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Cluster: Khurja
Report ID: KH/02/DPR

Detailed Project Report (DPR) on High alumina ball mill

Pasupatinath Industries

Khurja (Uttar Pradesh)

Prepared for

Bureau of Energy Efficiency
(13/GEF-UNIDO-BEE/LSP/14/4562)

The Energy and Resources Institute

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For more information

GEF-UNIDO-BEE PMU
Bureau of Energy Efficiency
4th Floor, Sewa Bhawan, Sector-1,
R.K. Puram, New Delhi-110066

Email: gubpmu@beenet.in
pmc@teri.res.in
Website: www.beeindia.gov.in
www.teriin.org

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This document is an output of an exercise undertaken by TERI under the GEF-UNIDO-BEE project's initiative for the benefit of MSME units and is primarily intended to assist the decision making by the management of the intended unit for the proposed technology. While every effort has been made to avoid any mistakes or omissions, GEF, UNIDO, BEE or TERI would not be in any way liable to any person or unit or other entity by reason of any mistake/omission in the document or any decision made upon relying on this document.

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The Energy and Resources Institute (TERI)
New Delhi

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List of abbreviations

BEE	:	Bureau of Energy Efficiency
CO_2	:	Carbon Dioxide
D/E	:	Debt /Equity
DPR	:	Detailed Project Report
DSCR	:	Debt Service Coverage Ratio
EE	:	Energy Efficient
GEF	:	Global Environmental Facility
GHG	:	Greenhouse Gas
HSD	:	High Speed Diesel
IDC	:	Investment without interest defer credit
IGDPR	:	Investment Grade Detailed Project Report
IRR	:	Internal Rate of Return
kW	:	Kilo Watt
kWh	:	Kilo Watt Hour
LSPs	:	Local Service Providers
MSME	:	Micro, Small and Medium Enterprises
MT	:	Metric Tonne
NG	:	Natural Gas
NPV	:	Net Present Value
O&M	:	Operation and Maintenance
RE	:	Renewable Energy
ROI	:	Return On Investment
SME	:	Small and Medium Enterprises
SPP	:	Simple Payback Period
TERI	:	The Energy and Resources Institute
Toe	:	Tonnes of oil equivalent
UNIDO	:	United Nations Industrial Development Organization
WACC	:	Weighted Average Cost of Capital

Executive summary

The overall aim of the GEF-UNIDO-BEE project 'Promoting Energy Efficiency (EE) and Renewable Energy (RE) in selected MSME clusters in India' is to develop and promote a market environment for introducing energy efficiency and enhancing the use of renewable energy technologies in process applications in selected energy-intensive MSME clusters in India. This would help in improving the productivity and competitiveness of the MSME units, as well as in reducing the overall carbon emissions and improving the local environment.

Under the GEF-UNIDO-BEE Project, TERI has been entrusted to undertake Capacity building of Local Service Providers (LSPs) to BEE. The Scope of Work under the project:

- Organizing 4 one-day training/ capacity building workshops for LSPs in each cluster.
- Development of 10 bankable DPRs for each cluster, based on mapping technology needs with capacities of local technology suppliers/service providers, and also replication potential and applications to banks in each cluster.

Brief introduction of the MSME unit

Name of the unit	M/s Pasupatinath Industries
Constitution	Proprietorship
MSME Classification	Small
No. of years in operation	-
Address: Registered Office:	Near Nehrupur Chungi, Murari Nagar, G T Road, Khurja - 203131, Bulandshahr, Uttar Pradesh
Industry-sector	Ceramic
Products manufactured	Crockeries, mugs
Name(s) of the promoters/ directors	Mr Gopal Krishna

A detailed assessment study was undertaken in the identified area with the use of the sophisticated handheld instruments. Energy consumption pattern and production data were collected to estimate the specific energy consumption of the unit. The unit level baseline of the unit was also estimated using the historical data. The plant is consuming about 1,96,592 kWh of electricity per year. The annual consumption of the fuel oil is 137.5 kL and HSD is 5,000 litres. The total energy consumption of the unit during last 12 months is estimated to be 155.3 toe which is equivalent to 89.2 lakh rupees. The total CO_2 emission during this period is estimated to be 570 tonnes. Electricity, HSD and fuel oil were considered for CO_2 emission estimation.

The unit manufactures the ceramic sanitary ware. The average production of the unit during 2017-18 is estimated to be 40,000 pieces per day.

Accepted/ recommended technology implementation

The recommended technology considered after discussion with the plant personnel for implementation in the unit is given below.

Technology	Annual energy saving Electricity (kWh)	Investment (Rs lakh)	Monetary savings[1] (Rs lakh/ year)	Simple payback period (Years)	Emission reduction (tonnes of CO_2)
Replacement of existing ball mill media and lining with high grade alumina media and lining	6,048	1.89	0.88	2.2	5.0

Other benefits

- The proposed project is not expected to bring in any change in process step or operating practices therefore no change expected in the product quality.
- Implementation of the selected technology in the unit may result in reduction in CO_2 emissions.

Cost of project & means of finance

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	1.90	1.97	1.95
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	23.04	17.26	18.89
4	NPV	Rs. In Lakh	0.64	0.33	0.42
5	DSCR	-	-	2.17	3.00

[1] Replacement of existing ball mill media and lining with high grade alumina media and distributed lining cost

1.0 Details of the unit

1.1 Particulars of unit

Table 1.1: Particulars of the unit

1	Name of the unit	M/s Pasupatinath Industries
2	Constitution	Proprietorship
3	Name of the contact person	Mr Gopal Krishan
4	Mobile / Ph. No	+91-9837051171
5	Email	-
6	Address: Registered office	Near Nehrupur Chungi, Murari Nagar. G T Road, Khurja - 203131, Bulandshahr, Uttar Pradesh
7	Factory	Near Nehrupur Chungi, Murari Nagar. G T Road, Khurja - 203131, Bulandshahr, Uttar Pradesh
8	Industry / Sector	MSME/Ceramic
9	Products manufactured	Crockeries, mugs
10	No of hours of operation/shift	8
11	No of shifts/ day	1
12	No of days/year	300
13	Installed capacity	50,000 pcs per day
14	Whether the unit is exporting its products (Yes/ No)	No
15	Quality certification, if any	-

2.0 Energy profile

2.1 Process flow diagram

Manufacturing of ceramic item uses wide range of raw material combination to produce different shape, size and colour. It requires both electrical and thermal energy at different stages of the process to operate the ball mill, casting/moulding, kilns, cutting & finishing machines and utilities such as motors, pumps air compressor etc. Ceramic manufacturing process primarily consists of mould preparation, body material preparation, shaping, drying and firing. Typical process flow chart is shown with figure 2.1.

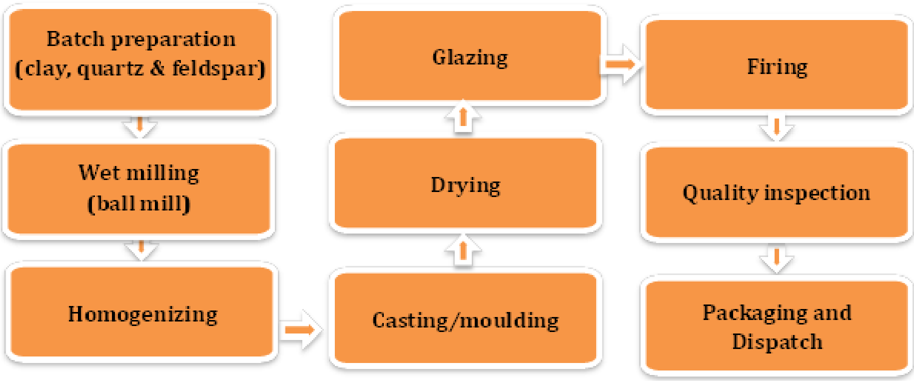


Figure 2.1: Process flow chart

2.2 Details of technology identified

The details of the existing technology installed in the unit are given in table 2.2.

Table 2.2: Details of existing technology

Parameters/ Equipment ID		Value
Equipment		Ball mill
Make		-
Purpose/Application		Homogenizing
Capacity		2 tonne
Operating hours per day		12
Mode of operation (batch/continuous)		Batch
Batch duration (hr)		4
Fuel details	Type	Electricity
	Consumption (units/day)	81

2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Paschimanchal Vidyut Vitaran Nigam Ltd. under the tariff category LMV6. The table 2.3 provides the details of energy used in the industry.

Table 2.3: Energy used and description of use

S No	Energy source	Description of use
1	Electricity	Motive power for different drives in different process sections and utilities
2	Fuel oil	Kiln

S No	Energy source	Description of use
3	HSD	Generator backup power

2.4 Energy sources, availability & tariff details

Different energy sources, availability of listed energy types and their respective tariffs are given in table 2.4.

Table 2.4: Energy sources, availability and tariffs

Particular	LMV6	
Fixed charges	• Up to 4 kW	: Rs. 245/kW/month
	• Above 4 kW to 9 kW	: Rs. 255/kW/month
	• Above 9 kW	: Rs. 275/kW/month
Energy charges	• Up to 1,000 kWh/month	: Rs. 7.00/kWh
	• Up to 2,000 kWh/month	: Rs. 7.35/kWh
	• Above 2,000 kWh/ month	: Rs. 7.60/kWh
TOD Charges	**Summer Months (April to September)**	
	• 05:00 hrs-11:00 hrs	: (-) 15%
	• 11:00 hrs-17:00 hrs	: 0%
	• 17:00 hrs-23:00 hrs	: (+) 15%
	• 23:00 hrs-05:00 hrs	: 0%
	Winter Months (October to March)	
	• 05:00 hrs-11:00 hrs	: 0%
	• 11:00 hrs-17:00 hrs	: 0%
	• 17:00 hrs-23:00 hrs	: (+) 15%
	• 23:00 hrs-05:00 hrs	: (-) 15%

2.5 Analysis of electricity consumption

Table 2.5: Electricity consumption profile

Month & Year	Electricity consumption (kWh)	Actual demand (kVA)	Monthly electricity bill (Rs)
May-18	15,836	64.8	1,44,556
Jun-18	16,880	56.0	1,43,149
Jul-18	16,432	53.6	1,39,095
Average	16383	58.1	1,42,267
Yearly	1,96,592	-	17,07,200

Figure 2.5 presents contract demand, recorded maximum demand and the energy consumption of the unit.

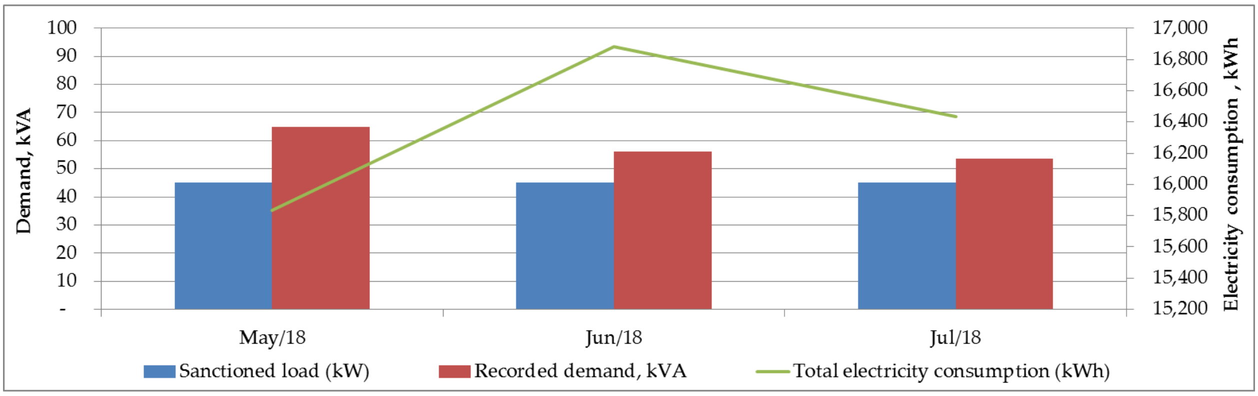


Figure 2.5: Demand pattern and energy consumption profile

2.6 Analysis of other energy forms/ fuels

The analysis of the other fuels/forms of energy used in the unit is given in table 2.6.

Table 2.6: Analysis of other energy/ fuel consumption

Parameters	Fuel oil (Ltrs)	HSD (Ltrs)
Consumption (unit/year)	1,37,500	5,000
Gross calorific value (per unit)	9765	8,300
Equivalent toe (per year)	134.3	4.2
Price (Rs per unit)	50.0	68.0
Total cost (lakh Rs per year)	68.75	3.4

The share of various energy forms used in the unit is given in figure 2.6.

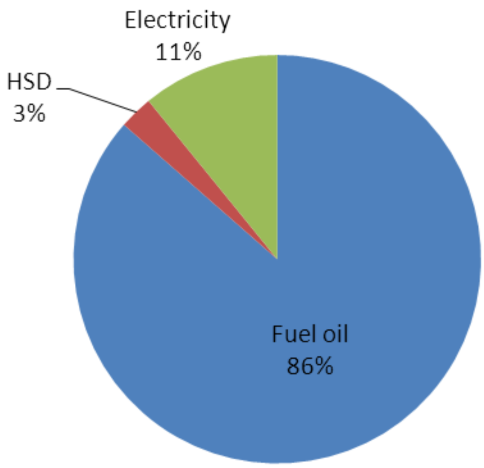


Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 196,592 kWh of electricity per year. The annual consumption of the fuel oil is 137 kL and HSD is 5,000 litres. The total energy consumption of the unit during last 12 months is estimated to be 155 toe which is equivalent to 89.2 lakh rupees. The total CO_2 emission during this period is estimated to be 570 tonnes. Electricity, HSD and fuel oil were considered for CO_2 emission estimation.

3.0 Proposed technology for energy efficiency

Based on the measurements, observations/ findings during detailed assessment study conducted in the unit, the following technology has been identified for energy efficiency improvement. The detail is given below.

3.1 Replacement of existing grinding media and lining with high alumina grinding media and lining

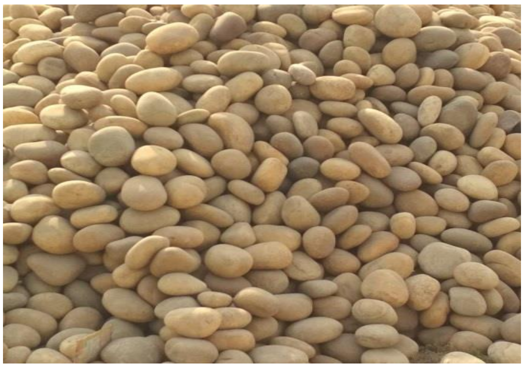
3.1.1 Background

The Pasupatinath Industries is manufacturer and supplier of crockeries and mugs. There are 5 number of ball mills in the unit. Two ball mills of 2 tonne capacity are used for glazing. Other three ball mills are used for clay preparation with two ball mills of 3 tonne capacity and the third one of 2 tonne capacity. The total connected load of the ball mills is 30 HP. These ball mills are operated continuously in batches. The average number of hours of operation of ball mills is 12 hours per day. The operational parameters such as electricity consumption and material loaded were monitored during the detailed assessment study.

Existing ball mill

3.1.2 Observations and analysis

In the existing ball mills, the grinding media used is mined stone pebble and inner lining is completed using refractory tiles, black cement and silica sand. The proposed grinding mill can have lining with alumina tiles using mortar of white cement and alumina powder which is expected to enhance lining life and batch consistency. Generally, mined or naturally available stoned pebbles are very regular in shape and size. Such uniform grinding media takes higher time for grinding and generates higher residue. A view of the existing and proposed grinding balls is shown below.



Existing mined stone pebble

Proposed high alumina ball

As compared with natural pebbles grinding media, the alumina grinding balls have better performance in terms of wear resistance, uniform size, high density and high mechanical strength. The high density and ultra-hardness of the alumina grinding ball enable increased loading of ball mill. The alumina grinding ball is compact and uniform in shape, the collide probability increased and grinding efficient increased. The alumina grinding ball can help in less contamination to the raw material and keep the chemical composition stabilized. Thus the alumina grinding ball is a better option for glaze grinding that ensures quality of production. A Comparison of existing and high alumina ball mill is provided in table 3.1.

Table 3.1: Comparison of existing ball mill and alumina ball mill

Parameter	Existing ball mill	Alumina ball mill
Outer shell	Mild steel	Mild steel
Inner lining tile material	Refractory	High alumina
Raw material of mortar	Black cement, silica sand	White cement, high alumina
Tile thickness	5 inch	2.5 inch
Mortar thickness	5 inch	2.5 inch
Grinding media	Mined stone pebble	High alumina ball
Annual replacement of ball	150%	40%
Gross lining cost	Low	High
Energy consumption	High	Low
Batch volume	Low	High
Overall first cost	Low	High
Lining life	6 years	12 years
Quality of grinding	Inconsistent	Consistent
Technology	Inferior	Superior

3.1.3 Recommendation

The industry may replace existing grinding system with energy efficient option with high alumina lining and balls for grinding application of same capacity that would help in reducing specific power consumption and overall operating cost. The cost benefit analysis of the proposed energy efficient alumina ball mills is provided in following sections.

3.2 Cost benefit analysis

The monetary saving from replacement of an existing grinding media using energy efficient high alumina milling system is Rs 0.88 lakhs per year with a simple payback period of 1.0 year. The detailed calculations of the recommended energy conservation measures for DPR are provided in table 3.2.

Table 3.2: Cost benefit analysis for energy savings measure

Parameter	Unit	Conventional	High alumina
Ball mill height	Inch	78	78
Ball mill diameter	Inch	72	72
Lining thickness	Inch	10	5
Tile thickness for lining	Inch	5	2.5
Quantity of raw clay material	tonne/batch	2.0	2.3
Quantity of grinding medium	tonne/batch	2.0	2.1
Quantity of water addition	tonne/batch	0.6	0.7
Total load/mass in ball mill	Tonne/batch	4.6	5.1
Connected motor rating	kW	11.2	11.2
Motor loading	%	60	60
Average power consumption	kWh/tonne	13.4	10.5

Parameter	Unit	Conventional	High alumina
No of operating hours	hr/day	12	10.8
Production	tonne/yr	1800	2070
SEC reduction	kWh/tonne		2.9
Annual energy saving	kWh/yr		6,048
Energy cost saving	Rs/yr		52,564
Cost of grinding ball	Rs/kg	25	50
Cost of new lining	Rs/ball mill	50000	103,500
Annual ball top-up	(%)	150	40
Top-up cost	Rs/yr	75000	41,400
Monetary saving from top up	Rs/yr		33,600
Capital investment			
Lining cost	Rs	44565	85947
Cost of grinding balls	Rs	50000	103500
Total investment for new system	Rs	145174	189447
Life of lining	year	5	12
Monetary saving from lining	Rs/year		1751
Annual monetary saving			
Energy cost saving	Rs/yr	52564	
Monetary saving from top up	Rs/yr	33600	
Monetary saving from lining	Rs/yr	1751	
Total saving	**Rs/yr**	**87915**	
Payback on incremental cost	year	2.2	

3.3 Pre-training requirements

There are no pre-training requirements for the proposed system.

3.4 Process down time for implementation

There is no process downtime required for implementation of the recommended measure since the unit has more than one ball mill and the modifications may be planned without affecting its regular operations.

3.5 Environmental benefits

3.5.1 CO_2 reduction[2]

Implementation of the selected energy conservation measures in the unit may result in reduction in CO_2 emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 5.0 tonnes of CO_2 per year.

3.5.2 Reduction in other pollution parameters (gas, liquid and solid)

There is not significant impact on the reduction in other pollution parameters including gas, liquid and solid.

[2] Source for emission factor: 2006 IPCC Guidelines for National Greenhouse Gas Inventories & for electricity: CO_2 Baseline Database for the Indian Power Sector, user guide version 12.0, May 2017 (CEA)

4.0 Project financials

4.1 Cost of project and means of finance

4.1.1 Particulars of machinery proposed for the project

The particulars of machinery proposed for the project is given in table 4.1.1.

Table 4.1.1: Particulars of machinery proposed for the project

S. No	Name of machinery (Model/ specification)	Name of manufacturer, contact person	Advantage	Disadvantage
1	Alumina grinding balls for Ball Mill Al_2O_3 percentage `68% $SiO_2 + Fe_2O_3 + CaO$ + others = 32% Water Absorption: = 0.02% Bulk Density (g/cm^3) = 3.00 Self-Wear Rate (24h) = 0.03%	Supercon Engineers Air Systems No. 293/4, Govindpuri, Kalkaji Govindpuri New Delhi - 110019 Delhi, India Mr. Harish Chauhan (08048077658)	-	-
2	Alumina grinding balls for Ball Mill Al_2O_3 percentage `68% $SiO_2 + Fe_2O_3 + CaO$ + others = 32% Water Absorption: = 0.02% Bulk Density (g/cm^3) = 3.00 Self-Wear Rate (24h) = 0.03%	Face Impex Private Limited No. 58/88, Shakti Chamber, 8A, National Highway Old Morbi Morbi - 363641 Gujarat, India Mr. Nitin Bopaliya (09714009174)	-	-
3	Alumina Lining & grinding balls for Ball Mill Al_2O_3 percentage `68%	Dhruvi Enterprise Sabarmati, Ahmedabad, Gujarat	-	-
4	Alumina Ball Mill Lining bricks	Jyoti Innovision Pvt. Ltd. Thaltej, Ahmedabad, Gujarat	-	-

4.1.2 Means of finance

The means of finance for the project is shown in table 4.1.2.

Table 4.1.2: Means of finance

(Rs Lakhs)

S. No.	Details	100% equity	D/E- 70:30	D/E- 50:50
1	Additional (Share) Capital	1.90	0.57	0.95
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	1.33	0.95
5	Others	-	-	-
	Total	**1.90**	**1.90**	**1.90**

4.2 Financial statement (project)

4.2.1 Assumptions

The assumptions made are provided in table 4.2.1.

Table 4.2.1: Assumptions made for financial calculations

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
General about unit				
No of working days	Days		300	
No of shifts per day	Shifts		1	
Annual operating hours	Hrs/year		3600	
Installed production capacity	tonnes/year		1800	
Production in last financial years	tonnes/year		1440	
Capacity utilization factor	%		80	
Proposed investment (Project)				
Total cost of the project	Rs. (in Lakh)	1.90	1.90	1.90
Investment without interest defer credit (IDC)	Rs. (in Lakh)	1.90	1.90	1.90
Implementation time	Months	6.00	6.00	6.00
Interest during the implementation phase	Rs. in lakhs	-	0.07	0.05
Total investment	Rs. in lakhs	1.90	1.97	1.95
Financing pattern				
Own funds	Rs. in lakhs	1.90	0.64	1.00
Loan funds (term loan)	Rs. in lakhs	-	1.33	0.95
Loan tenure	Years	-	5.0	5.0
Moratorium period (No EMI (interest and principal amount))	Months	-	6.0	6.0
Total repayment period	Months	-	66.0	66.0
Interest rate	%	-	10.5	10.5
Estimation of costs				
Operation & maintenance costs	%		5.0	
Annual escalation rate of O&M	%		5.0	
Estimation of revenue				
Reduction in energy cost	Rs. (in lakh)/year		0.88	
Total saving	(Rs Lakh/year)		0.88	
Straight line depreciation	%		16.21	
IT depreciation	%		80.0	
Income tax	%		33.99	
Period of cash flow analysis	Years		5.0	

4.2.2 Payback

The simple payback period on the investments made are shown in table 4.2.2.

Table 4.2.2: Payback analysis

Details	100% equity	D/E- 70:30	D/E- 50:50
Total project cost (Rs. In lakh)	1.90	1.97	1.95
Cash flow as annual saving (Rs. In lakh/year)	0.88	0.88	0.88
O&M Expenses for first year (Rs. In lakh/year)	0.10	0.10	0.10
Net Cash flow (Rs. In lakh/year)	0.79	0.78	0.78
SPP (months)	29.04	30.25	29.90
Considered (month)	29.00	30.20	29.90

4.2.3 NPV and IRR

The NPV and IRR calculations are shown in tables 4.2.3a, b and c.

Table 4.2.3a: NPV and IRR (100% equity)

Particulars / years	0	1	2	3	4	5
			(Rs.in lakhs)			
Profit after tax	-	0.48	0.56	0.22	0.20	0.20
Depreciation	-	0.31	0.31	0.31	0.31	0.31
Cash outflow	1.90	-	-	-	-	-
Net cash flow	-1.90	0.79	0.87	0.53	0.51	0.51
Discount rate % @ WACC	9.25	9.25	9.25	9.25	9.25	9.25
Discount factor	1.00	0.92	0.84	0.77	0.70	0.64
Present value	-1.90	0.72	0.73	0.41	0.36	0.32
Net present value	**0.64**					
Simple IRR considering regular cash flow	**23.04%**					

Table 4.2.3b: NPV and IRR (D/E – 7:3)

Particulars / years	0	1	2	3	4	5
	(Rs.in lakhs)					
Profit after tax	-	0.39	0.52	0.15	0.15	0.16
Depreciation	-	0.32	0.32	0.32	0.32	0.32
Cash outflow	1.97	-	-	-	-	-
Net cash flow	-1.97	0.71	0.83	0.47	0.47	0.48
Discount rate % @ WACC	10.09	10.09	10.09	10.09	10.09	10.09
Discount factor	1.00	0.91	0.83	0.75	0.68	0.62
Present value	-1.97	0.65	0.69	0.35	0.32	0.30
Net present value	**0.33**					
Simple IRR considering regular cash flow	**17.26%**					

Table 4.2.3c: NPV and IRR (D/E - 1:1)

Particulars / years	0	1	2	3	4	5

Particulars / years	0	1	2	3	4	5
	(Rs.in lakhs)					
Profit after tax	-	0.42	0.53	0.17	0.16	0.17
Depreciation	-	0.32	0.32	0.32	0.32	0.32
Cash outflow	1.95	-	-	-	-	-
Net cash flow	-1.95	0.73	0.84	0.49	0.48	0.49
Discount rate % @ WACC	9.86	9.86	9.86	9.86	9.86	9.86
Discount factor	1.00	0.91	0.83	0.75	0.69	0.62
Present value	-1.95	0.67	0.70	0.37	0.33	0.30
Net present value	**0.42**					
Simple IRR considering regular cash flow	**18.89%**					

4.3 Marketing & selling arrangement

The marketing and selling arrangements of the unit are given in table 4.3.

Table 4.3: Marketing & selling arrangements

Items	Remarks
Main Markets (locations)	All over India
Locational advantages	-
Indicate competitors	Other ceramic units
Any USP or specific market strength	-
Whether product has multiple applications	NA
Distribution channels (e.g. direct sales, retail network, distribution network)	Direct sales
Marketing team details, if any.	NA

4.4 Risk analysis and mitigation

The risk analysis and mitigation for the proposed options are given in table 4.4.

Table 4.4: Risk analysis and mitigation

Type of risk	Description	Mitigation
Technology	The equipment/technology provided by the supplier may not be of high quality, which may result in underperformance.	The equipment/technology should be procured from standard/reputed vendors only.
Market /Product	Demand of the product manufactured by the unit may change resulting in lower capacity utilization.	Regular vigilance/tab on the market scenario by the SME will help in better understanding of new substitute product. The unit may modify the product line based on the emerging market trend.
Policy/Regulatory	Changes in government regulation/policy related to pollution and taxes & duties can affect the viability of the unit.	Local industrial association may play a role in discussing these issues with the relevant governmental bodies on a regular basis, so that any concerns of the unit are brought to their notice.

4.5 Sensitivity analysis

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different situations are given in table 4.5.

Table 4.5: Sensitivity analysis

S. No.	Scenario	D/E ratio	Payback period (months)	NPV (Rs lakh)	IRR (%)	DSCR	ROI (%)
1	10% increase in estimated savings	100% equity	26.10	0.87	27.62	-	17.02
		70:30	27.20	0.55	21.82	2.35	25.66
		50:50	26.90	0.64	23.45	3.26	22.04
2	10% reduction in estimated savings	100% equity	32.70	0.41	18.33	-	13.07
		70:30	34.10	0.11	12.53	1.98	19.89
		50:50	33.70	0.20	14.16	2.73	16.85
3	10% rise in interest rates	70:30	30.40	0.27	16.67	2.12	22.68
		50:50	30.00	0.37	18.46	2.93	19.42
4	10% reduction in interest rates	70:30	30.10	0.40	17.85	2.21	23.49
		50:50	29.80	0.47	19.32	3.06	19.92

5.0 Conclusions & recommendations

The DPR has been prepared for the replacement of existing grinding media and lining with high alumina grinding media and lining based on the performance assessment study conducted at the unit and the acceptance of the unit management. The brief of selected energy conservation measure is given below.

5.1 List of energy conservation measures

The brief summary of the energy conservation measures are given in table 5.1.

Table 5.1: Summary of the energy conservation measures

Technology	Annual energy saving Electricity (kWh)	Investment (Rs lakh)	Monetary savings[3] (Rs lakh/ year)	Simple payback period (Years)	Emission reduction (tonnes of CO_2)
Replacement of existing ball mill media and lining with high grade alumina media and lining	6,048	1.89	0.88	2.20	5.0

The measure has an estimated investment of 1.89 lakh rupees and can yield a savings of 0.88 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 5.0 tonnes of CO_2. The financial indicators provided above in the table shows the project is financially viable and technically feasible.

5.2 Summary of the project

The summary of the project is given in table 5.2.

Table 5.2: Summary of the project

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	1.90	1.97	1.95
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	23.04	17.26	18.89
4	NPV	Rs. In Lakh	0.64	0.33	0.42
5	DSCR	-	-	2.17	3.00

5.3 Recommendations

The financial indicators provided above show the project is financially viable and technically feasible. It is recommended that the implementation of the identified the energy conservation measure may be undertaken by the unit.

[3] Replacement of existing ball mill media and lining with high grade alumina media and distributed lining cost

6.0 Financing schemes for EE investments for MSME sector

Government of India has many schemes to provide concessional finance for EE technologies among MSMEs. Some major government schemes are summarised in table 6.1.

Table 6.1: Major government schemes

Name of the scheme	Brief Description and key benefits
ZED assessment and certification	Assessment process, fee and subsidy are as follows: Online (e-Platform) self-assessment: Nil fee Desk Top assessment : Rs 10,000 per SME Complete assessment : Rs 80,000 ZED rating per SME; Rs 40,000 for additional ZED defence rating; Rs 40,000 for re-rating The rating costs will include cost of Rs 10,000/- as certification cost by QCI. Subsidy for Micro, Small and Medium Enterprises are 80%, 60% and 50% respectively.
Credit Linked Capital Subsidy Scheme (CLCSS) (2000-ongoing)	15% capital subsidy of cost of eligible plant and machinery / equipment for adoption of proven technologies for approved products / sub-sectors for MSE units subject to ceiling of INR 15 lakhs
Credit Guarantee Fund Scheme for Micro and small Enterprises (in partnership with SIDBI) (2000-ongoing)	This scheme was launched by MoMSME and SIDBI to alleviate the problem of collateral security and enable micro and small scale units to easily adopt new technologies. Under the scheme, collateral free loans up to Rs 1 crore can be provided to micro and small scale units. Additionally, in the event of a failure of the SME unit which availed collateral free credit facilities to discharge its liabilities to the lender, the Guarantee Trust would guarantee the loss incurred by the lender up to 75 / 80/ 85 per cent of the credit facility.
Technology and Quality Up gradation Support to MSMEs (TEQUP) (2010-ongoing)	The benefits available to SMEs under TEQUP include—technical assistance for energy audits, preparation of DPRs and significant capital subsidy on technologies yielding an energy savings of over 15%. The scheme offers a subsidy of 25% of the project cost, subject to a maximum of Rs. 10 lakhs. TEQUP, a scheme under NMCP, focuses on the two important issues in enhancing competitiveness of the SME sector, through EE and Product Quality Certification.
Technology Upgradation Fund Scheme (TUFS) (1999-ongoing)	Interest subsidy and /or capital subsidy for Textile and Jute Industry only. 1. To facilitate Technology Up gradation of Small Scale (SSE) units in the textile and jute industries. Key features being: • Promoter's margin -15%; • Subsidy – 15% available on investment in TUF compatible machinery subject to ceiling of Rs 45 lakh; • Loan amount – 70% of the cost of the machinery by way of Term Loan

Name of the scheme	Brief Description and key benefits
	• Interest rate: Reimbursement of 5% on the interest charged by the lending agency on a project of technology upgradation in conformity with the Scheme • Cover under Credit Guarantee Fund Scheme for Micro and Small Enterprises (CGMSE) available 2. To enable technology upgradation in micro and small power looms to improve their productivity, quality of products and/ or environmental conditions • 20% margin subsidy on investment in TUF compatible specified machinery subject to a ceiling of Rs 60 lakhs or Rs 1crore (whichever is applicable) on subsidy amount to each unit – released directly to the machinery manufacturer.
Tax incentives	• Accelerated depreciation is provided to the customers / users of the energy saving or renewable energy devises under the direct tax laws. • Under indirect taxes, specific concessional rates of duty are only available to CFLs and not to all energy efficient products • A further waiver of import tariffs and taxes for EE technology imports are dealt on a case to case basis, meaning higher costs for those imported technologies that are not available in the domestic markets at present.

Two financing schemes have been created by Bureau of Energy Efficiency (BEE) under The National Mission for Enhanced Energy Efficiency (NMEEE) for financing of energy efficiency projects - Venture Capital for Energy Efficiency (VCFEE) and Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE). These funds seek to provide appropriate fiscal instruments to supplement the efforts of the government for creation of energy efficiency market. Highlights of these two schemes are provided in the table 6.2.

Table 6.2: BEE's VCFEE and PRGFEE scheme

Venture Capital for Energy Efficiency (VCFEE)	• This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. • A single investment by the fund shall not exceed Rs 2 crore • Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)	• A PRGF is a risk sharing mechanism lowering the risk to the lender by substituting part of the risk of the borrower by granting guarantees ensuring repayment of part of the loan upon a default event. • Guarantees a maximum 50% of the loan (only principal). In case of default, the fund will: o Cover the first loss subject to maximum of 10% of the total guaranteed amount o Cover the remaining default (outstanding principal) amount on

Venture Capital for Energy Efficiency (VCFEE)	• This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. • A single investment by the fund shall not exceed Rs 2 crore • Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
	partial basis upto the maximum guaranteed amount • PFI shall take guarantee from the PRGFEE before disbursement of loan to the borrower. • The Guarantee will not exceed Rs 300 lakh per project or 50% of loan amount, whichever is less. • Maximum tenure of the guarantee will be 5 years from the date of issue of the guarantee

Indian Renewable Energy Development Agency (IREDA), a non-banking financial institution established by the government also extends financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation. The detailed financing guidelines for energy efficiency projects are provided in table 6.3.

Table 6.3: IREDA's financing guidelines

Eligible companies who can apply	Private Sector Companies/ firms, Central Public Sector Undertaking (CPSU), State Utilities/ Discoms/ Transcos/ Gencos/ Corporations, Joint Sector Companies which are not loss making.
Minimum loan amount	• Rs. 50 lakh
Type of projects considered for term loans	• Replacement / retrofit of selected equipment with energy efficient equipment • Modification of entire manufacturing processing • Recovery of waste heat for power generation
Incentive available	• Rebate in central excise duty • Rebate in interest rate on term loan • Rebate in prompt payment of loan instalment
Interest rate	• 10.60% to 11.90% depending upon the grading of the applicant with prompt payment rebate of 15 bps if payment is made on / before due dates • Interest rates are floating and would be reset on commissioning of the project or two years from the date of first disbursement. Thereafter, the rates will be reset after every two years. • Rebate of 0.5% in interest rates are available for projects set up in North Eastern States, Sikkim, J&K, Islands, Estuaries. Rebates of 0.5% in interest rates are also available for projects being set up by SC/ST, Women, Ex Servicemen and Handicapped categories involving project cost of upto Rs. 75.00 lakh.
Loan	Upto 70% of the total project cost. Promoter's contribution should be Minimum 30% of the total project cost
Maximum debt	3:1

equity ratio	The project cash flow should have a minimum average Debt Service Coverage Ratio of 1.3
Maximum repayment period	12 years with moratorium of maximum 12 months
Procurement procedures	The borrower is required to follow the established market practices for procurement and shall demonstrate that the quality goods and services are being purchased at reasonable and competitive prices. Wherever the loan is sanctioned against international lines of credit such as the World Bank, Asian Development Bank, kfW, etc., the relevant procedures will have to be followed and requisite documents will have to be submitted by the borrower

Small Industries Development Bank of India (SIDBI) has several schemes and focused lines of credit for providing financial assistance for energy efficiency and cleaner production projects for SMEs. Highlights of some of the major financial assistance schemes/projects managed by SIDBI are given in table 6.4.

Table 6.4: Major EE financing schemes/initiatives of SIDBI

End to End Energy Efficiency (4E) Program	Support for technical /advisory services such as: • Detailed Energy Audit • Support for implementation • Measurement & Verification Financing terms: • Terms loans upto 90% • Interest rate upto 3% below normal lending rate.
TIFAC-SIDBI Revolving Fund for Technology Innovation (Srijan Scheme)	To support SMEs for up-scaling and commercialization of innovative technology based project at flexible terms and interest rate. Preference accorded to sustainable technologies / products. Soft term loan with an interest of not more than 5%.
Partial Risk Sharing Facility for Energy Efficiency (PRSF) Project (supported by World Bank)	Sectors covered: • Large industries (excluding thermal power plants) • SMEs • Municipalities (including street lighting) • Buildings Coverage: • The minimum loan amount Rs 10 lakh and maximum loan amount of Rs 15 crore per project. • The extent of guarantee is 75% of the loan amount
JICA-SIDBI Financing Scheme	• The loan is used to provide SMEs with funds necessary to invest in energy-saving equipment (and some medical equipment) in the form of two-step loans through SIDBI or three-step loans through intermediary financial institutions.

	• Project uses an Energy Saving Equipment List approach • Equipment/machinery with energy saving potential less than 10% is not eligible. • Interest rate: As per credit rating and 1% below the normal lending rate • Separate technical assistance component which is used for wetting of loan applications, holding seminars to raise awareness of energy saving among SMEs and to improve the ability of financial institutions to screen loan applications for energy-saving efforts
KfW-SIDBI Financing Scheme	Coverage a) SMEs for energy efficiency projects b) SMEs and clusters for cleaner production and emission reduction measures, waste management and Common Effluent Treatment Plant (CETP) facilities Interest rate As per credit rating and 1% below the normal lending rate Eligible criteria 3 t CO_2 emission reduction per year per lakh invested List of eligible equipment/technology and potential suppliers developed for guidance

State Bank of India (SBI) has been provided a green line of credit by Japan Bank for International Cooperation (JBIC) for financing of energy efficiency investments. Highlights of the line of credit are given in table 6.5.

Table 6.5: JBIC-SBI Green Line

Key Features

- Amount : USD 90 million
- Repayment Schedule: First repayment on May 30, 2017 and final repayment date May 30, 2025 (equal instalment)

Eligibility Criteria

- Projects contributing to preservation of global environment, i.e. significant reduction of GHG emissions
- Acceptance of JBIC-MRV ('J-MRV") by the project proponent in terms of the numerical effect of the environment preservation. To ensure effective GHG reduction emissions in Green financed projects, JBIC reviews such effects through simple and practical Measurement Reporting Verification (MRV) process both in (a) prior estimation and (b) ex-post monitoring.
- Procurement in line with the "Guidelines for Procurement under Untied Loans by Japan Bank for International Cooperation"

Canara bank has a dedicated scheme for financing EE investment among SME sector as mentioned in table 6.6.

Table 6.6: Canara bank scheme of EE SME loans

Purpose	**For acquiring/adopting energy conservation/savings equipment/ measures by SMEs**
Eligibility	Units under Small and Medium Enterprises Cost of energy for the unit should constitute not less than 20% of the total cost of production Unit should possess energy audit report issued by an approved energy Consultant/Auditor. Borrowal a/cs-ASCC code S1 or S2 during previous review. Current account holders having dealings exclusively with us satisfactorily for a period of last one year
Maximum loan	Maximum Rs 100 lakhs in the form of term loan
Security	Prime: Assets created out of loan Collateral: Upto Rs.5 lakhs – NIL Above Rs.5 lakhs, as determined by the bank
Repayment	Maximum 5-7 years including moratorium of 6 months
Guarantee cover	Cover available under CGMSE of CGTMSE available for eligible loans
Margin	10% of the project cost
Rate of interest	1% less than the applicable rate
Upfront fee	1% of the loan
Insurance cover	Assets acquired and charged as security to Bank to be insured
Special offer, if any	**Grants :** Bank provides 25% of the cost of Energy Audit / Consultancy charges with a maximum of Rs 25000/- to the first 100 units on a first come first served basis which is in addition to the grant of Rs 25000/- being provided by IREDA(First 100 units)

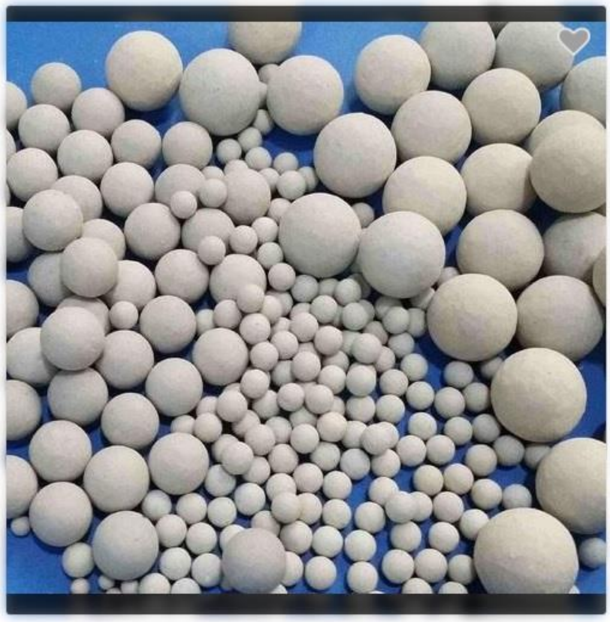
Among the private sector banks in India, Yes Bank is also active in financing of renewable energy and energy efficiency projects. The bank has an MOU with SIDBI for providing funding for EE through PRSF.

Most commercial banks charge interest rate between from 11% to 13% from MSMEs depending upon general criteria such as credit ratings, references, past lending record, balance sheet for last 3 years and so on. Interest rebate is offered for a few customers whose collateral value is around 125% of the loan amount. Further 0.5% concession in interest rate was offered to women entrepreneurs.

Annexures

Annexure 1: Budgetary offers / quotations

Quotation 1: Supercon Engineers Air Systems



Alumina Ceramic Balls

Material: Alumina Ceramic

Moh's Hardness: More than 9

Rs 55/Kilogram

Supercon Engineers Air Systems

Govindpuri, New Delhi, Delhi

Send to my mobile

Call this Supplier

08048077658

Response Rate:	97%
Nature of Business:	Manufacturer
Delivery Location:	All Over India

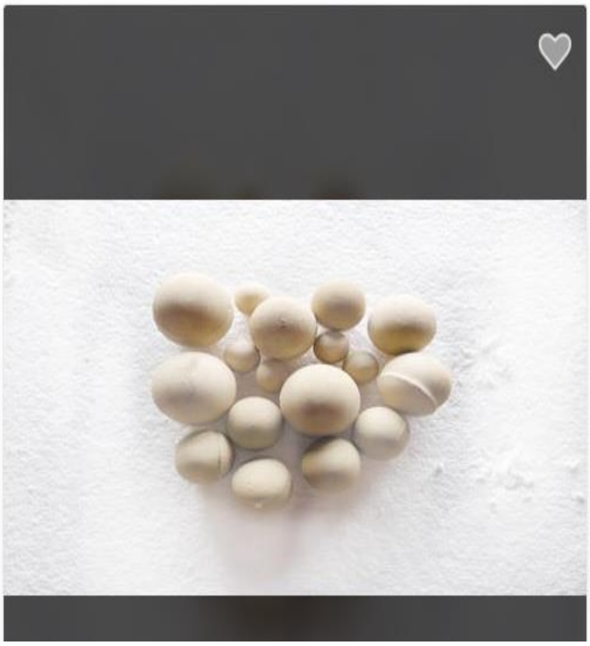
Contact Supplier
Have a question?

Get Latest Price
Request a quote

Product details:

Material	Alumina Ceramic
Moh's Hardness	More than 9

Quotation 2: Face Impex Pvt. Ltd.



Alumina Ceramic Balls

Physical State: solid

Grade Standard: Reagent Grade, Technical Grade

Rs 25/Kilogram

Face Impex Private Limited

Old Morbi, Morbi, Gujarat

Send to my mobile

Call this Supplier

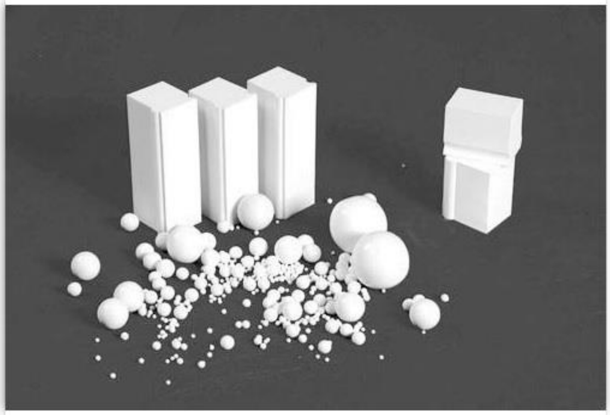
09714009174

Response Rate:	71%
Nature of Business:	Importer
Delivery Location:	Deals In India As Well As Global

Contact Supplier
Have a question?

Get Latest Price
Request a quote

Quotation 3: Dhruvi Enterprise



Alumina Balls And Bricks

Usage: Industrial

Rs 75/Kilogram

Dhruvi Enterprise

Sabarmati, Ahmedabad, Gujarat

Send to my mobile

Call this Supplier

08048606529

Response Rate: 75%

Nature of Business: Wholesale Trader

Delivery Location: All Over India

Contact Supplier – Have a question?

Get Latest Price – Request a quote

Product details:

Usage	Industrial

Quotation 4: Shaildeep Enterprise

Ball Mill Lining Bricks

Thickness: 30-90 mm

Color: White

Rs 100/Kilogram

Jyoti Innovision Private Limited

Thaltej, Ahmedabad, Gujarat

Send to my mobile

Call this Supplier

08048760852

Response Rate: 86%

Nature of Business: Manufacturer

Delivery Location: Deals In India As Well As Global

Contact Supplier – Have a question?

Get Latest Price – Request a quote

Product details:

Thickness	30-90 mm

Annexure 2: Instruments used

Instruments	Model/ Make	Application	Accuracy
Power analysers	Fluke: 435, Krykard ALM 10,	Electrical Parameters Harmonics analysis, power logging	± 0.5%