July 2018

DETAILED PROJECT REPORT
ON
REPLACEMENT OF OLD FO FIRED REHEATING FURNACE WITH NEW EE PNG FIRED FURNACE

M/s Gold Metal Extrusion –Jamnagar Brass Cluster

Submitted to

(Prepared under GEF-UNIDO-BEE Project)

Bureau of Energy Efficiency

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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

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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	Gold Metal Extrusion
Name(s) of the Plant Head	Mr.Ramesh Bhai
Contact person	Mr.Ramesh Bhai
Constitution	Private Company
MSME Classification	Small
Address:	Plot no:-770c , Phase2 , Dared , Jamnagar
Industry-sector	Manufacturing

1.2 Proposed EE Measure

During the plant visit it was observed that the plant was operating with old furnace oil-based reheating furnace and has a scope of replacing it with energy efficient pressurized natural gas (PNG) based reheating furnace. After discussion with the plant team and technology supplier, it was proposed to replace the old furnace at Gold Metal Extrusion. The expected reduction in

specific cost is Rs. 392/Tonne, which will lead to a saving of Rs. 7.88 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 /year)	Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual GHG reduction (T CO_2)
1	**Replacement of old FO fired reheating furnace with EE PNG fired furnace**	26.12	7.88	14.02	22	93.88

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	14.02
ii	**Means of Finance**	Self / Bank Finance	Self
Iii	**IRR**	%	78.03
Iv	**NPV at 70 % Debt**	Rs. Lakh	33.5

2. INTRODUCTION ABOUT RAJHANS METALS PVT. LTD.

2.1 Unit Profile

Gold Metal was established in 2004 and is involved in manufacturing of Brass Extrusions including extruded brass rods, extruded brass section, and extruded brass profiles in conformation to different standards like IS, BS, DIN, ASTM etc., which have applications in the manufacture of brass components etc.

It has carved a niche in the industry by rapid innovation and prompt response to the market trends and as a result, today Gold metal is a preferred name not only amongst domestic brass semis consumers but on the list of overseas consumers as well.

Unit has developed practices to create a hazard free and accident free working environment and systems like fume arrestor and ETP plant for zero discharge of water make the processes friendly to the humans.

Table 4: Unit Profile

Particulars	Details
Name of Plant	Gold Metal Extrusion
Name(s) of the Plant Head	Mr.Ramesh Bhai
Contact person	Mr.Ramesh Bhai
Contact Mail Id	info@goldmetalextrusion.com
Contact No	+91 9879610780
Constitution	Private Company
MSME Classification	SME
No. of years in operation	14 Years
No of operating hrs./day	12 hrs.
No of operating days/year	288 Days
Address:	Plot no:-770c , Phase2 , Dared , Jamnagar
Industry-sector	Manufacturing
Type of Products manufactured	Extruded Brass Rods, Brass Hollow Rods, Brass Wires & Coils, Brass Flat Bars, Brass Sections

2.2 Production Details

The various products manufactured in Gold metal are Extruded Bars Rods, Brass Hollow Rods, Brass Wires and Coils, Brass Flat Bars and Brass Section & profiles. Last year plant had an average

production of 157.23 Ton per month[1] .The graph below shows the Brass produced during last one year:

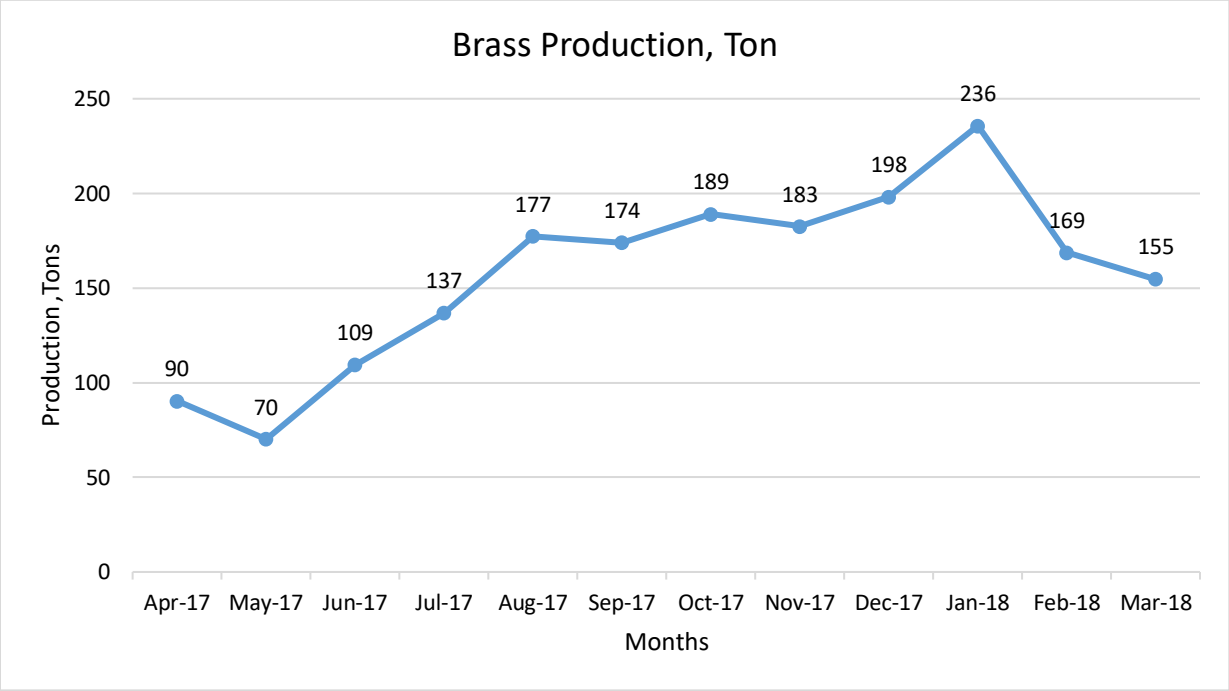


Figure 1: Production Details

[1] Average annual final product output of the plant was generally less than the reheating output due to processing losses of brass alloy at different stages such as extrusion, machining, etc.

2.3 Typical Brass Production Flow Diagram

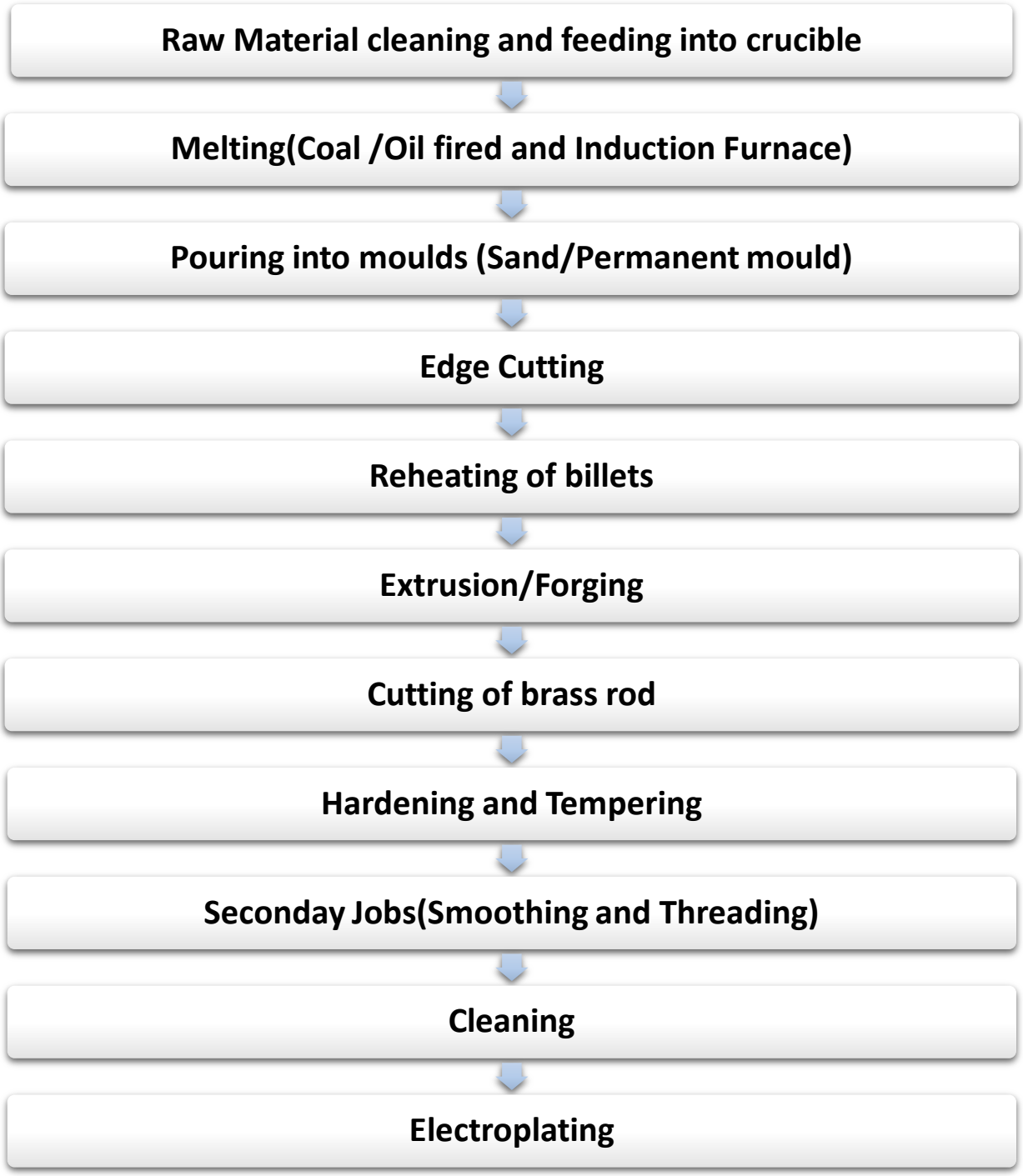


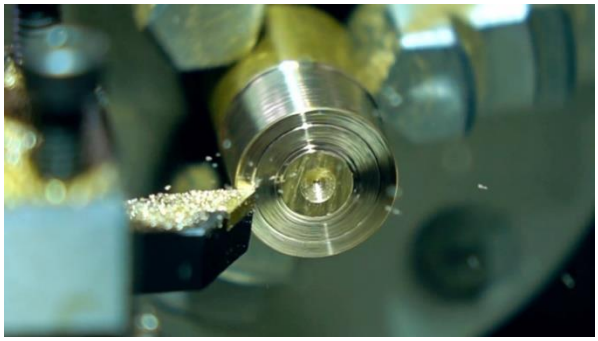
Figure 2: Typical Process Flow Chart

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, reheating, extrusion, machining 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**	-
FO	Rs/kg	**32**	9800

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

Table 6: Fuel Consumption Details

Month	Electricity Consumption (kWh)	Total Electricity Bill , Rs.(Lakhs)	Total Fuel Consumption, FO (Tonnes)	Total Fuel Bill, Rs(Lakhs)	Final Product, (Tonnes)[2]
Apr-17	78562	6.28	5.26	1.68	90.33
May-17	77001	6.16	5.18	1.66	70.12
Jun-17	82363	6.59	6.59	2.11	109.34
Jul-17	94570	7.57	7.12	2.28	136.79
Aug-17	85458	6.84	7.84	2.51	177.30
Sep-17	81248	6.50	7.87	2.52	173.99
Oct-17	95439	7.64	7.43	2.38	188.99

[2] Average annual final product output of the plant

Nov-17	75391	6.03	7.94	2.54	182.56
Dec-17	88939	7.12	8.18	2.62	198.11
Jan-18	93387	7.47	8.29	2.65	235.76
Feb-18	75176	6.01	6.46	2.07	168.77
Mar-18	69744	5.58	6.36	2.03	154.75

The major form of energy used in the plant is electricity which is imported from PGVCL grid supply at 11kV. Apart from electricity, furnace oil is the major source of thermal energy in the plant. Annually electricity cost accounts for 74.7% of the total fuel/energy cost and remaining 25.3% as thermal cost in the plant.

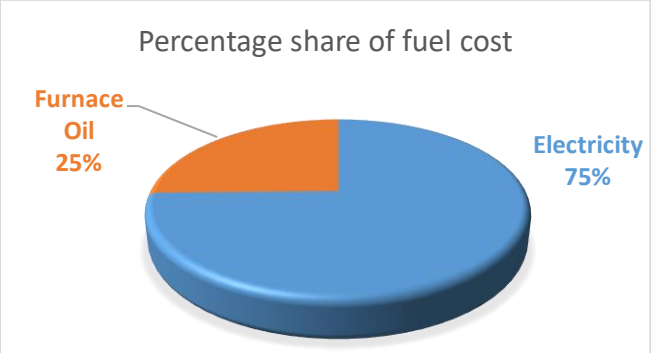


Figure 3: Percentage share of fuel cost

Based on the data collected from the plant, the graph below shows the variation of fuel cost over the last one year. Electricity cost was Rs. 6.6 Lakhs/month whereas the average thermal energy cost was Rs 2.25 Lakh/month.

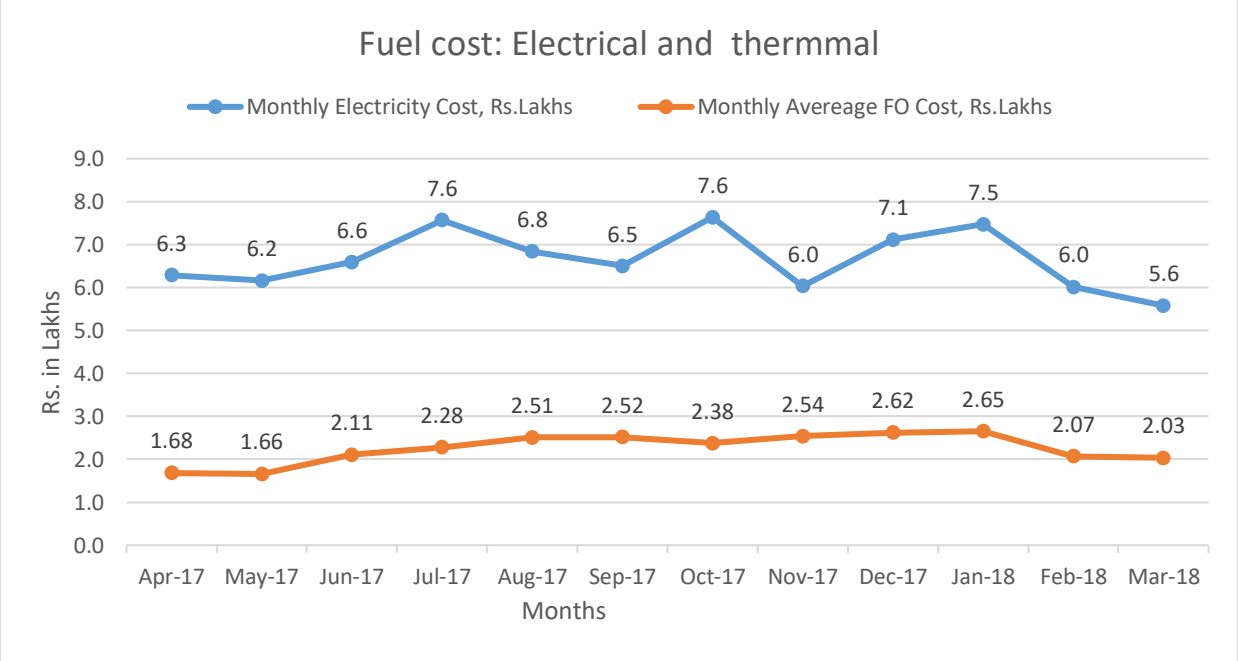


Figure 4: Fuel Cost Electrical and Thermal

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

3.1 Present System

Reheating furnace in brass industries is to reheat of raw material and 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 time and temperature of reheating of raw material.

During the feasibility study it was observed that most of the brass units are using inefficient furnace oil fired reheating furnace for reheating the brass billets and it was found that the efficiency of existing reheating furnace is low side. The following key reasons were contributing for the lower efficiencies of reheating furnaces:

Figure 5: Typical Reheating furnace

- **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. In a few cases it was observed a basic design recuperator was installed with a temperature gain of 20^{o}C and around 35% of heat input energy to reheating furnace was lost in the 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.
- **Location of Chimney**: In most of the unit's chimney was located at center of reheating furnaces; this causes the poor heat transfer between flue gasses and charge; this automatically leads to poor heat transfer efficiency between flue gas and reheating material.

- **Insulating Material**: Furnace lining of the existing furnace was done with the locally available firebricks. The firebricks with low alumina content tend to get worn out in a short duration and the insulation required for plugging heat loss through the furnace was usually done with locally available red bricks, which do not serve the purpose of insulation.

3.2 Observation and Analysis

The specific fuel consumption of the reheating furnace was estimated based on the data measured/collected during the field visit in the unit. The average quantity per batch has been estimated to be 697.3 kg per batch.

The detailed observed parameters for the 3 batches are given below:

Table 7: Operating Parameters for different batches

Parameters	Batch 1	Batch 2	Batch 3
Temperature of Inlet billet, ^{0}C	70	72	74
Temperature of Outlet billet, ^{0}C	820	800	810
Mass of output billet , kg	690	692	710
FO Consumption, kg	23.74	24.62	26.61
SEC(kg FO/Tonne)	34.41	35.58	37.48

The average production of the reheating section of the unit was estimated to be 6,973.33 kg per day. The specific power consumption of the unit was 35.82 kg FO/Tonne.

Based on the above observed/parameters/measured the overall efficiency of existing FO fired reheating furnace was 19.65% and the detailed calculation for the same is given below:

Table 8: Efficiency of furnace

Parameters	Value
Average mass of material during study, kg	697
Average temperature of Inlet billet, ^{0}C	70
Temperature of Outlet billet, ^{0}C	820
Specific heat of material, kCal/kg-^{0}C	0.09
Fuel Consumption, kg	24.99
Calorific Value of Fuel , kCal/kg	9,800.00
Heat Contained in material, kCal	48,116.00
Total Input to furnace , kCal	2,44,918.53
Furnace Efficiency, %	19.65

3.3 Recommendation

The process of reheating cost is one of the major costs in the overall brass manufacturing process, in typical brass manufacturing industry, which comes out to be `Rs. 1.04 to 1.07 per kg. The efficiency of the existing installed conventional reheating furnace was 19.65 % only in majority of the industries the furnaces are of very primitive design, which lead to increase in energy consumption in reheating furnace.

It is recommended to replace the existing furnace and install 2.3 Tonne/hr. capacity new energy efficient PNG fired furnace, equipped with following key design features:

- Energy efficient burners gas burners
- Air fuel ratio controller to optimize fuel consumption and improve reheating furnace efficiency
- Insulation of inside wall with high heat bricks, insulation of doors and chimney base to reduce radiation losses

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

- Improved product quality and overall plant productivity improvements
- Saving in reheating time - it automatically leads to energy savings
- Improved working environment

The design specifications of the new furnace are given below:

Table 9: Design Details of the new Furnace

Description	Specifications
Rated Capacity of furnace, kg/hr	2350
Process Temperature, °C(Minimum)	850
Useful dimensions of furnace	7500 mm (L) X 600 mm (W) X 1000 mm (H) max
Overall dimensions of furnace	7500 mm (L) X 1100 mm (W) X 2000 mm (H)
Capacity of Blower, HP	5 HP
No of burners required and make	Wesman or equivalent gas fired – 02 Nos. along with blower modulating type burners
Type of insulation	Fire bricks backed by insulation bricks and cera wool blankets on SW
Insulation thickens	300 mm at bottom and 200 mm at side walls

3.4 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

3.5 Savings

Energy consumption pattern and feasibility studies revealed that reheat operation in reheating furnaces depends on the design of the furnace, type and position of burners. Analysis was carried out on conventional reheating furnace and specific fuel consumption was found out to be 35.82litre/ton, whereas, specific gas consumption with proposed energy efficient gas fired reheating furnace is 26 Nm^3/ton[3]. The total average annual reheating production was 2008.32 tonnes hence; total furnace oil consumption in base case would be 71,945kg per year which will be replaced by gas and total gas consumption would be 52,216Nm^3 per year which will lead to an annual saving of 26.12 TOE/year and 93.88Ton/year CO_2 equivalent reduction.

Detailed savings calculations is given in below table

Table 11: Savings Calculation

Parameters	Value
Average No of batches per day, No	10
Annual operating days, days	288
Average production reheating per day, Tonne/day	6.97
Average Annual production reheating , Tonne	2,008.32
Efficiency of existing reheating furnace, %	19.65
Specific fuel consumption of conventional reheating furnace, Kg/Tonne	35.82
Efficiency of energy efficient reheating furnace,%	31.4
Specific fuel (Gas) consumption of energy efficient gas fire reheating furnace, Nm3/Tonne	26.0
Specific FO cost in existing furnace @32 /liter, Rs./Ton	1,146
Specific PNG cost in proposed furnace @29 /Nm3, Rs./Ton	754
Savings in fuel cost, Rs/Tonne	392
Total furnace oil consumption in base case, Kg/Year	71,945
Total gas consumption, Nm3/Year	52,216
Total annual monetary saving, Rs. Lakhs	7.88

[3] SEC Figure was provided by the OEM after conducting the detailed feasibility study in the plant

Investment Including GST and fixed cost for Gas connection, Rs. Lakhs	14.02
Payback period, Months	21
Annual Energy Saving, TOE/Year	26.12
CO_2 Reduction, Tons/Annum	93.88

4. FINANCIAL ANALYSIS

4.1 Project Cost

Table 12: Project Cost

Parameter	Amount in Rs Lakhs
Install New EE NG fired Reheating furnace	10.55
GST @18%	1.89
Approx. Piping and fixed Gas connection cost	1.57
Total Project Cost	14.02

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	Year 0	1 Year 1	2 Year 2	3 Year 3	4 Year 4	5 Year 5	6 Year 6	7 Year 7
Required Investment	14.02							
Energy Savings		7.9	8.0	8.2	8.4	8.5	8.7	8.9
O&M Cost		-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
Depreciation		5.6	3.4	2.02	1.2	0.7	0.4	0.3
Net Cash Flow	-14.02	12.8	10.7	9.5	8.9	8.6	8.4	8.4

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

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)	-14.02	11.6	8.8	7.1	6.0	5.2	4.7	4.2	33.5
NPV at CS 2 (50:50)	-14.02	11.4	8.6	6.8	5.7	4.9	4.3	3.9	31.7
NPV at CS 3 (100% Equity)	-14.02	11.1	8.1	6.3	5.1	4.3	3.6	3.2	27.6

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	78.03%	61.14%	42.69%
NPV at CS 1 (D70:E30)	33.51	23.53	13.55
NPV at CS2 (D50:E50)	31.68	20.35	11.33
NPV at CS3 (D0:E100)	27.59	18.98	10.37

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	78.03%	71.40%	64.61%
NPV at CS 1 (D70:E30)	33.51	29.52	25.52
NPV at CS2 (D50:E50)	31.68	27.86	24.04
NPV at CS3 (D0:E100)	27.59	24.15	20.70

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)	35.32	34.58	34.22	33.51	33.16	32.82

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, and 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 26.12TOE per annum. The proposed EE measure will result in decrease of CO_2 emissions by 93.88 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 reheating 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 26.12TOE per year with 93.88 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 /year)	Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual GHG reduction (T CO_2)
1	**Replacement of old FO fired reheating furnace with EE PNG fired furnace**	26.12	7.88	14.02	22	93.88

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 reheating furnace.

Table 21: Financial Analysis

Sl. No.	Particulars	Unit	Value
i	**Total Investment (Incl. of Tax)**	Rs. Lakh	14.02
ii	**Means of Finance**	Self / Bank Finance	Self
Iii	**IRR**	%	78.03
Iv	**NPV at 70 % Debt**	Rs. Lakh	33.5

7.1 Replication Potential

Most of the units in Jamnagar brass cluster are using basic design furnace oil fired reheating 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 – Gujarat Gas(PNG supplier)

GUJARAT GAS

13 July 2018

To,
M/s Gold Metal Extrusion,
Plot No. 770, GIDC phase-2,
Dared,
Jamnagar -361 004

Sub: Estimate of the Initial Connection Cost

Dear Sir,

With reference to the meeting had with you regarding the supply of Piped Natural Gas to your unit, the tentative cost of Connection is mentioned below as per the company's existing policy.

Please find the tentative connection cost and the pressure at which the gas could be supplied:

Sr. No.	Meter Type	Meter's Max. Flow	Max. Pressure	Conn. Cost Approx. with 18% GST (₹)
1	G-40 PD Meter	65 SCMH	110 Mbar	1,57,097.00

Please note that the above mentioned amounts may change/vary if there is any change in the company's policy.

Note:
1) The prevailing gas price is ₹37.08+ Prevailing taxes.
2) The Bank guarantee is to be submitted as per the below formula:
   Bank Guarantee Amount = DCQ (Daily Contracted Quantity)* 25 Days * Current Gas Price (With Tax)
3) In case the GSA (Gas Sales Agreement) is terminated, Gujarat Gas will take the Metering Skid / Meter into its custody and no amount apart from the bank guarantee would be returned/refunded.
4) Internal Piping work (After Meter Outlet) to be carried out by yourself as per guideline of Gujarat Gas.

We would also like to bring to your notice that this letter does not bind Gujarat Gas Limited to sign a Gas Sales Agreement with you.

Thanking you and assuring you of our best services.

Regards,

13.07.18.

Amit Goswami
Deputy Manager (Commercial & Marketing)
Gujarat Gas Limited

GUJARAT GAS LIMITED (A Group Company of GSPC – Government of Gujarat Undertaking) (Formerly known as GSPC Distribution Networks Limited)
Corporate Office : 2, Shanti Sadan Society, Near Parimal Garden, Ellisbridge, Ahmedabad - 380 006, Gujarat, India. **CIN :** L40200GJ2012SGC069118
Location Office : GUJARAT GAS CNG Station, Survey No.651/P2, Village:Chela, Jamnagar-Lalpur Highway, Taluka:Jamnagar-361001. **Tel.:** 0288-3081100
Registered Office : Gujarat Gas Limited, Gujarat Gas CNG Station, Sector 5/C, Gandhinagar – 382006, Gujarat.

8.2 Financial Quotation – Technology supplier

MATFAB ENGINEERING

Ref: - GME / 01 / 2018 /R0

Date:- 3rd JUNE 2018

Kind Attn: - Mr. Rameshbhai Viramgam

To,
M/S Gold Metal Extrusions
Jamnagar
Gujarat.
India.

Contact: - + (91) 9879610780
Email:- info@goldmetalextrusion.com

Subject: - Offer for natural gas fired billet re heating furnace of 2.3 T per hour capacity

Dear Sir,

We are very thankful to you for your valuable enquiry for the furnace

Our offer contains the following:

(1) Introduction
(2) Scope
(3) Technical Specifications
(4) Price
(5) Commercial Terms
(6) Payment terms
(7) Delivery
(8) Force Majeure
(9) Cancellation of order / orders
(10) Exclusions from the scope

Registered Office:
A 68, Paramsukh Society,,
B/H Navnirman High School,
Ranip, Ahmedabad -382480
Gujarat, India

Works:
Plot No. 5220 ,
Phase – IV, GIDC, Vatva,
Ahmedabad – 382445
Gujarat, India

Mobile:
+91 8141347273

Email:
info@matfabengineering.com
matfabengineering@gmail.com

Visit Us:
www.matfabengineering.com

(1) INTRODUCTION:-

We offer natural gas fired billet re heating furnace

(2) **SCOPE**:-

Our scope is to design, manufacture, supply, erection, commissioning and trial run of dual fuel fired re heating furnace. The furnace will have the features in brief as below:

- **Main Frame outer casing made of rigid structural steel;**

  The main outer casing will be made of rigid structural steel material with stiffeners in the frame in order to give strength. The main frame will be covered with a plate of suitable thickness.

- **Insulation;**

  The furnace inside will be insulated with high heat duty fire bricks backed up with insulation bricks and insulating material.
  All the doors will be lined with insulating castable.
  Chimney base will be lined with insulating materials.

- **Hydraulic Pusher Assembly for charging:**

  A single block type hydraulically operated pusher assembly along with the hydraulic power pack unit will be provided at the charging end to push the charging billets inside the furnace chamber.

- **Burners;**

  Weman or equivalent make gas burners of suitable no and capacity will be provided in order to achieve temperature in the furnace. These burners are very efficient burners and consume less energy compared to similar other burners with very minimum maintenance and ease of availability in terms of spares.

- **Combustion air blower ;**

  There will be one no of combustion air blower along with the motor and a damper to supply the combustion air to the burner system.

- **Door;**

  There will be two no of doors at each end of the furnace. The doors will be fabricated from structural steel and will be insulated with proper insulation in order to prevent the heat inside the furnace.

- **Control panel** ;

  A control panel will be made of sheet steel metal fabricated. It will house On and Off switches, emergency off, **automatic temperature controller for accurate temperature measurement**, Indicators and push buttons, switch gears for blowers, and fuel operation system.

- **Thermocouples for temperature measurement:**

  Suitable no of thermocouples will be provided in order to measure the temperature inside the furnace chamber.

Registered Office:
A 68, Paramsukh Society.,
B/H Navnirman High School,
Ranip, Ahmedabad -382480
Gujarat, India

Works:
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Phase – IV, GIDC, Vatva,
Ahmedabad – 382445
Gujarat, India

Mobile:
+91 8141347273

Email:
info@matfabengineering.com
matfabengineering@gmail.com

Visit Us:
www.matfabengineering.com

(3) TECHNICAL SPECIFICATIONS:-

Sr No.	Description	Specifications
01	Type of furnace	Natural Gas fired billet re heating furnace
02	Application	For Brass billet re Heating
03	Material load	2350 Kg per hour Maximum
04	Process Temperature	Minimum 850 Degree C
05	Weight of one billet	41 Kg min.
06	Billet size	5" dia. X 19" lg
07	Useful dimensions of the furnace	7500 mm (L) X 600 mm (W) X 1000 mm (H) max
08	Overall dimensions of the furnace	7500 mm (L) X 1100 mm (W) X 2000 mm (H)
09	Insulation Thickness	300 mm at bottom and 200 mm at side walls
10	Type of Insulation	Fire bricks backed by insulation bricks and cera wool blankets on SW
11	No of burners	Wesman or equivalent gas fired – 02 Nos. along with blowe modulating type burners
12	Fuel to be used	Gas
13	App consumption of fuel per hour	49.11 m3 initially then 34.78 m3 per hr
14	HP of combustion air blower	5 HP
15	Gas and Air line	Complete with all flow control and regulating valves and fittings
16	Flue duct and chimney	Flue will exhaust from furnace top near charging end and will be lined from inside and connected to chimney
17	Temperature controlling system	Automatic through micro processor based programmable type PID controller and modulating motor
18	Excess temperature safety	Digital On Off type with solenoid valve

(4) PRICE:-

Sr No	Description	Qty.	Price In Rs
01	Design, Manufacture, supply, erection, commissioning and trail run of gas fired brass billet re heating furnace suitable for your application and as per the specifications and scope mentioned above	01 Set.	10,55,000.00 (Rupees Ten Lac Fifty Five Thousand Only)

(5) COMMERCIAL TERMS

Price Basis:	Ex our works at Ahmedabad
Taxes and duties: -	Extra as applicable (GST)
Transportation	Extra by customer
Insurance:	Extra by customer
Packing Charges	Included
Validity of the offer	15 Days from the date here on

(6) **PAYMENT TERMS:-**

40% as an advance along with the purchase order
55% Balance on inspection clearance prior to despatch as decided and mutually agreed billing schedule.
5% after successful commissioning of the furnace

Registered Office:
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matfabengineering@gmail.com

Visit Us:
www.matfabengineering.com

(7) DELIVERY :-

The delivery period for the above mention items shall start after 10 to 12 weeks from the date of technically and commercially clear purchase order along with the advance payment.

(8) FORCE MAJEURE: -

The company will not be under in liability of what so ever type or kind of to the customer / buyer for non performing / part performing of job / jobs / project / order or non performance / part performance occurs because of the force majeure.

(9) CANCELLATION OF ORDER / ORDERS: -

Once the order placed cannot be cancelled for any reason. If the order will be cancelled then the advance given by the customer will not be returned and will be forfeited.

(10) **EXCLUSIONS FROM OUR SCOPE :-**

1. All the civil foundation work including the foundation bolts are excluded from our scope however we will provide the foundation drawing showing the load details
2. All the support structure and rail for furnace are excluded from our scope.
3. All the electrical cablings up to the point of use including between the furnace and the control panel and up to the control panel are to be provided by you and are excluded from our scope
4. All the transportation, loading and unloading and material handling facility during the erection / commissioning / trial of the furnace are excluded from our scope
5. All the skilled and unskilled man power as required at site during the erection / commissioning / trial of the furnace / oven are excluded from our scope.
6. Raw material for taking the trial of the oven is excluded from our scope.
7. To and fro charges, lodging, boarding and accommodation to our engineer / supervisor / worker / workers to be provided by you free of cost for installation and commissioning of the oven.
8. Tools, tackles and other materials which are not mentioned but required during the installation and commissioning of the furnace are excluded from our scope of supply.
9. Recuperator and chimney are excluded from our scope of supply.

Thanking You,

With best regards,

Rajesh Gohel
CEO
Matfab Engineering
Plot No. 5220,
Phase – IV,
Near Ramol Cross Road,
GIDC,
Vatva,
Ahmedabad.
Gujarat.
India.
Mobile: +91 8141347273
Email: matfabengineering@gmail.com , info@matfabengineering.com
Visit us: www.matfabengineering.com