

Detailed Project Report (DPR) on Premium efficiency class IE3 motors

Raj Rani Ceramics
Khurja (Uttar Pradesh)

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



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This DPR has been originally prepared by TERI as a part of 'Capacity Building of LSPs' activity under the GEF-UNIDO-BEE project 'Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India'.

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GEF-UNIDO-BEE Project, Bureau of Energy Efficiency, 2018

“Capacity Building of Local Service Providers”

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Acknowledgement

The Energy and Resources Institute (TERI) places on record its sincere thanks to Global Environment Facility (GEF), United Nations Industrial Development Organization (UNIDO) and Bureau of Energy Efficiency (BEE) for giving opportunity to partner in this prestigious assignment on Capacity Building of Local Service Providers (LSPs) under the GEF-UNIDO-BEE project 'Promoting energy efficiency and renewable energy in selected MSME clusters in India'.

TERI is particularly grateful to Mr Milind Deore, Director, Bureau of Energy Efficiency, Mr Sanjay Shrestha, Industrial Development Officer, Industrial Energy Efficiency Unit, Energy and Climate Branch, UNIDO, Mr Suresh Kennit, National Project Coordinator, UNIDO, Mr Niranjana Rao Devela, National Technology Coordinator, Mr Ajeet Singh, Cluster Leader, Khurja Foundry Cluster, UNIDO, Mr Girish Kumar, M/s Raj Rani Ceramics and Central Glass and Ceramic Research Institute (CGCRI), Khurja for their support and guidance during the project.

Last but not least, the interactions and deliberations with numerous foundry units, industry associations, technology providers and who were directly or indirectly involved throughout the study were exemplary and the whole exercise was thoroughly a rewarding experience for TERI.

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 Raj Rani Ceramics
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	Bone china crockery, Toys
Name(s) of the promoters/ directors	Mr Girish Kumar

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 1,57,980 kWh of electricity per year. The annual consumption of the fuel oil is 137.5 kL and HSD is 3,000 litres. The total energy consumption of the unit during last 12 months is estimated to be 141 toe which is equivalent to 83.8 lakh rupees. The total CO₂ emission during this period is estimated to be 532 tonnes. Electricity, HSD and fuel oil were considered for CO₂ emission estimation.

The unit manufactures the ceramic sanitary ware. The average production of the unit during 2017-18 is estimated to be 35,000 pcs 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 ¹ (Rs lakh)	Monetary savings (Rs lakh/ year)	Simple payback period (Years)	Emission reduction (tonnes of CO ₂)
Replacement of existing standard efficiency motors with Premium efficiency class IE3 motors	8,193	0.97	0.67	1.40	6.70

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	0.97	1.01	1.00
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	44.65	38.62	40.30
4	NPV	Rs. In Lakh	0.90	0.73	0.77
5	DSCR	-	-	3.09	4.29

¹Investment including the IE3 standard electric motors with taxes and miscellaneous – Rs. 0.97 lakhs

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 Raj Rani Ceramics
2	Constitution	Proprietorship
3	Name of the Contact Person	Mr. Girish Kumar
4	Mobile / Ph. No	+91-9837019900
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	Bone China Crockery ,Toys
10	No of hours of operation/shift	8
11	No of shifts/ day	1
12	No of days/year	300
13	Installed Capacity	40,000 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.

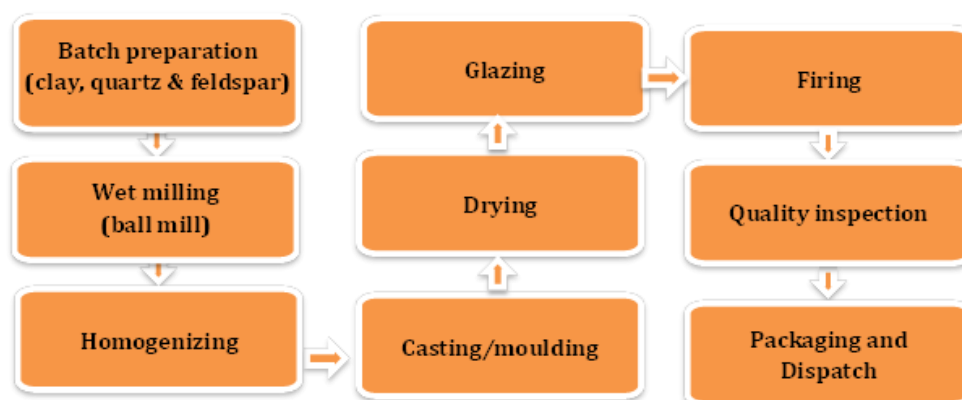


Figure 2.1: Process flow chart

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	Value
Equipment	Ball Mill	Pug Mill
Make	-	-
Purpose/ Application	Homogenizing	De-Airing
Capacity	3 T	1 T
Operating hours per day	20	20
Mode of operation (batch/continuous)	Batch	Batch
Cycle time (hours)	6	8
Fuel Details	Type	Electricity
	Consumption (units/day)	146.6
		55.2

2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Paschimanchal Vidyut Vitaran Nigam Limited under the tariff category LMV6. Table 2.3 provides the details of energy uses.

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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<p>Summer Months (April to September)</p> <ul style="list-style-type: none"> • 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% <p>Winter Months (October to March)</p> <ul style="list-style-type: none"> • 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)
Mar-18	15,062	37.4	1,22,192
Apr-18	11,752	34.0	97,387
May-18	13,346	35.0	1,09,768
Jun-18	12,500	37.0	1,03,835
Average	13,165	35.9	1,08,296
Yearly	157,980	-	1,299,546

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

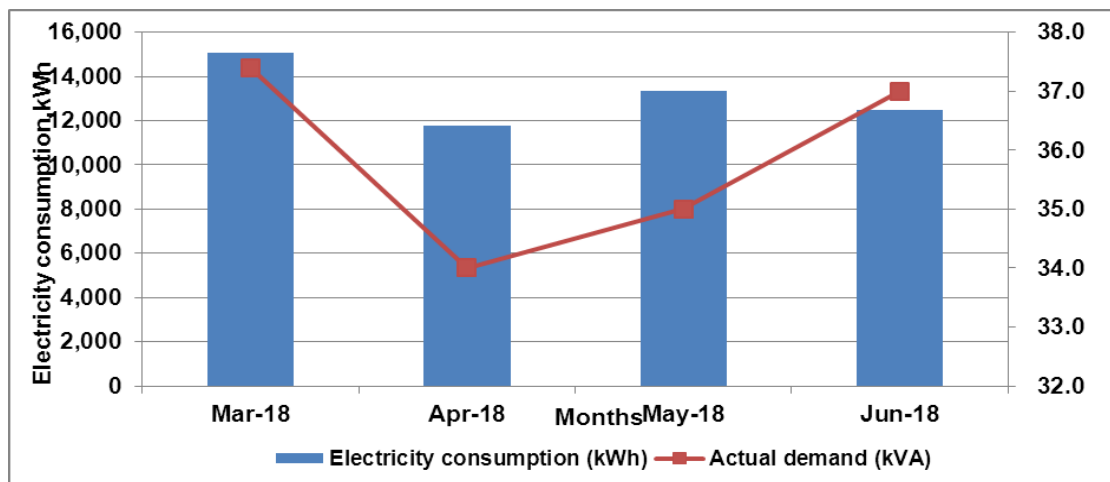


Figure 2.5: Demand pattern and energy consumption profile

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	FO (Ltrs)	HSD (Ltrs)
Consumption (unit/year)	137,500	3,000
Gross calorific value (per unit)	9,765	8,300
Equivalent toe (per year)	125.3	2.1
Price (Rs per unit)	50.0	68.0
Total cost (lakh Rs per year)	68.8	2.0

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

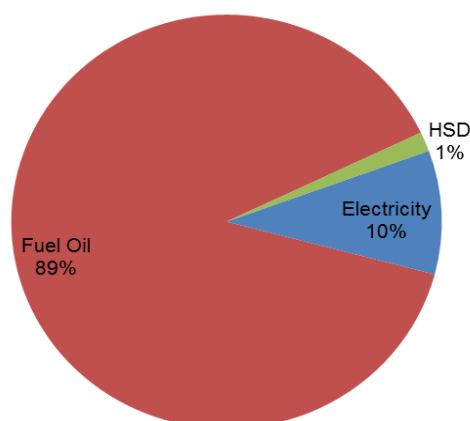


Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 1,57,980 kWh of electricity per year. The annual consumption of the fuel oil is 137.5 kL and HSD is 3,000 litres. The total energy consumption of the unit

during last 12 months is estimated to be 140 toe which is equivalent to 83.8 lakh rupees. The total CO₂ emission during this period is estimated to be 532 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 standard efficiency motors with energy efficient IE3 standard motors

3.1.1 Background

The Raj Rani Ceramics is manufacturer and supplier of bone china crockery, toys and electrical appliances. Two number of ball mills have been installed with a processing capacity of 3 tonne each. Both ball mills are coupled with a single electric motor of 15HP capacity. The unit has installed a pug mill with 7.5HP motor for de-airing application. The operational parameters of the mills such as power consumption were measured during the detailed assessment study and historic operating data for past one year is also collected.



3.1.2 Observations and analysis

The power consumption of the mill motors is estimated based on the data measured/collected during the field visit in the unit. The average raw material charging is about 2.5 tonne per batch. The measured trend of the active power is shown in figure 3.1.2.

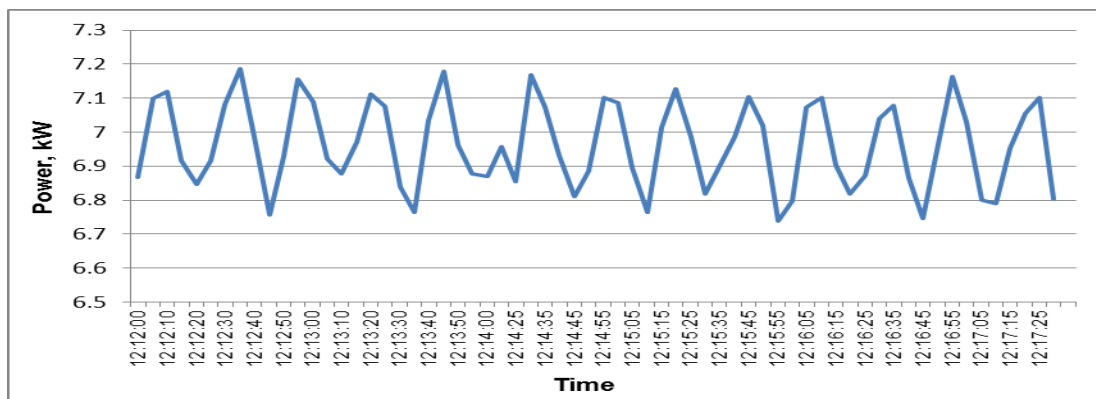


Figure 3.1.2a: Trend of the active power consumption of ball mill

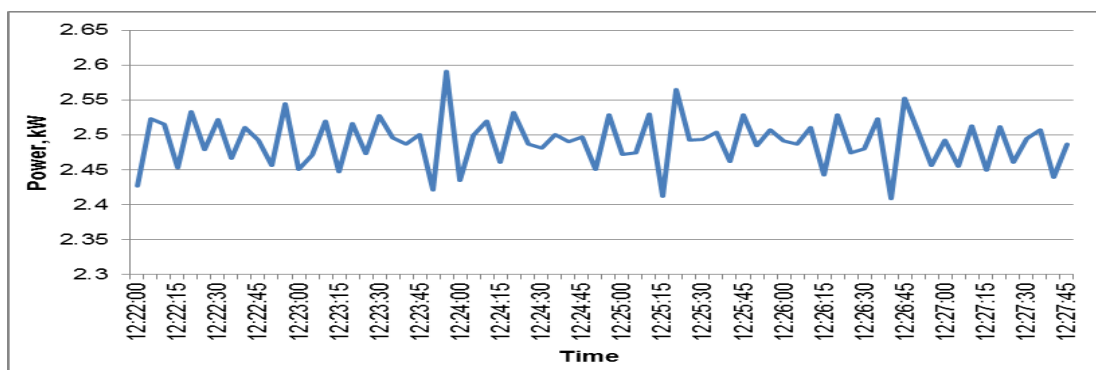
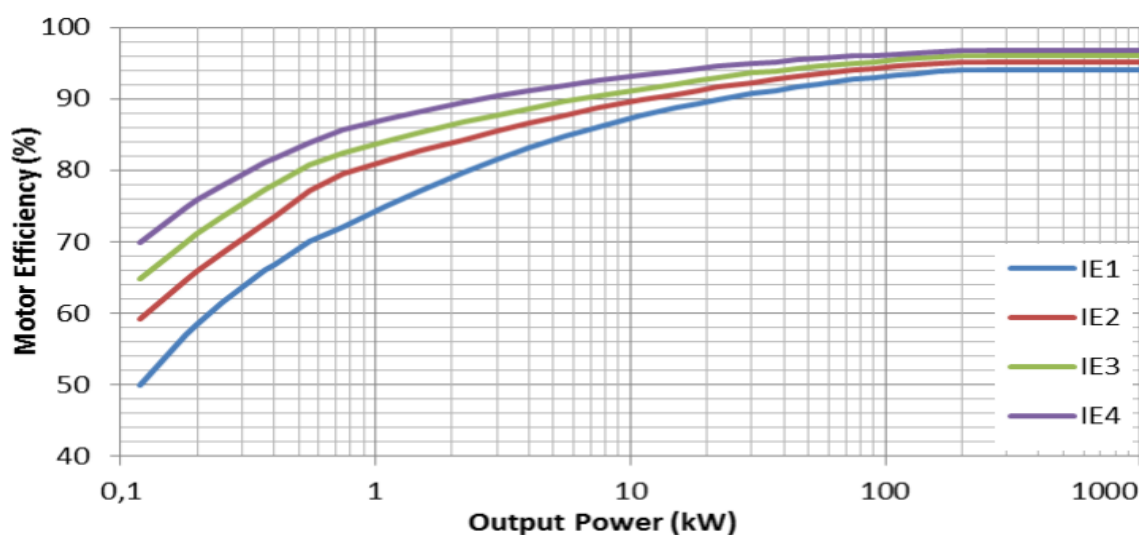


Figure 3.1.2b: Trend of the active power consumption of pug mill

The energy consumption is higher than the consumption in similar categories of motors due to low efficiencies of old and re-winded motors. Therefore, it is recommended to replace the existing standard efficiency motors with new IE3 standard premium efficiency motors.

3.1.3 Recommendation

The unit may adopt the premium efficiency class (IE3 standard) motors of same rating to reduce the power consumption. The proposed IE3 standard motors specifications include 11 kW and 5.5 kW rating with same frame size as present motors. The rated efficiency of new IE3 standard premium efficiency motors would be 90.3% and 88% respectively as specified by vendor.

**Figure 3.1.3:** Efficiency levels as per IS12615 (4 pole, 50Hz)

3.2 Cost benefit analysis

The estimated annual energy savings by replacement of existing standard efficiency motors of ball mill and pug mill with IE3 standard premium efficiency motors is 8,193 kWh equivalent to a monetary saving of Rs 0.67 lakh. The investment requirement is Rs 0.97 lakh with a simple payback period of 1.4 years. The detailed calculation of the recommended energy conservation measure is provided in table 3.2.

Table 3.2: Cost benefit analysis for energy savings measure

S. No	Parameters	Unit	Existing	Proposed
1	Average power consumption	kW	10.1	8.7
2	Operating time	hours/year	6,000	6,000
3	Energy consumption	kWh/year	60,536	52,342
4	Energy savings	kWh/year	-	8,193
5	Monetary savings	Rs/year	-	67,451
6	Investment required ²	Rs.	-	97,402
7	Payback period	Years	-	1.4

² Quotation- 1 has been considered for estimation of investments

3.3 Pre-training requirements

The training would be required on regular maintenance practices for new motors.

3.4 Process down time for implementation

There is no process downtime required for implementation of the recommended measure and the modifications may be planned without affecting its regular operations.

3.5 Environmental benefits

3.5.1 CO₂ reduction³

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 6.7 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.

³ 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	Basis of selection of supplier	Remarks (after sales service etc.)
1	IE3 standard premium efficiency motors	Hindustan Motors Aakash Powertech Pvt Ltd. Express Zone, A- Wing, Unit No. 501-505, W E Highway, Malad (E), Mumbai -400097 Tel No:- 61441600 , Fax No:- 1441650 Email:- Info@aakashpower.com	Reputed supplier	-
2	IE3 standard premium efficiency motors	Havells India Limited QRG Towers, 2D, Sector -126, Expressway, Noida - 201 304 Ph.: +91-120-3331000, E-mail: marketing@havells.com, www.havells.com	Reputed supplier	-
2	IE3 standard premium efficiency motors	Marathon Motors Aakash Powertech Pvt Ltd. Express Zone, A- Wing, Unit No. 501-505, W E Highway, Malad (E), Mumbai -400097 Tel No:- 61441600 , Fax No:- 1441650 Email:- Info@aakashpower.com	Reputed supplier	-

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	0.97	0.29	0.49
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	0.68	0.49
5	Others	-	-	-
	Total	0.97	0.97	0.97

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		2400	
Installed production capacity	tonnes/year		1000	
Production in last financial years	tonnes/year		800	
Capacity utilization factor	%		80	
Proposed investment (Project)				
Total cost of the project	Rs. (in Lakh)	0.97	0.97	0.97
Investment without interest defer credit (IDC)	Rs. (in Lakh)	0.97	0.97	0.97
Implementation time	Months	6.00	6.00	6.00
Interest during the implementation phase	Rs. in lakhs	-	0.04	0.03
Total investment	Rs. in lakhs	0.97	1.01	1.00
Financing pattern				
Own funds	Rs. in lakhs	0.97	0.33	0.51
Loan funds (term loan)	Rs. in lakhs	-	0.68	0.49
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		0.67	
Total saving	Rs lakh/year		0.67	
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

Details	100% equity	D/E- 70:30	D/E- 50:50
Total project cost (Rs. In lakh)	0.97	1.01	1.00
Cash flow as annual saving (Rs. In lakh/year)	0.67	0.67	0.67

O&M Expenses for first year (Rs. In lakh/year)	0.05	0.05	0.05
Net Cash flow (Rs. In lakh/year)	0.62	0.62	0.62
SPP (months)	18.73	19.47	19.26
Considered (month)	18.70	19.50	19.30

4.2.3 NPV and IRR

The NPV and IRR calculations are shown in table 4.2.3.

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

Particulars/ years	0	1	2	3	4	5
	(Rs.in lakhs)					
Profit after tax	-	0.46	0.36	0.26	0.25	0.25
Depreciation	-	0.16	0.16	0.16	0.16	0.16
Cash outflow	0.97	-	-	-	-	-
Net cash flow	-0.97	0.62	0.51	0.42	0.41	0.40
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	-0.97	0.57	0.43	0.32	0.29	0.26
Net present value	0.90					
Simple IRR considering regular cash flow	44.65%					

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	-	0.42	0.33	0.22	0.22	0.23
Depreciation	-	0.16	0.16	0.16	0.16	0.16
Cash outflow	1.01	-	-	-	-	-
Net cash flow	-1.01	0.59	0.50	0.39	0.38	0.39
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	-1.01	0.53	0.41	0.29	0.26	0.24
Net present value	0.73					
Simple IRR considering regular cash flow	38.62%					

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

Particulars/ years	0	1	2	3	4	5
	(Rs.in lakhs)					
Profit after tax	-	0.43	0.34	0.23	0.23	0.23
Depreciation	-	0.16	0.16	0.16	0.16	0.16
Cash outflow	1.00	-	-	-	-	-
Net cash flow	-1.00	0.60	0.50	0.39	0.39	0.39
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	-1.00	0.54	0.42	0.30	0.27	0.25
Net present value	0.77					
Simple IRR considering regular cash flow	40.30%					

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	16.90	1.07	50.91	-	24.33
		70:30	17.60	0.90	44.74	3.37	33.77
		50:50	17.40	0.94	46.46	4.68	30.20

DPR – Premium Efficiency Class IE3 Motors (Raj Rani Ceramics)

S. No.	Scenario	D/E ratio	Payback period (months)	NPV (Rs lakh)	IRR (%)	DSCR	ROI (%)
2	10% reduction in estimated savings	100% equity	21.00	0.72	38.29	-	20.77
		70:30	21.80	0.56	32.37	2.81	30.16
		50:50	21.60	0.60	34.03	3.90	26.43
3	10% rise in interest rates	70:30	19.50	0.69	38.01	3.03	31.94
		50:50	19.30	0.74	39.86	4.20	28.34
4	10% reduction in interest rates	70:30	19.40	0.77	39.22	3.16	32.37
		50:50	19.20	0.81	40.74	4.39	28.63

5.0 Conclusions & recommendations

The DPR has been prepared for replacement of existing standard efficiency motors in ball mills with IE3 premium efficiency class motors 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 (Rs lakh/year)	Simple payback period (Years)	Emission reduction (tonnes of CO ₂)
Replacement of existing standard efficiency motors with premium efficiency class IE3 motors	8,193	0.97	0.67	1.40	6.72

The measure has an estimated investment of 0.97 lakh rupees and can yield a monetary savings of 0.67 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is about 6.7 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	0.97	1.01	1.00
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	44.65	38.62	40.30
4	NPV	Rs. In Lakh	0.90	0.73	0.77
5	DSCR	-	-	3.09	4.29

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.

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:</p> <p>Online (e-Platform) self-assessment: Nil fee</p> <p>Desk Top assessment : Rs 10,000 per SME</p> <p>Complete assessment : Rs 80,000 ZED rating per SME; Rs 40,000 for additional ZED defence rating; Rs 40,000 for re-rating</p> <p>The rating costs will include cost of Rs 10,000/- as certification cost by QCI.</p> <p>Subsidy for Micro, Small and Medium Enterprises are 80%, 60% and 50% respectively.</p>
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)	<p>Interest subsidy and /or capital subsidy for Textile and Jute Industry only.</p> <p>1. To facilitate Technology Up gradation of Small Scale (SSE) units in the textile and jute industries. Key features being:</p> <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>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> <ol 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”

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: Aakash Powertech Pvt. Ltd.

aakash powertech pvt. Ltd.		AAKASH POWERTECH PVT.LTD			hindustan ELECTRIC MOTORS				
power channelling solutions									
Express Zone, A- Wing, Unit No. 501-505, W E Highway, Malad (E), Mumbai -400097 Tel No:- 61441600 , Fax No:- 61441650									
Email:- info@akashpower.com									
HINDUSTAN IE3 induction motors suitable for 415V±10%, 50Hz±5%, combined ±10%, 3 phase supply, foot mounted (B3 construction), ambient temperature 50°C, TEFC, Class 'F' insulation, IP55 protection, continuous rated (S1 duty) with bare shaft & key as per IS: 325 / IEC: 60034-1.									
KW	HP	Frame	Type Designation	Price	KW	HP	Frame	Type Designation	Price
2 Pole, 3000 RPM					4 Pole, 1500 RPM				
0.37	0.5	71	IE3	5150	0.37	0.5	71	IE3	5440
0.55	0.75	71	IE3	6710	0.55	0.75	80	IE3	7120
0.75	1	80	IE3	6930	0.75	1	80	IE3	7230
1.1	1.5	80	IE3	7570	1.1	1.5	90S	IE3	8920
1.5	2	90S	IE3	8670	1.5	2	90L	IE3	10840
2.2	3	90L	IE3	11140	2.2	3	100L	IE3	12910
3.7	5	100L	IE3	14290	3.7	5	112M	IE3	16360
5.5	7.5	132S	IE3	22580	5.5	7.5	132S	IE3	22720
7.5	10	132S	IE3	23370	7.5	10	132M	IE3	26860
9.3	12.5	160M	IE3	37820	9.3	12.5	160M	IE3	43340
11	15	160M	IE3	40840	11	15	160M	IE3	43340
15	20	160M	IE3	47840	15	20	160L	IE3	52850
18.5	25	160L	IE3	61490	18.5	25	180M	IE3	67640
22	30	180M	IE3	68210	22	30	180L	IE3	74080
30	40	200L	IE3	101450	30	40	200L	IE3	102200
37	50	200L	IE3	123180	37	50	225SX	IE3	119520
45	60	225M	IE3	158520	45	60	225MX	IE3	144870
55	75	250M	IE3	213420	55	75	250MX	IE3	199100
75	100	280S	IE3	266540	75	100	280SX	IE3	242300
90	120	280M	IE3	307470	90	120	280MX	IE3	282250
110	150	315S	IE3	388360	110	150	315SX	IE3	341860
125	170	315M	IE3	443700	125	170	315MX	IE3	379190
132	180	315M	IE3	477310	132	180	315MX	IE3	400580
160	215	315L	IE3	522850	160	215	315LX	IE3	506660
180	240	315L	IE3	550430	180	240	315LX	IE3	547660
200	270	315L	IE3	610440	200	270	315LX	IE3	570530
225	300	355S	IE3	645970	225	300	355SX	IE3	704340
250	335	355M	IE3	683760	250	335	355MX	IE3	703880
275	370	355L	IE3	723880	275	370	355LX	IE3	761080
315	425	355L	IE3	741290	315	425	355LX	IE3	816900

		AAKASH POWERTECH PVT.LTD			
Express Zone, A- Wing, Unit No. 501-505, W E Highway, Malad (E), Mumbai -400097 Tel No:- 61441600 , Fax No:- 61441650 Email:- info@aakashpower.com					
HINDUSTAN IE3 induction motors suitable for 415V±10%, 50Hz±5%, combined ±10%, 3 phase supply, foot mounted (B3 construction), ambient temperature 50°C, TEFC, Class 'F' insulation, IP55 protection, continuous rated (S1 duty) with bare shaft & key as per IS: 325 / IEC: 60034-1.					
KW	HP	Frame	Type Designation	Price	
6 Pole, 1000 RPM					
0.37	0.5	80	IE3	7560	
0.55	0.75	80	IE3	7750	
0.75	1	90S	IE3	8960	
1.1	1.5	90L	IE3	9580	
1.5	2	100L	IE3	14720	
2.2	3	112M	IE3	15550	
3.7	5	132S	IE3	22910	
5.5	7.5	132M	IE3	28180	
7.5	10	160M	IE3	42010	
9.3	12.5	160L	IE3	46980	
11	15	160L	IE3	51710	
15	20	180L	IE3	67550	
18.5	25	200L	IE3	96470	
22	30	200L	IE3	96470	
30	40	225MX	IE3	148440	
37	50	250MX	IE3	199630	
45	60	280SX	IE3	239120	
55	75	280MX	IE3	274590	
75	100	315SX	IE3	327750	
90	120	315MX	IE3	410120	
110	150	315MX	IE3	457320	
125	170	315LX	IE3	506820	
132	180	315LX	IE3	533860	
160	215	315LX	IE3	555880	
180	240	355MX	IE3	679090	
200	270	355MX	IE3	679090	
225	300	355LX	IE3	743430	
250	335	355LX	IE3	743430	

Quotation 2: Havells India Ltd.

Premium Series - (IE3)

Totally Enclosed Fan Cooled (TEFC) Squirrel Cage Induction Motors - Foot Mounted (B3)

Horizontal Foot Mounted Induction Motor suitable for 415V ± 10%, 3 Phase, 50 Hz ± 5%, Insulation Class 'F', Degree of protection IP 55, Ambient of 50°C conforming to IS 12615:2014, IEC 60034-30:2014

2 Pole -3000 RPM

HSN Code: 8501

Kw	HP	Frame	Cat. Ref.	L P ₹
0.18	0.25	MHPE63ZAA2	MHHPTBS20X18	5,910
0.25	0.33	MHPE63ZBA2	MHHPTBS20X25	6,080
0.37	0.5	MHPE71ZAA2	MHHPTGS20X37	6,430
0.55	0.75	MHPE71ZBA2	MHHPTGS20X55	7,750
0.75	1	MHPE80ZAA2	MHHPTDS20X75	8,020
1.1	1.5	MHPE80ZBA2	MHHPTDS20X1	8,740
1.5	2	MHPE90SAA2	MHCPTES201X5	10,020
1.8*	2.5	MHPE90SBA2	MHCPTES201X8	10,760
2.2	3	MHPE90LCA2	MHCPTFS202X2	12,850
3	4	MHPE100LAA2	MHCPTGS20003	15,105
3.7	5	MHPE100LBA2	MHCPTGS203X7	15,955
3.7*	5	MHPE112MAA2	MHCPTHS203X7	18,480
5.5	7.5	MHPE132SZA2	MHCPTIS205X5	26,040
7.5	10	MHPE132STA2	MHCPTIS207X5	26,945
9.3	12.5	MHPE160MTA2	MHCPTKS209X3	40,720
11	15	MHPE160MYA2	MHCPTKS20011	47,080
15	20	MHPE160MZA2	MHCPTKS20015	55,155
18.5	25	MHPE160LZA2	MHCPTLS218X5	70,875
22	30	MHPE180MZA2	MHCPTMS20022	76,420
30	40	MHPE200LPG2	MHCPTOS20030	1,13,660
37	50	MHPE200LRG2	MHCPTOS20037	1,38,020
45	60	MHPE225MP2	MHCPTQS20045	1,77,620
55	75	MHPE250MP2	MHCPTRS20055	2,39,150
75	100	MHPE280SV2	MHCPTSS20075	2,98,680
90	120	MHPE280MV2	MHCPTTS20090	3,44,540
110	150	MHPE315SYE2	MHCPTUS20110	4,35,205
132	180	MHPE315MZE2	MHCPTVS20132	5,34,830
160	215	MHPE315LYE2	MHCPTWS20160	5,85,920
180	240	MHPE315LYE2	MHCPTWS20180	6,16,830
200	270	MHPE315LZE2	MHCPTWS20200	6,84,090
225	300	MHPE355MA2	MHCPTY20225	7,23,340
250	335	MHPE355MB2	MHCPTY20250	7,66,255
275	370	MHPE355LA2	MHCPTZS20275	8,11,215
315	425	MHPE355LB2	MHCPTZS20315	8,30,725
335	455	MHPE355LC2	MHCPTZS20335	9,39,345

4 Pole -1500 RPM

HSN Code: 8501

Kw	HP	Frame	Cat. Ref.	L P ₹
0.12	0.16	MHPE63ZAA4	MHHPTBS40X12	5,625
0.18	0.25	MHPE63ZBA4	MHHPTBS40X18	5,860
0.25	0.33	MHPE71ZAA4	MHHPTCS40X25	6,520
0.37	0.5	MHPE71ZBA4	MHHPTCS40X37	6,790
0.55	0.75	MHPE80ZAA4	MHHPTDS40X55	8,225
0.75	1	MHPE80ZBA4	MHHPTDS40X75	8,355
1.1	1.5	MHPE90SAA4	MHCPTES401X1	9,475
1.5	2	MHPE90LBA4	MHCPTFS401X5	10,380
1.8	2.5	MHPE90LCA4	MHCPTFS401X8	11,085
2.2	3	MHPE100LAA4	MHCPTGS402X2	13,740
3.0*	4	MHPE100LBA4	MHCPTGS40003	14,540
3.7	5	MHPE112MAA4	MHCPTHS403X7	17,535
5.5	7.5	MHPE132SRA4	MHCPTIS405X5	24,265
7.5	10	MHPE132MTA4	MHCPTJS407X5	28,140
9.3	12.5	MHPE160MYA4	MHCPTKS409X3	42,700
11	15	MHPE160MZA4	MHCPTKS40011	45,525
15	20	MHPE160LZA4	MHCPTLS40015	56,580
18.5	25	MHPE180MZA4	MHCPTMS418X5	74,495
22	30	MHPE180LZA4	MHCPTNS40022	80,755
30	40	MHPE200LRG4	MHCPTOS40030	1,08,515
37	50	MHPE225SP4	MHCPTPS40037	1,33,920
45	60	MHPE225MP4	MHCPTQS40045	1,62,320
55	75	MHPE250MP4	MHCPTRS40055	2,23,100
75	100	MHPE280SV4	MHCPTSS40075	2,71,520
90	120	MHPE280MV4	MHCPTTS40090	3,16,275
110	150	MHPE315SYE4	MHCPTUS40110	3,83,095
132	180	MHPE315MYE4	MHCPTVS40132	4,48,885
160	220	MHPE315LYE4	MHCPTWS40160	5,26,660
180	240	MHPE315LYE4	MHCPTWS40180	5,60,185
200	270	MHPE315LZE4	MHCPTWS40200	6,39,360
225	300	MHPE355MA4	MHCPTY40225	6,57,385
250	340	MHPE355MB4	MHCPTY40250	7,08,135
275	370	MHPE355MC4	MHCPTY40275	7,16,960
315	425	MHPE355LA4	MHCPTZS40315	8,10,540
335	450	MHPE355LB4	MHCPTZS40335	8,10,505
350	470	MHPE355LC4	MHCPTZS40350	1,03,0470

* Class F insulation with temperature rise limited to Class B

Premium Series - (IE3)

Totally Enclosed Fan Cooled (TEFC) Squirrel Cage Induction Motors - Foot Mounted (B3)

Horizontal Foot Mounted Induction Motor suitable for 415V ± 10%, 3 Phase, 50 Hz ± 5%, Insulation Class 'F', Degree of protection IP 55, Ambient of 50°C conforming to IS 12615:2014, IEC 60034-30-2014



6 Pole -1000 RPM

HSN Code: 8501

Kw	HP	Frame	Cat. Ref.	L P ₹
0.18	0.25	MHPE71ZAA6	MHHPTCS60X18	6,205
0.25	0.33	MHPE71ZBA6	MHHPTCS60X25	7,330
0.37	0.5	MHPE80ZAA6	MHHPTDS60X37	8,730
0.55	0.75	MHPE80ZBA6	MHHPTDS60X55	8,965
0.75	1	MHPE90SAA6	MHCPTES60X75	10,085
1.1	1.5	MHPE90LBA6	MHCPTFS601X1	11,065
1.5	2	MHPE100LAA6	MHCPTGS601X5	14,185
1.8*	2.5	MHPE100LBA6	MHCPTGS601X8	14,715
2.2	3	MHPE112MAA6	MHCPTHS602X2	16,960
3*	4	MHPE112MBA6	MHCPTHS60003	21,300
3.7	5	MHPE132SYA6	MHCPTIS603X7	25,775
5.5	7.5	MHPE132MZA6	MHCPTJS605X5	26,790
7.5	10	MHPE160MZA6	MHCPTKS607X5	47,850
9.3	12.5	MHPE160LYA6	MHCPTLS609X3	54,925
11	15	MHPE160LZA6	MHCPTLS60011	59,605
15	20	MHPE180LZG6	MHCPTNS60015	75,675
18.5	25	MHPE200LPG6	MHCPTOS618X5	98,430
22	30	MHPE200LRG6	MHCPTOS60022	1,06,825
30	40	MHPE225MP6	MHCPTOS60030	1,66,330
37	50	MHPE250MP6	MHCPTRS60037	2,23,685
45	60	MHPE280SV6	MHCPTSS60045	2,67,950
55	75	MHPE280MV6	MHCPTTS60055	3,05,090
75	100	MHPE315SYE6	MHCPTUS60075	3,67,270
90	120	MHPE315MYE6	MHCPTVS60090	4,59,595
110	150	MHPE315MZE6	MHCPTVS60110	5,12,485
132	180	MHPE315LZE6	MHCPTWS60132	5,98,255
160	220	MHPE355MA6	MHCPTY60160	6,22,940
180	240	MHPE355MB6	MHCPTY60180	6,87,050
200	270	MHPE355MC6	MHCPTY60200	7,13,480
250	340	MHPE355LA6	MHCPTZS60250	7,68,965
315	425	MHPE355LB6	MHCPTZS60315	12,24,210

* Class F insulation with temperature rise limited to Class B

Quotation 3: Aakash Powertech Pvt. Ltd.

			AAKASH POWERTECH PVT.LTD					
Express Zone, A- Wing, Unit No. 501-505, W E Highway, Malad (E), Mumbai -400097 Tel No:- 61441600 , Fax No:- 61441650 Email:- info@akashpower.com								
Marathon Make, TEFC, Cast Iron, Power Supply AC 3 PHASE, 415 VOLTS +/- 10%, 50 HZ +/- 5%, COMBINED VARIATION +/-10% Insulation CLASS 'F' WITH TEMPERATURE RISE LIMITED TO CLASS 'B', Ambient 50 DEG.C., Altitude LESS THAN 1000 MTR. ABOVE M.S.L., Mounting HORIZONTAL FOOT MOUNTED (B3) Performance CONFORMING TO IS :325 ,Frame Dimensions CONFORMING TO IS : 1231 ,Protection IP-55 (IS :4691)								
MARATHON ""TERRAMAX"" SERIES (IE3)								
2 -Pole 3000 RPM			4 - Pole 1500 RPM			6 - Pole 1000 RPM		
Frame	KW	Price	Frame	KW	Price	Frame	KW	Price
						90S	0.75	10865
80	0.55	8345	80	0.55	8860	90L	1.1	11915
80	0.75	8625	80	0.75	8990	100L	1.5	15295
80	1.1	9415	90S	1.1	10210	112M	2.2	18280
90S	1.5	10785	90L	1.5	11175	132S	3	26695
90L	2.2	13855	100L	2.2	14815	132S	3.7	27800
100L	3	16280	100L	3	15665	132M	5.5	28905
112M	3.7	17205	112M	3.7	18910	160M	7.5	51645
132S	5.5	28085	132S	5.5	26170	160L	11	64325
132S	7.5	29070	132M	7.5	30360	180L	15	79424
160M	11	50805	160M	11	48640	200L	18.5	103421
160M	15	59520	160L	15	60460	200L	22	112404
160L	18.5	76495	180M	18.5	83764	225M	30	175201
180M	22	80233	180L	22	84759	250M	37	251627
200L	30	119187	200L	30	115995	280S	45	301279
200L	37	145473	225S	37	148411	280M	55	342527
225M	45	187217	225M	45	175343	315S	75	411181
250M	55	269439	250M	55	249660	315M	90	516112
280S	75	335037	280S	75	305406	315L	110	575130
280M	90	388056	280M	90	354318	315L	132	673170
315S	110	489174	315S	110	428948	355M	160	698307
315M	132	600113	315M	132	505020	355M	200	798371
315L	160	658749	315L	160	591005	355L	250	860444
315L	200	770942	315L	200	717345			
355M	250	858038	355M	250	790590			
355L	315	934224	355L	315	907155			
355L	355	1121065	355L	355	1125978			
355L	375	1233167	355L	375	1238553			

Annexure 2: Instruments used

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