

Detailed Project Report (DPR) on Automatic jigger machines

Rajeev Pottery
Khurja (Uttar Pradesh)

Prepared for
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“Capacity Building of Local Service Providers”

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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 Rajeev Pottery
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	Ceramic mugs
Name(s) of the promoters/ directors	Mr Sandeep Mittal

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 1,76,408 kWh of electricity per year. The annual consumption of the fuel oil is 50 kL and HSD is 12,000 litres. The total energy consumption of the unit during last 12 months is estimated to be 74 toe which is equivalent to 48.5 lakh rupees. The total CO₂ emission during this period is estimated to be 319 tonnes. Electricity, HSD and fuel oil were considered for CO₂ emission estimation.

The unit manufactures different types of ceramic mugs. The average production of the unit during 2017-18 is estimated to be 20,000 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 manual jigger with double roller head automatic jigger	3,612	23.01	19.0	1.2	3.0

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 CO₂ 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	23.01	23.86	23.61
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	56.73%	50.41%	52.18%
4	NPV	Rs. In Lakh	29.19	25.04	26.21
5	DSCR	-	-	3.64	5.05

¹ Includes energy savings as well as revenues from increased yield

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 Rajeev Pottery
2	Constitution	Proprietorship
3	Name of the contact person	Mr Sandeep Mittal
4	Mobile / Ph. No	+91-9837054172
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	Ceramic mugs
10	No of hours of operation/shift	8
11	No of shifts/ day	1
12	No of days/year	250
13	Installed capacity	750 tonne per year
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.

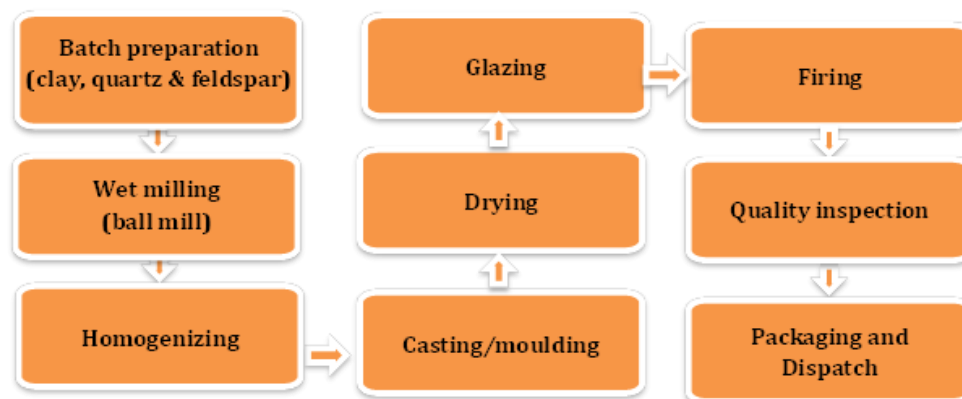


Figure 2.1: Process flow chart

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	Manual jigger machine
Purpose/Application	Green piece moulding
Capacity	24,000 pc/day
Operating hours per day	8
Mode of operation (batch/continuous)	Batch
Fuel details	Type Electricity
Consumption (units/day)	34

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
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	14,822	79.6	1,29,417
Jun-18	13,946	79.6	1,19,339
Jul-18	15,334	79.6	1,34,555
Average	14701	79.6	1,27,770
Yearly	1,76,408	-	15,33,244

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

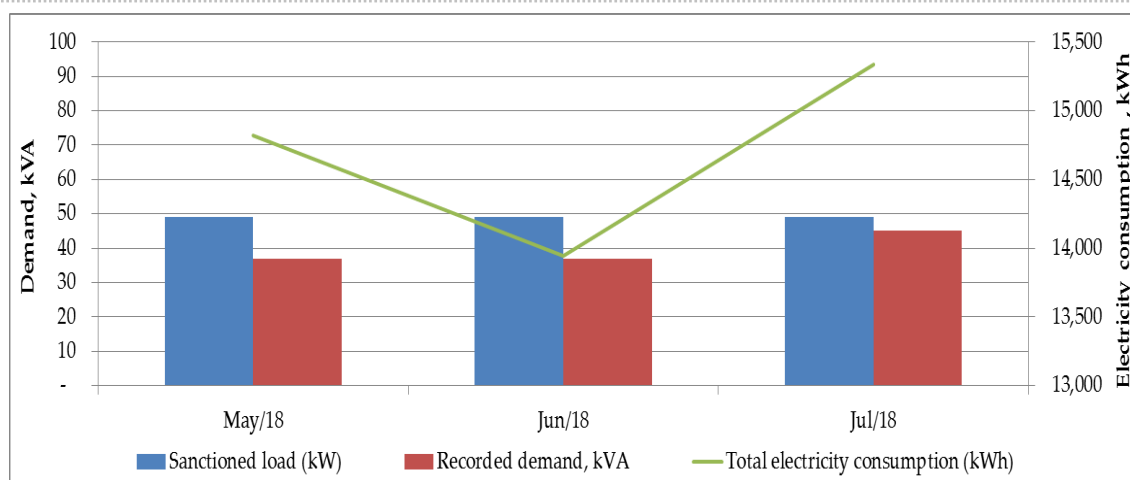


Figure 2.5: Demand pattern and energy consumption profile

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)	50,000	12,000
Gross calorific value (per unit)	9765	8,300
Equivalent toe (per year)	48.8	10.3
Price (Rs per unit)	50.0	68.0
Total cost (lakh Rs per year)	25.0	8.2

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

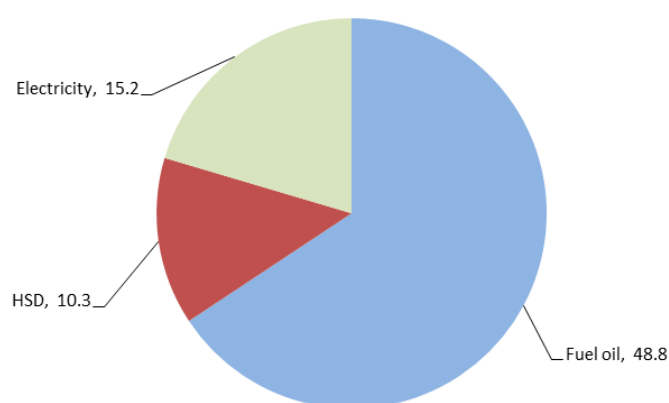


Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 176,408 kWh of electricity per year. The annual consumption of the fuel oil is 50 kL and HSD is 12,000 litres. The total energy consumption of the unit during last 12 months is estimated to be 74 toe which is equivalent to 48.5 lakh rupees. The total CO₂ emission during this period is estimated to be 319 tonnes. Electricity, HSD and fuel oil were considered for CO₂ 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

Rajeev Pottery is manufacturer and supplier of various types of ceramic mugs. The industry has installed manual jigger machines. The jigger machines are operated for about 8 hours per day. The average overall production from manual jigger machines is about 24,000 pieces per day. The operational parameters such as electricity consumption, production and rejections were monitored and collated during the detailed assessment study.



Existing manual jigger

3.1.2 Observations and analysis

The existing jigger machines are operated manually. About 8 jigger machines are connected on a common shaft with a connected load of 1.5 kW. Each jigger machine is operated by one skilled worker who loads, moulds and unloads the product from the jigger machine. Significant skill is required for operation of manual jigger machine. The average yield from manual jigger machine is about 85%.

As compared to manual jigger machine, automatic double roller head jigger machine is faster and produces moulded products of consistent quality. Hence, skilled workers are not required in case of auto jigger machines. It would require one semi-skilled worker for feeding the machine and one unskilled worker for removal of green pieces from the machine since the speed of automatic double head jigger machine is quite high. Thus the automatic double head jigger is a better option for manufacturing green mould pieces. A Comparison of existing manual jigger machine and automatic double head jigger machine is provided in table 3.1.2.



Automatic double roller head jigger machine

Table 3.1.2: Comparison of existing ball mill and alumina ball mill

Parameter	Existing ball mill	Alumina ball mill
Type of operation	Manual	Automatic
Speed of operation	Low	High
Type of worker required	Skilled	Semi-skilled and unskilled
Yield	85%	95%
Energy consumption	High	Low
Production volume	Low	High
Overall first cost	Low	High
Operating cost	High	Low
Quality of green product	Less consistent	More consistent
Technology	Inferior	Superior

3.1.3 Recommendation

The industry may replace existing manual jigger machines with efficient automatic double head jigger machines 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 existing manual jigger machine using efficient automatic double head jigger machine is Rs. 19.0 lakh per year. The investment for automatic jigger machine is Rs 23.01 lakh with a simple payback period of 1.2 years. 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	Automatic
Operating duration	hr/day	8	8
Connected load per machine	kW	1.5	1.5
Loading per machine	%	70	70
Total number of machines	Nos.	4	3
Annual energy consumption	kWh/yr	10,980	7,368
Average moulding production capacity	piece/day	24,000	24,000
Yield of green moulds	%	85	95
Yield after firing	%	90	98
Average kiln output	'000 piece/year	6000	6533
Additional production	' 000 piece/year		533
SEC for actual production	kWh/'000 piece	1.83	1.13
Annual energy savings	kWh/year		3,612
Annual monetary savings	Rs/year		31,381
Average product cost	Rs/piece	3.5	3.5
Additional revenue generation	Rs/year		18,66,667
Overall monetary savings			
Annual monetary savings	Rs/year		31,381
Additional Revenue generation	Rs/year		18,66,667
Overall monetary saving	Rs/year		18,98,047

Parameter	Unit	Conventional	Automatic
Capital investment			
Cost of auto jigger (including GST@18%)	Rs/set		7,67,000
Number of auto jigger required	(-)		3
Total investments	Rs		23,01,000
Simple payback period	Year		1.2
	month		16

3.3 Pre-training requirements

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

3.4 Process down time for implementation

The proposed system is table mounted, plugin and use type and hence there is no process downtime required for implementation of the recommended measure.

3.5 Environmental benefits

3.5.1 CO₂ reduction²

Implementation of the selected energy conservation measures in the unit may result in reduction in CO₂ emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 3.0 tonnes of CO₂ 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: CO₂ 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	Automatic jigger Number of roller head – 2 Total motor capacity-1.5 kW Speed adjustable	Hi-Tech Engineering Works, Bagh Rishaldar Police Chowki, Khaweash Gyan, Munda Khera Crossing, Khurja Dist. Bulandshahr, Uttar Pradesh	-	-

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	23.01	6.90	11.51
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	16.11	11.51
5	Others	-	-	-
Total		23.01	23.01	23.01

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		250	
No of shifts per day	Shifts		1	
Annual operating hours	Hrs/year		2000	
Installed production capacity	tonnes/year		1000	
Production in last financial years	tonnes/year		500	
Capacity utilization factor	%		67	
Proposed investment (Project)				

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
Total cost of the project	Rs. in lakhs	23.01	23.01	23.01
Investment without interest defer credit (IDC)	Rs. in lakhs	23.01	23.01	23.01
Implementation time	Months	6.00	6.00	6.00
Interest during the implementation phase	Rs. in lakhs	-	0.85	0.60
Total investment	Rs. in lakhs	23.01	23.86	23.61
Financing pattern				
Own funds	Rs. in lakhs	23.01	7.75	12.11
Loan funds (term loan)	Rs. in lakhs	-	16.11	11.51
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 lakh/year		18.98	
Total saving	Rs lakh/year		18.98	
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)	23.01	23.86	23.61
Cash flow as annual saving (Rs. In lakh/year)	18.98	18.98	18.98
O&M Expenses for first year (Rs. In lakh/year)	1.15	1.19	1.18
Net Cash flow (Rs. In lakh/year)	17.83	17.79	17.80
SPP (months)	15.49	16.09	15.92
Considered (month)	15.50	16.10	15.90

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	-	14.10	9.45	8.21	7.97	7.89
Depreciation	-	3.73	3.73	3.73	3.73	3.73

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	14.00	34.08	64.04	-	27.26
		70:30	14.50	29.83	57.53	3.97	36.34
		50:50	14.40	31.03	59.35	5.52	33.03
2	10% reduction in estimated savings	100% equity	17.30	24.29	49.34	-	23.93
		70:30	18.00	20.25	43.20	3.30	33.39
		50:50	17.80	21.39	44.92	4.58	29.79
3	10% rise in interest rates	70:30	16.20	23.92	49.78	3.56	34.86
		50:50	16.00	25.38	51.72	4.94	31.45
4	10% reduction in interest rates	70:30	16.00	26.20	51.05	3.72	35.19
		50:50	15.90	27.05	52.64	5.17	31.68

5.0 Conclusions & recommendations

The DPR has been prepared for replacement of existing manual jigger machines with automatic double head roller jigger machines based on the performance assessment study as well as acceptance by the management. The brief of the 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 manual jigger with double roller head automatic jigger	3,612	23.01	19.0	1.2	3.0

The measure has an estimated investment of 23.01 lakh rupees and can yield a savings of 19.0 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 3.0 tonnes of CO₂. 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	23.01	23.86	23.61
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	56.73	50.41	52.18
4	NPV	Rs. In Lakh	29.19	25.04	26.21
5	DSCR	-	-	3.64	5.05

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	<p>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.</p>
Credit Linked Capital Subsidy Scheme (CLCSS) (2000-ongoing)	<p>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</p>
Credit Guarantee Fund Scheme for Micro and small Enterprises (in partnership with SIDBI) (2000-ongoing)	<p>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.</p>
Technology and Quality Up gradation Support to MSMEs (TEQUP) (2010-ongoing)	<p>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.</p>
Technology Upgradation Fund Scheme (TUFS) (1999-ongoing)	<p>Interest subsidy and /or capital subsidy for Textile and Jute Industry only.</p> <ol style="list-style-type: none"> To facilitate Technology Up gradation of Small Scale (SSE) units in the textile and jute industries. Key features being: <ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> • 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 <p>2. To enable technology upgradation in micro and small power looms to improve their productivity, quality of products and/ or environmental conditions</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ Cover the first loss subject to maximum of 10% of the total guaranteed amount ○ Cover the remaining default (outstanding principal) amount on

Venture Capital for Energy Efficiency (VCFEE)	<ul style="list-style-type: none"> 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
	<p style="text-align: center;">partial basis upto the maximum guaranteed amount</p> <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Rs. 50 lakh
Type of projects considered for term loans	<ul style="list-style-type: none"> Replacement / retrofit of selected equipment with energy efficient equipment Modification of entire manufacturing processing Recovery of waste heat for power generation
Incentive available	<ul style="list-style-type: none"> Rebate in central excise duty Rebate in interest rate on term loan Rebate in prompt payment of loan instalment
Interest rate	<ul style="list-style-type: none"> 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	<p>Support for technical /advisory services such as:</p> <ul style="list-style-type: none"> • Detailed Energy Audit • Support for implementation • Measurement & Verification <p>Financing terms:</p> <ul style="list-style-type: none"> • Terms loans upto 90% • Interest rate upto 3% below normal lending rate.
TIFAC-SIDBI Revolving Fund for Technology Innovation (Srijan Scheme)	<p>To support SMEs for up-scaling and commercialization of innovative technology based project at flexible terms and interest rate.</p> <p>Preference accorded to sustainable technologies / products. Soft term loan with an interest of not more than 5%.</p>
Partial Risk Sharing Facility for Energy Efficiency (PRSF) Project (supported by World Bank)	<p>Sectors covered:</p> <ul style="list-style-type: none"> • Large industries (excluding thermal power plants) • SMEs • Municipalities (including street lighting) • Buildings <p>Coverage:</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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.

	<ul style="list-style-type: none"> • 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	<p>Coverage</p> <ul style="list-style-type: none"> 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 <p>Interest rate</p> <p>As per credit rating and 1% below the normal lending rate</p> <p>Eligible criteria</p> <p>3 t CO₂ emission reduction per year per lakh invested</p> <p>List of eligible equipment/technology and potential suppliers developed for guidance</p>

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

<p><u>Key Features</u></p> <ul style="list-style-type: none"> • Amount : USD 90 million • Repayment Schedule: First repayment on May 30, 2017 and final repayment date May 30, 2025 (equal instalment) <p><u>Eligibility Criteria</u></p> <ul style="list-style-type: none"> • 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”
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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: Hi-Tech Engineering Works

GSTIN: 09AJUPA0871G1ZL 9897159787

HI TECH ENGINEERING WORKS
Fabricators & Suppliers of Ceramics Machinery, Ball Mill, Pug Mill
Tunnel Klin, Shuttle Klin, Die Press & Jigger Jolly etc.
Khaweshgyan, Bagh Risaldar Police Chowki, KHURJA-203131

Dated. 14/08/18

Quotation of Roller Head
Jigger

To,
TERI N. VASHUDEVAN.
NEW DELHI

* Double Roller head jigger
Production.
No of Motor - 3.
1 Motor 2kv
2 Motor 1kv
Price without GST- 6,50,000/-

* Single Roller head jigger
Production -
No of Motor - 2
1 Motor 2kv
1 Motor 1kv
Price without GST. - 4,00,000/-

* Complete Assembly Plug in
Ready to Use

* klith out loading, packing,
transport charge

Hi-Tech E. Works
Mah. Khaweshgyan, Bagh
Risaldar, Police Chowki, Khurja

The key specifications quoted by the supplier include the following.

- Number of roller heads: 2
- Type: Table mounted and plugin use
- Production rate: 4000 pieces per roller head (Total: 8000 pieces from one table)

Annexure 2: Instruments used

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