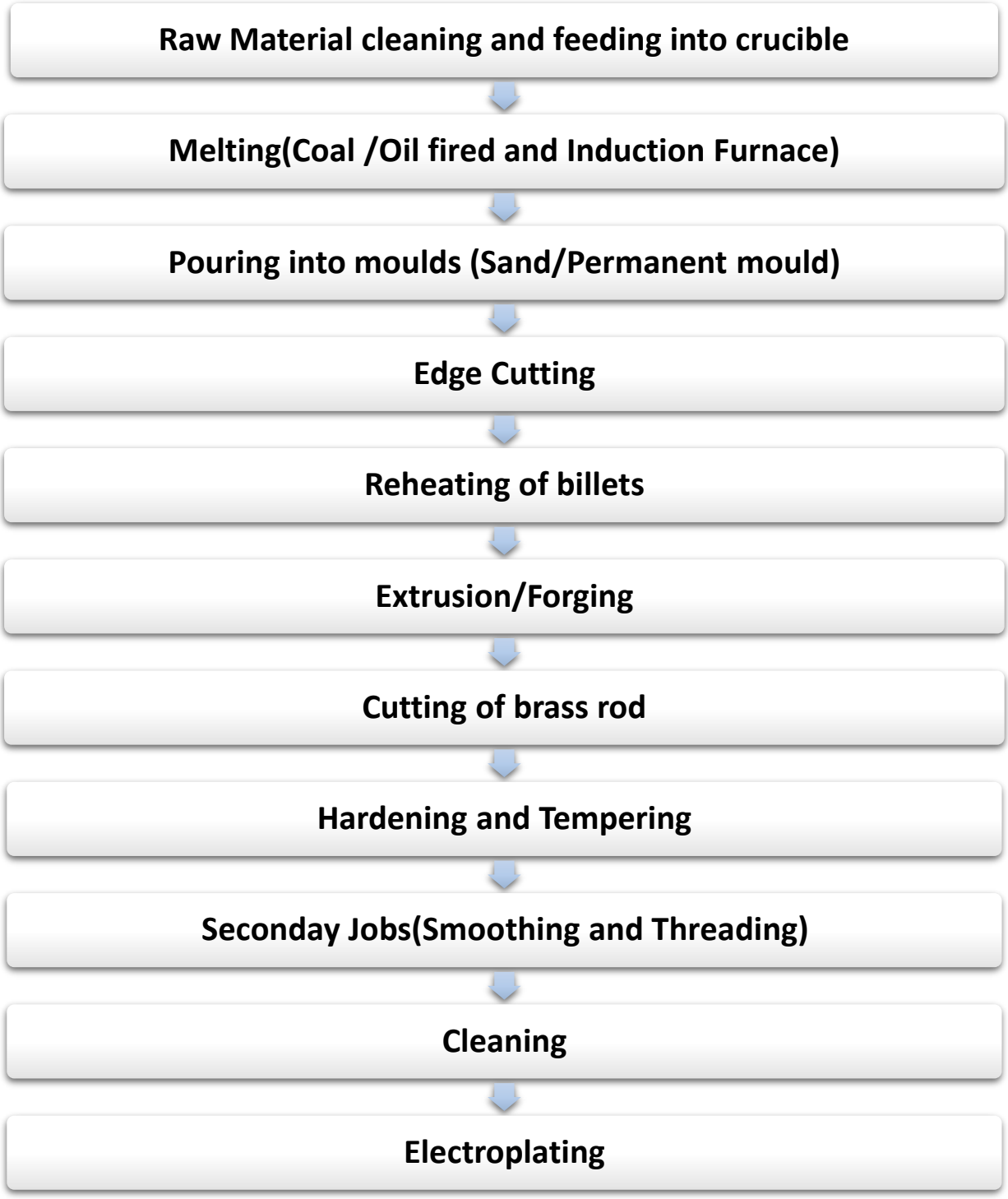


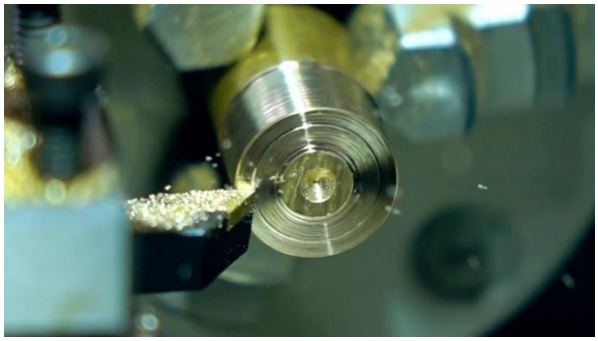
Figure 2: Typical Process Flow Chart

The production process mentioned in the above chart is almost similar to most of brass part manufacturing units in the cluster. However, depending on the final product, quality of final product and raw material properties, some of the stated process flow is altered to suit the requirement of industry. The major processes taking place at a typical Brass industry includes:

Melting: After separating the impurities form the brass scrap, the first step in making most of the products is melting the scarp in small furnace ranging from 100kg to 2000kg. Typically in Jamnagar pit type coal fired and induction melting furnaces are mainly used

Casting: After melting the next step involves casting molten brass in permanent mould or sand mould, depending upon the final product of the company. Sand moulding usually involves the preparing the consolidated sand mould around a pattern held within a supporting metal frame and removing the pattern to leave the mould cavity with cores. The liquid brass is poured into the cavity and allowed to solidify and when it does, the product is taken out of the mould cavity, trimmed and made to shape.

Machining: It is a broad term used to describe removal of material from a workpiece to get the desired shape and size of the material for further use. Machining is one of the key specialty of the products manufactured in Jamnagar clusters. Most of the plants are using traditional machines for grinding, grooving and other secondary jobs along with latest generation CNC machines for some specific jobs.



Electroplating: Is the process that is coating metals through reaction of the electrical conductive and chemical organics. The basic electroplating process consists of a plating bath filled with water containing a small amount of acid or alkali added to improve its conductivity.

- An anode (positive electrode) - either the plating metal or an inert electrode; this is expended as the process goes on and replenished periodically

- A cathode (negative electrode) - the item to be plated; these can be either hung inside the bath or placed in a barrel, which is rotated slowly to make the plating material deposited evenly

Usually, the bath is contained in metal container, lined with acid/alkali resistant membrane e.g. PVC sheet to make it insulated from electric circuit. The application of direct electric current across the bath solution causes the migration of positively charged particles (anions) towards the negative electrode (cathode) and negatively charged particles (cations) towards the positive electrodes (anode).

2.4 Energy Profile

Both electricity and thermal energy are used for carrying out various activities in plant like melting, machining, operation of utilities etc. The following fuels are used in the plant:

Table 5: Type of fuel used

Type of fuel/Energy used	Unit	Tariff	GCV
Electricity	Rs./kWh	**7.8**	-
Coal	Rs/kg	**28**	6500

The table below shows the average monthly energy consumption of the plant along with the average production of the finished goods during the last six months:

Table 6: Energy Consumption and Finished product Details

Month	Electricity Consumption (kWh)	Total Electricity Bill , Rs.(Lakhs)	Total Coal Consumption, (Tonnes)	Total Fuel Bill, Rs.(Lakhs)	Final Product, (Tonnes)[2]
Dec-17	2827	0.23	3.30	0.92	24.34
Jan-18	2050	0.17	3.15	0.88	18.69
Feb-18	1881	0.15	2.40	0.67	17.30
Mar-18	1533	0.12	2.50	0.70	18.25
Apr-18	1970	0.15	2.80	0.78	22.65
May-18	1873	0.15	3.08	0.86	19.65

[2] Average annual final product output of the plant was approximately 15.24% less than the melting production due to processing losses of brass alloy at different stages such as casting and machining

The major form of energy used in the plant is electricity which is imported from PGVCL grid supply at 415kV. Apart from electricity, furnace oil is the major source of thermal energy in the plant. Electricity accounts for 16.82% of the total fuel cost and rest 83.18% thermal cost in the plant. Based on the data collected from the plant, the graph below shows the variation of energy/fuel cost over the last 6 months. Average electricity cost is Rs. 0.16 Lakhs/month whereas the average thermal energy cost is Rs 0.80 Lakhs/month.

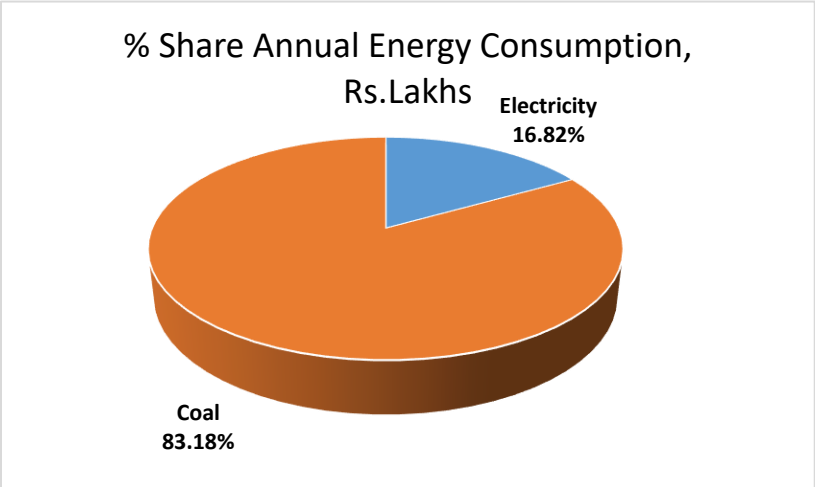


Figure 3: Percentage share of fuel cost

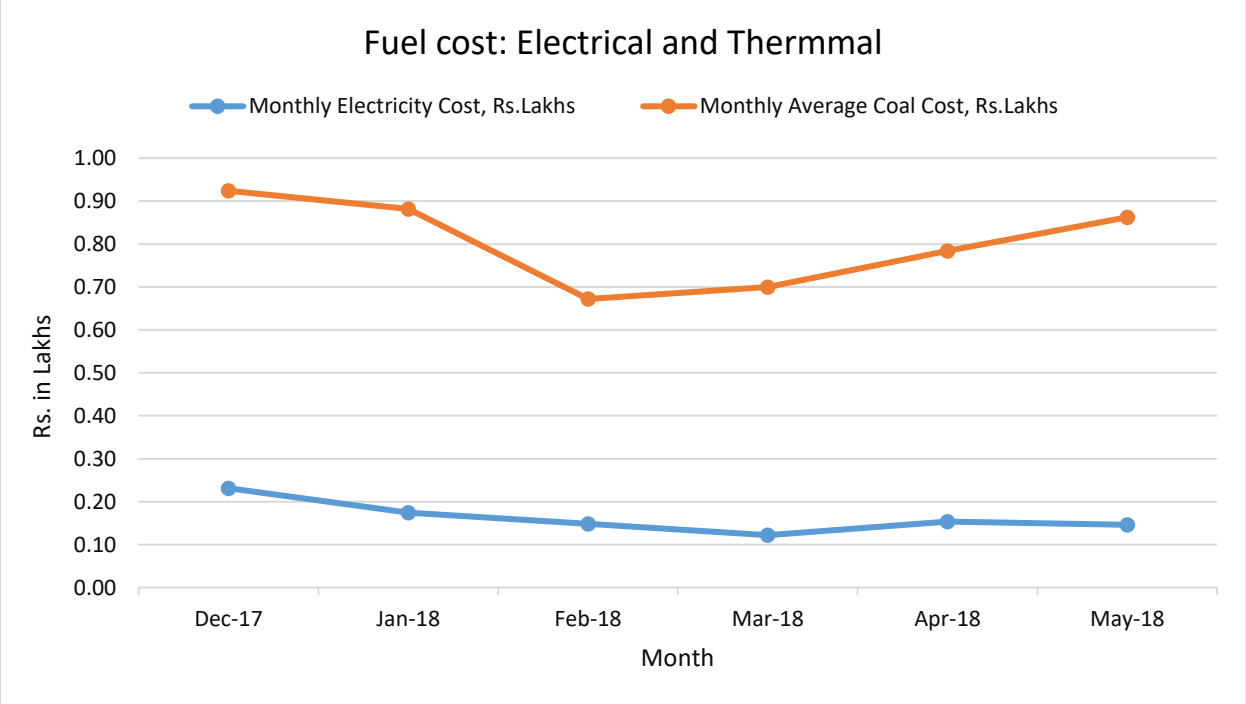


Figure 4: Energy Cost- Fuel & Electricity

3. PROPOSED EE MEASURE – REPLACEMENT OF FO MELTING FURNACE WITH NEW EE PNG FIRED FURNACE

3.1 Present System

Coal fired pit furnace in brass industries is uses to melt raw material(Brass scrap),which is subsequently used in pouring into different molds to obtain various shapes .It is one of the major energy & time-consuming process in the overall manufacturing process in brass industry. Apart from the energy and time, final product quality will also depend on temperature of liquid metal.

Figure 5: Pit type coal fired furnace

Generally, metallurgical coke is use as fuel in such furnace and the design of these furnaces is normally handmade and copied from standard furnace design. Furnace operator generally decides the melting time based on the impurity level in the raw material and color of the molten Brass. During the feasibility study it was observed that most of the brass units are using inefficient furnace coal fired furnace for melting and it was found that the efficiency of these existing furnace is on lower side.

The following key reasons were contributing for the lower efficiencies of reheating furnaces:

- **Improper Air fuel Ratio**: it was observed that, air fuel ratio is not proper maintained and leads to a reduction in furnace efficiency by 3-5%
- **Exhaust flue gases:** This was the one of the area where major amount of heat energy was getting lost; in majority of the units during the study recuperator was not installed to recover the heat from flue gasses
- **Inefficient Burner**: In Jamnagar majority of units were using locally fabricated burners for the combustion of fuel oil and these burners were either a far copy of a properly designed burner or sometimes substandard and locally designed. And Many a times, oil could be seen leaking from the burner joints
- Melting process is manual and most of the parameters are decided based on the hands on experience of the furnace operator, which sometimes can lead to overheating of material and more coal consumption

3.2 Observation and Analysis

The specific fuel consumption of the furnace was estimated based on the data measured/collected during the field visit in the unit. Furnace operation was observed for 4 bathes and coal consumption & melt production was taken. The unit was charging approximate 100% brass scrap (approximately 60% and 40% Zinc) in a batch. The average melting per batch has been estimated to be 285.25 kg per batch which has an average coal consumption 40.75kg.

The detailed observed parameters for the 4 batches are given below:

Table 7: Operating Parameters for different cycles

Parameters	Batch 1	Batch 2	Batch 3	Batch 4
Coal Consumption, kg	43	38	45	37
Liquid Metal Yield, kg	285	281	290	285
Time, Minutes	122.0	120.0	125.0	121.0
SEC(kg Coal/Tonne)	150.88	135.23	155.17	129.82

The specific coal consumption of the furnace was estimated to be 142.78 kg coal per tonne of liquid metal. The overall efficiency of existing coal fired reheating furnace was 13.18%, which is on lower side and the detailed calculation for the same is given below:

Table 8: Efficiency of furnace

Parameters	Value
Average Mass of the material in each batch, kg	285.25
Temperature of Inlet material,^{0}C	40
Temperature of molten material,^{0}C	990
Specific heat of material, kCal/kg-^{0}C	0.09
Latent heat fusion of Brass, kCal/kg	35.00
Sensible heat absorbed by material, kCal	24931
Latent heat of molten Brass material, kCal	9983.75
Total heat absorbed in Brass molten material	34915
Average coal Consumption in a batch, kg	40.8
Calorific Value of Coal , kCal/kg	6500
Total Input to furnace , kCal	264875
Furnace Efficiency , %	13.18

3.2 Recommendation

The process of melting brass scrap is one of the major costs in the overall brass manufacturing process, in a typical brass manufacturing industry, which comes out to be `Rs. 3,500 to Rs. 4,000 per tonne of brass. The efficiency of the existing installed conventional furnace was 13.18 % only

and in majority of the industries the furnaces are of very primitive design, which lead to increase in the fuel consumption of the furnace.

It is recommended to replace the existing coal fired furnace and install a new PNG fired of 300kg rated capacity, equipped with following key design features:

- Energy efficient burners gas burners
- Hydraulic tilting mechanism / Mechanical tilting/ Stationary

Key Advantages of replacing the conventional furnace with Energy Efficient furnace are:

Improvement in working environment

- Replacement of conventional furnaces with energy efficient furnaces will reduce furnace skin temperature, closed combustion chamber & temperature control of gas-fired pit furnaces, all those things will improve the working condition & safety of workers near to furnace

Improvement in workers skill

- Proposed energy efficient gas fired pit furnace's components procured from other companies and generates employment during installation and commissioning. Training must provide by equipment suppliers will improve, the technical skills of workers require for operation of the equipment. Demands of skilled labors increase after implementation of this project in Jamnagar brass cluster.

Improvement in product quality

- Most of the brass manufactured in Jamnagar brass industries is temperature sensitive. As already discussed in above chapters that inbuilt design of automatic temperature control system in energy efficient gas fired pit furnace will control temperature of material inside the furnace, this automatically improves quality of material. Type of material content is effect on quality of product. Quality of final product increase due to reduction of carbon ash of unburned coal mix in yield.

Increase in production

- Due to improved design of gas fired pit furnace will improves melting temperature; this automatically reduces melting time of brass. It was observed that melting is one of major time consuming area, reduction in cycle time and specific fuel consumption in brass manufacturing unit will improve productivity of the units in Jamnagar brass cluster.

Burning losses, losses due to design change, heat loss due to pouring time is reduces in new energy efficient gas furnace.

The design specifications of the new PNG fired furnace is given below:

Table 9: Design Details of the new Furnace

Description	Rating
Rated Capacity of furnace, kg	300
Pouring Temperature for Brass, °C	1000
Heating Source	Standard make burners
Insulation	Brick lining insulation

3.3 Supplier Details

Table 10: Supplier Detail

Equipment Detail	EE NG fired Reheating furnace
Supplier Name -1	Matfab Engineering
Address	Plot No. 5220, Phase IV, Near Ramol Cross Road, GIDC, Vatva ,Ahmedabad
Contact Person	Rajesh Gohel
Email Id	info@matfabengineering.com
Supplier Name -2	AFECO heating systems
Address	F-23, M.I.D.C. Gokul Shirgoan, Kolhapur – 416 234. Maharashtra
Contact Person	Jagdish Garud
Email Id	sales@afecoheating.com

3.4 Savings

Energy consumption pattern and feasibility studies revealed that melting operation in fuel fired furnaces depends on the design of the furnace, type and position of burners etc. A detailed analysis was carried out on conventional furnace and specific coal consumption was found out to be 142.78kg/tonne, whereas, specific gas consumption with proposed energy efficient gas fired furnace with recuperator is 95 Nm^3/tonne[3]. The total average annual melting of plant was 285.25 tonnes hence; total coal consumption in base case would be 40,727kg per year which will be replaced by gas and total gas consumption would be 27,098.87Nm^3 per year which will lead to an annual saving of 3.44 TOE/year and 35.03Ton/year CO_2 equivalent reduction.

[3] SEC figure was provided by OEM after the field visit and considering site operating conditions

Detailed savings calculations is given in below table

Table 11: Savings Calculation

Parameters	Units	Existing System	Proposed System
Furnace Type		Coal Fired	PNG Fired
Unit Price of Coal	Rs./kg	28	-
Unit Price of PNG	Rs./Nm^3		29
Average Specific coal Consumption	Kg/Tonne	142.78	-
Expected PNG Consumption (Hand Pouring)	Nm^3/Tonne		95.0
No of Heat Cycles in a day		4	
Average annual Operating days		250	
Annual Production(Melting)	Tonnes/Year	285.25	
Annual Energy consumption on base brass production(Melting)	Rs/Tonne	3998	2755
Reduction in Specific Energy Cost	Rs/Tonne	1243	-
Annual Monetary Savings	Rs. Lakhs/Year	3.54	
Investment	Rs. Lakhs/Year	8.87	
Simple Payback period	Months	30	
TOE Savings		3.44	
CO_2 Reduction	Tonne/Year	35.03	

4. FINANCIAL ANALYSIS

4.1 Project Cost

Table 12: Project Cost

Parameter	Amount in Rs Lakhs
New melting furnace with hydraulic tilting	4.93
Recuperator	1.15
Total GST @18%	1.094
Erection and commissioning	0.20
Approx. Piping and fixed Gas connection cost	1.50
Total Project Cost	8.87

4.2 Assumptions for Financial Analysis

- Cost of Debt (Interest rate) taken as 12%
- Yearly increase in fuel cost by 2% for cash flow analysis
- Depreciation method: Reducing balance method
- Depreciation rate: 40% [4]
- Life cycle of the project is taken as 7 years
- Three different Capital Structure considered
    - CS1 – 70:30 Debt Equity Ratio
    - CS2 – 50:50 Debt Equity Ratio
    - CS3 – 100 % Equity
- Return on equity is taken as 15 %
- Operation and Maintenance Cost taken as 5% of Initial investment
- For calculating weighted average cost of capital, the corporate tax rate is assumed as 30%

4.3 Cash Flow Analysis

Table 13: Cash flow of the project

Cash flow for the project		1	2	3	4	5	6	7
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Required Investment	8.87							
Energy Savings		3.5	3.6	3.7	3.8	3.8	3.9	4.0
O&M Cost		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Depreciation		3.5	2.1	1.28	0.8	0.5	0.3	0.2

[4] https://www.incometaxindia.gov.in/charts%20%20tables/depreciation%20rates.htm

Net Cash Flow	-8.9	6.7	5.3	4.5	4.1	3.9	3.7	3.7

The table below shows the WACC at various capital structure assumed for the financial analysis

Table 14: Capital Structure

Capital Structure			
Particulars	CS 1	CS 2	CS 3
Debt	70	50	0
Cost of Debt	0.12	0.12	0.12
Tax 30%	0.3	0.3	0.3
Equity	30	50	100
Sum of debt& Equity	100	100	100
Cost of Equity	0.15	0.15	0.15
WACC	10.38	11.7	15

Table 15: NPV Calculation

NPV Calculation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	NPV
NPV at CS 1 (70:30)	-8.87	6.0	4.4	3.4	2.8	2.4	2.1	1.9	13.9
NPV at CS 2 (50:50)	-8.87	6.0	4.2	3.2	2.6	2.2	1.9	1.7	13.1
NPV at CS 3 (100% Equity)	-8.87	5.8	4.0	3.0	2.3	1.9	1.6	1.4	11.2

4.4 Sensitivity Analysis

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different situations such as

- Change in energy savings
- Change in operating hours
- Change in interest rate

The sensitivity analysis will help to estimate the impact of key project indicators on attractiveness of the project, thereby helping to understand the financial viability.

Table 16: Sensitivity analysis: based on energy savings

Sensitivity analysis: based on energy savings			
	at 100% Savings	at 75% Savings	at 50% Savings
IRR	58%	45%	31%
NPV at CS 1 (D70:E30)	13.9	9.4	4.9
NPV at CS2 (D50:E50)	13.05	7.93	3.87
NPV at CS3 (D0:E100)	11.16	7.29	3.41

Table 17: Sensitivity analysis: change in operating hrs.

Sensitivity analysis: based on operating hours			
	at 100% Operating hours	at 90% Operating hours	at 80% Operating hours
IRR	58%	53%	48%
NPV at CS 1 (D70:E30)	13.9	12.1	10.3
NPV at CS2 (D50:E50)	13.05	11.3	9.6
NPV at CS3 (D0:E100)	11.16	9.6	8.1

Table 18: Sensitivity analysis: change in interest rate

Sensitivity analysis: change in interest rate						
	at 9.5% Interest rate	at 10.05% Interest rate	at 11% Interest rate	at 12% Interest Rate	at 12.5% Interest Rate	at 13% Interest Rate
NPV (70:30)	14.74	14.40	14.23	13.90	13.74	13.58

5. ENERGY EFFICIENCY FINANCING IN MSMEs

Financing plays a key role in facilitating procurement and implementation of energy efficient technologies and products in any industry. Government has given EE financing in MSMEs top priority since the sector contributes significantly towards India's economic growth. However, existing financing options are not sufficient to meet the financing requirement in the sector due to the large size of the sector. MSMEs using various financing schemes for technological up-gradation are still very less, as most of them use their own capital fund rather than making use of external financing models. Although financing models were very successful in some clusters, the scale-up of such activities is rather slow. This slow pace in implementation of energy efficiency financing in MSMEs is due to the various sector specific challenges in the sector.

Some of the key barriers to finance EE projects in the sector are:-

- Lack of available capital for investment as EE interventions being small may not get financed through FIs as they do not qualify as term loans
- Lack of clarity on financing schemes- repayment mechanism and complex procedural requirements
- Lack of availability of financing model that cater to the particular requirement of the MSME
- Lack of awareness among MSMEs with respect to benefits of implementing EE technologies
- FIs consider MSMEs as a high risk category due to low credit flow to this sector. This is due to several factors such as poor book-keeping practices, weak balance sheets, poor credit history and smaller sizes of MSME loans.
- Collateral based lending, advocated by FIs, restricts MSMEs from availing loans
- No formal M&V procedure available to estimate the savings achieved by implementing EE measure
- Risks associated with repayment of loans which include technical, commercial and performance risks

5.1 FI Schemes in Gujarat

Table 19: FI schemes in Gujarat

Sl.No	Name of Scheme	Purpose	Financial Details	Contact Address
1	**SIDBI Make in India Soft Loan Fund for Micro, Small & Medium Enterprises (SMILE)**	• The focus of the scheme is on technology upgradation which helps in reducing the impacts from process and operations as the reduction in resource consumption and productivity improvements are major outcome of technology upgradation • The program aims to bridge the gap by providing financial support to the companies.	• Rate of interest is according to credit rating • Interest rates for soft loans are from (8.90 % to 8.95 % pa) and term loans are in the range of (9.45% to 9.60% pa) • Min loan amount: Rs 25 Lakhs • Term Loan: 75% of the project cost as debt	Mr.Chandra Kant SIDBI, NO.1-2-3/4, Shreeji Patel Colony, Jamnagar-361008. Contact no : 0288 275 3954 Mail id : chandrakant@sidbi.in
2	**4E scheme (End to End Energy Efficiency Financing scheme)**	• The 4E scheme promoted by SIDBI aims to assist the industries in implementation of energy efficiency and renewable energy projects. • The scheme addresses all aspects of energy efficiency in a company from assessment and identification of energy efficiency interventions to facilitating implementation by providing technical and financial support	• Interest rate - 2.5% below market interest rate • Min loan amount: Rs 10 Lakhs • Max loan amount: Rs 150 Lakhs • 90% of the project cost as debt	Mr.Chandra Kant SIDBI,NO.1-2-3/4,Shreeji Patel Colony,Jamnagar-361008. Contact no : 0288 275 3954 Mail id : chandrakant@sidbi.in

3	**Partial Risk Sharing Facility for Energy Efficiency project (PRSF)**	• The partial risk sharing facility aims at transforming the energy efficiency market in India and promotion of Energy Service Contracting Model for the Energy Efficiency. • The scheme address barrier related to the financing aspects for energy efficiency	• Term Loan: 12%-15% • Min loan amount: Rs 10 Lakhs • Max loan amount: Rs 15 Cr • Total Project funding of – USD 43 million • Risk Sharing facility component of USD 37 million to be managed by SIDBI • Technical assistance component of USD 6 billion to be managed by SIDBI and EESL	Mr Chandra Kant SIDBI,NO.1-2-3/4,Shreeji Patel Colony,Jamnagar-361008. Contact no : 0288 275 3954 Mail id : chandrakant@sidbi.in
4	**Bank of Baroda's Scheme for Financing Energy Efficiency Projects**	All these Schemes from various banks (SBI, Bank of Baroda, Canara Bank) have their focus towards technology upgradation. Technology upgradation can lead to improvement in energy, productivity, and lower emission from the MSME company. As technology upgradation could be capital intensive most of the	• Loans of up to 75% of the total project cost, subject to maximum of Rs. 1 crore, will be provided. (Minimum amount of loan Rs. 5 Lakhs • Collateral will be required for all loans. An interest rate of bank base rate + 4% will be applicable, to be paid back over a period of 5 years.	Bank of Baroda Saru Section Road,Swastik Society,Park colony,Jamnagar,Gujarat,361008 Contact no : 0288 266 0779 Mail Id : Jamnag@bankofbaroda.com
5	**Canara Bank's Loan scheme for Energy Savings for SMEs**		• The scheme covers up to 90% of project costs of up to INR 1 million (EUR 13,000). • Max. loan: INR 10 million (EUR 130,000) • Security: collateral free up to INR 5 million (EUR 65,000), beyond INR 5 million collateral required as determined by the bank • Margin: 10% of project costs	Canara Bank, 1st Floor,New Super Market,Bedi Road,Jamnagar,Gujarat,361001 Ph no: 0288 267 6597

6	**SBI's Project Uptech for Energy Efficiency**	schemes from banking institutions aim at bridging the gaps for access to finance for MSME sector	• SBI identifies industrial clusters with potential for quick technology upgradation and a supporting environment. Based on studies in interested units, technology upgradation is undertaken if the same in viable. • With a ceiling of INR 1 lakh, an amount equal to that invested by the unit is provided under this loan. There is a start-up period of 3 years, with a repayment period of 5-7 years, at zero interest.	SBI Regional Office Junagadh Jamnagar Highway, Maheswari Nagar, Opp Anupam Cinema Hall, Kadiawad, Jamnagar, Gujarat 361001. Ph no : 0288 2554026 Mail id : sbi.01816@sbi.co.in
7	**Solar Roof Top Financing Scheme IREDA**	The loan scheme is applicable to grid interactive, rooftop solar PV plants for industries, institutions and commercial establishments. Financing can be accessed for single or aggregated investments.	• Interest rate: 9.9% - 10.75% • Max. repayment time: 9 years • Minimum promoter's contribution: 30% • The applicant's minimum capacity needs to be 1MW	IREDA Camp Office 603, Atlanta Towers Near Panchvati Circle, Gulabi Tekra Ahmedabad Ph No : 9811889805 Email Id : ashokyadav@ireda.in

6. ENVIRONMENTAL AND SOCIAL BENEFIT

6.1 Environmental Benefit

A resource-efficient business demonstrates a responsibility towards the environment. Energy and the environment are so closely linked, that, in addition to saving energy and reducing utility expenses, there are additional and often unreported benefits from conserving energy, saving natural resources being an important benefit.

Energy efficiency plays a major role, even where company output is increased, energy efficiency improvements can contribute significantly in most cases to reducing the negative impact of energy consumption per unit of output. Any increase in pollutant emissions will thus be minimized. Significant environmental benefits gained by adopting energy efficient technologies and processes may include lowering the demand for natural resources, reducing the emission of air pollutants, improving water quality, reducing the accumulation of solid waste and also reducing climate change impacts. Improving energy conservation at the facility can improve the facility's overall efficiency, which leads to a cleaner environment.

Reduction in Pollution Parameters

The proposed energy efficiency measure of installing energy efficient furnace will result in reduction of 3.44TOE per annum. The proposed EE measure will result in decrease of CO_2 emissions by 35.03 TCO_2 annually, thus resulting in reduced GHG effect.

6.2 Social Benefit

Work Environment

The Factories Act, 1948 covers various aspects relating to working environment maintenance and improvement. The good maintenance practices, technology up gradation, efficient use of energy and resource conservation not only contribute to energy and pollutant reduction but also contributes in ensuring safe and clean working environment to the employees of the organization. Many units have also been doing review of safety process and have provided access to safe working environment to the workers. Basic facilities such as first aid kit, PPE gears and many others have been made available

Skill Improvement

Implementing energy efficiency measures requires mix of people and skills. It involves upskilling workers at all levels from the shop floor to the board room to understand how companies manage their energy use—and to identify, evaluate and implement opportunities to improve

energy performance. As the project involved identifying energy saving projects, implementing and verifying the savings, the unit have understood how to estimate energy savings with respect to energy saving proposals and also energy wastage have been identified. The activity has been successful in bringing the awareness among workers on energy wastage reduction, technology up gradation possible, etc. Each new technology implemented in a brass unit will create an impact on the entire cluster as each unit can replicate the new technology and promote the concept of energy efficiency and renewable energy in entire Cluster and thus reduce the overall energy consumption of the cluster as a whole. Technical skills of persons will be definitely improved as the training provided by the OEMS' on latest technology will create awareness among the employees on new trends happening in market. The training also helps in improving the operational and maintenance skills of manpower required for efficient operation of the equipment.

7. CONCLUSION

Energy efficiency is an instrument to address the issue of energy crisis and also be employed as a cost-effective means to attain sustainability and business. Cost of energy is considered as a vital component for industries and warrant judicious use of energy. Amid spiraling power cost energy efficiency assumes at most importance for the sector to remain competitive.

The GEF, UNIDO and BEE project through its various engagements is able to demonstrate energy efficiency potential in Jamnagar Brass cluster. The project is able to promote the concept of energy efficiency and renewable energy in brass cluster through various capacity building programs for local service providers, technology feasibility studies in brass units, training programs on EE/RE technologies and also helped in penetrating new /latest technologies into the cluster.

The DPR on replacing the existing old FO fired furnace with EE NG fired furnace is prepared after the OEM came to the unit and also did a detailed feasibility study. This measure will significantly reduce the dependency on furnace oil which will result in an annual energy savings of 3.44TOE per year with 35.03 TCO_2 reduction annually.

The following table gives the overall summary of the savings achieved: -

Table 20: Proposed EE Measure

Sl No	EE Measure	Annual Energy Savings, (TOE)	Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual GHG reduction (T CO_2)
1	**Replacement of Coal melting furnace with new EE PNG fired furnace**	3.44	3.54	8.87	51	35.03

The summary of financial analysis given in the below table clearly indicates that implementation of this project is economically and financially viable with an attractive payback period. So it is recommended to install new NG fired furnace.

Table 21: Financial Analysis

Sl. No.	Particulars	Unit	Value
i	**Total Investment (Incl. of Tax)**	Rs. Lakh	8.87
ii	**Means of Finance**	Self / Bank Finance	Self
Iii	**IRR**	%	58.4
Iv	**NPV at 70 % Debt**	Rs. Lakh	13.9

7.1 Replication Potential

Most of the small scale units in Jamnagar brass cluster are using basic design pit type coal fired furnace and has huge replication potential. The implementation of this project will inspire other units to take up similar energy efficiency initiatives which eventually will lower the bottom line and increase the top line therefore the margin increases. Secondly, the very clear specifications on vendor and the cost base is already available which makes it easy for other units in the Jamnagar Brass cluster to access the technology and gives them a very good idea about the cost and benefits associated with the projects. Overall, the holistic approach adopted by the project will be extremely useful in achieving the goal of improving EE in the cluster.

8. ANNEXURE

8.1 Financial Quotation – Technology supplier

AFECO HEATING SYSTEMS
(AN ISO 9001-2008 CERTIFIED ORGANIZATION.)

AFECO HEATING SYSTEMS
F-23, M.I.D.C. GOKUL SHIRGOAN,
KOLHAPUR – 416 234. Maharashtra (India
Ph.: 91-231-2672620, Fax: 91-231-2672461
Email: sales@afecoheating.com
www.afecoheating.com

Mfg. of Industrial Electrical & Gas Fired Furnaces.

Date: April 24, 2018
AFECO/QTO/18-19/295

To,
Uma Cast
Plot No 769, GIDC,
Phase 2, Dared.
Jamnagar GJ(INDIA).
Email: anilpansara297@gmail.com

Kind Attn.: **Mr. Anil Pansara** **Mob- 9376596443**

Dear Sir,

It was nice pleasure to meet you at Jamnagar Brass Cluster Energy efficient program on dated 15th May & we acknowledge with thanks receipt of your enquiry regarding requirement of,

- **GAS FIRED Crucible Type MELTING Furnace -Capacity- 300 Kg**
- **with Hydraulic Tilting Mechanism / Mechanical Tilting/ Stationary**
- **Crucible Your Scope. TPC type.**
- **Recuperator**

As per the specifications & technical details given by you, please find enclosed here with our most competitive offer for the same.

If you have any quires please feel free to contact us on 0231-2672620, 9371634910. 9371634909. Our technical person will attend you soon.

An early reply on the above matter is highly appreciated.

Thanking you,
Yours truly,

For **AFECO HEATING SYSTEMS**

Jagdish Garud
Sales & Marketing Manager

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AFECO HEATING SYSTEMS
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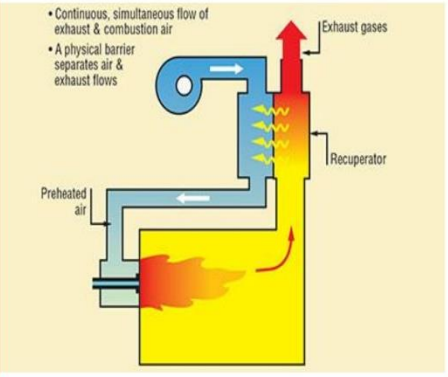
Ph.: 91-231-2672620, Fax: 91-231-2672461
Email: sales@afecoheating.com
www.afecoheating.com

Mfg. of Industrial Electrical & Gas Fired Furnaces.

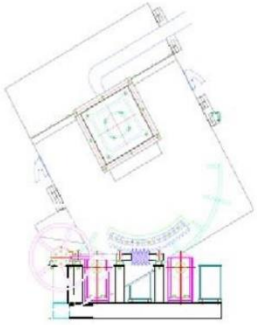
TECHNICAL DETAILS OF GAS FIRED CRUCIBLE TYPE MELTING FURNACE with Hydraulic Tilting Systems.

Hydraulic Tilting Furnace



Recuperator system

For Reference Purpose Only



Mechanical Tilting Furnace

Stationary Melting Furnace

2

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KOLHAPUR – 416 234. Maharashtra (India
Ph.: 91-231-2672620, Fax: 91-231-2672461
Email: sales@afecoheating.com
www.afecoheating.com

Mfg. of Industrial Electrical & Gas Fired Furnaces.

Benefits

- Less fuel consumption
- Exceptional thermal efficiency
- Fast, easy installation
- Minimum floor space
- Reduced operator fatigue results from cooler shell and relatively quiet operation
- No energy waste during non-productive hours-can be emptied and turned off
- Less scrap and less melt loss due to minimizing of temperature overshoot

Features

- Long-flame, nozzle-mix burner
- Self-contained, low-pressure combustion air blower.
- Interchangeable with crucible or pot
- Flame safety supervision standard
- Simplified operation

3

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(AN ISO 9001-2008 CERTIFIED ORGANIZATION.)

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Mfg. of Industrial Electrical & Gas Fired Furnaces.

QUOTATION

PNG/LPG FIRED CRUCIBLE TYPE MELTING FURNACE WITH HYDRAULIC TILTING MECHANISM.

1. TECHNICAL NAME	:	Hydraulic Tilting Type Melting **Furnace**
2. CAPACITY	:	300 Kg /Batch
3. Fuel	:	Natural Gas / LPG
4. MAX. TEMP.	:	1000°C.
5. WORKING TEMP.	:	1000°C
6. CRUCIBLE (Shape & Size)	:	**Your scope of supply**. TPC type Crucible
7. CONTROLLING	:	By Manual Leaver Controller with pendent.
8. INSULATION	:	Brick Lining Insulation
9. HEATING Source	:	Standard Make Burner
10. THERMO COUPLE	:	CR/Al. 'K' type Thermocouple One No. Supplied with the control panel To Measuring the Furnace chamber Temp. Not Melt Temp.
11. Hydraulic Power Pack	: -	For Tilting Mechanism with Cylinder (if required)
12 Mechanical Tilting	: -	Mechanical wheel with gear mechanism (If required)

13. FURNACE PRICE (without Crucible) :

Capacity 300 kg			
Fuel / Mechanism	Mechanical Tilting	Hydraulic Tilting	Stationary
Gas	Rs.4,35,000	Rs.4,93,000	Rs.3,85,000
Ex – works Kolhapur			

14. Recuperator : Rs.1,15,000/- Ex works Kolhapur

15. Erection & Commissioning : Rs. 20,000/-

Thanking You,
For **AFECO HEATING SYSTEMS**

JAGDISH GARUD
Sales & Marketing Manager

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