July 2018

DETAILED PROJECT REPORT
ON
REPLACEMENT OF EXISITING INDUCTION FURNACE NEW IGBT TYPE FURNCE

M/s Top Manufacturing Company –Jamnagar Brass Cluster

Submitted to

(Prepared under GEF-UNIDO-BEE Project)

Bureau of Energy Efficiency
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Prepared by

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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
PV	Photovoltaic
RE	Renewable Energy
TOE	Tonnes of Oil Equivalent
UNIDO	United Nation Development Organization
IGBT	Insulated Gate Bi-polar Transistor
SCR	Silicon Controlled Rectifier

ACKNOWLEDGEMENT

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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.

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Last but not least we are thankful to Top Manufacturing company especially Mr. Maganbhai, 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	Top Manufacturing company
Name(s) of the Plant Head	Mr. Magan Bhai
Contact person	Mr. Magan Bhai
Constitution	Private Company
MSME Classification	Small
Address:	C-2/30, Gidc : Udyog Nagar, Shankar Tekri, Shankar Tekri, Jamnagar, Gujarat 361004
Industry-sector	Manufacturing

1.2 Proposed EE Measure

During the plant visit it was observed that the plant was operating with old Thyristor type induction melting furnace and has a scope of replacing it with energy efficient IGBT type induction

melting furnace. After discussion with the plant team and technology supplier, it was proposed to replace the old furnace at Top Manufacturing Company. The expected reduction in energy consumption is 1,09,848kWh per year, which will lead to an annual saving of Rs. 8.57 lakhs. The details of the proposed EE measure are given in below:

Table 2: Proposed EE Measure

Sl No	EE Measure	Annual Energy Savings (kWh)	Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual GHG reduction (T CO_2)
1	**Replacement of existing induction furnace new IGBT type furnace**	1,09,848	8.57	26.29	37	90.08

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	26.29
ii	**Means of Finance**	Self / Bank Finance	Self
Iii	**IRR**	%	48.80
Iv	**NPV at 70 % Debt**	Rs. Lakh	31.4

2. INTRODUCTION ABOUT TOP MANUFACTURING COMPANY

2.1 Unit Profile

Top manufacturing company in involved in manufacturing of high quality brass rods, brass profiles & section and brass components related to automobile industry. Top manufacturing company is committed to providing quality products, services and value to their customers by creating an efficacy in manufacturing and delivery. Through excellence in its people, consistent quality and meticulous executions, company is providing raw materials to clients in various sectors such as auto components, plumbing, electric and agriculture. Top manufacturing has developed practices to create a hazard free and accident free working environment and systems like fume arrestor to make the processes friendly to the humans.

Table 4: Unit Profile

Particulars	Details
Name of Plant	Top Manufacturing company
Name(s) of the Plant Head	Mr. Magan Bhai
Contact person	Mr. Magan Bhai
Contact Mail Id	info@tyretubevalvestem.com
Contact No	+91 9824512448
Constitution	Private Company
MSME Classification	SME
No. of years in operation	-
No of operating hrs./day	24 hrs.
No of operating days/year	300 Days
Address:	C-2/30, Gidc : Udyog Nagar, Shankar Tekri, Shankar Tekri, Jamnagar, Gujarat 361004
Industry-sector	Manufacturing
Type of Products manufactured	Extruded Brass Rods, Brass Sections & profiles and brass components

2.2 Production Details

The various products manufactured in Top manufacturing company are Extruded Bars Rods, Brass section & profiles and Brass components for automotive sector. Last year plant had an average finished product output of 140.41 Ton per month[1]. The graph below shows the different Brass products manufactured during last one year:

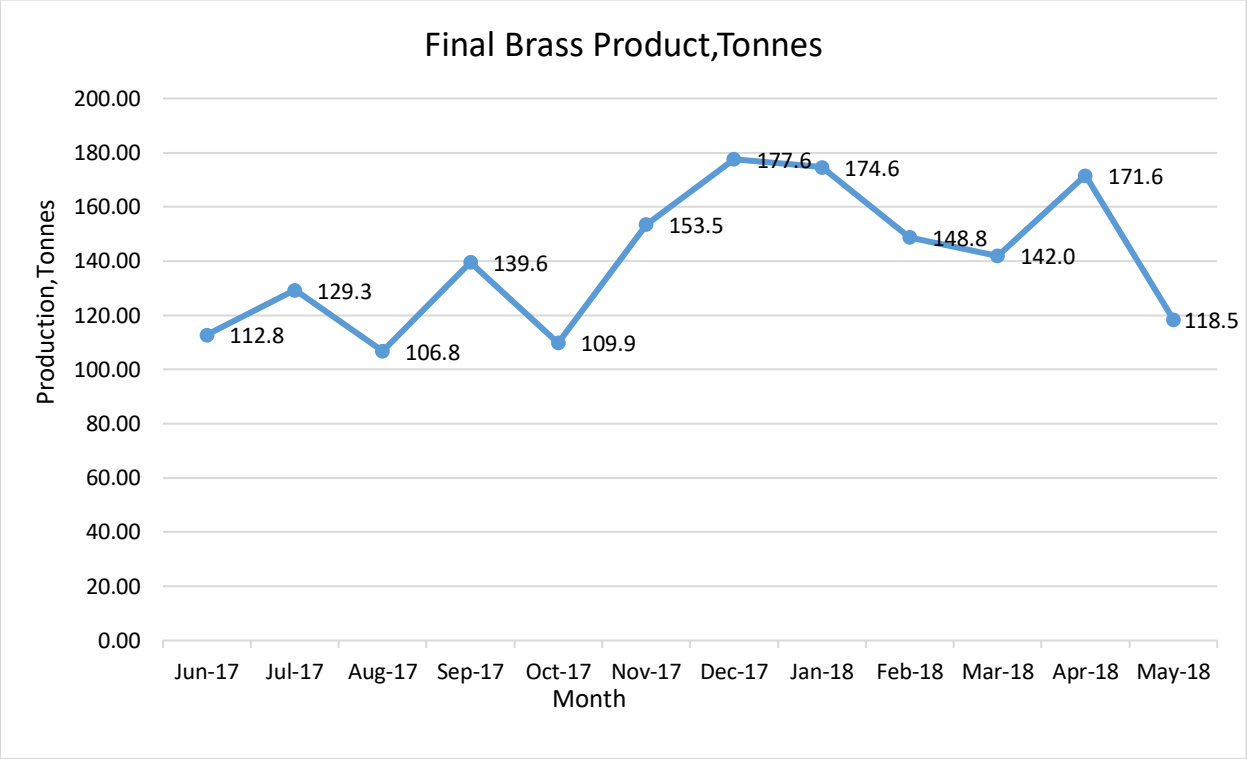


Figure 1: Production Details

[1] Finished brass goods

2.3 Typical Brass Production Flow Diagram

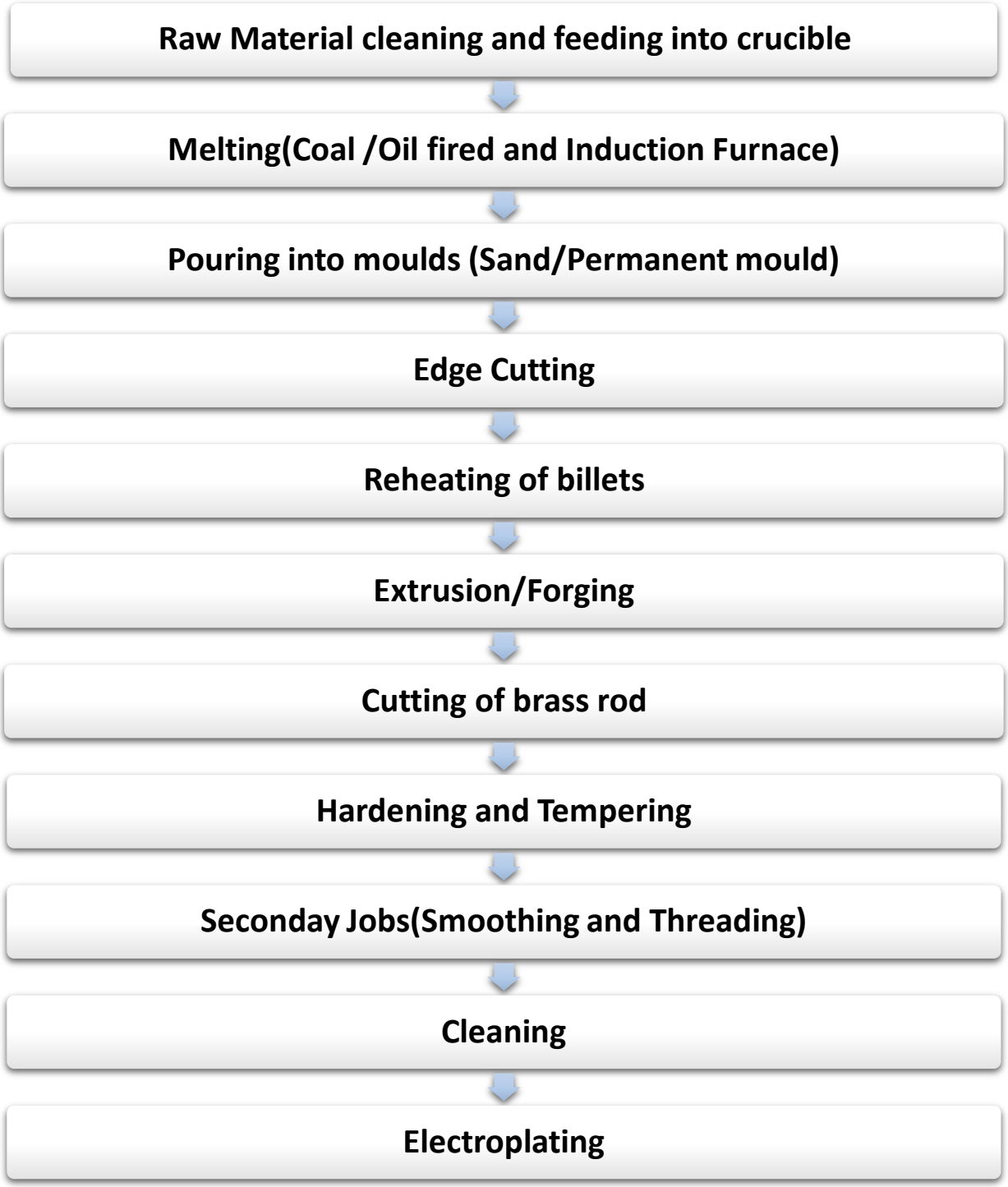


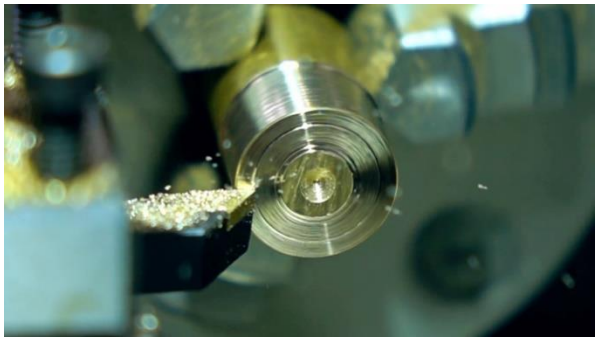
Figure 2: Typical Process Flow Chart

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, 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: Energy Consumption and Finished product Details

Month	Electricity Consumption (kWh)	Total Electricity Bill , Rs.(Lakhs)	Total Fuel Consumption, FO (Tonnes)	Total Fuel Bill, Rs(Lakhs)	Final Product, Tonnes[2]
Jun-17	38991	2.92	3.20	1.02	112.78
Jul-17	42590	3.17	3.41	1.09	129.33
Aug-17	41750	3.04	3.12	1.00	106.78
Sep-17	30345	2.27	4.08	1.30	139.59
Oct-17	42777	3.13	3.17	1.01	109.86
Nov-17	51622	3.75	4.63	1.48	153.51
Dec-17	64825	4.67	5.18	1.66	177.57

[2] Average annual final product output of the plant was approximately 17% less than the melting production due to processing losses of brass alloy at different stages like casting, reheating, extrusion and machining.

Jan-18	53042	3.85	5.18	1.66	174.64
Feb-18	55024	3.92	5.19	1.66	148.83
Mar-18	43837	3.18	3.18	1.02	141.99
Apr-18	60247	4.30	4.60	1.47	171.56
May-18	59185	4.08	4.54	1.45	118.49

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 72.75% of the total fuel/energy cost and remaining 27.25% as thermal cost in the plant.

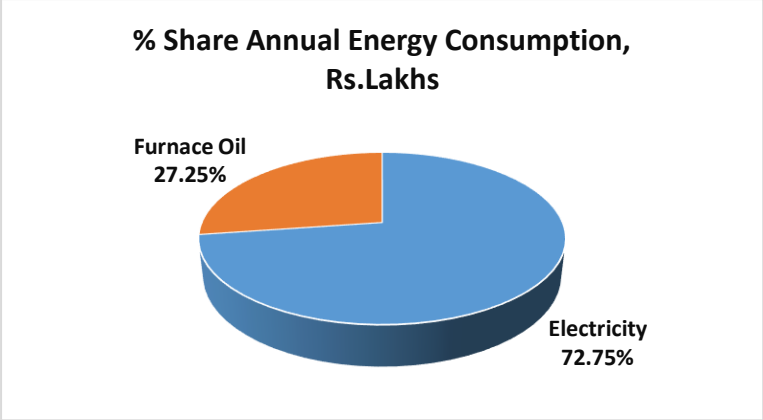


Figure 3: Percentage share of fuel cost

Based on the data collected from the plant, the graph below shows the variation of fuel cost over the last one year. Average electricity cost is Rs. 3.52 Lakhs/month whereas the average thermal energy cost is Rs. 1.32 Lakh/month.

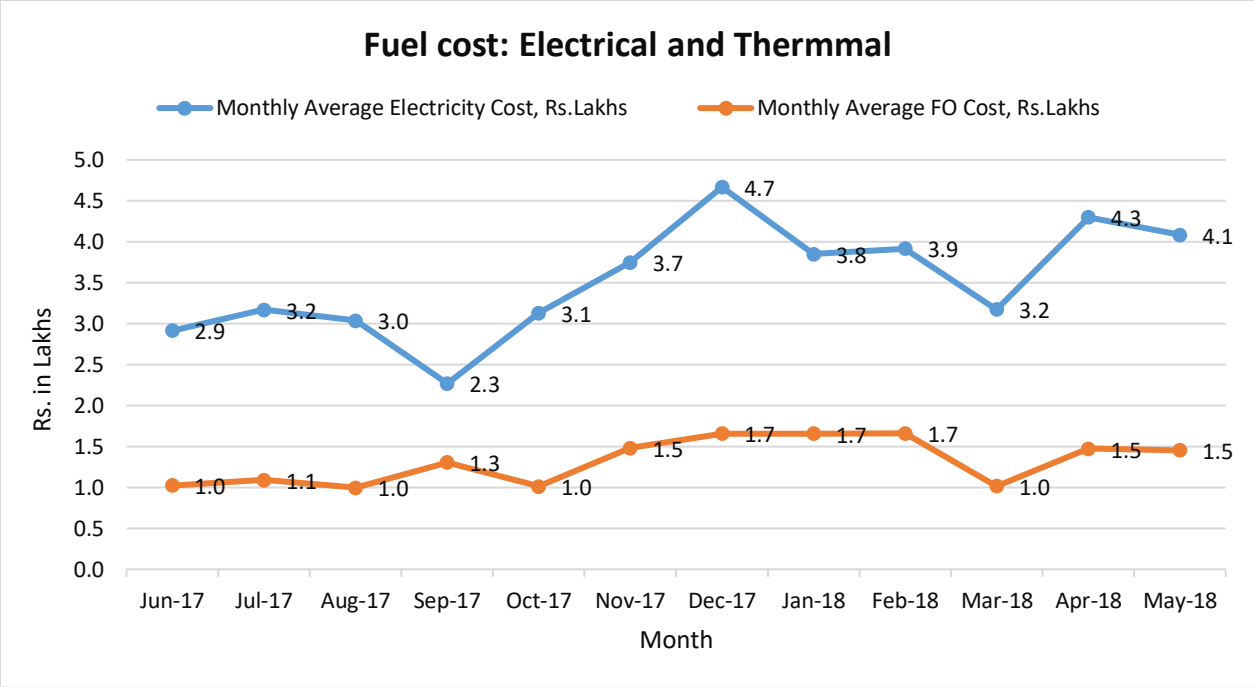


Figure 4: Fuel Cost Electrical and Thermal

3. PROPOSED EE MEASURE – REPLACEMENT OF EXISTING INDUCTION FURNACE WITH NEW IGBT TYPE INDUCTION FURNACE

3.1 Present System

Based on the measurements, observations/ findings during detailed assessment study conducted in the unit, it was found that the plant has the scope of improving the energy efficiency in the induction melting furnace. Top Manufacturing has installed an induction furnace of rated capacity of 100 kW with one crucible of capacity of 300 kg each for melting.

The operational parameters of the induction furnace including the electricity consumption and material charged were measured during the detailed assessment study along with the analysis of the past one year energy consumption and yield data. The operating parameters of the furnace during the study were given below:

Table 7: Existing Furnace Operating Parameters

Operating Parameters	Value
Equipment	Induction furnace
Type	Thyristor
Make	-
Purpose/Application	Melting
Rated Capacity	300kg
Operating Capacity of the furnace	340kg to 375kg
Operating Temperature (°C)	970
Mode of operation (batch/continuous)	Batch
Batch duration , minute	72 – 76
Electricity consumption, kWh	314.67 - 332.35 units/ tonne of melt

3.2 Observation and Analysis

The specific power consumption of the induction furnace was estimated based on the data measured/collected during the field visit in the unit. The electrical unit consumption was taken for 6 cycles[3] from the dedicated electricity board energy meter provided for the induction furnace. The unit was charging 100% brass scrap (approximately 60% and 40% Zinc) in a batch. The average melting per batch has been estimated to be 355.83 kg per batch based on the data

[3] The scan copy of electrical log book sheet is attached in annexure

provided by the plant. The plant was taking more liquid metal yield from the crucible than the design capacity.
The detailed observed parameters for the 6 cycles are given below:

Table 8: Operating Parameters for different cycles

Parameters	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6
Unit Consumption	114.5	113	117	113	116	118
Liquid Metal Yield, kg	350	340	370	340	360	375
Cycle Time, Minutes	76.0	72.0	72.0	74.0	73.0	72.0
SEC(kWh/Tonne)	327.14	332.35	316.22	332.35	322.22	314.67

The average production of the melting section of the unit is estimated to be 6,760.83kg melt production per day. The specific power consumption of the unit is estimated to be 324.16 kWh per tonne of liquid metal. The trend for power consumption and Brass melt in the induction furnace is shown below:

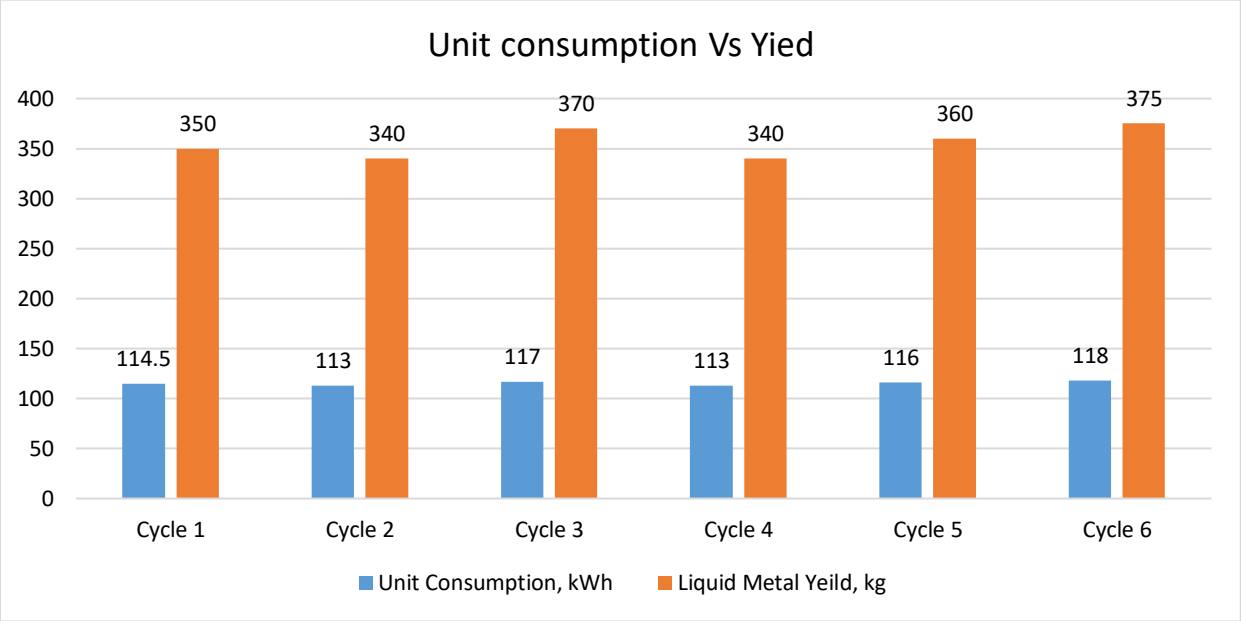


Figure 5: Trend for Energy consumption Vs Brass melt

The specific energy consumption was higher than the consumption in similar categories of furnaces with IGBT technology. Therefore, it is recommended to replace the existing induction furnace with a new induction furnace.

3.2 Recommendation

The unit has expansion plans and wants to upgrade the induction melting capacity from existing 300kg to 500kg with new IGBT technology. The proposed induction furnace specifications include

175 kW capacity of power panel and 500 kg crucible capacity. The specific energy consumption of new furnace would be 270kWh[4] per tonne as specified by vendor.

Key Advantages of replacing the conventional furnace with energy efficient furnace are:

- Inbuilt touch screen human machine interface (HMI) for better monitoring and controlling of power consumption and have up to 10 years storage facility of data like KWh consumed, daily/shift wise production report, tripping log ETC.
- IBGT based furnaces have higher efficiency in comparison to thyristor one
- Automatic Sintering facility with different sintering pattern to optimize the power consumption as the requirement of refractory mass material
- Near unity power factor (> 0.98) at any power level and any metal level which will reduce the overall power consumption in the furnace
- Constant output within specified range of input voltage variation to have better melting rate

The design specifications of the new IGBT type 175kW induction furnace are given below:

Table 9: Design Details of the new Furnace

Description	Rating
Rated Power, kW	175
Total Input, kVA	179
Input PF	0.98
Input Voltage, Volts	415
Output Frequency, Hz	500
Output Voltage, Volts	1050
Pouring Temperature for Brass, °C	1175
Nominal Capacity of furnace, Kg	500

3.3 Suppliers Details

Table 10: Supplier Detail

Equipment Detail	IGBT Induction Furnace
Supplier Name -1	Electrotherm India
Address	Survey No. 72, Village, Palodia, Taluka, Kalol, Dist. Gandhinagar - 382 115 Gujarat, India.
Contact Person	Kalpesh Chavda
Email Id	kalpesh.chavda@electrotherm.com
Supplier Name -2	Inductotherm India

[4] SEC figure was provided by OEM for small capacity furnaces

Address	Plot no. SM-6, Road no. 11, Sanand-II Industrial Estate, BOL Village, Sanand, Ahmedabad - 382170
Contact Person	Nishant Singh
Email Id	nsingh@inductothermindia.com
Supplier Name -3	Indo Power Furnace Pvt Ltd
Address	No. 56/ A - 4, Phase - 1,G. I. D. C., Vatva, Ahmedabad - 382445, Gujarat, India
Contact Person	Nandlal Pate
Email Id	indopowerfurnace@gmail.com

3.4 Savings

The estimated annual energy savings by replacement of existing SCR type induction furnace with IGBT type furnace is 1,09,848kWh equivalents to a monetary saving of Rs. 8.57 lakh. The investment requirement is Rs 26.29 lakh with a simple payback period of 37 months.
The replacement of the furnace will lead to a saving of 9.45 TOE/year and 90.08Ton/year CO_2 equivalent reduction.

Detailed savings calculations is given in below table:

Table 11: Savings Calculation

Parameters	Unit	Existing System	Proposed System
Furnace Type	-	Thyristor	IGBT
Electrical Capacity of furnace	kW	100	175
Capacity of Crucible	Kg	300	500
Average Specific energy consumption	kWh /Tonne	324.16	270
Average Cycle time	Minute per batch	73.17	65.00
Average heat Cycles per day		19	
Annual Operating days		300	
Average melting of Brass per cycle	kg	355.83	
Annual Melting of Brass	Tonne	2,028.25	
Annual Energy consumption on base brass production(Existing)	kWh/ Year	6,57,475	5,47,628
Annual energy saving on existing melting	kWh/year		1,09,848
Electricity cost	Rs/kWh		7.8
Total annual monetary saving	Rs. Lakhs		8.57
Investment Including GST@18%	Rs. Lakhs		26.29
Payback period	Months		37
Annual Energy Saving	TOE/Year		9.45
CO_2 Reduction	Tonnes/year		90.08

4. FINANCIAL ANALYSIS

4.1 Project Cost

Table 12: Project Cost

Parameter	Amount in Rs Lakhs
Installation of new IGBT type induction furnace	15.21
GST @18%	2.74
New cooling tower and EE Transformer with GST@18%	8.34
Total Project Cost	26.29

4.2 Assumptions for Financial Analysis

- Interest rate taken as 12 %
- Yearly increase in fuel cost by 2% for cash flow analysis
- Depreciation method: Reducing balance method
- Depreciation rate: 40% [5]
- 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, 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	26.29							
Energy Savings		8.6	8.7	8.9	9.1	9.3	9.5	9.6
O&M Cost		-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3
Depreciation		10.5	6.3	3.79	2.3	1.4	0.8	0.5
Net Cash Flow	-26.3	17.8	13.7	11.4	10.0	9.3	9.0	8.8

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

The table below shows the various capital structure assumed for the project finance

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)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	NPV
NPV at CS 2 (50:50)	-26.29	16.1	11.3	8.5	6.8	5.7	5.0	4.4	31.4
NPV at CS 3 (100% Equity)	-26.29	15.9	11.0	8.2	6.5	5.4	4.6	4.1	29.3

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

A good sensitivity analysis will help to estimate the behavioral nature thereby helping to understand the financial viability over a long period of time.

Table 16: Sensitivity analysis: based on energy savings

Sensitivity analysis: based on energy savings			
	at 100% Savings	at 75% Savings	at 50% Savings
IRR	49%	37%	25%
NPV at CS 1 (D70:E30)	31.4	20.5	9.7
NPV at CS2 (D50:E50)	29.30	16.84	7.03
NPV at CS3 (D0:E100)	24.61	15.25	5.88

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	49%	44%	40%
NPV at CS 1 (D70:E30)	31.4	27.0	22.7
NPV at CS2 (D50:E50)	29.30	25.1	21.0
NPV at CS3 (D0:E100)	24.61	20.9	17.1

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)	33.45	32.61	32.19	31.38	30.99	30.59

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 9.45TOE per annum. The proposed EE measure will result in decrease of CO_2 emissions by 90.08 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 9.45TOE per year with 90.08 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 (kWh)	Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual GHG reduction (T CO_2)
1	**Replacement of existing induction furnace new IGBT type furnace**	1,09,848	8.57	26.29	37	90.08

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 IGBT based Induction furnace.

Table 21: Financial Analysis

Sl. No.	Particulars	Unit	Value
i	**Total Investment (Incl. of Tax)**	Rs. Lakh	26.29
ii	**Means of Finance**	Self / Bank Finance	Self
Iii	**IRR**	%	48.80
Iv	**NPV at 70 % Debt**	Rs. Lakh	31.4

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 Quotation for Furnace

SALES CONTRACT

This is the minutes of meeting between Kalpesh Chavda of Electrotherm (India) Limited, Palodia, Ahmedabad (supplier) and MR. MAGANBHAI of TOP MANUFACTURING COMPANY (customer) on 1/2/2018 at Jamnagar on the supply of induction melting furnaces. Based on Quotation No. ET/I/ABD/SQ/20947/17-18, Dated-30/1/2018

TOP MANUFACTURING COMPANY (customer) hereby confirms a purchase order on Electrotherm (India) Limited, Palodia, Ahmedabad for Induction Furnace System (Equipment).

CUSTOMER DETAILS

Customer's Name & City: **TOP MANUFACTURING COMPANY**, Jamnagar

Delivery Address: **SHED NO. C-2/30 G.I.D.C., PHASE-I, SHANKAR,TEKRI,JAMNAGAR – 361 004 (GUJARAT) INDIA**

GSTN No. 24AAOPP4622P1Z5	ECC No.:
Director: **MR. MAGANBHAI**	Mobile No.: 9824512448
Contact Person (Site): **MR. MAGANBHAI**	Designation: Director
Contact No. 9824512448	E-mail: **info@tyretubevalvestem.com**

EQUIPMENT DETAILS

	Description							Quantity
1	PSU	Type	Model	KW	Volt	Frequency	Remarks	1
			Ig-Nite	175	415	500		
2	Furnace	Type	Model	Kg1	Kg2		Remarks	1
			Alu. Frame	500				
3	Remote							1
Note	For detailed Scope of Supply Please refer to quotation or attach extra sheet							

** Please refer quotation for additional details and requirements on melt rate.*

Basic Price (Ex works Palodia, Ahmedabad) for the items 1 to 3 above: Rs. 15.21 L (Rupees-Fifteen Lakh Twenty Thousand only).

Packing Charges : Extra at Rs. 1 %

Additional details on scope of supply, technical specifications and customer's scope of supply are mentioned quotation referred above.

Payment Terms: Rs. 6, 00,000 advance by Cheque NO. 009575, State Bank Of India,IFC Code-SBIN0060170
Balance payment together with taxes and duties and other applicable expenses by DD payable at Ahmedabad before Despatch.
Note: Advance is non-refundable.

Delivery: 60 Days from the date of receipt of 40% advance and drawing approval whichever is later in the process.
Note: It takes minimum 5-7 days for dispatch after full and final Payment for final testing, packing and Handling.

Taxes and duties (applicable at the time of despatch) and other commercial terms as indicated in the "Standard Terms and Conditions" included in the quotation No **ET/I/ABD/SQ/20947/17-18, Dated-30/1/2018**

The above mentioned details are acceptable to **TOP MANUFACTURING COMPANY** and Electrotherm (India) Ltd., and this form can be considered this as customer's purchase order on Electrotherm (India) Ltd.

Warranty: As per Quotation.

Erection and Commissioning and local conveyance Charges: Included in above mention prise.

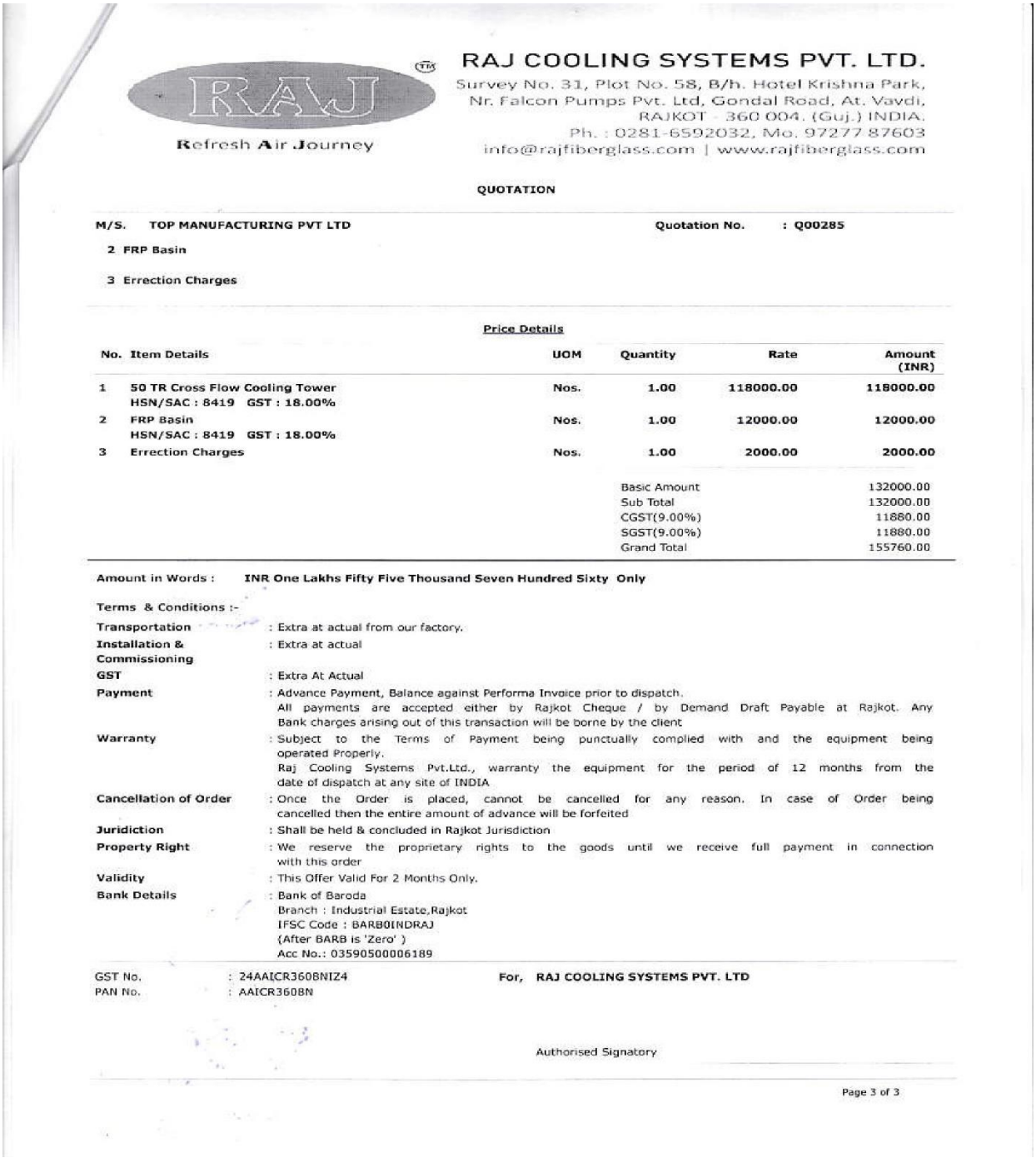
For ELECTROTHERM (INDIA) LTD.

Sales Executive

For Top MANUFACTURIN COMPANY

Authorised Signatory

8.2 Quotation for new cooling tower



RAJ
Refresh Air Journey

RAJ COOLING SYSTEMS PVT. LTD.
Survey No. 31, Plot No. 58, B/h. Hotel Krishna Park,
Nr. Falcon Pumps Pvt. Ltd, Gondal Road, At. Vavdi,
RAJKOT - 360 004. (Guj.) INDIA.
Ph. : 0281-6592032, Mo. 97277 87603
info@rajfiberglass.com | www.rajfiberglass.com

QUOTATION

M/S. TOP MANUFACTURING PVT LTD — **Quotation No. : Q00285**

2 FRP Basin

3 Erection Charges

Price Details

No.	Item Details	UOM	Quantity	Rate	Amount (INR)
1	50 TR Cross Flow Cooling Tower HSN/SAC : 8419 GST : 18.00%	Nos.	1.00	118000.00	118000.00
2	FRP Basin HSN/SAC : 8419 GST : 18.00%	Nos.	1.00	12000.00	12000.00
3	Erection Charges	Nos.	1.00	2000.00	2000.00

Basic Amount	132000.00
Sub Total	132000.00
CGST(9.00%)	11880.00
SGST(9.00%)	11880.00
Grand Total	155760.00

Amount in Words : INR One Lakhs Fifty Five Thousand Seven Hundred Sixty Only

Terms & Conditions :-

Transportation	: Extra at actual from our factory.
Installation & Commissioning	: Extra at actual
GST	: Extra At Actual
Payment	: Advance Payment, Balance against Performa Invoice prior to dispatch. All payments are accepted either by Rajkot Cheque / by Demand Draft Payable at Rajkot. Any Bank charges arising out of this transaction will be borne by the client
Warranty	: Subject to the Terms of Payment being punctually complied with and the equipment being operated Properly. Raj Cooling Systems Pvt.Ltd., warranty the equipment for the period of 12 months from the date of dispatch at any site of INDIA
Cancellation of Order	: Once the Order is placed, cannot be cancelled for any reason. In case of Order being cancelled then the entire amount of advance will be forfeited
Juridiction	: Shall be held & concluded in Rajkot Jurisdiction
Property Right	: We reserve the proprietary rights to the goods until we receive full payment in connection with this order
Validity	: This Offer Valid For 2 Months Only.
Bank Details	: Bank of Baroda Branch : Industrial Estate,Rajkot IFSC Code : BARB0INDRAJ (After BARB is 'Zero') Acc No.: 03590500006189

GST No. : 24AAICR3608NIZ4
PAN No. : AAICR3608N

For, RAJ COOLING SYSTEMS PVT. LTD

Authorised Signatory

Page 3 of 3

8.3 Quotation for EE Transformer

IS-1180
Part-1
7200040284

ISO:9001:2000

SKP Transformers
World Class Technology

REF: SKP/QUT/800/17-18

QUOTATION: Date: 12/02/2018

To,
M/s.Top Manufacturing Company.
Jamnagar.

SUB: Quotation for supply of 315 KVA Distribution Transformer as per IS:1180
(Energy Efficiency Level-2)

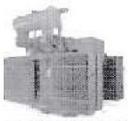
Dear Sir,
With reference to our previous offer and discussion & negotiation with you, we herewith submit our revise offer as follows:

1) Technical specifications with list of accessories.
2) Price Schedule.

Thanking You,
Yours truly,
FOR SKP TRANSFORMERS

PARTNER

1



Works: Plot No.519, P.O.Rakanpur, Ta. Kalol, Gandhinagar(N.G.) Phone: (02764)286342
Email: skptrans@rediffmail.com

IS-1180
Part-1
7200040284

ISO:9001:2000

SKP Transformers
World Class Technology

PRICE SCHEDULE

PRICE :

315 KVA : **Rs. 5,75,000=00 (Rs. Five Lac Seventy Five Thousands Only)**

COMMERCIAL TERMS & CONDITIONS:

- Above rates are Ex. our works Rakanpur based.
- Transformer is inclusive of first filling of oil.
- Statuary Taxes & duties will be charged extra as actual at the time of dispatch.

- GST : GST @ 18% will be charged extra.
- Delivery : Within 6 weeks after receipt of your order.
- Freight : Will be charged extra.
- Warranty : Transformer is warranted for the period of 12 months from the date of supply
- Payments : 40% in advance along with order and balance against Performa Invoice.
- Validity : 30 days from the date of offer.
- Inspection : Inspection & testing shall be carried out at our works.

Awaiting for your valued order.

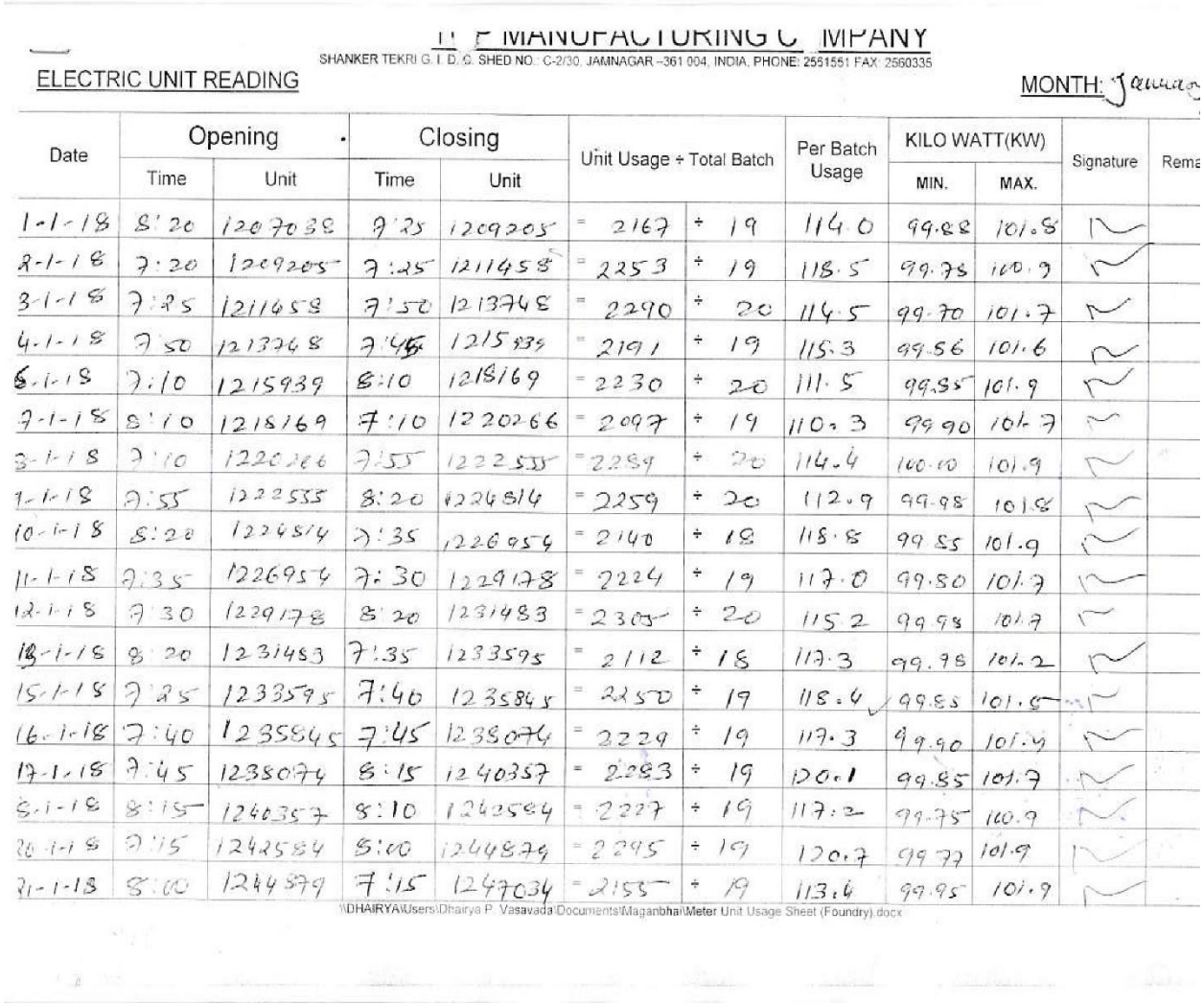
Thanking You,
Yours truly,
FOR SKP TRANSFORMERS

PARTNER

5

Works: Plot No.519, P.O.Rakanpur, Ta. Kalol, Gandhinagar(N.G.) Phone: (02764)286342
Email: skptrans@rediffmail.com

8.3 Log book scan copy



IT F MANUFACTURING C MPANY
SHANKER TEKRI G. I. D. C. SHED NO.: C-2/30, JAMNAGAR -361 004, INDIA. PHONE: 2551551 FAX: 2560335

ELECTRIC UNIT READING

MONTH: January

Date	Opening		Closing		Unit Usage ÷ Total Batch		Per Batch Usage	KILO WATT(KW)		Signature	Rema
	Time	Unit	Time	Unit				MIN.	MAX.		
1-1-18	8:20	1207038	9:25	1209205	= 2167	÷ 19	114.0	99.88	101.8		
2-1-18	7:20	1209205	7:25	1211458	= 2253	÷ 19	118.5	99.78	100.9		
3-1-18	7:25	1211458	7:50	1213748	= 2290	÷ 20	114.5	99.70	101.7		
4-1-18	7:50	1213748	7:45	1215939	= 2191	÷ 19	115.3	99.56	101.6		
5-1-18	7:10	1215939	8:10	1218169	= 2230	÷ 20	111.5	99.85	101.9		
7-1-18	8:10	1218169	7:10	1220266	= 2097	÷ 19	110.3	99.90	101.7		
8-1-18	7:10	1220266	7:55	1222535	= 2269	÷ 20	114.4	100.00	101.9		
9-1-18	7:55	1222535	8:20	1224814	= 2259	÷ 20	112.9	99.98	101.8		
10-1-18	8:20	1224814	7:35	1226954	= 2140	÷ 18	118.8	99.55	101.9		
11-1-18	7:35	1226954	7:30	1229178	= 2224	÷ 19	117.0	99.80	101.7		
12-1-18	7:30	1229178	8:20	1231483	= 2305	÷ 20	115.2	99.98	101.7		
13-1-18	8:20	1231483	7:35	1233595	= 2112	÷ 18	117.3	99.98	101.2		
15-1-18	7:25	1233595	7:40	1235845	= 2250	÷ 19	118.4	99.85	101.5		
16-1-18	7:40	1235845	7:45	1238074	= 2229	÷ 19	117.3	99.90	101.4		
17-1-18	7:45	1238074	8:15	1240357	= 2283	÷ 19	120.1	99.85	101.7		
5-1-18	8:15	1240357	8:10	1242584	= 2227	÷ 19	117.2	99.75	100.9		
20-1-18	7:15	1242584	8:00	1244879	= 2295	÷ 19	120.7	99.77	101.9		
21-1-18	8:00	1244879	7:15	1247034	= 2155	÷ 19	113.6	99.95	101.9		

\\DHAIRYA\Users\Dhairya P. Vasavada\Documents\Maganbhai\Meter Unit Usage Sheet (Foundry).docx