DETAILED PROJECT REPORT

ON

REPLACEMENT OF OIL FIRED ROTARY FURNACE WITH INDUCTION FURNACE

(BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER)

ENERGY IS LIFE
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Bureau of Energy Efficiency (BEE)

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REPLACEMENT OF OIL FIRED ROTARY FURNACE WITH INDUCTION FURNACE

BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER

BEE, 2011

Detailed Project Report on Replacement of Oil Fired Rotary Furnace with Induction Furnace

Foundry SME Cluster, Batala, Jalandhar , Ludhiana (Punjab) (India)

New Delhi: Bureau of Energy Efficiency

Detail Project Report No.: **BJL/FUR/ IND/07**

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Acknowledgement

We are sincerely thankful to the Bureau of Energy Efficiency, Ministry of Power, for giving us the opportunity to implement the 'BEE SME project in "BJL Foundry Cluster, Batala, Jalandhar & Ludhiana". We express our sincere gratitude to all concerned officials for their support and guidance during the conduct of this exercise.

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CII – AVANTHA Centre for Competitiveness for SMEs, Confederation of Indian Industry (CII) is also thankful to Industry Associations for their valuable inputs, cooperation, support and facilitating the implementation of BEE SME program in BJL Foundry Cluster.

We take this opportunity to express our appreciation for the excellent support provided by Foundry Unit Owners, Local Service Providers, and Equipment Suppliers for their active involvement and their valuable inputs in making the program successful and in completion of the Detailed Project Report (DPR).

CII – AVANTHA Centre for Competitiveness for SMEs, Confederation of Indian Industry (CII) is also thankful to all the SME owners, plant in charges and all workers of the SME units for their support during the energy use and technology audit studies and in implementation of the project objectives.

CII – AVANTHA Centre for Competitiveness for SMEs

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List of Abbreviations

BEE	Bureau of Energy Efficiency
SME	Small and Medium Enterprises
DPR	Detailed Project Report
GHG	Green House Gases
PF	Power Factor
EEF	Energy Efficient Motor
CDM	Clean Development Mechanism
DSCR	Debt Service Coverage Ratio
NPV	Net Present Value
IRR	Internal Rate of Return
ROI	Return on Investment
MT	Metric Tonne
SIDBI	Small Industries Development Bank of India

EXECUTIVE SUMMARY

Confederation of Indian Industry is executing BEE-SME program in Batala, Jalandhar and Ludhiana Foundry Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Batala, Jalandhar and Ludhiana Foundry cluster, is one of the largest Foundry clusters in India; accordingly this cluster was chosen for energy efficiency improvements by implementing energy efficient measures / technologies, so as to facilitate maximum replication in other Foundry clusters in India. The main energy forms used in the cluster units are grid electricity & fuel.

Most of the Industrial installations in the country have Oil Fired Rotary Furnaces used in foundry units having low efficiency leading to high fuel consumption and also cause pollution. This can be taken care by replacing Oil Fired Rotary Furnaces with induction furnace.

Implementation of induction furnace will reduce the running cost of energy. It helps in reducing the pollution and also the fuel consumption. Project implementation will lead to reduction in the melting cost by ` 13.68 Lakhs per year.

This DPR highlights the details of the study conducted for the replacement of Oil fired furnace with Induction Furnace for melting, possible Energy saving and its monetary benefit, availability of the technologies/design, local service providers, technical features & proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, sensitivity analysis in different scenarios and schedule of Project Implementation.

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

S. No.	Particular	Unit	Value
1	Project cost	`(in lakh)	27.15
2	Furnace Oil consumption in base case	Tonne/year	128750
3	Electricity consumption in proposed scenario	MWh/Year	458
4	Monetary benefit	`(in lakh)	13.68
5	Debit equity ratio	Ratio	3:1

S. No.	Particular	Unit	Value
6	Simple payback period	years	1.98
7	NPV	(in lakh)	22.90
8	IRR	%age	33.00
9	ROI	%age	26.32
10	Process down time	weeks	3
11	DSCR	Ratio	2.06
12	Co_2 reduction	Tonne/year	66.97

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

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve energy performance in 29 selected SMEs clusters. Batala, Jalandhar and Ludhiana Foundry Cluster is one of them. The BEE's SME Programme intends to enhance energy efficiency awareness by funding/subsidizing need based studies in SME clusters and giving energy conservation recommendations. For addressing the specific problems of these SMEs and enhancing energy efficiency in the clusters, BEE will be focusing on energy efficiency, energy conservation and technology up gradation through studies and pilot projects in these SMEs clusters.

Major Activities in the BEE - SME Program are furnished below:

Activity 1: Energy Use and Technology Audit

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

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

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

Activity 3: Implementation of Energy Efficiency Measures

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

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

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

1. INTRODUCTION

1.1. Brief Introduction about the Cluster

Indian foundry industry is very energy intensive. The energy input to the furnaces and the cost of energy play an important role in determining the cost of production of castings. Major energy consumption in medium and large scale foundry industry is the electrical energy for induction and Arc furnaces. Furnace oil is used in rotary furnaces. In Small foundry industry, coal is used for metal melting in Cupola furnaces. The energy costs contribute about 25 - 30% of the manufacturing cost in Indian foundry industry.

There are approximately 450 units, engaged in Foundry Cluster (automobile parts, agricultural implements, machine tools, diesel engine components, manhole covers, sewing machine stands, pump-sets, decorative gates and valves) production. The major locations wherein the units are spread are G.T. Road, Industrial area, Focal Point in Batala. In Jalandhar Dada Colony Industrial Area, Focal point, Focal Point Extn, Udyog Nagar, I.D.C, Kapurthala Road & Preet Nagar. In Ludhiana Focal Point Phase 5 to 8, Janta Nagar, Bhagwan Chowk Area & Industrial area – A/B. .

Availability of Electricity in Batala – across Dhir Road, GT Road is an issue; power is available from the grid for maximum 12/14 hours a day. There are some units in Jalandhar and Ludhiana having induction furnace in the range of 500 kg to 1 ton capacity whereas other units which are using local scrap as well as have high melting temperatures are having cupola and rotary furnace and has a capacity of minimum 5 ton per day.

The foundry produces a wide variety of castings such as manhole covers, pipe and pipe fittings, sanitary items, tube well body, metric weights, automobile components, railway parts, electric motor, fan body etc. 90% of the castings produced are from the SSI sector.

1.1.1. Energy Usage Pattern

Major energy sources being used in foundry cluster are electricity and fuels such as Coal, Furnace Oil, and Diesel. Electrical energy is being used in melting of iron in induction furnaces, operation of electrical utilities and thermal energy is being used in cupola furnaces operation.

1.1.2. Classification of Units

Broadly units are classified with respect to production capacity;

- Large Scale Units

- Medium Scale Units
- Small Scale Units

1.1.3. Production Wise Unit Breakup

Foundry cluster at Batala, Jalandhar and Ludhiana can be broken into three categories viz. small, medium and large size unit. Table 1.2 shows that production wise breakup of Foundry cluster.

Table 1.1 Production Wise Unit Breakups

S. No.	Type of Unit	Production Capacity
1	Large scale unit	More than 1500 MT
2	Medium scale unit	250 to 1500 MT
3	Small scale unit	Less than 250 MT

1.1.4. Products Manufactured

Foundry SME cluster at Batala, Jalandhar and Ludhiana produces a wide variety of castings such as manhole covers, pipe and pipe fittings, sanitary items, tube well body, metric weights, automobile components, railway parts, electric motor, fan body etc.

1.2. Process Flow diagram of a Foundry Cluster

The manufacturing process is described as below;

Melting Section:

The raw material is melted in melting furnace. The melting furnace can be an induction furnace or rotary or arc furnace or cupola furnace. Molten metal from the melting furnace is tapped in Ladles and then transferred to the holding furnaces. Typically the holding furnaces are induction furnaces. The holding furnace is used to maintain the required molten metal temperature and also acts as a buffer for storing molten metal for casting process. The molten metal is tapped from the holding furnace whenever it is required for casting process.

Sand Plant:

Green sand preparation is done in the sand plant. Return sand from the molding section is also utilized again after the reclamation process. Sand Muller's are used for green sand preparation. In the sand millers, green sand, additives and water are mixed in appropriate proportion. Then the prepared sand is stored in bunkers for making moulds.

Pattern Making:

Patterns are the exact facsimile of the final product produces. Generally these master patterns are made of Aluminum or wood. Using the patterns the sand moulds are prepared.

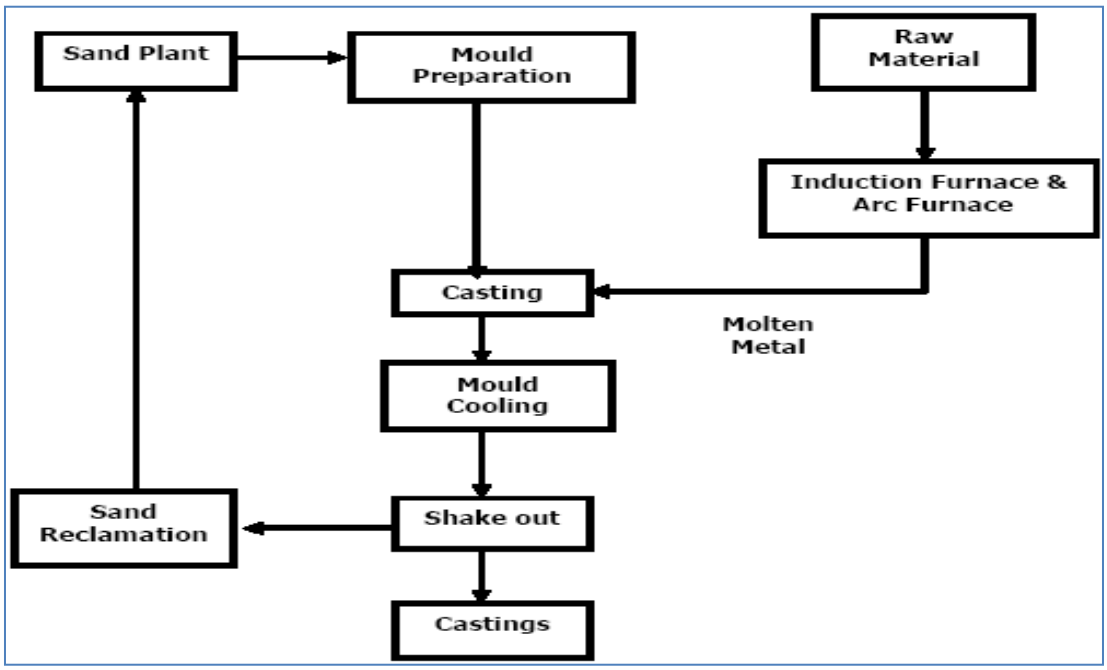

Figure 1.1 Process flow diagram of Typical foundry Units

Mould Preparation:

In small-scale industries still the moulds are handmade. Modern plants are utilizing pneumatic or hydraulically operated automatic molding machines for preparing the moulds. After the molding process if required the cores are placed at the appropriate position in the moulds. Then the moulds are kept ready for pouring the molten metal.

Casting:

The molten metal tapped from the holding furnace is poured into the moulds. The molten metal is allowed to cool in the moulds for the required period of time and the castings are produced. The moulds are then broken in the shake out for removing the sand and the used sand is sent back to the sand plant for reclamation and reuse. The castings produced are sent to fettling section for further operations such as shot blasting, heat treatment etc. depending upon the customer requirements.

1.3. Energy performance in existing situation

Major energy sources being used in foundry cluster are electricity and fuels such as Coal, Furnace Oil, and Diesel. Electrical energy is being used in melting of iron in induction furnaces, operation of electrical utilities and thermal energy is being used in cupola furnaces operation.

1.3.1. Average Production

The Average Production of the Foundry Units in above mentioned category during Year 2009-10 are as follows;

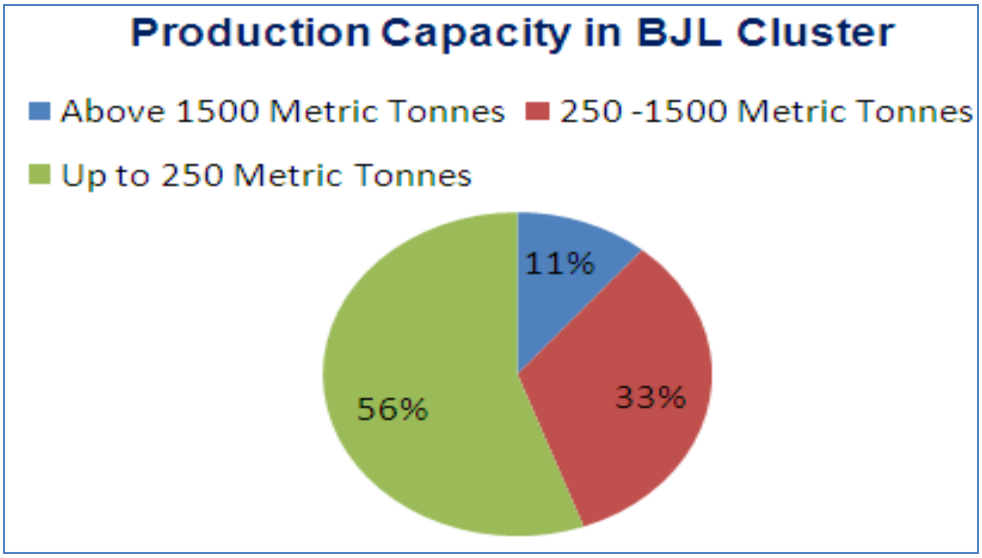

Figure 1.2 Production Capacity BJL Foundry cluster

Table 1.2 Annual Production Capacities

S. No.	Production Capacities	% of Units
1	Above 1500 Metric Tonne	11
2	250 to 1500 Metric Tonne	33
3	Below 250 Metric Tonne	56

1.3.2. Energy Consumption

Energy consumption (electrical) in a typical Foundry plant for different types of products is given in Table 1.3 below:

Table 1.3 Annual Energy Consumption (Electricity)

Electricity Consumption Pattern	Unit Consumed in kWh	Total Unit Consumption kWh
Blower Motor for Cupola	962100	26.92 Lakhs
Rotary Motor for Rotary Furnace	330000	
Melting material in Induction Furnace	1400000	

Table 1.4 Annual Energy Consumption (Coal & Furnace Oil)

Thermal Energy Consumption Pattern	Consumption per Year
Coal for Cupola	5000 Metric Tonnes
Furnace Oil for Rotary Furnace	17.8 Lakhs Litter

1.3.3. Specific Energy Consumption

Specific energy consumption of Foundry units depends upon the production capacity & their corresponding power consumption. Specific energy consumption also depends on type of furnace. A brief summary of specific energy consumption depending upon type of furnace is shown in below table;

Table 1.5 Specific Energy Consumption

S. No	Types of Furnace	Types of Fuel	Specific Fuel Consumption / One kg Molten Material	Cost of Fuel in `
1	Cupola	Coal	0.2 kg	2.6
2	Rotary Furnace	Furnace Oil	0.15 Lt	4.20
3	Arc / Induction Furnace	Electricity	0.72 kWh	3.6

**Assuming Coal rate Rs.15.0 /kg*

**Assuming F.O rate Rs. 28.0 /Lt.*

**Assuming electricity rate Rs 5.0/kWh*

1.4. Proposed Technology/Equipment

1.4.1. Description about the existing technology

During energy audit in the foundry units at Batala, Jalandhar and Ludhiana region, it was found that some units are using rotary oil fired furnaces for melting. The installed furnaces are utilized for melting the material at temperature of 1300 to 1500^{0}C. The rotary oil fired furnaces is the one of the common type of melting furnace used for the production of grey iron castings in all foundries. Rotary furnaces are being used for melting applications in foundries. Furnace remains in operation for 250 days/yr (Approx.). Rotary Retort Furnaces have long been used for the continuous heat treatment of a variety of Raw Materials. The rotary retort furnaces are particularly adaptable to controlled atmosphere operation up to 1500°C. These furnaces are particularly well suited for the processing of raw materials because the rotary conveying action tumbles the Materials, breaking up any jams or tangled clumps facilitating more thorough heat treatment of each of the individual part. The traditional rotary retort concept is not without problems: improper and uneven loading, jams of parts formed at the charge end that cannot be broken up in the retort, the maintenance of rotary bearing and seals within the heated shell and the loss of controlled atmosphere.

The rotary retort has a charging door mechanism that works with a loading mechanism to load controlled, pre-selected weight charges of uniform size parts into the retort, minimizing the loss of any controlled atmosphere.

Furnace ideally should heat as much of material as possible to a uniform temperature with the least possible fuel and labor. The key to efficient furnace operation lies in complete combustion of fuel with minimum excess air. Furnaces operate with relatively low efficiencies (as low as 7 percent) compared to other combustion equipment such as the boiler (with efficiencies higher than 90 percent). This is caused by the high operating temperatures in the furnace.

More than 90% of Pipe Fittings being used in India are made in Punjab. Oil Fired Rotary Furnaces are very popular for making malleable pipe fittings (and scaffoldings) due to less initial cost. Recent hike in Furnace Oil & Pig Iron has forced to adopt other option to counter the increased operating cost. Induction furnaces can be a better option in place of rotary furnaces.

1.5. Establishing the Baseline for the Proposed Technology

Presently all the Foundry units in Batala, Jalandhar and Ludhiana are operating with rotary oil fired furnaces. The existing energy consumption profile of the rotary oil fired furnaces is tabulated below:

Table 1.6 Baseline Consumption

S. No.	Parameters	Units	Existing System
1.	Raw Material Consumption	Tonne / Day	3.43
2.	Oil Consumption	lit /Day	515
3.	Raw Material rejection	Kg/Day	230
4.	Cost per batch	`/ Day	14420
5.	Output per batch	Tonne / Day	3.2
6.	***Annual Production***	***Tonne/ year***	***800***
7.	***Annual Production Cost***	***` (in lakh)/ year***	***36.05***

1.6. Barriers in adoption of proposed technology

1.6.1. Technological Barrier

- Lack of awareness and information of the losses in the use of an Oil Fired Furnace
- Due to lack of technical knowledge and expertise, Oil Fired Furnaces are used in the Foundry units.
- In this cluster, like many others, there is lack of leadership to take up the energy

efficiency projects in the plant.

1.6.2. Financial Barrier

Availing finance is not the major issue. Among the SMEs, the larger units, if convinced they are capable of either financing it themselves or get the finance from their banks. The smaller units will require competitive loan and other support to raise the loan. However as most of them have been able to expand their setup and grow, there is readiness to spend for energy efficiency technologies which have good returns. Energy Efficiency Financing Schemes such as SIDBI's, if focused on the cluster, will play a catalytic role in implementation of identified energy conservation projects & technologies.

1.6.3. Skilled Manpower

In Foundry cluster at Batala, Jalandhar and Ludhiana, the availability of skilled manpower is one of the limitations; this issue gets further aggravated due to more number of Foundry units as compared to the availability of skilled manpower. For major equipments of Foundry units like Oil Fired Furnaces for maintenance or the repair works of these equipments take care by the equipment suppliers itself.

2. PROPOSED TECHNOLOGY

2.1. Detailed Description of Technology

2.1.1. Description of Technology

An induction furnace is an electrical furnace in which the heat is applied by induction heating of metal. The advantage of the induction furnace is a clean, energy-efficient and well-controllable melting process compared to most other means of metal melting. Most modern foundries use this type of furnace and now also more iron foundries are replacing cupolas with induction furnaces to melt cast iron, as the former emit lots of dust and other pollutants. Induction furnace capacities range from less than one kilogram to one hundred tonnes capacity and are used to melt iron and steel, copper, aluminium and precious metals. Since no arc or combustion is used, the temperature of the material is no higher than required to melt it; this can prevent loss of valuable alloying elements.

Operating frequencies range from utility frequency (50 or 60 Hz) to 400 kHz or higher, usually depending on the material being melted, the capacity (volume) of the furnace and the melting speed required. Generally, the smaller the volume of the melts, the higher the frequency of the furnace used; this is due to the skin depth which is a measure of the distance an alternating current can penetrate beneath the surface of a conductor. For the same conductivity, the higher frequencies have a shallow skin depth - that is less penetration into the melt. Lower frequencies can generate stirring or turbulence in the metal. A preheated, 1-tonne furnace melting iron can melt cold charge to tapping readiness within an hour. Power supplies range from 10 kW to 15 MW, with melt sizes of 20 kg to 30 tonne of metal respectively.

The typical specific power consumption of induction furnace is given below.

- Arc furnace - 710 - 720 units/ tonne
- Main frequency induction furnace - 680 - 690 units/ tonne
- Medium frequency induction furnace - 550 - 600 units / tonne

Hence there is a good potential to save energy by installing medium frequency induction furnace.

Benefits of Installing Induction Melting Furnace

- Low melting cost
- Higher production
- Low rejection rates
- Better quality (malleability)
- S.G. Iron Castings can be made
- Cheaper scrap material can be used

- Less pollution i.e. environment friendly
- Less burning losses of alloys & Pig Iron

2.1.2. Technology Specification

For implementation of the proposed project, Oil Fired Rotary Furnaces must be replaced with Induction Furnace in the Foundry units. The Technical Specifications are provided in Annexure 7.

2.1.3. Suitability or Integration with Existing Process and Reasons for Selection

This is the simplest and widely accepted measure for energy cost reduction in all the industries. It does not affect the process but improves the process efficiency since these furnaces save fuel consumption.

Advantages:-

- Low melting cost
- Higher production
- Low rejection rates
- Better quality (malleability)
- S.G. Iron Castings can be made
- Cheaper scrap material can be used
- Less pollution i.e. environment friendly
- Less burning losses of alloys & Pig Iron

2.1.4. Availability of Technology

As far as technology is concerned Induction Frequency Furnaces are available in local/ national market. It is well proven technology which is adopted in many of the other similar and dissimilar units.

2.1.5. Source of Technology

Local vendors can arrange Induction Furnaces at order. Local service providers are also available at Batala, Jalandhar and Ludhiana. More details of service provider are given in annexure 6.

2.1.6. Terms and Conditions after Sale

Warranty period of one year will be provided from the date of invoice against any manufacturing defects. Details are provided in Annexure 7.

2.1.7. Process down Time during Implementation

Technology provider will bring the complete setup for the proposed project from their site and make all the arrangements for implementation at the client's site. And the process will be effected for a period of 2 to 3 weeks, when all the required is at the client's site.

2.2. Life Cycle Assessment

Life of the proposed induction furnace will be around 10 to 15 years which depends on the operating conditions and maintenance at client's side.

2.3. Suitable Unit for Implementation of the Identified Technology

From estimation of the saving potential on implementation of this project, here the Foundry units engaged in making castings, having Oil Fired Rotary Furnace can be considered.

3. ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1. Technical Benefits

3.1.1. Electricity savings per year

Project of Installation of Induction Furnaces in place of Oil Fired Rotary Furnaces will not result in savings of electricity consumption meanwhile it will raise the consumption by 458 MW and will replace the FO consumption at the same time (128750 kg/year).

3.1.2. Improvement in product quality

This project is not contributing to any improvement in product quality.

3.1.3. Improvement in production

This project is not contributing for increasing in production in Foundry units.

3.1.4. Reduction in raw material consumption

Raw material consumption will be reduced after the implementation of the proposed project and is estimated to around 25.5* tonne per year.

* Reduction of raw material rejection is considered at the rate of 3% or 102 kg of Raw material per batch of the output required. Rate of rejection are 7% and 4% in the case of oil fired furnace and induction furnace respectively.

3.1.5. Reduction in other losses

This project does not contribute to any reduction in any loss.

3.2. Monetary Benefits

Annual monetary savings with installation of Induction Furnace will be `13.68 Lakhs per year with reduction in consumption in fuel is estimated to be about 128750 kg per year.

Table 3.1 Monetary savings

S. No.	Parameters	Units	Existing System	Proposed System
1.	Raw Material Consumption	Tonne / Day	3.43	3.328
2.	Oil Consumption	lit./Day	515	--
3.	Electricity Consumption	kWh/ day	--	1830
4.	Raw Material rejection	Kg/Day	230	128
5.	Cost of oil	`/ lit	28	--
6.	Cost of electricity	`/ kWh	--	5
7.	Reduction in energy rate of rejection	`/ day		204
8.	Cost per batch	`/ Day	14420	8948
9.	Output per day	Tonne / Day		3.2

S. No.	Parameters	Units	Existing System	Proposed System
10.	*Annual Production*	*Tonne/ year*		*800*
11.	*Annual Production Cost*	*₹ in lakh)/ year*	*36.05*	*22.37*
12.	*Annual Cost reduction*	*₹ in lakh)/ year*		*13.68*
13.	*Payback*	*Years*		*1.98*

3.3. Social Benefits

3.3.1. Improvement in Working Environment in the Plant

The proposed system will burn the fuel efficiently, so less fuel would be required every batch thus working environment in the plant will be cleaner when compared to the existing system.

3.3.2. Improvement in Skill Set of Workers

The technical skills of workers will definitely improve. Training on the regular maintenance will help in improving the technical understanding of the workers.

3.4. Environmental Benefits

The major GHG reduction would be in CO_2 reduction. Emission reductions are estimated around 66.97 tons of CO_2 per annum.

4. INSTALLATION OF THE PROPOSED TECHNOLOGY

4.1. Cost of Technology Implementation

The cost of technology quoted by the vendor is ` 6.10 lakh.

Table 4.1 Details of Proposed Technology Installation Cost

S. No.	Particular	Cost` in (Lakhs)
1	***Equipment cost***	***22.80***
	Power Unit	14.00
	Melting Furnace	8.00
	Optional	0.80
2	***Other cost (Taxes)***	***2.85***
	Excise Duty @ 10%	2.28
	Education Cess on Excise duty @ 2%	0.05
	Higher Education Cess on Excise duty @ 1%	0.02
	CST @ 2% against Form 'C'	0.50
3	***Misc***	***0.50***
4	***Civil Cost***	***1.00***
5	***Total Cost***	***27.15***

4.1.1. Technology Cost

Cost of the project is about `27.15Lakhs which includes the purchase of Induction Furnace and related activities.

4.1.2. Other Cost

Other costs required will be `02.85 Lakh which includes taxes and other miscellaneous costs will be `0.50 Lakh as the contingency amount commissioning, manpower cost, transportation etc.

4.2. Arrangements of Funds

4.2.1. Entrepreneur's Contribution

Entrepreneur will contribute 25% of the total project cost which is `6.79Lakhs.

4.2.2. Loan Amount

Remaining 75% cost of the proposed project will be borrowed from bank, which is ` 20.36 Lakhs.

4.2.3. Terms & Conditions of Loan

The interest rate is considered at 10% which is normal rate of interest for energy efficiency projects. The loan tenure is 5 years excluding initial moratorium period is 6 months from the date of first disbursement of loan.

4.3. Financial Indicators

4.3.1. Cash Flow Analysis

Profitability and cash flow statements have been worked out for a period of 8 years. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below. The cost of equipment considered is inclusive of hot water storage tanks also.

- The Operation and Maintenance cost is estimated at 4 % of cost of total project with 5 % increase in every year as escalations.
- Interest on term loan is estimated at 10 %.
- Depreciation is provided as per the rates provided in the companies Act.

Based on the above assumptions, profitability and cash flow statements have been prepared and calculated in Annexure-3.

4.3.2. Simple Payback Period

The total project cost of the proposed technology is `27.15 Lakhs and monetary savings due to reduction in oil consumption is `13.68 Lakh hence, the simple payback period works out to be 1.98 years.

4.3.3. Net Present Value (NPV)

The Net present value of the investment at 10% works out to be ` 22.90Lakhs.

4.3.4. Internal Rate of Return (IRR)

The after tax Internal Rate of Return of the project works out to be 33.00%. Thus the project is financially viable.

4.3.5. Return on Investment (ROI)

The average return on investment of the project activity works out at 26.32%.

Table 4.2 Financial Indicators of Proposed Technology

S No	Particular	Unit	Value
1	Simple Payback	Year	1.98
2	NPV	` In Lakh	22.90
3	IRR	%age	33.00
4	ROI	%age	26.32
5	DSCR	Ratio	2.06

4.4. Sensitivity analysis in realistic, pessimistic and optimistic scenarios

A sensitivity analysis has been carried out to ascertain how the project financials would

behave in different situations like when there is an increase in rupees savings or decrease in rupees savings. For the purpose of sensitive analysis, two following scenarios have been considered.

- **Optimistic scenario (Increase in monetary savings by 5%)**
- **Pessimistic scenario (Decrease in monetary savings by 5%)**

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

Table 4.3 Sensitivity Analysis in Different Scenarios

Scenario	Monetary Benefit(`Lakh/year)	IRR (%)	NPV(in Lakh)	ROI (%)	DSCR
Pessimistic	13.00	30.54	20.28	26.07	1.95
Base	13.68	33.00	22.90	26.32	2.06
Optimistic	14.36	35.44	25.52	26.54	2.17

4.5. Procurement and Implementation Schedule

Procurement and implementation schedule required for implementation of this technology is about 8 weeks and 2 to 3 weeks required as a process break down. Details of procurement and implementation schedules are shown in Table 4.4 below

Table 4.4 Procurement and Implementation Schedule

S. No.	Activities	Weeks						
		1	2	3	…	6	7	8
1	Planning and material order							
2	Procurement							
3	Dismantling of Oil fired Furnace							
4	Commissioning							

ANNEXURES

Annexure 1: Energy audit data used for baseline establishment

S. No.	Parameters	Units	Existing System
1.	Raw Material Consumption	Tonne / Day	3.43
2.	Oil Consumption	lit /Day	515
3.	Raw Material rejection	Kg/Day	230
4.	Cost per batch	`/ Day	14420
5.	Output per day	Tonne / Day	3.2
6.	Annual Production	Tonne/ year	800
7.	Annual Production Cost	`(in lakh)/ year	36.05

Annexure 2: Detailed Technology Assessment Report

S. No.	Parameters	Units	Existing System	Proposed System
1.	Raw Material Consumption	Tonne / Day	3.43	3.328
2.	Oil Consumption	lit /Day	515	--
3.	Electricity Consumption	kWh/ day	--	1830
4.	Raw Material rejection	Kg/Day	230	128
5.	Cost of oil	`/ lit	28	--
6.	Cost of electricity	`/ kWh	--	5
7.	Rate of Reduction in Energy Consumption of Rejected Material	`/ kg		2
8.	Reduction in Energy Consumption of Rejected Material	`/ Day		204
9.	Cost per batch	`/ Day	14420	8948
10.	Output per day	Tonne / Day		3.2
11.	Annual Production	Tonne/ year		800
12.	Annual Production Cost	`(in lakh)/ year	36.05	22.37
13.	Annual Cost reduction	`(in lakh)/ year		13.68
14	Payback	Years		1.98

Annexure 3: Detailed Financial Calculations

Name of the Technology	Induction Furnace		
Rated Capacity	**175 kW**		
Details	**Unit**	**Value**	**Basis**
Installed Capacity	TPD	3.5	
No. of Operating Days	Days	250	
No. of Shifts/ Hours	No. / Hours	1 / 8	
Proposed Investment			
Plant & Machinery	` (in lakh)	25.65	
Civil Work	` (in lakh)	1.00	
Erection & Commissioning	` (in lakh)	0.00	
Misc. Cost	` (in lakh)	0.50	
Total Investment	` (in lakh)	27.15	
Financing pattern			
Own Funds (Equity)	` (in lakh)	6.79	Feasibility Study
Loan Funds (Term Loan)	` (in lakh)	20.36	Feasibility Study
Loan Tenure	Years	5.00	Assumed
Moratorium Period	Months	6.00	Assumed
Repayment Period	Months	66.00	Assumed
Interest Rate	%age	10.00%	
Estimation of Costs			
O & M Costs	% on Plant & Equip	4.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Oil savings	tone/Year	129	
Cost	` / Tonne	28000	
Electricity Consumption	MWh/Year	466	
Cost	`/ MWh	5000	
Rate of Reduction in Energy Consumption of Rejected Material	`/ kg	2	
Reduction in Rejection of material	kg / year	25500	
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

Estimation of Interest on Term Loan **` (in lakh)**

Years	Opening Balance	Repayment	Closing Balance	Interest
1	20.36	1.02	19.35	2.36
2	19.35	3.05	16.29	1.80
3	16.29	4.07	12.22	1.44
4	12.22	5.09	7.13	0.99
5	7.13	5.09	2.04	0.48
6	2.04	2.04	0.00	0.06
		20.36		

WDV Depreciation **`(in lakh)**

Particulars / years	**1**	**2**
Plant and Machinery		
Cost	27.15	5.43
Depreciation	21.72	4.34
WDV	5.43	1.09

Projected Profitability **` (in lakh)**

Particulars / Years	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Electricity savings	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68
Total Revenue (A)	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68
Expenses								
O & M Expenses	1.09	1.14	1.20	1.26	1.32	1.39	1.46	1.53
Total Expenses (B)	1.09	1.14	1.20	1.26	1.32	1.39	1.46	1.53
PBDIT (A)-(B)	12.59	12.54	12.48	12.42	12.36	12.29	12.22	12.15
Interest	2.36	1.80	1.44	0.99	0.48	0.06	0.00	0.00
PBDT	10.23	10.74	11.04	11.43	11.88	12.23	12.22	12.15
Depreciation	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
PBT	8.80	9.31	9.61	10.00	10.44	10.80	10.79	10.72
Income tax	0.00	2.18	3.75	3.89	4.04	4.16	4.16	4.13
Profit after tax (PAT)	8.80	7.14	5.85	6.11	6.41	6.64	6.64	6.59

Computation of Tax **` (in lakh)**

Particulars / Years	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Profit before tax	8.80	9.31	9.61	10.00	10.44	10.80	10.79	10.72
Add: Book depreciation	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
Less: WDV depreciation	21.72	4.34	-	-	-	-	-	-
Taxable profit	(11.49)	6.40	11.04	11.43	11.88	12.23	12.22	12.15
Income Tax	-	2.18	3.75	3.89	4.04	4.16	4.16	4.13

Projected Balance Sheet **` (in lakh)**

Particulars / Years	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Share Capital (D)	6.79	6.79	6.79	6.79	6.79	6.79	6.79	6.79
Reserves & Surplus (E)	8.80	15.93	21.79	27.90	34.31	40.95	47.59	54.17
Term Loans (F)	19.35	16.29	12.22	7.13	2.04	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	34.93	39.01	40.79	41.82	43.13	47.74	54.37	60.96
Assets	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Gross Fixed Assets	27.15	27.15	27.15	27.15	27.15	27.15	27.15	27.15
Less Accumulated Depreciation	1.43	2.87	4.30	5.73	7.17	8.60	10.04	11.47
Net Fixed Assets	25.72	24.28	22.85	21.42	19.98	18.55	17.12	15.68
Cash & Bank Balance	9.21	14.73	17.94	20.40	23.15	29.19	37.26	45.28
TOTAL ASSETS	34.93	39.01	40.79	41.82	43.13	47.74	54.37	60.96
Net Worth	15.59	22.72	28.58	34.69	41.10	47.74	54.37	60.96
Debt Equity Ratio	2.85	2.40	1.80	1.05	0.30	0.00	0.00	0.00

Projected Cash Flow **` (in lakh)**

Particulars / Years	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Sources									
Share Capital	6.79	-	-	-	-	-	-	-	-
Term Loan	20.36								
Profit After tax		8.80	7.14	5.85	6.11	6.41	6.64	6.64	6.59
Depreciation		1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

Particulars / Years	0	1	2	3	4	5	6	7	8
Total Sources	27.15	10.23	8.57	7.29	7.55	7.84	8.08	8.07	8.02
Application									
Capital Expenditure	27.15								
Repayment Of Loan	-	1.02	3.05	4.07	5.09	5.09	2.04	0.00	0.00
Total Application	27.15	1.02	3.05	4.07	5.09	5.09	2.04	0.00	0.00
Net Surplus	-	9.21	5.51	3.21	2.46	2.75	6.04	8.07	8.02
Add: Opening Balance	-	-	9.21	14.73	17.94	20.40	23.15	29.19	37.26
Closing Balance	-	9.21	14.73	17.94	20.40	23.15	29.19	37.26	45.28

IRR **` (in lakh)**

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		8.80	7.14	5.85	6.11	6.41	6.64	6.64	6.59
Depreciation		1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
Interest on Term Loan		2.36	1.80	1.44	0.99	0.48	0.06	-	-
Cash outflow	(27.15)	-	-	-	-	-	-	-	-
Net Cash flow	(27.15)	12.59	10.36	8.73	8.54	8.32	8.14	8.07	8.02
IRR	33.00 %								
NPV	22.90								

Break Even Point **` (in lakh)**

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
O & M Expenses (75%)	0.81	0.86	0.90	0.94	0.99	1.04	1.09	1.15
Sub Total(G)	0.81	0.86	0.90	0.94	0.99	1.04	1.09	1.15
Fixed Expenses								
O & M Expenses (25%)	0.27	0.29	0.30	0.31	0.33	0.35	0.36	0.38
Interest on Term Loan	2.36	1.80	1.44	0.99	0.48	0.06	0.00	0.00
Depreciation (H)	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
Sub Total (I)	4.07	3.51	3.18	2.74	2.25	1.84	1.80	1.82
Sales (J)	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68
Contribution (K)	12.87	12.82	12.78	12.74	12.69	12.64	12.59	12.53
Break Even Point (L= G/I)%	31.61%	27.40%	24.85%	21.50%	17.69%	14.56%	14.28%	14.49%
Cash Break Even {(I)-(H)}%	20.46%	16.22%	13.64%	10.24%	6.40%	3.21%	2.89%	3.05%
Break Even Sales (J)*(L)	4.32	3.75	3.40	2.94	2.42	1.99	1.95	1.98

Return on Investment **` (in lakh)**

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	8.80	9.31	9.61	10.00	10.44	10.80	10.79	10.72	80.47
Net Worth	15.59	22.72	28.58	34.69	41.10	47.74	54.37	60.96	305.74
									26.32%

Debt Service Coverage Ratio **` (in lakh)**

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	8.80	7.14	5.85	6.11	6.41	6.64	6.64	6.59	40.95
Depreciation	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	8.60
Interest on Term Loan	2.36	1.80	1.44	0.99	0.48	0.06	0.00	0.00	7.13
Total (M)	12.59	10.36	8.73	8.54	8.32	8.14	8.07	8.02	56.68

DEBT

Interest on Term Loan	2.36	1.80	1.44	0.99	0.48	0.06	0.00	0.00	7.13
Repayment of Term Loan	1.02	3.05	4.07	5.09	5.09	2.04	0.00	0.00	20.36
Total (N)	3.38	4.85	5.52	6.08	5.57	2.10	0.00	0.00	27.49
DSCR (M/N)	3.73	2.14	1.58	1.40	1.49	3.88	0.00	0.00	2.06
Average DSCR	2.06								

Annexure 4: Procurement and implementation schedule

S. No.	Activities	Weeks						
		1	2	3	…	6	7	8
1	Planning and material order							
2	Procurement							
3	Dismantling of Oil Fired Furnace							
4	Commissioning							

Annexure 5: Break-up of Process down Time

S No	Activities	Weeks		
		6/8	7/8	8/8
1	Dismantling of Oil Fired Furnace			
2	Installing Induction Furnace			
3	Testing & Trial			

Annexure 6: Details of technology service providers

S. No.	Source of product	Details of Local vendor / service provider
1.	INDUCTOTHERM (INDIA) PVT. LTD.	**Ajit Chaturvedi** Regional Sales Head Mobile# 91 93111 50284 **B-444, Pacific Business Park,** **Sahibabad Industrial Area, Site-IV,** **Ghaziabad-201010 (U.P.)** E-mail: ajitc@inductothermindia.com Phone: 0120-2771068, 2771069, 3143028.
2.	M/S ENCON INTERNATIONAL (P) LTD.	**Mr. R.P. Sood** 14/6, Mathura Road, Faridabad - 121 003 (Haryana) Tel: +91-129-2275307 Fax: +91-129-2276448 E mail: encon@ndb.vsnl.net.in
3.	ADVANCE HEATING SYSTEMS	d1/23 (back side) Mayapuri ind. area, phase-ii, New Delhi -110064 Tel: 91-11-5139315 Email:advanceheat@yahoo.com
4.	INDUSTRIAL FURNACE & CONTROLS	Vempu road, Bangalore -560021 Tel:+ 91-80-3329840 Fax: + 91-80-3329840 E-mail: ifc1@vsnl.com Website http://www.indfurnace.com
5.	MACRO FURNACES PVT. LTD.	16/2, mathura road, faridabad -121002 Tel:+ 91-129-5260004 Fax: + 91-129-5260146 E-mail: aastha10@rediffmail.com

Annexure 7: Quotations or Techno-commercial bids for new technology /equipment

INDUCTOTHERM (INDIA) PVT. LTD.
An Inductotherm Group Company

ISO 9001 BUREAU VERITAS Certification

M/s. CII - BEE Avantha Centre for Competitiveness
Block-3, Sector 31/A,
CHANDIGARH
Cell: 9872600687
Kind Attn: Mr. Gagandeep Mohey (Director)

27th July, 2011

Sub: Your requirement of Induction Furnace

Dear Sir,

This is in reference to your discussions with our Mr. Surinder Arora, in connection with your requirement of Medium Frequency Induction Melting Furnace. We really appreciate your interest in Inductotherm Induction Melting Furnace.

As per our discussion, we are pleased to enclose herewith following preliminary quotations for your perusal:

* Quotation No. QDE11291 for 1 No.175 KW/1000 HZ VIP POWER TRAK-R-PI with 2 Nos. 300Kg DURALINE FURNACES.

We are also enclosing herewith technical specification sheet, scope of supply, standard terms & conditions and other relevant literatures.

Trust our offer is in line with your requirement. If you need any further information/assistance from our side, please feel free to contact our Mr. Surinder Arora (Cell# 9356780314).

Thanking you,

Sincerely,

S.R.SUBRAMANIAN
NATIONAL SALES MANAGER (MELTING)
Cell # 09344130922
Encl: Quotation consists of price sheet, technical specification, bulletins, standard terms & conditions (TAC-03).

INDUCTOTHERM Induction Melting | INDUCTOHEAT Induction Heating | THERMATOOL Induction Welding

Regd Office & Works:
Shri Kishorebhai D. Vyas Building, Ambli-Bopal Road, Bopal, Ahmedabad - 380 058. Ph. : (02717) 23 1961. Fax : (02717) 23 1266/68
E-mail : iil@inductothermindia.com Website : www.inductothermindia.com
Branches & Service Centres: Bangalore, Chennai, Coimbatore, Delhi, Dhanbad, Hyderabad, Jaipur, Kolhapur, Kolkata, Ludhiana, Mumbai, Muzaffarnagar, Pune, Raipur, Rajkot, Rourkela.

175KW /1000 Hz VIP POWER TRAK-R-PI (3 Phase, 6 Pulse)		
A.	**Power Unit** **One (1) No. 175KW/1000Hz Power & Control System** *with internal water circulating system, two furnace selector switches, one hydraulic power supply unit and remote control consol.*	Rs.14,00,000
B.	**Melting Furnace** **Two (2) Nos. 300Kg DURALINE FURNACES** *with hydraulic tilting arrangement, standard set of water cooled copper tubing, and water cooled leads (without lid).*	Rs.8,00,000
C.	**Optional** *Two (2) Nos. Handle Operated Furnace Selector Switches*	Rs.80,000

All the above quoted prices are ex-works, Bopal (Ahmedabad). They do not include any applicable excise duty or sales tax. Packing, Forwarding and Insurance charges will be extra.

Presently excise duty @ 10%, education cess @ 2% on excise duty, secondary & higher education cess @ 1% on excise duty and CST @ 2% against form "C" will be applicable on Induction Furnace. However, duties and taxes ruling at the time of delivery will be applicable.

The quoted prices are strictly valid for Thirty (30) days. Thereafter, you have to obtain fresh quotation. The quoted prices are valid only if the equipment is to be installed and commissioned in India by Inductotherm (India) Pvt. Ltd.

Delivery will be within [3] Three to [4] Four months. Other terms and conditions are as per the enclosed Standard Terms and Conditions (Bulletin No. TAC-03).

Sincerely,

S.R.SUBRAMANIAN
NATIONAL SALES MANAGER (MELTING)
Cell # 09344130922

175 KW/1000 HZ VIP POWER TRAK-R-PI (3 Phase, 6 Pulse)

A. APPLICATION REQUIREMENTS		
1.	Alloy to be melted	Steel / Iron
2.	Melt temperature	1650°C / 1480°C
B. CHARACTERISTICS OF RECOMMENDED POWER UNIT		
1.	Rated KW	175 KW
2.	Maximum KW	175 KW
3.	Nominal Furnace Frequency	1000 Hz
4.	Line Power Factor	0.95 and above
5.	KVA required at input of VIP POWER TRAK-R	195 KVA on load
6.	Melt Rate at 175 KW **	290 Kg/hr – Steel 322 Kg/hr - Iron
7.	Power Connection	460 V, 3 Phase, 50 Hz
C. CHARACTERISTICS OF RECOMMENDED MELTING FURNACE		
1.	Nominal capacity (Steel capacity)	300Kg
2.	Style of Furnace	Duraline
3.	Pouring Mechanism	Hydraulic tilt
4.	Furnace Lining *(Recommended - to be provided by the customer)*	Silica .... Iron Mgo .....Steel

** The above melt rate is based on a nominal furnace size for second heat when lining is hot, charge is dense and bus runs proper. The voltage should be steady within allowable range. Cooling water should be as per our specification. Melt rates will be for the weight of charge and does not include time for initial charging, pouring, superheating, deslagging or chemical analysis. Please note that slag consumes nearly double the power.

A. POWER UNIT

I. ELECTRICAL PANEL

1. CABINET

Metal cabinet, duly painted fitted with panel doors, which are gasketed and equipped with locks. In addition, micro switches are provided which illuminate a lamp on the monitor board and shut off power to prevent injury to personnel when the lift off panel or doors are opened.

Power connections are easily made through the top and water connections are through the side of the cabinet.

2. RECTIFIER SECTION WITH FILETER

a) High power SCRs with snubbers for rectification.
This rectifier is designed to minimize line harmonics compared to phase controlled rectifier.

b) Fast acting semi-conductor fuses.

c) One no. of Air core encapsulated current limiting reactor.

d) DC capacitors located in capacitor section.

This design of converter and filter section reduces losses compared to iron core current limit reactor(s) and helps to provide constant DC voltage to the voltage fed inverter.
This design helps to achieve the conversion efficiency not less than 97%

3. INVERTER SECTION

This section contains inverter panel containing high power inverter SCRs with snubbers, anti parallel diodes and DI/DT reactors. This helps to provide full power throughout the melt cycle.

4. CAPACITOR SECTION

a) This section contains all the required DC filters and medium frequency AC Capacitors.

b) One pressure switch, installed in each capacitor

c) One indicating lamp located on the monitor board to notify the operator, when the capacitor pressure switch has been actuated.

5. GROUND/METAL LEAK DETECTOR

One sensing ground/metal leak detector ready to sense and indicate any ground and metal leak. Consisting of indicating lamp, milliammeters, probe disconnect switch to disconnect the probe from the power supply.

6. CONTROL & MONITOR SYSTEM

a) Three direct reading instruments, including frequency meter, kilowatt meter and furnace volt meter.

b) One main control board for controlling of the equipment, which eliminates electronic complexity and simplifies maintenance. This board is locatedin a compartment. A cooling fan with heat exchanger is provided for temperature control.

c) ON/OFF push buttons are provided on the control door.

d) One power control knob is provided on the control door to set the desired power level.

f) One circuit monitor for monitoring and indicating functional parameters, such as water pressure,water temperature and other electrical faults.

7. INTERNAL CLOSED WATER SYSTEM (Inside the cabinet)

This contains one feed manifold with temperature and pressure switches and one drain manifold with temperature sensors for different paths of cooling system

II. INTERNAL CLOSED WATER SYSTEM (OUTSIDE THE CABINET)

This structure contains one plate type water to water heat exchanger, expansion/air separator tank, one mono block non-ferrous pump with starter and one deionizer cartridge for continuous purification of internal water.

III. FURNACE SWITCH ASSEMBLY

Furnace selector switch saves time for selecting the required furnace. For better contact it is made out of silver plated copper blades.

IV. HYDRAULIC POWER UNIT

One hydraulic pumping unit (without oil and starter) to supply pressurized fluid to the tilting cylinders complete with pump, pump motor, fluid reservoir, pressure relief valve, pressure gauge, return line filter and filter air breather cap all mounted on a common base with seamless pipes and fittings.

B. MELTING FURNACE

DURALINE FURNACE

Hydraulically tilted coreless melting furnace for housing and providing rigid support to the induction coil. Constructed out of cast aluminium alloy side plates, top and bottom made out of refractory with stainless steel fibre reinforcement. This coreless Duraline without shunts design helps in reducing energy loss.

Included in each furnace will be:

1. A set of shrouded hydraulic cylinders with check valve for the hydraulic tilting of the furnace.
2. Manually operated hydraulic direction control valve for tilting.
3. Leak detector assembly with stainless steel probe wires and hardware.
4. Set of flexible water-cooled power leads for connection between the power induction coil and power supply unit. Water-cooled leads are with sleeves for protection against metal splash.
5. Furnace is mounted on the pair of self-aligning, pillow block type pivot bearings.

Refractory and melt-out former is not in our scope of supply as it is easily available in the market and you need this material as consumable.

INTERCONNECTING ARRANGEMENT

A suitable size of air/water cooled copper conductor is provided to connect the power panel with the crucible.

C. DRAWINGS & MANUALS

Equipment layout drawings, wiring and water diagrams, equipment outline, furnace cross section drawing and an operating and maintenance manual.

Necessary Requirements at Customers end:

Procurement and installations of following equipment and systems is customer's responsibility.

1. Power line up to furnace transformer.
2. Furnace Transformer
3. Power line from transformer to panel
4. 433V, 3 Phase/50 Hz power supply to all the auxiliaries like external pumps, cooling tower, internal water pump and hydraulic power unit with suitable starter.
5. Cooling water system including RCC / Plastic water tanks, cooling tower, pumps, plate type heat exchanger (mentioned in our drawing as PHE2), D.M. or soft water treatment unit, piping, fittings as suggested by our Project Engineering Department.
6. Overhead tank for emergency water supply to coil, in case of failure of water system.
7. Complete civil work like furnace platform, foundations, overhead tank, underground tank etc. Supplier will provide necessary foundation layout drawing/load data.
8. Pressurized air supply, if required.
9. Overhead crane, pouring ladles/system, pyrometer, charging device, ramming tools and other misc. equipment/tools required to start/run the system.
10. Consumables like hydraulic oil, distilled water, asbestos/silica paper/board, coil grouting material, ramming mass etc.
11. Statutory of electricity board, factory inspectorate, pollution control and any other statutory requirements.
12. Lining former

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

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