

# Detailed Project Report On Energy Efficient Induction Furnace

Siena Engineering Private Limited  
Indore (MP)

*Prepared for*

Bureau of Energy Efficiency  
(13/GEF-UNIDO-BEE/LSP/14/4562)



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This DPR has been originally prepared by TERI as a part of 'Capacity Building of LSPs' activity under the GEF-UNIDO-BEE project 'Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India'.

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The Energy and Resources Institute (TERI)  
New Delhi



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## List of abbreviations

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BEE	:	Bureau of Energy Efficiency
CO <sub>2</sub>	:	Carbon Dioxide
Cr	:	Chromium
D/E	:	Debt /Equity
DPR	:	Detailed Project Report
DSCR	:	Debt Service Coverage Ratio
EE	:	Energy Efficient
GEF	:	Global Environmental Facility
GHG	:	Green House Gas
GVMM	:	Gujarat Vahepari Maha Mandal
IGBT	:	insulated-gate Bipolar Transistor
IGDPR	:	Investment Grade Detailed Project Report
IRR	:	Internal Rate of Return
kW	:	Kilo Watt
kWh	:	Kilo Watt Hour
LDO	:	Light diesel oil
LSPs	:	Local Service Providers
Mg	:	Magnesium
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
SCR	:	Silicon Control Rectifier
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 Siena Engineering Private Limited
Constitution	Private Limited
MSME Classification	Small
No. of years in operation	12
Address: Registered Office:	303, Navneet Plaza 5/2 Old Palasia, Indore (MP)
Industry-sector	Steel casting
Products manufactured	Manufacturer of fabricated metal products, except machinery and equipment
Name(s) of the promoters/ directors	Mr. Shashikant Jain
Existing banking arrangements along with the details of facilities availed	ICICI Bank Limited Auto loan

### Brief highlights of the past financial position of the MSME unit

		(Rs lakh)
S. No	Particulars	FY 2016-17 (Audited)
1	Total income	3,584
2	Net profit	84

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. The total energy consumption of the unit during last 12 months was 556.6 toe which is equivalent to 351.2 lakh rupees. The total CO<sub>2</sub> emission during this period is estimated to be 4,150 tonnes. Electricity, LDO and LPG were considered for CO<sub>2</sub> emission estimation.

The unit manufactures the fabricated metal products, except machinery and equipment for Indian railways. The total annual production of the unit during 2017-18 is estimated to be 3,128 tonnes. The major source of energy is electricity, consume in the foundry, machining and lighting.

## Accepted/ recommended technology implementation

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

Technology	Annual energy saving Electricity (kWh)	Investment (Rs lakh) <sup>1</sup>	Monetary savings (Rs lakh/ year)	Simple payback period (Years)	Emission reduction (tonnes of CO <sub>2</sub> )
Replacement of existing induction furnace by new IGBT type induction furnace	829,069	91.5	54.9	1.7	680

## 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 CO<sub>2</sub> 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	91.5	91.5	91.5
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	36.2	32.0	33.2
4	NPV	Rs. In Lakh	63.0	50.0	53.7
5	DSCR	-	-	2.1	0.92

<sup>1</sup> Investment including the (i) Power panel and crucible – Rs. 56.9 lakh, (ii) Transformer – Rs. 16.3 lakh and (iii) Installation, Taxes and other misc. cost – Rs. 18.3 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 Siena Engineering Private Limited	
2	Constitution	Private Limited	
3	MSME Registration No/UAN	MP23B0002577	
4	PCB consent No.	PCB ID: 18724	
5	Date of incorporation / commencement of business	2006	
6	Name of the Contact Person	Mr. Shashikant Jain	
7	Mobile / Ph. No	+91-9826022222	
8	Email	siena@siena.co.in	
9	Address: Factory	18-A&22, Sector - 3 Sagore, Pithampur, Dhar (MP)	Owned
10	Registered Office	303, Navneet Plaza 5/2 Old Palasia, Indore (MP)	Owned
11	Industry / Sector	MSME/Manufacturing	
12	Products Manufactured	Manufacturer of fabricated metal products, except machinery and equipment	
13	No of hours of operation/shift	8	
14	No of shifts/ day	3	
15	No of days/year	300	
16	Installed Capacity	2.5 MT per batch	
17	Whether the unit is exporting its products (Yes/ No)	No	
18	Quality Certification, if any	NA	



## 2.0 Energy profile

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### 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.

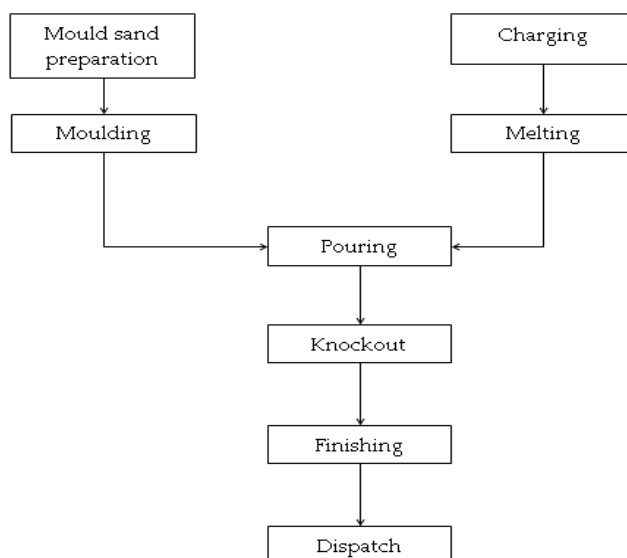


Figure 2.1.4: Process flow chart

## 2.2 Details of technology identified

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

Table 2.2: Details of existing technology

Parameters/ Equipment ID	Value
Equipment	Induction furnace
Type	SCR
Make	-
Purpose/Application	Melting
Capacity	2,500 kg
Operating Temperature (oC)	1,640
Mode of operation (batch/continuous)	Batch
Batch duration (minute)	150-160
Fuel Details	Type
	Consumption (unit/batch)
	Electricity
	800-900 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	LDO	Core making process
3	LPG	Core making process/ladle preheating

## 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 1,250 kVA sanctioned contract demand. 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

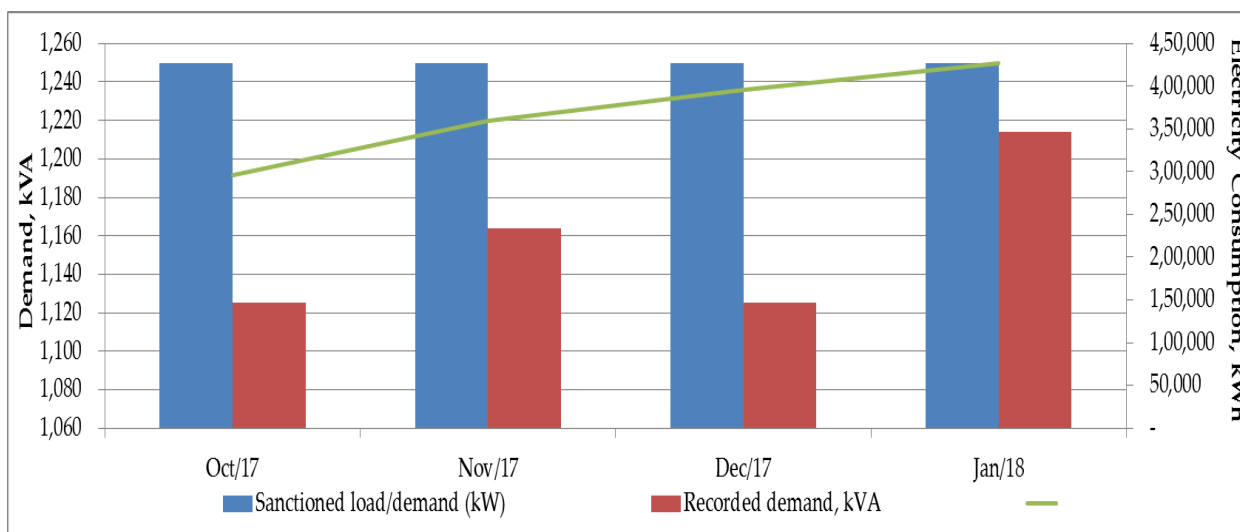
Particular	For supply at 33 kV
Demand charges	Rs. 530/ KVA/month
Energy charges	Rs. 5.0/ kWh

## 2.5 Analysis of electricity consumption

**Table 2.5:** Electricity consumption profile

Month & Year	Electricity consumption (kWh)	Sanctioned load/demand (kVA)	Power factor	Recorded demand, kVA	Demand charges (Rs)	Energy charges (Rs)	Monthly bill (Rs)
Oct-17	2,95,560	1,250	0.95	1,125	5,96,250	14,77,800	20,96,171
Nov-17	3,59,160	1,250	0.96	1,164	6,16,920	17,95,800	22,51,749
Dec-17	3,95,340	1,250	0.95	1,125	5,96,250	19,76,700	26,08,094
Jan-18	4,26,780	1,250	0.94	1,214	6,43,420	21,33,900	27,83,467
<b>Yearly</b>	<b>44,30,520</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>73,58,520</b>	<b>2,21,52,600</b>	<b>2,92,18,443</b>

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

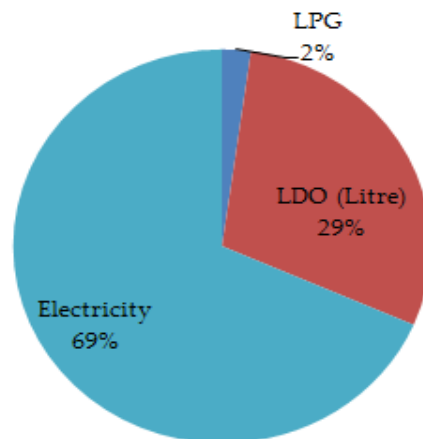
The analysis of the other fuels/forms of energy used in the unit is given in table 2.6.

**Table 2.6:** Analysis of other energy/ fuel consumption

Parameters	LPG (kg)	LDO (Litre)
Consumption unit/year	10,355	1,77,360
Calorific value per unit	11,900	9,202
Equivalent toe per year	12.3	163.2
Price (Rs per unit)	58.6	29.9

Parameters	LPG (kg)	LDO (Litre)
Total price per year	6,06,699	53,02,328

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 44,30,520 kWh of electricity per year. The annual consumption of the LDO is 177,360 litres and LPG is 10,355 kg. The total energy consumption of the unit during last 12 months is estimated to be 556.6 toe which is equivalent to 351 lakh rupees. The total CO<sub>2</sub> emission during this period is estimated to be 4,150 tonnes. Electricity, LDO and LPG were considered for CO<sub>2</sub> 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 Siena Engineering Private Limited is manufactures of the fabricated metal products, except machinery and equipment for Indian railways and installed an induction furnace of rated capacity of 850 kW with two crucible of capacity of 2,500 kg each for melting. The operational parameters of the induction furnace including the electricity consumption and material charged were measured during the detailed assessment study 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 unit is charging approximate 75 per cent mild steel scrap, 25 per cent process return and about 0.5 per cent additions (Ni, Cr, Mg etc.) in a batch. The average melting per batch has been estimated to be 2,425 kg per batch based on the data provided by the plant. The average pouring temperature is 1640 °C. The measured trend of the active power and specific power is shown in figure 3.1.2a.

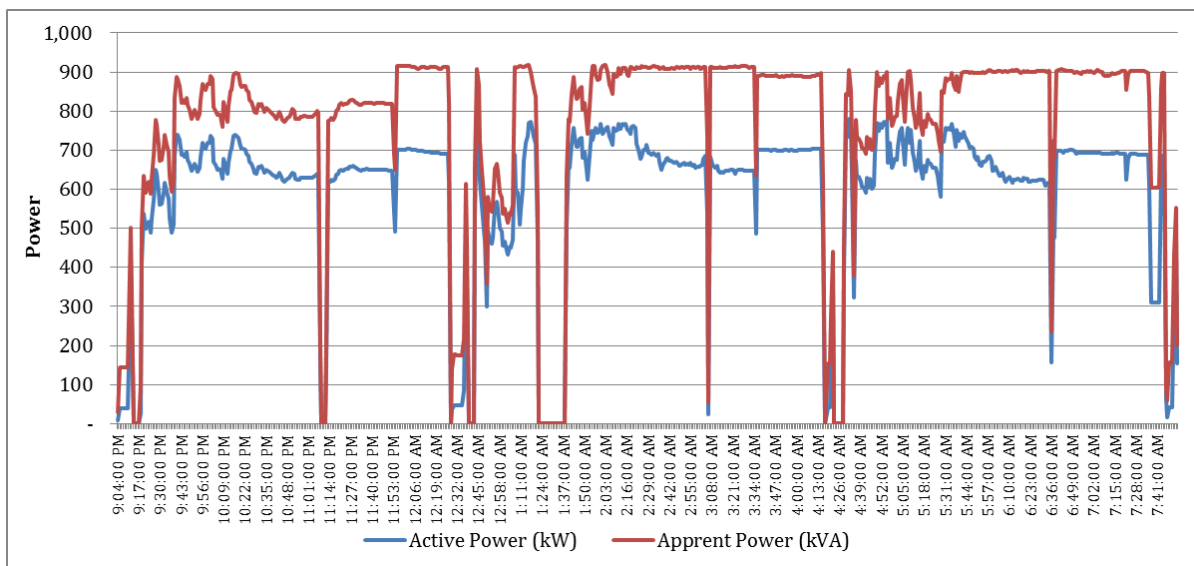
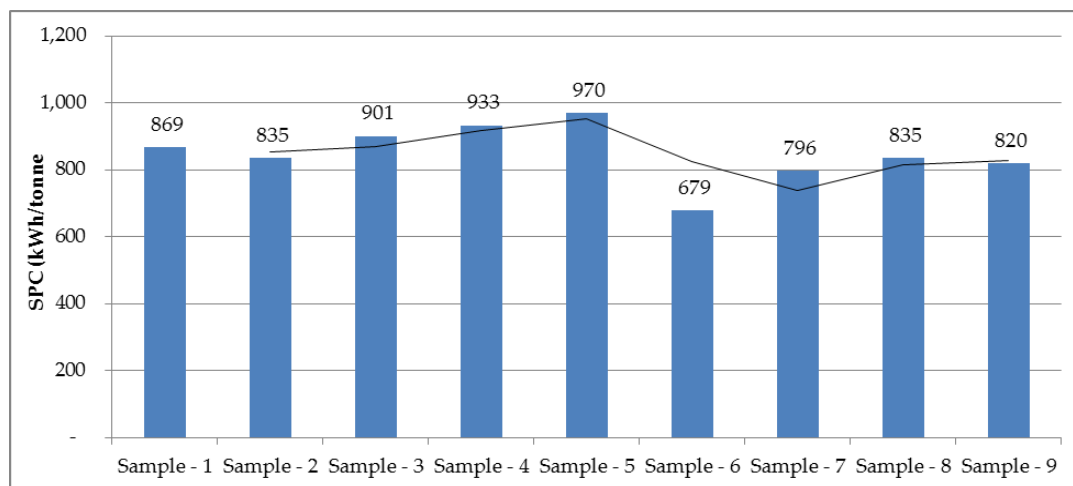


Figure 3.1.2a: Trend of the active power and specific power

The average production of the melting section of the unit is estimated to be 29,085 kg melt production per day. The specific power consumption of the unit is estimated to be 851 kWh per tonne of liquid metal. The trend of specific power consumption (kWh per tonne of melt) of the induction furnace is shown in figure 3.1.2b



**Figure 3.1.2b:** The trend of specific power consumption

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

### 3.1.3 Recommendation

The unit may adopt the new induction furnace of same capacity to reduce the specific power consumption. The proposed induction furnace specifications include 850 kW capacity of power panel and 2,500 kg crucible capacity. The specific energy consumption (induction furnace and auxiliary) of new furnace would be 586 kWh per tonne as specified by vendor at pouring temperature 1640 °C.

## 3.2 Cost benefit analysis

The estimated annual energy savings by replacement of existing SCR type induction furnace with IGBT type furnace is 829,069 kWh equivalent to a monetary saving of Rs 54.9 lakh. The investment requirement is Rs 91.5 lakh with a simple payback period of 1.7 years. The detailed calculations of the recommended energy conservation measures for IGDP are provided in table 3.2.

**Table 3.2:** Cost benefit analysis for recommended energy savings measures

Make	Unit	Existing	Proposed
Type	-	SCR	IGBT
Capacity	kW	850	850
Crucible	Kg	2500	2500
<b>Operational parameters</b>			
Average input power	kWh/day	24,763	17,055
Average melting rate	kg/day	29,085	29,085
Specific energy consumption	kWh per metric tonne	851.4	586.4
Cycle time	Minute per batch	120	80
Melting (2017-18)	Metric tonne per year	31,28,533	31,28,533
Total annual consumption	kWh per year	26,63,609	18,34,540
Annual energy saving	kWh per year	-	8,29,069
Electricity cost	INR per unit	-	6.6

Make	Unit	Existing	Proposed
Monetary saving	lakh INR per year	-	54.9
Investment cost	lakh INR	-	73.2
Installation, Taxes and other misc. cost	lakh INR	-	18.3
Total investment <sup>2</sup>	lakh INR	-	91.5
Payback period	Years	-	1.7

### 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.

### 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 CO<sub>2</sub> reduction<sup>3</sup>

Implementation of the selected energy conservation measures in the unit may result in reduction in CO<sub>2</sub> emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 680 tonne of CO<sub>2</sub> 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.

<sup>2</sup> Quotation - 1 has been considered for estimation of investments

<sup>3</sup> Source for emission factor for fuels: 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Electricity: CO<sub>2</sub> 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
Q-1	850 kW / 500 Hz IGBT based solid state power source. <ul style="list-style-type: none"> <li>850 kW solid state fully fired uncontrolled rectifier.</li> <li>Medium frequency IGBT based 850 kW rated inverter.</li> <li>Programmable Logic Controller with 7" colour touchscreen HMI.</li> <li>Energy meter with Ethernet communication.</li> <li>Earth leakage and water conductivity monitoring system.</li> <li>Electrical wiring drawings and water circuit diagrams.</li> </ul>	Mr Shailesh Patel Director B/2-3, Sarthi Comp. & Estate, Opp. Gujarat Vahepari Maha Mandal (GVMM), Odhav, Ahmedabad - 382 415 (India) M: 093747 64116	<ul style="list-style-type: none"> <li>Intelligent active demand manager.</li> <li>Medium frequency IGBT based induction furnace</li> <li>Provide end-end solution (such as panel, crucible, transformers, water cooling system, PLC etc.)</li> <li>Experience in the sector</li> <li>Old relationship with unit</li> <li>Local service centre</li> </ul>	-
Q-2	1000 kW / 500 Hz Quick-Melt "IG-nite"-Series Solid State Power Supply Unit with two 2500 Kg ET-Steel Frame Melting Furnaces	Mr Sundar Swami (Head - Foundry Furnace Division) Electrotherm (India) Limited	<ul style="list-style-type: none"> <li>Provides induction furnace for ferrous metals (iron &amp; steel) that gives you superior performance &amp; minimizes the heat loss during the process.</li> <li>Medium frequency IGBT based induction furnace</li> <li>Provide end-end solution (such as panel, crucible, transformers, water cooling system, PLC etc.)</li> <li>Experience in the sector</li> <li>Local service centre</li> </ul>	-
Q-3	One [1] No. 1000 KW/500 Hz VIP® - ITM SERIES IGBT LI POWER AND CONTROL SYSTEM with internal water circulating system and hydraulic	Mr Nishant Singh Area Sales Head Inductoherm (India) Pvt. Ltd., Plot No. SM - 6, Road No. 11, Sanand-II	<ul style="list-style-type: none"> <li>Intelligent active demand manager.</li> <li>Medium frequency IGBT based induction furnace</li> </ul>	-

S. No.	Name of machinery (Model/ specification)	Name of manufacturer, contact person	Advantage	Disadvantage
	power supply unit.	Industrial Estate, BOL Village, Sanand, Ahmedabad - 382 170	<ul style="list-style-type: none"> <li>Provide end-end solution (such as panel, crucible, transformers, water cooling system, PLC etc.)</li> <li>Experience in the sector</li> </ul>	

## 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	91.50	27.45	45.75
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	64.05	45.75
5	Others	-	-	-
<b>Total</b>		<b>91.50</b>	<b>91.50</b>	<b>91.50</b>

## 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
<b>General about unit</b>				
No of working days	Days		300	
No of shifts per day	Shifts		2	
Annual operating hours	Hrs./year		7,200	
Installed production capacity	tonnes/year		-	
Production in last financial years	tonnes/year		3128	
Capacity utilization factor	%		-	
<b>Proposed investment (Project)</b>				
Total cost of the project	Rs. (in Lakh)	91.50	91.50	91.50
Investment without interest defer credit (IDC)	Rs. (in Lakh)	91.50	91.50	91.50
Implementation time	Weeks	3	3	3
Interest during the implementation phase	Rs. in lakhs	-	0.39	0.28
Total investment	Rs. in lakhs	91.50	91.90	91.80
<b>Financing pattern</b>				
Own funds	Rs. in lakhs	91.50	27.84	46.0
Loan funds (term loan)	Rs. in lakhs	-	64.05	45.8
Loan tenure	Years	-	5.00	5.00



Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
Moratorium period (No EMI (interest and principal amount))	Months	-	3.00	3.00
Total repayment period	Months	-	60	60
Interest rate	%	-	10.50	10.50
<b>Estimation of costs</b>				
Operation & maintenance costs	%		5	
Annual escalation rate of O&M	%		5	
<b>Estimation of revenue</b>				
Reduction in energy cost	Rs. (in lakh)/ year		54.90	
Total saving	(Rs Lakh/year)		54.90	
Straight line depreciation	%		16.20	
IT depreciation	%		80.00	
Income tax	%		34.00	
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)	91.50	91.89	91.78
Cash flow as annual saving (Rs. In lakh/year)	54.89	54.89	54.89
O&M Expenses for first year (Rs. In lakh/year)	4.58	4.59	4.59
Net Cash flow (Rs. In lakh/year)	50.31	50.29	50.30
SPP (months)	21.82	21.93	21.90
Considered (month)	21.80	21.90	21.90

## 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	-	35.48	30.98	19.06	18.10	17.77
Depreciation	-	14.83	14.83	14.83	14.83	14.83
Cash outflow	91.50	-	-	-	-	-
Net cash flow	-91.50	50.31	45.82	33.90	32.93	32.60
Discount rate % @ WACC	9.30	9.30	9.30	9.30	9.30	9.30
Discount factor	1.00	0.91	0.84	0.77	0.71	0.64
Present value	-91.50	46.05	38.39	25.99	23.12	20.95
<b>Net present value</b>		<b>63.00</b>				
<b>Simple IRR considering regular cash flow</b>		<b>36.25%</b>				

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

Particulars / years	0	1	2	3	4	5
	(Rs.in lakhs)					

DPR - Energy Efficient Induction Furnace (Siena Engineering Private Limited)

Particulars / years	0	1	2	3	4	5
	<b>(Rs.in lakhs)</b>					
Profit after tax	-	32.14	28.39	16.02	15.93	16.57
Depreciation	-	14.90	14.90	14.90	14.90	14.90
Cash outflow	91.89	-	-	-	-	-
Net cash flow	-91.89	47.04	43.29	30.92	30.83	31.46
Discount rate % @ WACC	10.10	10.10	10.10	10.10	10.10	10.10
Discount factor	1.00	0.90	0.82	0.75	0.68	0.62
Present value	-91.89	42.71	35.70	23.15	20.96	19.43
<b>Net present value</b>	<b>50.07</b>					
<b>Simple IRR considering regular cash flow</b>	<b>32.02%</b>					

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

Particulars / years	0	1	2	3	4	5
	<b>(Rs.in lakhs)</b>					
Profit after tax	-	33.10	29.13	16.89	16.55	16.91
Depreciation	-	14.88	14.88	14.88	14.88	14.88
Cash outflow	91.78	-	-	-	-	-
Net cash flow	-91.78	47.97	44.01	31.77	31.43	31.79
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	0.67	0.62
Present value	-91.78	43.66	36.46	23.95	21.57	19.85
<b>Net present value</b>	<b>53.71</b>					
<b>Simple IRR considering regular cash flow</b>	<b>33.23%</b>					

### 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)	Indian Railways
Locational advantages	-
Indicate competitors	Other 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 for various scenarios which may affect the return on investment 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	19.70	77.14	41.82	-	21.86
		70:30	19.80	63.91	37.64	2.12	32.45
		50:50	19.70	67.64	38.83	0.92	28.26
2	10% reduction in estimated savings	100% equity	24.50	48.85	30.56	-	18.13
		70:30	24.60	36.22	26.27	2.12	28.39
		50:50	24.60	39.78	27.50	0.92	24.10
3	10% rise in interest rates	70:30	21.90	46.64	31.58	2.12	30.50
		50:50	21.90	51.20	32.91	0.92	26.26
4	10% reduction in interest rates	70:30	21.90	53.58	32.47	2.12	30.78
		50:50	21.90	56.26	33.55	0.91	26.48

## 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

Technology	Annual energy saving Electricity (kWh)	Investment (Rs lakh)	Monetary savings (Rs lakh/ year)	Simple payback period (Years)	Emission reduction (tonnes of CO <sub>2</sub> )
Replacement of existing induction furnace by new IGBT type induction furnace	829,069	91.5	54.9	1.7	680

The measure has an estimated investment of 91.5 lakh rupees and can yield a savings of 54.9 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 680 tonnes of CO<sub>2</sub>. 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	91.5	91.5	91.5
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	36.2	32.0	33.2
4	NPV	Rs. In Lakh	63.0	50.0	53.7
5	DSCR	-	-	2.1	0.92

### 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"> <li>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"> <li>Promoter’s margin -15%;</li> <li>Subsidy - 15% available on investment in TUF compatible machinery subject to ceiling of Rs 45 lakh;</li> <li>Loan amount - 70% of the cost of the machinery by way of Term Loan</li> </ul> </li> </ol>

Name of the scheme	Brief Description and key benefits
	<ul style="list-style-type: none"> <li>• Interest rate: Reimbursement of 5% on the interest charged by the lending agency on a project of technology upgradation in conformity with the Scheme</li> <li>• Cover under Credit Guarantee Fund Scheme for Micro and Small Enterprises (CGMSE) available</li> </ul> <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"> <li>• 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.</li> </ul>
Tax incentives	<ul style="list-style-type: none"> <li>• Accelerated depreciation is provided to the customers / users of the energy saving or renewable energy devises under the direct tax laws.</li> <li>• Under indirect taxes, specific concessional rates of duty are only available to CFLs and not to all energy efficient products</li> <li>• 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.</li> </ul>

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"> <li>• This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase.</li> <li>• A single investment by the fund shall not exceed Rs 2 crore</li> <li>• 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</li> </ul>
Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Guarantees a maximum 50% of the loan (only principal). In case of default, the fund will: <ul style="list-style-type: none"> <li>○ Cover the first loss subject to maximum of 10% of the total guaranteed amount</li> <li>○ Cover the remaining default (outstanding principal) amount on</li> </ul> </li> </ul>



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

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"> <li>Rs. 50 lakh</li> </ul>
Type of projects considered for term loans	<ul style="list-style-type: none"> <li>Replacement / retrofit of selected equipment with energy efficient equipment</li> <li>Modification of entire manufacturing processing</li> <li>Recovery of waste heat for power generation</li> </ul>
Incentive available	<ul style="list-style-type: none"> <li>Rebate in central excise duty</li> <li>Rebate in interest rate on term loan</li> <li>Rebate in prompt payment of loan instalment</li> </ul>
Interest rate	<ul style="list-style-type: none"> <li>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</li> <li>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.</li> <li>Rebate of 0.5% in interest rates are available for projects set up in North Eastern States, Sikkim, J&amp;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.</li> </ul>
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"> <li>• Detailed Energy Audit</li> <li>• Support for implementation</li> <li>• Measurement &amp; Verification</li> </ul> <p>Financing terms:</p> <ul style="list-style-type: none"> <li>• Terms loans upto 90%</li> <li>• Interest rate upto 3% below normal lending rate.</li> </ul>
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"> <li>• Large industries (excluding thermal power plants)</li> <li>• SMEs</li> <li>• Municipalities (including street lighting)</li> <li>• Buildings</li> </ul> <p>Coverage:</p> <ul style="list-style-type: none"> <li>• The minimum loan amount Rs 10 lakh and maximum loan amount of Rs 15 crore per project.</li> <li>• The extent of guarantee is 75% of the loan amount</li> </ul>
JICA-SIDBI Financing Scheme	<ul style="list-style-type: none"> <li>• 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.</li> </ul>

	<ul style="list-style-type: none"> <li>• Project uses an Energy Saving Equipment List approach</li> <li>• Equipment/machinery with energy saving potential less than 10% is not eligible.</li> <li>• Interest rate: As per credit rating and 1% below the normal lending rate</li> <li>• 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</li> </ul>
KfW-SIDBI Financing Scheme	<p>Coverage</p> <ul style="list-style-type: none"> <li>a) SMEs for energy efficiency projects</li> <li>b) SMEs and clusters for cleaner production and emission reduction measures, waste management and Common Effluent Treatment Plant (CETP) facilities</li> </ul> <p>Interest rate</p> <p>As per credit rating and 1% below the normal lending rate</p> <p>Eligible criteria</p> <p>3 t CO<sub>2</sub> 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><b><u>Key Features</u></b></p> <ul style="list-style-type: none"> <li>• Amount : USD 90 million</li> <li>• Repayment Schedule: First repayment on May 30, 2017 and final repayment date May 30, 2025 (equal instalment)</li> </ul> <p><b><u>Eligibility Criteria</u></b></p> <ul style="list-style-type: none"> <li>• Projects contributing to preservation of global environment, i.e. significant reduction of GHG emissions</li> <li>• 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.</li> <li>• Procurement in line with the "Guidelines for Procurement under Untied Loans by Japan Bank for International Cooperation"</li> </ul>
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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

<b>Purpose</b>	<b>For acquiring/adopting energy conservation/savings equipment/measures by SMEs</b>
<b>Eligibility</b>	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
<b>Maximum loan</b>	Maximum Rs 100 lakhs in the form of term loan
<b>Security</b>	Prime: Assets created out of loan Collateral: Upto Rs.5 lakhs - NIL Above Rs.5 lakhs, as determined by the bank
<b>Repayment</b>	Maximum 5-7 years including moratorium of 6 months
<b>Guarantee cover</b>	Cover available under CGMSE of CGTMSE available for eligible loans
<b>Margin</b>	10% of the project cost
<b>Rate of interest</b>	1% less than the applicable rate
<b>Upfront fee</b>	1% of the loan
<b>Insurance cover</b>	Assets acquired and charged as security to Bank to be insured
<b>Special offer, if any</b>	<b>Grants :</b> 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: Copy of certificates from the competent authorities

<http://udyogadhaar.gov.in/ua/PrintApplication>

Udyog Aadhaar										
<b>B</b>	Type of Enterprise	Micro	Small	Medium						
	Manufacturing	A	B	C						
	Services	D	E	F						
	UJAN	MP2380002577								
<b>Udyog Aadhaar Memorandum</b>										
1. Aadhaar Number	938543633308									
2. PAN Number	AAACR9432N									
3. Name of Entrepreneur	SHASHIKANT JAIN									
4. Social Category of Entrepreneur	GENERAL									
5. Gender	Male									
6. Physically Handicapped	No									
7. Name of Enterprise	SIENA ENGINEERING PVT.LTD									
8. Type of Organization	Private Limited Company									
9. Location of Plant Details										
SN	Flat/Door/Block No.	Name of Premises/Building Village	Road/Street/ Lane	Area/Locality	City	Pin	State	District		
1	18-A & 22	Sector-3	Sagore	Pithampur	Dhar	464775	MADHYA PRADESH	DHAR		
Official Address of Enterprise		303, NAVNEET PLAZA 5/2, OLD PALASHA WORE(M.P)								
10.	District		INDORE		State		MADHYA PRADESH		Pin	452018
	Mobile No.		6029022222		Email:		siena@siena.co.in			
11. Date of commencement	21/03/2006									
12. Previous Registration details-if any	EM-2 :: 23251200077									
13. Bank Details										
	IFS Code		KIC0000410							
	Bank Account:		004105914068							
14. Major Activity	MANUFACTURING									
SN	NIC 2 Digit		NIC 4 Digit		NIC 6 Digit Code			Activity Type		
1	25 - Manufacture of fabricated metal products, except machinery and equipment		2599 - Manufacture of other fabricated metal products n.e.c.		25999 - Manufacture of other fabricated metal products n.e.c.			Manufacturing		
17. Persons employed	160									
18. Investment (Plant & Machinery / Equipment's)	430(Rs. in Lakhs)									
19. District Industry Centre	INDORE									
Declaration										
I hereby declare that information given above is true to the best of my knowledge. Any information, that may be required to be verified, shall be provided immediately before the concerned authority.										
MyMamo Mobile App (Beta Version) is available now for download. <a href="https://play.google.com/store/apps/details?id=mamo.mamsrva">https://play.google.com/store/apps/details?id=mamo.mamsrva</a>										



**Consent Order**

M.P. Pollution Control Board - Dhar  
 Scheme No. 78, C-11, Plot-2  
 Aaranya, Vijay Nagar, Indore  
 Dhar  
 Tele : 0731- 2559386, 4261255

RED-SMALL	CCA-Renewal	VALIDITY (A/W): 31/12/2017 VALIDITY (H): 23/09/2018	CONSENT NO: ***	PCB ID: 18724
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NO: /MPPCB/DHR

Dated: 23/05/2016

To,  
 The Occupier,  
M/s. Siena Engineering Pvt Ltd,  
 18 A & 22,, Sector-3, Industrial Area, Pithampur,  
 City : Pithampur,  
 Dist : Dhar, Tal : Dhar, SIDC : SIDC Pithampur

Subject: Grant of Consent to Operate under section 25 of the Water (Prevention & Control of Pollution) Act,1974 under section 21 of the Air (Prevention & Control of Pollution) Act,1981 and Authorization under Hazardous and other wastes (Management & Transboundary movement) Rule, 2016 .

Ref: Your Consent to Operate Application Receipt No. 166130 Dt. 17/04/2016 and last communication received on Dt.11/04/2016

With reference to your above application for consent to operate has been considered under the aforesaid Acts and existing rules therein. The M. P. Pollution Control Board has agreed to grant consent upto 31/12/2017 & authorisation up to 23/09/2018, subject to the fulfillment of the terms & conditions, enclosed with this letter and-

**SUBJECT TO THE FOLLOWING CONDITIONS :-**

- a. Location: 18 A & 22,, Sector-3, Industrial Area, Pithampur , Dhar,
- b. The capital investment in lakhs: Rs. 667
- c. Product & Production Capacity:

Product	Consented Qty / year
Railway components ( steel casting)	2800.000 M.T

Note:- For any change in above industry shall obtain fresh consent from the board.

The Validity of the consent is upto 31/12/2017 and has to be renewed before expiry of consent validity. Online application through XGN with annual license fees in this regard shall be submitted to this office 6 months before expiry of the consent/Authorization. Board reserves the right to amend/cancel / revoke the above condition in part or whole as and when required.

**Enclosures:-**

- Conditions under Water Act
- Conditions under Air Act
- Conditions under Hazardous Rules
- General conditions

*e-Sign*  
 Signing from UIDAI  
 DIGITAL SIGNATURE  
 Digitally Sign with Aadhaar

HEMANT KUMAR SHARMA  
 Regional Officer  
 e-Signed On 26/05/2016 20:24:42  
 (Organic Authentication on AADHAR from UIDAI Server)  
 TPAV # 8964JKA467

Consent No:AWH-37411, Validity:31/12/2017, Hazd Validity:23/09/2018, Outward No:12168,26/05/2016, TPAV # 8964JKA467

e-Signed (Physical Signature NOT requires)

Page: 1 / 6 **N I C**





**Consent Order**

M.P. Pollution Control Board - Dhar  
 Scheme No. 78, C-11, Plot-2  
 Aaranya, Vijay Nagar, Indore  
 Dhar  
 Tele : 0731- 2559386, 4261255

**CONDITIONS PERTAINING TO AIR (PREVENTION & CONTROL OF POLLUTION) ACT 1981 :-**

1. The applicant shall provide comprehensive air pollution control system consisting of control equipments as per the proposal submitted to the Board with reference to generation of emission and same shall be operated & maintained continuously so as to achieve the level of pollutants to the following standards:-

Name of section	Capacity	Stack height	Control equipment to be installed	P.M, SOX, NOX
D.G. Sets	500 kva	3	Dust Suppressor, Not Applicable.	150,100,50
Furnace	annealing furnace	12	Green Belt, Natural Draft, Not Applicable.	150,100,50
Induction Furnace	induction furnace 0.5 tph	0	Hood Cover,	150,100,50
Induction Furnace	induction furnace 1.0 tph	0	Hood Cover,	150,100,50
Induction Furnace	induction furnace 2.5 tph	0	Hood Cover,	150,100,50
No data	shot blast	7	Bag Filter, Dust Collector, Gravity Settling Chamber,	150,100,50

2-The applicant shall observe the following fuel pattern:

Name of Fuel	Quantity
Diesel	20 litres
ldo	70 litres

*Additional Air condition: (if any)*



### Consent Order

M.P. Pollution Control Board - Dhar  
 Scheme No. 78, C-11, Plot-2  
 Aaranyu, Vijay Nagar, Indore  
 Dhar  
 Tele : 0731- 2559386, 4261255

**CONDITIONS PERTAINING TO WATER (PREVENTION & CONTROL OF POLLUTION) ACT 1974 :-**

1. The daily quantity of trade effluent at out fall of the unit shall not exceed 0.000 KL/day, and the daily quantity of sewage at out fall of the unit shall not exceed 1.000 KL/day
2. Trade Effluent Treatment:-N.A.

3. Sewage Treatment :- The applicant shall provide comprehensive sewage treatment system as per the proposal submitted to the Board and maintain the same properly to achieve following standards-

pH	Between	5.5 - 9.0
Suspended Solids.	Not exceed	100 mg/l.
BOD 3 Days 20°C	Not exceed	30 mg/l.
COD	Not exceed	250 mg/l.
Oil and grease	Not exceed	10 mg/l.

Sr	Water Code (Qty in klpd - Kilo Ltr per Day)	WC : 5,000	WWG : 1,000	Water Source	Remark
1	Cooling Water	2,500	0,000	SIDC	
2	Domestic Purpose	2,500	1,500	SIDC	

**Additional Water condition:- (if any) :-**

## Annexure 2: Budgetary offers / quotations

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### Quotation - 1: 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 850 kW / 2500 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/1660/1819 for 850 kW IGBT based Induction Power Source with DM Water Circulation Unit, Tank Capacitor banks, Hydraulic Unit, 2500 Kg Steel frame 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

Qtn. No.: OTM/1660/1819  
Date: 11-May.-18  
Page: 2 of 10

Industrial Energy Efficiency &  
Sustainable Technologies  
Delhi



QUOTATION

Sr.No.	Description	Qty.	Price (Rs. in Lacs)
1.	<b>850 kW / 500 Hz IGBT Based Solid State Power Source.</b> <ul style="list-style-type: none"> <li>• 850 kW Solid State Fully fired uncontrolled Rectifier.</li> <li>• Medium Frequency IGBT based 850 Kw rated inverter.</li> <li>• <b>Programmable Logic Controller with 7" Colour Touch screen HMI.</b></li> <li>• <b>Energy Meter with Ethernet Communication.</b></li> <li>• Earth Leakage and Water Conductivity Monitoring System.</li> <li>• <b>Electrical wiring drawings and water circuit diagrams.</b></li> </ul>	1 No.	19.80
	<b>Intelligent Active Demand Manager.</b> <ul style="list-style-type: none"> <li>• <b>Active Demand Controller with Auto Power Control circuit.</b></li> <li>• <b>Additional Programmable Logic Controller Module.</b></li> <li>• <b>One No. Additional Energy Meter with RS-485 Communication.</b></li> <li>• <b>Enclosure with 96 x 96 cutout for Energy Meter, with internal wiring and Fuse Protection.</b></li> </ul>	1 unit	
	<b>Auxiliaries:</b> <ul style="list-style-type: none"> <li>• D. M. Water circulation unit complete with non-Ferrous pump, Plate type Heat Exchanger and D.M. Resin Cylinder.</li> <li>• Hydraulic Power Pack direction control valves, sub plate, mounting stand with Hydraulic Pipes.</li> </ul>	1 set	
2.	<b>2500 kg steel frame Melting Furnace.</b> <ul style="list-style-type: none"> <li>• One No. of 2500 kg Steel frame melting furnace complete with EC Grade high Purity Copper coil with high temperature Insulation, Refractory casted Top and Bottom Assemblies, Lamination shunts made with <b>Very Low loss stampings</b>, Hydraulic cylinders etc.</li> <li>• <b>Medium Frequency Tank Capacitor Bank,</b></li> <li>• Copper Bus-bars from capacitor bank to Melting Furnace Coil.</li> <li>• Copper busbars from Capacitor bank to Power supply unit.</li> <li>• One set of Inlet and Outlet manifolds, Magnetic Flow switches, Valves, Temperature and Pressure Gauges, etc.</li> <li>• Furnace Erection materials consisting of Carbon Free Rubber hoses, fastener, fittings, etc</li> </ul>	2 No.	34.40
3.	<b>Additional Plate type heat exchanger for Coil DM water cooling.</b>	1 No	2.70
<b>TOTAL OF ABOVE Rs. 56.90 LAC. TOTAL INDIAN RUPEES FIFTY SIX LAC AND NINTY THOUSAND ONLY.</b>			

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

Qtn. No.: OTM/1660/1819  
Date: 11-May.-18  
Page: 3 of 10

Industrial Energy Efficiency &  
Sustainable Technologies  
Delhi



### TECHNICAL SPECIFICATIONS

Sr. No.	Description	Specifications
1.	Rated Power	850 kW
2.	Input KVA	865 kVA
3.	<b>Line Power factor (pf) at any load conditions</b>	<b>Above 0.98</b>
4.	Power Supply Input Voltage (± 5% variation in voltage is permissible)	650 Volts
5.	Rating of rectifier	850 KW
6.	Rating and Frequency of inverter	850 KW / 500 Hz
7.	Nominal capacity of furnace	2500 KG
<b>Process Specifications</b>		
8.	Operating Power in KW	850
9.	Metal to be melt	steel
10.	Melting Temperature Deg. Cent.	1650°C
11.	Scrap Yield	100 %
12.	Melting rate Kg/Hr @ rated power	1545
13.	Average melting time in minutes @ 95% load factor	100-103 minutes
14. #	Power consumption in KWh/T ( +/- 5%)	550 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 30 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;<br>Balance against Proforma Invoice before dispatch.                |
| 9. | Warranty                       | : | 12 months from the date of Commissioning or<br>15 months from the date of Dispatch whichever is earlier. |

**OTHER AUXILIARIES THAT ARE NOT IN OUR SCOPE OF SUPPLY**

1. 1000 KVA, 33KV/0.65 KV, 3ph 50 Hz Rectifier Duty furnace transformer.
2. Input Supply of 865 KVA, 650V, 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 (150 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).

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



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 650V, 3 Ph. 50Hz , 850KW 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/0.65 Kv, 1000 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.

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

## Quotation - 2: Electrotherm India Private Limited

Industrial Energy Efficiency & Sustainable Technologies, New Delhi

E/CS/MK/QF04 Rev.00



### OFFER FOR 1000 KW / 2500 KG MEDIUM FREQUENCY INDUCTION FURNACE

Sr. No.	Description	Qty.	Price (₹ in Lacs)
1	1000 KW / 500 Hz "IG-nite"- Series Medium Frequency Solid State Power Supply Unit Consisting of: • D. M. Water Circulation Unit • Capacitor Rack • D. C. Choke • Operator Control Desk	1 No.	32.10
2	2500 Kg ET-Steel Frame Melting Furnace complete with refractory top & bottom, Copper Coil with Cooling Turns, Lamination Packets secured in a Frame Structure, Hydraulic Cylinders and Inlet & Outlet Sub-Manifolds etc.	1 No.	20.20
3	Hydraulic Power Pack	1 No.	
4	2500 Kg ET-Steel Frame Melting Furnace complete with refractory top & bottom, Copper Coil with Cooling Turns, Lamination Packets secured in a Frame Structure, Hydraulic Cylinders and Inlet & Outlet Sub-Manifolds etc.	1 No.	19.10
5	Manually operated Furnace Change Over Switches	1 Set	
<b>Total Ex- works Price for above: ₹ 71.40 Lacs</b> <b>(RUPEES SEVENTY ONE LACS FORTY THOUSAND ONLY)</b>			

#### Optional:

Sr. No.	Description	Qty.	Price (₹. in Lacs)
1	1250 KVA, 11 KV / 750 V Furnace Transformer	1 No.	16.30
<b>Total Ex- Works Price for above In ₹</b> <b>(RUPEES SIXTEEN LACS THIRTY THOUSAND ONLY)</b>			<b>16.30</b>

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

for ELECTROTHERM (INDIA) LIMITED

SUNDAR SWAMI  
HEAD - FOUNDRY FURNACE DIVISION

Page: 3

Proposal No: ET//DEL/SQ/21947/17-18

Date: March 9, 2018





**TECHNICAL SPECIFICATION OF "IG-nite" - SERIES SYSTEM  
MEDIUM FREQUENCY INDUCTION MELTING FURNACE**

Sr. No.	Description	Rating
1.	Rated Power (KW)	1000
2.	Total Input KVA	1063
3.	Input PF	0.98
4.	Input Voltage (Volts)	750
5.	Output Frequency (Hz)	500
6.	Output Voltage (Volts)	2000
7.	Pouring Temperature (°C)	1650
8.	Nominal Capacity of furnace in Kg for Steel	2500
9.	Melting Rate for Steel at Pouring Temperature (Kg/Hr)	1910

**Notes:**

- Melt rate specified is on charge weight with best charging practices and best melting operations excluding all non-productive time. (When furnace is not doing any melting operation like - initial charging, pouring, superheating, holding for chemical analysis or de-slagging.).
- The scrap should be cleaned, sized and dense, yield should be better than 99%. Slag consumes nearly double the power than consumed by scrap
- Furnace lining should be in hot condition after second heat of lining with recommended lining thickness. Water temperature of coil should be as specified.
- There should be rated voltage available in the input of power supply. Power drops if the input supply drops below 99%. Power factor mentioned is at full load.
- There should not be any stoppages during heat while trial run.
- The charging and slag removal should be uniform and without any noticed delay.
- Chemical composition of the metal considered is Plain Carbon Steel / Mild Steel maximum temperature considered is as given in above table.
- Defined melt rate is with standard length of our bus bars and water cooled cables.
- Melt rate may vary  $\pm 3\%$ .

## Quotation – 3: Inductotherm India Pvt Ltd.



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  
iil@inductothermindia.com  
[www.inductothermindia.com](http://www.inductothermindia.com)

M/s. Siena Engineering Pvt. Ltd.,  
Plot No: 18A-22 & S – 3/3, Pithampur, Sector – 3,  
Sagore Road, Dist – Dhar,  
Madhya Pradesh.

Kind Attn.: Mr. S.K. Jain  
Mob No.: 9826022222  
Email: [skjain@siena.co.in](mailto:skjain@siena.co.in)

### Sub: Your Requirement of Induction Melting Furnace

Dear Madam / Sir,

This is in reference to your discussions with the 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. 1000 KW/500 Hz VIP® - I™ SERIES IGBT LI POWER SUPPLY WITH Two [2] Nos. 2000 KG DURALINE FURNACES.**

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 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).



QAHD112707 - A Dated: May 18, 2018  
SIENA ENGINEERING PVT. LTD.,

GIVING OUR CUSTOMERS THE COMPETITIVE  
EDGE SINCE 1953, **UNINTERRUPTED**

## PRICING

<b>1000 KW/500 Hz VIP<sup>®</sup> - I<sup>™</sup> SERIES IGBT LI [6 PHASE – 12 PULSE]</b>		
<b>A.</b>	<b><u>POWER UNIT</u></b> One [1] No. 1000 KW/500 Hz VIP <sup>®</sup> - I <sup>™</sup> SERIES IGBT LI POWER AND CONTROL SYSTEM with internal water circulating system and hydraulic power supply unit.	<b>Rs.52,96,000/-</b>
<b>B.</b>	<b><u>MELTING FURNACE</u></b> Two [2] Nos. 2000 KG DURALINE FURNACE with hydraulic tilting arrangement, water cooled leads & interconnecting arrangement (Without lid).	<b>Rs.31,00,000/-</b>
<b>C.</b>	<b><u>Optional</u></b> Two [2] Nos. Handle operated Furnace Selector Switches.	<b>Rs.1,80,000/-</b>

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, **SGST @ 9% & CGST @ 9%** will be 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**



QAHD112707 - A Dated: May 18, 2018  
 SIENA ENGINEERING PVT. LTD.,  
 GIVING OUR CUSTOMERS THE COMPETITIVE  
 EDGE SINCE 1953, **UNINTERRUPTED**



## Annexure 3: Instruments used

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Instruments	Model/ Make	Application	Accuracy
Power analysers	Fluke: 435, Fluke: 43B,	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