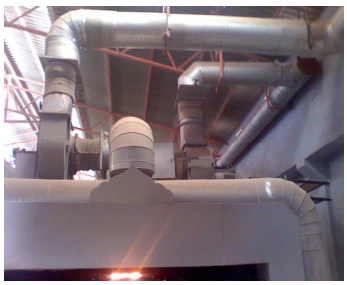
DETAILED PROJECT REPORT
ON
FABRICATION OF DRYER ON TUNNEL KILN FOR PRE HEATING OF MATERIAL
(MORBI CERAMIC CLUSTER)








Bureau of Energy Efficiency

Prepared By

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FABRICATION OF
DRYER ON TUNNEL KILN
FOR PRE HEATING OF MATERIAL

MORBI CERAMIC CLUSTER

BEE, 2010

Detailed Project Report on Fabrication of Dryer on Tunnel Kiln for Pre-heating of Material

Ceramic SME Cluster, Morbi, Gujarat (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: **MRV/CRM/HCM/04**

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Acknowledgement

We sincerely appreciate the efforts of industry, energy auditors, equipment manufacturers, technology providers, consultants and other experts in the area of energy conservation for joining hands with Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India for preparing the Detailed Project Report (DPR) under BEE SME Program in SMEs clusters. We appreciate the support of suppliers/vendors for providing the adoptable energy efficient equipments/technical details to the SMEs.

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

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List of Abbreviations

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

SEE-Tech Solution Pvt. Ltd. is executing BEE-SME program in Morbi Ceramic Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Morbi ceramic cluster is one of the largest ceramic 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 ceramic clusters in India.

The main energy forms used in the cluster units are grid electricity, Natural Gas, Charcoal, Lignite and small quantity of Diesel oil. Natural Gas is used as fuel for Tunnel kiln for final baking of product. In Sanitary ware unit, about 50% of total energy cost required for Tunnel kiln.

Project implementation will lead to reduction in Natural Gas consumption by 43,382 SCM per year however; this intervention will not have any effect on the existing consumption pattern of electricity.

The total investment, debt equity ratio for financing the project, monetary savings, Internal rate of return (IRR), Net present value (NPV),Debt service coverage ratio (DSCR) Return on investment (ROI) etc for implementing energy efficient boiler is furnished in Table A below

Table A Financial indicator of proposed technology

S.No	*Particular*	*Unit*	*Value*
1	Project cost	₹ (in Lakh)	6.64
2	Natural Gas saving	SCM/year	43382
3	Monetary benefit	₹ (in Lakh)	6.50
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	years	1.00
6	NPV in 3 years @ 10.00%	₹ (in Lakh)	12.78
7	IRR	%	70.74
8	ROI	%	33.91
9	DSCR	Ratio	3.93
10	Process down time	Days	4-5

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

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 25 selected SMEs clusters. Morbi Ceramic 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

Morbi SME Cluster is one of the largest ceramic clusters in India and mainly famous for manufacturing of ceramic tiles. Over 70% of total ceramic tiles product comes from Morbi cluster. The nearest airport is at Rajkot, which is 67 KM from Morbi by road. Morbi could also be reached from Ahmadabad by Railway as well as by road which is about 184 KM.

There are approximately 479 ceramic units in this cluster which are engaged in manufacturing of Wall Tiles, Vitrified Tiles, Floor Tiles, Sanitary wares, Roofing Tiles and others product. There are around 50 more ceramic units coming up in Morbi.

Majority of the cluster units are of integrated type, where the raw material is processed in-house to the final product. Majority of the units in the cluster are dependent on local / run of the mill technologies which is supplied by local service provider. Table 1.1 shows the total energy consumption scenario at Morbi cluster.

Table 1.1 Details of annual energy consumption scenario at Morbi ceramic cluster

S. No	Type of Fuel	Unit	Value	% contribution
1	Electricity	GWh /year	1,200	8.23
2	Natural Gas	SCM/year	660,000,000	46.32
3	Charcoal	Tonne/year	165,000	8.55
4	Lignite	Tonne/year	1,320,000	36.84
5	Diesel	Litre/year	800,000	0.06

Energy usages pattern

Average monthly electricity consumption in ceramic industry ranges from 1 lakh to 2 lakh kWh depending on the size of the industry. In thermal energy, solid fuel such as lignite, charcoal, Indonesian coal, briquette, etc are used in spray dryer and natural gas is used in kiln in all industries except few of them. Solid fuel consumption in spray dryer ranges from 80 to 160 kg/MT of production. Natural Gas consumption in kiln varies from 1.01 to 1.4 SCM/m^2 of tiles produced.

Classification of Units

The ceramic units can be categorized into four types based on product manufacture

- Floor Tiles unit

- Wall Tiles
- Vitrified Tiles unit
- Sanitary Wares unit

Production wise unit breakup

Morbi ceramic cluster can be breakup into three categories viz. small, medium and large scale unit. Table 1.2 shows that production wise breakup of Morbi cluster.

Table 1.2 Production wise unit breakups

Type of product	*No. of Units.*				*Production (m^2/day or MT[1]/day)*			
Scale of Unit	**Small**	**Medium**	**Large**	**Total**	**Small**	**Medium**	**Large**	**Total**
Wall Tiles	43	100	35	178	2,500	3,500	7,500	13,500
Floor Tiles	8	38	6	52	3,000	4,000	7,000	14,000
Vitrified Tiles		22	4	26		5,760	11,520	17,280
Sanitary Wares	10	24	9	43	4	8	14	26

Products Manufactured

Different types of products manufactured in Morbi SME cluster are as shown in Table 3 below

Table 1.3 Product manufactured

S. No	*Type of Product*	*% share*	*Units*
1	Wall Tiles	37	178
2	Vitrified Tiles	8	36
3	Floor Tiles	11	52
4	Sanitary Wares	9	43
5	Spray Dryer Mud Manufacturing Units	8	40
6	Roofing Tiles (seasonal operation)	25	120
7	Third Firing Manufacturing (Producing pictures on tiles)	37	10
Total			479

[1] *In case of sanitary wares, production is measured in terms of MT.*

Production process of manufacturing of sanitary ware

Only difference between manufacturing process of tiles and sanitary wares is the moulding process. In case of sanitary wares, manual moulding is carried out whereas in case of tiles hydraulic press is used to form the biscuits.

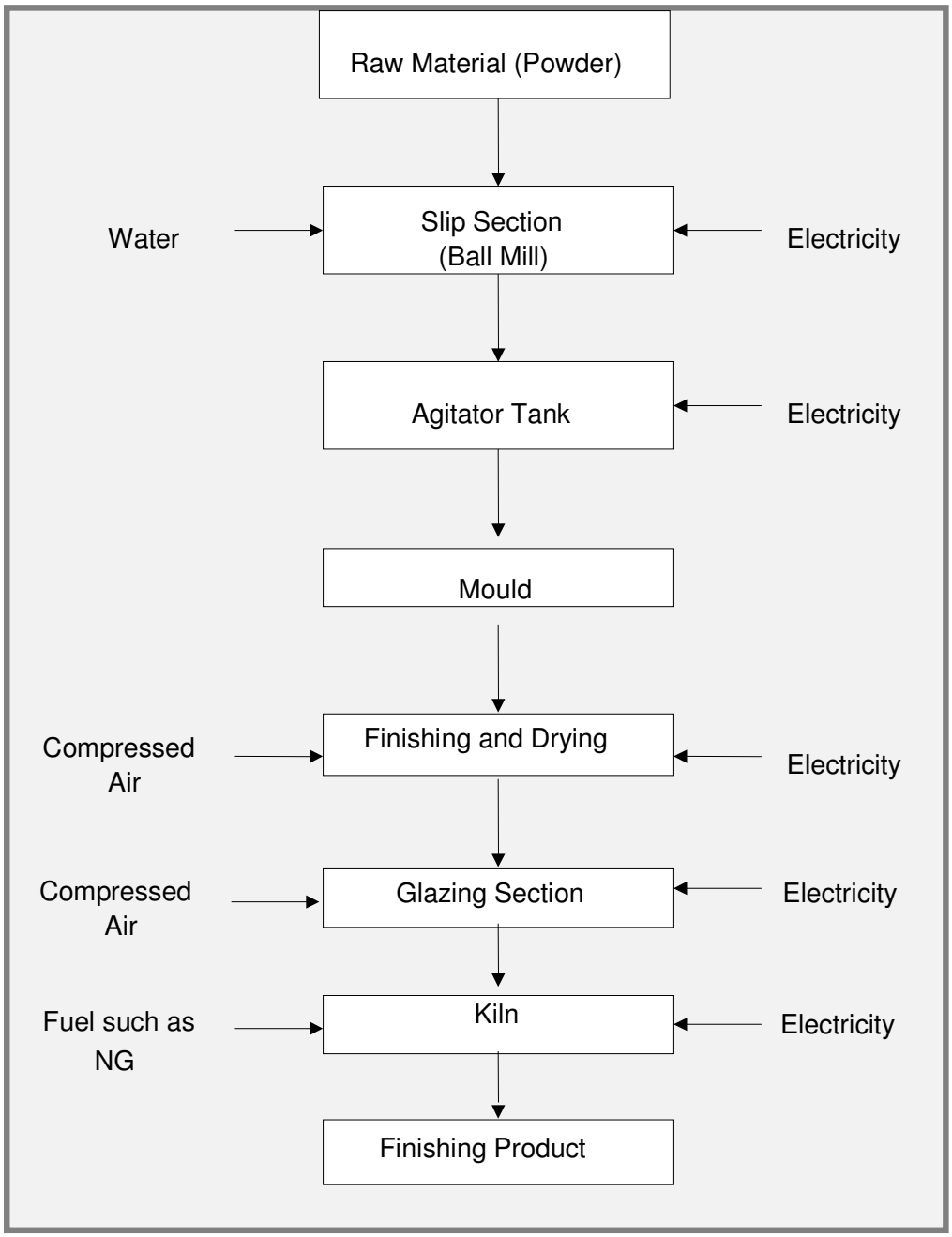


Figure 1.1 Process flow diagram of sanitary ware

Wet Grinding

Raw materials such as clay, feldspar, quartz, calcite etc. are mixed with water in a proper proportion and are grinded in a ball mill to make a homogeneous mixture. Ball Mill is a batch type of process. After completion of one batch of ball mill, slurry is taken in to the underground tanks fitted with agitator motor in each tank to maintain the uniformity of mixture.

Moulding

The slip (slurry) is poured into the moulds by a hand held hose. The slip is pumped through a hydraulic pump into the mould.

Drying

The cast wares are then dried in natural environment with the help of ceiling fans.

Glazing

The dried wares are then glazed in spray glazing booths, where compressed air is used for spray glazing.

Firing

The glazed wares are then fired in the kilns up to a temperature of 1200 ^{o}C where the natural gas is used as a fuel. The output from the kiln is inspected before packaging and dispatch.

1.2 Energy performance in existing situation

1.2.1 Average production

Annual production in terms of m^2 per year is taken in case of tiles and MT per year for sanitary wares is given in the following Table 1.4 below.

Table 1.4 Annual productions from a typical unit

Type of product	*No. of Units.*				*Production (m^2/day or MT*/day)*			
Scale of Unit	Small	Medium	Large	Total	Small	Medium	Large	Total
Wall Tiles	43	100	35	178	2,500	3,500	7,500	13,500
Floor Tiles	8	38	6	52	3,000	4,000	7,000	14,000
Vitrified Tiles	-	22	4	26	-	5,760	11,520	17,280
Sanitary Wares	10	24	9	43	4	8	14	26

1.2.2 Fuel consumption

Energy consumption both electrical and thermal by a typical ceramic industry for different types of products is given in table 1.5 below.

Table 1.5 Annual energy consumption

Energy	*Electricity (GWh per year)*			*Natural gas (SCM per year)*			*Solid Fuel [lignite] (Tonne per year)*		
Scale of Unit	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Wall Tiles	0.9	1.5	2.4	750,000	1,050,000	2,250,000	2,400	2,880	3,600
Floor Tiles	0.9	1.5	2.4	900,000	1,200,000	2,100,000	3,600	4,200	4,800
Vitrified Tiles	NA[2]	6.0	2.4	NA	2,700,000	6,000,000	NA	6,000	9,000
Sanitary Wares	0.24	0.45	0.9	120,000	240,000	420,000	NA	NA	NA

1.2.3 Specific Energy Consumption

Specific energy consumption both electrical and thermal energy per m^2 or MT of production for each type of ceramic industry is given in Table 1.6 below.

Table 1.6 Specific energy consumption of different ceramic unit

Energy	*Electricity (kWh/m^2) or (*kWh/MT)*			*Natural gas (SCM/m^2) or (SCM/MT)*			*Solid Fuel [lignite] (kg/m^2)*		
Scale of Unit	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Wall Tiles	1.20	1.43	1.07	1.00	1.00	1.00	3.20	2.74	1.60
Floor Tiles	1.00	1.25	1.14	1.00	1.00	1.00	4.00	3.50	2.29
Vitrified Tiles	NA	3.47	3.47	NA	1.56	1.74	NA	3.47	2.60
Sanitary Wares	200.00	187.50	214.29	100.00	100.00	100.00	NA	NA	NA

[2] *Not Applicable*

1.3 Proposed technology/equipment

1.3.1 Description of technology/equipment

Tunnel kiln is used for final baking of sanitary wares in unit. Natural gas is used as a fuel in tunnel kiln. There are two sources in tunnel kiln where the heat from tunnel kiln is exhaust to atmosphere. One is the smoke air (flue gas) from preheating zone and another one is the hot air from the cooling zone of the tunnel kiln. If flue gas is utilized for preheating of combustion air then we can use the hot air for another purpose. Presently, hot air from cooling at a temperature of around 120 ^{o}C is discharged to atmosphere.

1.3.2 Role in process

Tunnel kiln is used for final baking of the sanitary ware products to get the finish product. Natural gas is used as a fuel in tunnel kiln. Sanitary ware products are fired upto a temperature of about 1200 ^{o}C in the tunnel kiln. It removes the moisture present in the product and also improves the strength of the products by baking at higher temperature.

1.4 Benchmarking for existing specific energy consumption

Energy consumption in tunnel kiln would depend on following mentioned things

- Baking temperature which depends on the product to be dried
- Operational & maintenance practices
- Type of fuel and its calorific value
- Quantity of product to be baked

Energy use and technology audit studies were conducted in various units of Morbi ceramic cluster, the baseline energy consumption of present tunnel 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 boilers

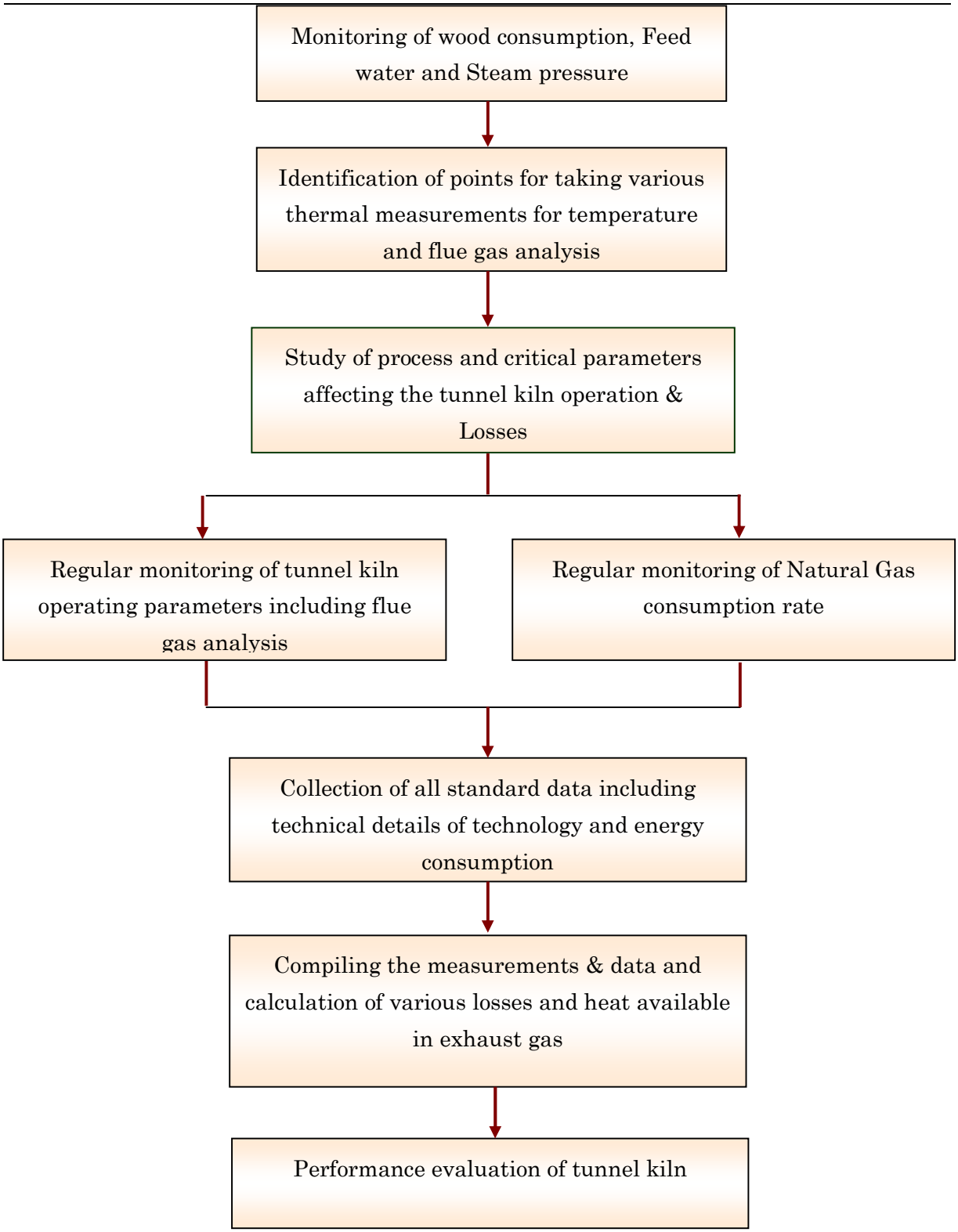


Figure 1.2 Energy Audit methodologies

1.4.2 Design and operating parameters specification

In tunnel kiln, one of the requirement is that the product should be heated upto a temperature of about 1200 °C. Electrical and thermal energy consumption in tunnel kiln for different plant capacities are given in Table 1.7.

Table 1.7 Fuel Consumption in tunnel Kiln for different plant capacities

Plant Capacity Nags/day (Pieces/day)	*Unit*	*2000 (27 MT/day)*	*1000 (13.5 MT/day)*
Electricity Consumption	GWh/year	0.14	0.12
Natural Gas Consumption	SCM/year	841216	578431

1.4.3 Operating efficiency analysis

Operating efficiency of tunnel kilns is found to be in the range of 19% to 26% varies from unit to unit. Detailed parameters and calculations used for operating efficiency evaluation of tunnel kiln efficiency are given in the annexure 1.

1.5 Barriers in adoption of proposed technology/technology

1.5.1 Technological Barrier

- Lack of awareness and information about the new and emerging energy efficient technologies available in the market.
- Dependence on local technology suppliers for uninterrupted after sales service
- The majority of the textile unit owners / entrepreneurs do not have in-depth technical expertise
- The lack of technical know-how made it impossible for the textile unit owners to identify the most effective technical measures

1.5.2 Financial Barrier

- Majority of the units in the cluster are of tiny and owners don't have financial strength
- Implementation of the proposed project activity requires considerable investment of Rs 3.90 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 Morbi ceramic cluster, the availability of skilled manpower is one of the limitations due to more number of ceramic units as compared to the availability of skilled manpower. One local technical persons available at Morbi takes care of about 5 - 10 ceramic units. For major equipment of ceramic units like kiln, Polishing Machine etc, maintenance or the repair work of these equipments will be taken by the technology suppliers itself even the suppliers like Sacmi, KEDA, Modena etc depute one of their representatives staying at Morbi for the maintenance work. Local technical persons of Morbi takes care As not many experts/skilled persons are available in the cluster, one expert takes care of all maintenance & operational problems of about 5 - 10 industries.

1.5.4 Other barrier (If any)

On discussion with the plant person during our audit, many of them agree with the possible saving measures but they demand demonstration of same energy saving technologies in some other plant and then they have readiness to follow.

2 PROPOSED TECHNOLOGY

2.1 Detailed description of technology

2.1.1 Description of technology

Here, propose technology will recover the waste heat of hot air from cooling zone of tunnel kiln. For implementation of such system, requires a design structure i.e. similar to dryer type enclosure with proper insulation. In this structure, we place the raw material in trolley ready before sending to tunnel kiln and send the hot air from the cooling zone of tunnel kiln so that the material in the drier gets heated. This results in reduction in fuel consumption in tunnel kiln.

For implementation of this system, we require the following

- Structure similar to dryer with proper insulation
- Piping arrangement from exhaust of tunnel kiln to dryer.
- Instrumentation system for proper monitoring

2.1.2 Technology specification

For implementation of the waste heat recovery system on tunnel kiln of plant capacity of about 1000 (13.5 MT/day) pieces/day, required the following operating parameters shown in Table 2.1.

Table 2.1 Operating Parameters of technology

S.No.	Particulars	Unit	Existing Technology	Proposed Technology
1	Rapid air cooling blower flow rate	m^3/hr	2826	2826
2	Heat given by hot air to material	KCal/hr	0	49,375

2.1.3 Suitability over existing technology

Implementation of this technology on a tunnel kiln requires the design of fabrication of tunnel kiln based on the operating parameters and the arrangement for retrofitting of fabrication of tunnel kiln at the exhaust of hot air from cooling zone. If required, put a very small capacity of axial fan. Presently, hot air from final cooling zone emit at a temperature of about 120 ^oC is released to the atmosphere.

This technology has been selected for the following reasons:

- In sanitary ware unit, major energy cost of unit is consumed in tunnel kiln only.

- It reduces the fuel consumption in tunnel kiln.
- It significantly increases efficiency of the Kiln.
- Resulting in reduction in GHG emissions.
- Technology is easily available.

2.1.4 Superiority over existing technology

In this technology exhaust hot air from cooling zone is utilized to pre heat the input material. This leads to decrease the Natural Gas consumption in tunnel kiln.

2.1.5 Availability of technology

Fabrication of tunnel kiln is one of the well waste heat recovery technologies in market. Many of the persons already know about this technology but had not implemented yet. The main reason is that kiln suppliers are not providing this facility. There are many suppliers available in Gujarat which provides this technology.

2.1.6 Source of technology

This technology is already in use in furnaces where the operating temperature is same like in tunnel kilns operating parameter. They also got the results of reduction in fuel consumption and the technology is running successfully.

2.1.7 Technical specification of technology

Technical specification of proposed technology is shown in Annexure 9.

2.1.8 Terms and conditions in sales of technology

They provide the guarantee for proper design and insulation of the system. The entire material requirement is either provided by client or vendor itself provides the whole system which depends upon the convenience of client.

2.1.9 Process down time during implementation

Process down time require is about 4 - 5 days which is required only for making the piping arrangement from exhaust of cooling zone of tunnel kiln and Break down period of 4-5 days is shown in Annexure-7.

2.2 Life cycle assessment and risks analysis

Life cycle of provided heat exchanger is about 10-12 years but it required cleaning at regular intervals to achieve the better performance.

The factors which effects the implementation of this technology are as follows

- Lack of initiative of the unit owner
- Always have attitude that we implement only after seeing the same installation in same unit i.e. want demonstration.
- Availability of space at plant in kiln section.

2.3 Suitable Unit for Implementation of Proposed Technology

At Morbi, there are total 43 sanitary ware units. Nearly 80% of the sanitary ware units are having the production capacity of about 800 to 1000 pieces per day i.e. 10 to 14 MT per day. Therefore, the size of the identified technology should have plant production capacity of about 1000 pieces per day.

3 ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical benefit

3.1.1 Fuel saving

Preheating of raw material through installation of dryer in tunnel kiln which use hot air released from cooling zone of tunnel kiln leads to savings of about 7.5% on total Natural Gas consumption in tunnel kiln. Hence new technology will save 43,382 SCM of Natural Gas per year thereby, save ₹ 6.5 lakh per year.

3.1.2 Electricity saving

No electricity savings are considered in the proposed technology because it is not reducing the electricity consumption in tunnel kiln but however this will increase the electricity consumption but it is negligible in comparison to thermal energy

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.

3.1.4 Increase in production

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

3.1.5 Reduction in raw material

Raw material consumption is same even after the implementation of proposed technology.

3.1.6 Reduction in other losses

This project reduces the heat loss from cooling zone of tunnel kiln.

3.2 Monetary benefits

Annual monetary savings due to implementation of new technology of tunnel kiln is ₹ 6.5 lakh per year. Energy & monetary benefit analysis of new proposed technology in tunnel kiln after implementation are shown in Table 3.1 below.

Table 3.1 Energy and monetary benefit due to project implementation

S.No	Parameter	Unit	Value
1	Present Natural Gas consumption	SCM/ year	5,78,431
2	Operational hours	Hours/day	24
3	Operational days	Days/year	321
4	Natural Gas consumption after implementation	SCM/ year	5,35,049
5	Saving of Natural Gas	SCM/ year	43,382
6	Cost of Natural Gas	₹ /SCM	15
7	Monetary saving	₹ in lakh	6.50

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

Proposed technology reduces the overall GHG emission which improves the working environment of the plant and surrounding also.

3.3.2 Improvement in workers skill

Not contributing to any improvement in skill sets of workers. They only get the knowledge on how savings in fuel consumption will be achieved by waste heat recovery system.

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.

3.4.2 Reduction in GHG emission

Implementation of this technology will results in reduction in CO_2 emissions due to reduction in overall fuel consumption. Implementation of project will result in saving of 43,382 SCM Natural Gas per year which leads to 89 tCO_2 emission reduction per year from one unit. Similarly, there are 43 Sanitary ware units in Morbi ceramic cluster, if all units will implement this project then total CO_2 emission reduction will be approximately 3824 tCO_2 per year. This will also help in getting the carbon credit benefit through Clean Development Mechanism (CDM) project.

3.4.3 Reduction in other emissions like SO_X

Sulphur is not present in Natural Gas; hence there is no impact on SO_X emissions.

4 INSTALLATION OF PROPOSED TECHNOLOGY

4.1 Cost of technology implementation

4.1.1 Material cost

Cost of the material is about ₹ 5.00 lakh which includes the design and fabrication of new technology on the tunnel kiln.

4.1.2 Erection, commissioning and other misc. cost

Erection & commissioning cost is ₹ 0.75 lakh which includes the piping, instrumentation, labour work etc and ₹ 0.89 lakh for misc. cost.

Table 4.1 Details of proposed technology installation cost

S.No	Particular	Unit	cost
1	Material cost	₹ (in Lakh)	5.00
2	Erection & Commissioning cost	₹ (in Lakh)	0.75
3	Interest during implementation	₹ (in Lakh)	0.14
4	Other misc. cost	₹ (in Lakh)	0.75
5	Total cost	₹ (in Lakh)	6.64

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

Entrepreneur will contribute 25 % of the total project cost which is ₹ 1.66 lakh.

4.2.2 Loan amount.

Remaining 75 % cost of the proposed project will be taken from the bank which is ₹ 4.98 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 initial moratorium period is 6 months from the date of first disbursement of loan.

4.3 Financial indicators

4.3.1 Cash flow analysis

Profitability and cash flow statements have been worked out for a period of 5 years. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below. The cost of technology considered is inclusive of hot water storage tanks also.

The project is expected to achieve monetary savings of ₹ 6.50 lakh per annum.

- The Operation and Maintenance cost is estimated at 10 % 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-5.

4.3.2 Simple payback period

The total project cost of the proposed technology is ₹ 6.64 lakh and monetary savings due to reduction in Natural Gas consumption is ₹ 6.51 lakh hence, the simple payback period works out to be 1 year.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10 % works out to be ₹ 12.78 lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 70.74%. 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 33.91%.

Table 4.2 Financial indicators of proposed technology/technology

S.No.	*Particular*	*Unit*	*Value*
1	Simple payback period	year	1
2	NPV	₹ (in lakh)	12.78
3	IRR	%	70.74
4	ROI	%	33.91

4.4 Sensitivity analysis

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 has been considered

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

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

Table 4.3 Sensitivity analysis in different scenario

Scenario	*Fuel Saving, (SCM per year)*	*IRR (%)*	*NPV (₹ in lakh)*	*ROI (%)*
Pessimistic	41213	66.10	11.75	33.68
Realistic	43382	70.74	12.78	33.91
Optimistic	45551	75.36	13.82	34.12

4.5 Procurement and implementation schedule

Table 4.4 Procurement and implementation schedule

S. No.	*Activities*	*Weeks*				
		1	*2*	*3*	*4*	*5*
1	Designing					
2	Fabrication as per design.					
3	Commissioning					

Annexure

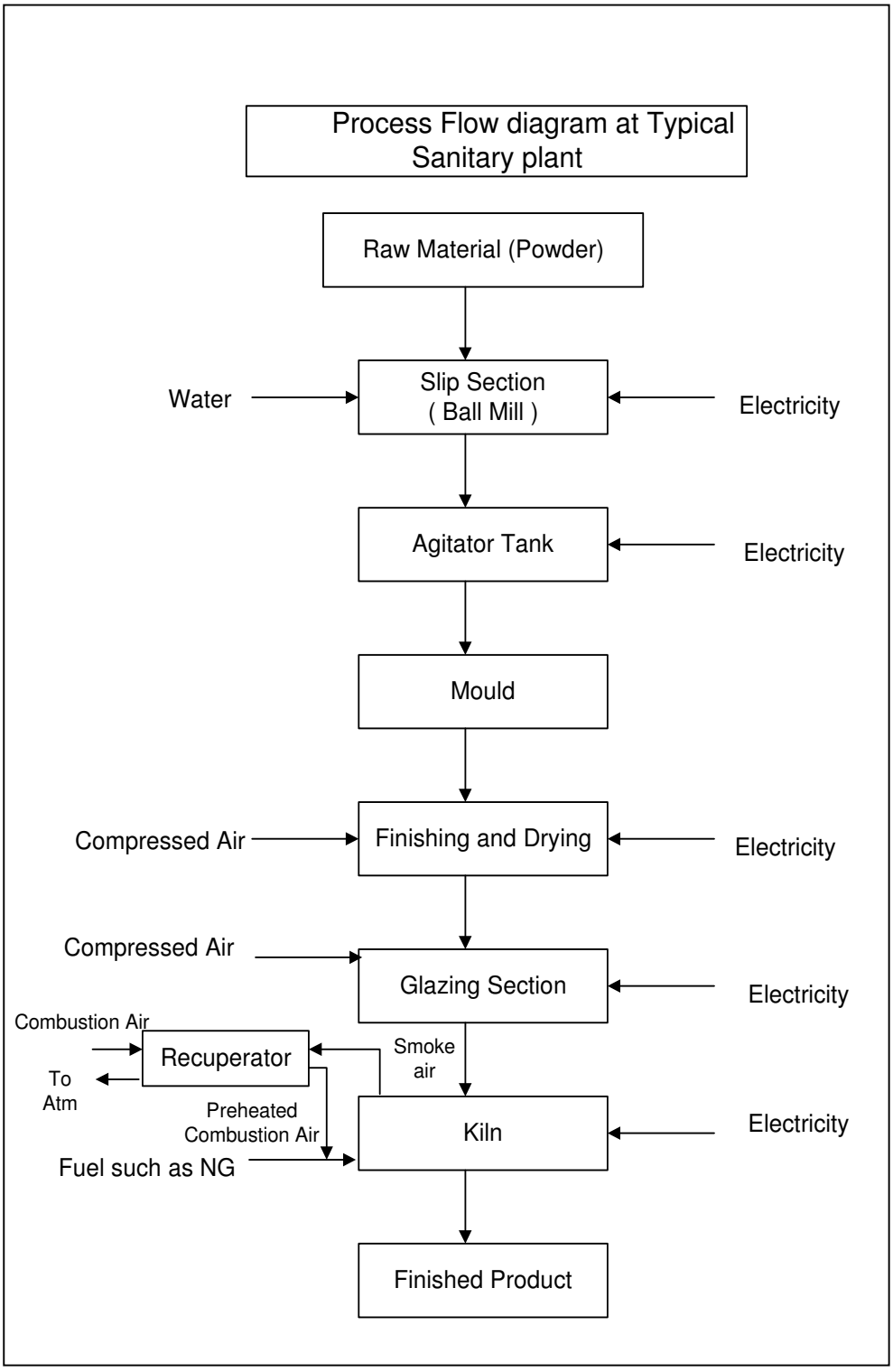
Annexure -1: Energy audit data used for baseline establishment under the sub head 1.4 in Chapter-1

Efficiency of tunnel kiln can be calculated as follows:

Input Data

S. No.	Parameter	Unit	Value
1	Natural Gas Consumption	SCM/day	1800
2	Production from kiln	Pieces/day	1000
3	Production from kiln	MT/day	13.5
4	Weight of one Piece going to kiln	kg	14
5	Weight of one Piece coming out from kiln	kg	13.5
6	Kiln Cycle time	hr	14
7	Highest heating temperature in firing zone	^{o}C	1210
8	Flue gas temperature	^{o}C	192
9	Hot air temperature from cooling zone	^{o}C	150
10	Heat required to heat the product	KCal/day	3,001,050
11	Heat supplied by fuel	KCal/day	15,840,000
12	Efficiency of kiln	%	18.95

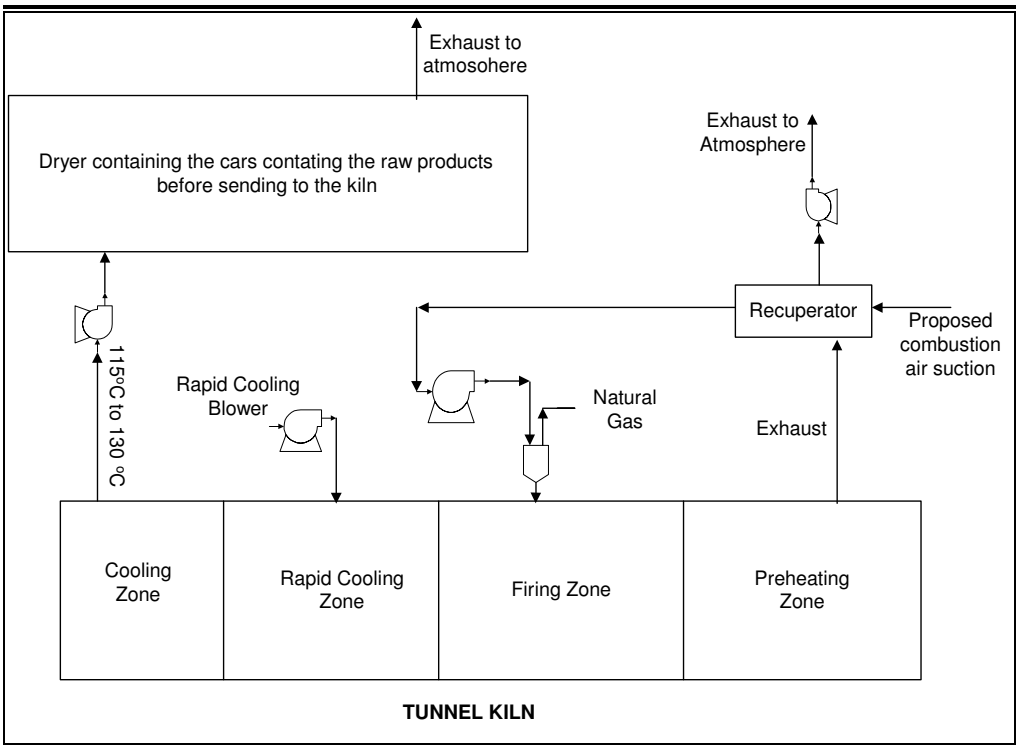
Annexure -2: Process flow diagram



Annexure -3: Detailed technology assessment report

S.No.	Particular	Unit	Existing Technology	Proposed Technology
1	Working day in a year	days	321	321
2	Natural Gas Consumption	SCM/day	1800	1665.4
3	Gross calorific value of Natural Gas	KCal/SCM	8800	8800
4	Specific heat of combustion air	KCal/kg^{0}C	0.24	0.24
5	Density of air	Kg/m^3	0.91	0.91
6	Rapid cooling air blower flow rate	m^3/hr		2,826
7	Heat gain by material	KCal/ hr		49,375
8	Equivalent natural gas saving	SCM/hour		5.61
9	Saving in natural gas consumption	SCM/day		134.6
10	Saving in natural gas consumption	%		7.5
11	Saving in natural gas consumption	SCM/year		43,382
12	Cost of natural gas	₹ SCM		15
13	Monetary saving	₹ (in lakh)		6.50

Annexure -4 Drawings for proposed electrical & civil works



Annexure -5: Detailed financial analysis as mentioned in subhead 4.3 in Chapter-4

Assumption

Name of the Technology	***Fabrication of tunnel kiln***		
Rated Capacity	***13.5 MT/day***		
Details	***Unit***	***Value***	***Basis***
Installed Capacity	MT	13.5	Feasibility Study
No of working days	Days	321	Feasibility Study
No of Shifts per day	Shifts	1	Feasibility Study
Capacity Utilization Factor	%		Feasibility Study
Proposed Investment			
Plant & Machinery	₹ (in lakh)	5.00	Feasibility Study
Erection & Commissioning	₹ (in lakh)	0.75	Feasibility Study
Investment without IDC	₹ (in lakh)	5.75	Feasibility Study
Interest During Implementation	₹ (in lakh)	0.14	Feasibility Study
Other Cost (Misc.)	₹ (in lakh)	0.75	Feasibility Study
Total Investment	₹ (in lakh)	6.64	Feasibility Study
Financing pattern			
Own Funds (Equity)	₹ (in lakh)	1.66	Feasibility Study
Loan Funds (Term Loan)	₹ (in lakh)	4.98	Feasibility Study
Loan Tenure	years	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%	10.00%	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	10.00%	Feasibility Study
Annual Escalation	%	5.00%	Feasibility Study
Estimation of Revenue			
Gas savings	SCM	43382	
Cost	₹ /SCM	15	
St. line Depn.	%	5.28%	Indian Companies Act
IT Depreciation	%	80.00%	Income Tax Rules
Income Tax	%	33.99%	Income Tax

Estimation of term loan

₹ (in lakh)

Years	Opening Balance	Repayment	Closing Balance	Interest
1	4.98	0.36	4.62	0.45
2	4.62	0.96	3.66	0.42
3	3.66	1.08	2.58	0.31
4	2.58	0.96	1.62	0.21
5	1.62	1.08	0.54	0.11
6	0.54	0.54	0.00	0.02
		4.98		

WDV Depreciation

₹ (in lakh)

Particulars / years	1	2	3	4
Plant and Machinery				
Cost	5.89	1.18	0.24	0.05
Depreciation	4.72	0.94	0.19	0.04
WDV	1.18	0.24	0.05	0.01

Projected Profitability

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	Total
Revenue through Savings							
Fuel savings	6.51	6.51	6.51	6.51	6.51	6.51	39.04
Total Revenue (A)	6.51	6.51	6.51	6.51	6.51	6.51	39.04
EXPENSES							
O & M Expenses	0.66	0.70	0.73	0.77	0.81	0.85	4.52
Total Expenses (B)	0.66	0.70	0.73	0.77	0.81	0.85	4.52
PBDIT (A)-(B)	5.84	5.81	5.77	5.74	5.70	5.66	34.52
Interest	0.45	0.42	0.31	0.21	0.11	0.02	1.52
PBDT	5.39	5.39	5.46	5.52	5.59	5.64	33.00
Depreciation	0.35	0.35	0.35	0.35	0.35	0.35	2.10
PBT	5.04	5.04	5.11	5.17	5.24	5.29	30.90
Income tax	-	1.51	1.79	1.86	1.90	1.92	8.99
Profit after tax (PAT)	5.04	3.53	3.32	3.31	3.34	3.37	21.91

Computation of Tax

₹ (in lakh)

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*
Profit before tax	5.04	5.04	5.11	5.17	5.24	5.29
Add: Book depreciation	0.35	0.35	0.35	0.35	0.35	0.35
Less: WDV depreciation	4.72	0.94	0.19	0.04	-	-
Taxable profit	0.68	4.45	5.27	5.49	5.59	5.64
Income Tax	-	1.51	1.79	1.86	1.90	1.92

Projected Balance Sheet

Particulars / Years	1	2	3	4	5	6
LIABILITIES						
Share Capital (D)	1.66	1.66	1.66	1.66	1.66	1.66
Reserves & Surplus (E)	5.04	8.57	11.89	15.20	18.53	21.91
Term Loans (F)	4.62	3.66	2.58	1.62	0.54	0.00
TOTAL LIABILITIES (D)+(E)+(F)	11.33	13.89	16.13	18.48	20.74	23.57

Assets

Gross Fixed Assets	6.64	6.64	6.64	6.64	6.64	6.64
Less : Accm. depreciation	0.35	0.70	1.05	1.40	1.75	2.10
Net Fixed Assets	6.29	5.94	5.59	5.24	4.89	4.54
Cash & Bank Balance	5.03	7.95	10.54	13.24	15.85	19.03
TOTAL ASSETS	11.33	13.89	16.13	18.48	20.74	23.57
Net Worth	6.70	10.23	13.55	16.86	20.20	23.57
Debt Equity Ratio	0.69	0.36	0.19	0.10	0.03	0.00

Projected Cash Flow

₹ (in lakh)

Particulars / Years	***0***	***1***	***2***	***3***	***4***	***5***	***6***
Sources							
Share Capital	1.66	-	-	-	-	-	-
Term Loan	4.98						
Profit After tax		5.04	3.53	3.32	3.31	3.34	3.37
Depreciation		0.35	0.35	0.35	0.35	0.35	0.35
Total Sources	6.64	5.39	3.88	3.67	3.66	3.69	3.73
Application							
Capital Expenditure	6.64						
Repayment Of Loan	-	0.36	0.96	1.08	0.96	1.08	0.54
Total Application	6.64	0.36	0.96	1.08	0.96	1.08	0.54
Net Surplus	-	5.03	2.92	2.59	2.70	2.61	3.19
Add: Opening Balance	-	-	5.03	7.95	10.54	13.24	15.85
Closing Balance	-	5.03	7.95	10.54	13.24	15.85	19.03

IRR

₹ (in lakh)

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***	***6***
Profit after Tax		5.04	3.53	3.32	3.31	3.34	3.37
Depreciation		0.35	0.35	0.35	0.35	0.35	0.35
Interest on Term Loan		0.45	0.42	0.31	0.21	0.11	0.02
Salvage / Realisable value					0.66		-
Cash outflow	(6.64)	-	-	-	-	-	-
Net Cash flow	(6.64)	5.84	4.30	3.98	4.54	3.80	3.74
IRR	***70.74%***						

NPV	***12.78***

Break Even Point

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***
Variable Expenses						
Oper. & Maintenance Exp (75%)	0.50	0.52	0.55	0.58	0.61	0.64
Sub Total **(G)**	0.50	0.52	0.55	0.58	0.61	0.64
Fixed Expenses						
Oper. & Maintenance Exp (25%)	0.17	0.17	0.18	0.19	0.20	0.21
Interest on Term Loan	0.45	0.42	0.31	0.21	0.11	0.02
Depreciation **(H)**	0.35	0.35	0.35	0.35	0.35	0.35
Sub Total **(I)**	0.97	0.94	0.85	0.76	0.67	0.58
Sales **(J)**	6.51	6.51	6.51	6.51	6.51	6.51
Contribution (K)	6.01	5.98	5.96	5.93	5.90	5.87
Break Even Point **(L= G/I)**	16.08%	15.77%	14.23%	12.77%	11.28%	9.84%
Cash Break Even {**(I)-(H)**}/**(K)**	10.25%	9.90%	8.34%	6.86%	5.34%	3.87%
BREAK EVEN SALES **(J)*(L)**	1.05	1.03	0.93	0.83	0.73	64.05%

Return on Investment

₹ (in lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***Total***
Net Profit Before Taxes	5.04	5.04	5.11	5.17	5.24	5.29	30.90
Net Worth	6.70	10.23	13.55	16.86	20.20	23.57	91.11
ROI	33.91%						

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***Total***
CASH INFLOW							
Profit after Tax	5.04	3.53	3.32	3.31	3.34	3.37	21.91
Depreciation	0.35	0..35	0.35	0.35	0.35	0.35	0.35
Interest on Term Loan	0.45	0.42	0.31	0.21	0.11	0.02	1.52
TOTAL**(M)**	5.84	4.30	3.98	3.87	3.80	3.74	25.54

DEBT

Interest on Term Loan	0.45	0.42	0.31	0.21	0.11	0.02	1.52
Repayment of Term Loan	0.36	0.96	1.08	0.96	1.08	0.54	4.98
TOTAL**(N)**	0.81	1.38	1.39	1.17	1.19	0.56	6.50
Average DSCR	***3.93***						

Annexure -6: Details of procurement and implementation

S. No.	Activities	Weeks				
		1	2	3	4	5
1	Designing					
2	Fabrication as per design.					
3	Commissioning					

Annexure:-7 Break up of process down time.

S. No.	Activities	Number of Days				
		1	2	3	4	5
1	Time period required for cooling down of tunnel kiln					
2	Dismantling and installation for piping system					
3	Insulation and commissioning					

Annexure -8: Details of technology service providers

S.No.	Technology	Name of Service Provider	Address	Contact Person and No.
1.	Fabricator of tunnel kiln	Payal Allien Engineering	Morbi	Mr. Hasmukh Patel - 09427934644

Annexure -9: *Technical Specifications*/Quotation for proposed technology

Technical Specifications:

Implementation of this project requires the design of a structure i.e dryer along with the pipeline arrangement with proper insulation. Design of this project, varies from industry to industry according to the dimensions of kiln cars, space availability etc.

Based on the available data during our audit, we had calculated the proposed dimensions for the implementation of this project for one typical sanitary ware unit.

Dimensions of dryer:

- Length of dryer (equal to half of length of tunnel kiln) = 25 m
- Width of dryer (equal to width of tunnel kiln) = 1.8 m
- Height of dryer (equal to height of tunnel kiln) = 2.33 m

Piping arrangement and insulation details

Pipe line of length of about 5 m is to be provided from the exhaust of cooling zone of tunnel kiln to the dryer. The material of construction used is MS.

Type of insulation used is Glass wool having a thickness of 2 inches.

One ID blower of the following specifications will be required

Rated Flow = 12000 m3/hr

Rated Pressure = 20 mm Hg

Rated Power, HP = 10

Operating temperature = 120 ^{o}C

Quotation for proposed technology

J.P. DAVE

Specialist for :- Low thermal, Mass Insulation,Ceramic Kiln.
Mobile : 98256 28879, Phone : (O)

8/Shakti Chambers, N.H. 8-A, MORBI (Guj.) India, Pin Code 363642.

Ref. :

Date : 21/04/2010.

To
See - tech. solution P.Ltd.
NAGPUR.

Res. Sir,
We are service provider in Tunnel kiln JOBS for CERAMICS Industries in following Consern Technologies.

- Fabrication of Tunnel kiln JOBS.
- Ceramic kiln Brick work and Low themal mass insulation.
- Comb. equipamenrts & Machineries. (waste heat recovery)

Note:- JOB work charges we offer on visit partey site all varibles.

J.P. DAVE

Standard application form for financial assistance to existing units
(upto and including Rs. 50 lakh)

I Applicant details

1	Name of Unit	
2	Address for correspondence	
3	Constitution	
4	SSI Registration. No.	
5	Date of Incorporation	
6	Date of Commencement of Operations	
7	Activity / Industry	

	Registered Office	Factory / Service Establishment (existing)	Factory / Service Establishment (proposed)
Full Address			
Contact Person(s)			
Tel No.			
Fax No.			
E mail address			

II Promoters/Directors

Bio-data of all the promoters/directors of the unit (Preferably make separate sheet for each promoter/director)

Promoter/Director	
Name	
Full Address(incl Tel no./ mobile no)	
Age	
Passport No.	
Father's / husband's name	
Qualification	
Experience	
Functional responsibility in the unit	
Relationship with Chief Promoter	
Shareholding in the unit	
Net worth	

Pl. furnish details of any other shareholder having more than 5% in the unit.

III. Products Manufactured

Sl. No.	Product	Installed capacity p.a.	Present capacity utilisation	End use of product	Export orientation
					Yes/ No

IV. Existing Facilities with Banks /FIs incl. SIDBI

a	Name of the Bank(s) / FI, Branch,	
b	Dealing person and contact tel. no.(s)..	
c	Dealing since (each Bank / FI)	

Facilities enjoyed :

Nature of facility (bankwise)	Amount (Rs. lakh)		Rate of interest	Nature of Security and value
	Sanctioned	Outstanding as on ___		
Fund based				
-Term Loan				
-Working capital				
Non Fund Based				

Are there any defaults ? Yes/No

V. Financial Position of applicant unit/ associate concern

(Rs. lakh)

	Net-worth			Sales			Net profit		
	Y1	Y2	Y3	Y1	Y2	Y3	Y1	Y2	Y3
Applicant unit									
Associate concern I									
Associate concern II									

Details of Associate concerns to be given as per **Annexure I**.

VI. Project Details

6.1. Purpose for which assistance now required :

	Purpose	
1	Indicate whether Expansion /diversification / modernisation and details	Technology Upgradation for Energy Efficiency
2	If new products envisaged give details	N/A
3	Details of expected incremental qualitative / quantitative benefits	Saving in the fuel bill to the extent of 20-25% leading to commensurate improvement in the bottom line of the applicant unit.
4	Expected month/year of implementation	10 months
5	No. of employees existing and additional	

Cost of Project (Rs. Lakh)

Sr. No.	Details	Total Amount
1	Civil Works	0.00
2	Plant & Machinery (incl. installation) * -Indigenous -Imported	5.00
3	Erection & commisioning charge	0.75
4	Preliminary & pre-operative expenses	0.14
5	Contingency provision, if any (basis)(includes insulation, electrical work etc.)	0.75
	TOTAL	6.64
** Details of Plant and machinery/ Misc. fixed assets at **Annexure II and III***		

Indicate details of expenditure already incurred, if any and how the expenditure was financed ?

6.3. **Means of Finance**

(Rs. Lakh)

Sr. No.	Details	Total
1	Additional share capital / Internal accruals	1.66
2	Interest free Unsecured Loans	
3	Term Loan proposed from SIDBI / Banks	4.98
	Total	6.64

6.4 Whether additional Working Capital required for the unit. If yes, amount and arrangements proposed may be indicated:

6.5 **Technology**

S. No.	Item	
1	Any Technical collaboration? If yes, details	
2	Details of main technical professionals employed	
3	Any quality certification obtained ? If yes enclose certificate.	

6.6 **Raw material / Labour/ Utilities**

1	Raw material (Details, arrangement, sources and distance)	
2	Power	Connected Load Utilised load Requirement of power for Additional machines Back-up arrangement (DG)
3	Other critical inputs if any	

6.7 **Marketing & Selling Arrangements**

Items	Applicants remarks
Main Markets (Locations)	
Main buyers, Indicate clearly if the unit is relying on a single buyer	
Indicate competitors	
Whether product has multiple applications	
Distribution channels (e.g. direct sales, retail network, distribution network)	
Marketing team details, if any.	
Orders on hand (enclose copies)	

6.8 **Projected profitability** : Statement to be enclosed as per **Annexure IV**.

6.9 **Others**

Items	
Please indicate the various licenses / consents for the project / unit already obtained from the respective authorities	
Please indicate licenses / consents for the project / unit that are yet to be obtained.	
Category as per pollution control dept. If polluting, pollution control measures taken	
Whether the project is entitled for any govt. subsidy, tax exemptions. Details thereof	
Repayment period (in months) sought including repayment holiday requested, if any,	
Details of Collateral security offered and value (basis).	
List of guarantors for the proposed loan	

Enclose documents as indicated in the check list at Annexure V.

6.10 **Strengths / Weaknesses of the borrower** (such as market standing, product/ service differentiation, technical expertise, infrastructure facilities etc.)

Strengths	

Weaknesses	

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 application; 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**

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.
Fabrication of tunnel kiln	Payal Allien Engineering Morbi Mr. Hasmukh Patel - 09427934644	3 Weeks	5.00	Pre heating of materials	Crediability of the Technolgy Provider	

- Furnish competitive quotations, catalogues / invoice for each machinery proposed to be acquired
- In case of second hand /fabricated machinery, indicate the need / reasons for acquiring such machinery. Also enclose Chartered Engineer's certificate regarding residual value and life in respect of second hand machinery.

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 a whole*

S.No.	Item	Actuals for previous year	Y1	Y2	Y3	Y4	Y5	Y6	TOTAL
1	Total Income		6.51	6.51	6.51	6.51	6.51	6.51	39.04
2	Raw materials								
	Power and fuel								
	Wages and salaries								
	Selling expenses								
	Other expenses		0.66	0.70	0.73	0.77	0.81	0.85	4.52
	Total Cost		0.66	0.70	0.73	0.77	0.81	0.85	4.52
3	Profit before depreciation, Interest and taxes (PBDIT) (2 - 1)		5.84	5.81	5.77	5.74	5.70	5.66	34.52
4	Interest on Term Loan		0.45	0.42	0.31	0.21	0.11	0.02	1.52
5	Interest on Working Capital								
6	Interest on unsecured loans								
7	Depreciation		0.35	0.35	0.35	0.35	0.35	0.35	2.10
8	Profit before Tax (3 - 4 - 5 - 6 - 7)		5.04	5.04	5.11	5.17	5.24	5.29	30.90
9	Tax		-	1.51	1.79	1.86	1.90	1.92	8.99
10	Profit after Tax (8 - 9)		5.04	3.53	3.32	3.31	3.34	3.37	21.91
11	Dividends/ Withdrawals								
12	Cash Accruals (10 - 11 + 7)		5.39	3.88	3.67	3.66	3.69	3.72	24.01
13	Repayments of all term liabilities (Principal)		0.36	0.96	1.08	0.96	1.08	0.54	4.98
14	Debt Service Coverage Ratio ((10+7+4)/(13+4))		7.22	3.12	2.86	3.30	3.19	6.74	
15	Average DSCR (Total of 10+7+4 for projected period/(Total of 13+4 for projected period)		3.93						

* Please give projections for the entire tenure of SIDBI / Bank loan.

Annexure V

CHECK LIST of documents to be submitted along with the application

S. No.	Documents	Y/N	Reasons for Non-submission
1	SSI Regn. / CA certificate certifying SSI status		
2	Certified copies of Memorandum & Articles of association / Partnership Deed		
3	Audited financial results for the last three years of Applicant unit		
4	Copies of lease deed / sale deed on which the unit is situated		
5	Copies of sanction letters from commercial banks / FIs which have sanctioned assistance to the unit		
6	NOC from pollution control board/consent letter, if applicable		
7	IT Returns/Assessment orders/Sales tax returns of the Applicant Unit/ promoters/directors for 2 years		
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		

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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

SEE-Tech Solutions Pvt. Ltd
11/5, MIDC, Infotech Park,
Near VRCE Telephone Exchange,
South Ambazari Road,
Nagpur – 440022
Website: www.letsconserve.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