DETAILED PROJECT REPORT
ON
ENERGY EFFICIENT MOTOR FOR BRICK PRESS-10HP
(EAST & WEST GODAVARI REFRACTORIES CLUSTER)

ENERGY IS LIFE
BEE
CONSERVE IT

Bureau of Energy Efficiency

Prepared By

APITCO LIMITED
Engineering Growth

Reviewed By

ISTSL

ENERGY EFFICIENT MOTOR FOR BRICK PRESS -10 HP

East & West Godavari Refractory Manufacturing Cluster

BEE, 2010

Detailed Project Report on Energy Efficient Motor for Brick Press Refractory Cluster, East &West Godavari, Andhra Pradesh (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: E&W**/Ref/EEM/03**

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Andhra Pradesh Industrial & Technical Consultancy Organization Ltd. (APITCO) is also thankful to “*The Ceramic Manufacturing Welfare Association, Rajamundry at East & west Godavari Districts*” for their valuable inputs, co-operation, support and identification of the units for energy use and technology audit studies and facilitating the implementation of BEE SME program.

We take this opportunity to express our appreciation for the excellent support provided by unit owners, local service providers, and equipment suppliers for their active involvement and their valuable inputs in making the program successful and in completion of the Detailed Project Report (DPR).

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APITCO Limited

Hyderabad

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Lists of Abbreviations

BEE - Bureau of Energy Efficiency

DPR - Detailed Project Report

DSCR - Debt Service Coverage Ratio

GHG - Green House Gases

HP - Horse Power

IRR - Internal Rate of Return

MoP - Ministry of Power

MSME - Micro Small and Medium Enterprises

NPV - Net Present Value

ROI - Return on Investment

MoMSME - Ministry of Micro Small and Medium Enterprises

SIDBI - Small Industrial Development Bank of India

EXECUTIVE SUMMARY

APITCO Ltd is executing BEE-SME program in East and West Godavari (Refractories) Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Rajahmundry is one of the oldest clusters of state of Andhra Pradesh producing Refractories and potteries. These industries were in operation since last four to five decades. Earlier, these industries were used to produce potteries for domestic market, which are commonly used for storing pickles for longer time. The products called 'Jars' are the most commonly used container in Southern India specifically in the state of Andhra Pradesh for storing various food items. During the course of time, the demand for potteries (Jars) was considerably reduced due to change in economy and food habits. These pottery making units were diversified to produce Refractories which are used in industries as insulation.

Majority of the industries are producing Refractories and very few units are producing potteries. These industries have been in operation for the last 25 to 30 years. The main raw materials are clay, refractory grog, other chemicals etc.

The major Energy used in cluster is Coal and Wood and Electricity. Coal and wood are used as fuel in down draft kilns for heat treatment of refractory bricks. Electricity is used for drive the prime movers used in Brick Press, grinding machines, clay mixers, crushers etc. The total energy cost in refractory industries varies from 40% to 50 % of production cost. The down draft kilns requires higher thermal energy, which is major share of total energy consumed.

The Brick press is operated by inbuilt motors with pulley. The raw material is feed in to the desired shaped die and press the material under the pressure using the motor. The Brick making operations in refractory Industries are daily about 12 hrs for making refractory bricks using unshaped refractory material. The environment in Brick making area is dusty and wet which will affect the efficiency of motors and other parts of machinery. If the Brick making motor is inefficient the power consumption will be high.

During the energy use and technology audit in Refractory Manufacturing Industries all Brick press motors exists normal efficiency compare to energy efficient motors. To reduce the power consumption, it is essential to replace energy efficient motor for brick press.

The DPR highlights the details of the study conducted for assessing the potential for installation of energy efficient motor in brick press, possible monetary benefit, availability of the technologies/design, local service providers, technical features and proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, and schedule of Project Implementation.

This bankable DPR also found eligible for subsidy scheme of MoMSME for "Technology and Quality Upgradation Support to Micro, Small and Medium Enterprises" under "National Manufacturing and Competitiveness Programme". The key indicators of the DPR including the Project cost, debt equity ratio, monetary benefit and other necessary parameters are given in table below

S.No	Particular	Unit	Value
1	Project cost	` (in Lakh)	0.206
2	Power saving	kWh/annum	2800
3	Monetary benefit	` (in Lakh)	0.11
4	Simple payback period	Years	1.96
5	NPV	` (in Lakh)	0.13
6	IRR	%age	31.37
7	ROI	%age	31.81
8	Average DSCR	Ratio	1.76
9	Process down time	Days	1
10	CO_2 emission reduction	Tons/annum	2

The projected profitability and cash flow statements indicate that the project implementation i.e. installation of Energy efficient Motor for Brick Press in refractory manufacturing cluster for reducing the power consumption will be financially viable and technically feasible.

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 29 selected SMEs clusters. Bhimavaram Ice Making Units Cluster is one of them. The BEE's SME Programme intends to enhance the energy efficiency awareness by funding/subsidizing need based studies in SME clusters and giving energy conservation recommendations. For addressing the specific problems of these SMEs and enhancing energy efficiency in the clusters, BEE will be focusing on energy efficiency, energy conservation and technology up-gradation through studies and pilot projects in these SMEs clusters.

Major activities in the BEE -SME program are furnished below:

Activity 1: Energy use and technology audit

The energy use technology studies would provide information on technology status, best operating practices, gaps in skills and knowledge on energy conservation opportunities, energy saving potential and new energy efficient technologies, etc for each of the sub sector in SMEs.

Activity 2: Capacity building of stake holders in cluster on energy efficiency

In most of the cases SME entrepreneurs are dependent on the locally available technologies, service providers for various reasons. To address this issue BEE has also undertaken capacity building of local service providers and entrepreneurs/ Managers of SMEs on energy efficiency improvement in their units as well as clusters. The local service providers will be trained in order to be able to provide the local services in setting up of energy efficiency projects in the clusters

Activity 3: Implementation of energy efficiency measures

To implement the technology up-gradation project in the clusters, BEE has proposed to prepare the technology based detailed project reports (DPRs) for a minimum of five technologies in three capacities for each technology.

Activity 4: Facilitation of innovative financing mechanisms for implementation of energy efficiency projects

The objective of this activity is to facilitate the uptake of energy efficiency measures through innovative financing mechanisms without creating market distortion.

1 INTRODUCTION

1.1 Brief Introduction about cluster

Rajahmundry is one of the oldest Industrial clusters and located in state of Andhra Pradesh and manufacturing Refractories products and potteries. These industries were in operation since last four to five decades. Earlier, these industries were used to manufacture potteries for domestic market, which are commonly used for storing pickles for longer time. The products called 'Jars' are the most commonly used container in Southern India specifically in the state of Andhra Pradesh for storing various food items. During the course of time, the demand for potteries (Jars) was considerably reduced due to change in economy and food habits. These pottery making units were diversified to refractory manufacturing due to demand.

Majority of the industries are manufacturing Refractories and very few units are potteries. There are about 83 industries in the cluster. These industries have been in operation for the last 20 to 30 years. The main raw materials are clay, refractory grog, other chemicals etc. The major Energy used in refractory cluster is Electricity and Fuels like Coal and Wood. Electricity is used for drive the prime movers of brick making units, grinding machines, mixers etc. Coal and wood are used as fuel in down draft kilns for heat treatment of the bricks.

The cost of energy is varies from 30% to 50% of production cost which is depending up on the kilns and capacities. In refractory industries, major cost is contributed by energy cost followed by raw material cost and labor cost.

1.1.1 Production process

The main process operation for manufacturing refractory bricks adopted in cluster units are as follows:

The raw material i.e. Clay 60%, refractory Greg 40% and water is feed manually and sent to clay mister for uniform mixing . The refractory bricks are either prepared by manually (Hollow bricks) or in molding machines (Solid bricks) and the bricks are dried naturally/ using fans for 2 to 3 days and naturally dried bricks are loaded to the kiln.

The heating of the bricks is done under slow firing in kiln for 72 hours for removing the moisture content. In the slow firing, for every one hour, about one shovel of coal (3.5 kgs)

in each grate is burnt. The temperature is maintained between 100 – 200^{o}C. During this period all the doors and damper existing in the kiln are kept open.

After slow firing firstly raw material charging door in kiln is closed. Out of 24 holes provided in kiln, 4 no's of top holes are closed every 8 hrs from the time of charging door closed. After closing the all the doors, rapid firing system started by adding 1 shovel of coal per hour in every coal feeding doors.

After 72 hours, the full firing period is carried out for 48 hours and the temperature of the kiln is increased from 200 ^{o}C to 1050 ^{o}C. The damper position in kiln is kept opened for about 25%. After completion of the rapid firing for 48 hours, all the coal feed points /grates and damper are closed and firing is stopped. Then the kiln is left for maintain the temperature (soaking) for 24 hours and then the kiln is taken for natural cooling and the bricks are unloaded after 24 hours of natural cooling.

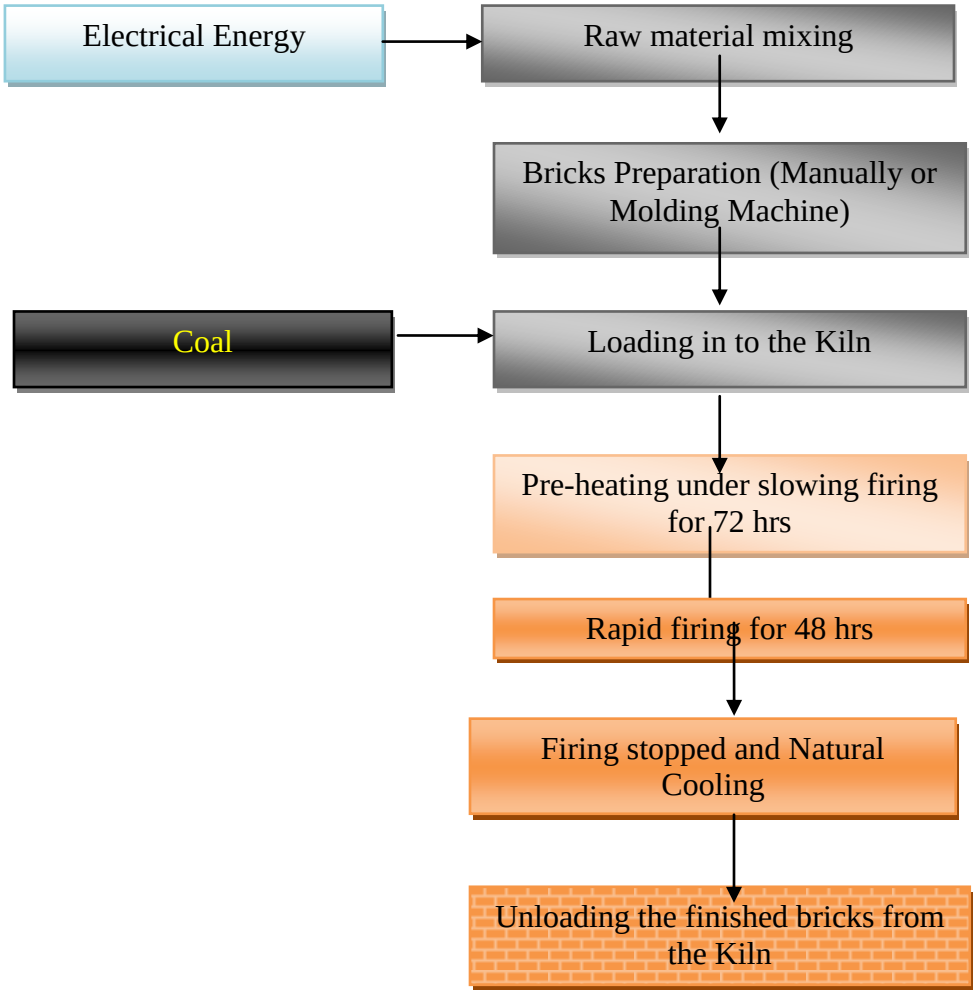


Figure 1.1: General process flowchart of a typical Refractory Unit

1.2 Energy performance in existing situation

1.2.1 Fuel and electricity consumption of a typical unit in the cluster

The main energy forms used in a typical unit in the cluster are electricity, coal, and wood. Electricity is used for drive the prime mover of brick making unit, mixers, grinding machine, etc. Coal and wood is used as fuel in the down draft kiln. The energy consumption of a typical unit in cluster is furnished in Table 1.1 below:

Table 1.1: Energy consumption of a typical unit

S.No.	Name of Unit	Yearly Consumption		
		Coal (Tons)	Electricity (kWh)	Wood (Tons)
1	M/s. Padma Ceramics and Refractories	700	31488	150

1.2.2 Average production by a typical unit in the cluster

The average production in a typical refractory unit is between 700 tons of Refractory Bricks per annum.

1.2.3 Specific Energy Consumption

The main energy forms used in the refractory production are electricity, coal, and wood. The Specific energy consumption for electrical and thermal energy per ton of Production for a typical unit is furnished in Table 1.2 below:

Table 1.2: Specific energy consumption for a typical unit

S. No.	Type of Fuel	Units	Sp. Energy Consumption
1	Coal Consumption	Tons/ ton of products	1.0
2	Grid Power consumption	kWh/ ton	45
3	Wood consumption	tons/ ton of Product	0.21

1.3 Existing technology/equipment

1.3.1 Description of existing technology

The refractory Manufacturing Industries use Brick Press for preparation of refractory Bricks using unshaped Refractory material. The Brick press is a machine used for making the refractory bricks in desired shape. Using the Brick press, the brick is under goes the compressive strength using the Brick Press. Unlike manual brick making, using the brick press large quantity of bricks can be manufactured. The brick press required electrical

energy to operate the motors. The capacity of Press is depends up on the production capacity and the type of bricks can be manufactured in the industry.

The Brick press is operated by inbuilt motors with pulley. The raw material is feed in to the desired shaped die and press the material under the pressure using the motor. The Brick making operations in refractory Industries are daily about 12 hrs for making refractory bricks using unshaped refractory material. The environment in Brick making area is dusty and wet which will affect the efficiency of motors and other parts of machinery. If the Brick making motor is inefficient the power consumption will be high.

During the energy use and technology audit in Refractory Manufacturing Industries all Brick press motors exists normal efficiency compare to energy efficient motors. To reduce the power consumption, it is essential to replace energy efficient motor.

Power costs will certainly continue to rise and further escalate motor operating expense. To reduce the power consumption by the Brick press during the Refractory Manufacturing plant operation it is essential to implement energy efficient motor for Brick Press. By installing Energy Efficient Motor in Brick Press will result considerable energy savings and there by reduction in production cost. A detail of existing brick press motor is given in the Table 1.3 below:

Table 1.3 Existing Brick Press motor specifications

S.No	Details	Specifications
1	Rated HP	10
2	Voltage (V)	440
3	Rated Amps (I)	15
4	Frequency Hz	50
5	Power Consumption (kW)	6.0
6	Efficiency (%age)	80

1.3.2 Its role in the whole process

The crushed raw material i.e. Clay, crushed Grog is mixed with small portion of water in clay mixture/ ball mill for uniform mixture. The raw material is thoroughly mixed in the clay mixture/ ball mill. The product from the clay mixture/ ball mill is called unshaped refractory. This unshaped refractory material is used to prepare product by using molding press/ annual press for required shape. The unshaped refractory material is then used in molding

press /press/ manual to form required shape of product. The finished products from molds have moisture content. The shape of products are varies depending up on the requirement of client.

1.4 Establishing the baseline for the equipment

1.4.1 Design and operating parameters

The present power consumption by Brick Press motor is 6.0 kW. These motor is operated for 12 hours in a day and 350 days per year.

1.4.2 Electricity consumption in existing system

The electricity consumption by Brick Press motor in refractory Manufacturing Units in East & west Godavari cluster is given in Table 1.4 below:

Table 1.4 Electricity consumption by Brick Press Motor

S. No	Name of the unit	Motor Capacity (HP)	Actual Power consumption (kW)
1	M/s. Padma Ceramics and Refractories	10	6.0

1.4.2 Operating efficiency of the existing motor

The detailed energy audit studies had been undertaken in various units in the Refractory Manufacturing Units in the Cluster, East & West Godavari to evaluate the Brick Press motors efficiencies. Based on age and number of times the motor under gone re winded, the efficiency of Brick Press motors in the name plate is found to be 80-82% and during the operation of the motor the efficiency is lower than the manufacturer's specification due to wind losses, core losses etc. Now a day's higher efficiency motors (eef1) are available and the efficiencies are more than the standard and existing motors.

1.5 Barriers for adoption of new and energy efficient technology / equipment

1.5.1 Technological Barriers

The major technical barriers that prevented for implementation of the energy efficient motors in the cluster are:

- Dependence on local equipment suppliers and availability of the motors at lower cost.
- Lack of awareness of the energy efficient motors.

1.5.2 Financial Barrier

The replacement of motors requires high investment and repair and rewinding of the motor will cost very less. Hence, many of the owners don't show interest due to high initial investment and lack of financial strength to invest. Further, the lack of awareness of the losses and monetary benefit of energy efficient motors also one of the major factor for implementing the energy efficient motors.

Energy Efficiency Financing Schemes such as SIDBI's, if focused on the cluster, will play a catalytic role in implementation of identified energy conservation projects & technologies.

The cluster has significant potential for implementing energy efficiency motors.

1.5.3 Skilled manpower

Not applicable

1.5.4 Other barrier(s)

Information on the energy efficient technologies not available among cluster unit owners, though the suppliers are available locally of energy efficient motors, the information was not disseminated among cluster units.

2. TECHNOLOGY/EQUIPMENT FOR ENERGY EFFICIENCY IMPROVEMENTS

2.1 Detailed description of Technology/Equipment selected

2.1.1 Description of equipment

The project activity is replacement of inefficient motors with new energy efficient motors in Refractory manufacturing units located in E&W Godavari. The new motor will have 90% of overall efficiency at full load conditions. The high efficiency motors having the following special features:

- These motors are available in TEFC construction for use in safe areas and also in flameproof enclosure for use in Hazardous areas.
- Low loss special grade of thinner laminations. This reduces the Iron loss even at partial loads.
- Thicker conductors and more copper contents reduce copper loss due to lower resistance.
- Longer core length, reduced and uniform air gap between stator and rotor to reduce stray losses.
- Special design of fan and fan cover to reduce windage losses

Considering the above facts and for reducing electricity consumption by the Brick Press motor it is suggested to install energy efficient motors in Refractory units.

Advantage

- The benefits of using these motors in continuous duty applications like Blowers, Compressors, Fans, Exhausters, Crushers and Pumps etc will result the energy savings at full and part load conditions. In many applications the load factor of the motor will be range of 60-70% like Brick Press in Refractory Industries.
- The efficiency curve of standard motor is dropping in nature i.e., there is a sharp fall in efficiency at partial loads. But the energy efficient motors have a flat efficiency curve and hence the fall in efficiency is marginal. Thus energy saving is significant even in part loads.

2.1.2 Technology /Equipment specifications

The detailed specification of suggested energy efficient motor for is furnished in table 2.1 below:

Table 2.1: Technical Specifications of Energy Efficient motor

S. No.	Parameter	Unit	Value
1	Rated Capacity	HP	10
2	Rated Current	Amps	14.10
3	Speed	RPM	1445
4	Efficiency	% age	90
5	Power Factor	% age	0.82

2.1.3 Justification of the technology selected & Suitability

The Brick Press is major energy consuming equipment in refractory cluster where shaped material is formed before kept in the kiln. Based on detailed energy audits conducted for various motors installed in Brick Press in refractory units, major motors are age-old and many times re-winded. Due to the reason the efficiency of the motor will decrease and power consumption by Brick Press will increase at same load conditions.

But new energy efficient motors will have overall efficiency of 90 % (at full load) compare to the existing motor efficiency of 80-82%. The following benefits are possible for selection of this technology

- Reduce electricity consumption during full and part load conditions
- It reduces the GHG emissions
- Lower payback period for Continuous Operation
- High power factor
- Flat efficiency curve for at all loads
- Higher Motor life

2.1.4 Superiority over existing technology/equipment

The energy efficient motors having following superior features over existing motors

- Improved and higher efficiency is available from and at 60% to 100% load
- The efficiency curve is almost flat during part load conditions which result higher energy savings
- The special design features also result in lower operating temperatures which enhance the life of motor and reduce the maintenance costs

- These motors have inherently low noise and vibration and help in conservation of environment
- These motors are with highest power factor due the special exclusive design.
- The higher power factor reduces cable loss
- Saving is also made by reducing capacitors required to improve power factor

2.1.5 Availability of the proposed technology/equipment

The energy efficient motor suppliers are available in cluster locations.

2.1.6 Source of technology/equipment for the project

The source of the technology is indigenous and is locally available.

2.1.7 Service/technology providers

A detail of energy efficient motors suppliers has been furnished in Annexure 6.

2.1.8 Terms of sales

No specific terms and conditions

2.1.9 Process down time during implementation

The process down time for installation of energy efficient motor is considered one day which is required to dismantling/ replacing the existing motor and installation of new motor and providing electrical connections.

2.2 Life cycle assessment and risks analysis

The life of energy efficient motor is considered at 20 years. There is no risk involved as the motor are technology proven and are successfully in operation in all industries.

2.3 Suitable unit/plant size in terms of capacity/production

The motors are selected similar to the existing capacity of motor and actual power drawn at full load based on energy audits carried out plus 20% margin to overcome sudden load.

3. ECONOMIC BENEFITS OF NEW ENERGY EFFICIENT TECHNOLOGY

3.1 Technical benefits

3.1.1 Fuel savings per year

No fuel saving is possible

3.1.2 Electricity savings per year

The efficiency of the EE motor is more than the existing motor and hence it reduces electricity consumption at same loading condition. The power savings due to installation of new energy efficient motor is 2800 kWh per annum. Details of electricity saving calculation are given at Annexure 2.

3.1.3 Improvement in product quality

There is no significant impact on the product quality.

3.1.4 Increase in production

There is no significant effect on production capacity.

3.1.5 Reduction in raw material consumption

Raw material consumption will be same.

3.1.6 Reduction in other losses

Due to improved power factor of new energy efficient motor, the distribution losses may also reduce.

3.2 Monetary benefits

The monetary benefit due to installation of new energy efficient motor is ` 0.11 lakh per annum due to reduction in electricity consumption. Details of energy saving calculation are furnished in Table 3.1 below:

Table 3.1: Energy and monetary benefits

Sr. No	Parameter	Unit	Value
1	Present Power consumption	kWh/annum	25200
2	Power Consumption by new EE motor	kWh/yr	22400
3	Power saving	kWh/annum	2800
4	Monetary saving @ ` 3.75/kWh	`/annum (In lakh)	0.11

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

As installation of new efficient motor may reduce the breakdowns and hence working environment may improve.

3.3.2 Improvement in skill set of workers

The technology selected for implementation is new and energy efficient motor and will create the awareness among the workforce on efficiency in motors and how it will reduce the power consumption.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

None

3.4.2 Reduction in GHG emission such as CO2, NOx, etc

The major GHG emission reduction source is CO_2. The technology will reduce grid electricity consumption and emission reductions are estimated at 2 tons of CO_2 per annum due to implementation of the project activity.

3.4.3 Reduction in other emissions like SOx

No significant impact on SOx emissions.

4. INSTALLATION OF NEW ENERGY EFFICIENT MOTOR

4.1 Cost of technology/equipment implementation

4.1.1 Cost of technology/equipments

The total cost for motor is estimated at ` 0.206 lakh, which includes motor cost and other charges and discounts as per the Quotation in Annexure 7.

4.1.2 Other costs

Other charges include cabling and panel modification. Project cost details are furnished in Table 4.1 below:

Table 4.1: Project detail cost

Sr. No.	*Particular*	*Unit*	*Value*
1	New Energy Efficient motor	` in lakh	0.201
2	Panel, Switch & Cabling, Elec. and Modifications etc.	` in lakh	0.005
3	Total Investment	` in lakh	0.206

4.2 Arrangement of funds

4.2.1 Entrepreneur's contribution

The entrepreneur's contribution is 25% of total project cost, which works out at 0.05 lakh.

4.2.2 Loan amount

The term loan is 75% of the total project cost, which is ` 0.15 lakh.

4.2.3 Terms & conditions of loan

The interest rate is considered at 10.0% which is prevailing interest rate of SIDBI for energy efficiency related projects. The loan tenure is 3 years and the moratorium period is 3 months.

4.3 Financial indicators

4.3.1 Cash flow analysis

Considering the above discussed assumptions, the net cash accruals starting with ` 0.06 lakh in the first year operation and increases to ` 0.27 lakh at the end of 6rd year.

4.3.2 Simple payback period

The total project cost of the proposed technology is ` 0.206 lakh and monetary savings due to reduction in power consumption is ` 0.11 lakh and the simple payback period works out to be 1.96 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10.0% interest rate works out to be ` 0.13 lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 31.37%. Thus the project is financially viable.

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 31.81%. The average DSCR is 1.76.

4.4 Sensitivity analysis in realistic, pessimistic and optimistic scenarios

A sensitivity analysis has been worked out to ascertain how the project financials would behave in different situations like there is an increase in power savings or decrease. For the purpose of sensitive analysis, two scenarios are considered are.

- Increase in power savings by 5%
- Decrease in power savings by 5%

Table 4.2: Sensitivity analysis

Particulars	*IRR* %	*NPV* ` in lakh	*ROI* %	*DSCR*
Normal	31.37	0.13	31.81	1.76
5% increase in power savings	33.99	.014	32.10	1.85
5% decrease in power savings	28.73	0.11	31.48	1.67

In each scenario, other inputs are assumed as constant.

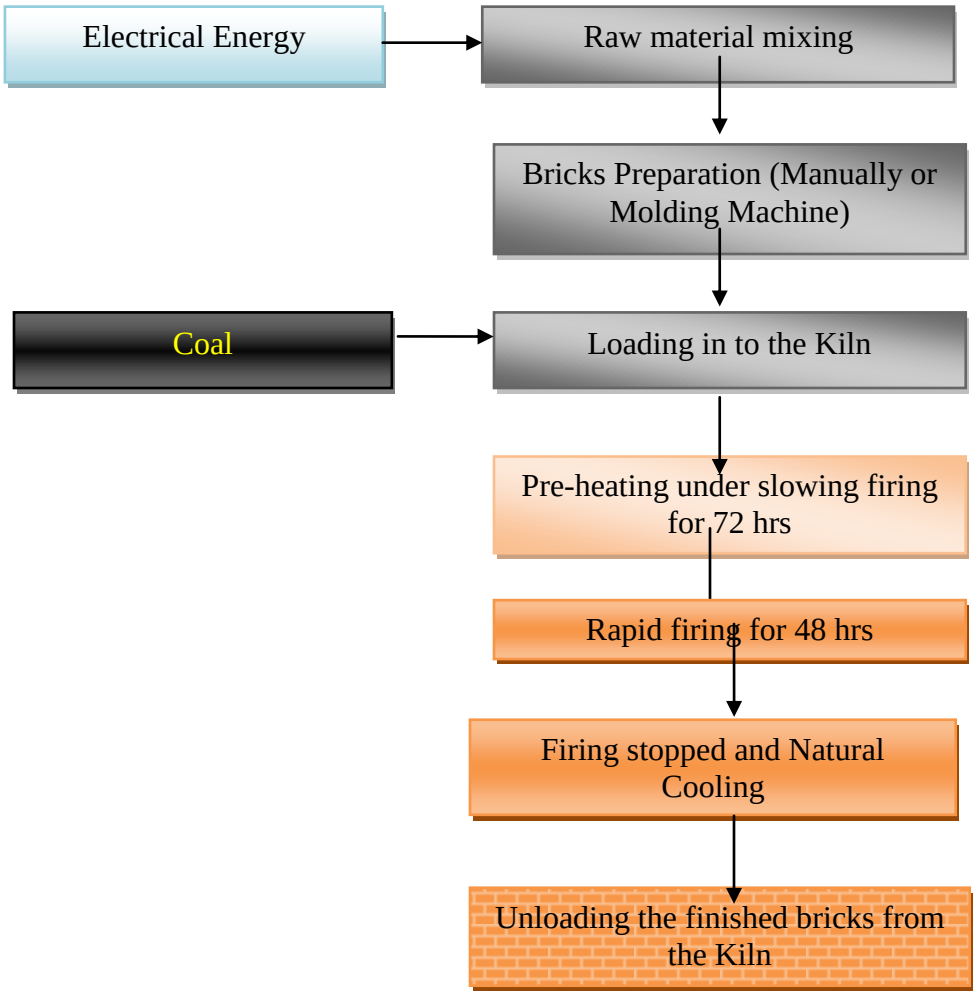
4.5 Procurement and implementation schedule

The project is expected to be completed in 1 week from the date of release of purchase order. The detailed schedule of project implementation is furnished in Annexure 5.

ANNEXURE

Annexure 1: Process Flow Diagram

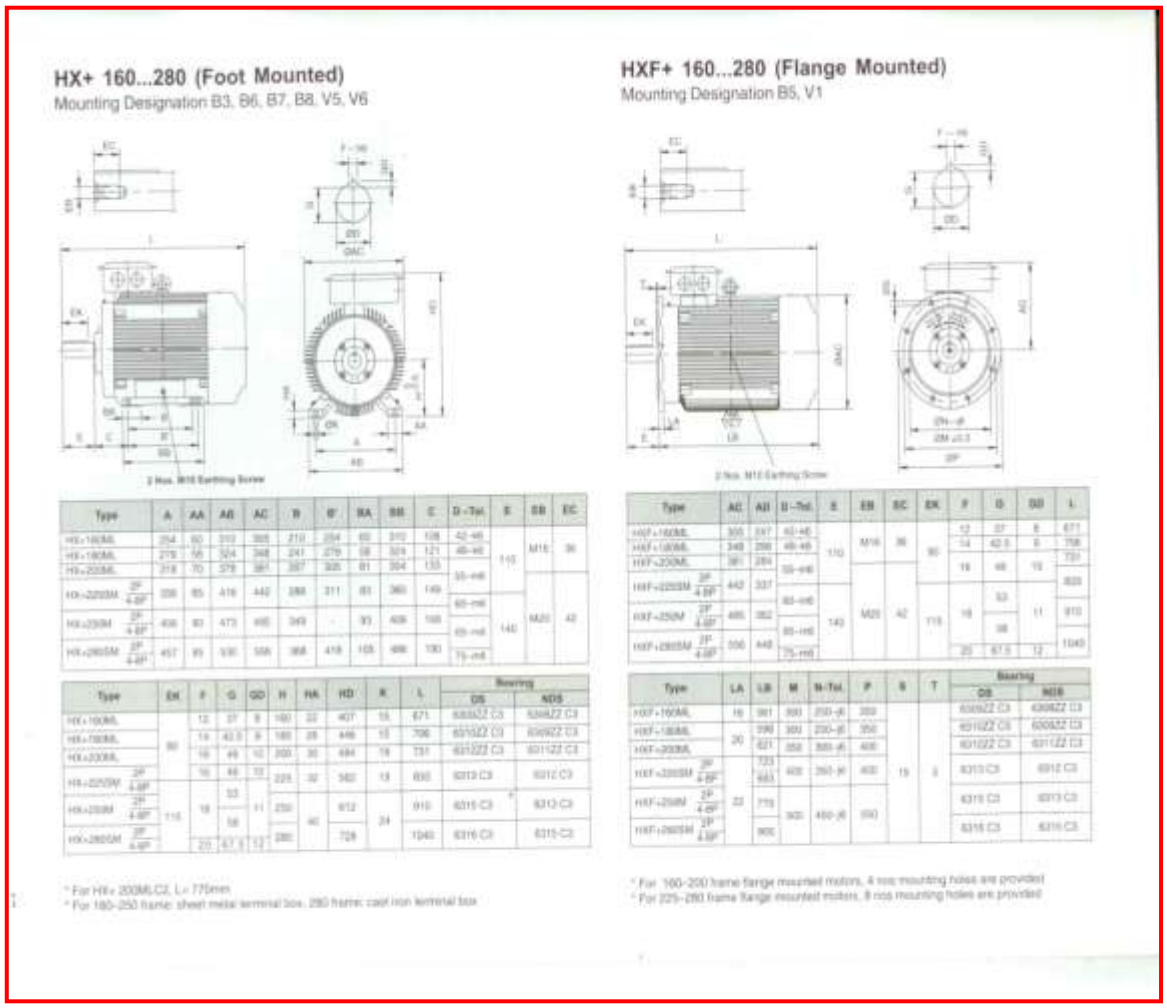
Process flow diagram will remain the same after implementation of proposed energy efficient motor.



Annexure 2: Detailed technology assessment report – Brick Press Motor

S.No	Particulars	Unit	Value
1	Present rated	HP	10
2	Present rated	kW	7.46
3	Efficiency of existing motor	% age	80
4	Input Power	kW	9.33
5	Actual power consumption	kW	6
6	% Loading	%	64.34
7	New Energy Efficient Motor	kW	7.46
8	Efficiency of energy efficient motor	% age	90
9	Input Power to New Motor at full load	kW	8.29
10	Power Consumption at same loading	kW	5.33
11	Power savings	kW	0.67
12	Total operating hours	Hrs	4200
13	Power savings per annum	kWh	2800
14	Monetary savings per annum (@ ` 3.75 per kWh)	` in lakh	0.11
15	Investment required for new energy efficient motor	` in lakh	0.206
16	Payback period	years	1.96

Annexure 3: Detailed drawing for civil work required for EE Motor



HX+ 160...280 (Foot Mounted)

Mounting Designation B3, B6, B7, B8, V5, V6

HXF+ 160...280 (Flange Mounted)

Mounting Designation B5, V1

Type	A	AA	AB	AC	B	BB	BA	C	D -Tol.	E	EB	EC
HX+160ML	254	60	310	305	210	254	60	108	42 +0.018 +0.002	110	M16	35
HX+160ML	279	56	324	348	241	279	58	121	48 +0.018 +0.002			
HX+200ML	318	70	378	381	267	305	61	134	55 +0.030 +0.011			
HX+225SM 2P 4-8P	356	65	416	442	286	311	63	360	60 +0.030 +0.011	140	M20	42
HX+250M 2P 4-8P	406	80	473	490	349	-	93	406	65 +0.030 +0.011			
HX+280SM 2P 4-8P	457	85	530	556	368	419	105	486	75 +0.030 +0.011			

Type	EK	F	G	GD	H	HA	HD	K	L	Bearing DE	Bearing NDE
HX+160ML	80	12	37	8	160	22	407	15	671	6306ZZ C3	6306ZZ C3
HX+180ML		14	42.5	8	180	25	446	15	706	6310ZZ C3	6306ZZ C3
HX+200ML		16	49	10	200	30	494	19	731	6312ZZ C3	6311ZZ C3
HX+225SM 2P 4-8P	110	16	49	10	225	32	562	19	830	6313 C3	6312 C3
HX+250M 2P 4-8P		18	53	11	250	40	612	24	910	6315 C3	6313 C3
HX+280SM 2P 4-8P			58		280		728		1040	6316 C3	6315 C3
		20	67.5	12							

* For HX+ 200ML/C2, L= 775mm

* For 160-250 frame: sheet metal terminal box, 280 frame: cast iron terminal box

Type	AC	AD	D -Tol.	E	EB	EC	EK	F	G	GD	L
HXF+160ML	305	347	42 +0.018 +0.002	110	M16	35	80	12	37	8	671
HXF+180ML	348	398	48 +0.018 +0.002					14	42.5	8	706
HXF+200ML	381	284	55 +0.030 +0.011					16	49	10	731
HXF+225SM 2P 4-8P	442	337	60 +0.030 +0.011	140	M20	42	115	16	53	11	830
HXF+250M 2P 4-8P	495	352	65 +0.030 +0.011						58		910
HXF+280SM 2P 4-8P	556	448	75 +0.030 +0.011					20	67.5	12	1040

Type	LA	LB	M	N -Tol.	P	S	T	Bearing DE	Bearing NDE
HXF+160ML	20	361	300	250 -0.5	350	19	5	6306ZZ C3	6306ZZ C3
HXF+180ML		396	300	250 -0.5	350			6310ZZ C3	6306ZZ C3
HXF+200ML		421	350	300 -0.5	400			6312 C3	6311ZZ C3
HXF+225SM 2P 4-8P	22	733 663	400	350 -0.5	450			6313 C3	6312 C3
HXF+250M 2P 4-8P		773	500	450 -0.5	550			6315 C3	6313 C3
HXF+280SM 2P 4-8P		905						6316 C3	6315 C3

* For 160-200 frame flange mounted motors, 4 nos mounting holes are provided

* For 225-280 frame flange mounted motors, 8 nos mounting holes are provided

Annexure 4: Detailed financial calculations & analysis

Assumptions

Name of the Technology	**New Energy Efficient Motor**		
Rated Capacity	***10 HP***		
Details	Unit	Values	Basis
Installed capacity	HP	10	
No of working days	Days	350	
No of Operating Hours	Hrs.	12	
Proposed Investment			
New Energy Efficient Motor	` in lakh	0.201	
Cabling, Civil and Modifications	` in lakh	0.005	
Total Investment	` in lakh	0.206	
Financing pattern			
Own Funds (Internal Accruals)	` in lakh	0.05	Feasibility Study
Loan Funds (Term Loan)	` in lakh	0.15	Feasibility Study
Loan Tenure	Years	3	Assumed
Moratorium Period	Months	3	Assumed
Repayment Period	Months	39	Assumed
Interest Rate	%	10	SIDBI Lending Rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	2	Feasibility Study
Annual Escalation	%	5	Feasibility Study
Estimation of Revenue			
power savings	kWh/annum	2800	Detailed calculations enclosed
power cost	`/kWh	3.75	
St. line Depn.	%	5.28	Indian Companies Act
IT Depreciation	%	80.00	Income Tax Rules
Income Tax	%	33.99	Income Tax

Estimation of Interest on Term Loan **` (in lakh)**

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	0.15	0.02	0.13	0.02
2	0.13	0.05	0.08	0.01
3	0.08	0.06	0.03	0.01
4	0.03	0.02	0.01	0.00
		0.15		

WDV Depreciation **` (in lakh)**

Particulars / years	***1***	***2***
Plant and Machinery		
Cost	0.21	0.04
Depreciation	0.16	0.03
WDV	0.04	0.01

Projected Profitability **` (in lakh)**

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***
Fuel savings	0.11	0.11	0.11	0.11	0.11	0.11
Total Revenue (A)	0.11	0.11	0.11	0.11	0.11	0.11
Expenses						
O & M Expenses	0.00	0.00	0.00	0.00	0.01	0.01
Total Expenses (B)	0.00	0.00	0.00	0.00	0.01	0.01
PBDIT (A)-(B)	0.10	0.10	0.10	0.10	0.10	0.10
Interest	0.02	0.01	0.01	0.00	0.00	0.00
PBDT	0.08	0.09	0.09	0.10	0.10	0.10
Depreciation	0.01	0.01	0.01	0.01	0.01	0.01
PBT	0.07	0.08	0.08	0.09	0.09	0.09
Income tax	0.00	0.02	0.03	0.03	0.03	0.03
Profit after tax (PAT)	0.07	0.06	0.05	0.05	0.06	0.05

Computation of Tax **` (in lakh)**

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***
Profit before tax	0.07	0.08	0.08	0.09	0.09	0.09
Add: Book depreciation	0.01	0.01	0.01	0.01	0.01	0.01
Less: WDV depreciation	0.16	0.03	-	-	-	-
Taxable profit	(0.08)	0.06	0.09	0.10	0.10	0.10
Income Tax	-	0.02	0.03	0.03	0.03	0.03

Projected Balance Sheet **` (in lakh)**

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***
Share Capital (D)	0.05	0.05	0.05	0.05	0.05	0.05
Reserves & Surplus (E)	0.07	0.13	0.18	0.24	0.29	0.35
Term Loans (F)	0.13	0.08	0.03	0.01	0.01	0.01
Total Liabilities (D)+(E)+(F)	0.25	0.27	0.26	0.30	0.35	0.41
Assets	1	2	3	4	5	6
Gross Fixed Assets	0.21	0.21	0.21	0.21	0.21	0.21
Less Accm. Depreciation	0.01	0.02	0.03	0.04	0.05	0.07
Net Fixed Assets	0.20	0.18	0.17	0.16	0.15	0.14
Cash & Bank Balance	0.06	0.08	0.09	0.14	0.20	0.27
TOTAL ASSETS	0.25	0.27	0.26	0.30	0.35	0.41
Net Worth	0.12	0.18	0.24	0.29	0.35	0.40
Debt Equity Ratio	2.53	1.60	0.53	0.18	0.18	0.18

Projected Cash Flow

` (in lakh)

Particulars / Years	0	1	2	3	4	5	6
Sources							
Share Capital	0.05	-	-	-	-	-	-
Term Loan	0.15						
Profit After tax		0.07	0.06	0.05	0.05	0.06	0.05
Depreciation		0.01	0.01	0.01	0.01	0.01	0.01
Total Sources	0.21	0.08	0.07	0.06	0.07	0.07	0.07
Application							
Capital Expenditure	0.21						
Repayment Of Loan	-	0.02	0.05	0.06	0.02	0.00	0.00
Total Application	0.21	0.02	0.05	0.06	0.02	0.00	0.00
Net Surplus	-	0.06	0.02	0.01	0.05	0.07	0.07
Add: Opening Balance	-	-	0.06	0.08	0.09	0.14	0.20
Closing Balance	-	0.06	0.08	0.09	0.14	0.20	0.27

IRR

` (in lakh)

Particulars / months	0	1	2	3	4	5	6
Profit after Tax		0.07	0.06	0.05	0.05	0.06	0.05
Depreciation		0.01	0.01	0.01	0.01	0.01	0.01
Interest on Term Loan		0.02	0.01	0.01	0.00	-	-
Cash outflow	(0.21)	-	-	-	-	-	-
Net Cash flow	(0.21)	0.10	0.08	0.07	0.07	0.07	0.07
IRR	31.37%						
NPV	0.13						

Break Even Point

` (in lakh)

Particulars / Years	1	2	3	4	5	6
Variable Expenses						
Oper. & Maintenance Exp (75%)	0.003	0.003	0.003	0.004	0.004	0.004
Sub Total*(G)*	0.003	0.003	0.003	0.004	0.004	0.004
Fixed Expenses						
Oper. & Maintenance Exp (25%)	0.001	0.001	0.001	0.001	0.001	0.001
Interest on Term Loan	0.018	0.011	0.006	0.001	0.000	0.000
Depreciation *(H)*	0.011	0.011	0.011	0.011	0.011	0.011
Sub Total (I)	0.029	0.023	0.018	0.013	0.012	0.012
Sales (J)	0.105	0.105	0.105	0.105	0.105	0.105
Contribution (K)	0.102	0.102	0.102	0.101	0.101	0.101
Break Even Point (L= G/I)	28.93%	22.43%	17.62%	12.43%	11.98%	12.06%
Cash Break Even {(I)-(H)}	18.26%	11.74%	6.92%	1.71%	1.24%	1.30%
Break Even Sales (J)*(L)	0.030	0.024	0.019	0.013	0.013	0.013

Return on Investment

` (in lakh)

Particulars / Years	1	2	3	4	5	6	Total
Net Profit Before Taxes	0.07	0.08	0.08	0.09	0.09	0.09	0.50
Net Worth	0.12	0.18	0.24	0.29	0.35	0.40	1.58
							31.81%

Debt Service Coverage Ratio **` (in lakh)**

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***Total***
Cash Inflow							
Profit after Tax	0.07	0.06	0.05	0.05	0.06	0.05	0.24
Depreciation	0.01	0.01	0.01	0.01	0.01	0.01	0.04
Interest on Term Loan	0.02	0.01	0.01	0.00	0.00	0.00	0.03
Total (M)	0.10	0.08	0.07	0.07	0.07	0.07	0.32

DEBT

Interest on Term Loan	0.02	0.01	0.01	0.00	0.00	0.00	0.03
Repayment of Term Loan	0.02	0.05	0.06	0.02	0.00	0.00	0.15
Total (N)	0.04	0.06	0.06	0.02	0.00	0.00	0.18
DSCR	2.43	1.38	1.12	3.58	0.00	0.00	1.76
Average DSCR (M/N)	1.76						

Annexure 5: Details of procurement and implementation plan

Project Implementation schedule

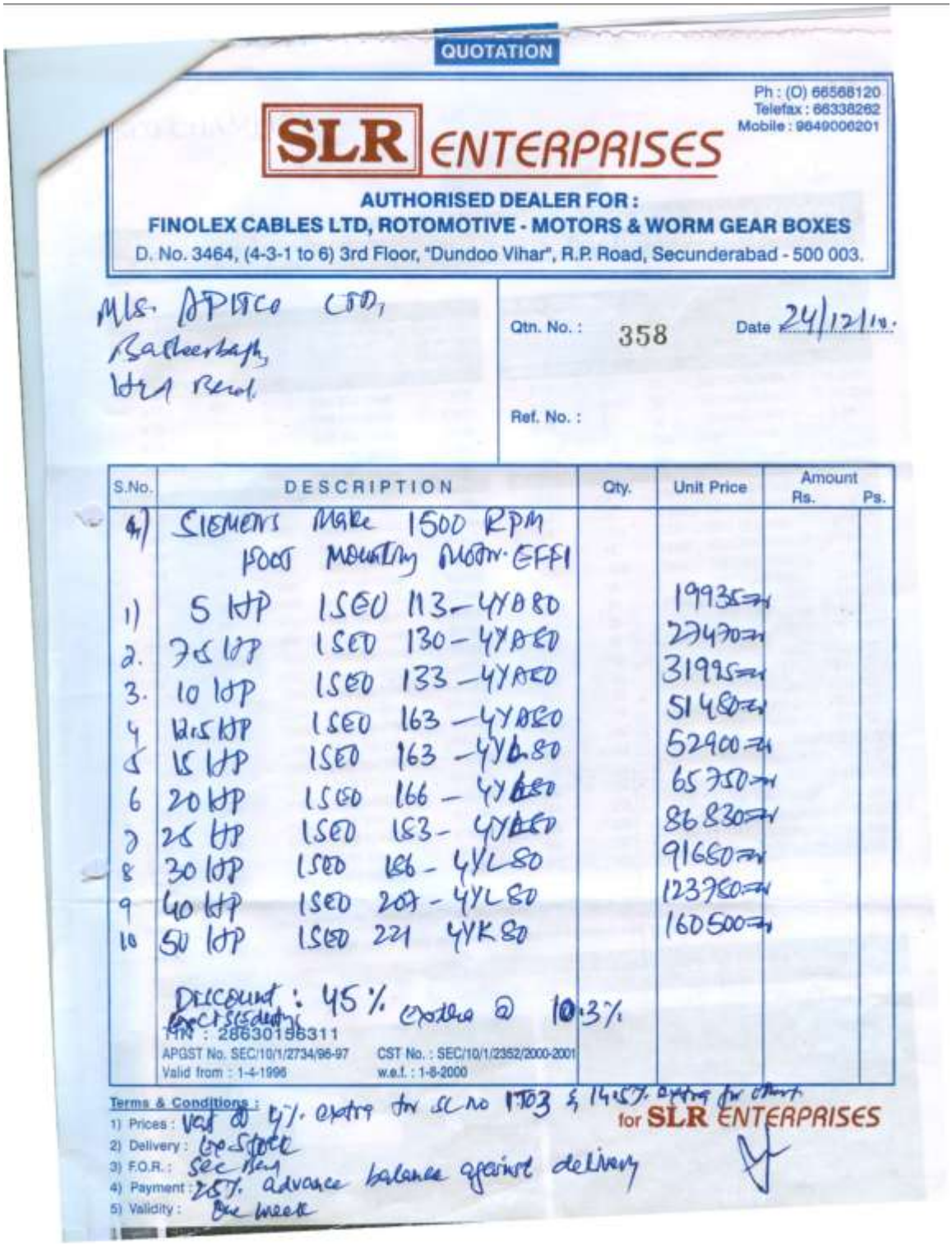
S. No	Activity	Days			
		2	4	6	7
1	Placement of Orders for Equipment				
2	Supply of energy efficient motor				
3	Erection and Commissioning				
4	Trial runs				

The process down time is considered for only one day.

Annexure 6: Details of technology/equipment and service providers

Equipment details	Source of technology	Service/technology providers
Energy Efficient Motors	SIEMENS	SLR Enterprises D.No:3464, (4-3-1 to 6) 3rd Floor, "Dundoo Vihar" R.P.Road Secunderabad-500 003 Ph No:040-66588120 Fax:040-66338262 Mobile:9849006201

Annexure 7: Quotation or techno-commercial bid



QUOTATION

Ph : (O) 66568120
Telefax : 66338262
Mobile : 9849006201

SLR ENTERPRISES

AUTHORISED DEALER FOR :
FINOLEX CABLES LTD, ROTOMOTIVE - MOTORS & WORM GEAR BOXES
D. No. 3464, (4-3-1 to 6) 3rd Floor, "Dundoo Vihar", R.P. Road, Secunderabad - 500 003.

M/s. APIICO CDD, Balcherlapally, Hyd Road.

Qtn. No. : 358 Date 24/12/10.

Ref. No. :

S.No.	DESCRIPTION	Qty.	Unit Price	Amount Rs.	Ps.
	SIEMENS Make 1500 RPM FOOT MOUNTING MOTOR EFFI				
1)	5 HP 1SE0 113-4YA80		19935/-		
2.	7½ HP 1SE0 130-4YA80		23470/-		
3.	10 HP 1SE0 133-4YA80		31995/-		
4	12½ HP 1SE0 163-4YA80		51480/-		
5	15 HP 1SE0 163-4YA80		52900/-		
6	20 HP 1SE0 166-4YA80		65750/-		
7	25 HP 1SE0 183-4YA80		86830/-		
8	30 HP 1SE0 186-4YL80		91650/-		
9	40 HP 1SE0 207-4YL80		123750/-		
10	50 HP 1SE0 221 4YK80		160500/-		
	Discount : 45% extra @ 10.3% less 5% cash discount				

TIN : 28630195311
APGST No. SEC/10/1/2734/96-97 Valid from : 1-4-1996
CST No. : SEC/10/1/2352/2000-2001 w.e.f. : 1-8-2000

Terms & Conditions :
1) Prices : Vat @ 4% extra for SL no 1703 & 1457 extra for above
2) Delivery : Ex-Stock
3) F.O.R. : Secunderabad
4) Payment : 25% advance balance against delivery
5) Validity : One week

for SLR ENTERPRISES

Bureau of Energy Efficiency (BEE)
(Ministry of Power, Government of India)
4th Floor, Sewa Bhawan, R. K. Puram, New Delhi – 110066
Ph.: +91 – 11 – 26179699 (5 Lines), Fax: +91 – 11 – 26178352
Websites: www.bee-india.nic.in, www.energymanagertraining.com

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Website: www.techsmall.com