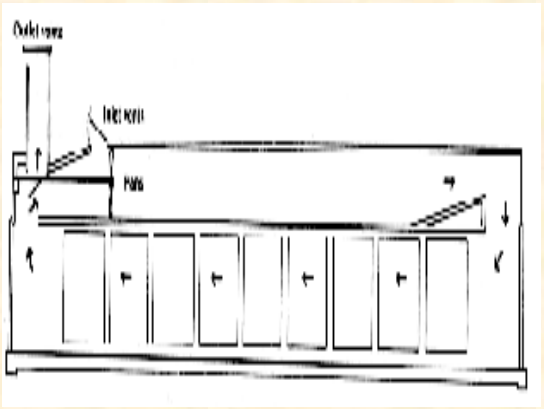
DETAILED PROJECT REPORT
ON
TUNNEL KILN -50 TPD
(EAST & WEST GODAVARI REFRACTORIES CLUSTER)



ENERGY IS LIFE
BEE
CONSERVE IT

Bureau of Energy Efficiency

Prepared By

APITCO LIMITED
Engineering Growth

Reviewed By

ISTSL

TUNNEL KILN-50 TPD

EAST AND WEST GODAVARI REFRACTORIES CLUSTER

BEE, 2011
Detailed Project Report on Tunnel Kiln 50TDP
E&W Refractory SME Cluster, Andhra Pradesh (India)
New Delhi: Bureau of Energy Efficiency;
Detail Project Report No.: **E&W/Tunnel kiln/03**

For more information

Bureau of Energy Efficiency (BEE)
(Ministry of Power, Government of India)
4th Floor, Sewa Bhawan
R. K. Puram, New Delhi – 110066

Telephone +91-11-26179699

Fax+91-11-26178352

Websites: www.bee-india.nic.in
Email: jsood@beenet.in/
pktiwari@beenet.in

Acknowledgement

We are sincerely thankful to the Bureau of Energy Efficiency, Ministry of Power, for giving us the opportunity to implement the BEE SME project in “refractory Cluster, East & West Godavari District of Andhra Pradesh”. We express our sincere gratitude to all concerned officials for their support and guidance during the conduct of this exercise.

Dr. Ajay Mathur, Director General, BEE

Smt. Abha Shukla, Secretary, BEE

Shri Jitendra Sood, Energy Economist, BEE

Shri Pawan Kumar Tiwari, Advisor (SME), BEE

Shri Rajeev Yadav, Project Economist, BEE

Andhra Pradesh Industrial & Technical Consultancy Organization Ltd. (APITCO) is also thankful to “*The Ceramic Manufacturing Welfare Association, Rajamundry at East & west Godavari Districts*” for their valuable inputs, co-operation, support and identification of the units for energy use and technology audit studies and facilitating the implementation of BEE SME program.

We take this opportunity to express our appreciation for the excellent support provided by 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).

APITCO 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.

APITCO Limited

Hyderabad

Contents

List of Annexures

List of Tables

List of Figures

I. LISTS OF ABBREVATIONS

- BEE - Bureau of Energy Efficiency
- DPR - Detailed Project Report
- DSCR - Debt Service Coverage Ratio
- DD - Down Draft Kiln
- FD - Forced Draft
- GHG - Green House Gases
- HP - Horse Power
- IRR - Internal Rate of Return
- ID - Induced Draft
- MoP - Ministry of Power
- MoSME - Micro Small and Medium Enterprises
- NPV - Net Present Value
- ROI - Return On Investment
- SIDBI - Small Industries Development of India
- SME - Small and Medium Enterprises

EXECUTIVE SUMMARY

APITCO Ltd is executing BEE-SME program in East and West Godavari (Refractory) Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units. Rajahmundry is one of the oldest clusters of state of Andhra Pradesh producing refractory and potteries. These industries were in operation since last four to five decades. Earlier, these industries were used to produce potteries for domestic market, which are commonly used for storing pickles for longer time. The products called 'Jars' are the most commonly used container in Southern India specifically in the state of Andhra Pradesh for storing various food items. During the course of time, the demand for potteries (Jars) was considerably reduced due to change in economy and food habits. These pottery making units were diversified to produce refractory which are used in industries as insulation.

Majority of the industries are producing refractory and very few units are producing potteries. These industries have been in operation for the last 20 to 30 years. The main raw materials used in refractory material manufacturing are clay, refractory grog, other chemicals etc.

The major Energy used in cluster is Electricity and Fuels i.e. Coal and Wood. Electricity is used for drive the prime movers of brick making units, grinding machines, mixers etc. Coal and Bio mass are used as fuel in down draft kilns for heat treatment of the bricks.

The total energy cost in refractory industries varies from 30% to 50% of production cost. The down draft kilns requires higher thermal energy, which is major share of total energy consumed.

The Down draft kilns are constructed using ordinary bricks, refractory bricks and clay. The shape of the kiln is round with roof mounted structure. These kilns have one or two charging doors depending up on the requirement is provided in the structure for keep the material inside the kiln. The firing doors are provided in around the structure to supply the heat flames inside the kiln. Coal, Fire wood is used as a fuel in the DD kilns to generate heat flames. The generated heat from firing doors is spread across the kiln and heats up the material inside the kiln. The air required for the combustion of coal is drawn from natural draft circulation.

This DPR is prepared for installation of Tunnel kiln instead of the Down draft kiln for enhancing the combustion efficiency and reducing fuel consumption.

The DPR highlights the details of the study conducted for assessing the potential for using of tunnel kiln in place of DD kiln, potential of energy saving, possible monetary benefit, availability of the technologies/design, local service providers, technical features and proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, 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 below

S.No	Particular	Unit	Value
1	Project cost	` (in Lakh)	260.50
2	Fuel Saving (Coal)	Tons/annum	2088
3	Cost of Power consumption	` /annum	3.30
4	Monetary benefit	` (in Lakh)	90.65
5	Simple payback period	Years	2.87
6	NPV	` (in Lakh)	112.36
7	IRR	%age	20.45
8	ROI	%age	21.00
9	Average DSCR	Ratio	1.60
10	Process down time	Days	Nil
11	CO_2 emission reduction	Tons/annum	3757

The projected profitability and cash flow statements indicate that the project implementation i.e. installation of Tunnel kiln for improving the thermal efficiency 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 29 selected SMEs clusters. East and West Godavari Refractory Cluster is one of them. The BEE's SME Program 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:

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 up of energy efficiency projects in the clusters.

Activity 3: Implementation of energy efficiency measures

To implement the technology up-gradation project in the clusters, BEE has proposed to prepare the technology based detailed project reports (DPR's) 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 cluster

Rajahmundry is one of the oldest Industrial clusters and located in state of Andhra Pradesh and manufacturing refractory products and potteries. These industries were in operation since last four to five decades. Earlier, these industries were used to manufacture potteries for domestic market, which are commonly used for storing pickles for longer time. The products called 'Jars' are the most commonly used container in Southern India specifically in the state of Andhra Pradesh for storing various food items. During the course of time, the demand for potteries (Jars) was considerably reduced due to change in economy and food habits. These pottery making units were diversified to refractory manufacturing due to demand.

Majority of the industries are manufacturing refractory and very few units are potteries. There are about 83 industries in the cluster. These industries have been in operation for the last 20 to 30 years. The main raw materials are clay, refractory grog, other chemicals etc. The major Energy used in refractory cluster is Electricity and Fuels like Coal and Wood. Electricity is used for drive the prime movers of brick making units, grinding machines, mixers etc. Coal and wood are used as fuel in down draft kilns for heat treatment of the bricks.

The cost of energy is varies from 30% to 50% of production cost which is depending up on the kilns and capacities. In refractory industries, major cost is contributed by energy cost followed by raw material cost and labor cost.

1.1.1 Production process

The main process operation for manufacturing refractory bricks adopted in cluster units are as follows:

The raw material i.e. Clay 60%, refractory Greg 40% and water is feed manually and sent to clay mister for uniform mixing . The refractory bricks are either prepared by manually (Hollow bricks) or in molding machines (Solid bricks) and the bricks are dried naturally/ using fans for 2 to 3 days and naturally dried bricks are loaded to the kiln.

The heating of the bricks is done under slow firing in kiln for 72 hours for removing the moisture content. In the slow firing, for every one hour, about one shovel of coal (3.5 kgs) in each grate is burnt. The temperature is maintained between 100–200^{o}C. During this period all the doors and damper existing in the kiln are kept open.

After slow firing firstly raw material charging door in kiln is closed. Out of 24 holes provided in kiln, 4 no's of top holes are closed every 8 hrs from the time of charging door closed. After closing the all the doors, rapid firing system started by adding 1 shovel of coal per hour in every coal feeding doors.

After 72 hours, the full firing period is carried out for 48 hours and the temperature of the kiln is increased from 200 ^{o}C to 1050 ^{o}C. The damper position in kiln is kept opened for about 25%. After completion of the rapid firing for 48 hours, all the coal feed points /grates and damper are closed and firing is stopped. Then the kiln is left for maintain the temperature (soaking) for 24 hours and then the kiln is taken for natural cooling and the bricks are unloaded after 24 hours of natural cooling.

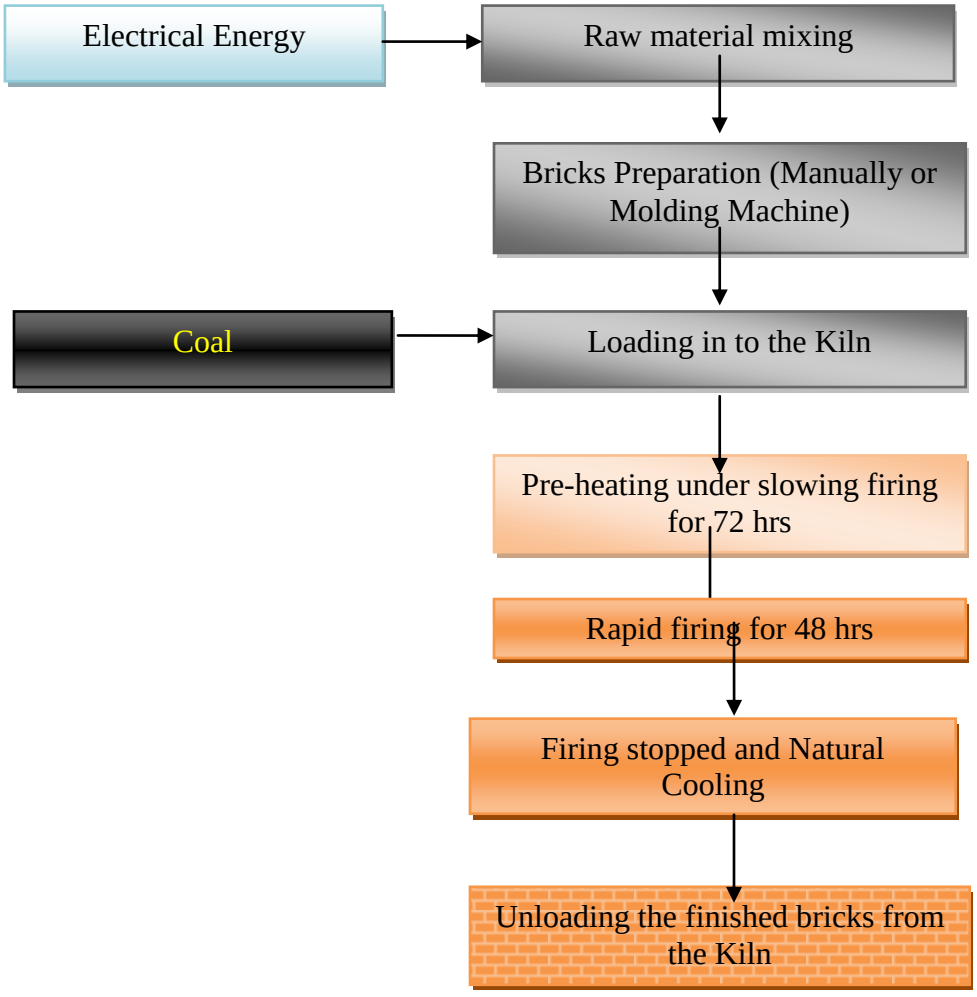


Figure 1: General Process Flowchart of a Typical Refractory Manufacturing Unit

1.2 Energy performance in existing situation

1.2.1 Fuel and electricity consumption of a typical unit in the cluster

The main energy forms used in a typical unit in the cluster are electricity, coal, and wood. Electricity is used for drive the prime mover of brick making unit, mixers, grinding machine, etc. Coal and wood is used as fuel in the down draft kiln. The energy consumption of a typical unit in cluster is furnished in Table 1.1 below:

Table 1.1: Energy consumption of a typical unit

S.No	Name of Unit	Yearly Consumption		
		Coal (Tons)	Electricity (kWh)	Wood (Tons)
1	M/s. Padma Sree Refractories	1500	17695	800

1.2.2 Average production by a typical unit in the cluster

The average production in a year in a typical unit is 1500 tons.

1.2.3 Specific Energy Consumption

The main energy forms used in the refractory production are electricity, coal, and wood. The Specific energy consumption for electrical and thermal energy per ton of Production for a typical unit is furnished in Table 1.2 below:

Table 1.2: Specific energy consumption for a typical unit

S. No.	Type of Fuel	Units	Sp. Energy Consumption
1	Coal Consumption	kg of coal / kg of Product	0.94
2	Grid Electricity consumption	kWh/ kg of Product	11.05
3	Wood consumption	kg of Wood/ kg of Product	8.00

1.3 Existing technology/equipment

1.3.1 Description of existing technology

Down draft Kiln is a furnace used in refractory manufacturing industry to heat up the refractory material where undergo chemical, physical reactions. These Down Draft kilns

are used for all type of refractory including ceramic and bricks manufacturing.

The Down draft kilns are constructed using ordinary bricks, refractory bricks and clay. The shape of the kiln is round with roof mounted structure. These kilns have one or two charging doors depending up on the requirement is provided in the structure for keep the material inside the kiln. The firing doors are provided in around the structure to supply the heat flames inside the kiln. Coal, Fire wood is used as a fuel in the DD kilns to generate heat flames. The generated heat from firing doors is spread across the kiln and heats up the material inside the kiln. The air required for the combustion of coal is drawn from natural draft circulation.

The Production capacity is depend upon dimensions of kiln being constructed and type of product manufactured in the unit. The dimensions of typical kiln used in East & west Godavari Refractory Cluster is presented below.

The D.D kiln is a common type of kiln used in all cluster units for curing/heat treatment of refractory bricks. Coal is used as fuel and the capacity of the down draft kiln is 280 tons/batch. Wood is also used in small quantities for enhancing the burning of the coal in the kiln. About 2 to 3 batches are produced in a month. The DD kiln is operated on continuous basis for 15-18 days for each batch as per the requirement.

The kilns are very old design and are constructed with the local masonries and the thermal efficiency of the kilns is found to be low. The design of the down draft kilns is more or less identical in all cluster units. The major draw backs of the existing down draft kilns are:

- There is no proper provision for supplying combustion air and the combustion air intake and resulting high unburnt carbon.
- Less heat transfer between flue gases and refractory
- Inadequacies in maintaining and controlling uniform furnace temperature resulting in uneven surface hardness
- Low combustion efficiency due to poor control system
- High radiation losses from the charging ports of the kiln
- No control over the temperature and fuel feeding
- High flue gas temperature and no proper heat utilization in the furnace
- Low efficiency of the furnaces

1.3.2 Its role in the whole process

The down draft kiln is used for heat treatment and curing of the refractory bricks.

1.4 Establishing the baseline for the equipment to be changed

1.4.1 Design and operating parameters

The main energy forms used for DD kiln are coal and wood. Electricity is also used in small quantities for operation of the mixing mill, grinders, refractory making machine, lighting etc.

The down draft kiln is one of the old design kiln and constructed locally and doesn't have any name plate details. The life of the DD kiln is considered at 30 to 40 years. The production capacity of the DD kiln is 200 tons /batch. The coal consumption depends on the following parameters such as quantity of refractory, type, grade of coal, temperature required, coal heat value etc. The operating parameters of the DD kiln collected for a typical unit during the field visit is furnished below:

The detailed study had been carried out for evaluating operating efficiency of the kiln and to identify measures which can affect fuel savings. The following sections present the performance assessment and measures for reducing coal consumption. The details of the performance of the down draft kiln is furnished below:

- Duration of the batch : 15-18 days
- Products : hollow refractory bricks
- Designed capacity :200 Tons
- Production : 180 tons
- Coal consumption : 280 tons
- Calorific value of coal : 4200 kcal/kg
- Excess air measured : 30%
- Slow firing : 5 days
- Rapid firing : 8 days
- Heat maintained : 3 day
- Normal cooling : 1 day

1.4.2 Coal consumption

The operating efficiency of the DD Kilns in various units had been evaluated during energy use and technology audits using coal as fuel. The efficiencies of the DD kilns are found to be in the range of 10 % to 15 % in various units of the cluster. The details of coal consumption, electricity consumption and efficiencies of existing kiln are furnished below in table 1.3 below:

Table 1.3 Energy Consumption & Efficiency of typical units in the cluster

S. No	Name of the unit	Coal Consumption (Tons/annum)	Electricity Consumption (kWh/annum)	DD Kiln Efficiency (%)
1	Padma Sree Refractories	1500	17695	15

1.5 Barriers for adoption of new and energy efficient technology / equipment

1.5.1 Technological Barriers

The major technical barriers that prevented the implementation of the Tunnel Kiln in the cluster are:

- No single unit has installed Tunnel kiln in the cluster units, this may be due to lack of awareness of the technology among SME owners and though some of the unit owners are interested, no demonstration projects or no single unit were implemented Tunnel kiln, this was also one of major reason for not taking up the project in the cluster.
- Secondly, due to Lack of knowledge of the technical benefits of the Tunnel kiln among the SME owners in the cluster
- Thirdly, majority of the owners of the cluster are more focused on the successful technologies implementation in the cluster before implementation and as so far, no unit had been implemented Tunnel kiln.

1.5.2 Financial Barrier

- Though, many SME owners are interested to install Tunnel kiln, due to high initial investment and the SME owners could not implement in the cluster.
- Further, lack of awareness of the losses and monetary benefit of the Tunnel kiln was also one of the major barrier that prevented implementation of the tunnel kiln in cluster units

- Energy Efficiency Financing Schemes such as SIDBI's, if taken up in the cluster, many SME owners will come forward to up taken up the technology due to financial attractiveness of the technology.

1.5.3 Skilled manpower

Lack of skilled manpower was also one of the major barriers in the cluster.

1.5.4 Other barrier(s)

Majority of the SME owners doesn't have knowledge of the financial incentives offered by government agencies for the Tunnel kiln and vigorous circulation of the financial incentives of the Tunnel kiln and motivation from the local state nodal agencies among the unit's owners may affect the owners in taking up the technology for implementation.

2. TECHNOLOGY OPTION FOR ENERGY EFFICIENCY IMPROVEMENTS

2.1 Detailed description of technology/equipment selected

2.1.1 Description of technology

The tunnel kiln is a car pushing type continuous kiln consists of preheating, firing and cooling zones. It is suitable for a large production and is fabricated at the spot. The advantage of using tunnel kiln in refractory manufacturing is to provide the temperature conformity, lower the fuel consumption i.e. sometimes 50% lower than with Down Draft Kilns. Design features and operational benefits are

- Consistent, high volume production from units
- High levels of control giving top quality products
- Low energy usage and lower cost production
- Computer controlled to make operation simple and reliable
- Low maintenance and minimal downtime
- Storage and handling systems for easy operation
- Flexibility when required for product variations
- Reduced internal air movement for a better firing environment
- Modular construction for assembly prior to shipment
- Space saving concepts including multiple level installations
- Automated Robotic or Manual car movement to suit plant situation

A number of different methods can be used to heat tunnel kilns. Typical heat sources include electrical heating elements and gas-fired units, with dual heating systems also existing. Some may also conserve energy by capturing heat at the cooling end and recalculating it to help pre-heat materials that are entering the device.

Materials like bricks, tiles, and ceramics are some common products that may be mass-produced with the aid of a tunnel kiln. Products like these may also be fired using an intermittent kiln, though that involves loading the device, sealing it off, and then unloading it for each new batch. Tunnel kilns provide the benefit of a continuous process, such that some materials are beginning to heat at one end of the device, while others are being fired in the middle, and still more are cooling down at the far end.

So it is recommend to install tunnel kilns in refractory industries located in East & West Godavari District for Energy saving. By using tunnel kiln high production rate, pre heating of material, cooling was done efficiently and economically compare to the other conventional kilns like down draft kilns.

All Refractory Industries constructed/ installed Down Draft kilns for heating of refractory products. The efficiency of down draft kilns are varying from 10-15%, which is less. The energy consumption by down draft kiln is very high compare to other energy efficient kiln like Tunnel kilns. Due to improve the efficiency of kiln, the best option for refractory industries is installing Tunnel kilns with existing Down Draft Kilns.

During the operation of Tunnel kiln the pre heating, low energy consumption, cooling process will be done in the kiln with less energy consumption compare to Down Draft kilns. Due to tunnel kiln the coal consumption is reduced to 45% per batch of production.

Fig.2.1 Tunnel Kilns

2.1.2 Technology /Equipment specifications

The technical specifications of the proposed Tunnel kiln are 50 TPD and of above 200 ton capacities per batch of Refractories in down draft kilns are furnished in table 2.1 below:

Table 2.1 Proposed Technology Equipment Specifications

S.No	Parameter	Unit	Value
1	Capacity	TPD	50
2	Fuel	Type	Coal
3	Process time-Ambient to 1200C	Hrs	24
4	Soaking at 1000	Hrs	6
5	1000 to 50C	Hrs	18
6	Cool to cool	Hrs	48
7	Calorific Value of Coal	Kcal/kg	4200
8	Energy Consumption	Kcal/kg of product	1150

2.1.3 Justification of the technology selected

The present down draft kilns has low efficiency due to poor combustion, less air supply resulting high Unburnt carbon, high flue gas losses, no proper monitoring of air and fuel supply. The Tunnel kiln will have more efficiency due to better combustion, high combustion efficiency, less flue gas losses, less manpower cost, easily control on fuel feeding, less fuel consumption due to pre heating etc. Further, the parameters can be critically controlled in the Tunnel kiln. Overall, the energy cost per ton of Refractories is low than the coal firing. The following are the reasons for selection of this technology:

- Low energy cost
- Better control of the kiln temperature
- Low flue gas losses hence more efficiency
- Reduces GHG emissions

2.1.4 Superiority over existing technology/equipment

The following benefits during the implementation of tunnel kiln compared to DD kilns.

- Production time will reduced
- Coal consumption will reduced due to waste heat is utilized during the pre heating process in tunnel kiln
- Higher production rate compared to DD kilns for same process time

- Low cost of energy cost
- Low operating costs
- Reduces GHG emissions
- Improved combustion
- The fuel feeding can be critically controlled

2.1.5 Availability of the proposed technology/equipment

The tunnel kiln manufacturers and suppliers are available in India. The details of the local service provider are furnished in Annexure 6.

2.1.6 Source of technology/equipment for the project

The technology is indigenous and is available in India.

2.1.7 Service/technology providers

The service providers are available in India.

2.1.8 Terms of sales

Terms and condition for sale of tunnel kiln of supplier is shown in annexure 7.

2.1.9 Process down time during implementation

The process down time for installation of Tunnel kiln is not effect to the production due to separate structure is constructed with in the plant. Other wise to install the Tunnel kiln by dismantling the existing down draft kiln completely and will required 6 months process down time.

2.2 Life cycle assessment and risks analysis

The life of the Tunnel kiln is considered at 20 years.

2.3 Suitable unit/plant size

The proposed Tunnel kiln is suitable for minimum 50 tons per day and can be installed in all the units having similar capacity.

3. ECONOMIC BENEFITS OF NEW ENERGY EFFICIENT TECHNOLOGY

3.1 Technical benefits

3.1.1 Monetary savings per year

The project activity is installation of Tunnel Kiln for reducing production cost. Based on the detailed studies undertaken, the coal consumption in of DD kiln for 180 tonne production is 280 tons while with tunnel kiln will be 140.82 tons. Hence, for total 15 batches in a year, reduction in coal consumption would be 2088 tonne per year.

3.1.2 Electricity savings per year

No electrical savings is envisaged by Tunnel kiln, further, the Tunnel Kiln consumes some electricity consumption for operation of fans and Blower etc. total cost electricity consumption is ` 0.22 lakh/batch.

3.1.3 Improvement in product quality

The project activity is installation of Tunnel kiln, due to better control of the thermal parameters; the product quality may improve to certain extent.

3.1.4 Improvement in production

The Production is increased due to Tunnel kiln and the production will be daily not batch type.

3.1.5 Reduction in raw material consumption

No significant effect on the raw materials consumption.

3.1.6 Reduction in other losses

There is no reduction in other losses.

3.2 Monetary benefits

3.2.1 Monetary savings due to reduction in energy consumption

The installation of tunnel Kiln reduces production cost and monetary savings is estimated at ` 90.65 lakh per annum. A detail of energy and monetary benefit calculation is given in annexure 2.

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

The project activity is Installation of Tunnel kiln instead of DD Kiln and working environment in the plant is clean due to the continuous production of the product and the waste heat recovery system.

3.3.2 Improvement in skill set of workers

The technology selected for the implementation is new. The technology implemented will create awareness and operation and maintenance of the new technology and hence improves skills of the workers.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

There is no significant impact in effluent generation due to implementation of the project activity.

3.4.2 Reduction in GHG emission such as CO2, NOx, etc

The proposed project saves about 2088 tons coal per year. This roughly corresponds to 3757 tonnes of CO2 emission reduction per year.

3.4.3 Reduction in other emissions like SOx

As the project activity reduces coal consumption, the SOx emissions also reduces to some extent.

4. IMPLEMENTATION OF NEW ENERGY EFFICIENT TECHNOLOGY

4.1 Cost of technology/equipment implementation

4.1.1 Cost of technology/equipments

The total cost for installation of Tunnel kiln for 50TPD capacity is estimated at ` 255.50 lakhs, which includes cost of tunnel kiln and applicable taxes etc.

4.1.2 Other costs

The civil works, erection, commissioning charges are included in the above cost.

Table 4.1 Details of proposed equipment installation cost

S.No	Particular	Unit	Value
1	Equipment cost	` (in Lakh)	255.50
3	Other misc. cost	` (in Lakh)	5.0
4	Total cost	` (in Lakh)	260.50

4.2 Arrangement of funds

4.2.1 Entrepreneur's contribution

The entrepreneur's contribution is 25% of total project cost, which works out at ` 65.13 lakhs.

4.2.2 Loan amount

The term loan is 75% of the total project cost, which works out at `195.38 lakhs.

4.2.3 Terms & conditions of loan

The interest rate is considered at 10.00% which is normal interest rate for energy efficiency projects. The loan tenure is 7 years and the moratorium period is 6 months.

4.3 Financial indicators

4.3.1 Cash flow analysis

Considering the above discussed assumptions, the net cash accruals starting with ` 54.43 lakhs in the first year operation and increases to ` 279.26 lakhs at the end of tenth year.

4.3.2 Simple payback period

The total project cost of the proposed technology is ` 260.50 lakhs and monetary savings due to reduction in energy/production cost is ` 90.65 and payback period works out to be 2.87 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10.0% interest rate works out to be `112.36 lakhs.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 20.45%. Thus the project is financially viable. The average DSCR works out at 1.60.

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 21.00%.

Details of all the financial parameters for the replacement of conventional furnace with energy efficient furnace are presented in Table 4.2 below:

Table 4.2 Financial parameters

S. No	Parameter	Unit	Value
1	Simple payback period	Years	2.87
2	NPV	` in lakh	112.36
3	IRR	%age	20.45
4	ROI	%age	21.00
5	DSCR	Ratio	1.60

4.4 Sensitivity analysis in realistic, pessimistic and optimistic scenarios

A sensitivity analysis has been worked out to ascertain how the project financials would behave in different situations like there is an increase in monetary savings and decrease. For the purpose of sensitive analysis, two scenarios are considered are.

- Increase in fuel saving savings by 10%
- Decrease in fuel savings by 10%

Table 4.3 Sensitivity analysis

Particulars	***IRR*** %	***NPV*** ` (in Lakh)	***ROI*** %	***DSCR***
Normal	20.45	112.36	21.00	1.60
10% increase in fuel savings	23.99	153.37	21.54	1.77
10% decrease in fuel savings	16.79	71.35	20.27	1.42

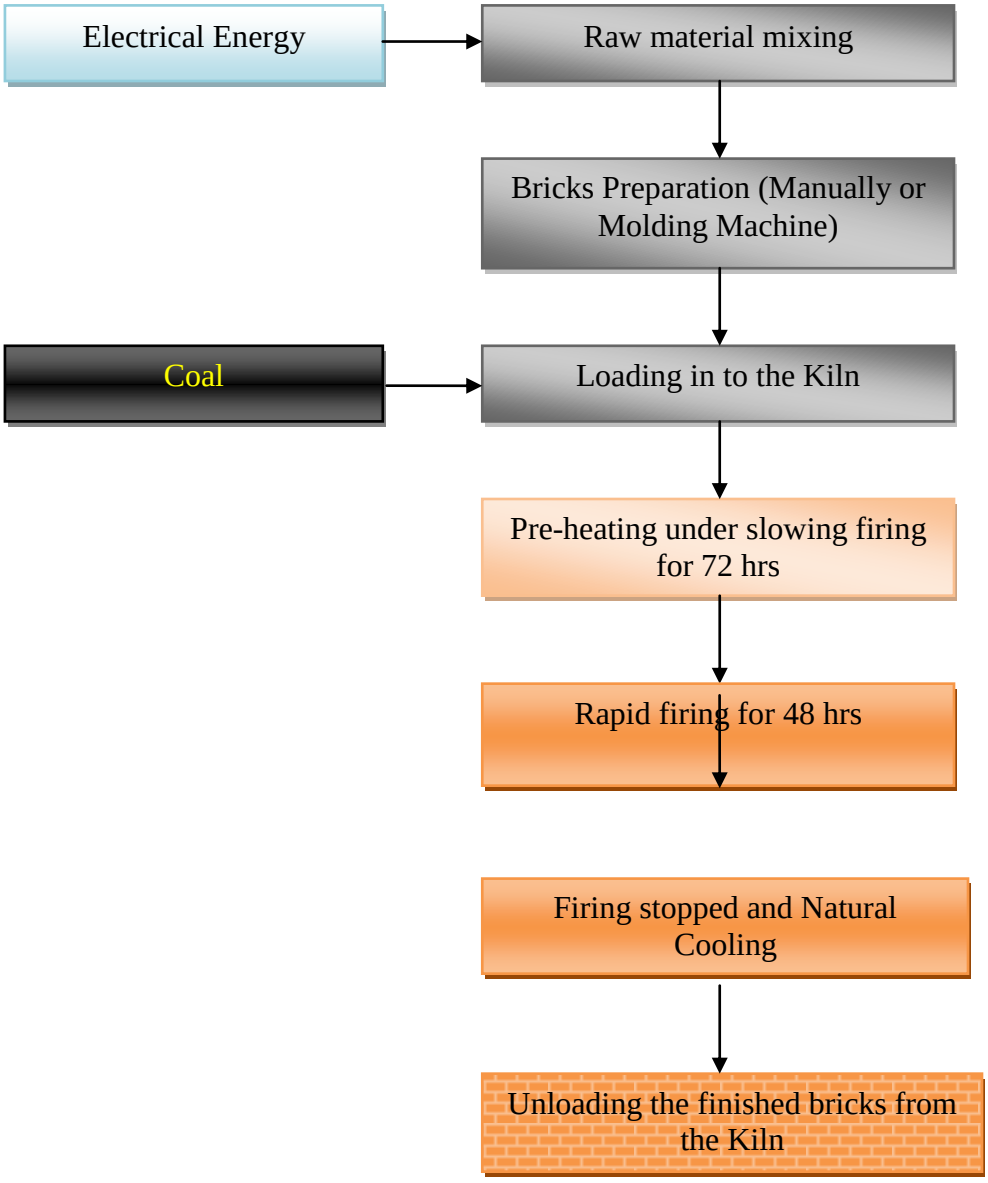
In each scenario, other inputs are assumed as constant.

4.5 Procurement and implementation schedule

The project is expected to be completed in 12 weeks from the date of financial closure and release of work order to the supplier. The detailed schedule of project implementation is furnished in Annexure 5.

ANNEXURES

Annexure 1: Process Flow Diagram



Annexure 2: Technology Assessment Report- Tunnel Kiln

S.No	Parameter	Unit	Details
1	Installed Capacity	Tons/batch	200
2	Production Capacity	Tons/batch	180
3	Coal consumption	Tons/batch	280
4	Calorific value of coal	kCal/kg	4200
5	Specific coal consumption	Ton/Ton of coal	1.56
6	Total installed capacity of Tunnel Kiln	TDP	50.00
7	Total output tunnel kiln	TDP	50.00
8	Heat required for refractory brick	kCal/kg	1150
9	Heat required for refractory brick	kCal/day	57500000
10	Efficiency of tunnel kiln	%age	35.00%
11	Coal required in tunnel kiln	ton/day	39.12
12	Specific coal consumption	Ton/Ton of coal	0.78
13	Fuel consumption for same production	Tons/batch	140.82
14	Fuel saving	Tons/batch	139.18
15	Electricity cost	C` lakh/batch	0.22
16	Cost of coal	Rs./Ton	4500
17	Monetary benefit per batch	`.in lakh/batch	6.04
18	No. of batches	batches/year	15
19	Total monetary benefits	`/annum	90.65
20	Total coal Savings	Tons/annum	2088
21	Investment	` in lakh	260.5
22	Payback period	years	2.87

Annexure 3: Techno Economic Financial Analysis

Name of the Technology	*Tunnel Kiln*		
Rated Capacity	*50 TDP*		
Details	*Unit*	*Value*	*Basis*
Installed Capacity	TDP	50	
Total No of batch per year	No.	15	
Proposed Investment			
Cost of plant & Machinery	`(in lakh)	255.50	Feasibility Study
Other cost	`(in lakh)	5.0	Feasibility Study
Total Investment	`(in lakh)	260.50	Feasibility Study
Financing pattern			
Own Funds (Internal Accruals)	`(in lakh)	65.13	Feasibility Study
Loan Funds (Term Loan)	`(in lakh)	195.38	Feasibility Study
Loan Tenure	Years	7	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	90	Assumed
Interest Rate	%	10.00	
Estimation of Costs			
O& M Costs	%(on Plant & Equip)	4.00	Feasibility Study
Annual Escalation	%	5.00	Feasibility Study
Estimation of Revenue			
Coal Saving per batch	tons/batch	139.18	-
Cost of fuel	`/Tons	4500	-
Electricity consumption cost	`./batch	0.22	-
total no. batch	no.	15	-
St. line Depreciation	%	5.28	Indian Companies Act
IT Depreciation	%	80.00	Income Tax Rules
Income Tax	%	33.99	Income Tax Act 2008-09

Estimation of Interest on term loan ***`(in lakh)***

Years	Opening Balance	Repayment	Closing Balance	Interest
1	195.38	3.00	192.38	22.79
2	192.38	6.00	186.38	18.96
3	186.38	12.00	174.38	18.09
4	174.38	24.00	150.38	16.34
5	150.38	30.00	120.38	13.70
6	120.38	36.00	84.38	10.40
7	84.38	51.50	32.88	6.17
8	32.88	32.88	-0.01	0.96
		195.38		

WDV Depreciation ***`(in lakh)***

Particulars / years	*1*	*2*
Plant and Machinery		
Cost	260.50	52.10
Depreciation	208.40	41.68
WDV	52.10	10.42

Projected Profitability ***`(in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Revenue through Savings										
Fuel savings	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65
Total Revenue (A)	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65
Expenses										
O & M Expenses	10.42	10.94	11.49	12.06	12.67	13.30	13.96	14.66	15.40	16.16
Total Expenses (B)	10.42	10.94	11.49	12.06	12.67	13.30	13.96	14.66	15.40	16.16
PBDIT (A)-(B)	80.23	79.71	79.16	78.59	77.98	77.35	76.69	75.99	75.25	74.48
Interest	22.79	18.96	18.09	16.34	13.70	10.40	6.17	0.96	-	-
PBDT	57.43	60.74	61.07	62.24	64.28	66.95	70.52	75.03	75.25	74.48
Depreciation	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75
PBT	43.68	46.99	47.32	48.49	50.52	53.20	56.77	61.27	61.50	60.73
Income tax	-	6.48	20.76	21.16	21.85	22.76	23.97	25.50	25.58	25.32
Profit after tax (PAT)	43.68	40.51	26.56	27.33	28.68	30.44	32.80	35.77	35.92	35.41

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

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Profit before tax	43.68	46.99	47.32	48.49	50.52	53.20	56.77	61.27	61.50	60.73
Add: Book depreciation	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75
Less: WDV depreciation	208.40	41.68	-	-	-	-	-	-	-	-
Taxable profit	(150.97)	19.06	61.07	62.24	64.28	66.95	70.52	75.03	75.25	74.48
Income Tax	-	6.48	20.76	21.16	21.85	22.76	23.97	25.50	25.58	25.32

Projected Balance Sheet

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Liabilities										
Share Capital (D)	65.13	65.13	65.13	65.13	65.13	65.13	65.13	65.13	65.13	65.13
Reserves & Surplus (E)	43.68	84.19	110.75	138.08	166.76	197.20	229.99	265.76	301.69	337.10
Term Loans (F)	192.38	186.38	174.38	150.38	120.38	84.38	32.88	-0.01	-0.01	-0.01
TOTAL LIABILITIES (D)+(E)+(F)	301.18	335.69	350.25	353.58	352.26	346.70	327.99	330.88	366.81	402.22
Assets										
Gross Fixed Assets	260.50	260.50	260.50	260.50	260.50	260.50	260.50	260.50	260.50	260.50
Less Accm. depreciation	13.75	27.51	41.26	55.02	68.77	82.53	96.28	110.04	123.79	137.54
Net Fixed Assets	246.75	232.99	219.24	205.48	191.73	177.97	164.22	150.46	136.71	122.96
Cash & Bank Balance	54.43	102.70	131.01	148.10	160.53	168.72	163.77	180.42	230.09	279.26

TOTAL ASSETS	301.18	335.69	350.25	353.58	352.26	346.70	327.99	330.88	366.81	402.22
Net Worth	108.81	149.32	175.87	203.20	231.88	262.32	295.12	330.89	366.81	402.22
Debt Equity Ratio	2.95	2.86	2.68	2.31	1.85	1.30	0.50	0.00	0.00	0.00

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

Particulars / Years	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Sources											
Share Capital	65.13	-	-	-	-	-	-	-	-	-	-
Term Loan	195.38										
Profit After tax		43.68	40.51	26.56	27.33	28.68	30.44	32.80	35.77	35.92	35.41
Depreciation		13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75
Total Sources	260.50	57.43	54.26	40.31	41.09	42.43	44.20	46.55	49.53	49.68	49.17
Application											
Capital Expenditure	260.50										
Repayment Of Loan	-	3.00	6.00	12.00	24.00	30.00	36.00	51.50	32.88	-	-
Total Application	260.50	3.00	6.00	12.00	24.00	30.00	36.00	51.50	32.88	-	-
Net Surplus	-	54.43	48.26	28.31	17.09	12.43	8.20	(4.95)	16.65	49.68	49.17
Add: Opening Balance	-	-	54.43	102.70	131.01	148.10	160.53	168.72	163.77	180.42	230.09
Closing Balance	-	54.43	102.70	131.01	148.10	160.53	168.72	163.77	180.42	230.09	279.26

IRR

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Profit after Tax		43.68	40.51	26.56	27.33	28.68	30.44	32.80	35.77	35.92	35.41
Depreciation		13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75
Interest on Term Loan		22.79	18.96	18.09	16.34	13.70	10.40	6.17	0.96	-	-
Cash outflow	(260.50)	-	-	-	-	-	-	-	-	-	-
Net Cash flow	(260.50)	80.23	73.23	58.40	57.43	56.14	54.59	52.72	50.48	49.68	49.17
IRR	20.45%										

NPV	112.36

Break Even Point

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Variable Expenses										
Oper. & Maintenance Exp (75%)	7.82	8.21	8.62	9.05	9.50	9.97	10.47	11.00	11.55	12.12
Sub Total*(G)*	7.82	8.21	8.62	9.05	9.50	9.97	10.47	11.00	11.55	12.12
Fixed *Expenses*										
Oper. & Maintenance Exp (25%)	2.61	2.74	2.87	3.02	3.17	3.32	3.49	3.67	3.85	4.04
Interest on Term Loan	22.79	18.96	18.09	16.34	13.70	10.40	6.17	0.96	0.00	0.00
Depreciation *(H)*	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75
Sub Total (I)	39.15	35.45	34.72	33.11	30.63	27.48	23.41	18.38	17.60	17.80
Sales (J)	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65	90.65
Contribution (K)	82.83	82.44	82.03	81.60	81.15	80.67	80.18	79.65	79.10	78.53

Break Even Point (L= G/I)	47.27%	43.00%	42.32%	40.58%	37.74%	34.06%	29.20%	23.07%	22.25%	22.66%
Cash Break Even {(I)-(H)}	30.66%	26.32%	25.55%	23.72%	20.79%	17.01%	12.04%	5.81%	4.87%	5.15%
Break Even Sales (J)*(L)	42.85	38.98	38.36	36.79	34.21	30.87	26.47	20.92	20.17	20.54

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

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***Total***
Net Profit Before Taxes	43.68	46.99	47.32	48.49	50.52	53.20	56.77	61.27	61.50	60.73	530.46
Net Worth	108.81	149.32	175.87	203.20	231.88	262.32	295.12	330.89	366.81	402.22	2526.44
											21.00%

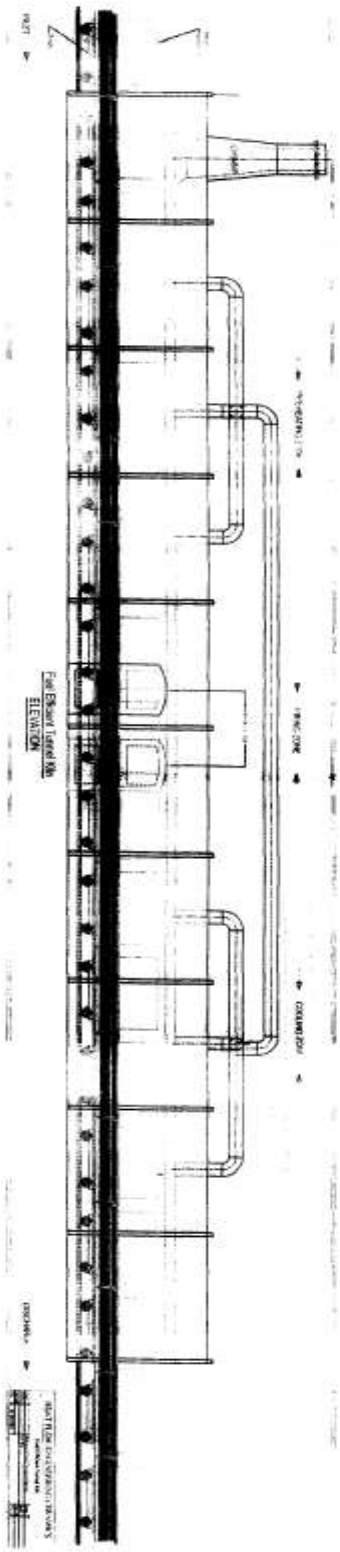
Debt Service Coverage Ratio ***`(in lakh)***

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***Total***
Cash Inflow											
Profit after Tax	43.68	40.51	26.56	27.33	28.68	30.44	32.80	35.77	35.92	35.41	265.76
Depreciation	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	110.04
Interest on Term Loan	22.79	18.96	18.09	16.34	13.70	10.40	6.17	0.96	0.00	0.00	107.42
Total (M)	80.23	73.23	58.40	57.43	56.14	54.59	52.72	50.48	49.68	49.17	483.22

DEBT

Interest on Term Loan	22.79	18.96	18.09	16.34	13.70	10.40	6.17	0.96	0.00	0.00	107.42
Repayment of Term Loan	3.00	6.00	12.00	24.00	30.00	36.00	51.50	32.88	0.00	0.00	195.38
Total (N)	25.79	24.96	30.09	40.34	43.70	46.40	57.67	33.84	0.00	0.00	302.80
DSCR	3.11	2.93	1.94	1.42	1.28	1.18	0.91	1.49	0.00	0.00	1.60
Average DSCR (M/N)	1.60										

Annexure 4: Technical Drawings of Tunnel Kiln



Annexure 5: Procurement and Implementation Plan with Schedule

S. No.	Activities	Weeks							
		1	2	3	4	5/6	7/8	9/10	11/12
1	Release of work orders								
2	Fabrication work								
3	Gas lines, platform construction and civil works								
4	Delivery, Commissioning and Trial Runs								

Annexure 6: Technology/Equipment and Service Providers

Equipment details	Source of technology	Service/technology providers
tunnel Kiln	**India**	**ISSOJET BURNER PVT LTD** 13-B, Electronic & Electrical Industrial Estate, Hosur - 635109, Tamil Nadu, India. Mobile : +91-9443226435 Tel : +91-4344-242343, 243857, 657125, 677126,292255,292257. Fax : +91-4344- 243857 Email : issojet@issojet.com Website: http://www.issojet.com/

Annexure 7: Techno-Commercial Bids

REF: IBPL/ALH/TK-3/R0 **DATE: 10/10/2011**

TO

Mr.M.A.Sudheesh,
Sr.Consultant,
APITCO Ltd,
8th Floor,
Parishrama Bhavan, Basheer Bagh,
Hyderabad-4.

DEAR SIR,

SUB:QUOTATION FOR REFRACTORY BRICKS/HOLLOW BRICKS/PICKLE JARS (10 tpd) TUNNEL KILN -REG.

REF: Your Mail dated Oct 7, 2011.

Thank you very much for your enquiry of **TUNNEL KILN** for the operating temperature of 1200°C with fuel of producer gas.

We are giving our lowest offer for ONE Kiln construction and Commissioning.

We are pleased to offer our enclosed proposal for **ISSOJET TUNNEL KILN** to fire refractory bricks. Maximizing loading can increase total capacity.

The estimated cost will be of our standard materials. The KILN construction is explained in details. If you do have any clarifications please feel free to contact us.

The technical requirement for the construction of the kiln varies considerably from the technical requirements for starting up and operating the kiln. We have also included in our quotation for the services of ISSOJET representative to checkout and balance the combustion system. Simultaneously instructing your production people for the proper operation and maintenance of the ISSOJET KILN.

We at ISSOJET BURNER PVT. LTD., look forward to supply you with ONE ISSOJET TUNNEL KILN.

We look forward to receive a favorable response to our enclosed proposal.

Thanking you,

Yours faithfully,
For **ISSOJET BURNER PVT LTD,**

K.RAMALINGAM,
Managing Director.

Encl:a/a

QUOTATION

ISSOJET TUNNEL KILN

PART 1.0 - BASIC SPECIFICATIONS

1.01 : PRODUCT/CAPACITY:

PRODUCT : REFRACTORY BRICKS/HOLLOW BRICKS/ PICKLE JARS
CAPACITY : 50TPD

1.02 : FIRING CYCLE :

OPEN FIRING

CYCLE TIME CALCULATION:

Ambient to 1200°C : 24 hrs
Soaking at 1000°C : 6 hrs
1000°c to 50°c : 18 hrs
Cool to cool total : 48 hrs

1.03 : NO. OF CAR CALCULATION:

OPEN FIRING

Setting dimensions : L = 2m, W = 1.25m, = H 1m x 1 No.
Useable setting volume : 2.5 m^3 (15 % for circulation per car)
Product tonnage per car : 2.5 T
Tonnage required per day : 50 T

1.04: LENGTH OF KILN CALCULATION:

Let us take 20 cars per day.
Pushing rate = 1.2 hr / car
No. of cars in all zones
= Maximum firing cycle hours / Hours required per car
= 48 / 1.2
= 40 Cars
Length required per car = 2 m (approx.)
Total length of Kiln = 84 m

Length of the Preheating Zone = 40 m
Length of the firing zone = 10 m
Length of the Cooling Zone = 30 m
No. of cars in Preheating Zone = 20 Cars
No. of cars in firing zone = 5 Cars
No. of cars in Cooling Zone = 15 Cars
No. of cars as spare = 10 Cars

1.05: TUNNEL KILN COMBUSTION SYSTEM:

Type of combustion	: Issojet burner system
Type of fuel	: Producer gas / LIGNITE
Burner rating	: 1, 25, 000 kcal/ hr
Total no. of burners	: 14
No. of zones	: 7

1.06 : BLOWERS :

EXHAUST BLOWER	: 45 HP
COMBUSTION BLOWER	: 12 HP x 2 nos
BOOSTER	: 10 HP x 2 nos

1.07: CONTROLS:

Fuel flow control	: Manual
Temperature control	: Manual
Kiln pressure Control	: Manual
Combustion Air control	: Manual
Voltage power	: 440 volt, 50 cycles, 3 phase
Voltage control	: 220 volt/50 hertz/1 phase

1.08: KILN ZONE REFRACTORY :

1000°C FIRING ZONE

Hot face1 Material: Ceramic Module (128kg/m^3) Thick: 12"
Cold face Material: MS Mesh Thick: 3mm

1000°C<600°C

Hot face1 Material: Ceramic Module (128kg/m^3) Thick: 9"
Cold face Material: MS Mesh Thick: 3mm

600°C<300°C

Hot face1 Material: Ceramic Module (128kg/m^3) Thick: 6"
Cold face Material: MS Mesh Thick: 3mm

300°C<50°C

Hot face1 Material: Ceramic Module (128kg/m^3) Thick: 4"
Cold face Material: MS Mesh Thick: 3mm

1.09: KILN SPECIFIC FUEL FUEL CONSUMPTION :

Approximately : 1150 kcals/kg for Refractory Bricks (1200 deg C)
Approximately : 800 kcals/kg for Clay Bricks (900 deg C)
Approximately : 900 kcals/kg for Clay Bricks (1000 deg C)

PART 2.0 – DESIGN CONCEPT:

2.01: ISSOJET COMBUSTION SYSTEM

Fuel and combustion air are combined in a perfect ratio to produce a fast, compact flame with complete combustion in the mixing chamber. This produces 100% combustion efficiency with no flames entering into the kiln.

Close control of kiln temperature throughout the firing cycle assures close control of product quality. Product can be heated as fast as heat can be absorbed.

The firing flexibility of the ISSOJET combustion system enables the user to have complete control of all firing variables (firing rate, cooling rate, circulation, fuel/air ratio, excess air & kiln pressure) to assure maximum firing efficiency.

2.02: OVER TEMPERATURE CONTROL

Over temperature control with alarm is an independent system providing a backup to the temperature control system. The over temperature alarm will notify operating personnel, so that corrective action can be taken to save the product and to prevent high temperature which will damage the kiln.

2.03: SIDE DRAFT EXHAUST SYSTEM

A powered Side draft exhaust system forces the circulating kiln gases through the setting to the bottom middle of the car. This system improves the temperature uniformity and increases the transfer of heat to the product before the gases exit the kiln, therefore, improving the fuel efficiency of the entire kiln system.

2.04: CUSTOMER BENEFITS

The above described features, which are common to all TUNNEL kilns result in significant benefits to the customers.

- **Improved quality**
- **Lower fuel cost**
- **Reduced maintenance cost**
- **Less floor space required**
- **Total firing flexibility**
- **Negligible rejection rate**

PART 3: TUNNEL KILN DESCRIPTION:

3.01: KILN CONSTRUCTION:

Kiln car supporting the ware is to be moved into the kiln using hydraulic system or by Winch. The kiln door operated manually by hoist comes down and closes perfectly. The kiln structural is a welded steel plate casing with welded structural steel reinforcement. This kiln structure is lined with ceramic fibres of different thickness according to operating temperature.

3.02: COMBUSTION SYSTEM

A total of 14 burners with ISSOJET system are installed in the kiln in 7 different zones, with each zone controlling the operation of the each burner. In one side of the kiln, there will be 1 burner and in opposite of the kiln shell there will be another 1 burner.

The combustion system further includes a centrifugal type combustion air blower mounted on the floor near the kiln.

The TUNNEL KILN as described above is designed completely by M/S. ISSOJET BURNER PVT. LTD.

3.03: EXHAUST SYSTEM:

One lot of exhaust equipment with control flap is equipped for side-draft exhaust system. Equipment includes one high temperature exhaust fan for 400°C operation and one adjustable sheet metal damper to admit a controlled amount of flue gas into the fan inlet to prevent over heating of the exhaust fan. Flue equipment does not include refractory lined flue to the fan. No refractory lining from the fan outlet to the building exterior.

3.04: INSTRUMENT PANEL BOARD PLUS MOTOR CONTROL

One lot temperature control instrumentation including specific instrument components as later specified, all mounted on a steel instrument panel board, plus also one lot motor control apparatus as listed below.

The instrument control panel board is fabricated of sheet metal; spray painted with white Siemens grey.

All instruments for temperature control and recording, diffusion air control and motor start/stop control are mounted directly on the panel board. Pilot lamps, pushbuttons, etc., are mounted on the door panel and wires are numbered in terminal strips mounted on the sub panel inside the control panel. Necessary control and inter-connecting relays, etc., are also mounted on this sub panel. Circuit breakers are mounted on the sub panel for protection of the control circuits.

A main disconnect switch which operates through a panel-mounted key switch is provided to energize all control circuits within the panel. Instrument panel board requires 220 volt, 50 hertz service, approximately 20 amps, with appropriate branch circuit protection and with the neutral side directly connected to an earth ground. Separate across the line starters, each in separate enclosure and with 220 volt coil for remote pushbutton, are supplied for each drive motor. Purchaser is to supply separate three phase feed with appropriate branch line protection as required by local codes for each motor, with motor starter to be field mounted by purchaser in the most convenient location.

3.05 – TEMPERATURE CONTROL SYSTEM

Also mounted on the panel board is the necessary instruments for measuring, and displaying the kiln temperature and the kiln firing program is controlled manually.

The fuel input rate to each of the zone is continuously monitored and adjusted manually to get desired time – temperature, firing cycle.

The instrument system utilizes instrument components manufactured by reputed companies and includes “k” type thermocouples.

3.06 - KILN PRESSURE CONTROL

One lot pressure system to maintain a constant preset pressure inside the kiln regardless of change in the fuel or diffusion air input rate. The system includes an INCLINED MANOMETER which is normally mounted on the kiln. This unit displays pressure online directly from the kiln. Using this pressure the butterfly valve located at the outlet of the high temperature exhaust fan is controlled.

3.07 - KILN CARS

The kiln cars are fabricated of welded structural steel including four single flanged wheels with taper roller bearings arranged to run on two rail tracks. The car is topped with a layer of insulating castables.

PART 5: SCOPE OF WORK:

5.01: TECHNICAL SUPERVISOR :

ISSOJET BURNER PVT. LTD. will provide a technical supervisor to oversee the construction of the kiln.

The technical supervisor will interpret drawings and advise the purchaser and/or purchaser's sub-contractor on technical matter concerning the construction of the ISSOJET equipment. The ISSOJET technical supervisor is not responsible for the quality of the work performed by labour not under ISSOJET's direct employs.

5.02 : START-UP SERVICE :

ISSOJET BURNER PVT. LTD. will provide a service representative to instruct and supervise purchaser's factory personnel, in the preliminary check-out and start-up of this equipment. Labour and supplies, material and tools required for operation and maintenance, beginning with the time of original light up are all provided by the purchaser.

5.03 : ISSOJET BURNER PVT. LTD. WORK

A).DESIGN & DRAWING:

1).Supply of Civil, Mechanical including ducting & piping, Hydraulic, Combustion schematic, Refractory, Electrical & Electronics.

2).Kiln operating, Trouble shooting, Maintenance guide & complete set of catalogues.

3).Conducting operator training classes.

B).CIVIL WORK:

1).Civil work supervision

C).MECHANICAL:

1). Kiln structural assembly
2). Car structural assembly
3). All Ducts, pipes and flexible hoses
4). Complete painting
5). Rail track system
6). Self supported Chimney (18m)
7). Door hoist

D).COMBUSTION SCHEMATICS

1).Exhaust Blower, Booster and Combustion Blower.
2).Valves, Regulators and Control dampers.
3).ISSOJET Burner assembly
4).Test cocks
5)."U" Tube manometer
6).Thermocouples

E).REFRACTORY

1).Kiln refractory
2).Car refractory
3).Flue refractory
4).Burner refractory
5).Refractory construction
6).Combustion air line insulation with aluminum cladding sheet
7).Mortar
8).Castables
9).Ceramic blanket
10).Inconel rod for hook brick & base brick
11).Supervision of refractory construction

F).ELECTRICAL & ELECTRONICS

1).Control Panel
2).Temperature indicators
3).Thermocouples
4).Compensating cable
5).Power panel
6).Wiring between Power Panel & Control Panel
7).Wiring between Power Panel to the motor.
8).Isolation transformer
9).UPS
10).Computer & Printer

G).DUCTING & PIPING

1). ON THE HOOD PIPING

1). Gas piping
2). Combustion air piping
3). Recirculation piping
4). Waste heat piping

2). OFF THE HOOD PIPING

1). Gas piping - Between Gasifier & Kiln
2). Combustion air piping
3). Waste heat piping

H).ERECTION & COMMISSIONING

1).Above mentioned works.

6.01 : CUSTOMER SUPPLY

A).CIVIL WORK:

1).Rail foundation
2).Flue foundation
3).Exhaust chimney foundation
4).Control room
5).All blower foundations
6).LPG Train foundations
7).Building drawings showing location of columns and ceiling clearances and construction.

B).REFRACTORY

1). NIL

C).COMBUSTION SCHEMATICS

1). Fuel specifications to include: Specific gravity, calorific value.

D).ELECTRICAL & ELECTRONICS

1). Incoming wiring to the power panel
2). A/C for control room
3). Electrical supply at one point.

E).ERECTION & COMMISSIONING

1). Providing LPG cylinder and oxygen cylinder for gas cutting.
2). Providing electricity at one point for welding.
3). During complete Erection & Commissioning period – Accommodation at free of cost for MD & Engineers.

PART 7.0 : PRICING FOR TUNNEL

The prices presented below are for one kiln purchased, constructed and started at the same time.

7.01: Design and Drawing : Rs 3, 00,000/-

7.02: Labour charges for technical supervision, Erection and commissioning of one Issojet tunnel kiln plus related systems : Rs 15,00,000/-

7.03: Supply of materials as per bill of materials and specifications by Issojet Burner Pvt. Ltd for one Tunnel Kiln system, Super structural for all cars : Rs 2, 10, 00,000/-

7.04: Gasifier system for producing gas from Coal : Extra

7.05: Extra car : Rs 1, 10,000/- Each

7.06: Inland freight and forwarding charges Extra.

PART 8.0: TERMS AND CONDITIONS.

8.01: DELIVERY:

Delivery can be made within 3 or 4 months per kiln after receipt of your technically and commercially clear purchase order.

8.02: TERMS OF PAYMENT:

FOR LABOUR CHARGES:

Design and drawing:
After finalizing and submitting the layout: 100%

Erection & commissioning charges:
At starting : 50%
50% completion of work : 30%
After Erection : 20%

For supply items:
40% advance, balance against delivery.

8.03: ERECTION & COMMISIONING: 3 months.

8.04: QUOTATION VALIDITY PERIOD: Prices are firm for **a period of two (2) months**, after which they are subject to reconsideration and possible revision.

8.05: TAXES

SALES TAX : As applicable. 2% CST against "C" form. (As Applicable)
SERVICE TAX : As applicable. Extra 10.3%. (As Applicable)
EXCISE : As applicable. Extra 10.3%. (As Applicable)

8.06 : INSURANCE : We will cover labour provided by us with ESI workmen's compensation. The purchaser should agree to carry all other liability or compensation insurance for protection of other labourers and of the public. The purchaser further cover the equipment or any parts thereof with insurance to protect the interests of ISSOJET furnace from all losses by fire, accident or otherwise until the price has been fully paid.

8.07 : CANCELLATION : All orders resulting from this proposal are considered firm contracts and cancellation or suspension will be accepted by ISSOJET BURNER PVT. LTD. only upon terms which will protect us against loss and will reimburse us for work in process and supplier's cancellation charges and our overhead expenses and profit.

8.08 : DRAWINGS : All drawings, designs and specifications related to this project will remain the property of ISSOJET BURNER PVT. LTD. The purchaser agrees to use drawings and engineering data furnished by ISSOJET BURNER PVT. LTD., only for the purpose of erecting and maintaining the equipment covered by this contract and not for duplication in whole or in part, and further agrees not to give, loan, exhibit or sell to any person, drawings or prints or knowledge derived there from.

All construction work is to be done in accordance with the ISSOJET BURNER PVT. LTD. drawings. Any changes in these drawings or deviation from these specifications requested by the purchaser will be at extra cost. There will be no changes made to the construction drawings or procedures without the approval of the ISSOJET BURNER PVT. LTD. Engineering Department.

Any properly accredited representative of ISSOJET BURNER PVT. LTD., shall advise all times, after suitable notification be admitted to the job site, during normal business hours, during construction and thereafter, and have access to the equipment for the purpose of observing its operation.

8.09: LICENSE : To permit the purchaser to construct certain parts of the kiln system quoted herein, ISSOJET BURNER PVT. LTD. will be issuing certain confidential drawings, technical data and other detailed information for this construction. These confidential drawings and data remain the property of ISSOJET BURNER PVT. LTD. and it is mutually agreed that this information will be used for this one contract only.

8.10 : COSTING : To control the cost of the kiln, CUSTOMER will provide all relevant purchase order, job order copies to ISSOJET BURNER PVT. LTD. If necessary.

8.11 : WARRANTY : The equipment manufactured by us is warranted to be free from defects in workmanship and material under normal use and service and under proper operating conditions for a period of 90 days after original equipment start-up, provided such start-up takes place within six months after shipment of

drawings and bill of materials from our plant. Our responsibility is expressly limited to material supplied by us.

In case of apparatus not manufactured by us, such as blowers or controls or other ancillary apparatus furnished with our equipment or as part thereof, our liability, if any, is limited to such warranty as may be given to us by the original manufacturers.

In the event of our equipment is found to be defective in workmanship or material, our liability shall be limited to the repair or replacement f.o.b. our factory, of such equipment, provided that written notice must be given to us within 90 days after equipment start-up.

We hope the above details will give the clarity of the project.

If you do have any doubt please feel free to contact us.

Thanking You,

FOR ISSOJET BURNER PVT. LTD.

Dr.K. RAMALINGAM
MANAGING DIRECTOR.

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

APITCO Limited
8th floor, Parisrama Bhavan
Basheerbagh, Hyderabad -500004
Phones: +91- 040-23237333, 23237981,
Fax: +91-40-23298945
E-mail: hyd1_apitco@bsnl.in
Website: www.apitco.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