

Detailed Project Report On IGBT Induction Furnace

N. G. Enterprises
Indore (MP)

Prepared for

Bureau of Energy Efficiency
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The Energy and Resources Institute (TERI)
New Delhi

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List of abbreviations

BEE	:	Bureau of Energy Efficiency
CO ₂	:	Carbon Dioxide
D/E	:	Debt /Equity
DPR	:	Detailed Project Report
DSCR	:	Debt Service Coverage Ratio
EE	:	Energy Efficient
GEF	:	Global Environmental Facility
GHG	:	Green House Gas
IGBT	:	Insulated-gate Bipolar Transistor
IGDPR	:	Investment Grade Detailed Project Report
IRR	:	Internal Rate of Return
kW	:	Kilo Watt
kWh	:	Kilo Watt Hour
LSPs	:	Local Service Providers
MSME	:	Micro, Small and Medium Enterprises
MT	:	Metric Tonne
NPV	:	Net Present Value
O&M	:	Operation and Maintenance
RE	:	Renewable Energy
ROI	:	Return On Investment
SME	:	Small and Medium Enterprises
SPP	:	Simple Payback Period
TERI	:	The Energy and Resources Institute
Toe	:	Tonnes of oil equivalent
UNIDO	:	United Nations Industrial Development Organization

Executive summary

The overall aim of the GEF-UNIDO-BEE project 'Promoting Energy Efficiency (EE) and Renewable Energy (RE) in selected MSME clusters in India' is to develop and promote a market environment for introducing energy efficiency and enhancing the use of renewable energy technologies in process applications in selected energy-intensive MSME clusters in India. This would help in improving the productivity and competitiveness of the MSME units, as well as in reducing the overall carbon emissions and improving the local environment.

Under the GEF-UNIDO-BEE Project, TERI has been entrusted to undertake Capacity building of Local Service Providers (LSPs) to BEE. The Scope of Work under the project

- Organizing 4 one-day training/ capacity building workshops for LSPs in each cluster.
- Development of 10 bankable DPRs for each cluster, based on mapping technology needs with capacities of local technology suppliers/service providers, and also replication potential and applications to banks in each cluster.

Brief introduction of the MSME unit

Name of the unit	M/s N. G. Enterprises
Constitution	Proprietorship
MSME Classification	Small
No. of years in operation	32
Address: Registered Office:	108, Sector-B, Sanwer Road, Indore Ujjain (M.P)
Industry-sector	Foundry (Steel)
Products manufactured	Manufacturer of stone crusher machine parts
Name(s) of the promoters/ directors	Mr Nirangen Garg, Mr Nandan Garg

A detailed assessment study was undertaken in the identified area with the use of the sophisticated handheld instruments. Energy consumption pattern and production data were collected to estimate the specific energy consumption of the unit. The unit level baseline of the unit was also estimated using the historical data. The plant is consuming about 426,800 kWh of electricity per year. The annual consumption of the Coal is 67 MT. The total energy consumption of the unit during last 12 months is estimated to be 80.4 toe which is equivalent to 61.1 lakh rupees. The total CO₂ emission during this period is estimated to be 545 tonnes. Electricity and coke were considered for CO₂ emission estimation.

The unit manufactures the steel castings for stone crusher machines. The total annual liquid metal production of the unit during 2017-18 was approximate 480 tonnes and total annual good castings production is around 408 tonnes. The major source of energy is coal is used in melting furnace and electricity is consumed in the induction melting a furnace, motors and lighting.

Accepted/ recommended technology implementation

The recommended technology considered after discussion with the plant personnel for implementation in the unit is given below.

Energy conservation measure	Annual energy saving		Investment (Rs. Lakh) ¹	Monetary savings (Rs. Lakh per year)	Simple payback period (Yrs)	Emission reduction (tonnes of CO ₂)
	Electricity (kWh)	Coke (tonnes)				
Replacement of existing cupola and induction furnace with EE induction furnace	1,50,335	60	64.2	33.1	1.9	298

Other benefits

- The proposed project is not expected to bring in any change in process step or operating practices therefore no change expected in the product quality.
- Implementation of the selected technology in the unit may result in reduction in CO₂ emissions.

Cost of project & means of finance

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	64.2	64.2	64.2
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	28.3	24.0	25.2
4	NPV	Rs. In Lakh	30.4	21.6	24.1
5	DSCR	-	-	2.1	0.9

¹ Investment including the (i) power unit – Rs. 47.98 lakh (ii) Applicable taxes and other misc. charges – 16.22 lakh

1.0 Details of the unit

1.1 Particulars of unit

Table 1.1: Particulars of the unit

1	Name of the unit	M/s N. G. Enterprises
2	Constitution	Proprietorship
3	Date of incorporation / commencement of business	1985
4	Name of the Contact Person	Mr. Niranjn Garg
7	Mobile / Ph. No	+91-9827033041
8	Email	nandanenterprisesindore@gmail.com
9	Address: Registered Office	108, Sector-B, Sanwer Road, Indore, Ujjain (M.P) Owned
10	Factory	108, Sector-B, Sanwer Road, Indore, Ujjain (M.P) Owned
11	Industry / Sector	MSME/Manufacturing
12	Products Manufactured	Manufacturer of stone crusher machine parts
13	No of hours of operation/shift	12
14	No of shifts/ day	01
15	No of days/year	300
16	Installed Capacity	6,700 MT per year
17	Whether the unit is exporting its products (Yes/ No)	No
18	Quality Certification, if any	NA

2.0 Energy profile

2.1 Process flow diagram

The major steps of process are mould sand preparation, charge preparation followed by melting, pouring, knockout and finishing. The steps are explained below.

2.1.1 Sand preparation plant

The major equipment installed is sand siever, sand mixer and sand transport belts and elevators. Electricity is used to run all rotary machines in sand preparation plant. Fresh sand is mixed with adhesives in sand mixer then it is pressed in mould casing by pressing machine. In casing some amount of burnt sand is reused with fresh sand.

2.1.2 Core preparation and moulding

For core preparation, fresh sand is used. Cores are baked in LDO fired ovens. After hardening of core it is mounted in mould. In mould preparation fresh and burnt sand is pressed by machines which operate on pneumatic in mould casing. Upper and lower half of mould is assembled together and then it gets ready to pouring.

2.1.3 Melting

Melting of charge is done with help of induction furnace. Induction furnace runs on medium frequency three phase electrical supply. Once melt attained required temperature and metallurgy, the liquid melt is poured into the earlier prepared sand moulds using ladles.

2.1.4 Knockout and finishing

Mould is left to cool for certain time, then it follows to a vibrator with grated surface, it knocks-out the sand and the casting is send for finishing, which involves shot blasting and machining job.

The process flow diagram for major product and steel grade casting produced in the foundry is given in figure 2.1.4.

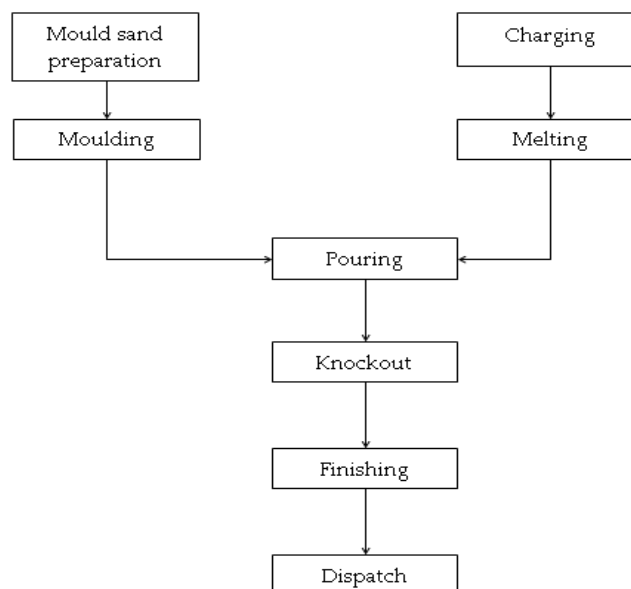


Figure 2.1.4: Process flow chart

2.2 Details of technology identified

The details of the existing technology installed in the unit are given in table 2.2.

Table 2.2a: Details of existing technology

Parameters/ Equipment ID	Value
Equipment	Induction furnace
Type	SCR
Make	Electrotherm
Capacity	250 kW, 300 kg X 2 crucible
Operating Temperature (oC)	1550
Mode of operation (batch/continuous)	Batch
Batch duration (minute)	75
Fuel Details Type	Electricity
Consumption (unit/batch)	900-1000 units/ tonne of melt

2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited. Table 2.3 provides the details of energy uses.

Table 2.3: Energy used and description of use

S No	Energy source	Description of use
1	Electricity	Motive power for different drives in different process sections and utilities
2	coke	For Cupola melting furnace

2.4 Energy sources, availability & tariff details

The power supply to the facility is from Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited grid @ 33 kV, with 200 kVA sanctioned contract demand. The unit different energy sources, availability of listed energy types and their respective tariffs are given in table 2.4.

Table 2.4: Energy sources, availability and tariffs

Particular	For supply at 33 kV
Demand charges	Rs. 530.00/ kVA/month
Energy charges	Rs. 5.0/ kWh

2.5 Analysis of electricity consumption

Table 2.5: Electricity consumption profile

Month	Electricity consumption, kWh/month	Contract demand, kVA	Actual Demand, kVA	Energy Charges, Rs.	Demand Charges, Rs.	PF	PF Rebate, Rs.	Monthly Bill amount, Rs.
Jan-18	41,950	200	210	2,68,254	1,07,100	0.98	-13,330	3,52,748
Feb-18	43,340	200	202	2,78,330	1,03,020	0.99	-13,830	3,54,673
Mar-18	21,410	200	201	1,39,165	1,02,510	0.96	-2,658	2,40,325
Average	35,567	200	204	2,28,583	1,04,210	1	-9,939	3,15,915

Month	Electricity consumption, kWh/month	Contract demand, kVA	Actual Demand, kVA	Energy Charges, Rs.	Demand Charges, Rs.	PF	PF Rebate, Rs.	Monthly Bill amount, Rs.
Yearly	4,26,800			27,42,996	12,50,520		-1,19,272	37,90,984

Figure 2.5 presents contract demand, recorded maximum demand and the energy consumption of the unit.

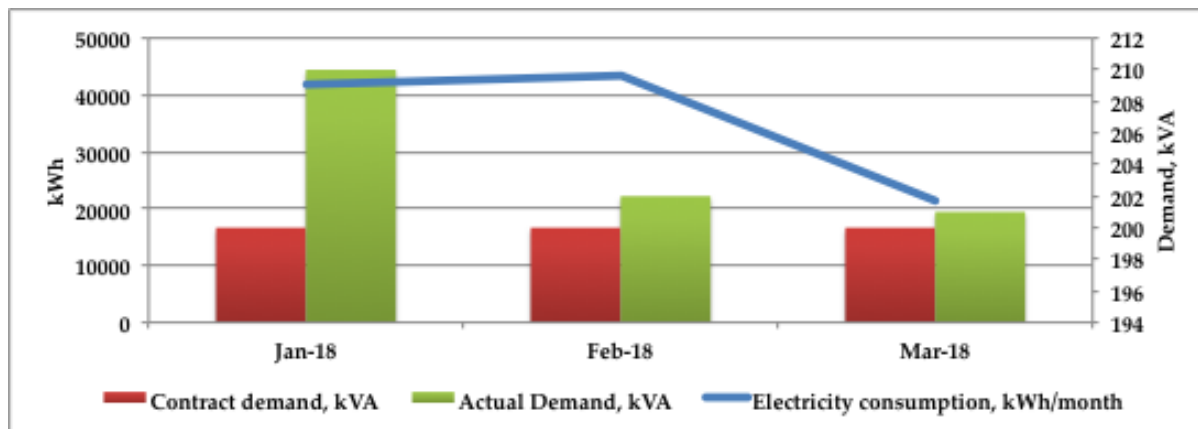


Figure 2.5: Demand pattern and energy consumption profile

2.6 Analysis of other energy forms/ fuels

The analysis of the other fuels/forms of energy used in the unit is given in table 2.6.

Table 2.6: Analysis of other energy/ fuel consumption

Parameters	Coke, MT
Consumption unit/year	67
Calorific value per unit	6,500
Equivalent toe per year	43.7
Price (Rs per unit)	32
Total price per year	22

The share of various energy forms used in the unit is given in figure 2.6.

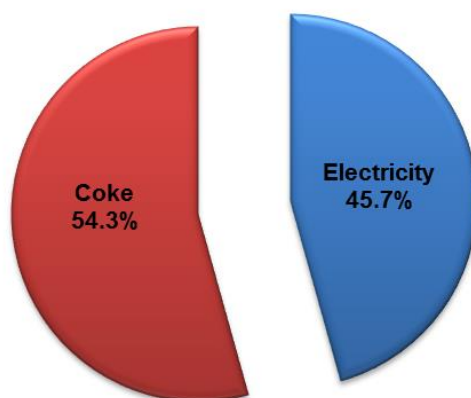


Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 426,800 kWh of electricity per year. The annual consumption of the Coal is 67 MT. The total energy consumption of the unit during last 12 months is estimated to be 80.4 toe which is equivalent to 61.1 lakh rupees. The total CO₂ emission during this period is estimated to be 545 tonnes. Electricity and coke were considered for CO₂ emission estimation.

3.0 Proposed technology for energy efficiency

Based on the measurements, observations/ findings during detailed assessment study conducted in the unit, the following technology has been identified for energy efficiency improvement. The detail is given below.

3.1 Replacement of existing induction furnace by new IGBT type induction furnace

3.1.1 Background

The Plant is manufacture of accessories and parts of stone crusher machine. To cater the melting requirements, the plant has installed a cupola furnace (27 inch) as well as an induction furnace of rated capacity of 250 kW with two crucible of capacity of 300 kg each for melting (one standby). The operational parameters of the melting facility including the coke and electricity consumption and material charged were measured during the detailed assessment study and analysis of the past one year data.

3.1.2 Observations and analysis

The specific power consumption of the induction furnace is estimated based on the data measured/collected during the field visit in the unit. The average melting per batch has been estimated to be 270 kg per batch based on the data provided by the plant. The measured trend of the active power and specific power is shown in figure 3.1.2.

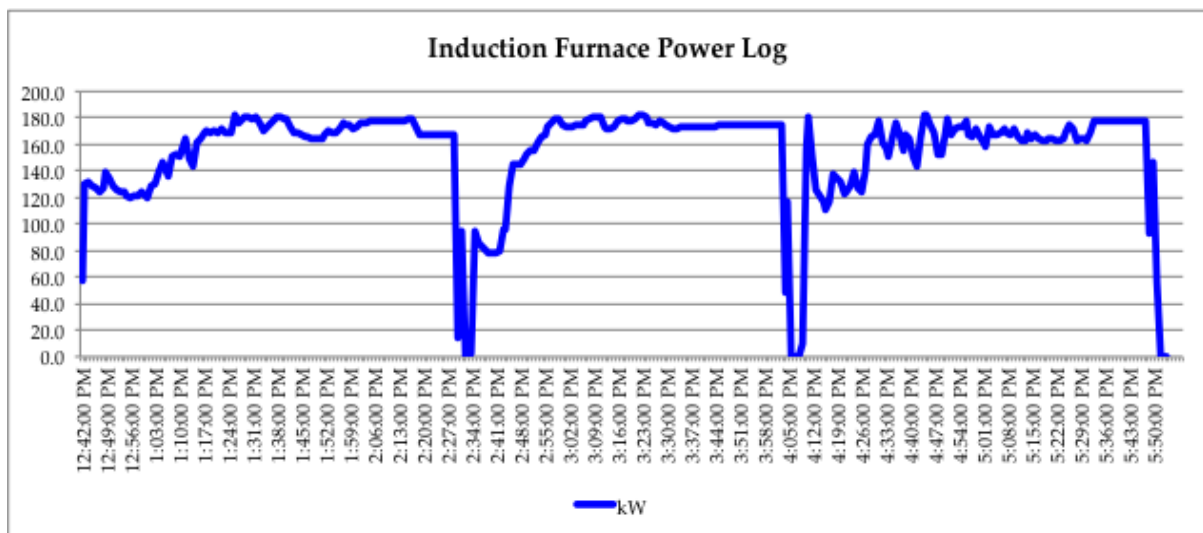


Figure 3.1.2: Trend of the active power and specific power

The average production of the melting section of the unit is estimated to be 10 tonnes per month melt production. The specific power consumption of the unit is estimated to be 993 kWh per tonne of liquid metal. The specific energy consumption is higher than the consumption in similar categories of furnaces. The detailed analysis of the specific power consumption of the induction furnace is given in table 3.1.2.

Table 3.1.2: SEC from sample heats

Heat no	kWh/heat	Weight/heat	kWh/tonne	Temp	Power Lag, minutes
1	289.4	270	1,072	1,570	22
2	243.2	270	901	1,570	20
3	271.9	270	1,007	1,570	20
Average	268.2	270	993	1,570	21

Similarly, the data related to operation of cupola is collected/ measured during the detailed study. The specific coke consumption ratio of cupola is estimated to be about 7.5:1.

3.1.3 Recommendation

The unit may replace the existing cupola and induction furnace by new IGBT type induction furnace of same capacity to reduce the specific energy consumption. The proposed induction furnace specifications include 550 kW capacity of power panel (flexible to operate in the range of 350-550 kW) and 1,000 kg crucible capacity. The specific energy consumption (induction furnace and auxiliary) of new furnace would be 650 to 680 kWh per tonne of steel estimated based on cluster studies done by TERI.

3.2 Cost benefit analysis

The estimated annual energy savings by replacement of existing SCR type induction furnace with IGBT type furnace 150,335 kWh of electricity and 60 tonne of coke which is equivalent to a monetary saving of Rs 33.1 lakh. The investment requirement is Rs 64.2 lakh with a simple payback period of 1.9 years. The detailed calculations of the recommended energy conservation measures for DPR are provided in table 3.2.

Table 3.2: Cost benefit analysis for recommended energy savings measures

Parameters	Unit	Existing	Proposed
Specific energy consumption of the furnace	kWh/tonne	993	680
Production from furnace	Tonne/year	480	480
Working days per year	Days/year	300	300
Savings in electricity consumption	kWh/tonne	-	313
Annual energy savings	kWh/year	-	1,50,335
Monetary benefits	Rs lakh/yr	-	13.9
Monetary saving after Cupola non-usage	Rs lakh/yr	-	19.2
Total monetary savings	Rs lakh/yr	-	33.1
Total investment cost ²	Rs lakh	-	64.2
Payback period	Years	-	1.9

3.3 Pre-training requirements

The training would be required on best charging practices and best melting operations. Also best practices to be adopted for operation like - initial charging, pouring, superheating, holding for chemical analysis or de-slagging.

² Quotation - 1 has been considered for estimation of investments

3.4 Process down time for implementation

The estimated process down time required for implementation of recommended measure is estimated to be 3 days after commissioning and testing of the new furnace.

3.5 Environmental benefits

3.5.1 CO₂ reduction³

Implementation of the selected energy conservation measures in the unit may result in reduction in CO₂ emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 298 tonne of CO₂ per year.

3.5.2 Reduction in other pollution parameters (gas, liquid and solid)

There is not significant impact on the reduction in other pollution parameters including gas, liquid and solid.

3.6 Social benefits

3.6.1 Improvement in working environment

Not envisaged

3.6.2 Increase in manpower skills

Not envisaged

3.6.3 Increase in wages/salary of workers

Not envisaged

3.6.4 Health & safety of plant & personnel

Not envisaged

³ Source for emission factor: 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Electricity: CO₂ Baseline Database for the Indian Power Sector, user guide version 12.0, May 2017 (CEA)

4.0 Project financials

4.1 Cost of project and means of finance

4.1.1 Particulars of machinery and technology comparison

The particulars of machinery proposed for the project is given in table 4.1.1.

Table 4.1.1: Particulars of machinery proposed for the project

S. No.	Name of machinery (Model/ specification)	Name of manufacturer, contact person	Advantage	Disadvantage
1	One [1] No. 1000 KW/500 Hz VIP® - ITM SERIES IGBT LI POWER AND CONTROL SYSTEM with internal water circulating system and hydraulic power supply unit.	Mr Nishant Singh Area Sales Head Inductotherm (India) Pvt. Ltd., Plot No. SM - 6, Road No. 11, Sanand-II Industrial Estate, BOL Village, Sanand, Ahmedabad - 382 170	<ul style="list-style-type: none"> • Intelligent active demand manager. • Medium frequency IGBT based induction furnace • Provide end-end solution (such as panel, crucible, transformers, water cooling system, PLC etc.) • Experience in the sector 	
2	550 KW/500 Hz IGBT based Induction power source with DM water circulation unit, Hydraulic unit, one no of 2000Kg aluminium frame box type melting furnace with built in tank capacitor bank.. <ul style="list-style-type: none"> • 550 kW Solid State Medium Frequency IGBT Power Source. • Programmable Logic Controller with 7.0" Colour Touch screen HMI. • Energy Meter with Ethernet Communication. • Earth Leakage and Water Conductivity Monitoring System. • Wiring Drawings and water circuit diagrams • Medium Frequency Tank Capacitor bank 	Shailesh Patel (Director) ORITECH solutions B/2-3, Sarthi Comp. & Estate, Opp. Gujarat Vahepari Maha Mandal (GVMM), Odhav, Ahmedabad - 382 415 (INDIA) Ph: +91-79-32957055, Tele-fax: +91-79-22901350 E-mail: info@oritech.in web: www.oritech.in	<ul style="list-style-type: none"> • 20+ years of experience in the Development of Induction equipment • Continuous research and development process • Persistently upgrading and technology • Admirable quality norms and testing standards 	
3	Advance digital controlled CF-VFI solid state power supply unit (IGBT based) <ul style="list-style-type: none"> • 500 kW/1kHz • Robust induction melting 	Plasma Induction Mr Mayur Suhagiya 330/1p, Hajipur Kalol, Gandhinagar Gujarat	<ul style="list-style-type: none"> • Full coil leak metal detection system • Fully captive electromagnetic flux containment system. 	

S. No.	Name of machinery (Model/ specification)	Name of manufacturer, contact person	Advantage	Disadvantage
	furnace (Al. Frame) with Hydraulic titling arrangement suitable for 500 kg	+91-9727765253	<ul style="list-style-type: none"> Hydraulic flow control valves. Precast solid refractory bottom. Emergency hoist connection arrangement. Dual Hydraulic tilt cylinders with hand pump in power pack. 	
	<ul style="list-style-type: none"> DM water circulation unit Heavy duty hydraulic power pack Advance digital energy monitoring system 			

4.1.2 Means of finance

The means of finance for the project is shown in table 4.1.2.

Table 4.1.2: Means of finance

S. No.	Details	100% equity	D/E- 70:30	D/E- 50:50
1	Additional (Share) Capital	64.2	19.3	32.1
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	44.9	32.1
5	Others	-	-	-
Total		64.2	64.2	64.2

4.2 Financial statement (project)

4.2.1 Assumptions

The assumptions made are provided in table 4.2.1.

Table 4.2.1: Assumptions made

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
General about unit				
No of working days	Days			300
No of shifts per day	Shifts			2
Annual operating hours	Hrs/year			7200
Installed production capacity	tonnes/year			-
Production in last financial years	tonnes/year			-
Capacity utilization factor	%			-
Proposed investment (Project)				
Total cost of the project	Rs. (in Lakh)	64.2	64.2	64.2
Investment without interest defer credit (IDC)	Rs. (in Lakh)	64.2	64.2	64.2
Implementation time	Weeks	6	3	3
Interest during the implementation phase	Rs. in lakhs	-	0.3	0.2
Total investment	Rs. in lakhs	64.2	64.4	64.4
Financing pattern				
Own funds	Rs. in lakhs	64.2	19.5	32.3

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
Loan funds (term loan)	Rs. in lakhs	-	44.9	32.1
Loan tenure	Years	-	5.0	5.0
Moratorium period (No EMI (interest and principal amount))	Months	-	3.0	3.0
Total repayment period	Months	-	60.0	60.0
Interest rate	%	-	10.5	10.5
Estimation of costs				
Operation & maintenance costs	%			5
Annual escalation rate of O&M	%			5
Estimation of revenue				
Reduction in energy cost	Rs. (in lakh)/year			33.1
Total saving	(Rs Lakh/year)			33.1
Straight line depreciation	%			16.2
IT depreciation	%			80.0
Income tax	%			34.0
Period of cash flow analysis	Years			5

4.2.2 Payback

The simple payback period on the investments made are shown in table 4.2.2.

Table 4.2.2: Payback

Details	100% equity	D/E- 70:30	D/E- 50:50
Total project cost (Rs. In lakh)	64.2	64.4	64.4
Cash flow as annual saving (Rs. In lakh/year)	33.1	33.1	33.1
O&M Expenses for first year (Rs. In lakh/year)	3.2	3.2	3.2
Net Cash flow (Rs. In lakh/year)	29.9	29.9	29.9
SPP (months)	25.7	25.8	25.8
Considered (month)	25.7	25.8	25.8

4.2.3 NPV and IRR

The NPV and IRR calculations are shown in table 4.2.3.

Table 4.2.3a: NPV and IRR (100% equity)

Particulars / years	0	1	2	3	4	5
(Rs.in lakhs)						
Profit after tax	-	19.53	20.02	9.84	9.16	8.93
Depreciation	-	10.40	10.40	10.40	10.40	10.40
Cash outflow	64.17	-	-	-	-	-
Net cash flow	-64.17	29.93	30.42	20.24	19.56	19.33
Discount rate % @ WACC	9.3	9.3	9.3	9.3	9.3	9.3
Discount factor	1	0.92	0.84	0.77	0.70	0.64
Present value	-64.17	27.40	25.48	15.52	13.73	12.42
Net present value	30.38					
Simple IRR considering regular cash flow	28.30%					

Table 4.2.3b: NPV and IRR (D/E- 70:30)

Particulars / years	0	1	2	3	4	5
	(Rs.in lakhs)					
Profit after tax	-	17.19	18.20	7.70	7.64	8.09
Depreciation	-	10.45	10.45	10.45	10.45	10.45
Cash outflow	64.44	-	-	-	-	-
Net cash flow	-64.44	27.64	28.64	18.15	18.09	18.53
Discount rate % @ WACC	10.10	10.10	10.10	10.10	10.10	10.10
Discount factor	1.00	0.91	0.83	0.75	0.68	0.62
Present value	-64.44	25.10	23.62	13.59	12.30	11.44
Net present value	21.61					
Simple IRR considering regular cash flow	23.97%					

Table 4.2.3c: NPV and IRR (D/E- 50:50)

Particulars / years	0	1	2	3	4	5
	(Rs.in lakhs)					
Profit after tax	-	17.86	18.72	8.31	8.07	8.33
Depreciation	-	10.43	10.43	10.43	10.43	10.43
Cash outflow	64.36	-	-	-	-	-
Net cash flow	-64.36	28.29	29.15	18.75	18.51	18.76
Discount rate % @ WACC	9.90	9.90	9.90	9.90	9.90	9.90
Discount factor	1.00	0.91	0.83	0.75	0.69	0.63
Present value	-64.36	25.75	24.15	14.13	12.70	11.72
Net present value	24.08					
Simple IRR considering regular cash flow	25.21%					

4.3 Marketing & selling arrangement

The marketing and selling arrangements of the unit are given in table 4.3.

Table 4.3: Marketing & selling arrangements

Items	Remarks
Main Markets (locations)	Pan India
Locational advantages	-
Indicate competitors	Other Induction melting furnace manufacturing units
Any USP or specific market strength	-
Whether product has multiple applications	NA
Distribution channels (e.g. direct sales, retail network, distribution network)	Direct sales
Marketing team details, if any.	NA

4.4 Risk analysis and mitigation

The risk analysis and mitigation for the proposed options are given in table 4.4.

Table 4.4: Risk analysis and mitigation

Type of risk	Description	Mitigation
Technology	The equipment/technology provided by the supplier may not be of high quality, which may result in underperformance.	The equipment/technology should be procured from standard/reputed vendors only.
Market / Product	Demand of the product manufactured by the unit may change resulting in lower capacity utilization.	Regular vigilance/tab on the market scenario by the SME will help in better understanding of new substitute product. The unit may modify the product line based on the emerging market trend.
Policy/Regulatory	Changes in government regulation/policy related to pollution and taxes & duties can affect the viability of the unit.	Local industrial association may play a role in discussing these issues with the relevant governmental bodies on a regular basis, so that any concerns of the unit are brought to their notice.

4.5 Sensitivity analysis

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different scenarios is given in table 4.5.

Table 4.5: Sensitivity analysis

S. No.	Scenario	D/E ratio	Payback period (months)	NPV (Rs lakh)	IRR (%)	DSCR	ROI (%)
1	10% increase in estimated savings	100% equity	2.2	11.6	489.1	-	44.2
		70:30:00	2.2	11.2	483.1	2.1	47.0
		50:50:00	2.2	11.3	484.9	0.9	46.2
2	10% reduction in estimated savings	100% equity	2.7	9.3	392.7	-	43.3
		70:30:00	2.7	9.0	387.1	2.1	46.6
		50:50:00	2.7	9.1	388.7	0.9	45.6
3	10% rise in interest rates	70:30:00	2.4	9.9	434.4	2.1	46.8
		50:50:00	2.4	10.1	436.3	0.9	45.9
4	10% reduction in interest rates	70:30:00	2.4	10.3	435.6	2.1	46.8
		50:50:00	2.4	10.4	437.1	0.9	45.9

5.0 Conclusions & recommendations

The IGDPR prepared for the replacement of existing induction furnace by new IGBT type induction furnace based on the performance assessment study conducted at unit and the acceptance of the unit management. The brief of selected energy conservation measure is given below.

5.1 List of energy conservation measures

The brief summary of the energy conservation measures are given in table 5.1.

Table 5.1: Summary of the energy conservation measures

S. No	Energy conservation measure	Annual energy saving		Investment (Rs. Lakh)	Monetary savings (Rs. Lakh per year)	Simple payback period (Yrs)	Emission reduction (tonnes of CO ₂)
		Electricity (kWh)	Coke (tonnes)				
1	Replacement of existing cupola and induction furnace with EE induction furnace	1,50,335	60	64.2	33.1	1.9	298

The measure has an estimated investment of 64.2 lakh rupees and can yield a savings of 33.1 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 298 tonnes of CO₂. The financial indicators provided above in the table shows the project is financially viable and technically feasible.

5.2 Summary of the project

The summary of the project is given in table 5.2.

Table 5.2: Summary of the project

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	64.2	64.2	64.2
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	28.3	24.0	25.2
4	NPV	Rs. In Lakh	30.4	21.6	24.1
5	DSCR	-	-	2.1	0.9

5.3 Recommendations

The financial indicators provided above show the project is financially viable and technically feasible. It is recommended that the implementation of the identified the energy conservation measures may be undertaken by the unit.

6.0 Financing schemes for EE investments for MSME sector

Government of India has many schemes to provide concessional finance for EE technologies among MSMEs. Some major government schemes are summarised in table 6.1.

Table 6.1: Major government schemes

Name of the scheme	Brief Description and key benefits
ZED assessment and certification	<p>Assessment process, fee and subsidy are as follows: Online (e-Platform) self-assessment: Nil fee Desk Top assessment : Rs 10,000 per SME Complete assessment : Rs 80,000 ZED rating per SME; Rs 40,000 for additional ZED defence rating; Rs 40,000 for re-rating The rating costs will include cost of Rs 10,000/- as certification cost by QCI. Subsidy for Micro, Small and Medium Enterprises are 80%, 60% and 50% respectively.</p>
Credit Linked Capital Subsidy Scheme (CLCSS) (2000-ongoing)	<p>15% capital subsidy of cost of eligible plant and machinery / equipment for adoption of proven technologies for approved products / sub-sectors for MSE units subject to ceiling of INR 15 lakhs</p>
Credit Guarantee Fund Scheme for Micro and small Enterprises (in partnership with SIDBI) (2000-ongoing)	<p>This scheme was launched by MoMSME and SIDBI to alleviate the problem of collateral security and enable micro and small scale units to easily adopt new technologies. Under the scheme, collateral free loans up to Rs 1 crore can be provided to micro and small scale units. Additionally, in the event of a failure of the SME unit which availed collateral free credit facilities to discharge its liabilities to the lender, the Guarantee Trust would guarantee the loss incurred by the lender up to 75 / 80/ 85 per cent of the credit facility.</p>
Technology and Quality Up gradation Support to MSMEs (TEQUP) (2010-ongoing)	<p>The benefits available to SMEs under TEQUP include –technical assistance for energy audits, preparation of DPRs and significant capital subsidy on technologies yielding an energy savings of over 15%. The scheme offers a subsidy of 25% of the project cost, subject to a maximum of Rs. 10 lakhs. TEQUP, a scheme under NMCP, focuses on the two important issues in enhancing competitiveness of the SME sector, through EE and Product Quality Certification.</p>
Technology Upgradation Fund Scheme (TUFS) (1999-ongoing)	<p>Interest subsidy and /or capital subsidy for Textile and Jute Industry only.</p> <ol style="list-style-type: none"> To facilitate Technology Up gradation of Small Scale (SSE) units in the textile and jute industries. Key features being: <ul style="list-style-type: none"> Promoter’s margin -15%; Subsidy - 15% available on investment in TUF compatible machinery subject to ceiling of Rs 45 lakh; Loan amount - 70% of the cost of the machinery by way of Term Loan

Name of the scheme	Brief Description and key benefits
	<ul style="list-style-type: none"> • Interest rate: Reimbursement of 5% on the interest charged by the lending agency on a project of technology upgradation in conformity with the Scheme • Cover under Credit Guarantee Fund Scheme for Micro and Small Enterprises (CGMSE) available <p>2. To enable technology upgradation in micro and small power looms to improve their productivity, quality of products and/ or environmental conditions</p> <ul style="list-style-type: none"> • 20% margin subsidy on investment in TUF compatible specified machinery subject to a ceiling of Rs 60 lakhs or Rs 1crore (whichever is applicable) on subsidy amount to each unit – released directly to the machinery manufacturer.
Tax incentives	<ul style="list-style-type: none"> • Accelerated depreciation is provided to the customers / users of the energy saving or renewable energy devises under the direct tax laws. • Under indirect taxes, specific concessional rates of duty are only available to CFLs and not to all energy efficient products • A further waiver of import tariffs and taxes for EE technology imports are dealt on a case to case basis, meaning higher costs for those imported technologies that are not available in the domestic markets at present.

Two financing schemes have been created by Bureau of Energy Efficiency (BEE) under The National Mission for Enhanced Energy Efficiency (NMEEE) for financing of energy efficiency projects - Venture Capital for Energy Efficiency (VCFEE) and Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE). These funds seek to provide appropriate fiscal instruments to supplement the efforts of the government for creation of energy efficiency market. Highlights of these two schemes are provided in the table 6.2.

Table 6.2: BEE's VCFEE and PRGFEE scheme

Venture Capital for Energy Efficiency (VCFEE)	<ul style="list-style-type: none"> • This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. • A single investment by the fund shall not exceed Rs 2 crore • Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)	<ul style="list-style-type: none"> • A PRGF is a risk sharing mechanism lowering the risk to the lender by substituting part of the risk of the borrower by granting guarantees ensuring repayment of part of the loan upon a default event. • Guarantees a maximum 50% of the loan (only principal). In case of default, the fund will: <ul style="list-style-type: none"> ○ Cover the first loss subject to maximum of 10% of the total guaranteed amount ○ Cover the remaining default (outstanding principal) amount on

Venture Capital for Energy Efficiency (VCFEE)	<ul style="list-style-type: none"> This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. A single investment by the fund shall not exceed Rs 2 crore Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
	<p style="text-align: center;">partial basis upto the maximum guaranteed amount</p> <ul style="list-style-type: none"> PFI shall take guarantee from the PRGFEE before disbursement of loan to the borrower. The Guarantee will not exceed Rs 300 lakh per project or 50% of loan amount, whichever is less. Maximum tenure of the guarantee will be 5 years from the date of issue of the guarantee

Indian Renewable Energy Development Agency (IREDA), a non-banking financial institution established by the government also extends financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation. The detailed financing guidelines for energy efficiency projects are provided in table 6.3.

Table 6.3: IREDA's financing guidelines

Eligible companies who can apply	Private Sector Companies/ firms, Central Public Sector Undertaking (CPSU), State Utilities/ Discoms/ Transcos/ Gencos/ Corporations, Joint Sector Companies which are not loss making.
Minimum loan amount	<ul style="list-style-type: none"> Rs. 50 lakh
Type of projects considered for term loans	<ul style="list-style-type: none"> Replacement / retrofit of selected equipment with energy efficient equipment Modification of entire manufacturing processing Recovery of waste heat for power generation
Incentive available	<ul style="list-style-type: none"> Rebate in central excise duty Rebate in interest rate on term loan Rebate in prompt payment of loan instalment
Interest rate	<ul style="list-style-type: none"> 10.60% to 11.90% depending upon the grading of the applicant with prompt payment rebate of 15 bps if payment is made on / before due dates Interest rates are floating and would be reset on commissioning of the project or two years from the date of first disbursement. Thereafter, the rates will be reset after every two years. Rebate of 0.5% in interest rates are available for projects set up in North Eastern States, Sikkim, J&K, Islands, Estuaries. Rebates of 0.5% in interest rates are also available for projects being set up by SC/ST, Women, Ex Servicemen and Handicapped categories involving project cost of upto Rs. 75.00 lakh.
Loan	Upto 70% of the total project cost. Promoter's contribution should be Minimum 30% of the total project cost
Maximum debt	3:1

equity ratio	The project cash flow should have a minimum average Debt Service Coverage Ratio of 1.3
Maximum repayment period	12 years with moratorium of maximum 12 months
Procurement procedures	The borrower is required to follow the established market practices for procurement and shall demonstrate that the quality goods and services are being purchased at reasonable and competitive prices. Wherever the loan is sanctioned against international lines of credit such as the World Bank, Asian Development Bank, kfW, etc., the relevant procedures will have to be followed and requisite documents will have to be submitted by the borrower

Small Industries Development Bank of India (SIDBI) has several schemes and focused lines of credit for providing financial assistance for energy efficiency and cleaner production projects for SMEs. Highlights of some of the major financial assistance schemes/projects managed by SIDBI are given in table 6.4.

Table 6.4: Major EE financing schemes/initiatives of SIDBI

End to End Energy Efficiency (4E) Program	<p>Support for technical /advisory services such as:</p> <ul style="list-style-type: none"> • Detailed Energy Audit • Support for implementation • Measurement & Verification <p>Financing terms:</p> <ul style="list-style-type: none"> • Terms loans upto 90% • Interest rate upto 3% below normal lending rate.
TIFAC-SIDBI Revolving Fund for Technology Innovation (Srijan Scheme)	<p>To support SMEs for up-scaling and commercialization of innovative technology based project at flexible terms and interest rate.</p> <p>Preference accorded to sustainable technologies / products. Soft term loan with an interest of not more than 5%.</p>
Partial Risk Sharing Facility for Energy Efficiency (PRSF) Project (supported by World Bank)	<p>Sectors covered:</p> <ul style="list-style-type: none"> • Large industries (excluding thermal power plants) • SMEs • Municipalities (including street lighting) • Buildings <p>Coverage:</p> <ul style="list-style-type: none"> • The minimum loan amount Rs 10 lakh and maximum loan amount of Rs 15 crore per project. • The extent of guarantee is 75% of the loan amount
JICA-SIDBI Financing Scheme	<ul style="list-style-type: none"> • The loan is used to provide SMEs with funds necessary to invest in energy-saving equipment (and some medical equipment) in the form of two-step loans through SIDBI or three-step loans through intermediary financial institutions.

	<ul style="list-style-type: none"> • Project uses an Energy Saving Equipment List approach • Equipment/machinery with energy saving potential less than 10% is not eligible. • Interest rate: As per credit rating and 1% below the normal lending rate • Separate technical assistance component which is used for wetting of loan applications, holding seminars to raise awareness of energy saving among SMEs and to improve the ability of financial institutions to screen loan applications for energy-saving efforts
KfW-SIDBI Financing Scheme	<p>Coverage</p> <ul style="list-style-type: none"> a) SMEs for energy efficiency projects b) SMEs and clusters for cleaner production and emission reduction measures, waste management and Common Effluent Treatment Plant (CETP) facilities <p>Interest rate</p> <p>As per credit rating and 1% below the normal lending rate</p> <p>Eligible criteria</p> <p>3 t CO₂ emission reduction per year per lakh invested</p> <p>List of eligible equipment/technology and potential suppliers developed for guidance</p>

State Bank of India (SBI) has been provided a green line of credit by Japan Bank for International Cooperation (JBIC) for financing of energy efficiency investments. Highlights of the line of credit are given in table 6.5.

Table 6.5: JBIC-SBI Green Line

<p><u>Key Features</u></p> <ul style="list-style-type: none"> • Amount : USD 90 million • Repayment Schedule: First repayment on May 30, 2017 and final repayment date May 30, 2025 (equal instalment) <p><u>Eligibility Criteria</u></p> <ul style="list-style-type: none"> • Projects contributing to preservation of global environment, i.e. significant reduction of GHG emissions • Acceptance of JBIC-MRV (“J-MRV”) by the project proponent in terms of the numerical effect of the environment preservation. To ensure effective GHG reduction emissions in Green financed projects, JBIC reviews such effects through simple and practical Measurement Reporting Verification (MRV) process both in (a) prior estimation and (b) ex-post monitoring. • Procurement in line with the “Guidelines for Procurement under Untied Loans by Japan Bank for International Cooperation”
--

Canara bank has a dedicated scheme for financing EE investment among SME sector as mentioned in table 6.6.

Table 6.6: Canara bank scheme of EE SME loans

Purpose	For acquiring/adopting energy conservation/savings equipment/measures by SMEs
Eligibility	Units under Small and Medium Enterprises Cost of energy for the unit should constitute not less than 20% of the total cost of production Unit should possess energy audit report issued by an approved energy Consultant/Auditor. Borrowal a/cs-ASCC code S1 or S2 during previous review. Current account holders having dealings exclusively with us satisfactorily for a period of last one year
Maximum loan	Maximum Rs 100 lakhs in the form of term loan
Security	Prime: Assets created out of loan Collateral: Upto Rs.5 lakhs – NIL Above Rs.5 lakhs, as determined by the bank
Repayment	Maximum 5-7 years including moratorium of 6 months
Guarantee cover	Cover available under CGMSE of CGTMSE available for eligible loans
Margin	10% of the project cost
Rate of interest	1% less than the applicable rate
Upfront fee	1% of the loan
Insurance cover	Assets acquired and charged as security to Bank to be insured
Special offer, if any	Grants : Bank provides 25% of the cost of Energy Audit / Consultancy charges with a maximum of Rs 25000/- to the first 100 units on a first come first served basis which is in addition to the grant of Rs 25000/- being provided by IREDA(First 100 units)

Among the private sector banks in India, Yes Bank is also active in financing of renewable energy and energy efficiency projects. The bank has an MOU with SIDBI for providing funding for EE through PRSF.

Most commercial banks charge interest rate between from 11% to 13% from MSMEs depending upon general criteria such as credit ratings, references, past lending record, balance sheet for last 3 years and so on. Interest rebate is offered for a few customers whose collateral value is around 125% of the loan amount. Further 0.5% concession in interest rate was offered to women entrepreneurs.

Annexures

Annexure 1: Budgetary offers / quotations

Quotation 1: Inductotherm India Pvt. Ltd

Annexure 1



Inductotherm (India) Pvt. Ltd.
Plot No. SM - 6, Road No. 11
Sanand-II Industrial Estate,
BOL Village, Sanand,
Ahmedabad - 382 170, India
CIN No. U29120GJ1982PTC005739

Tel: +91.2717.62.1000
Fax: +91.2717.62.1111
Toll Free No: 1800.419.2900
it@inductothermIndia.com
www.inductothermIndia.com

Sub: Your Requirement of Induction Melting Furnace

Dear Sir,

This is in reference to your discussions with undersigned in connection with your requirement of Medium Frequency Induction Melting Furnace. We really appreciate your interest in Inductotherm Induction Melting Furnace.

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

- > **Quotation for One [1] No. 550 KW/1000 Hz VIP® - I™ SERIES IGBT LI POWER SUPPLY WITH One [1] No. 500 KG DURALINE FURNACE.**

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

Hope our offer is in line with your requirement. If you need any further information/assistance from our side, please feel free to contact undersigned or our **Mr. Tarun Sangal, General Manager (Capital Sales) (Cell # 09377673760)**.

Thanking you,

Sincerely,

NISHANT SINGH
AREA SALES HEAD
Cell # 09375226751

Encl: Quotation consists of price sheet, technical specification, bulletins, standard terms & conditions (TAC-03).



QAHD112460 // Dated: December 30, 2017
PIONEER ENGINEERING INDUSTRIES
GIVING OUR CUSTOMERS THE COMPETITIVE
EDGE SINCE 1953, UNINTERRUPTED

TECHNICAL SPECIFICATIONS			
550 KW/1000 Hz VIP® - I™ SERIES IGBT LI			
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	550 KW	
2.	Maximum KW	550 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	610 KVA on load	
6.	Melt Rate at 550 KW **	1025 Kg/hour -- Steel 1125 Kg/hour - Iron	
7.	Power Connection	575 V, 3 Phase, 50 Hz	
C. CHARACTERISTICS OF RECOMMENDED MELTING FURNACE			
1.	Nominal capacity (Steel Capacity)	500 Kg	
2.	Style of Furnace	DURALINE	
3.	Pouring Mechanism	Hydraulic tilt	
4.	Furnace Lining (Recommended - to be provided by the customer)	Silica..... Iron Mgo..... Steel	
<p>** 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.</p>			



QAHD112460 /I Dated: December 30, 2017
 PIONEER ENGINEERING INDUSTRIES
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 EDGE SINCE 1953, UNINTERRUPTED

PRICING

550 KW/1000 Hz VIP® - I™ SERIES IGBT LI		
A.	<u>POWER UNIT</u>	
	One [1] No. 550 KW/1000 Hz VIP® - I™ SERIES IGBT LI POWER AND CONTROL SYSTEM with internal water circulating system and hydraulic power supply unit.	Rs.41,58,000/-
B.	<u>MELTING FURNACE</u>	
	One [1] No. 500 KG DURALINE FURNACE with hydraulic tilting arrangement, water cooled leads & interconnecting arrangement (Without lid).	Rs.6,40,000/-

All the above quoted prices are ex-works, Sanand (Ahmedabad). They do not include any applicable taxes. Packing, Forwarding and Insurance charges will be extra.

Presently IGST @ 18% is applicable on Induction Furnace. However 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 Two [2] to Three [3] months. Other terms and conditions are as per the enclosed Standard Terms and Conditions (Bulletin No. TAC-03).

For INDUCTOTHERM (INDIA) PVT. LTD.

NISHANT SINGH
AREA SALES HEAD



QAHD112460 /I Dated: December 30, 2017
PIONEER ENGINEERING INDUSTRIES
GIVING OUR CUSTOMERS THE COMPETITIVE
EDGE SINCE 1953, UNINTERRUPTED

Quotation 2: Oritech Solutions



May 11, 2018
Industrial Energy Efficiency & Sustainable Technologies
The Energy & Resources Institute (TERI)
Darbari Seth Block, I H C Complex
Lodhi Road, New Delhi 110 003/India
Mobile: 9910648515

Kind Attn: Mr. Pawaan Kumar Tiwari

SUBJECT: Offer for 550 kW / 500 Kg IGBT based INDUCTION MELTING FURNACE

Dear Sir,

This is in connection to our discussion regarding your requirement of Induction melting Furnace for steel Melting.

As per your requirement please find our offer No.: OTM/1661/1819 for 550 kW IGBT based Induction Power Source with DM Water Circulation Unit, Tank Capacitor banks, Hydraulic Unit, 500 Kg Aluminum Frame Box type melting furnace.

We look forward to associate further with your company.
For any further information/details, please feel free to contact us.

Thanking you,

Yours faithfully,

for **ORITECH** solutions

Shailesh Patel
DIRECTOR
M: 093747 64116

B/2-3, Sarthi Comp. & Estate, Opp. Gujarat Vahepari Maha Mandal (GVMM),
Odhav, Ahmedabad – 382 415 (INDIA)
Ph: +91-79-32957055, Tele-fax: +91-79-22901350 | E-mail: info@oritech.in | web: www.oritech.in

Qtn. No.: OTM/1661/1819
Date: 11-May.-18
Page: 2 of 10

Industrial Energy Efficiency &
Sustainable Technologies
Delhi



QUOTATION

Sr.No.	Description	Qty.	Price (Rs. in Lacs)
1.	550 kW / 500 Hz IGBT Based Solid State Power Source. <ul style="list-style-type: none"> • 550 kW Solid State Fully fired uncontrolled Rectifier. • Medium Frequency IGBT based 550 Kw rated inverter. • Programmable Logic Controller with 7” Colour Touch screen HMI. • Energy Meter with Ethernet Communication. • Earth Leakage and Water Conductivity Monitoring System. • Electrical wiring drawings and water circuit diagrams. 	1 No.	16.60
	Intelligent Active Demand Manager. <ul style="list-style-type: none"> • Active Demand Controller with Auto Power Control circuit. • Additional Programmable Logic Controller Module. • One No. Additional Energy Meter with RS-485 Communication. • Enclosure with 96 x 96 cutout for Energy Meter, with internal wiring and Fuse Protection. 	1 unit	
	Auxiliaries: <ul style="list-style-type: none"> • D. M. Water circulation unit complete with non-Ferrous pump, Plate type Heat Exchanger and D.M. Resin Cylinder. • Hydraulic Power Pack direction control valves, sub plate, mounting stand with Hydraulic Pipes. 	1 set	
2.	500 kg Aluminum Frame Box type Melting Furnace. <ul style="list-style-type: none"> • One No. of 500 kg Aluminum frame melting furnace. • One set Medium frequency tank capacitor bank. • Copper Bus-bars from Capacitor bank to Melting Furnace. • One set of Inlet and Outlet manifolds, Magnetic Flow switches, Valves, Temperature and Pressure Gauges. • Furnace Erection materials consisting of Carbon Free Rubber hoses, fastener, fittings, etc. • Hydraulic tilting components consists of direction control valve, interconnecting seamless pipe etc. 	2 No.	12.40
3.	Additional Plate type heat exchanger for Coil DM water cooling.	1 No	1.70
TOTAL OF ABOVE Rs. 30.70 LAC. TOTAL INDIAN RUPEES THIRTY LAC AND SEVENTY THOUSAND ONLY.			

B/2-3, Sarthi Comp. & Estate, Opp. Gujarat Vahepari Maha Mandal (GVMM),
Odhav, Ahmedabad – 382 415 (INDIA)
Ph: +91-79-32957055, Tele-fax: +91-79-22901350 | E-mail: info@oritech.in | web: www.ortech.in

TECHNICAL SPECIFICATIONS

Sr. No.	Description	Specifications
1.	Rated Power	550 kW
2.	Input KVA	565 kVA
3.	Line Power factor (pf) at any load conditions	Above 0.980
4.	Power Supply Input Voltage (± 5% variation in voltage is permissible)	575 Volts
5.	Rating of rectifier	550 KW
6.	Rating and Frequency of inverter	550 KW / 500 Hz
7.	Nominal capacity of furnace	500 KG
Process Specifications		
8.	Operating Power in KW	550
9.	Metal to be melt	steel
10.	Melting Temperature Deg. Cent.	1530°C
11.	Scrap Yield	100 %
12.	Melting rate Kg/Hr @ rated power	1010
13.	Average melting time in minutes @ 95% load factor	30-32 minutes
14. #	Power consumption in KWh/T (+/- 5%)	545 KWh/T.

Above energy consumption is valid for, furnace lined with recommended sized formar, furnace in hot condition, Good quality clean and sized foundry scrap with minimum bulk density of 1000-1200 Kgs/m3(@ Charging rate of 20 Kgs/Minutes) , good working conditions, proper feeding, no un-necessary superheating and holding and furnace must be running at full load.

Slag will consume power @ 1100 KWh/T



Extra features of the IGBT based Induction melting system

- **Most advanced and highly efficient IGBT Inverter design compared to conventional Thyristorised design available in market.**
- **Guaranteed 7.5 – 10 % less energy Consumption compared to any other furnaces.**
- **Indigenously developed IGBT Inverter design NO IGBT Chopper.**
- **Maintains Output power with wide variation in input voltage.**
- **Water cooled cable carries only active current of inverter, saving of electrical energy upto 2-5%.**
- **Max. demand controller gives same production even with upto 10-15% lower sanctioned load.**
- 7" colour touch screen HMI with following specification.
 - Display with 65536 colour, resolution 800x480 pixels, MCU 32 bit RISC micro controller, Flash ROM 128MB, 64MB SDRAM, Backup memory 16 MB, 01 nos USB client Ver 1.1, 3 nos com port.
- Max. Up to 10 years of Storage facility of data like KWh consumed, daily/ shift wise production report, tripping log ETC.
- Automatic Sintering facility for upto 99 type of different sintering pattern.
- Data can be saved to USB pen drive and further printed in to MS- Excel format.
- Online interlock and tripping navigation facilities with description and photographs for easy diagnostic of fault.
- **Ethernet connectivity to access system from anywhere in the world.**
- **No Separate Load Manager, Power Optimizer OR power factor correction bank required.**

TERMS AND CONDITIONS

- | | | | |
|----|--------------------------------|---|---|
| 1. | Price | : | Ex our works. |
| 2. | Validity | : | 30 days from the date of this Quotation. |
| 3. | Packing | : | 1% of the basic value for wooden box packing(Except item No 2). |
| 4. | GST | : | 18 % Or as applicable at the time of dispatch. |
| 5. | Other Levis / Taxes | : | As applicable at the time of dispatch, to your account. |
| 6. | Freight with Transit Insurance | : | At actual, to your account. |
| 7. | Delivery Period | : | 14 to 16 weeks after receipt of Techno-Commercial confirmed Purchase Order and Advance payment. |
| 8. | Payment Terms | : | 40 % as Advance with Purchase Order; Balance against Proforma Invoice before dispatch. |
| 9. | Warranty | : | 12 months from the date of Commissioning or 15 months from the date of Dispatch whichever is earlier. |

OTHER AUXILIARIES THAT ARE NOT IN OUR SCOPE OF SUPPLY

1. 600 KVA, 33KV/0.575 KV,3ph 50 Hz Rectifier Duty furnace transformer.
2. Input Supply of 565 KVA, 575V, 3-ph, 50 Hz with Suitable rated cable/ busbars along with terminations and cables for the Main Equipment.
3. Pumps for DM water cooling and Coil cooling DM water circulation.
4. Cooling tower (90 TR).
5. Communication data cable from plant main input to melting furnace power supply unit.
6. DM Water storage tank for coil cooling circuit with associated pipe line, valves, filters and gauges etc.
7. Overhead water tank and underground water storage arrangement.
8. Melting former and hydraulic oil. (drawing of melting former will be provided by us).

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11. Cable tray and conduits for the entire plant.
12. LT Circuit breakers for all the water circulating pumps, Hydraulic power pack

Water Cooling System

13. All types of water pipes & fittings, valves gauges etc. for system cooling as per drawing given.
14. Water circulating pumps for coil DM water circulation. (for closed loop type water circuit)
15. Water circulating pumps for Power source DM water and coil DM cooling water circulation.
16. Cooling tower.

Laboratory Setup and Temperature Measuring Devices

17. Chemical, physical, mechanical and metallurgical laboratory including spectrometer.
18. Temperature measuring instruments other than specified in quotation section.

Scrap/ casting Handling/ transfer System

19. Material handling / transfer equipment viz. EOT cranes, magnets, scrap / casting transfer cars, lifting beams, from scrap yard/ casting bay to induction melting system.

Casting Facility

20. Complete Casting facilities.

Pollution Control System

21. Complete air pollution control system / fume extraction system to meet local / international norms, and suitable dust disposal system.

Workshop and Refractory Lining Devises

22. Complete workshop machinery including argon welding machine.
23. Tools & tackles for breaking and ramming of Heating coil refractory lining.

Erection Facility

24. Necessary material handling equipment, tools & tackles required for placement, erection, testing and commissioning of the plant and machinery.



9. Supply of 415V, 3-ph, 50 Hz for the for DM pump, Hydraulic Pump and other cooling pumps with interconnecting cables, starters, switch gears, etc.
10. Secondary Water Cooling system (cooling tower, Pump etc.) with associated pipeline, fittings and storage tank. We will provide drawing for pipeline and ratings of parts.
11. Piping and fitting related to the Hydraulic Oil Circulation Circuit. (Pipe and connections will be provided by us.)
12. All civil engineering works including platform, foundation, drains, ducting, lighting, etc.
13. Earthing connection for the Main equipment.
14. Necessary tools, handling equipments, utilities, skilled and unskilled work force necessary for erection and commissioning of the equipment.
15. All other items/equipment/tackles, which are not specified above under 'QUOTATION' section.

Customer's Scope of Work, Supply and Services

Civil and Structural Work

1. Design and execution of entire civil and structural work for steel melting shop, raw material yard; water complex (underground soft and raw water tanks, overhead emergency water tanks, service tank); stores and office buildings; civil work related with foundations and platforms for induction Melting Furnace, transformer and all other machinery; rooms for workshop, hydraulic, compressor, laboratory, electrical system; anchors and bolts and wall embedment for all machinery foundation; earthing pits including coal and salt for filling for all machinery; HVAC system for the plant; and plant lighting. **We will be providing General Arrangement drawing with component placement with loading conditions, detailed civil design has to be arranged by customer based on the details provided and, and the detailed design has to be sent to us for approval.**

Electrical Equipment

2. Main input supply of 575V, 3 Ph. 50Hz , 550KW at the input of induction melting power supply unit along with suitable rated cables/ busbars and switch gears.
3. Rectifier duty furnace transformer of 11 Kv/0.575 Kv, 600 KVA, 3 Ph, 50Hz, Dyn11.
4. 415 V, 50Hz for auxiliary loads like pumps, motors, cooling towers, etc. up to respective load points.
5. Communication cable from plant main input to melting furnace power supply unit for max. demand controller.
6. Emergency power supply through DG set in case of main power failure.
7. All types of MV cables and LV cables. Communication cable from plant main input to Induction melting furnace.
8. Power distribution board, LV control panels and motor control centers for all electrical load of the plant **including for all loads related with Induction melting system** like pumps & motors, cooling towers, etc.
9. DSL for EOT cranes.
10. Earthing strips as per local norms.

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Quotation 3: Plasma Induction

2018



PROPOSAL

INDUCTION MELTING FURNACE

KIND ATTN: MR.VIVEK SHARMA
RAJKOT
E MAIL: vivek.sharma@teri.res.in
: vivek_honest@yahoo.co.in



PLASMA INDUCTION
AHMEDABAD
26/04/2018



PROPOSAL-A

OUR RECOMMENDATION TO YOUR REQUIREMENT:

Sr. No	Description	Quant	Price(Lakh)
1	Advance Digital Controlled VF-VFI Solid State Power Supply Unit. 500KW/1KHz (IGBT Based)	1 Set	29.75Lakh
2	Robust Induction Melting furnace (Aluminum frame) with Hydraulic tilting arrangement suitable for 500KG	1 Set	
3	DM Water Circulation Unit <ul style="list-style-type: none"> • Water storage tank of Suitable capacity. • Plate Type Heat Exchanger.(Alfa Laval) • Non-ferrous pump. • Resin cartridge. • RTD Based Water Temperature Monitoring System. • Copper manifold For Coil Water Circuit. Interconnecting pipes and other accessories.	1 Set	
4	Heavy duty Hydraulic Power Pack. With ABB make Motor and Yuken make Valves	1 Set	
5	Advance Digital Energy Monitoring System	1 Set	
6	Heavy Duty and specially designed for high frequency Interconnecting bus bar and water-cooled cable leads between the PSU & Induction furnace.	1 Set	
7	High Pressure Rugged with Carbon free Water hoses of suitable length. (make: Gates)	1 Set	
9	InstructionOperational Manual.	1 Set	

Please refer to our standard terms and conditions attached with this offer for price basis and commercial terms.

**Optional:**

SR.NO	DESCRIPTION	QTY	PRICE
1.	Power Demanding Load Manager With PLC HMI with auto Sintering.	1 Set	1.85 Lakh

TECHNICAL SPECIFICATION # ATECHNICAL SPECIFICATION OF INDUCTION FURNACE

SR. NO.	DESCRIPTION	SPECIFICATIONS
1.	MF Output Power-Rated (KW)	500KW
2.	At Input KVA	510Kva
3.	Line PF @ any load condition	0.99 and above
4.*	Power Supply Input Voltage (Isolation) (Volts)	460 V
5.	Frequency	1 KHZ
6.	Generator Efficiency (O/p. power factor)	95% constant at any power level



TERM & CONDITION

- Tax :18% GST.(GST.NO:24AANFP1676L1ZR)
- Payment Terms: 40% of basic order value as advance with Purchase order balance against proforma invoice before dispatch.
- Erection & Commissioning Charge: Rs30, 000/- Paid by customer.
- Packing and Forwarding :2%extra
- Freight:at actual To Pay Basis.
- Insurance: as actual.
- Engineer Conveyance: To-Fro, lodging & boarding expenses and local conveyance expenses paid by customer.
- Delivery Time :8 to 10 week

MAYUR SUHAGIYA

+91-9727765253



330/1p, Hajipur, Ta: Kalol, Di: Gandhinagar

Via: Ahmedabad-Vadsar Road.

E mail: sales@plasmainduction.com

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OFFER NO. MGJ180426115

Annexure 2: Instruments used

Instruments	Model/ Make	Application	Accuracy
Power analysers	Fluke: 435, Krykard: ALM 10	Electrical Parameters Harmonics analysis, power logging	$\pm 0.5\%$
Thermal imager	875-2/Testo	Surface Temperature & Image	$\pm 2\%$
Infrared thermometer	Testo: 845, Comark: KM848	Surface Temperature	$\pm 0.75\%$ of mv