DETAILED PROJECT REPORT

ON

ENERGY COST REDUCTION WITH INFRARED THERMOMETER

(BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER)

ENERGY IS LIFE
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Bureau of Energy Efficiency (BEE)

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ENERGY COST REDUCTION WITH INFRARED THERMOMETER

BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER

BEE, 2011

Detailed Project Report on Installation of Infrared Thermometer For Furnaces In Foundry Units

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

New Delhi: Bureau of Energy Efficiency

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

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

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

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

CII – AVANTHA Centre for Competitiveness for SMEs

Confederation of Indian Industry

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Contents

List of Annexure

List of Tables

List of Figures

List of Abbreviations

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

EXECUTIVE SUMMARY

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

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

Most of the Industrial installations in the country have large electrical loads which are severely inductive in nature, such as motors, large machines etc which results in a high power consumption. In a number of cases it is observed that the operators maintain a high temperature than required by the castings. This means loss and wastage of energy by electricity boards as well as for Foundry units. This can be taken care by installing online infrared pyrometers with induction furnace.

Implementation of online infrared pyrometers will reduce the running cost of energy. It helps in reducing the electricity bill amount by availing the benefit of improvement in specific power consumption and so reduction in power consumption from the Punjab State Electricity Board.

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

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

S. No.	Particular	Unit	Value
1	Project cost	`(in lakh)	0.46
2	Monetary benefit	`(in lakh)	0.50

S. No.	Particular	Unit	Value
3	Debit equity ratio	Ratio	3:1
4	Simple payback period	years	0.92
5	NPV	(in lakh)	1.41
6	IRR	%age	87.09
7	ROI	%age	28.56
8	Process down time	Days	5
9	DSCR	Ratio	4.53
10	CO_2 reduction	Tonne/year	8.1

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

ABOUT BEE'S SME PROGRAM

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

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

Activity 1: Energy Use and Technology Audit

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

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

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

Activity 3: Implementation of Energy Efficiency Measures

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

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

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

1. INTRODUCTION

1.1. Brief Introduction about the Cluster

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

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

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

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

1.1.1. Energy Usage Pattern

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

1.1.2. Classification of Units

Broadly units are classified with respect to production capacity;

- Large Scale Units

- Medium Scale Units
- Small Scale Units

1.1.3. Production Wise Unit Breakup

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

Table 1.1 Production Wise Unit Breakups

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

1.1.4. Products Manufactured

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

1.2. Process Flow diagram of a Foundry Cluster

The manufacturing process is described as below;

Melting Section:

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

Sand Plant:

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

Pattern Making:

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

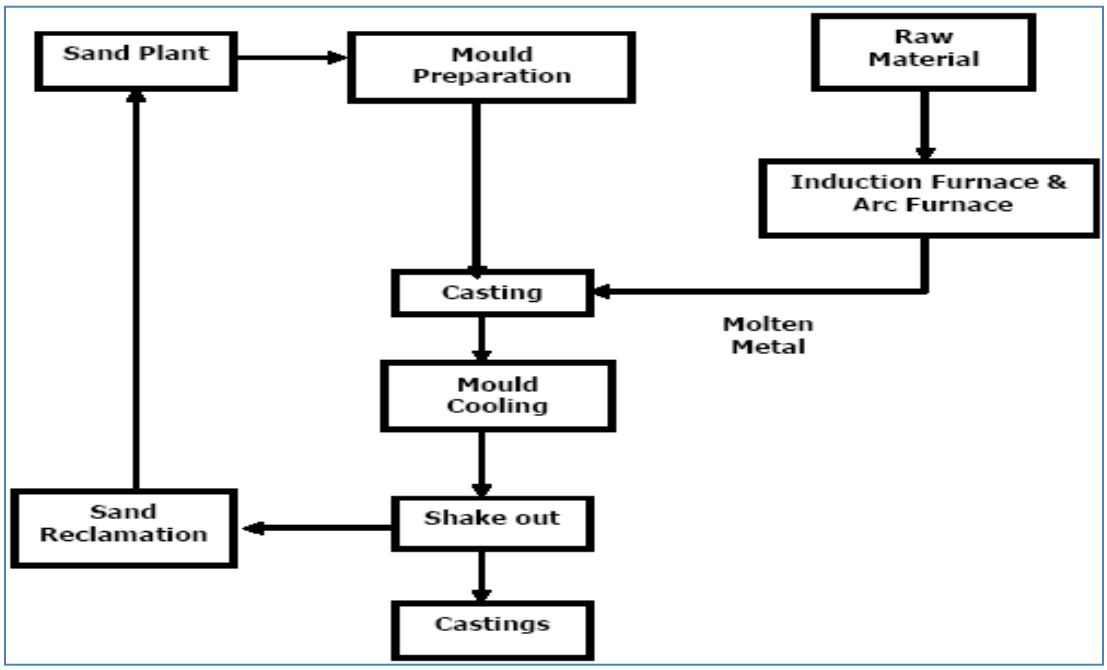

Figure 1.1 Process flow diagram of Typical foundry Units

Mould Preparation:

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

Casting:

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

1.3. Energy performance in existing situation

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

1.3.1. Average Production

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

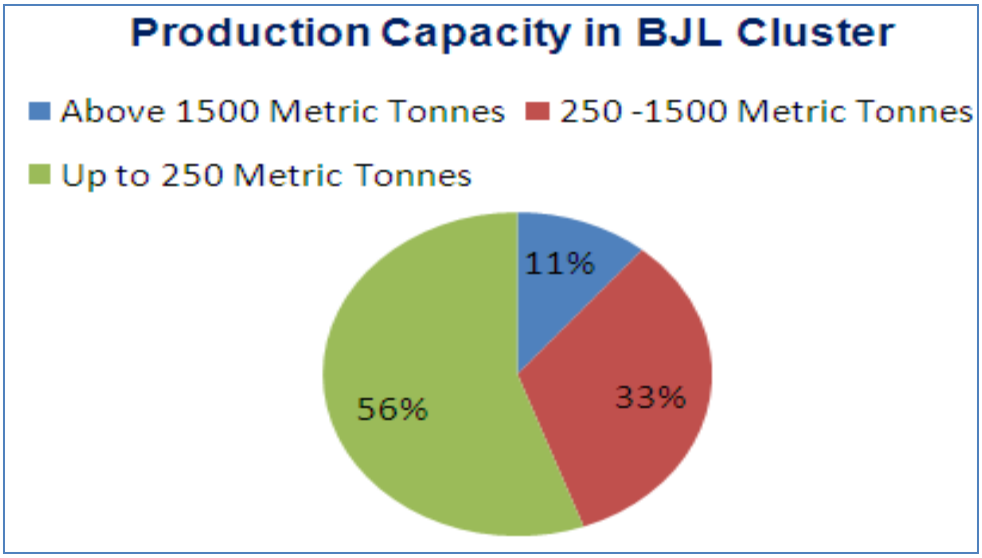

Figure 1.2 Production Capacity BJL Foundry cluster

Table 1.2 Annual Production Capacities

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

1.3.2. Energy Consumption

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

Table 1.3 Annual Energy Consumption (Electricity)

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

Table 1.4 Annual Energy Consumption (Coal & Furnace Oil)

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

1.3.3. Specific Energy Consumption

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

Table 1.5 Specific Energy Consumption

S. No	Types of Furnace	Types of Fuel	Specific Fuel Consumption / One kg Molten Material	Cost of Fuel in `
1	Cupola	Coal	0.2 kg	3.0
2	Rotary Furnace	Furnace Oil	0.15 Lt	4.20
3	***Arc/ Induction Furnace***	***Electricity***	***0.72 kWh***	***3.6***

**Assuming Coal rate Rs.15.0 /kg*

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

**Assuming electricity rate Rs 5.0/kWh*

1.4. Proposed Technology/Equipment

1.4.1. Description about the existing technology

Molten metal temperature is an important parameter for the casting process. Lower molten metal temperature will lead to defective castings. The tendency of the operators of the furnace is to maintain higher molten metal temperature than the requirement considering all the temperature drops during metal transfer.

Typically units found in foundries are in the range of 1 to 10 tonnes. The furnace generally consists of a cylindrical steel shell which is lined with acid or basic refractories. The roof which can normally swing away to facilitate charging, generally contains three carbon electrodes operating on a high tension three-phase power supply. These electrodes protrude vertically through the roof and an electric current passes directly through them and into the metal bath. The distance between the electrodes and the metal bath is automatically controlled and determines the power input into the bath.

These furnaces generally have a door at the back for alloying, oxygen lancing and slag removal purposes, and a pouring spout at the front. The entire unit is capable of being tilted for discharge of the melt through the pouring spout.

Lost of sound levels, can be produced only in place energy is available in a large scale and the movement of scrap through the locality can cause health hazards. Electric arc steelmaking is only economical where there is plentiful electricity, with a well-developed electrical grid.

In the present situation the temperature is measured using a contact type thermometer at intervals leading to situation where the temperature overshoots the recommended value, leading to more electricity consumption.

1.5. Establishing the Baseline for the Proposed Technology

Molten metal temperature is an important parameter for the casting process. Lower molten metal temperature will lead to defective castings. The tendency of the operators of the furnace is to maintain higher molten metal temperature than the requirement considering all the temperature drops during metal transfer.

The temperature of molten metal in the furnace is monitored periodically using contact type thermocouple. This is done to ensure that the temperature of the molten metal is more than the requirement. This temperature measurement at intervals using contact type thermocouple leads to overshoot in temperature. The overshoot in molten metal temperature leads to increased power consumption in the furnace. Temperature requirement for molten metal is 1460^0C. The molten temperature overshoots beyond 1480^0C. The existing energy consumption profile of the Arc furnace is tabulated below:

Table 1.6 Baseline Consumption

S. No.	Parameters	Units	Existing System
1.	Raw Material	Tonne / Day	8.32
2.	Electricity Consumption	kWh/Day	5990.4
3.	Raw Material rejection	Kg/Day	0.32
4.	Cost per batch (Electricity @ ` 5/kWh)	`/ Day	29952
5.	Output per batch	Tonne / Day	8
6.	No. of operating days	Days	250
7.	***Annual Production***	***Tonne/ year***	***2000***
8	***Annual Production Cost***	***` in lakh)/ year***	***74.88***

1.6. Barriers in adoption of proposed technology

1.6.1. Technological Barrier

- Lack of awareness and information of the loss in terms of overshooting of temperature
- Lack of technical knowledge and expertise.

- In this cluster, like many others, there is lack of leadership to take up the energy efficiency projects in the plant..

1.6.2. Financial Barrier

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

1.6.3. Skilled Manpower

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

2. PROPOSED TECHNOLOGY

2.1. Detailed Description of Technology

2.1.1. Description of Technology

Molten metal temperature is an important parameter for the casting process. Lower molten metal temperature will lead to defective castings. The tendency of the operators of the furnace is to maintain higher molten metal temperature than the requirement considering all the temperature drops during metal transfer. The temperature of molten metal in the furnace is monitored periodically using contact type thermocouple. This is done to ensure that the temperature of the molten metal is more than the requirement. This temperature measurement at intervals using contact type thermocouple leads to overshoot in temperature. The overshoot in molten metal temperature leads to increased power consumption in the furnace.

The latest trend is to install online infrared pyrometer. The pyrometer continuously monitors the molten metal temperature and can be prominently displayed. This facilitates the tapping of molten metal within the required temperature and minimizes overshoot in temperature. Online infrared pyrometer was installed for continuously monitoring the molten metal temperature. The overshoot in temperature of molten metal was avoided.

Eliminates overshoot in molten metal temperature. Reduction in energy consumption of about 5 kWh /ton of molten metal is achieved. Details furnished at Annexure 8.

Additionally a size of the display of about 2 Ft by 1 Ft would also be installed to monitor by the furnace operator, enabling the operator to easily see the temperature displayed from the distance location. And the price has been included in the DPR quotation.

2.1.2. Technology Specification

The technical Specifications are been provided in Annexure 7.

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

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

In DPR it has been recommended to install an Online Infrared Thermometer. This instrument would continuously measure the temperature. When the desired temperature is reached, human intervention is required to the extent of switching off the power supply, thus avoiding overshoot of the temperature and saving of electricity. In the present situation the temperature is measured using a contact type thermometer at intervals

leading to situation where the temperature overshoots the recommended value, leading to more electricity consumption.

2.1.4. Availability of Technology

Now days when energy cost is high, it is poor practice to use a conventional cupola furnace. As far as technology is concerned Infrared Thermometer are available in local/ national market. It is well proven technology which is adopted in many of the other similar and dissimilar units. Local vendors can arrange Infrared Thermometer at order. Local service providers are also available at Batala, Jalandhar and Ludhiana. More details of service provider are given in annexure 6.

2.1.5. Source of Technology

Infrared Thermometer is available in local/ national market. It is well proven technology which is adopted in many of the other similar and dissimilar units. Local vendors can arrange Infrared Thermometer at order. Local service providers are also available at Batala, Jalandhar and Ludhiana.

2.1.6. Terms and Conditions after Sale

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

2.1.7. Process down Time during Implementation

Technology provider will bring the complete setup for the proposed project from their site and make all the arrangements for implementation at the client's site. And the process will be effected for a period of 5 days, when all the required is at the client's site.

2.2. Life Cycle Assessment

Life of the proposed Infrared Thermometer will be around 5 to 10 years which depends on the operating conditions and maintenance at client's side.

2.3. Suitable Unit for Implementation of the Identified Technology

For estimation of the saving potential on implementation of this project, here the Foundry units engaged in making castings can be considered.

3. ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1. Technical Benefits

3.1.1. Electricity savings per year

Project of Installation of online Infrared Thermometer in place of conventional Thermometer will result in savings of electricity consumption of about 10MWh.

3.1.2. Improvement in product quality

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

3.1.3. Improvement in production

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

3.1.4. Reduction in raw material consumption

Raw material consumption will not be reduced after the implementation of the proposed project.

3.1.5. Reduction in other losses

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

3.2. Monetary Benefits

Annual monetary savings after installation of Infrared non contact type thermometer at the arc Furnace will be `0.50 Lakhs per year with reduction in consumption in Electricity is estimated to be about 10 MWh per year.

Table 3.1 Monetary savings

S. No.	Parameters	Units	Existing System	Proposed System
1.	Raw Material	Tonne / Day	8.32	8.32
2.	Electricity Consumption	kWh/Day	5990.4	5948.8
3.	Raw Material rejection	Kg/Day	0.32	0.32
4.	Cost per batch (Electricity @ ` 5/kWh)	`/ Day	29952	29752
5.	Output per batch	Tonne / Day	8	8
6.	No. of operating days	Days	250	250
7.	***Annual Production***	***Tonne/ year***	***2000***	***2000***
8.	***Annual Production Cost***	***`(in lakh)/ year***	***74.88***	***74.38***
9.	***Annual Electricity Reduction***	kWh/Year		***10000***
10	***Annual Cost reduction***	***`(in lakh)/ year***		***0.50***

3.3. Social Benefits

3.3.1. Improvement in Working Environment in the Plant

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

3.3.2. Improvement in Skill Set of Workers

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

3.4. Environmental Benefits

The major GHG reduction would be in CO_2 reduction. Emission reductions are estimated around 8.1 tons of CO_2 per annum.

4. INSTALLATION OF THE PROPOSED TECHNOLOGY

4.1. Cost of Technology Implementation

The cost of technology quoted by the vendor is ` 0.25 lakh.

Table 4.1 Details of Proposed Technology Installation Cost

S. No.	Particular	Cost in `
1	Equipment cost	25000
2	Taxes @ 12.5%	3125
3	Civil Works	3000
4	Erection & Commissioning	5000
5	Other cost	10000
6	Total Cost	46125

4.1.1. Technology Cost

Cost of the project is about `0.46 Lakhs which includes the purchase of Infrared Thermometer.

4.1.2. Other Cost

Other costs required will be `0.10 Lakh including manpower cost, transportation etc with commissioning charges of ` 0.05 lakh, and Civil costs of ` 0.03 lakh.

4.2. Arrangements of Funds

4.2.1. Entrepreneur's Contribution

Entrepreneur will contribute 25% of the total project cost which is `0.12 Lakhs.

4.2.2. Loan Amount

Remaining 75% cost of the proposed project will be borrowed from bank, which is ` 0.35 Lakhs.

4.2.3. Terms & Conditions of Loan

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

4.3. Financial Indicators

4.3.1. Cash Flow Analysis

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

tanks also.

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

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

4.3.2. Simple Payback Period

The total project cost of the proposed technology is ` 0.46 Lakhs and monetary savings due to reduction in electricity consumption costs ` 0.50 Lakhs hence, the simple payback period works out to be 0.92 years.

4.3.3. Net Present Value (NPV)

The Net present value of the investment at 10% works out to be 1.41 Lakhs.

4.3.4. Internal Rate of Return (IRR)

The after tax Internal Rate of Return of the project works out to be 87.09%. Thus the project is financially viable.

4.3.5. Return on Investment (ROI)

The average return on investment of the project activity works out at 28.56%.

Table 4.2 Financial Indicators of Proposed Technology

S No	Particular	Unit	Value
1	Simple Payback	Year	0.92
2	NPV	` In Lakh	1.41
3	IRR	%age	87.09
4	ROI	%age	28.56
5	DSCR	Ratio	4.53

4.4. Sensitivity analysis in realistic, pessimistic and optimistic scenarios

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different situations like when there is an increase in rupees savings or decrease in rupees savings. For the purpose of sensitive analysis, two following scenarios have been considered.

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

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

Table 4.3 Sensitivity Analysis in Different Scenarios

Scenario	Monetary Benefit(`Lakh/year)	IRR (%)	NPV(in Lakh)	ROI (%)	DSCR
Pessimistic	0.475	82.07	1.32	28.47	4.30
Base	0.50	87.09	1.41	28.56	4.53
Optimistic	0.525	92.10	1.51	28.65	4.76

4.5. Procurement and Implementation Schedule

Procurement and implementation schedule required for implementation of this technology is about 7 weeks and 5 days are required as a process break down. Details of procurement and implementation schedules are shown in Table 4.4 below

Table 4.4 Procurement and Implementation Schedule

S. No.	Activities	Weeks						
		1	2	3	4	5	6	7
1	Material Planning and Procurement							
2	Installation of Infrared Thermometer							
3	Testing & Trial							

ANNEXURES

Annexure 1: Energy audit data used for baseline establishment

S. No.	*Parameters*	*Units*	*Existing System*
1.	Raw Material	Tonne / Day	8.32
2.	Electricity Consumption	kWh/Day	5990.4
3.	Raw Material rejection	Kg/Day	0.32
4.	Cost per batch (Electricity @ ` 5/kWh)	`/ Day	29952
5.	Output per batch	Tonne / Day	8
6.	***No of operating days***	***Days***	***250***
7.	***Annual Production***	***Tonne/ year***	***2000***
8	***Annual Production Cost***	***(` in lakh)/ year***	***74.88***

Annexure 2: Detailed Technology Assessment Report

S. No.	Parameters	Units	Existing System	Proposed System
1.	Raw Material	Tonne / Day	8.32	8.32
2.	Electricity Consumption	kWh/Day	5990.4	5948.8
3.	Raw Material rejection	Kg/Day	0.32	0.32
4.	Cost per batch (Electricity @ ` 5/kWh)	`/ Day	29952	29752
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9.	***Annual Electricity Reduction***	kWh/Year		***10000***
10	***Annual Cost reduction***	***` in lakh)/ year***		***0.50***

Annexure 3: Detailed Financial Calculations

Name of the Technology	Online Infrared Thermometer		
Details	**Unit**	**Value**	**Basis**
No. of Operating Days	Days	250	
No. of Shifts/ Hours	No. / Hours	1 / 8	
Proposed Investment			
Plant & Machinery	` (in lakh)	0.28	
Civil Work	` (in lakh)	0.03	
Erection & Commissioning	` (in lakh)	0.05	
Misc. Cost	` (in lakh)	0.10	
Total Investment	` (in lakh)	0.46	
Financing pattern			
Own Funds (Equity)	` (in lakh)	0.12	Feasibility Study
Loan Funds (Term Loan)	` (in lakh)	0.35	Feasibility Study
Loan Tenure	Years	5.00	Assumed
Moratorium Period	Months	6.00	Assumed
Repayment Period	Months	66.00	Assumed
Interest Rate	%age	10.00%	
Estimation of Costs			
O & M Costs	% on Plant & Equip	4.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Electricity Savings	kWh/Year	10000	
Cost of Coal	`/kWh	5	
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

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

Years	Opening Balance	Repayment	Closing Balance	Interest
1	0.35	0.02	0.33	0.04
2	0.33	0.05	0.28	0.03
3	0.28	0.07	0.21	0.02
4	0.21	0.09	0.12	0.02
5	0.12	0.09	0.03	0.01
6	0.03	0.03	0.00	0.00
		0.35		

WDV Depreciation **`(in lakh)**

Particulars / years	1	2
Plant and Machinery		
Cost	0.46	0.09
Depreciation	0.37	0.07
WDV	0.09	0.02

Projected Profitability **` (in lakh)**

Particulars / Years	1	2	3	4	5	6	7	8
Electricity savings	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total Revenue (A)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Expenses								
O & M Expenses	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Total Expenses (B)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
PBDIT (A)-(B)	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.47
Interest	0.04	0.03	0.02	0.02	0.01	0.00	0.00	0.00
PBDT	0.44	0.45	0.46	0.46	0.47	0.48	0.48	0.47
Depreciation	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
PBT	0.42	0.43	0.43	0.44	0.45	0.45	0.45	0.45
Income tax	0.00	0.13	0.15	0.16	0.16	0.16	0.16	0.16
Profit after tax (PAT)	0.42	0.30	0.28	0.28	0.29	0.29	0.29	0.29

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

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	0.42	0.43	0.43	0.44	0.45	0.45	0.45	0.45
Add: Book depreciation	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Less: WDV depreciation	0.37	0.07	-	-	-	-	-	-
Taxable profit	0.07	0.38	0.46	0.46	0.47	0.48	0.48	0.47
Income Tax	-	0.13	0.15	0.16	0.16	0.16	0.16	0.16

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

Particulars / Years	1	2	3	4	5	6	7	8
Share Capital (D)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Reserves & Surplus (E)	0.42	0.71	0.99	1.27	1.56	1.85	2.14	2.42
Term Loans (F)	0.33	0.28	0.21	0.12	0.03	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	0.86	1.11	1.31	1.51	1.71	1.96	2.25	2.54
Assets	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Gross Fixed Assets	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Less Accumulated Depreciation	0.02	0.05	0.07	0.10	0.12	0.15	0.17	0.19
Net Fixed Assets	0.44	0.41	0.39	0.36	0.34	0.32	0.29	0.27
Cash & Bank Balance	0.42	0.69	0.93	1.14	1.37	1.65	1.96	2.27
TOTAL ASSETS	0.86	1.11	1.31	1.51	1.71	1.96	2.25	2.54
Net Worth	0.53	0.83	1.11	1.39	1.67	1.96	2.25	2.54
Debt Equity Ratio	2.85	2.40	1.80	1.05	0.30	0.00	0.00	0.00

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

Particulars / Years	0	1	2	3	4	5	6	7	8
Sources									
Share Capital	0.12	-	-	-	-	-	-	-	-
Term Loan	0.35								
Profit After tax		0.42	0.30	0.28	0.28	0.29	0.29	0.29	0.29
Depreciation		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Total Sources	0.46	0.44	0.32	0.30	0.30	0.31	0.31	0.31	0.31

Particulars / Years	0	1	2	3	4	5	6	7	8
Application									
Capital Expenditure	0.46								
Repayment Of Loan	-	0.02	0.05	0.07	0.09	0.09	0.03	0.00	0.00
Total Application	0.46	0.02	0.05	0.07	0.09	0.09	0.03	0.00	0.00
Net Surplus	-	0.42	0.27	0.23	0.22	0.22	0.28	0.31	0.31
Add: Opening Balance	-	-	0.42	0.69	0.93	1.14	1.37	1.65	1.96
Closing Balance	-	0.42	0.69	0.93	1.14	1.37	1.65	1.96	2.27

IRR **` (in lakh)**

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		0.42	0.30	0.28	0.28	0.29	0.29	0.29	0.29
Depreciation		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Interest on Term Loan		0.04	0.03	0.02	0.02	0.01	0.00	-	-
Cash outflow	(0.46)	-	-	-	-	-	-	-	-
Net Cash flow	(0.46)	0.48	0.35	0.32	0.32	0.32	0.31	0.31	0.31
IRR	87.09 %								
NPV	1.41								

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

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
O & M Expenses (75%)	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Sub Total(G)	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Fixed Expenses								
O & M Expenses (25%)	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Interest on Term Loan	0.04	0.03	0.02	0.02	0.01	0.00	0.00	0.00
Depreciation (H)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Sub Total (I)	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.03
Sales (J)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Contribution (K)	0.49	0.49	0.48	0.48	0.48	0.48	0.48	0.48
Break Even Point (L= G/I)%	14.21%	12.30%	11.13%	9.61%	7.89%	6.48%	6.34%	6.42%
Cash Break Even {(I)-(H)}%	9.20%	7.28%	6.11%	4.58%	2.85%	1.43%	1.28%	1.35%
Break Even Sales (J)*(L)	0.07	0.06	0.06	0.05	0.04	0.03	0.03	0.03

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

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	0.42	0.43	0.43	0.44	0.45	0.45	0.45	0.45	3.51
Net Worth	0.53	0.83	1.11	1.39	1.67	1.96	2.25	2.54	12.28
									28.56%

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

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	0.42	0.30	0.28	0.28	0.29	0.29	0.29	0.29	1.85
Depreciation	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.15
Interest on Term Loan	0.04	0.03	0.02	0.02	0.01	0.00	0.00	0.00	0.12
Total (M)	0.48	0.35	0.32	0.32	0.32	0.31	0.31	0.31	2.11

DEBT

Interest on Term Loan	0.04	0.03	0.02	0.02	0.01	0.00	0.00	0.00	0.12
Repayment of Term Loan	0.02	0.05	0.07	0.09	0.09	0.03	0.00	0.00	0.35
Total (N)	0.06	0.08	0.09	0.10	0.09	0.04	0.00	0.00	0.47
DSCR (M/N)	8.39	4.28	3.47	3.11	3.36	8.84	0.00	0.00	4.53
Average DSCR	4.53								

Annexure 4: Procurement and implementation schedule

S. No.	Activities	Weeks						
		1	2	3	4	5	6	7
1	Material Planning and Procurement							
2	Installation of Infrared Thermometer							
3	Testing & Trial							

Annexure 5: Details of technology service providers

S. No.	Source of product	Details of Local vendor / service provider
1.	Spectro Lab Equipment Pvt. Ltd.	Mr. Rajeev Sharma met@spectrogrp.com E-41 Okhala Indl. Area, Phase II New Delhi 110020
2.	INDUCTOTHERM (INDIA) PVT. LTD.	**Ajit Chaturvedi** Regional Sales Head Mobile# 91 93111 50284 **B-444, Pacific Business Park,** **Sahibabad Industrial Area, Site-IV,** **Ghaziabad-201010 (U.P.)** E-mail: ajitc@inductothermindia.com Phone: 0120-2771068, 2771069, 3143028.
3.	M/S ENCON INTERNATIONAL (P) LTD.	**Mr. R.P. Sood** 14/6, Mathura Road, Faridabad - 121 003 (Haryana) Tel: +91-129-2275307 Fax: +91-129-2276448 E mail: encon@ndb.vsnl.net.in
4.	ADVANCE HEATING SYSTEMS	d1/23 (back side) Mayapuri ind. area, phase-ii, New Delhi -110064 Tel: 91-11-5139315 Email:advanceheat@yahoo.com
5.	INDUSTRIAL FURNACE & CONTROLS	Vempu road, Bangalore -560021 Tel:+ 91-80-3329840 Fax: + 91-80-3329840 E-mail: ifc1@vsnl.com Website http://www.indfurnace.com
6.	MACRO FURNACES PVT. LTD.	16/2, mathura road, faridabad -121002 Tel:+ 91-129-5260004 Fax: + 91-129-5260146 E-mail: aastha10@rediffmail.com

Annexure 6: Quotations or Techno-commercial bids for new technology /equipment

SPECTRO
Lab Equipments Pvt. Ltd.

E-41 Okhla Indl. Area, Phase -II
New Delhi - 110 020, India
Phone : (011) 4052-2053, (011) 4052-2000
FAX : (011) 4050-3150/51
e-mail : sales@spectrolabequipments.com
URL :www.spectrolabequipments.com

M/s CONFEDERATION OF INDIAN INDUSTRY
CII - AVANTHA CENTRE FOR COMPETITIVENESS
BLOCK - 3, SECTOR - 31/A, CHANDIGARH - 160030
CHANDIGARH
INDIA
Phone No. : 91-172-5080784
Fax : 91-172-2606259

Date : July 15, 2011
Quotation No. : 2741
Reference No.:

Kind Attn: **MR. GAGANDEEP MOHEY**

Dear Sir / Madam,
With reference to the discussion / mail, we have pleasure in submitting our quotation for the following:

S.No.	Description	Rate	Qty	Amount
1	**PRECISE INFRARED THERMOMETER LASER SLE-THERMO(1450)** 	25,000	1	25,000

Features:
1) Precise non-contact measurements;
2) High distance to target ratio measures smaller surface areas at greater distances;
3) Widest temperature range;
4) Unique flat surface, modern housing design;
5) Built-in laser pointer;
6) Automatic data hold;
7) °F/°C switch;
8) Emissivity digitally adjustable from 0.10 to 1.0;
9) MAX,MIN,DIF,AVG temperature displays;
10) Backlight LCD display;
11) Built-in laser pointer;
12) Automatic selection range and display resolution 0.1°F(0.1°C);
13) Set high and low alarms .
Unit Size :120*53*220mm
Net weight:320g
Specification:

Measuring range: -50~1600? (?58~2912?);
D:S=50:1 ;
Display resolution:0.1°C (0.1?)
Accuracy:
-50 ~ -20? (?58~-4?); ±5? (9?)
-20 ~ 200? (?4~392?); ±1.5% of reading +2? (3.6?)
200 ~ 1050? (392~1922?); ±2.0% of reading +2? (3.6?)
1050 ~ 1300? (1922~2372?); ±2.0% of reading +2? (3.6?)
1300 ~ 1600? (2372~2912?); ±2.0% of reading +2? (3.6?)
Response time: less than 1 sec
Spectral response: 3~14μm
Over range indication:

Note: Please mention our Quotation No. in your P.O. **Authorised Signatory**

For any clarification please contact - Mr. Rajeev Sharma (09873001545) Email: met@spectrogrp.com,
Mr. Suneil Dua (9953999353) Email: sd@spectro.in

S.No.	Description	Rate	Qty	Amount

		Rs.	25,000.00
	Grand Total	Rs.	25,000.00

Terms & Conditions:

1. The prices quoted for Ex-works Delhi
2. Payment Terms : 80% in advance (balance through COD basis.)
3. TAX : VAT 12.5% or 2% on total order value against c form.)
4. Octroi and other Govt. taxes as per actual to be paid by customer.
5. Packing and forwarding charges - included.
6. Freight and insurance as per actual to be paid by customer.
7. Warranty : 12 months
8. This quotation is valid for a period : 30 days
9. Delivery period : 30 days

Note: **Please mention our Quotation No. in your P.O.** **Authorised Signatory**

For any clarification please contact - Mr. Rajeev Sharma (09873001545) Email: met@spectrogrp.com,
Mr. Suneil Dua (9953999353) Email: sd@spectro.in

Annexure 7: Justification of the Proposed System

Energy Conservation in Foundry Industry

Case study - 6

MONITOR TEMPERTURE OF MOLTEN METAL CONTINUOUSLY SUING ONLINE INFRARED THERMOMETER

Background

Molten metal temperature is an important parameter for the casting process. Lower molten metal temperature will lead to defective castings. The tendency of the operators of the furnace is to maintain higher molten metal temperature than the requirement considering all the temperature drops during metal transfer.

The temperature of molten metal in the furnace is monitored periodically using contact type thermocouple. This is done to ensure that the temperature of the molten metal is more than the requirement.

This temperature measurement at intervals using contact type thermocouple leads to overshoot in temperature. The overshoot in molten metal temperature leads to increased power consumption in the furnace.

The latest trend is to install online infrared pyrometer. The pyrometer continuously monitors the molten metal temperature and can be prominently displayed. This facilitates tapping of molten metal within the required temperature and minimise overshoot in temperature.

Previous status

Temperature requirement for molten metal is 1460°C. The molten temperature overshoots beyond 1480°C.

Energy saving project

Online infrared pyrometer was installed for continuously monitoring the molten metal temperature.

The overshoot in temperature of molten metal was avoided.

Benefits

Eliminates overshoot in molten metal temperature. Reduction in energy consumption of about 5 units/ton of molten metal is achieved.

Financial analysis

The total benefits resulted to an annual saving of **Rs 0.20 million**. The investment made was **Rs 0.20 million**. The simple payback period for this project was **12 Months.**

PROJECT-6: MONITOR TEMPERTURE OF MOLTEN METAL CONTINUOUSLY SUING ONLINE INFRARED THERMOMETER

Savings/Year (Rs Million)	0.2
Investment (Rs Million)	0.2

Year	0	1	2	3	4	5	6	7	8	9	10
Inflow											
Energy saving (A)		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Out flow											
Initial Cost (B)	0.2										
Less Depreciation (C)		0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Income (D)=A-C		0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Tax @ 30.5 % on (D)		0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cash Inflow after Tax	**-0.2**	**0.0**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Cumulative cash flow		**0.0**	**0.1**	**0.3**	**0.4**	**0.6**	**0.7**	**0.8**	**1.0**	**1.1**	**1.3**

NPV (Rs. Million)	**0.5**
IRR	**46.02%**

Basis for Calculation

*** Investment being for energy efficient equipment, 100 % depreciation is considered in the first year**
*** NPV & IRR are calculated for 10 years**
*** Corporate tax is considered as 30.5 % (as existing in India presently)**
*** Interest on investment is considered as 12 % for Calculating NPV**

Confederation of Indian Industry - Energy Management Cell

Extract from IREDA's "***Investor Manual***" Foundry Industry '***Case Study 6'***, page no. 426.

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

Confederation of Indian Industry
CII – AVANTHA Centre for Competitiveness
Block No.3, Dakshin Marg
Sector 31-A, Chandigarh - 160030
Tel: 0172-5080784 (D) / 2666517-19
Fax: 0172-2606259 / 2614974
E-mail: harinder.singh@cii.in
Website: www.ciicfc.org

India SME Technology Services Ltd
DFC Building, Plot No.37-38,
D-Block, Pankha Road,
Institutional Area, Janakpuri, New Delhi-110058
Tel: +91-11-28525534, Fax: +91-11-28525535
Website: www.techsmall.com