

DETAILED PROJECT REPORT
ON
ENERGY COST REDUCTION BY INSTALLING GASIFIER
FOR KILNS
STUDY FOR: 30T/DAY CAPACITY KILN



Bureau of Energy Efficiency (BEE)

Prepared By



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INSTALLATION OF GASIFIER UNITS

JODHPUR LIMESTONE CLUSTER

BEE, 2011

Detailed Project Report on installing gasifier units for Kilns
Limestone SME Cluster, Jodhpur (Rajasthan) (India)

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List of Abbreviations

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

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 production process of lime, like cement production, is highly energy-intensive, but energy requirements in lime production are lower than cement and the types of fuels required could be a variety of low-grade fuels.

Quicklime is manufactured by calcination of limestone at temperatures around 900°C which is almost 35 per cent lower than the heat required for cement clinker production. A high proportion of the total energy requirement in lime production is used in kiln for calcinating the limestone. Thus, as in the case of cement, the principal means of achieving energy-efficiency lies in improving the performance of the kilns. In industrialized countries, production of quicklime is done by burning the limestone in large and fully automated rotary kilns. However, in most developing countries, a vertical shaft kiln, using simple masonry for the wall of the kiln is more common.

Brief introduction to Vertical-shaft kilns

Vertical-shaft lime kilns, however, have, proved to be one of the most suitable and economical method of small-scale lime production in many developing countries (3 to 10 t/d capacity). For example, a vertical-shaft lime kiln can burn lime on a continuous basis resulting in considerable savings in heat losses. The kiln, having three distinct zones of operations (preheating, calcining and cooling), is attractive and efficient in terms of use of fuel. Further efficiency can be achieved by incorporating insulation in the wall of the kiln. These are only a few characteristics that make the use of the vertical-shaft lime-kiln technology more advantageous than the other traditional methods.

Energy-saving opportunities

For any given kiln, the flame length and heat transfer are determined by the fuel characteristics,

the fuel to air ratio and the quantity of excess air. The fuel to air ratio is primarily dependent on the ratio of the burner momentum and that of the secondary air.

Due to above mentioned parameters lime recovery kilns present a significant challenge to burn pet coke or other solid fuels. Due to the low volatile content of the pet coke, the distinct flame characteristics and the need for NOx control, the combustion designing of kiln is very critical.

Considering above mentioned combustion characteristic Produce gas based Gasifier for combustion in Lime kiln is an energy efficient technology.

The producer gas based Lime calcinations Kilns are designed to enhance product throughput, quality, to reduce production cost and to eliminate dependency on single fuel.

This technology has been selected for the following reasons:

- Optimum combustion of fuel to ensure better combustion efficiency.
- Due to proper combustion lower emission of CO.
- Improved Calcinations Quality of Lime stone.
- Completely environment friendly system.
- Elimination of single fuel dependency.

Using of proposed technology reduce combustion losses. This will results in decrease in the fuel consumption in Kiln. Thus it improves performance of existing system.

Comparison of saving in existing system and proposed system on the basis of energy consumption and material loss is as depicted in following table.

Description	Units	Existing System	Proposed System	Saving Potential	Remark
Energy Consumption	Kcal/KG	1530-1650	1100-1200	330-550 Kcal/MT	Theoretical Energy requirement is 900KCal/Kg

Fuel required to produce energy for Calcinations of IMT of finished product	KG/MT	180 Kg- Pet Coke	220 Kg-Per Coke	350-400 Rs/MT	Cost-Rs/KG(Pet coke)- Rs.9/KG Cost Rs/KG(Bituminous coal)-Rs.5.5/KG
Wastage/Loss per MT of Finished product	%	5 to 10	NIL	175-350 Rs/MT	Market price of finished product Rs.3500/MT

In addition to this, Gasification plants can also use the Rise husk after bracketing.

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 installing energy efficient kiln is furnished in Table below.

Financials for producer gas based gassifier		
Name of Project	Replacement of Old and Inefficient motors	
	Units	Value
Project Cost	Rs(Lakhs)	62.7
Saving Potential	Rs(Lakhs) per year	25.0
IRR	%	11
NPV	Rs(Lakhs)	1.18
ROI	%	97
Simple payback period	Months	30

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 Program 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 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

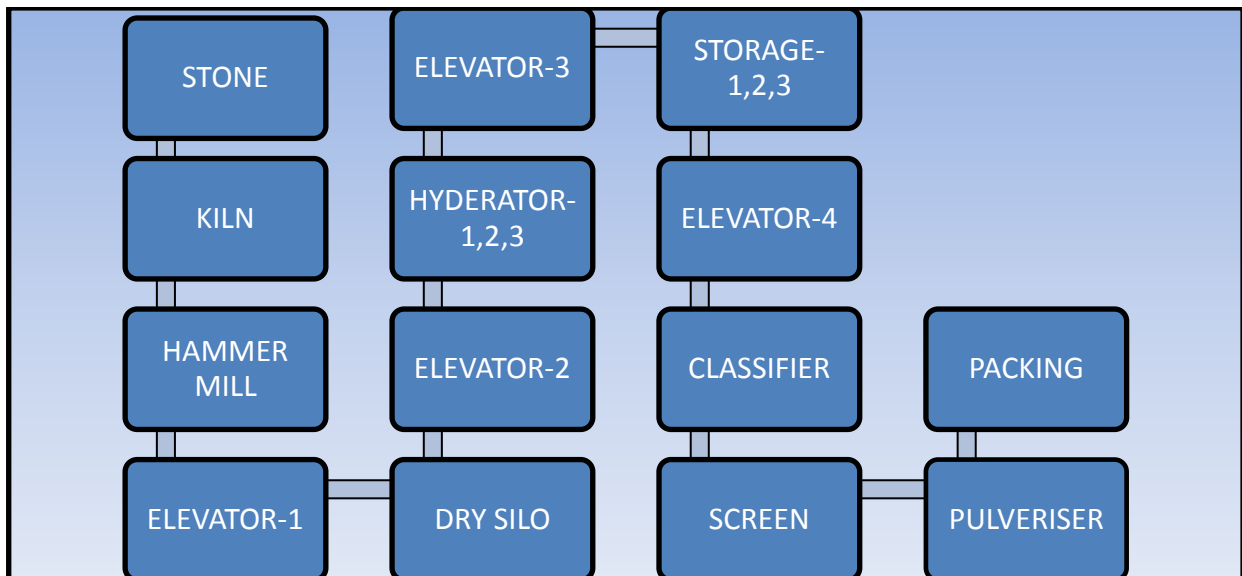


Figure 1.1 Process Flow Diagram of Hydrated Lime

Hydrated Lime Production

In lime stone industry kiln is major consumer of energy. Conventionally it is done in direct heat treatment to 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. A 30TPD capacity kiln is of following dimensions.

Internal Diameter	:	1850	mm
Outer Diameter	:	2950	mm
Internal Height	:	16600	mm
Overall Height	:	23000	mm

In traditional Kiln insulation is provided by fire bricks lining. The heat losses from fire bricks lining is around 40 to 45% causing substantial heat losses.

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)
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

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	30T Quicklime Lime/ day	5.0-6.0 MT Pet coke	0.2 MT Pet coke/T Quicklime	Rs 1.44/Kg of Quick lime

Table 1.5: Annual Energy Consumption for Kilns

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	30T Hydrated Lime/ day	300 -315 KWh	10-12 Kwh	Rs 55.0

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 10-12 kWh/MT of hydrated lime produced.

1.3 Proposed Technology/Equipment

1.3.1 Description of existing 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 this total heat, percentage of radiation loss is coming out to be in the range of 15% to 20% of total energy supplied.

Conventionally lime treatment is done in direct heat treatment of 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.

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 Energy Audit Methodology

The following methodology was adopted to evaluate the performance of Kiln.

- Monitoring of fuel
- Identification of various points for thermal measurement
- Analysis of critical parameter affecting kiln operation

1.4.2 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 loading zone, Combustion zone, Cooling zone & Unloading Zone. Major role of the kiln is for heat treatment of lime stone a temperature of about 1200°C.

Operating efficiency Analysis

Operating efficiency of kilns is found to be in the range of 30% to 40%. 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 57.00 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

For any given kiln, the flame length and heat transfer are determined by the fuel characteristics, the fuel to air ratio and the quantity of excess air. The fuel to air ratio is primarily dependent on the ratio of the burner momentum and that of the secondary air.

Due to above mentioned parameters lime recovery kilns present a significant challenge to burn pet coke or other solid fuels. Due to the low volatile content of the pet coke, the distinct flame characteristics and the need for NO_x control, the combustion designing of kiln is very critical.

Considering above mentioned combustion characteristic Produce gas based Gasifier for combustion in Lime kiln is an energy efficient technology.

Specification for 15 to 30TPD lime kiln producer gas unit is as follows.

Description	Specification
Kcal/Hr	1000000
Coal Consumption	4750Kg/Day
Calorific Value of gas	1250-1350 Kcal/Nm ³
Feed material	Coal
Gas pressure	150-200mmWC
Gas temperature	200-250 °C
Calorific value of coal	5200-5500 Kcal/Kg
Required size of coal	15 -70 mm
Ash fusion temperature of coal	1400 °C

Table: Specification for 15 to 30TPD lime kiln producer gas unit

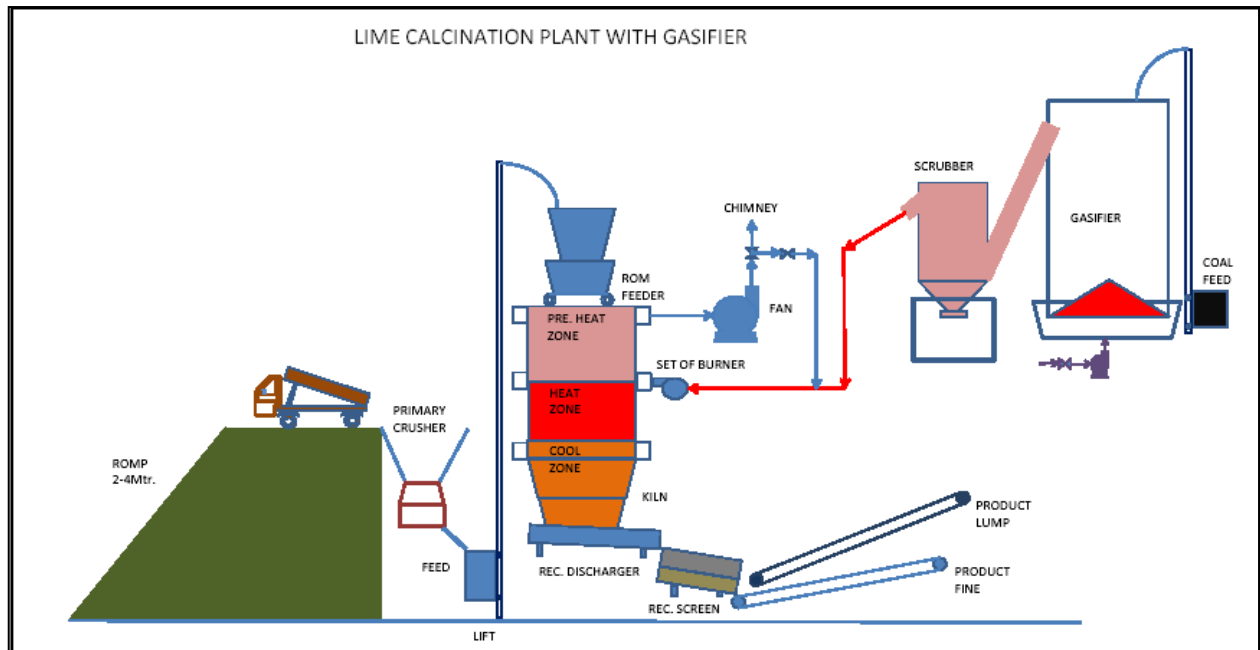


Table: Figure for 25TPD lime kiln with producer gas unit

2.1.2 Suitability of Existing Technology

The producer gas based Lime calcinations Kilns are designed to enhance product throughput, quality, to reduce production cost and to eliminate dependency on single fuel..

This technology has been selected for the following reasons:

- Optimum combustion of fuel to ensure better combustion efficiency.
- Due to proper combustion lower emission of CO.
- Improved Calcinations Quality of Lime stone.
- Completely environment friendly system.
- Elimination of single fuel dependency.
- Optimum utilization of manpower to improve productivity.

2.1.3 Superiority over Existing Technology

Using of proposed technology reduce combustion losses. This will results in decrease in the fuel consumption in Kiln. Thus it improves performance of existing system.

Comparison of saving in existing system and proposed system on the basis of energy consumption and material loss is as depicted in following table.

Description	Units	Existing System	Proposed System	Saving Potential	Remark
Energy Consumption	Kcal/KG	1530-1650	1100-1200	330-550 Kcal/MT	Theoretical Energy requirement is 900KCAL/Kg
Fuel required to produce energy for Calcinations of IMT of finished product	KG/MT	180 Kg- Pet Coke	220 Kg-Per Coke	350-400 Rs/MT	Cost-Rs/KG(Pet coke)-Rs.9/KG Cost Rs/KG(Bituminous coal)-Rs.5.5/KG
Wastage/Loss per MT of Finished product	%	5 to 10	NIL	175-350 Rs/MT	Market price of finished product Rs.3500/MT

In addition to this, Gasification plants can also use the Rise husk after bracketing.

2.1.4 Availability of Technology

Service providers of this project are available at across India. 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 technology improvement project is about 10 to 12 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 implementing new technology to achieve a better competitive position in industry.

3 ECONOMIC BENEFITS FROM PROPOSED EQUIPMENT

3.1 Technical Benefits

3.1.1 Fuel Saving

Comparison of saving in existing system and proposed system on the basis of energy consumption pattern is as depicted in following table.

Description	Units	Existing System	Proposed System	Saving Potential	Remark
Energy Consumption	Kcal/KG	1530-1650	1100-1200	330-550 Kcal/MT	Theoretical Energy requirement is 900KCAL/Kg
Fuel required to produce energy for Calcinations of IMT of finished product	KG/MT	180 Kg-Pet Coke	220 Kg-Per Coke	350-400 Rs/MT	Cost-Rs/KG(Pet coke)-Rs.9/KG Cost Rs/KG(Bituminous coal)-Rs.5.5/KG

Considering improvement in specific energy consumption and difference in cost of fuel a net energy saving of Rs. 350 to 400/Kg can be achieved by using the technology.

For a small unit with annual production of 9000 Kg a net saving of about Rs.33.00 Lakhs can be achieved.

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 fuel 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 49.00 lakh per year. Energy & monetary benefit analysis of insulation improvement are shown in Table 3.1 below:

Description	Units	Existing System	Proposed System	Saving Potential	Remark
Energy Consumption	Kcal/KG	1530-1650	1100-1200	330-550 Kcal/MT	Theoretical Energy requirement is 900KCAL/Kg
Fuel required to produce energy for Calcinations of IMT of finished product	KG/MT	180 Kg- Pet Coke	220 Kg-Per Coke	350-400 Rs/MT	Cost-Rs/KG(Pet coke)-Rs.9/KG Cost Rs/KG(Bituminous coal)-Rs.5.5/KG
Wastage/Loss per MT of Finished product	%	5 to 10	NIL	175-350 Rs/MT	Market price of finished product Rs.3500/MT

Table 3.1 Energy and Monetary Benefit due to Project Implementation

Total saving on per tone production of finished product on account of improvement in specific energy consumption and reduction in loss will be Rs 525.0 to Rs.750.0 per MT.

For a small unit with annual production of 9000Tonne a net saving of about Rs.49.00 Lakhs can be achieved.

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 on operation and maintenance 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 CO₂ 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 57.00 Lakh, which exclude EPC cost.

4.1.2 Erection & Commissioning and other Miscellaneous Cost

Erection & commissioning cost is 2.85 Lakh which includes services, manpower cost work, etc, Lakh and other misc. cost is 2.85 Lakh.

Table 4.1 Details of Proposed Equipment Installation Cost

S.No	Description	Units	Values
1	Equipment cost	(Lakhs)	57.0
2	Erection and Commissioning cost	(Lakhs)	2.85
3	Miscellaneous Cost	(Lakhs)	2.85
4	Total cost	(Lakhs)	62.7

4.2 Arrangements of Funds

4.2.1 Entrepreneur's Contribution

Entrepreneur will contribute 25% of the total project cost which is 15.675 lakh.

4.2.2 Loan Amount

Remaining 75% cost of the proposed project will be funded by bank which is 47.025 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 Rs.49.00 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 Rs.62.7lakhs and monetary savings due to reduction in fuel consumption is Rs.49.0 lakh hence, the simple payback period works out to be 16 months.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 12% works out to be 68.65 Lakhs

4.3.4 Internal Rate of Return (IRR)

The after tax Internal Rate of Return of the project works out to be 51.72%. 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 100%.

Table 4.2 Financial Indicators of Proposed Technology

S.No	Description	Units	Values
1	Simple Payback	Months	14
2	NPV	Rs. In Lakh	68.65
3	IRR	%	51.72
4	ROI	%	100

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.

Scenario	Monetary Benefit (Rs Lakh/year)	IRR (%)	NPV(in Lakh	ROI (%)
Pessimistic	46.55	47.7	61.76	15
Base	49.0	51.72	68.65	14
Optimistic	51.45	55.64	75.54	13

Table 4.3 Sensitivity Analysis on Fuel Saving

4.5 Procurement and Implementation Schedule

Procurement and implementation schedule required for implementation of this technology is about 10 to 12 weeks for modification in existing units and 9 weeks for process break down. Details of procurement and Implementation schedules are shown in Annexure 6.

ANNEXURES

Annexure -1: Energy audit data used for baseline establishment

Description	Units	Existing System	Proposed System	Saving Potential	Remark
Energy Consumption	Kcal/KG	1530-1650	1100-1200	330-550 Kcal/MT	Theoretical Energy requirement is 900KCAI/Kg
Fuel required to produce energy for Calcinations of IMT of finished product	KG/MT	180 Kg- Pet Coke	220 Kg-Per Coke	350-400 Rs/MT	Cost-Rs/KG(Pet coke)- Rs.9/KG Cost Rs/KG(Bituminous coal)-Rs.5.5/KG
Wastage/Loss per MT of Finished product	%	5 to 10	NIL	175-350 Rs/MT	Market price of finished product Rs.3500/MT

Annexure -2: Detailed Technology Assessment Report

Description	Specification
Kcal/Hr	1000000
Coal Consumption	4750Kg/Day
Calorific Value of gas	1250-1350 Kcal/Nm ³
Feed material	Coal
Gas pressure	150-200mmWC
Gas temperature	200-250 °C
Calorific value of coal	5200-5500 Kcal/Kg
Required size of coal	15 -70 mm
Ash fusion temperature of coal	1400 °C

Table: Specification for 15 to 30TPD lime kiln producer gas unit

Description	Specification
Power consumption	75KVA
Raw water consumption	5000 Ltr/Day
Man Power	2 skilled,7 Unskilled
Fuel	Bituminous coal

Table: Utility requirement

Other benefits of using technology:

- Optimum combustion of fuel to ensure better combustion efficiency.
- Due to proper combustion lower emission of CO.
- Improved Calcinations Quality of Lime stone
- Completely environment friendly system
- Elimination of single fuel dependency
- Optimum utilization of manpower to improve productivity.

Annexure -3: Detailed Financial Calculations & Analysis

Assumptions	Units	Value	Source
Commercial Inputs			
Required Investment (cost of Equipment+ EPC cost+Misc. cost)	Rs(Lakhs)	62.70	
O&M cost (5% of equipment cost)	Rs(Lakhs)	2.850	
Acceleration in O&M cost per year	%	5%	
Debt/Equity ratio		3 to1	
Debt component of Investment	75%	47.03	
Equity component of investment	25%	15.68	
Interest on term loan	%	10%	SIDBI Lending rates
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 CALCULATION						
Particulars/ Years		1	2	3	4	5
Revenue						
Total saving	Rs(Lakhs)	49.00	49.00	49.00	49.00	49.00
Expenditure						
O&M Expenditure	Rs(Lakhs)	2.85	2.99	3.14	3.30	3.46
Interest on term loan	Rs(Lakhs)	4.62	3.53	2.18	0.84	0.00
Book depreciation	Rs(Lakhs)	3.01	2.85	2.70	2.56	2.42
Total expenses		10.48	9.37	8.03	6.70	5.89
PBT	Rs(Lakhs)	38.52	39.63	40.97	42.30	43.11
Tax		0.00	14.23	14.65	15.06	15.30
PAT		38.52	25.40	26.32	27.24	27.81
Cash Flow Statement						

		1	2	3	4	5
PAT		38.52	25.40	26.32	27.24	27.81
Add: Depreciation		3.01	2.85	2.70	2.56	2.42
Add: Interest		4.62	3.53	2.18	0.84	0.00
Net cash In flow		46.15	31.77	31.21	30.64	30.23
Net cash out flow		-62.70				
Net cash flow		-16.55	31.77	31.21	30.64	30.23
	-62.7	46.15	31.77	31.21	30.64	30.23
IRR	52%					
NPV	68.66					
ROI	200.0%					

Cash statement						
		1	2	3	4	5
Source						
Equity	15.68					
Loan	47.03					
PAT		38.52	25.40	26.32	27.24	27.81
Depreciation		3.01	2.85	2.70	2.56	2.42
Total	62.70	41.53	28.25	29.02	29.80	30.23
Application						
Capital expenditure	62.7					
Loan repayment		4.62	3.53	2.18	0.84	0.00
Total	62.7	4.62	3.53	2.18	0.84	0.00
Net surplus	0.00	36.91	24.72	26.84	28.96	30.23
Add: Opening balance	0		36.91	61.63	88.47	117.43
Closing balance	0	36.91	61.63	88.47	117.43	147.66

Tax calculation						
		1	2	3	4	5
PBT	Rs(Lakhs)	38.52	39.63	40.97	42.30	43.11
ADD: Book depreciation		3.01	2.85	2.70	2.56	2.42
SUB: IT Depreciation		45.60	0.60	0.57	0.54	0.51
PBT&D		-4.07	41.88	43.10	44.32	45.02
Tax		0.00	14.23	14.65	15.06	15.30

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	47.03	1.18	0.00	47.03	6.72	4.62
	2	47.03	1.18	0.00	47.03		
	3	47.03	1.18	3.36	43.67		
	4	43.67	1.09	3.36	40.31		
2	1	40.31	1.01	3.36	36.95	13.44	3.53
	2	36.95	0.92	3.36	33.59		
	3	33.59	0.84	3.36	30.23		
	4	30.23	0.76	3.36	26.87		
3	1	26.87	0.67	3.36	23.51	13.44	2.18
	2	23.51	0.59	3.36	20.15		
	3	20.15	0.50	3.36	16.79		
	4	16.79	0.42	3.36	13.44		
4	1	13.44	0.34	3.36	10.08	13.44	0.84
	2	10.08	0.25	3.36	6.72		
	3	6.72	0.17	3.36	3.36		
	4	3.36	0.08	3.36	0.00		

Depreciation schedule						
Depreciation as per companies act						
	1	2	3	4	5	
Value of machine at the beginning of year	57.00	53.99	51.14	48.44	45.88	
Depreciation	3.01	2.85	2.70	2.56	2.42	
Net value at the end of year	53.99	51.14	48.44	45.88	43.46	
Depreciation as per IT act						
	1	2	3	4	5	
Value of machine at the beginning of year	57.00	11.40	10.80	10.23	9.69	
Depreciation	45.60	0.60	0.57	0.54	0.51	
Net value at the end of year	11.40	10.80	10.23	9.69	9.18	

Annexure -4: Procurement and Implementation Schedule

Procurement and Implementation Schedule for existing unit

S. No.	Activities	Weeks											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Identification of unit to be modified												
2	Planning and material order												
3	Procurement												
4	EPC, Commissioning and testing												

Annexure -5: Break-up of Process down Time

S. No.	Activities	Days								
		1	2	3	4	5	6	7	8	9
1	Time required for cooling down of Kiln									
2	Dismantling process of existing kiln									
3	EPC of the new kiln									
4	Commissioning and Testing									

Annexure -6: Details of Technology Service Providers

S.No	Name of Company	Contact person	Contact Details	Address
1	KINC Mineral Technologies Pvt.Ltd	Mr.Viral Parek	0265-2581689	14,Haribhakti Industrial Estate, Dobhoi Road, Vadodra Gujarat

Annexure -7: Quotations for Proposed Technology



KINC Mineral Technologies Pvt. Ltd.
INNOVATIONS IN MINERAL PROCESSING

EQUIPMENT DESIGN, SUPPLY, CONSULTANCY, PROCESS & PROJECT ENGINEERING FOR MINERAL PROCESSING AND ALLIED INDUSTRIES.

1.4. COST

PRICE – VALID UNTIL January 31, 2012

Design, manufacturing, supply and implementation for producer gasification system for 15THD to 30 TPD lime calcination kiln, with complete auxiliary equipment. **Rs. 57.0 Lakhs**

Erection/Commissioning assistance:

Our representative will visit you for commissioning assistance. The actual installation work will be carried out by you. Should you require the service of our technician for installation work, the same will be made available @Rs.4000/- per man day plus to and fro fare and lodging/Boarding etc.

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				
Total				

3.2 Means of Finance:

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

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.
Producer gas based gasifier system	Attached Doc.	2 Month	57.0	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		49.00	49.00	49.00	49.00	49.00	49.00
2	Raw material							
	Power and fuel							
	Wages and salaries							
	Selling expenses							
	Other expenses		10.48	9.37	8.03	6.70	5.89	10.48
	Total cost		10.48	9.37	8.03	6.70	5.89	10.48
3	Profit before depreciation, interest and taxes (PBDIT)		46.15	46.01	45.86	45.70	45.54	46.15
4	Interest on term loan		4.62	3.53	2.18	0.84	0.00	4.62
5	Interest on working capital		-	-	-	-	-	-
6	Interest on unsecured land		-	-	-	-	-	-
7	Depreciation		3.01	2.85	2.70	2.56	2.42	3.01
8	PBT		38.52	39.63	40.97	42.30	43.11	38.52
9	Tax		0.00	14.23	14.65	15.06	15.30	0.00
10	PAT		38.52	25.40	26.32	27.24	27.81	38.52
11	Dividends/ withdrawal							
12	Cash accruals							
13	Debt service coverage ratio		0.57	0.67	1.01	2.04	0.57	
	Av. DSCR	1.07						

Annexure V

CHECK LIST of documents to beSubmitted 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

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