Project code: 2017IE08
Cluster: Indore
Report ID: IN/09/DPR

Detailed Project Report
On
Premium efficiency class IE3 motors

P. S. Crankshaft Pvt. Ltd
Indore (MP)

Prepared for

Bureau of Energy Efficiency

(13/GEF-UNIDO-BEE/LSP/14/4562)

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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	:	Green House Gas
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
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

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 P S Crankshaft Pvt. Ltd.
Constitution	Private Limited
MSME Classification	Small
No. of years in operation	5
Address: Registered Office:	151-152, Sector-1, Ind. Area, Pithampur-454775 (MP), India
Industry-sector	MSME, Foundry
Products manufactured	Manufacturer of camshafts for Tractors
Name(s) of the promoters/ directors	Mr. Shanmugam (MD)

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 total energy consumption of the unit during last 12 months was 42.9 toe which is equivalent to 60.8 lakh rupees. The total CO_2 emission during this period is estimated to be 409 tonnes. Electricity was considered for CO_2 emission estimation.

The unit manufactures the cast iron castings of camshafts. The total annual liquid metal production of the unit during 2017-18 is estimated to be 600 tonnes and total annual good castings production is around 420 tonnes. The major source of energy is electricity consumed in the induction melting a furnace, motors, lighting and other auxiliaries.

Accepted/ recommended technology implementation

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

Energy conservation measures	Annual energy savings	Investment[1]	Savings	Simple Payback	Emission reduction (tonnes of CO_2)
	Electricity (kWh)	(Rs Lakh)	(Rs. Lakh/ year)	(Year)	
Replacement of existing standard efficiency motors with premium efficiency class IE3 motors	13,742	2.81	1.7	1.7	11.3

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	2.81	2.81	2.81
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	36.02	31.45	33.01
4	NPV	Rs. In Lakh	1.91	1.51	1.63
5	DSCR	-	-	2.71	3.76

[1] Investment including the capital cost of motors Rs. 1.95 lakhs (supplier is offering 18% discount on list price) and taxes & other miscellaneous costs Rs. 0.86 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 P S Crankshaft Private Limited	
2	Constitution	Private Limited	
3	Date of incorporation / commencement of business	2013	
4	Name of the Contact Person	Mr. Shanmugam	
7	Mobile / Ph. No	+91 9302460029	
8	Email		
9	Address: Registered Office	151-152, Sector-1, Ind. Area, Pithampur-454775 (MP), India	Owned
10	Factory	151-152, Sector-1, Ind. Area, Pithampur-454775 (MP), India	Owned
11	Industry / Sector	MSME/Manufacturing	
12	Products Manufactured	Manufacturer of camshafts	
13	No of hours of operation/shift	08	
14	No of shifts/ day	02	
15	No of days/year	300	
16	Installed Capacity	4,000 MT per year	
17	Whether the unit is exporting its products (Yes/ No)	Yes	
18	Quality Certification, if any	ISO/TS 16949-29:2009	

2.0 Energy profile

2.1 Process flow diagram

The major steps of process are mould sand preparation, charge preparation followed by melting, pouring, knockout and finishing. The steps are explained below.

2.1.1 Sand preparation plant

The major equipment installed is sand siever, sand mixer and sand transport belts and elevators. Electricity is used to run all rotary machines in sand preparation plant. Fresh sand is mixed with adhesives in sand mixer then it is pressed in mould casing by pressing machine. In casing some amount of burnt sand is reused with fresh sand.

2.1.2 Core preparation and moulding

For core preparation, fresh sand is used. Cores are baked in LDO fired ovens. After hardening of core it is mounted in mould. In mould preparation fresh and burnt sand is pressed by machines which operate on pneumatic in mould casing. Upper and lower half of mould is assembled together and then it gets ready to pouring.

2.1.3 Melting

Melting of charge is done with help of induction furnace. Induction furnace runs on medium frequency three phase electrical supply. Once melt attained required temperature and metallurgy, the liquid melt is poured into the earlier prepared sand moulds using ladles.

2.1.4 Knockout and finishing

Mould is left to cool for certain time, then it follows to a vibrator with grated surface, it knocks-out the sand and the casting is send for finishing, which involves shot blasting and machining job.

The process flow diagram for major product and steel grade casting produced in the foundry is given in figure 2.1.4.

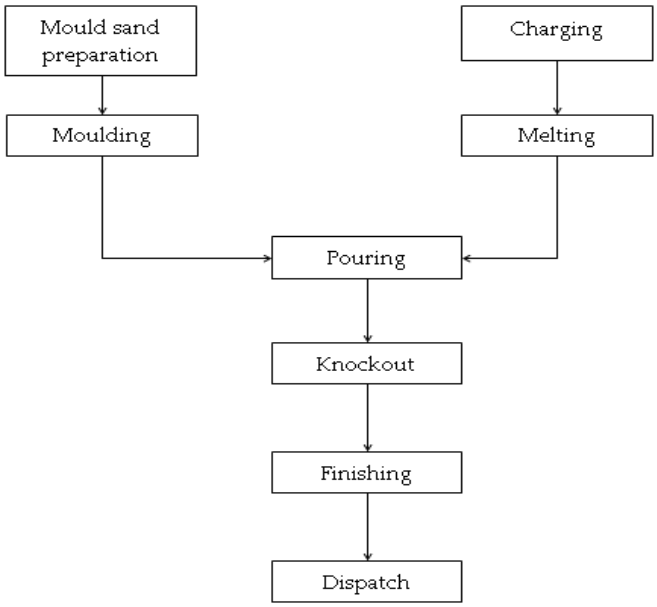

Figure 2.1.4: Process flow chart

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

S. No.	Motor ID	Design Specifications				
		Voltage (Volt)	Current, amp (A)	Motor rating (kW)	Speed	Efficiency (%)
1	Mixer motor-Load	415	89.5	44.8	1,440	89.2
	Mixer motor-Unload	415	89.5	44.8	1,440	89.2
2	Shot blast#1 impeller motor	415	14.0	7.5	1,450	83.5
3	Shot blast#2 impeller motor	415	9.0	5.5	1,440	84.7
4	Muller mixer motor	415	18.0	11.0	1,440	87.6

2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited. 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

2.4 Energy sources, availability & tariff details

The power supply to the facility is from Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited grid @ 11 kV, with 450 kVA sanctioned contract demand. 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	HT-Industrial connections
Demand charges	Rs. 330/ KVA/month
Energy charges (11kV supply)	*Rs. 6.0/ kWh for consumption in excess of 50% load factor *Rs. 6.6/kWh for consumption below 50% of load factor Rs. 6.0/ kWh (average cost)

2.5 Analysis of electricity consumption

Table 2.5: Electricity consumption profile

Month	Electricity consumption, kWh/month	Contract demand, kVA	Actual Demand, kVA	Energy Charges, Rs.	Demand Charges, Rs.	PF	PF Rebate, Rs.	Monthly Bill amount, Rs.
Jan-18	24,868	450	405	1,61,648	2,06,550	0.81	20,884	5,12,896
Feb-18	47,238	450	405	3,07,053	2,06,550	0.86	12,206	5,09,741

Month	Electricity consumption, kWh/month	Contract demand, kVA	Actual Demand, kVA	Energy Charges, Rs.	Demand Charges, Rs.	PF	PF Rebate, Rs.	Monthly Bill amount, Rs.
Mar-18	52,470	450	405	3,41,061	2,06,550	0.88	6,779	4,96,919
Average	**41,525**	**450**	**405**	**2,69,921**	**2,06,550**	**0.85**	**13,290**	**5,06,519**
Yearly	**498,304**	**-**	**-**	**3,239,048**	**2,478,600**	**-**	**159,476**	**6,078,224**

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

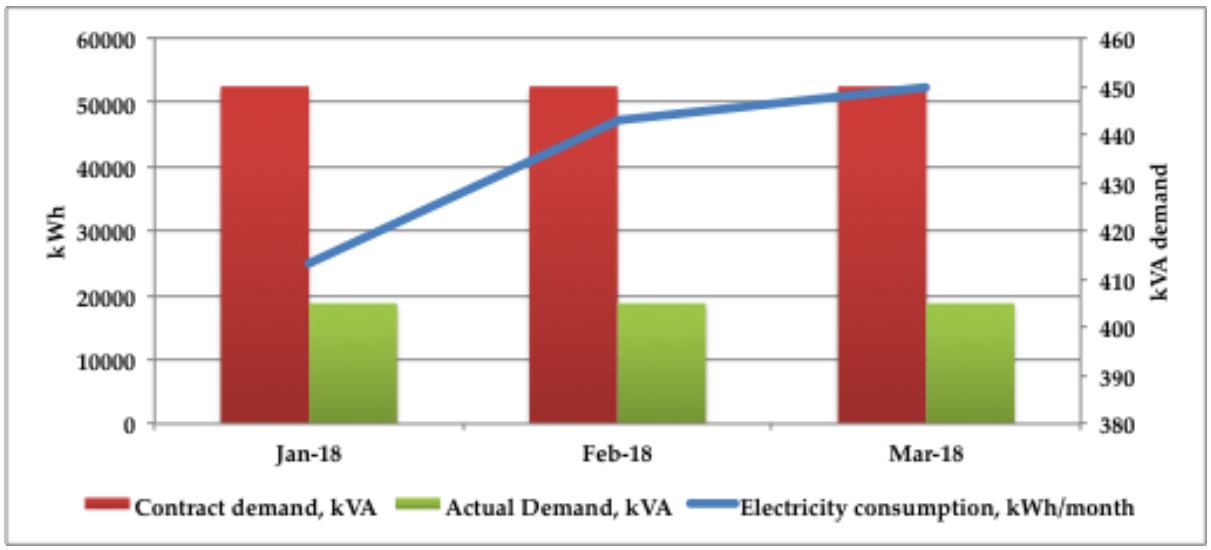

Figure 2.5: Demand pattern and energy consumption profile

The plant is consuming about 498,304 kWh of electricity per year. The total energy consumption of the unit during last 12 months is estimated to be 43 toe which is equivalent to 60.8 lakh rupees. The total CO_2 emission during this period is estimated to be 409 tonnes. Only electricity was 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 standard efficiency motors with new IE3 standard motors for sand plant

3.1.1 Background

M/s P S Crankshaft (P) Limited manufactures crankshafts for tractors. The plant is usingold motors of low efficiency for the sand plant, shot blast impellers motors and Muller mixers. The details of the motors installed in the sand plant of the unit are given in table 3.1.1.

Table 3.1.1: Details of motors in sand plant

S. No.	Motor ID	Design Specifications				
		Voltage (Volt)	Current, amp (A)	Motor rating (kW)	Speed	Efficiency (%)
1	Mixer motor-Load	415	89.5	44.8	1,440	89.2
	Mixer motor-Unload	415	89.5	44.8	1,440	89.2
2	Shot blast#1 impeller motor	415	14.0	7.5	1,450	83.5
3	Shot blast#2 impeller motor	415	9.0	5.5	1,440	84.7
4	Muller mixer motor	415	18.0	11.0	1,440	87.6

The operational parameters of these motors including the electricity consumption and material charged were measured during the detailed assessment study and historic operating data for past one year is also collected.

3.1.2 Observations and analysis

Some of these motors were rewinded once or twice which is affecting its overall performance. Most of the motors are old and are of standard efficiency class and their performance has deteoriated over the period due to rewinding and other reasons. Analysis done using the measured values indicates that there is a significant scope for energy potential by replacing these old motors with new premium efficiency class IE3 motors.

Table 3.1.2: Performance of motors

Motor ID	Operational parameters				Loading
	Voltage, volt	Current, amp	Power factor (PF)	Active Power (kW)	Percentage
Mixture motor-Load	426	59	0.9	39.0	78
Mixture motor-Unload	406	17.5	0.9	14.7	29

Motor ID	Operational parameters				Loading
	Voltage, volt	Current, amp	Power factor (PF)	Active Power (kW)	Percentage
Shot blast#1 impeller motor	412	9	0.8	6.2	69
Shot blast#2 impeller motor	412	6.7	0.9	5.8	89
Muller mixer motor	411	11	0.8	8.1	65

3.1.3 Recommendation

The unit may adopt the new IE3 standard motors of same rating to reduce the power consumption. The proposed IE3 standard motors specifications include 60HP sand mixer motor, 10HP and 7.5HP shot blasting impeller motors and 15HP batch Muller mixer with same frame size as present motors. The rated efficiency of new IE3 standard premium efficiency motors would be 2 to 3% more than the IE2 standard motor as specified by vendor.

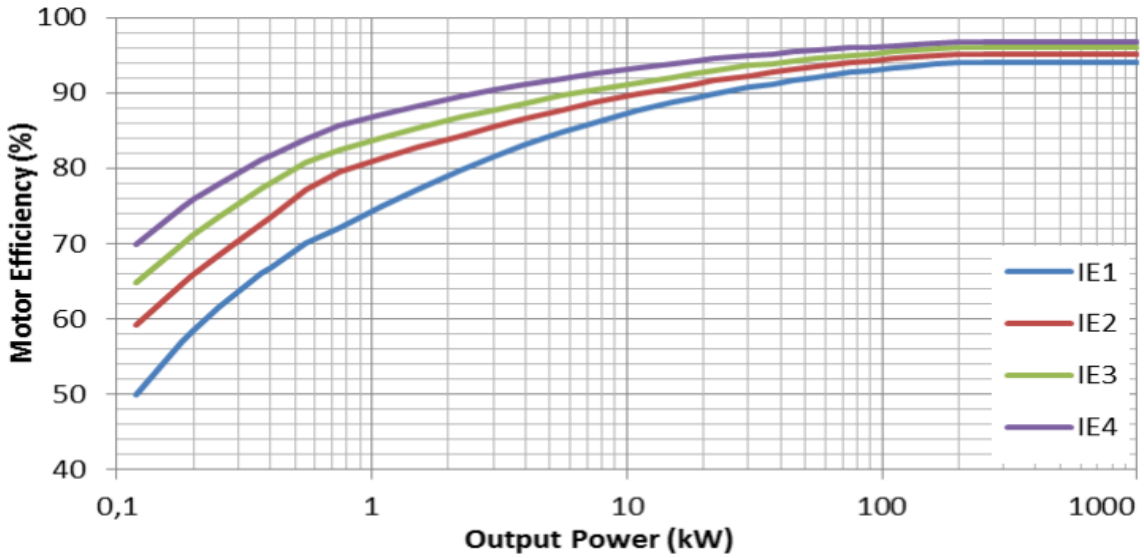

Figure 3.1.3: Efficiency levels as per IS12615 (4 pole, 50Hz)

3.2 Cost benefit analysis

The estimated annual energy savings by replacement of existing mentioned motors of standard efficiency with premium efficiency class IE3 motors is 13,742 kWh equivalents to a monetary saving of Rs 1.68 lakh. The investment[2] requirement is Rs 2.81 lakh with a simple payback period of 1.7 years. The detailed calculation of the recommended energy conservation measure is provided in table 3.2.

Table 3.2a: Cost benefit analysis for 60 HP mixer motor

Parameters	Unit	Existing	Proposed
Motor rating	kW	45	45
Motor efficiency	%	89.2	94
Power consumption - on load	kW	39.0	36.9

[2] Quotation no.1 is considered for calculation due to competitive cost.

Parameters	Unit	Existing	Proposed
Power consumption - unload	kW	14.7	13.9
Operating time	hours/year	4,800	4,800
Estimated loading	%	85	85
Energy consumption	kWh/year	1,69,704	1,60,696
Energy savings	kWh/year	-	9,008
Monetary savings	Rs/year	-	1.1

Table 3.2b: Cost benefit analysis for 10HP shot blast 1 impeller motor

Parameters	Unit	Existing	Proposed
Motor rating	kW	7.5	7.5
Motor efficiency	%	83.5	90
Power consumption	kW	6.20	5.73
Operating time	hours/year	4,200	4,200
Energy consumption	kWh/year	26,040	24,052
Energy savings	kWh/year	-	1,988
Monetary savings	Rs/year	-	0.24

Table 3.2c: Cost benefit analysis for 7.5HP shot blast-2 impeller motor

Parameters	Unit	Existing	Proposed
Motor rating	kW	5.5	5.50
Motor efficiency	%	84.7	90
Power consumption	kW	5.80	5.48
Operating time	hours/year	4,200	4,200
Energy consumption	kWh/year	24,360	23,028
Energy savings	kWh/year	-	1,332
Monetary savings	Rs/year	-	0.16

Table 3.2d: Cost benefit analysis for 15HP batch Muller mixer motor

Parameters	Unit	Existing	Proposed
Motor rating	kW	11	11
Motor efficiency	%	87.60	91
Power consumption	kW	8.10	7.76
Operating time	hours/year	4,200	4,200
Energy consumption	kWh/year	34,020	32,606
Energy savings	kWh/year	-	1,414
Monetary savings	Rs/year	-	0.20

3.3 Pre-training requirements

The training would be required on periodic maintenance of the electric motors.

3.4 Process down time for implementation

The estimated process down time required for implementation of recommended measure is estimated to be maximum 1 day after commissioning and testing of the new motors.

3.5 Environmental benefits

3.5.1 CO_2 reduction[3]

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 11.3 tonne 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.

[3] Source for emission factor: 2006 IPCC Guidelines for National Greenhouse Gas Inventories
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 and technology comparison

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

Quotation no.	Name of machinery (Model/ specification)	Name of manufacturer, contact person	Advantage
1	Reference Quote: Hindustan make, Premium efficiency class (IE3), LT Motor	Aakash Powertech Pvt Ltd Express Zone, A- Wing, Unit No. 501-505, W E Highway, Malad (E), Mumbai -400097 Tel No:- 61441600 , Fax No:- 61441650Email:- info@aakashpower.com	Reliable service
2	Reference quote: ABB make, Premium efficiency class (IE3), LT Motor	Shaildeep Enterprises Plot no. 1, survey no.235, Near Galaxy Agrico, B/H Pitrukrupa, Rajkot	Locally available

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

S. No.	Details	100% equity	D/E- 70:30	D/E- 50:50
1	Additional (Share) Capital	2.81	0.84	1.40
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	1.97	1.40
5	Others	-	-	-
	Total	**2.81**	**2.81**	**2.81**

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

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		2	
Annual operating hours	hours/year		4,800	
Installed production capacity	tonnes/year		4,000	
Production in last financial years	tonnes/year		2,340	
Capacity utilization factor	%		59	

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
Proposed investment (Project)				
Total cost of the project	Rs. (in Lakh)	2.81	2.81	2.81
Investment without interest defer credit (IDC)	Rs. (in Lakh)	2.81	2.81	2.81
Implementation time	Months	1	1	1
Interest during the implementation phase	Rs. in lakhs	0	0.02	0.01
Total investment	Rs. in lakhs	2.81	2.83	2.80
Financing pattern				
Own funds	Rs. in lakhs	2.81	0.90	1.40
Loan funds (term loan)	Rs. in lakhs	0	1.97	1.40
Loan tenure	Years	0	5	5
Moratorium period (No EMI (interest and principal amount))	Months	0	6	6
Total repayment period	Months	0	60	60
Interest rate	%	0	10.50	10.50
Estimation of costs				
Operation & maintenance costs	%		5	
Annual escalation rate of O&M	%		5	
Estimation of revenue				
Reduction in energy cost	Rs. (in lakh)/year		1.68	
Total saving	(Rs Lakh/year)		1.68	
Straight line depreciation	%		16.21	
IT depreciation	%		80.00	
Income tax	%		33.99	
Period of cash flow analysis	Years		5.00	

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)	2.81	2.83	2.82
Cash flow as annual saving (Rs. In lakh/year)	1.68	1.68	1.68
O&M Expenses for first year (Rs. In lakh/year)	0.14	0.14	0.14
Net Cash flow (Rs. In lakh/year)	1.54	1.54	1.54
SPP (months)	21.92	22.04	21.99
Considered (month)	21.90	22.00	22.00

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

Particulars / years	0	1	2	3	4	5
			(Rs.in lakhs)			
Profit after tax	-	1.08	0.95	0.58	0.55	0.54
Depreciation	-	0.45	0.45	0.45	0.45	0.45
Cash outflow	2.81	-	-	-	-	-
Net cash flow	-2.81	1.54	1.40	1.03	1.01	1.00
Discount rate % @ WACC	9.30	9.30	9.30	9.30	9.30	9.30
Discount factor	1.00	0.92	0.84	0.77	0.7	0.64
Present value	-2.81	1.41	1.18	0.79	0.71	0.64
Net present value	**1.91**					
Simple IRR considering regular cash flow	**36.02%**					

Table 4.2.3b: NPV and IRR (D/E- 70:30)

Particulars / years	0	1	2	3	4	5
			(Rs.in lakhs)			
Profit after tax	-	0.98	0.87	0.49	0.48	0.50
Depreciation	-	0.46	0.46	0.46	0.46	0.46
Cash outflow	2.83	-	-	-	-	-
Net cash flow	-2.83	1.44	1.33	0.95	0.94	0.96
Discount rate % @ WACC	10.10	10.10	10.10	10.10	10.10	10.10
Discount factor	1.00	0.91	0.83	0.75	0.68	0.62
Present value	-2.83	1.31	1.10	0.71	0.64	0.59
Net present value	**1.52**					
Simple IRR considering regular cash flow	**31.77%**					

Table 4.2.3c: NPV and IRR (D/E- 50:50)

Particulars / years	0	1	2	3	4	5
			(Rs.in lakhs)			
Profit after tax	-	1.01	0.89	0.51	0.50	0.52
Depreciation	-	0.46	0.46	0.46	0.46	0.46
Cash outflow	2.82	-	-	-	-	-
Net cash flow	-2.82	1.47	1.35	0.97	0.96	0.97
Discount rate % @ WACC	9.90	9.90	9.90	9.90	9.90	9.90
Discount factor	1.00	0.91	0.83	0.75	0.69	0.63
Present value	-2.82	1.34	1.12	0.73	0.66	0.61
Net present value	**1.63**					
Simple IRR considering regular cash flow	**33.01%**					

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)	Pan India
Locational advantages	-
Indicate competitors	Other motor manufacturing industries
Any USP or specific market strength	-
Whether product has multiple applications	NA

Items	Remarks
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 scenarios 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	19.80	2.33	41.39	-	41.39
		70:30	17.70	2.22	44.16	3.34	33.63
		50:50	20.40	1.99	37.09	4.09	27.48
2	10% reduction in estimated savings	100% equity	24.60	1.48	30.35	-	18.05
		70:30	25.60	1.02	24.53	2.47	26.98
		50:50	25.30	1.15	26.17	3.42	23.30
3	10% rise in interest rates	70:30	22.90	1.34	29.61	2.66	29.10
		50:50	22.60	1.50	31.43	3.68	25.46
4	10% reduction in interest rates	70:30	22.70	1.56	30.81	2.77	29.64
		50:50	22.50	1.66	32.29	3.85	25.81

5.0 Conclusions & recommendations

The IGDPR prepared for the replacement of existing standard efficiency motors with new premium efficiency class IE3 motors based on the performance assessment study conducted at 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

Energy conservation measures	Annual energy savings	Investment	Savings	Simple Payback	Emission reduction (tonnes CO_2)
	Electricity (kWh)	(Rs Lakh)	(Rs. Lakh/ year)	(Year)	
Replacement of existing standard efficiency motors with premium efficiency class IE3 motors	13,742	2.81	1.7	1.7	11.3

The measure has an estimated investment of 2.81 lakh rupees and can yield a savings of 1.7 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 11.3 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- 7:3	D/E- 1:1
1	Cost of Project	Rs. In Lakh	2.81	2.81	2.81
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	36.02	31.45	33.01
4	NPV	Rs. In Lakh	1.91	1.51	1.63
5	DSCR	-	-	2.71	3.76

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 measures 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	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: Aakash Powertech Pvt. Ltd

aakash powertech pvt. ltd.
power channelling solutions

AAKASH POWERTECH PVT.LTD

hindustan ELECTRIC MOTORS

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	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.
power channelling solutions

AAKASH POWERTECH PVT.LTD

hindustan ELECTRIC MOTORS

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

Effective from 16.11.2017

Quotation 2: Shaildeep Enterprise

Shaildeep Enterprise
Plot No.1, Survey No.235, Nr.Galaxy Agrico, B/H, Hotel Pitrukrupa, Veraval (Shapar) Dist.Rajkot-360024,
Ph.:02827-252479, Cell: - 07201977277, 7201877277 E-mail: shaildeepent@gmail.com

To, M/S. VIVEK SHARMA Kind Attention :Mr. Vivek Sharma Contact: 09850366248 Email ID: vivek_honest@yahoo.co.in	Our Reference: SD/QTN/040/17-18 Date: 28-03-2018 Rev.: Enquiry Reference: **E-mail** Enquiry date:27-03-2018

Dear Sir,

This is with reference to your enquiry of electric motors; we are pleased to submit our offer offer as below

A. GENERAL TECHNICAL SPECIFICATIONS

Ø ABB make totally Enclosed Fan Cooled (TEFC) Squirrel Cage, Induction Motors, Continuously rated (S1) suitable for operation on 415 Volt ± 10% 3 phase, 50 Hz ± 5%, A.C. supply with Class F insulation for 50° C ambient temperature, IP55 and as per IS_325 and IS 12615:2011.

Ø IE2 motors. Standard test certificate is available with every motor. Motor Datasheet and GA Drawing attached.

Ø Offered Motors are suitable for Direct On Line starting. In case application calls for VFD. It is recommended to use VFD Duty Motors. Extra charges @ 5% on quoted prices for VFD Duty Motors.

Ø Offered Motors are suitable for Direct Coupling. In case your application calls for V belt and Pulley, It is recommended to use Roller bearing at NDE side. Roller bearing Charges Extra for160 TO 200 Frame INR 1500 225 to 250 Frames is INR 3000 per Motor.

B. PRICE SCHEDULE

ABB MAKE IE3 TEFC MOTOR SUITABLE DIRECT COUPLING									
Sr. No.	Qty	KW/HP	RPM	Mount	Type Of Starting	Frame Size	Unit Price	Total Amount	Delivery
1	1	45/60	1000	B3-FOOT	DOL	E3HX280SMA6	191638	191638/-	6-8 WEEK
2	1	22/30	1475	B3-FOOT	DOL	M2BAX180MLB4 IE3	56678	56677/-	6-8 WEEK

Shaildeep Enterprise
Plot No.1, Survey No.235, Nr.Galaxy Agrico, B/H, Hotel Pitrukrupa, Veraval (Shapar) Dist.Rajkot-360024,
Ph.:02827-252479, Cell: - 07201977277, 7201877277 E-mail: shaildeepent@gmail.com

C. Terms and Conditions:

Testing Charge	:	Motors will be supplied with Routine Test Certificate. However any witness testing required. Same will be charged extra as per Manufacturers price list
Taxes / Surcharge	:	GST extra as applicable. Present Rate of GST will be 18%
Validity	:	15 Days from the date of our offer
Payment	:	100% Invoice prior to dispatch within 2 day
P&F / Insurance	:	NIL
Price	:	Ex Rajkot. Freight To pay
Warranty	:	Limited to a period of 12 months from the date of installation or 18 months from the date of dispatch, ex-works whichever is earlier.
Delivery		As mentioned in above price schedule

D. Our GST Details are as below

Company Name	:	Shaildeep Enterprise
GSTIN	:	24ACTFS1580L1ZJ

E. Bank Detail :

Bank Name	:	Central Bank Of India
Branch	:	Main Branch Rajkot
A/C No.	:	3468387369
A/C Type	:	CC
NEFT CODE	:	CBIN0280571

We hope it will be in line with your requirement, incase if you have any query please feel free to contact us.

Thanking you once again and assuring you of our best services at all times.

Truly Yours,

For, Shaildeep Enterprise

Dipen Devani

7600053277

Annexure 2: Instruments used

Instruments	Model/ Make	Application	Accuracy
Power analysers	Fluke: 435, Krykard: ALM 10	Electrical Parameters Harmonics analysis, power logging	± 0.5%
Thermal imager	875-2/Testo	Surface Temperature & Image	± 2%
Infrared thermometer	Testo: 845, Comark: KM848	Surface Temperature	±0.75% of mv