

**DETAILED PROJECT REPORT**  
**ON**  
**ENERGY COST SAVING BY KILN INSULATION**  
**IMPROVEMENT**  
**CAPACITY-15TPD**  
**(JODHPUR LIMESTONE CLUSTER)**



**Bureau of Energy Efficiency (BEE)**

Prepared By



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**KILN INSULATION IMPROVEMENT  
CAPACITY-15TPD**

**JODHPUR LIMESTONE CLUSTER**

BEE, 2011

Detailed Project Report on Energy efficiency improvement by kiln insulation  
Limestone SME Cluster, Jodhpur (Rajasthan) (India)

New Delhi: Bureau of Energy Efficiency

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**We have received very encouraging feedback for the BEE SME Program in various SME Clusters. Therefore, it was decided to bring out the DPR for the benefits of SMEs. We sincerely thank the officials of BEE, Executing Agencies and ISTSL for all the support and cooperation extended for preparation of the DPR. We gracefully acknowledge the diligent efforts and commitments of all those who have contributed in preparation of the DPR.**

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### *List of Abbreviations*

<b>BEE</b>	<b>Bureau of Energy Efficiency</b>
<b>SME</b>	<b>Small and Medium Enterprises</b>
<b>DPR</b>	<b>Detailed Project Report</b>
<b>GHG</b>	<b>Green House Gases</b>
<b>NG</b>	<b>Natural Gas</b>
<b>CDM</b>	<b>Clean Development Mechanism</b>
<b>DSCR</b>	<b>Debt Service Coverage Ratio</b>
<b>NPV</b>	<b>Net Present Value</b>
<b>IRR</b>	<b>Internal Rate of Return</b>
<b>ROI</b>	<b>Return on Investment</b>
<b>WHR</b>	<b>Waste Heat Recovery</b>
<b>SCM</b>	<b>Standard Cubic Meter</b>
<b>MT</b>	<b>Metric Tonne</b>
<b>SIDBI</b>	<b>Small Industries Development Bank of India</b>

## EXECUTIVE SUMMARY

CII – AVANTHA Centre for Competitiveness for SMEs, one of the Centre of Excellence of Confederation of Indian Industry (CII) is executing BEE - SME Program in Jodhpur Lime Stone Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

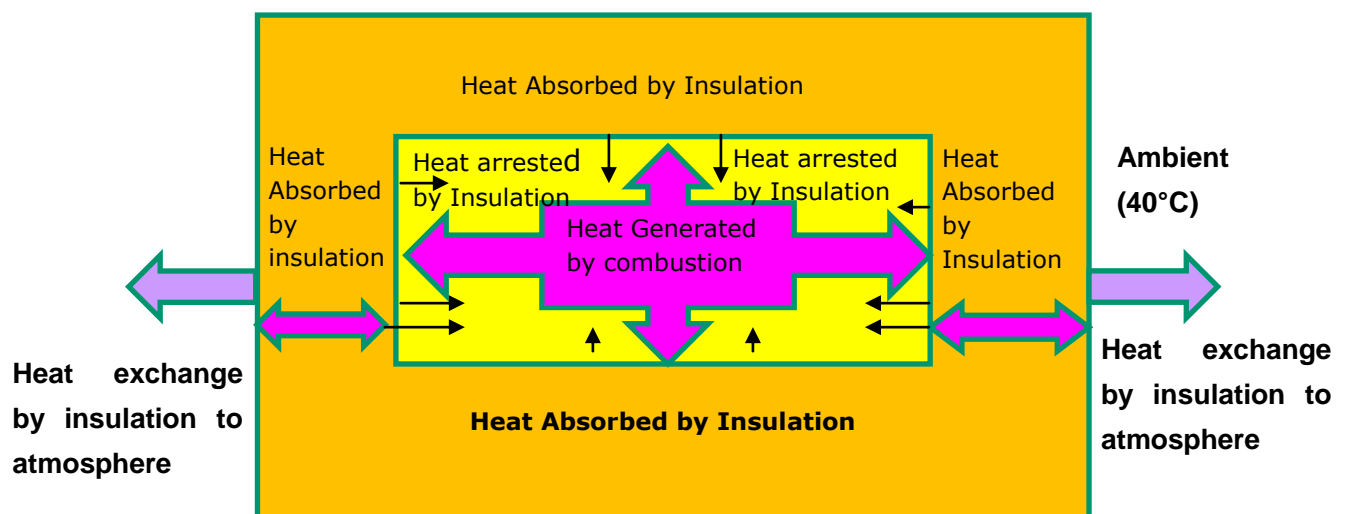
Jodhpur Lime Stone cluster is one of the largest Lime clusters in India; accordingly this cluster was chosen for energy efficiency improvements by implementing energy efficient measures / technologies, so as to facilitate maximum replication in other Lime Stone units in India.

The main energy forms used in the cluster units are Pet coke and grid electricity. In Lime Stone units, pet coke bill is about 80% of total plant energy bill and rest is of electricity. Pet coke is used as fuel in kiln for getting quick lime from raw lime stone.

Kiln is mainly used for heat treatment of raw lime stone where Inside temperature at firing zone of kiln is maintained at 1000 to 1200°C. Out of total heat loss, about 15 to 20% heat loss occur in the form of radiation loss. This radiation loss can be reduced by replacing the damaged insulation and increasing the insulation thickness of the kiln.

This DPR studies in detail the proposal for insulation improvement of a typical unit of 5000 tonnes production of quick lime per year.

Implementation of Insulation over kiln will reduce the running cost of energy. It helps in reducing the pet coke consumption by availing the benefit of improvement in kiln efficiency and so reduction in fuel consumption.



Project implementation will lead to reduction in fuel bill by Rs. 2.5 Lakh per year.

Fuel Consumption = 1200 MT / yr  
 Temperature inside furnace = 1000°C – 1200°C  
 Higher surface temperature  
 Energy saving potential = 3%  
 Energy saving = 0.03 x 1200 MT/year  
 =36 MT / yr  
 Monetary saving = 36 MT/yr x Rs. 7000/MT  
 = Rs. 2.5 Lakhs

The total investment, debt equity ratio for financing the project, monetary savings, Internal rate of return (IRR), Net present value (NPV), Return on investment (ROI) etc for implementing insulation over kiln is furnished in Table below.

Financials for BEE projects		
Name of Project	Replacement of Old and Inefficient motors	
	Units	Value
Project Cost	Rs(Lakhs)	1.2
Saving Potential	Rs(Lakhs) per year	2.5
IRR	%	145
NPV	Rs(Lakhs)	5.2
Simple payback period	Months	3

***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 the energy performance in 25 selected SMEs clusters. Jodhpur Lime Stone Cluster is one of them. The BEE's SME Programme intends to enhance the 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:***

### ***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.

### **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

### **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.

### **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.

## 1.0 INTRODUCTION

### 1.1 Brief Introduction about Cluster

Jodhpur SME Cluster is one of the largest Lime stone clusters in India, which is famous for manufacturing of hydrated lime. Jodhpur limestone cluster is well connected by rail, road and air ways. The nearest airport is at Jodhpur, which is 15 KM from Jodhpur by road.

There are approximately 100 lime stone units in this cluster which are engaged in manufacturing of hydrated lime.

**Table1.1: Details of Energy Consumption at Jodhpur Cluster**

S.No	Type of fuel	Unit	Value	Contribution in Equivalent Energy Term (%)
1	Pet coke	MT/year	1200	75
2	Electricity	kWh/year	120000	25

### Energy Usage Pattern

Average monthly electricity consumption in lime stone units ranges from 1 lakh to 2 lakh kWh depending on the size of the plant. In thermal energy, solid fuel pet coke is used in kiln in all plants. Solid fuel consumption (Petcock) in kiln varies from 500 MT/ year to 2500 MT / year of hydrated lime production. On an average 3 MT of Pet coke is used to get 15 MT of quick lime.

### Classification of Units

The Lime stone cluster units can be categorized into following four types based on production capacity

- 1) Large Scale Units
- 2) Medium Scale Units
- 3) Small Scale Units

### Production wise Unit Breakup

Jodhpur Lime Stone cluster can be broken into three categories viz. small, medium and large size unit. Table 1.2 shows that production wise breakup of Lime stone cluster.

**Table 1.2 Production wise Unit breakups**

Type of Unit	Number of units	Production range ( MT)
Small Scale unit	10-15	Less than 5000
Medium Scale Unit	65-70	5000-15000
Large Scale Unit	2-5	More than 15000

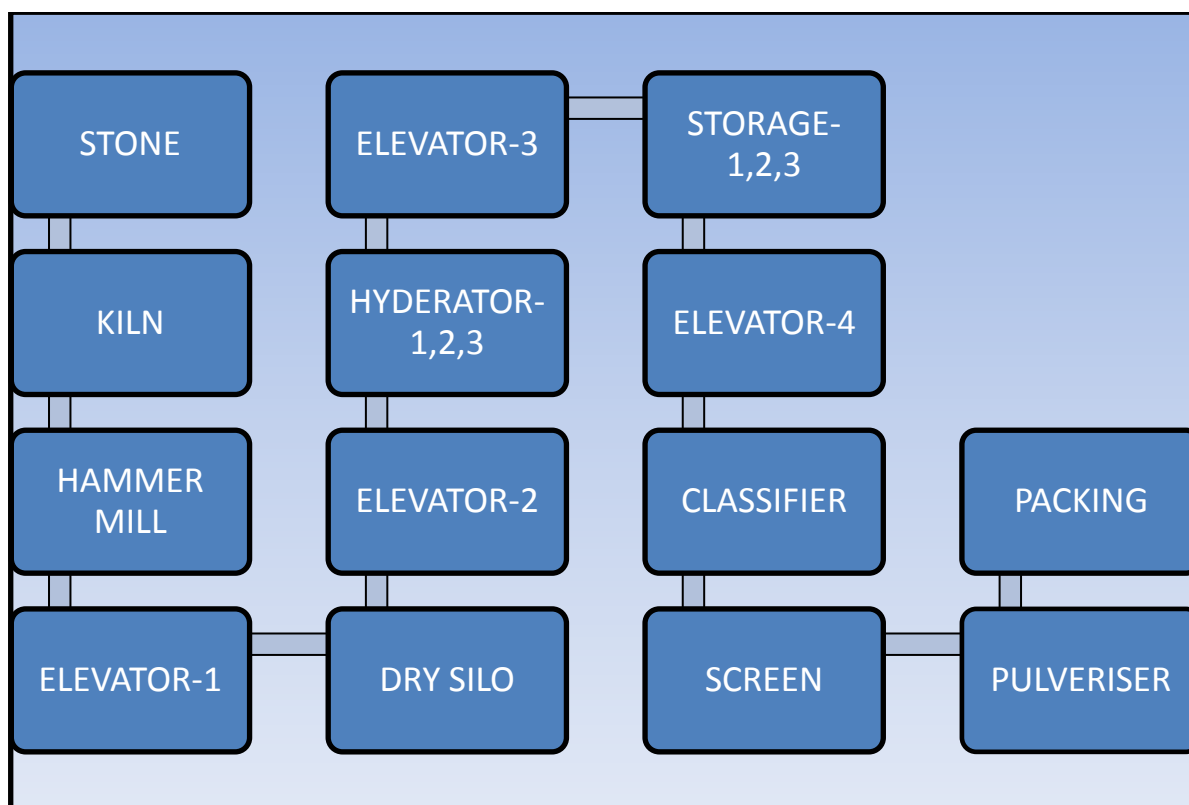
Two types of products are manufactured in Jodhpur SME cluster are as shown in Table 1.3 below.

**Table 1.3 Products Manufactured**

S.No	Type of Product	Units
1	Hydrated Lime	50-55
2	Quick Lime	10-15

**Production Process of Hydrated lime**

**Figure 1.1 Process Flow Diagram of Hydrated Lime**



## Hydrated Lime Production

In lime stone industry kiln is major consumer of energy. Conventionally it is done in direct flame to fire the products. Kiln is batch type kiln, where raw material is fed from top side and at bottom after 12-13 hrs finished product (quick lime) is taken out.

Raw product undergoes loading section, combustion zone, cooling zone and then under loading section. Material movement is by gravity. Kiln is constructed with refractory and insulating bricks. Lime Stone cluster units in Jodhpur region producing large quantity of quick lime and hydrated lime.

Lime stone cluster in Jodhpur is spread across a large number of small companies, each company comprises of about 1 to 5 number of production units. Capacity of company varies from 15TPD to about 75TPD.

A Kiln is major energy consumer in the process of Hydrated lime production. Each kiln in the cluster is about 35 feet long, and its internal diameter is 8.5 feet to 10 feet. The kiln lining is made of refractory material bricks, and in between the refractory material bricks and the fire brick, there is a layer of high strength heat insulating yellow sand.

In traditional Kiln insulation is provided by fire bricks lining. The heat losses from fire bricks lining is around 40 to 45% which can be improved from existing 40% to 10% by providing better insulation and thus minimizing heat losses.

With the technical support of experts in insulating materials, the Team suggested trying new refractory bricks/castables at zones of kiln system to reduce heat loss. For example, Insulation Bricks, Insulation castables i.e Monoline-7, Insulite-7, Magnesia 85% castable, Ceramic Fibre Blanket/wool, Insulate (Mixture of Quartz and Mica) is insulating material which is new technology for kiln insulation.

This option gives as saving potential at least of 4% in petcoke because it reduces the batch time from 13 hrs to 11 or 12 hrs. In addition to that extra heat availability after doing insulation, the un burn petcock contents is approximate Nil. After doing back-up insulation the temperature will increase from 950°C to 1050°C and achieve core calcinations.

### 1.2 Energy Performance in Existing Situation

#### 1.2.1 Average Production

Annual production in typical unit in Jodhpur Lime Stone cluster is given in Table 1.4 below:

**Table 1.4 Annual productions from a typical unit**

Type of Unit	Number of units	Production range ( MT/Annum)
Small Scale unit	10-15	Less than 5000
Medium Scale Unit	65-70	5000-15000
Large Scale Unit	2-5	More than 15000

Energy consumption (both electrical and thermal) in a typical lime stone plant for different types of products is given in Table 1.5.

**Table 1.5: Annual Energy Consumption for Kilns**

Type of Kiln	Energy type Used	Running Hrs/Day	Production Capacity	Fuel Consumption/Day	Specific Energy Consumption/Ton Quicklime	Specific Energy Consumption in Rupees
Vertical Shaft	Pet Coke	Continuous	15T Quicklime Lime/ day	2.5-3.0 MT Pet coke	0.2 MT Pet coke/T Quicklime	Rs 1.44/Kg of Quick lime

For production of hydrated lime, apart from pet coke electricity energy is also used. Mainly Electricity is used for running hydrator, hammer, Classifier, elevators, blowers, rollers & conveyers of the kiln etc.

**Table 1.6 Specific Energy Consumption for Crushing & Hydration motors**

Type of process	Energy type Used	Running Hrs/Day	Production Capacity	Electricity Consumption	Specific Energy Consumption/Ton Hydrated Lime	Specific Energy Consumption in Rupees
Crushing & Hydration	Electricity	8 to 10	18T Hydrated Lime/ day	250 -270 KWh	14-16 Kwh	Rs 75.0

### 1.2.2 Specific Energy Consumption

Pet coke consumption in Kiln is in the range of 2.5 – 3.0 Tonnes to produce around 15 Tonnes of quick lime. So, based on the lime output from Kiln, Specific energy consumption is coming around 0.2 Tonnes of Reliance pet coke (@ 7400 Kcal/kg)/T of quick lime produced.



Specific energy consumption of Lime stone units depends upon the production capacity & their corresponding power consumption. Units of Jodhpur are having Specific energy consumption for electrical motors are in range of 14-16 kWh/MT of hydrated lime produced.

### **1.3 Proposed Technology/Equipment**

#### **1.3.1 Description of Technology/Equipment**

Kiln is mainly used for baking of the raw lime stone. Pet coke is used as a fuel in kiln. Inside temperature at firing zone of kiln is maintained at 1000 to 1200OC. Out of total heat, percentage of radiation loss is coming out to be in the range of 15% to 20% of total energy supplied. This radiation loss can be reduced by replacing the damaged insulation and increasing the insulation thickness of the kiln. Kiln insulation improvement, will lead to saving in Pet Coke consumption in kiln.

#### **1.3.2 Role in Process**

Role of Kiln is to bake the lime stone, to get quick lime products and deliver the finished products. Final quality of product depends on the firing temperature and cycle time of kiln. In kiln, final moisture is removed and heating at higher temperature imparts strength to the quick lime.

### **1.4 Benchmarking for Existing Specific Energy Consumption**

Energy Consumption in kiln depends upon following parameters.

- Heating temperature which depends on the type of product to be fired
- Operational & maintenance practices
- Type of fuel and its calorific value
- Quantity of product to be heated
- Amount of air supplied for fuel combustion
- Length of Kiln
- Insulation level & its condition

Energy use and technology audit studies were conducted in various units of Jodhpur Lime Stone cluster, the baseline energy consumption of present Kiln and the performance of the same is carried out and attached in Annexure 1.

### **1.4.1 Design and operation parameters specification**

In all Lime stone units, Pet coke is used as a fuel. Kiln is divided into different zones depending upon zonal temperature. The zones are classified as loading zone, Combustion zone, Cooling zone & Unloading Zone. Major role of the kiln is for heat treatment of lime stone at a temperature of about 1200°C.

### **Operating efficiency Analysis**

Operating efficiency of kilns is found to be in the range of 30% to 35%. Detailed parameters and calculations used for operating efficiency evaluation of kiln and heat loss calculations are given in the Annexure 1.

## **1.5 Barriers in Adoption of Product Technology/Equipment**

### **1.5.1 Technological Barrier**

- In Jodhpur Lime Stone cluster, overall technical understanding on lime stone manufacturing is good and rapidly increasing, however awareness and information about the new and emerging energy efficiency technologies available in market is less.
- In this cluster there is lack of leadership to take up the energy efficiency projects.
- The majority of the limestone plant owners are only concern about their production instead on efficiency improvement.
- Dependence on local equipment suppliers for uninterrupted after sales service

### **1.5.2 Financial Barrier**

- Implementation of the proposed project activity requires considerable investment of 1.2 lakh, which is a significant investment and not commonly seen in the cluster for energy efficiency.
- The majority of the unit owners are of the view that it makes business sense for them to invest in enhancing production capacity rather than making investment in energy efficiency.
- The unit owners in the cluster are wary of approaching banks for financial assistance due to their old perception that getting loan sanctioned from Banks involves lot of paper work / documentation and needs collateral security.

### **1.5.3 Skilled Manpower**

In Jodhpur Lime Stone cluster, the availability of skilled manpower is one of the limitations, this

issue gets further aggravated due to more number of lime stone units as compared to the availability of skilled manpower. One local technical person available at lime stone unit takes care of about 5 to 10 lime stone units. For major equipments of lime stone units like kiln, hammer mill, hydrator Machine etc.

## 2 PROPOSED TECHNOLOGY

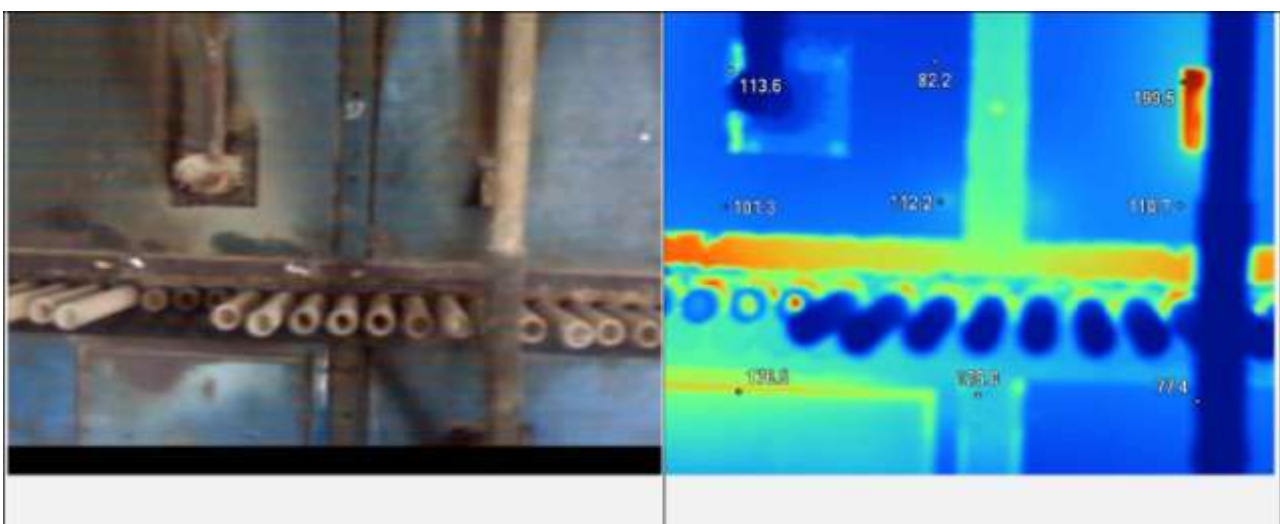
### 2.1 Detailed Description of Technology

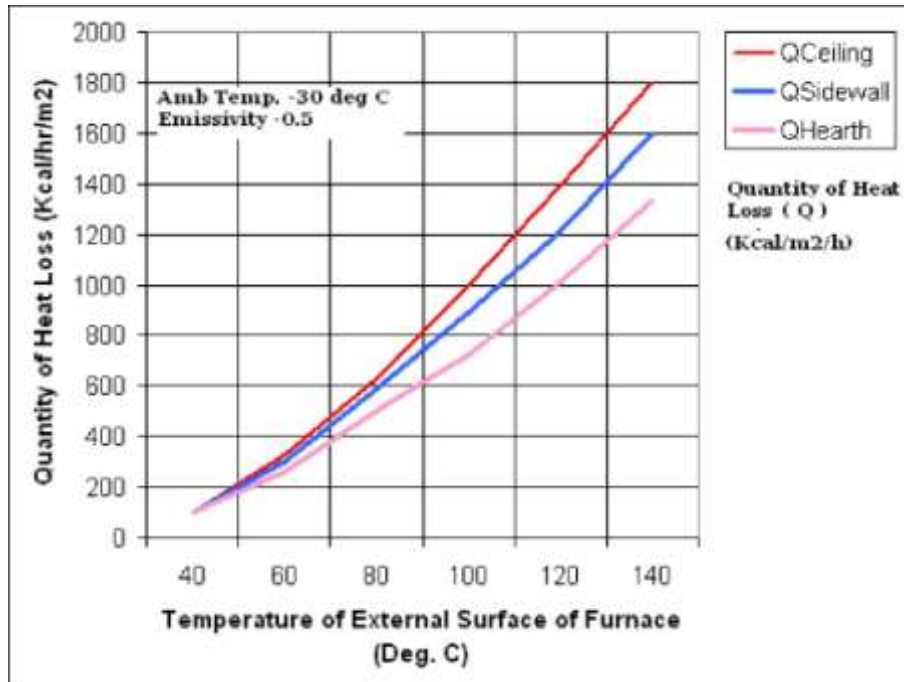
#### 2.1.1 Description of Technology

Maximum efficiency of the Kiln is in the range of 30% to 40% and remaining 60% to 70% are losses from the kiln. Out of these losses percentage of radiation loss is coming out to be in the range of 15% to 20% of total energy supplied. This radiation loss can be reduced by replacing the damaged insulation and improving the existing insulation of the kiln. Insulation improvement, leads to saving in fuel consumption in Kiln. In this study saving potential of around 5% of total fuel consumption in kiln, is identified by reducing radiation losses.

One of the important aspects in this work is to maintain the repaired insulation which can be done by checking the surface temperature timely. Units need to keep thermocouple & infra read gun type portable temperature measuring instruments to measure the surface temperature and plant persons should check it themselves status of the insulation. Both of these instruments are extremely cost effective. It is further recommended that at least once a year, the units must go for a thermograph based survey of the insulation. Left had side is photograph where as the right side picture is its thermograph which clearly identifies the hot spots in red color where insulation needs to be improved. Once the insulation work is carried out again thermograph needs to be taken to check the quality of repaired insulation. Such a holistic approach is required for insulation improvement.

**Figure 2.1: Thermal Image Showing the Surface Temperature of Kiln**





**Figure2.2: Graph Showing the Quantification of Heat Loss through Kiln Surface**

### 2.1.2 Suitability of Existing Technology

In this technology radiation losses are reduced by replacing the damaged insulation or by improving the insulation of the kiln which leads to saving in fuel consumption in kiln.

To sustain the improved insulation level, insulation levels must be regularly checked. If timely corrective actions are not taken then the losses may increase. This measure can be implemented during annual shut down period to avoid loss of production. To maintain the sustainability of achieved results from the insulation improvement, awareness creation is mainly required. Loss quantification due to poor insulation needs to be explained by the LSP to the unit owners, and then this will drive the unit owners to maintain the implemented and achieved results of insulation improvement project on a regular basis.

This technology has been selected for the following reasons:

- In lime stone unit, major energy cost of unit is consumed in kiln.
- It reduces the fuel consumption in kiln.
- It increase the efficiency of kiln
- Resulting in reduction in the GHG emission

- Technology is easily available and proven

### **2.1.3 Superiority over Existing Technology**

In this technology radiation loss from kiln will be reducing by replacing the damaged insulation of the kiln. This will result in decrease in the fuel consumption in Kiln. Thus it improves performance of existing system.

### **2.1.4 Availability of Technology**

Service providers of this project are available at Jodhpur itself. Even many of the vendors are trying to personally visit the units to tell the unit owners about the savings achieved by insulation improvement in kiln.

### **2.1.5 Source of Technology**

This Technology is already used in many of the industries and savings have been already achieved. This technology is very common and easy to implement. It reduces the fuel consumption in kiln also it increase the efficiency of Kiln and this technology is well established and easily available.

### **2.1.6 Terms and Conditions in Sales of Equipment**

The Technology supplier shall give guarantee for proper performance after implementation of this project.

### **2.1.7 Process down Time during Implementation**

Process down time requirement will be of one month for implementation of this project. Week wise break up of one month is shown in Annexure-6.

### **2.1.8 Life Cycle Assessment**

Life cycle of this proposed insulation improvement project is about 4 to 5 years provided it requires periodic repair and maintenance work of damaged insulation spots over the period.

### **2.1.9 Suitable Unit for Implementation of Proposed Technology**

In Jodhpur, there are around 100 Lime stone units. Nearly 60% of the units have potential of insulation improvement, where this technology can be implemented.

### **3 ECONOMIC BENEFITS FROM PROPOSED EQUIPMENT**

#### **3.1 Technical Benefits**

##### **3.1.1 Fuel Saving**

Energy & Monetary savings due to reduction in radiation loss in a typical lime stone cluster are presented in this chapter. Pet Coke consumption in a kiln is 1200 MT per year and the proposed Pet coke consumption in the kiln for the same production after kiln insulation improvement project implementation will be 1152 MT per year. Therefore, implementation of this project will lead to saving of approximately 4% in pet coke consumption in kiln which is about 48 MT per year.

##### **3.1.2 Electricity Saving**

No electricity savings are considered in the proposed technology because it is not reducing the electricity consumption in the kiln.

##### **3.1.3 Improvement in Product Quality**

Product quality achieved would be same as the present quality. It does not have any impact in improving the quality of the product. However it improves the kiln efficiency and reduces pet coke consumption.

##### **3.1.4 Increase in Production**

The proposed technology does not contribute to any improvement in production.

##### **3.1.5 Reduction in Raw Material Consumption**

Raw material consumption will be the same after the implementation of the proposed project.

##### **3.1.6 Reduction in Other Losses**

After implementation of this project, surface heat loss from the kiln will be reduced.

### 3.2 Monetary Benefits

Annual monetary savings due to insulation Improvement is 3.0 lakh per year. Energy & monetary benefit analysis of insulation improvement are shown in Table 3.1 below:

**Table 3.1 Energy and Monetary Benefit due to Project Implementation**

S.No.	Particulars	Unit	Existing situation	Proposed situation
1	Pet Coke consumption	MT/year	1200	1152
2	Saving in pet coke consumption	%	-	3
3	Cost of Pet coke	Rs/MT	7000	
4	Monetary Saving	Rs (lakh/year)	-	2.5

### 3.3 Social Benefits

#### 3.3.1 Improvement in Working Environment in the Plant

Implementation of this project will result in the heat loss from the surfaces of the kiln which indirectly reduces the temperature near the kiln.

#### 3.3.2 Improvement in Workers Skill

The technical skills of persons will definitely improve. As the training of surface temperature measuring instruments will be provided by equipment suppliers this will improve the technical skills of manpower required for operating of the equipment and also the technologies implemented will create awareness among the workforce.

### 3.4 Environmental Benefits

#### 3.4.1 Reduction in Flue Gas Generation

By implementing this project there is definitely reduction in pet coke consumption which leads to reduction in flue gas generation.

#### 3.4.2 Reduction in GHG Emission

Implementation of this technology will results in reduction in CO<sub>2</sub> emissions due to reduction in overall fuel consumption.

## 4 IMPLEMENTATION OF PROPOSED EQUIPMENT

### 4.1 Cost of Equipment Implementation

#### 4.1.1 Equipments Cost

Cost of project is about 1.2 Lakhs, which includes EPC cost of project.

#### 4.1.2 Erection & Commissioning and other Miscellaneous Cost

Erection & commissioning cost is 0.1 Lakh which includes services, manpower cost work, etc, Lakh and other misc. cost is 0.1 Lakh.

**Table 4.1 Details of Proposed Equipment Installation Cost**

S.No	Description	Units	Values
1	Equipment cost	(Lakhs)	1.0
2	Erection and Commissioning cost	(Lakhs)	0.1
3	Miscellaneous Cost	(Lakhs)	0.1
4	Total cost	(Lakhs)	1.2

## 4.2 Arrangements of Funds

### 4.2.1 Entrepreneur's Contribution

Entrepreneur will contribute 25% of the total project cost which is 0.3 lakh.

### 4.2.2 Loan Amount

Remaining 75% cost of the proposed project will be funded by bank which is 0.9 lakh.

### 4.2.3 Terms & Conditions of Loan

The interest rate is considered at 10% which is SIDBI's rate of interest for energy efficient projects. The loan tenure is 5 years excluding the moratorium period of 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 5 years. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below.

The project is expected to achieve monetary savings of 3.0 lakh per annum.



- The Repair and Maintenance cost is estimated at 5% 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-4.

#### 4.3.2 Simple Payback Period

The total project cost of the proposed technology is 1.2 lakhs and monetary savings due to reduction in fuel consumption is 2.5 lakh hence, the simple payback period works out to be 0.5 years.

#### 4.3.3 Net Present Value (NPV)

The Net present value of the investment at 12% works out to be 5.0 Lakhs

#### 4.3.4 Internal Rate of Return (IRR)

The after tax Internal Rate of Return of the project works out to be 172%. 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 170%.

**Table 4.2 Financial Indicators of Proposed Technology**

S.No	Description	Units	Values
1	Simple Payback	Months	3
2	NPV	Rs. In Lakh	5.2
3	IRR	%	145

#### 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 fuel savings or decrease in fuel savings. For the purpose of sensitive analysis, two following scenarios have been considered.

- **Optimistic scenario (Increase in fuel savings by 5%)**
- **Pessimistic scenario (Decrease in fuel 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 on Fuel Saving**

Scenario	Monetary Benefit( Rs Lakh/year)	IRR (%)	NPV(in Lakh)	Pay back period
Pessimistic	3.275	137	4.87	3
Base	2.5	145	5.12	3
Optimistic	2.625	151	5.5	3

#### 4.5 Procurement and Implementation Schedule

Procurement and implementation schedule required for implementation of this technology is about 7 weeks and 4-5 weeks required as a process break down. Details of procurement and

Implementation schedules are shown in Table 4.4 below and in Annexure 6 also.

**Table 4.4 Procurement and Implementation Schedule**

S. No.	Activities	Weeks						
		1	2	3	4	5	6	7
1	Identification of Damaged Insulation area in Kiln	■						
2	Planning and material order		■					
3	Procurement		■	■				
4	Commissioning			■	■	■	■	■

## ANNEXURES

### Annexure -1: Energy audit data used for baseline establishment

S. No.	Parameters	Units	Before	After
1	Height of Kiln	m	30	30
2	Diameter of Kiln	feet	8.5 to10.0	8.5 to10.0
3	Type of insulation		Fire brick insulation	Fire brick insulation
4	Observation on insulation		Insulation leakage	Proper insulation
5	Fuel consumption	MT/Year	1200	1164
6	Weight of Lime stone going to kiln	MT/Day	30	30
7	Weight of Quick Lime coming out from kiln	MT/Day	15	15
8	Production from Kiln	MT/Day	15	15
9	Highest temperature in firing zone	°C	1200	1200
10	Surface temperature	°C	90 to 95	60 to 65
11	Operating efficiency	%	30	

### Specific Energy Consumption of kiln

Type of Kiln	Energy type Used	Running Hrs/Day	Production Capacity	Fuel Consumption/Day	Specific Energy Consumption/Ton Quicklime	Specific Energy Consumption in Rupees
Vertical Shaft	Pet Coke	Continuous	15T Quicklime Lime/ day	2.5-3.0 MT Pet coke	0.2 MT Pet coke/T Quicklime	Rs 1.44/Kg of Quick lime

### Annexure -3: Detailed Technology Assessment Report

S. No.	Parameters	Units	Before	After
1	Height of Kiln	m	30	30
2	Diameter of Kiln	feet	8.5 to10.0	8.5 to10.0
3	Type of insulation		Fire brick insulation	Fire brick insulation
4	Observation on insulation		Insulation leakage	Proper insulation
5	Fuel consumption	MT/Year	1200	1164
6	Weight of Lime stone going to kiln	MT/Day	30	30
7	Weight of Quick Lime coming out from kiln	MT/Day	15	15
8	Production from Kiln	MT/Day	15	15
9	Highest temperature in firing zone	°C	1200	1200
10	Surface temperature	°C	90 to 95	60 to 65

11	Saving in fuel consumption	%	-	3
12	Saving in cost of fuel	Rs(Lakhs/Year)		2.5

#### Annexure -4: Detailed Financial Calculations & Analysis

Assumptions		
Commercial Inputs	Units	Value
Required Investment(cost of Equipment+ EPC cost+ Misc. cost)	Rs(Lakhs)	1.20
O&M cost (5% of equipment cost)	Rs(Lakhs)	0.060
Acceleration in O&M cost per year	%	5%
Debt/Equity ratio		3 to1
Debt component of Investment	75%	0.90
Equity component of investment	25%	0.30
Interest on term loan	%	10%
Loan tenure	Years	4
Moratorium period	Months	6
Depreciation rate (Companies act)	%	5.28%
Depreciation rate (IT act)	%	80%
Income tax rate	%	33.99%

PROFITABILITY & IRR Calculations						
Particulars/ Years		1	2	3	4	5
Revenue						
Total saving	Rs(Lakhs)	2.50	2.50	2.50	2.50	2.50
Expenditure						
O&M Expenditure	Rs(Lakhs)	0.06	0.06	0.07	0.07	0.07

<b>Interest on term loan</b>	Rs(Lakhs)	0.09	0.07	0.04	0.02	0.00
<b>Book depreciation</b>	Rs(Lakhs)	0.06	0.06	0.06	0.05	0.05
<b>Total expenses</b>		0.21	0.19	0.16	0.14	0.12
<b>PBT</b>	Rs(Lakhs)	2.29	2.31	2.34	2.36	2.38
<b>Tax</b>		0.47	0.80	0.81	0.82	0.82
<b>PAT</b>		1.82	1.51	1.53	1.54	1.55

<b>Cash Flow Statement</b>						
		1.00	2.00	3.00	4.00	5.00
<b>PAT</b>		1.82	1.51	1.53	1.54	1.55
<b>Add: Depreciation</b>		0.06	0.06	0.06	0.05	0.05
<b>Add: Interest</b>		0.09	0.07	0.04	0.02	0.00
<b>Net cash In flow</b>		1.97	1.64	1.62	1.61	1.61
<b>Net cash out flow</b>		-1.20				
<b>Net cash flow</b>		0.77	1.64	1.62	1.61	1.61
	-1.2	1.97	1.64	1.62	1.61	1.61
<b>IRR</b>	151%					
<b>NPV</b>	5.26					

<b>Cash statement</b>						
		1	2	3	4	5
<b>Source</b>						
<b>Equity</b>	0.30					
<b>Loan</b>	0.90					
<b>PAT</b>		1.82	1.51	1.53	1.54	1.55
<b>Depreciation</b>		0.06	0.06	0.06	0.05	0.05
<b>Total</b>	1.20	1.88	1.57	1.58	1.60	1.61
<b>Application</b>						
<b>Capital expenditure</b>	1.2					
<b>Loan repayment</b>		0.09	0.07	0.04	0.02	0.00
<b>Total</b>	1.2	0.09	0.07	0.04	0.02	0.00
<b>Net surplus</b>	0.00	1.79	1.50	1.54	1.58	1.61
<b>Add: Opening balance</b>	0		1.79	3.29	4.83	6.41
<b>Closing balance</b>	0	1.79	3.29	4.83	6.41	8.02

Tax calculation						
		1	2	3	4	5
<b>PBT</b>	Rs(Lakhs)	2.29	2.31	2.34	2.36	2.38
<b>ADD: Book depreciation</b>		0.06	0.06	0.06	0.05	0.05
<b>SUB: IT Depreciation</b>		0.96	0.01	0.01	0.01	0.01
<b>PBT&amp;D</b>		1.39	2.36	2.38	2.40	2.42
<b>Tax</b>		0.47	0.80	0.81	0.82	0.82

Loan payment schedule							
YEARS	QUARTERS	BALANCE AT THE BEGNING OF QUARTER	QUARTER INTEREST	QUARTER'S PRINCIPEL PAYMENT	BALANCE AT THE END OF QUARTER	ANNUAL PRINCIPEL PAYMENT	ANNUAL INTEREST PAYMENT
1	1	0.90	0.02	0.00	0.90	0.13	0.09
	2	0.90	0.02	0.00	0.90		
	3	0.90	0.02	0.06	0.84		
	4	0.84	0.02	0.06	0.77		
2	1	0.77	0.02	0.06	0.71	0.26	0.07
	2	0.71	0.02	0.06	0.64		
	3	0.64	0.02	0.06	0.58		
	4	0.58	0.01	0.06	0.51		
3	1	0.51	0.01	0.06	0.45	0.26	0.04
	2	0.45	0.01	0.06	0.39		
	3	0.39	0.01	0.06	0.32		
	4	0.32	0.01	0.06	0.26		
4	1	0.26	0.01	0.06	0.19	0.26	0.02
	2	0.19	0.00	0.06	0.13		
	3	0.13	0.00	0.06	0.06		
	4	0.06	0.00	0.06	0.00		

Depreciation schedule						
<b>Depreciation as per companies act</b>		1	2	3	4	5
<b>Value of machine at the beginning of year</b>		1.20	1.14	1.08	1.02	0.97
Depreciation		0.06	0.06	0.06	0.05	0.05
Net value at the end of year		1.14	1.08	1.02	0.97	0.91
<b>Depreciation as per IT act</b>		1	2	3	4	5
<b>Value of machine at the beginning of year</b>		1.20	0.24	0.23	0.22	0.20
Depreciation		0.96	0.01	0.01	0.01	0.01
Net value at the end of year		0.24	0.23	0.22	0.20	0.19

#### Annexure -5: Procurement and Implementation Schedule

S. No.	Activities	Weeks						
		1	2	3	4	5	6	7
1	Identification of Damaged Insulation area in Kiln							
2	Planning and material order							
3	Procurement							
4	Commissioning							



### Annexure -6: Break-up of Process down Time

S. No.	Activities	Days			
		1	2	3	4
1	Time required for cooling down of Kiln				
2	Dismantling of damaged insulation portion				
3	Putting new refractory lining in place of damaged				
4	Testing and Commissioning				

### Annexure -7: Details of Technology Service Providers

Name of service provider	Contact Person	Address	Email.Id
Shri Sadguru Dev Engg. Services	A/4, New Veena Vihar, Datta Mandir Road, Dahanukar Wadi, Kandivali (W), Mumbai-67	Mr. Ravi Patel 09969378982	sadgurudev_engg@yahoo.co.in
Poonam Refractories	Bazar Road, Post Box No. 2, Wankaner-363621 (Dist. Rajkot)	Mr. Ketan Mehta 09825224640	dhimantmehta@yahoo.co.in
Steamco Services	05,Jai shri Siddhivinayak Co. Op.Hsg-so., Gr. Floor,Shivaji Nagar, B-Cabin, Thane (W)-400602	Mr. Rajesh Bamane 09820998390	steamco.services@vsnl.net

## Annexure -8: Quotations for Proposed Technology

### **SHREE TIRUPATI REFRACTORIES & CERAMICS**

12-A-26, P&T ROAD, NEAR COMMUNITY HALL,

BAPUNAGAR, BHILWARA-311 001 RAJASTHAN

TELEFAX: 01482-240889, MOBILE: 9829210889

EMAIL: [refinsul@yahoo.co.in](mailto:refinsul@yahoo.co.in) WEBSITE: [www.tirupatirefractories.com](http://www.tirupatirefractories.com)

Ref.No.STRC/2011-12/1239

Dated: 22/08/2011

Dear Sir,

Sub: Insulation Bricks for Lime Kilns.

We thank you very much for your mail and understood the cost of production is going very higher side due to non use of Insulation material in the lime kiln walls. Here we have suitable Insulation Bricks being manufactured in our plant in Bhilwara,Rajasthan. Using our Insulation Bricks will give definite benefit as follows :-

1. MAINTAINING OF UNIFORM TEMPERATURE IN THE KILN SO THAT THE ENTIRE MATERIAL OF THE KILN IS FIRED EQUALLY.
2. PREVENTION OF LOSS OF HEAT: USING OUR INSULATION BRICK WILL SAVE THE HEAT BY 25% APPROX. AND THE PAY BACK PERIOD IS VERY LITTLE.
3. LOW OUTER WALL TEMPERATURE: IT WILL MAINTAIN LOW OUTER WALL TEMPERATURE TO AVOID OPERATIONAL HAZARDS.

We are giving the details of such bricks as follows :-

1. Insulation Bricks Size: 230x115x75mm @Rs.16.00 per brick

For Side/End Arch @Rs.1/- per brick will be charged extra.

Specification :

Bulk Density : 0.9 gm/cc Max.

Cold Crushing Strength : 20 Kg/Cm<sup>2</sup> Min.

Service Temperature : 1250oC Max.

Thermal Conductivity: 0.22 Kcal/m/hr/oC Max.

GENERAL TERMS & CONDITIONS :

PRICE : Ex-our works Bhilwara basis.

TAX : VAT @5% extra.

DELIVERY : 1,00,000 brick per month with 15 days lead period.

TRANSPORTATION : By truck L/R To-Pay as actuals.

PAYMENT : 50% payment is in advance alongwith order and balance against delivery at your site.

Assuring you our best services all the times.

Best regards,

FOR SHREE TIRUPATI REFRACTORIES & CERAMICS

SANJAY GOSWAMI PROPRIETOR

## Annexure 8

To be submitted by Indian company/firm  
Seeking financial assistance under  
TIFAC-SIDBI Revolving Fund for Technology Innovation

**सृजन (SRIJAN)**  
**Application Format**

### PART A: Brief about the Unit

#### 1.1 Particulars of company / firm

1	Name	
2	Constitution	
3	Year of incorporation / commencement of operations	
4	Address of registered office and site of operations	
5	Main Promoter(s) / contact details	

#### 1.2 Particulars of Promoters

Name (age)	Educational/ Professional qualification	No of years of professional experience	No of years of entrepre- neurial experience	Stake in the firm / company (%)

#### 1.3 Present line of business and Technology / product successfully developed by the entity in the past:

**1.4 Technology know-how Partner (name, designation with educational and professional background, affiliation address, telephone, fax, e-mail etc.):**

## **PART B: Technical Information**

### **2 Project title:**

#### **2.1 Background:**

#### **2.2 Project objectives :**

#### **2.3 Major Targets :**

#### **2.4 Process / Products proposed to be developed under the project along with specifications etc.:**

#### **2.5 Technology development/demonstration in Product/Process**

**Technology development:**

**(i) Process:**

**(ii) Product:**

**2.5.1 Detailed technology description:**

**2.6 What is the specialty / novelty / uniqueness / innovation about the technology:**

**2.7 Work already carried out for proof of concept / technology validation:**

**2.8 Whether the technology has been already patented. If yes, provide the details:**

**2.9 Process flow-charts / schematic diagram etc.:**

**2.10 Raw materials and their availability:**

**2.11 Comparative advantages / disadvantages over the conventional/ emerging technologies and brief comments on competitions / challenges:**

**2.12 Techno-economics, cost benefit analysis and demand statistics in next 2/3 years:**

**2.13 Environmental Impact, if any:**

**2.14 Work Plan:**

**2.14.1 Project Duration (in months):**

**2.14.2 Time schedule indicating important activities/milestones & duration (*bar-chart*):**

### 2.15 Deliverables of the project:

### 2.16 List of existing facilities already available for the proposed project (land, building, machinery, software, manpower, utilities etc.)

## PART C: Financial information

### 3.1 Total Project Cost:

Project head	Area / Qty./ Specifications/ Capacity	Company/Firm Contribution (Lakh)	Contribution from Fund (Lakh)	Total Cost (Lakh)
Cost of construction / augmentation of factory shed for the project				
Technology Know-how fee / patent / licensing				
Equipment / Machinery / Utilities				
Consumables / Raw Materials				
Equipment for Testing & Evaluation / Quality Control				
Manpower Salaries				
Marketing related expenses				
Working Capital Margin				



Others (pl specify)				
Contingency				
<b>Total</b>				

### 3.2 Means of Finance:

<b>Means of finance</b>	<b>Amount (` lakh)</b>
Additional Share capital	
Unsecured loans from .....	
SIDBI Assistance	
Assistance sought from the Fund	
Others (pl specify)	
<b>Total</b>	

### 3.3 Detailed Break-up of following Heads of Project Cost with equipment details (in tabular form):

- 3.3.1 Capital Equipment / plants & machinery
- 3.3.2 Testing & Laboratory Equipment
- 3.3.3 Manpower Salaries
- 3.3.4 Consumables/Raw Materials

### 3.4 What makes the technology different from existing ones and advantage in terms of business opportunities?

### 3.5 Whether this proposal has been submitted to any other agency for funding support (if yes, give details)

**3.6 Financial performance:** In case of existing entity, brief business highlights given below  
(Pl. enclose last FY audited accounts with auditors report).

(` Lakhs)

Particular	FY ....	FY .....	Particular	FY .....	FY ....
Revenue			Share Capital (promoters)		
EBDITA			Share capital (others)*		
Profit After Tax (PAT)			Net worth/ Accumulated losses		
Initial/ product dev expenses not written off			Bank term loans		
Net Profit Margin (%)			Unsec loans – promoters		
Debt Equity Ratio (DER)			Unsec loans – others		
			Bank borrowings –WC		

*\*please provide details*

**3.7 Credit/ Banking facilities from SIDBI / other banks/ FIs/ PE or VC or Angel investors in respect of customer (` Lakh)**

PE/ VC/ Angel inv/ Bank, branch	Facility	Sanc amt	Outstanding

**3.7.1 Whether any over dues in any banking credit facilities by the applicant enterprise/ associate concerns in past 2 years.**

**3.7.2 Whether any of the accounts of the enterprise/ associate concern classified as NPA/ any restructuring done during past 3 years or any OTS done ever.**

**3.7.3 Whether any default in promoters' personal/ consumer loans/credit card payments, etc.**

### 3.8 Tentative Business projections ( in Lakh)

Particular	First Year		Second Year		Third year		Fourth year	
	H1	H2	H1	H2	H1	H2	H1	H2
Sales								
PAT								

### 4. Key strengths and risk factors

### 5. Any other relevant information

### DECLARATION

I/We certify that all information furnished by me/ us above and in the appendix/annexures/ statements and other papers enclosed is true; I/we have no borrowing arrangements for the unit with any bank / FI except as indicated in the application; that there are no overdues / statutory dues/government enquiry/proceedings/prosecution against the unit/associate concerns/ promoters/directors except as indicated in the preliminary information; that no legal action has been/ is being taken against the unit/associate concerns/promoters/directors; that I/ we shall furnish all other information that may be required by SIDBI in connection with my/our application and I/ We have no objection to your furnishing the information submitted by me/ us to any agency as you may deem fit in connection with consideration of the assistance. We have no objection to SIDBI/ its representatives making suitable enquiries while considering the application.

Place:

Signature

Date:

Name & Designation with Seal

## Annexure I

### Details of Associate Concerns

Name , Address & products manufactured	Existing since	Name & Address of existing Banker (s)	Facilities Enjoyed	Share holding of the main promoter(s) of applicant unit

## Annexure II

### Particulars of machinery proposed for the project

Name of machinery, (model / specification)	Name of manufacturer, contact person, e-mail address telephone no	Lead time for delivery Of machinery	Invoice price (for Indigenous machinery) / CIF price (for imported) (Rs. lakh)	Purpose /use of machine.	Basis of selection of supplier	Remarks reg. After Sale Service etc.
Insulation Improvement	Attached Doc.	1 Month		To Improve energy Efficiency	Techno-commercial competitiveness.	

### Annexure III

#### Details of Misc. Assets / equipment Proposed

S.No.	Name of item	Supplier	Cost (Rs. lakh)	Purpose/ use of MFA	Remarks

## Annexure IV

### Profitability projections for the unit/company as whole:

S. No.	Items	Actuals for previous years	Y1	Y2	Y3	Y4	Y5	Total
1	Total income		2.5	2.5	2.5	2.5	2.5	12.5
2	Raw material							
	Power and fuel							
	Wages and salaries							
	Selling expenses							
	Other expenses		0.03	0.032	0.033	0.035	0.036	0.166
	Total cost		0.03	0.032	0.033	0.035	0.036	0.166
3	Profit before depreciation, interest and taxes (PBDIT)		2.38	2.40	2.43	2.45	2.47	12.13
4	Interest on term loan		0.09	0.07	0.04	0.02	0.0	0.22
5	Interest on working capital		-	-	-	-	-	
6	Interest on unsecured land		-	-	-	-	-	
7	Depreciation		0.032	0.03	0.028	0.03	0.027	0.147
8	PBT		2.35	2.32	2.4	2.42	2.44	11.93
9	Tax		0.65	0.81	0.82	0.83	0.84	3.95
10	PAT							
11	Dividends/							

	withdrawal							
12	Cash accruals							
13	Debt service coverage ratio		1.89	2.2	3.5	8.15	-	
	Av. DSCR	<b>3.96</b>						

**Annexure V**

**CHECK LIST of documents to be**

**Submitted along with the application**



S. No	Documents	Y/N	Reasons for Non-Submission
1	SSI Regn. / CA certificate certifying SSI status.		
2	Certified copies of Memorandum & Articles of association / Partnership Deed.		
3	Audited financial results for the last three years of Applicant unit.		
4	Copies of lease deed / sale deed on which the unit is situated.		
5	Copies of sanction letters from commercial banks/ FIs which have sanctioned assistance to the unit.		
6	NOC from pollution control board/consent letter, if applicable.		
7	IT Returns/Assessment orders/Sales tax returns of the Applicant Unit/ promoters/directors for 2years.		
8	List of existing plant and machinery.		
9	Competitive quotations for machines and Misc.fixed assets proposed to be acquired under the scheme.		
10	Duly signed latest net worth statements of promoters/directors & guarantors in SIDBI format;In case of guarantors please furnish, Name, Age,Father's/Husband's name, residential address.Details of similar guarantee, if any, given to other institutions.		
11	2 sets of photographs along with signatures of all promoters/directors/guarantors duly certified by a Bank or Gazetted Officer.		
12	Audited financial results for last three years for each associate concerns. If applicable.		
13	Copy of title deed of collateral security and valuation report.		



**Bureau of Energy Efficiency (BEE)**

(Ministry of Power, Government of India)

4th Floor, Sewa Bhawan, R. K. Puram, New Delhi – 110066



**Confederation of Indian Industry**

CII – AVANTHA Centre for Competitiveness

Block No.3, Dakshin Marg

Sector 31-A, Chandigarh - 160030



**India SME Technology Services Ltd**

DFC Building, Plot No.37-38,

D-Block, Pankha Road,



**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](http://www.bee-india.nic.in), [www.energymanagertraining.com](http://www.energymanagertraining.com)

**SEE-Tech Solutions Pvt. Ltd**

11/5, MIDC, Infotech Park,  
Near VRCE Telephone Exchange,  
South Ambazari Road,  
Nagpur – 440022

Website: [www.letsconserve.org](http://www.letsconserve.org)



**India SME Technology Services Ltd**

DFC Building, Plot No.37-38,  
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Website: [www.techsmall.com](http://www.techsmall.com)