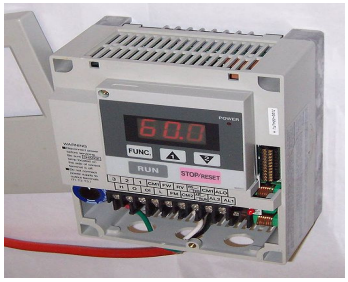
DETAILED PROJECT REPORT
ON
ENERGY CONSERVATION IN AGITATION SECTION
(MORBI CERAMIC CLUSTER)









Bureau of Energy Efficiency

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Environment
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ENERGY CONSERVATION IN AGITATION SECTION

MORBI CERAMIC CLUSTER

BEE, 2010
Detailed Project Report on Energy Conservation in Agitation section
Ceramic SME Cluster, Morbi, Gujarat (India)
New Delhi: Bureau of Energy Efficiency;
Detail Project Report No.: **MRV/CRM/EAS/07**

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Acknowledgement

We sincerely appreciate the efforts of industry, energy auditors, equipment manufacturers, technology providers, consultants and other experts in the area of energy conservation for joining hands with Bureau of Energy Efficiency (BEE), Ministry of Power, and Government of India for preparing the Detailed Project Report (DPR) under BEE SME Program in SMEs clusters. We appreciate the support of suppliers/vendors for providing the adoptable energy efficient equipments/technical details to the SMEs.

We have received very encouraging feedback for the BEE SME Program in various SME Clusters. Therefore, it was decided to bring out the DPR for the benefits of SMEs. We sincerely thank the officials of BEE, Executing Agencies and ISTSL for all the support and cooperation extended for preparation of the DPR. We gracefully acknowledge the diligent efforts and commitments of all those who have contributed in preparation of the DPR.

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List of Abbreviation

BEE	Bureau of Energy Efficiency
EE	Energy Efficient
SME	Small and Medium Enterprises
DPR	Detailed Project Report
GHG	Green House Gases
CDM	Clean Development Mechanism
DSCR	Debt Service Coverage Ratio
NPV	Net Present Value
IRR	Internal Rate of Return
ROI	Return on Investment
SCM	Standard Cubic Meter
MWh	Mega Watt hour
SIDBI	Small Industrial Development Bank of India
VFD	Variable Frequency Drives

EXECUTIVE SUMMARY

SEE-Tech Solution Pvt. Ltd. is executing BEE-SME program in Morbi Ceramic Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Morbi cluster is one of the largest ceramic clusters in India; accordingly this cluster was chosen for energy efficiency improvements by implementing energy efficient measures/technologies, so as to facilitate maximum replication in other ceramic clusters in India. The main energy forms used in the cluster units are grid electricity, Natural gas, charcoal, lignite and small quantity of diesel oil.

In ceramic industry, grinding of raw material is important for getting the good quality of the final product. After grinding process, the material is then sent to the underground tanks containing agitators. Agitators are required to maintain the uniformity of the grinded material. The agitator motors run continuously for the continuous production. Loading on the agitator motors varies with the addition of new grinded material. Therefore electricity saving is possible in agitation section.

Energy conservation in agitation section can be achieved by any one of following three technologies viz. installation of VFD on agitator motor, replacing conventional motor with energy efficient motor and use of On –Off controller system.

Total investment required and financial indicators calculated such as debt equity ratio, monetary saving, IRR, NPV, DSCR and ROI etc for proposed technologies are furnished in Tables below:

Installation of VFD on agitator motor

S.No	*Particular*	*Unit*	*Value*
1	Project cost	₹(in lakh)	3.99
2	Electricity saving	kWh/year	52,648
3	Monetary benefit	₹(in lakh)	2.13
4	Debit equity ratio	ratio	3:1
5	Simple payback period	years	1.87
6	NPV	₹(in lakh)	1.76
7	IRR	%age	27.67
8	ROI	%age	34.27
9	DSCR	ratio	195
10	Process down time	days	Not required

Replacement of conventional motor with energy efficient motors

S.No	Particular	Unit	Value
1	Project cost	₹(in lakh)	2.01
2	Electricity saving	kWh/year	14,529
3	Monetary benefit	₹(in lakh)	0.59
4	Debit equity ratio	ratio	3:1
5	Simple payback period	years	3.4
6	NPV in 11 years @ 10.00%	₹(in lakh)	0.62
7	IRR	%age	29.21
8	ROI	%age	25.40
9	DSCR	ratio	1.60
10	Process down time	days	Not required

Use On-Off controller system

S.No	Particular	Unit	Value
1	Project cost	₹(in lakh)	0.22
2	Electricity saving	kWh/year	105,297
3	Monetary benefit	₹(in lakh)	4.26
4	Debit equity ratio	ratio	3:1
5	Simple payback period	years	0.05
6	NPV in 11 years @ 10.00%	₹(in lakh)	8.09
7	IRR	%age	1895.43
8	ROI	%age	59.76
9	DSCR	ratio	49.75
10	Process down time	days	Not required

The projected profitability and cash flow statements indicate that the proposed projects implementation is 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 25 selected SMEs clusters. Morbi Ceramic 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*:**

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.

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

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.

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

Morbi SME Cluster is one of the largest ceramic clusters in India and mainly famous for manufacturing of ceramic tiles. Over 70% of total ceramic tiles product comes from Morbi cluster. This cluster is spread over a stretch of about 10km on the Morbi–Dhuva Highway.

There are approximately 479 ceramic units in this cluster which are engaged in manufacturing of wall tiles, vitrified tiles, floor tiles, sanitary wares, roofing tiles and others product. There are around 50 more ceramic units coming up in Morbi cluster.

Primary raw materials required for manufacturing of tiles are various types of clay, quartz, calcite/wool astonite, frits & Glazes. Most of the raw materials are easily available in Gujarat and in the neighboring state of Rajasthan. Some of the units use raw material produced at another plant. The main reason for growth of ceramic cluster in Morbi is easy availability of raw material viz; clay suitable for ceramic tiles.

The main form of energy used by the cluster units are grid electricity, Natural gas, charcoal, lignite, and diesel oil. Major consumptions of energy are in the form of Natural gas and lignite. Details of total energy consumption at Morbi ceramic cluster are furnished in Table 1.1 below:

Table 1.1 Details of annual energy consumption

S. No	*Type of Fuel*	*Unit*	*Value*	*% contribution*
1	Electricity	GWh/year	1,200	8.23
2	Natural gas	SCM/year	660,000,000	46.32
3	Charcoal	tonne/year	165,000	8.55
4	Lignite	tonne/year	1,320,000	36.84
5	Diesel	litre/year	800,000	0.06

Classification of Units

The ceramic units can be broadly categorized into four types based on product manufactured

- Floor tiles unit
- Sanitary ware unit
- Vitrified tiles unit
- Wall tiles unit

Further the ceramic cluster is classified into three type based on capacity of unit viz small scale, medium scale and large scale unit.

Products Manufactured

There are many types of ceramic product manufactured from four different types of units. Details of product manufactured and number of units engaged in manufacturing of such products are given in Table 1.2 below:

Table 1.2 Details of types of product manufactured

S. No	Type of Product	No. of unit	%age share
1	Wall Tiles	178	37
2	Vitrified Tiles	36	8
3	Floor Tiles	52	11
4	Sanitary Wares	43	9
5	Spray dryer Mud manufacturing	40	8
6	Roofing Tiles (seasonal operation)	120	25
7	Third firing manufacturing (Producing pictures on tiles)	10	2
8	Total	479	

Capacity wise production

Capacity wise production breakup is furnished in Table 1.3 below:

Table 1.3 Production wise unit breakups

Type of product	No. of Units.				Production (m^2/day or MT[a]/day)			
Scale of Unit	Small	Medium	Large	Total	Small	Medium	Large	Total
Wall Tiles	43	100	35	178	2,500	3,500	7,500	13,500
Floor Tiles	8	38	6	52	3,000	4,000	7,000	14,000
Vitrified Tiles	NA	22	4	26[b]	NA	5,760	11,520	17,280
Sanitary Wares	10	24	9	43	4	8	14	26

[a]- In case of sanitary wares, production is measured in MT.
[b]- During audit no SSI vitrified tiles units were covered, therefore production data are not available for these units.

Energy usages pattern

Average monthly electricity consumption in ceramic unit ranges from 1 lakh to 2 lakh kWh depending on the size of the unit. In thermal energy, solid fuel such as lignite, charcoal, Indonesian coal, briquette, etc are used in spray dryer and Natural gas is used in kiln in all almost all units. Solid fuel consumption in spray dryer ranges from 80 to 160 kg/MT and. Natural gas consumption in kiln varies from 1.01 to 1.4 SCM/m^2 of tiles produced.

General production process for ceramic cluster

The units of Morbi ceramic cluster are involved in the manufacturing of 4 different types of products such as floor tiles, wall tiles, vitrified tiles and sanitary wares. Production process for manufacture of wall, floor and vitrified tiles is nearly the same except some differences in process parameters while the manufacturing process of sanitary wares inter alia involves manual moulding whereas in case of tiles, press is used to form the biscuits. General production processes for manufacturing of ceramic products is are following:

Wet Grinding

The raw material such as clay, feldspar, quartz, calcite etc. are mixed with water in a proper proportion and grind in a ball mill to make homogeneous mixture. Ball Mill is a batch type of process. After completion of one batch of ball mill, slurry is sent to the underground tanks containing the agitator motor in each tank to maintain the uniformity of mixture. Mainly blungers are used for mixing and grinding in case of wall and floor tiles, while ball mills are used for grinding in case of vitrified tiles.

Spray Drying

After preparation of slurry of required density it is stored in the underground tanks in which it is agitated to maintain uniformity of slurry. The slurry is then pumped through a hydraulic pump into the spray dryer where it is sprayed through nozzles. The material is dried in spray dryer to remove the moisture added during the grinding process in a ball mill. The moisture in the raw material is brought down to about 5–6 % from 35-40%. The product from spray dryer is stored in silos. Hot flue gases at a temperature of about 550 – 600 °C is used as the heating source which is generated by combustion of lignite, Indonesian coal, saw dust, briquette, Natural gas etc.

Pressing/Moulding

The product from spray dryer is then sent to the press section which is pneumatically operated where the required sizes of biscuit tiles are formed. In case of sanitary ware manual moulding is carried out by hand held hose.

Drying

After pressing/moulding products containing about 5–6% moisture is dried to about 2–3% moisture in a dryer. In some units, hot air from kiln cooling zone exhaust is used in dryers and additional fuel firing is provided if required whereas in case of wall and floor tiles, fuel firing is done continuously.

Glazing

After drying, biscuit tiles are send for glazing on a glaze line. Glaze is prepared in ball mills. Glazing is required for designing on tiles. In case of sanitary ware the dried wares are glazed in several spray glazing booths, where compressed air is used.

Firing and Baking

After glazing product are then sent for final firing in kiln where temperature of 1100-1150 ^{o}C is maintained in the kiln. Natural gas is used for combustion in kiln. In some units hot air from gasifier is utilized for combustion.

Sizing

Tiles coming out of kiln are sent for sizing and calibration in case of wall and floor tiles. The tiles are cut in proper sizes so that all tiles have similar dimensions. After sizing the finished product is ready for dispatch.

Polishing

Polishing is required for vitrified tiles. It utilizes 40-45% of total electricity consumption of plant. After kiln the vitrified tiles are passed through polishing line. Polishing line consist of sizing, calibration and polishing machines.

General production process flow diagram for manufacturing of ceramic product is shown in Figure 1.1.

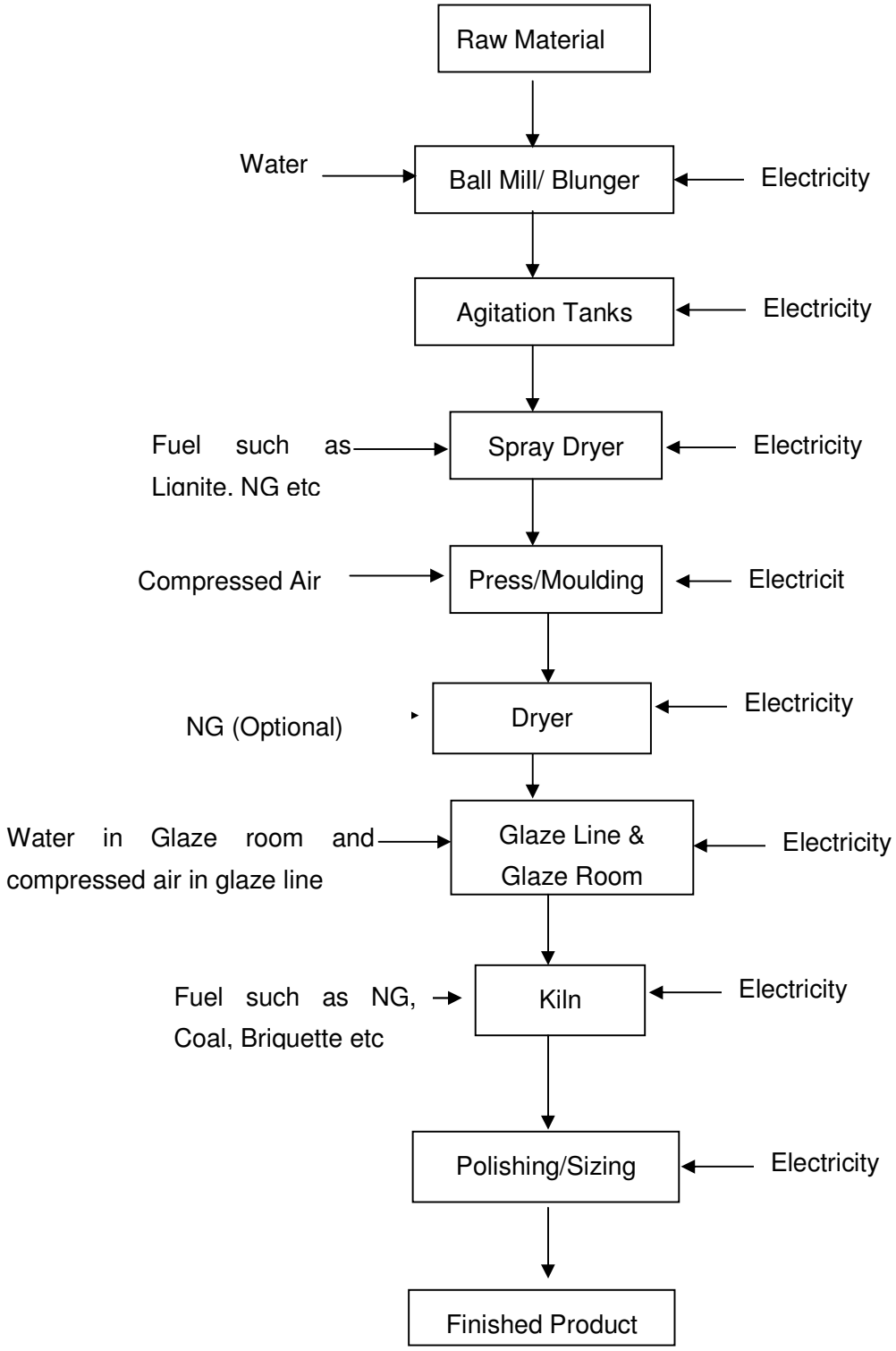

Figure 1.1Process flow diagram

1.2 Energy performance in existing system

1.2.1 Fuel consumption

Average fuel and electricity consumption in a typical ceramic unit is given in Table 1.4 below:

Table 1.4 Average fuel and electricity consumption

Energy	*Electricity (MWh per year)*			*Natural gas (SCM per year)*			*Solid Fuel [lignite] (Tonne per year)*		
Scale of Unit	*Small*	*Medium*	*Large*	*Small*	*Medium*	*Large*	*Small*	*Medium*	*Large*
Wall Tiles	900	1500	2400	750,000	1,050,000	2,250,000	2,400	2,880	3,600
Floor Tiles	900	1500	2400	900,000	1,200,000	2,100,000	3,600	4,200	4,800
Vitrified Tiles	NA	6000	12000	NA	2,700,000	6,000,000	NA	6,000	9,000
Sanitary Wares	2400	450	900	120,000	240,000	420,000	NA	NA	NA

1.2.2 Average annual production

Annual production in terms of m^2/year is taken in case of tiles and in terms of MT/year in case of sanitary wares is given in the following Table 1.5 below:

Table 1.5 Average annual production

S. No.	*Type of Industry*	*Production (m^2/year) or MT/year*		
		Small scale	*Medium scale*	*Large scale*
1	Vitrified Tiles	750,000	1,050,000	2,250,000
2	Wall Tiles	900,000	1,200,000	2,100,000
3	Floor Tiles	NA	1,728,000	3,456,000
4	Sanitary Wares	1200	2400	4200

1.2.3 Specific energy consumption

Specific energy consumption both electrical and thermal energy per m^2 or MT of production for different type of ceramic products are furnished in Table 1.6 below:

Table 1.6 Specific energy consumption

S. No.	Type of Industry	kWh/m^2 or kWh/piece[c]	SCM/m^2 or SCM/ piece[c]
1	Vitrified Tiles	3.71 - 5.01	1.51 - 3.11
2	Wall Tiles	0.61 - 2.47	0.68 - 1.65
3	Floor Tiles	1.51 - 1.92	1.28 - 1.8
4	Sanitary Wares	0.78 - 1.73	1.10 - 1.49

Equipment wise specific energy consumption

The specific energy consumption of the equipments used in the ceramic industry is given in Table 1.7 below wherever possible.

Table 1.7 Equipment wise specific energy consumption

S.No	Equipment	Electrical energy		Thermal energy	
		Unit	Vale	Unit	value
1	Ball Mill/Blunger	kWh/MT	4 -12		-
2	Agitation process	kWh/m^3/hr	0.2 - 0.8		-
3	Spray Dryer	-	-	kg/MT	80 - 160
4	Press	kWh/m^2	0.22- 0.4		-
5	Dryer	kWh/m^2	0.011	SCM/m^2	0 - 0.63
6	Glaze line + Glaze ball mill	kWh/MT	2 - 9		-
7	Kiln	kWh/m^2	0.36 - 1.26	SCM/m^2	1.01 -1.4
8	Polishing line/sizing	kWh/m^2	1.74 - 2.35		-

[c] *In sanitary ware production is measured in term of pieces only.*

1.3 Existing technology/equipment

1.3.1 Description of existing technology

In ceramic industry, grinding of raw material is important for getting the good quality of the final product. After grinding process, the material is then sent to the underground tanks containing agitators. Agitators are required to maintain the uniformity of the grinded material. The agitator motors run continuously for the continuous production. Loading on the agitator motors also varies with the addition of new grinded material.

1.3.2 Role in process

Agitation process is required to maintain the uniformity of the grinded raw material. As the wet grinding process is carried out at Morbi ceramic cluster because of the quality of raw material they are getting, it is very important to maintain the uniformity of the material so that this is pumped to spray dryer for further process.

1.4 Baseline establishment for existing technology

1.4.1 Design and operating parameters

Average annual electricity consumption in agitation section for different types of ceramic products is given in Table 1.8 below:

Table 1.8 Electricity consumption in agitation section

S. No.	Type of industry	Unit	Value
1	Wall and Floor Tiles	kWh/year	30,752
2	Vitrified Tiles	kWh/year	2,37,864
3	Sanitary wares unit	kWh/year	29,132

1.4.2 Operating efficiency and how it is determined

Operating efficiencies of different agitation motors is calculated and is given in Annexure 1.

1.4.3 Specific electricity consumption

Specific electrical energy consumption in agitation section is given in Table 1.9 below:

Table 1.9 Specific energy consumption in agitation section

S. No.	Section	Unit	Value
1	Wall and Floor Tiles	kWh/m^2	0.105
2	Vitrified Tiles	kWh/m^2	0.224
3	Sanitary wares unit	kWh/m^2	0.082

1.5 Barriers in adoption of proposed technology

1.5.1 Technological barrier

In Morbi cluster, overall technical understanding on ceramic manufacturing is good and rapidly increasing. Important equipments like kiln, polishing machine and agitator etc are bought from Italy (Sacmi) and China (Modena), which are leading suppliers of these equipments world wide. Many of the unit owners are frequently visiting international ceramic fairs and ceramic process equipment suppliers, thus keeping them informed. It has been observed that at cluster level there is committed interested for leadership and following up is quick. In general, there is readiness to adopt provided delivery, outcome and results are demonstrated.

However the first change is still a challenge, upon success, later on duplication and adaptation is extremely prevalent in the cluster. The technologies need to be demonstrated within the cluster. While carrying out the audits and presenting the Energy audit reports to the units, in the discussion with the plant owners & other personnel, many of them agreed with many of the identified energy saving measures and technologies but they demanded demonstration of the energy saving technologies in any plant and thereafter they have readiness to follow.

1.5.2 Financial barrier

Availing finance is not the major issue. Among the SMEs, the larger units, if convinced are capable of either financing it themselves or get the finance from their banks. The smaller units will require competitive loan and other support to raise the loan. However as most of them have been able to expand their setup and grow, there is readiness to spend for energy efficiency technologies which have good returns. 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.

1.5.3 Skilled manpower

In Morbi ceramic cluster, the availability of skilled manpower is one of the problems due to more number of units. One local technical persons available at Morbi takes care of about 5-10 ceramic units. Maintenance or repair work of major equipments of ceramic units like kiln, polishing machine etc, are generally taken care by the equipment suppliers itself as they station one of their experienced technical representative at Morbi for the maintenance work.

Specialized and focused training of the local service providers on better operation and maintenance of the equipments, importance of the energy and its use and energy conservation measures will improve awareness among the unit owners and workforce. Original equipment suppliers should also participate in these programs.

1.5.4 Other barrier (If any)

Many of the new technology provider's (especially some foreign technology leaders) have not shown keen interest in implementation of their new innovative technologies. This appears to be because of fear of duplication.

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2. PROPOSED EQUIPMENT FOR ENERGY EFFICENCY IMPROVEMENT

2.1 Description of proposed equipment

2.1.1 Detailed of proposed equipment

Energy conservation in agitation section can be achieved by any one of the following 3 technologies.

Installation of VFD on agitator motors

It is observed that the loading on agitator motors is in between 30% to 65%. Also speed of motors is higher than the required speed for most of the time during agitation process. It is to be noted that agitation is a variable load process. Initially when the fresh charge comes from Ball Mill/Blunger, loading on motor is in between 65 to 72%. However after some time as the raw material become uniform then loading on motor decreases. For most of the time motor keeps on rotating at higher speed than the required. Installation of the variable frequency drive (VFD) on agitator motors can saves electricity consumption in agitation section by 15%.

Replacement of conventional motors by energy efficient motors

In agitation section, loading on motors is adequate at the start of the batch i.e. just after addition of slurry in the agitation tank, however as the mixture becomes uniform loading on motor decreases to less than 50%. This reduction in motor loading decreases the motor efficiency and thereby results in more electricity consumption. As the motors are standard efficiency motors, at reduced load drop in efficiency is very high, therefore replacement of the existing standard efficiency motors by energy efficient motors will result in significant saving of electricity consumption in agitator motors. It is to be noted that while energy efficient motors have better efficiency (1.5% to 3%) at full load but at partial load (< 50%) this difference goes as high as 4% to 8% resulting in higher savings at low load situations.

Use of ON – OFF Controller system

In agitation section, agitators are provided in underground tanks to maintain the uniformity of the slurry. These motors operate for about 24 hours in a day. Installation of automatically ON - OFF system on the agitator motors do not affect the uniformity (quality) of slurry but gives saving in electricity consumption in agitator motors. This system automatically switches ON agitator motors for about 10 minutes and then switches OFF for about 5 minutes. This means that in one hour agitator motors operate for about 40 minutes and remain switch off for about 20 minutes. This could result in approximately 30% saving in electricity consumption of agitator motors.

2.1.2 Equipment/technology specification

Technical specifications of the equipments required for all the 3 projects are given in the quotations attach in Annexure 8.

2.1.3 Integration with existing equipment

For implementation of any one technology, there will be no requirement of shutdown of the production. The project can be implemented in phases.

This technologies has been selected because of the following reasons

- Electricity consumption in agitation section is more
- Results are already seen in few ceramic industries where this project is implemented and in operation.
- It results in reduction in GHG emissions

2.1.4 Superiority over existing system

This project results in saving of electricity consumption in the agitation process. It helps to save the unnecessary supply of electricity to the agitation section.

2.1.5 Source of equipment

This technology is already in use in few ceramic industries at Morbi. These units practically observed the savings achieved after implementation of this project in their plant.

2.1.6 Availability of technology/equipment

As Gujarat is the major hub of industrial units, VFD and energy efficient motors can be easily available at Morbi itself. Most of the persons located at Morbi deals in supply of the same.

2.1.7 Service providers

Details of technologies service providers are shown in Annexure 7.

2.1.8 Terms and conditions in sales of equipment

Warranty period of one year from the date of invoice against any manufacturing defects will be provided. Details of term and condition are shown in Annexure 8.

2.1.9 Process down time

Process down time is not required. In any ceramic unit, more than one agitation tanks are operating. Therefore, this project can be installed alternatively in phases i.e. project will be installed on the motor of agitation tank one by one.

2.2 Life cycle assessment and risks analysis

Life cycle of these projects will be 10 years.

Risk involve in implementation of this project are as follows:

- Lack of initiative of the unit owner
- Unwillingness for investment in this project due to fear of affecting the production rate.
- Availability of skilled manpower in industry

2.3 Suitable unit for Implementation of proposed technology

Suitable unit for implementation of these technologies are floor tiles unit having the production capacity of about 13,680 m^2 per day and having total Natural gas consumption is about 74,06,655 kWh per year.

3. ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical benefit

3.1.1 Fuel saving

Implementation of this project does not result in reduction in fuel consumption in ceramic industry.

3.1.2 Electricity saving

Amount of electricity save in agitator section depends upon which type of technologies used for energy saving. Electricity saving through different technologies is as follow:

Installation of VFD on agitator motors

Implementation of this technologies results in electricity saving of about 52,648 kWh per year of total electricity consumption in agitation section.

Replacement of conventional motors by energy efficient motors

Implementation of this technology results in electricity saving of about 14,529 kWh per year of total electricity consumption in agitation section.

Use of ON – OFF Controller system

Implementation of this project results in electricity saving of about 1,05,297 kWh per year of total electricity consumption in agitation section.

3.1.3 Improvement in product quality

Product quality achieved would be same as in the present quality. It does not have any impact on the improvement in the quality of the product.

3.1.4 Increase in production

Implementation of these technologies will not lead to any increase in production.

3.1.5 Reduction in raw material

Raw material consumption is same even after the implementation of proposed technologies.

3.1.6 Reduction in other losses

There is no other reduction losses

3.2 Monetary benefits

Monetary benefits due to implementation of these technologies are shown in Table 3.1 below:

Table 3.1 Energy and monetary benefit

S.No	Parameter	Unit	Value
1	Present electricity consumption in agitator	kWh/year	3,50,989
2	Electricity saving due to VFD	kWh/year	52,648
3	Electricity saving due to replacement of conventional motor with energy efficient motor	kWh/year	14,529
4	Electricity saving due to use of On-Off controller	kWh/year	1,05,297
5	Total working days	days	330
6	Cost of electricity	₹ /kWh	4.05
7	Total monetary due to VFD	₹ in lakh/year	2.13
8	Total monetary benefit due to replacement of conventional motor with energy efficient motor	₹ in lakh/year	0.59
9	Total monetary benefit due to use of On-Off controller	₹ in lakh/year	4.26

Further details of total monetary benefits are given in Annexure 3.

3.3 Social benefits

3.3.1 Improvement in working environment

No improvement on the working environment in the plant.

3.3.2 Improvement in workers skill

Technical skills of persons will definitely be improved. As the training will be provided by equipment suppliers which improve the technical skills of manpower required for operating of the equipment and also the technology implementation will create awareness among the workforce about energy efficiency and energy saving.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

There is no significant impact in effluent generation due to implementation of the project.

3.4.2 Reduction in GHG emission

Implementation of this project will result in saving of electricity consumption. Installation of VFD will save about 52648 kWh of electricity per year which will reduce 42 tCO_2 emissions per year. Similarly, replacement of conventional motor will save 11 tCO_2 emissions per year and use of

On-Off controller will reduce about 84 tCO_2 emissions per year. Availing carbon credit benefits against implementation of these projects will generate extra revenue.

3.4.3 Reduction in other emissions like SO_X

Due to reduction in electricity consumption after implementation of these projects, equivalent amount of SOx emission will be reduce.

4 INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of project

4.1.1 Equipment cost

Total cost of equipment depends upon type of technologies being used. Details of cost of equipment for different technologies are shown in Table 4.1 below:

Table 4.1 Equipment cost for different technologies

S.No	Particular	Unit	Value
1	Cost of VFD	₹ (in lakh)	3.12
2	Cost of energy efficient motors	₹ (in lakh)	1.61
3	Cost of On-Off controller system	₹ (in lakh)	0.16

4.1.2 Erection, commissioning and other misc. cost

Other cost includes cost of erection & commissioning, electrical modification in existing work place, implementation during implementation and man power cost. Details of other cost requires for different technologies are furnished in Table 4.2 below:

Table 4.2 Other cost required for different technologies

S.No	Particular	Unit	Value
1	Other cost requires for VFD installation	₹ (in lakh)	0.81
2	Other cost for energy efficient motors	₹ (in lakh)	0.40
3	Other cost for use of On-Off controller system	₹ (in lakh)	0.056

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

Entrepreneur will have to contribute 25% of total project cost.

4.2.2 Loan amount.

Remaining 75% cost of project will be loan amount.

4.2.3 Subsidy by Government

As the overall energy efficiency in the project is more than 15% it qualifies for subsidy of 25 % of the project cost as per the NMCP scheme of Ministry of MSME, GoI. 25 % of the project cost. As the subsidy is normally available after implementation of the project the same has not been taken in the project cost and means of finance. On receipt of subsidy from Ministry of MSME, GoI through the nodal agency the amount of subsidy is generally set off [reduced] from the loan outstanding by the lender bank. Availability of this subsidy will make the project economically more attractive.

4.2.4 Terms & conditions of loan

The interest rate is considered at 10% which is SIDBI's rate of interest for energy efficient projects. The loan tenure is 4 years excluding initial moratorium period is 6 months from the date of first disbursement of loan for VFD and Energy Efficient motor. The loan tenure is 2 years excluding initial moratorium period of 3 months for On-Off Controller.

4.3 Financial indicators

4.3.1 Cash flow analysis

Profitability and cash flow statements have been worked out for a period of 5 years for VFD and Energy Efficient motor and 3 years for On-Off Controller. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below.

- The Operation and maintenance cost is estimated at 5% of cost of total project with 3% increase in every year as escalations.
- Interest on term loan is estimated at 10%.
- Depreciation is provided as per the rates provided in the companies act.

Based on the above assumptions, profitability and cash flow statements have been prepared and calculated in Annexure 5.

4.3.2 Simple payback period

Installation of VFD on agitator motors

The total project cost of the proposed technology is ₹ 3.99 lakh and monetary savings is ₹ 2.13 lakh hence the simple payback period works out to be 1.87 years.

Replacement of conventional motors by energy efficient motors

The total project cost of the proposed technology is ₹ 2.01 lakh and monetary savings is ₹ 0.59 lakh hence the simple payback period works out to be 3.40 years.

Use of ON – OFF Controller system

The total project cost of the proposed technology is ₹ 0.22 lakh and monetary savings is ₹ 4.26 lakh hence the simple payback period works out to be 0.05 years.

4.3.3 Net Present Value (NPV)

Installation of VFD on agitator motors

The Net present value of the investment at 10% works out to be ₹ 1.76 lakh.

Replacement of conventional motors by energy efficient motors

The Net present value of the investment at 10% works out to be ₹ 0.62 lakh.

Use of ON – OFF Controller system

The Net present value of the investment at 10% works out to be ₹ 8.09 lakh.

4.3.4 Internal rate of return (IRR)

Installation of VFD on agitator motors

The after tax internal rate of return of the project works out to be 27.67%. Thus the project is financially viable.

Replacement of conventional motors by energy efficient motors

The after tax internal rate of return of the project works out to be 29.21%. Thus the project is financially viable

Use of ON – OFF Controller system

The after tax internal rate of return of the project works out to be 1895.43%. Thus the project is financially viable

4.3.5 Return on investment (ROI)

Installation of VFD on agitator motors

The average return on investment of the project activity works out at 34.27%.

Replacement of conventional motors by energy efficient motors

The average return on investment of the project activity works out at 25.40%.

Use of ON – OFF Controller system

The average return on investment of the project activity works out at 59.76%.

Details of financial indicator are shown in Table 4.3 below:

Table 4.3 Financial indicators of proposed technologies/equipments

S.No	Particulars	Unit	Value		
			VFD	Energy efficient motor	On-Off controller
1	Simple Pay Back period	Years	1.87	3.40	0.05
2	IRR	%age	27.67	29.21	1895.43
3	NPV	lakh	1.76	0.62	8.09
4	ROI	%age	34.27	25.40	59.76
5	DSCR	Ratio	1.95	1.60	49.75

4.4 Sensitivity analysis

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

- Optimistic scenario (Increase in fuel savings by 5%)
- Pessimistic scenario (Decrease in fuel savings by 5%)

In each scenario, other inputs are assumed as a constant. The financial indicators in each of the above situation are indicated along with standard indicators.

Details of sensitivity analysis at different scenarios are shown in Table 4.4below:

Table 4.4 Sensitivity analysis at different scenarios (VFD)

Particulars	DSCR	IRR	ROI	NPV
Normal	1.36	16.70%	20.76%	351.67
5% increase in fuel savings	1.43	18.54%	21.33%	452.69
5% decrease in fuel savings	1.29	14.83%	20.11%	250.65

Table 4.5 Sensitivity analysis at different scenarios (EE Motor)

Particulars	*DSCR*	*IRR*	*ROI*	*NPV*
Normal	1.60	29.21%	25.40%	0.62
5% increase in fuel savings	1.66	31.45%	26.41%	0.70
5% decrease in fuel savings	1.55	26.91%	24.26%	0.54

Table 4.6 Sensitivity analysis at different scenarios (On-Off Controller)

Particulars	*DSCR*	*IRR*	*ROI*	*NPV*
Normal	49.75	1895.43%	59.76%	8.09
5% increase in fuel savings	52.24	1992.03%	59.79%	8.51
5% decrease in fuel savings	47.26	1798.83%	59.74%	7.67

4.5 Procurement and implementation schedule

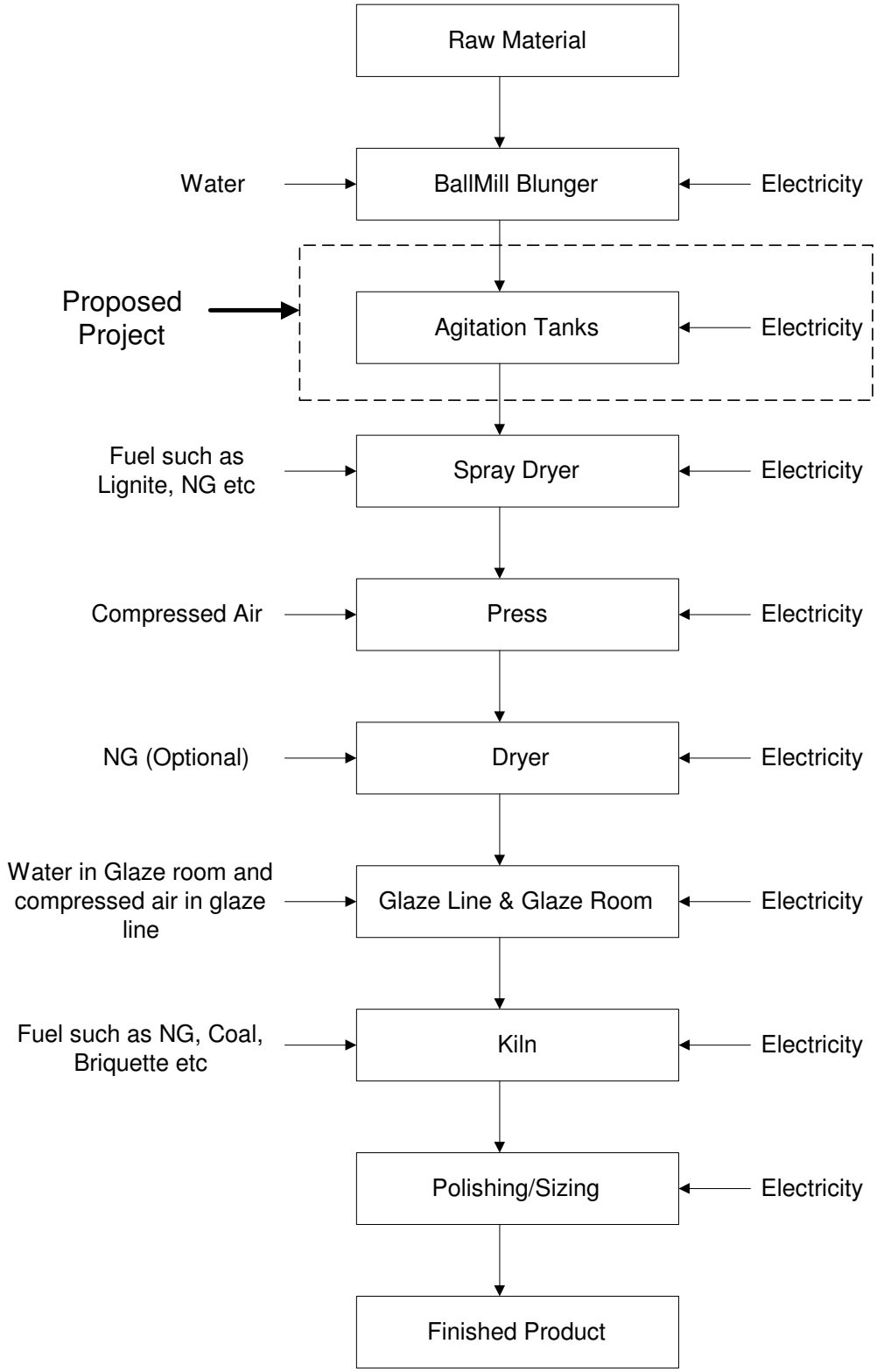
Total procurement period for implementation of different technologies are shown in Annexure 6.

Annexure

Annexure -1: Energy audit data used for baseline establishment

S. No.	Agitator Motor	Rated capacity KW	Measured power KW	%age Loading	% operating efficiency
1	Motor No. 1	5.5	3.4	50	70.32
2	Motor No. 2	5.5	3.78	55	72.55
3	Motor No. 3	5.5	2.78	40	65.09
4	Motor No. 4	5.5	2.00	29	53.45
5	Motor No. 5	5.5	1.41	21	35.33
6	Motor No. 6	5.5	1.59	23	42.31
7	Motor No. 7	5.5	3.08	45	67.93

Annexure -2: Process flow diagram after project implementation



Annexure -3: Detailed technology assessment report

Installation of VFD on agitator motors

S. No.	Particular	Unit	Existing Technology	Proposed Technology
1	Agitator motors of installed capacity 7.5 KW each	-	8	8
2	Saving in electricity consumption after implementation of this project	%age	-	15
3	Electricity Consumption in agitation process	kWh/year	3,50,989	2,98,341
4	Working days in a year	days	330	330
5	Cost of electricity	₹/kWh	4.05	4.05
6	Energy cost for agitation process	₹ in lakh/year	14.21	12.08
7	Electricity saving in agitation process	kWh/year		52,648
8	Monetary Saving in agitation process	₹ in lakh/year		2.13

Replacement of conventional motors by energy efficient motors

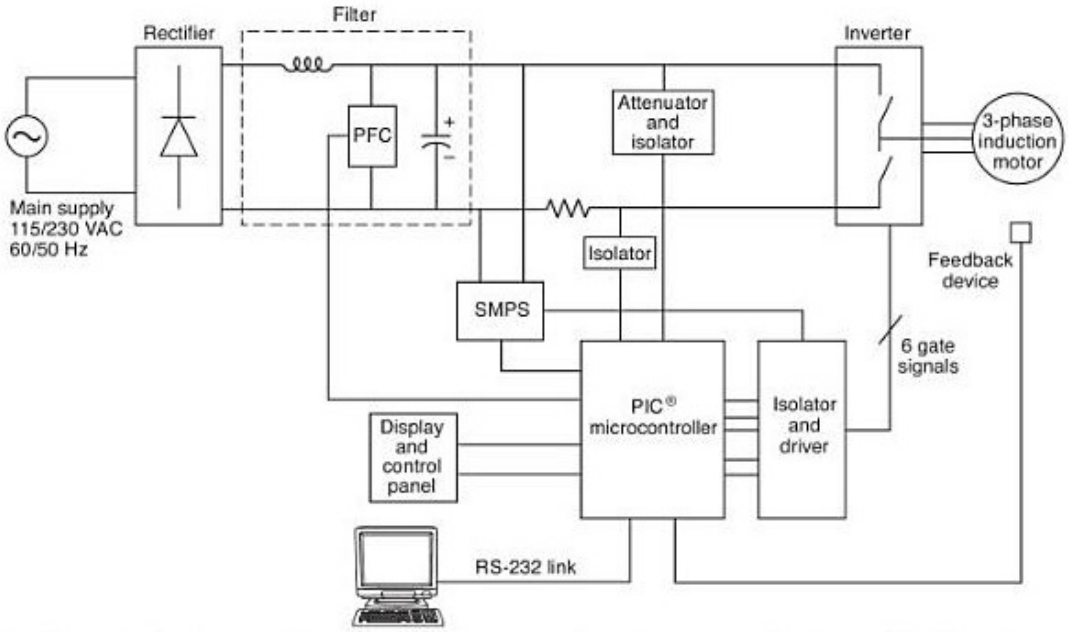
S. No.	Particular	Unit	Existing Technology	Proposed Technology
1	Agitator motors of installed capacity 7.5 KW each	-	8	8
2	Average operating efficiency of agitator motors	%age	85	88.10
3	Electricity Consumption in agitation process	kWh/year	3,50,989	3,36,460
4	Working days in a year	days	330	330
5	Cost of electricity	₹/kWh	4.05	4.05
6	Energy cost for agitation process	₹ in lakh/year	14.21	13.62
7	Electricity saving in agitation process	kWh/year		14529
8	Monetary Saving in agitation process	₹ in lakh/year		0.59

Use of ON – OFF Controller system

S. No.	*Particular*	*Unit*	*Existing Technology*	*Proposed Technology*
1	Agitator motors of installed capacity 7.5 KW each	-	8	8
2	Saving in electricity consumption after implementation of this project	%age	-	30
3	Electricity Consumption in agitation process	kWh/year	3,50,989	2,45,692
4	Working days in a year	days	330	330
5	Cost of electricity	₹/kWh	4.05	4.05
6	Energy cost for agitation process	₹ in lakh/year	14.21	9.95
7	Electricity saving in agitation process	kWh/year		14529
8	Monetary Saving in agitation process	₹ in lakh/year		0.59

Annexure -4 Drawings for proposed electrical & civil works

Detail diagram of functioning and connection of variable frequency drive is shown below



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Detailed engineering need not be required for replacing conventional motor with energy efficient motors.

Annexure -5: Detailed financial analysis

Assumption

Installation of VFD on motor

Name of the Technology			
Rated Capacity			
Details	***Unit***	***Value***	***Basis***
Installed Capacity			Feasibility Study
No of working days	Days		Feasibility Study
No of Shifts per day	Shifts		Feasibility Study
Capacity Utilization Factor	%		Feasibility Study
Proposed Investment			
Plant & Machinery	₹ (in lakh)	2.85	Feasibility Study
Erection & Commissioning	₹ (in lakh)	0.29	Feasibility Study
Investment without IDC	₹ (in lakh)	3.14	Feasibility Study
Interest During Implementation	₹ (in lakh)	0.08	Feasibility Study
Taxes(VAT)	₹ (in lakh)	0.14	Feasibility Study
Other charges(Contingency)	₹ (in lakh)	0.29	Feasibility Study
Total Investment	₹ (in lakh)	3.64	Feasibility Study
Financing pattern			
Own Funds (Equity)	₹ (in lakh)	0.91	Feasibility Study
Loan Funds (Term Loan)	₹ (in lakh)	2.73	Feasibility Study
Loan Tenure	years	4	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%	10.00	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	5.00	Feasibility Study
Annual Escalation	%	3.00	Feasibility Study
Estimation of Revenue			
Electricity saving	kWh/year	40524	
Cost of electricity	₹ / kWh	3.85	
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

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

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	2.99	0.24	2.75	0.27
2	2.75	0.60	2.15	0.25
3	2.15	0.72	1.43	0.18
4	1.43	0.84	0.59	0.10
5	0.59	0.59	0.00	0.02
		2.99		

WDV Depreciation

Particulars / years	*1*	*2*	*3*	*4*
Plant and Machinery				
Cost	3.52	0.70	0.14	0.03
Depreciation	2.81	0.56	0.11	0.02
WDV	0.70	0.14	0.03	0.01

Projected Profitability ***₹ (in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*Total*
Fuel savings	2.13	2.13	2.13	2.13	2.13	10.66
Total Revenue (A)	2.13	2.13	2.13	2.13	2.13	10.66
O & M Expenses	0.20	0.21	0.21	0.22	0.22	1.06
Total Expenses (B)	0.20	0.21	0.21	0.22	0.22	1.06
PBDIT (A)-(B)	1.93	1.93	1.92	1.91	1.91	9.60
Interest	0.27	0.25	0.18	0.10	0.02	0.82
PBDT	1.66	1.68	1.74	1.81	1.89	8.78
Depreciation	0.21	0.21	0.21	0.21	0.21	1.05
PBT	1.45	1.47	1.53	1.60	1.68	7.73
Income tax	0.00	0.38	0.55	0.61	0.64	2.18
Profit after tax (PAT)	1.45	1.09	0.98	0.99	1.04	5.55

Computation of Tax ***₹ (in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*
Profit before tax	1.45	1.47	1.53	1.60	1.68
Add: Book depreciation	0.21	0.21	0.21	0.21	0.21
Less: WDV depreciation	2.81	0.56	0.11	0.02	-
Taxable profit	(1.15)	1.12	1.63	1.79	1.89
Income Tax	-	0.38	0.55	0.61	0.64

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

Particulars / Years	*1*	*2*	*3*	*4*	*5*
Liabilities					
Share Capital (D)	1.00	1.00	1.00	1.00	1.00
Reserves & Surplus (E)	1.45	2.54	3.52	4.51	5.55
Term Loans (F)	2.75	2.15	1.43	0.59	0.00
Total Liabilities D)+(E)+(F)	5.20	5.69	5.94	6.10	6.54

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Assets					
Gross Fixed Assets	3.99	3.99	3.99	3.99	3.99
Less: Accm. Depreciation	0.21	0.42	0.63	0.84	1.05
Net Fixed Assets	3.78	3.56	3.35	3.14	2.93
Cash & Bank Balance	1.42	2.12	2.59	2.95	3.61
TOTAL ASSETS	5.20	5.69	5.94	6.10	6.54
Net Worth	2.45	3.54	4.51	5.51	6.54
Dept equity ratio	1.12	0.61	0.32	0.11	0.00

Projected Cash Flow: ***₹(in lakh)***

Particulars / Years	*0*	*1*	*2*	*3*	*4*	*5*
Sources						
Share Capital	1.00	-	-	-		-
Term Loan	2.99					
Profit After tax		1.45	1.09	0.98	0.99	1.04
Depreciation		0.21	0.21	0.21	0.21	0.21
Total Sources	**3.99**	**1.66**	**1.30**	**1.19**	**1.20**	**1.25**
Application						
Capital Expenditure	3.99					
Repayment of Loan	-	0.24	0.60	0.72	0.84	0.59
Total Application	3.99	0.24	0.60	0.72	0.84	0.59
Net Surplus	-	1.42	0.70	0.47	0.36	0.66
Add: Opening Balance	-	-	1.42	2.12	2.59	2.95
Closing Balance	-	1.42	2.12	2.59	2.95	3.61

Calculation of Internal Rate of Return ***₹(in lakh)***

Particulars / months	*0*	*1*	*2*	*3*	*4*	*5*
Profit after Tax		1.45	1.09	0.98	0.99	1.04
Depreciation		0.21	0.21	0.21	0.21	0.21
Interest on Term Loan		0.27	0.25	0.18	0.10	0.02
Salvage/Realizable value						
Cash outflow	(3.99)	-	-	-	-	-
Net Cash flow	(3.99)	1.93	1.55	1.37	1.31	1.27
IRR	**27.16%**					
NPV	**1.76**					

Break Even Point ***₹(in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*
Variable Expenses					
Oper. & Maintenance Exp (75%)	0.15	0.15	0.16	0.16	0.17
Sub Total (G)	0.15	0.15	0.16	0.16	0.17
Fixed Expenses					
Oper. & Maintenance Exp (25%)	0.05	0.05	0.05	0.05	0.06
Interest on Term Loan	0.27	0.25	0.18	0.10	0.02
Depreciation *(H)*	0.21	0.21	0.21	0.21	0.21
Sub Total (I)	0.53	0.51	0.45	0.37	0.28
Sales (J)	2.13	2.13	2.13	2.13	2.13
Contribution (K)	1.98	1.98	1.97	1.97	1.96
Break Even Point (L= G/I)	26.71%	25.75%	22.57%	18.77%	14.48%
Cash Break Even {(I)-(H)}	16.10%	15.11%	11.91%	8.08%	3.76%
BREAK EVEN SALES (J)*(L)	0.57	0.55	0.48	0.40	0.31

Return on Investment ***₹ (in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*Total*
Net Profit Before Taxes	1.45	1.47	1.53	1.60	1.68	7.73
Net Worth	2.45	3.54	4.51	5.51	6.54	22.55
						34.27%

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

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*Total*
Cash Inflow						
Profit after Tax	1.45	1.09	0.98	0.99	1.04	5.55
Depreciation	0.21	0.21	0.21	0.21	0.21	1.05
Interest on Term Loan	0.27	0.25	0.18	0.10	0.02	0.82
TOTAL **(M)**	1.93	1.55	1.37	1.31	1.27	7.42

Debt

Interest on Term Loan	0.27	0.25	0.18	0.10	0.02	0.82
Repayment of Term Loan	0.24	0.60	0.72	0.84	0.59	2.99
TOTAL (N)	0.51	0.85	0.90	0.94	0.61	3.81
Average DSCR (M/N)	1.95					

Installation of Energy Efficient Motor

Name of the Technology	***Energy Efficient Motor***		
Rated Capacity			
Details	***Unit***	***Value***	***Basis***
Installed Capacity			Feasibility Study
No of working days	Days		Feasibility Study
No of Shifts per day	Shifts		Feasibility Study
Capacity Utilization Factor	%		Feasibility Study
Proposed Investment			
Plant & Machinery	₹ (in lakh)	1.61	Feasibility Study
Erection & Commissioning	₹ (in lakh)	0.03	Feasibility Study
Investment without IDC	₹ (in lakh)	1.64	Feasibility Study
Interest During Implementation	₹ (in lakh)	0.04	Feasibility Study
Taxes(VAT)	₹ (in lakh)	0.08	Feasibility Study
Other charges(Contingency)	₹ (in lakh)	0.24	Feasibility Study
Total Investment	₹ (in lakh)	2.01	Feasibility Study
Financing pattern			
Own Funds (Equity)	₹ (in lakh)	0.51	Feasibility Study
Loan Funds (Term Loan)	₹ (in lakh)	1.50	Feasibility Study
Loan Tenure	years	4	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	54	Assumed
Interest Rate	%	10.00	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	5.00	Feasibility Study
Annual Escalation	%	3.00	Feasibility Study
Estimation of Revenue			
Electricity saving	kWh/year	14529	
Cost of electricity	₹ / kWh	4.05	
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

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

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	1.50	0.06	1.44	0.14
2	1.44	0.24	1.20	0.13
3	1.20	0.36	0.84	0.10
4	0.84	0.48	0.36	0.06
5	0.36	0.36	0.00	0.01
		1.50		

WDV Depreciation

Particulars / years	*1*	*2*	*3*	*4*
Plant and Machinery				
Cost	1.68	0.34	0.07	0.01
Depreciation	1.35	0.27	0.05	0.01
WDV	0.34	0.07	0.01	0.00

Projected Profitability ***₹ (in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*Total*
Fuel savings	0.59	0.59	0.59	0.59	0.59	2.94
Total Revenue (A)	0.59	0.59	0.59	0.59	0.59	2.94
O & M Expenses	0.10	0.10	0.11	0.11	0.11	0.53
Total Expenses (B)	0.10	0.10	0.11	0.11	0.11	0.53
PBDIT (A)-(B)	0.49	0.49	0.48	0.48	0.48	2.41
Interest	0.14	0.13	0.10	0.06	0.01	0.45
PBDT	0.35	0.35	0.38	0.42	0.46	1.96
Depreciation	0.11	0.11	0.11	0.11	0.11	0.53
PBT	0.25	0.25	0.27	0.31	0.36	1.43
Income tax	0.00	0.03	0.11	0.14	0.16	0.43
Profit after tax (PAT)	0.25	0.22	0.16	0.17	0.20	1.00

Computation of Tax ***₹ (in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*
Profit before tax	0.25	0.25	0.27	0.31	0.36
Add: Book depreciation	0.11	0.11	0.11	0.11	0.11
Less: WDV depreciation	1.35	0.27	0.05	0.01	-
Taxable profit	(1.00)	0.08	0.32	0.41	0.46
Income Tax	-	0.03	0.11	0.14	0.16

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

Particulars / Years	*1*	*2*	*3*	*4*	*5*
Liabilities					
Share Capital (D)	0.50	0.50	0.50	0.50	0.50
Reserves & Surplus (E)	0.25	0.46	0.63	0.80	1.00
Term Loans (F)	1.44	1.20	0.84	0.36	0.00
Total Liabilities D)+(E)+(F)	2.19	2.17	1.97	1.66	1.50

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Assets					
Gross Fixed Assets	2.01	2.01	2.01	2.01	2.01
Less: Accm. Depreciation	0.11	0.21	0.32	0.42	0.53
Net Fixed Assets	1.90	1.79	1.69	1.58	1.48
Cash & Bank Balance	0.29	0.38	0.28	0.08	0.03

TOTAL ASSETS	2.19	2.17	1.97	1.66	1.50
Net Worth	0.75	0.96	1.13	1.30	1.50
Dept equity ratio	1.93	1.25	0.75	0.28	0.00

Projected Cash Flow: ***₹ (in lakh)***

Particulars / Years	***0***	***1***	***2***	***3***	***4***	***5***
Sources						
Share Capital	0.50	-	-	-	-	-
Term Loan	1.50					
Profit After tax		0.25	0.22	0.16	0.17	0.20
Depreciation		0.11	0.11	0.11	0.11	0.11
Total Sources	2.01	0.35	0.32	0.27	0.28	0.31
Application						
Capital Expenditure	2.01					
Repayment of Loan	-	0.06	0.24	0.36	0.48	0.36
Total Application	2.01	0.06	0.24	0.36	0.48	0.36
Net Surplus	-	0.29	0.08	(0.09)	(0.20)	(0.05)
Add: Opening Balance	-	-	0.29	0.38	0.28	0.08
Closing Balance	-	0.29	0.38	0.28	0.08	0.03

Calculation of Internal Rate of Return ***₹ (in lakh)***

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***
Profit after Tax			0.22	0.16	0.17	0.20
Depreciation			0.27	0.05	0.01	-
Interest on Term Loan			0.13	0.10	0.06	0.01
Salvage/Realizable value						
Cash outflow		-	-	-	-	-
Net Cash flow			0.62	0.32	0.25	0.21
IRR	29.21%					
NPV	0.62					

Break Even Point ***₹ (in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*
Variable Expenses					
Oper. & Maintenance Exp (75%)	0.08	0.08	0.08	0.08	0.08
Sub Total (G)	0.08	0.08	0.08	0.08	0.08
Fixed Expenses					
Oper. & Maintenance Exp (25%)	0.03	0.03	0.03	0.03	0.03
Interest on Term Loan	0.14	0.13	0.10	0.06	0.01
Depreciation *(H)*	1.35	0.27	0.05	0.01	0.00
Sub Total (I)	1.51	0.43	0.18	0.10	0.04
Sales (J)	0.59	0.59	0.59	0.59	0.59
Contribution (K)	0.51	0.51	0.51	0.51	0.50

Break Even Point (L= G/I)	293.92%	83.88%	36.26%	19.89%	7.99%
Cash Break Even {(I)-(H)}	16.10%	15.11%	11.91%	8.08%	3.76%
BREAK EVEN SALES (J)*(L)	0.57	0.55	0.48	0.40	0.31

Return on Investment ***₹ (in lakh)***

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***Total***
Net Profit Before Taxes	0.25	0.25	0.27	0.31	0.36	1.43
Net Worth	0.75	0.96	1.13	1.30	1.50	5.64
						25.40%

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

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***Total***
Cash Inflow						
Profit after Tax	0.25	0.22	0.16	0.17	0.20	1.00
Depreciation	1.35	0.27	0.05	0.01	0.00	1.68
Interest on Term Loan	0.14	0.13	0.10	0.06	0.01	0.45
TOTAL **(M)**	1.73	0.62	0.32	0.25	0.21	3.13

Debt

Interest on Term Loan	0.14	0.13	0.10	0.06	0.01	0.45
Repayment of Term Loan	0.06	0.24	0.36	0.48	0.36	1.50
TOTAL (N)	0.20	0.37	0.46	0.54	0.37	1.95
Average DSCR (M/N)	1.60					

Annexure:-6 Procurement and implementation schedule

For installation of VFD on agitator motors

S. No.	Activity	No. of Weeks				
		1	2	3	4	5
1	Order for supply of VFD to vendor					
2	Receipt of the VFD at client site					
3	Installation and connections for the VFD circuit					
4	Installation of VFD in one day shut down time					

For replacement of conventional motors by energy efficient motors

S. No.	Activity	No. of Weeks			
		1	2	3	4
1	Order for supply of the energy efficient motors				
2	Receipt of the energy efficient motors at client site				
3	Replacement of the existing motors by the energy efficient motors in phases				

For use of ON – OFF Controller system

S. No.	Activity	No. of Weeks			
		1	2	3	4
1	Order for supply of the controller system				
2	Receipt of the system at client site				
3	Installation of the controller system				

Annexure -7: Details of technology service providers

Installation of VFD on agitator motors

Name of Service Provider	*Address*	*Contact Person and No.*	*Email ID*
Crystal Controls	309, Abhishree complex, Opp. Star India Bazar, Nr. Jodhpur Char Rasta, satellite, Ahmedabad – 15	Mr. Dhanji Ghinaiya - 09714714192, 079 – 26923306	dghinaiya@gmail.com
Sathguru Drives & Controls	1-A, Second Street, Bharathi Nagar, Kamarajar Road, Coimbatore, Tamil Nadu, India, 641 001.	Mr. S.P.Manokaran (91-9843059659) (91)-(422)-2593737	sathguru@vsnl.com
Hi - Rel Electronics Limited	B - 117/118 , G. I. D. C. Electronics Zone, Sector No. 25, Gandhinagar, Gujarat, India, 382 044.	Mr. Laxman Senghani 09725010815	laxman@hirel.net

Replacement of conventional motors by energy efficient motors

Name of Service Provider	*Address*	*Contact Person and No.*	*Email ID*
ABB Ltd	ABB Limited, RN Kalkaji	Mr. Dinesh Mistry 09724334560	dinesh.c.mistry@in.abb.com
LUBI Group of industries	Lubi Group of Industries Near Kalyan Mills, Naroda Road, Ahmedabad - 380 025 INDIA.	Mr. Ruturaj Rajaji 09825040538	mktsales@lubipumps.com, rporecha@lubipumps.com, expsales@lubipumps.com
National Electrical Industry	2 nd floor , vimla complex, Old Sharda Mandir Rlwy Crossing, Ahmedabad-380006, Gujrat ,India	Mr.Anuj Patel 9898084805	neind@vsnl.com, elmo.neind@gmail.com
BHARAT BIJLEE LTD.	Arth, 8-Rashmi Society, Behind A. K. Patel House, Mithakhali, Cross Road, Ahmedabad - 380 009	Mr. Varma (sr. manager)- 09869271084	anil.varma@bharatbijlee.com bblahmedabad@ahd.bharatbijlee.com
Siemens Ltd	I IA DT Regional Sales 3rd Floor, Prerna Arbour, Girish Cold Drinks Cross Roads, Off C.G.Road, 380009 Ahmedabad	Mr. Arvind Mehta 9825506565	amey.pataskar@siemens.com, prajwal.khapekar@siemens.com

Use of ON – OFF Controller system

Name of Service Provider	*Address*	*Contact Person and No.*	*Email ID*
Shiwkon Digitek Pvt. Limited	309 - Pushpam, Opp.Seema Hall, 100 Feet, Shyamal - Anand Nagar Road. Satellite, Ahmedabad - 380 015	Mr. Hardik Patel - 09825050706	hardik@shiwkon.com

Annexure -8: Quotations or Techno-commercial bids for new technology/equipment

For Project 1: Installation of VFD on agitator motors

CRYSTAL CONTROLS
309, ABHISHREE COMPLEX, OPP. STAR INDIA BAZAR, NR. JODHPUR CHAR RASTA, SATELLITE, AHMEDABAD - 15.
TELEFAX : (079) 2692 3306 (M) 98241 30299, 97147 14192 E-MAIL : crystalcontrols@gmail.com

Ref.: CC/ENE/qnt/0152/09-10 **Dt.: 25/03/2010**

To,
See-Tech Solution Pvt. Ltd.
Nagpur, Maharashtra.

Kind Attn. : Mr. Milind Chittawar
Subject : Quotation for Mitsubishi makes AC Drives.

Respected Sir,

This has reference to our telephonic discussion for above-mentioned requirement.

We are please to introduce ourselves as System Integrator for **Mitsubishi / Messung Automation** products.

We hope our product is in line with your requirement and prices quoted are attractive.

	Mitsubishi AC Drive Price List		
	3.1.2 INVERTER - D -700 - Three Phase Drive (I/P 400 V 3ϕ, O/P 400 V 3ϕ) (Flux Vector Control With In-Built Brake Unit 150% O/L for 60 sec. & 200% O/L for 0.5 sec.)		
1	FR-D740-012-EC	CAPACITY: 0.4 KW (0.5 HP) O/P CURRENT 1.2 AMPS	21000
2	FR-D740-022-EC	CAPACITY: 0.75 KW (1.0 HP) O/P CURRENT 2.2 AMPS	21300
3	FR-D740-036-EC	CAPACITY: 1.5 KW (2.0 HP) O/P CURRENT 3.6 AMPS	26500
4	FR-D740-050-EC	CAPACITY: 2.2 KW (3.0 HP) O/P CURRENT 5.0 AMPS	29900
5	FR-D740-080-EC	CAPACITY: 3.7 KW (5.0 HP) O/P CURRENT 8.0 AMPS	36500
6	FR-D740-120-EC	CAPACITY: 5.5 KW (7.5 HP) O/P CURRENT 12.0 AMPS	40000
7	FR-D740-160-EC	CAPACITY: 7.5 KW (10.0 HP) O/P CURRENT 16.0 AMPS	45000
	3.1.2 INVERTER - E -700 - Three Phase Drive (I/P 400 V 3ϕ, O/P 400 V 3ϕ) (Advance Flux Vector Control With In-Built Brake Unit 150% O/L for 60 sec. & 200% O/L for 03 sec.)		
1	FR-E740-016-EC	CAPACITY: 0.4 KW (0.5 HP) O/P CURRENT 1.6 AMPS	29000
2	FR-E740-026-EC	CAPACITY: 0.75 KW (1.0 HP) O/P CURRENT 2.6 AMPS	29500
3	FR-E740-040-EC	CAPACITY: 1.5 KW (2.0 HP) O/P CURRENT 4.0 AMPS	33000
4	FR-E740-060-EC	CAPACITY: 2.2 KW (3.0 HP) O/P CURRENT 6.0 AMPS	37500
5	FR-E740-095-EC	CAPACITY: 3.7 KW (5.0 HP) O/P CURRENT 9.5 AMPS	42500
6	FR-E740-120-EC	CAPACITY: 5.5 KW (7.5 HP) O/P CURRENT 12.0 AMPS	52500
7	FR-E740-170-EC	CAPACITY: 7.5 KW (10.0 HP) O/P CURRENT 17.0 AMPS	65000
8	FR-E740-230-EC	CAPACITY: 11 KW (15.0 HP) O/P CURRENT 23.0 AMPS	78000
9	FR-E740-300-EC	CAPACITY: 15 KW (20.0 HP) O/P CURRENT 30.0 AMPS	81000

For Project 2: Replacement of conventional motors by energy efficient motors

CE

Bharat Bijlee

eff1

TEFC ENERGY EFFICIENT MOTORS

For Foot mounted (B3 construction) Induction Motors suitable for 415V ±10%, 50Hz ±5%,combined variation ±10%, 3 phase supply, Insulation Class F, Degree of Protection IP55,Ambient Temperature 50° C, Conforms to IS:325

3000 rpm 2 Pole					
kW	HP	Frame	Type	Price	Excise
0.37	0.50	71	MH071-2A3	8330	343
0.55	0.75	71	MH071-233	9200	379
0.75	1.00	80	MH080-213	9530	393
1.10	1.50	80	MH080-233	10410	429
1.50	2.00	90S	MH09S-243	11530	475
2.20	3.00	90L	MH09L-273	14750	608
3.70	5.00	100L	MH10L-233	18120	747
5.50	7.50	132S	MH13S-253	27750	1143
7.50	10.00	132S	MH13S-293	30660	1263
9.30	12.50	160M	MH16M-233	49940	2058
11.00	15.00	160M	MH16M-253	53550	2206
15.00	20.00	160M	MH16M-263	62740	2585
18.50	25.00	160L	MH16L-293	85130	3507
22.00	30.00	180M	MH18M-233	90760	3739
30.00	40.00	200L	MH20L-2A3	128880	5310
37.00	50.00	200L	MH20L-253	164550	6779
45.00	60.00	225M	MH22M-253	211750	8724
55.00	75.00	250M	MH25M-233	272100	11211
75.00	100.00	280S	MH28S-233	354180	14592
90.00	120.00	280M	MH28M-253	410590	16916
110.00	150.00	315S	MH31S-233	517540	21323
125.00	170.00	315M	MH31M-2A3	607490	25029
132.00	180.00	315M	MH31M-233	636600	26228
150.00	200.00	315L	MH31L-2A3	673020	27728
160.00	215.00	315L	MH31L-253	697350	28731
180.00	240.00	315L	MH31L-2B3	733810	30233
* 200.00	270.00	315L	MH31L-273	817720	33690
* 250.00	335.00	355L	MH35L-213	907180	37376
* 315.00	425.00	355L	MH35L-233	988310	40718

* These ratings are sutiable for Ambient Temperature 45 °C

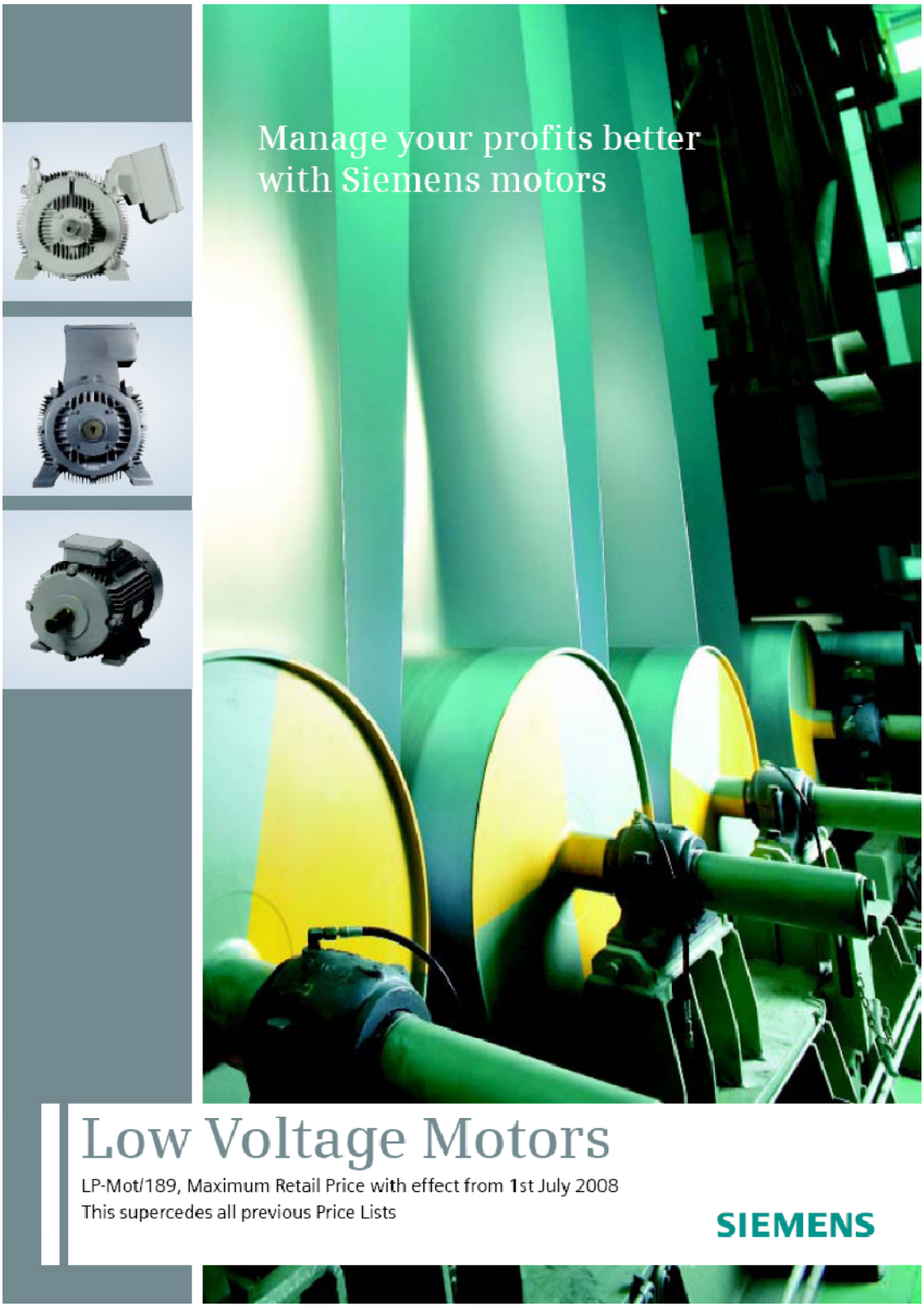
1500 rpm 4 Pole					
kW	HP	Frame	Type	Price	Excise
0.37	0.50	71	MH071-433	8800	363
0.55	0.75	80	MH080-433	9800	404
0.75	1.00	80	MH080-453	9870	407
1.10	1.50	90S	MH09S-423	10770	444
1.50	2.00	90L	MH09L-473	11770	485
2.20	3.00	100L	MH10L-473	15570	641
3.70	5.00	112M	MH11M-473	19920	821
5.50	7.50	132S	MH13S-473	27450	1131
7.50	10.00	132M	MH13M-443	32050	1321
9.30	12.50	160M	MH16M-4C3	49980	2059
11.00	15.00	160M	MH16M-4K3	51290	2113
15.00	20.00	160L	MH16L-4B3	63750	2627
18.50	25.00	180M	MH18M-473	86000	3543
22.00	30.00	180L	MH18L-483	91640	3776
30.00	40.00	200L	MH20L-453	123630	5094
37.00	50.00	225S	MH22S-433	158820	6543
45.00	60.00	225M	MH22M-453	192560	7933
55.00	75.00	250M	MH25M-433	252410	10399
75.00	100.00	280S	MH28S-413	323100	13312
90.00	120.00	280M	MH28M-433	374860	15444
110.00	150.00	315S	MH31S-413	453850	18699
125.00	170.00	315M	MH31M-4A3	519210	21391
132.00	180.00	315M	MH31M-433	532430	21936
150.00	200.00	315L	MH31L-4A3	575440	23708
160.00	215.00	315L	MH31L-453	597500	24617
180.00	240.00	315L	MH31L-463	666380	27455
200.00	270.00	315L	MH31L-473	760630	31338
250.00	335.00	355L	MH35L-413	801270	33012
315.00	422.00	355L	MH35L-433	959620	39536
355.00	480.00	355L	MH35L-453	1235380	50898
400.00	540.00	400M	MH40M-413	1694940	69832
450.00	600.00	400M	MH40M-433	1749430	72077
500.00	670.00	400M	MH40M-453	1816890	74856
560.00	750.00	400L	MH40L-473	1913520	78837
630.00	850.00	400L	MH40L-493	1970350	81178

eff1

Increased Safety Ex 'e', Non Sparking Ex 'n' can be offered upto 355 Frame.For Price & frame size refer to Marketing Office

Eff1 will be punched on name plate as per IS 12615: 2004 for

2 Pole -0.37kW to 160 kW
4Pole -0.37kW to 160kW
6 Pole -0.37kW to 132 kW
8Pole -0.37kW to 110kW


Manage your profits better
with Siemens motors
Low Voltage Motors
LP-Mot/189, Maximum Retail Price with effect from 1st July 2008
This supercedes all previous Price Lists
SIEMENS

CHAMPION Series. Degree of Prot. IP55, Ins Class 'F'. Ambient 50°C
415V ±10%, 50Hz ± 5%, combined ±10%. Prices for IMB3 (foot mounted) versions.

2 - Pole 3000 rev/min				
Output		Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
kW	HP			
240VΔ / 415VY 50Hz				
0.18	0.25	63	1LA0 060-2YA80	5,960
0.25	0.35	63	1LA0 063-2YA80	6,130
0.37	0.5	71	1LA0 070-2YA80	6,500
0.55	0.75	71	1LA0 073-2YA80	7,210
0.75	1	80	1LA0 080-2YA80	7,460
1.1	1.5	80	1LA0 083-2YA80	8,150
1.5	2	90S	1LA0 090-2YA80	9,040
415VΔ 50Hz				
2.2	3	90L	1LA0 096-2YA80	11,580
3.7	5	100L	1LA0 107-2YA80	14,260
5.5	7.5	112M	1LA0 114-2YA80	21,880
7.5	10	132S	1LA0 131-2YA80	24,170
9.3	12.5	132M	1LA0 133-2YA80	39,410
11	15	160M	1LA0 161-2YC80	42,210
15	20	160M	1LA0 165-2YC80#	49,450
18.5	25	160L	1LA0 166-2YC80#	67,110
22	30	180M	1LA0 183-2YA80#	74,990
30	40	200L	1LA0 207-2YB80	106,360
37	50	200L	1LA0 208-2YB80#	135,970
45	60	225M	1LA0 223-2YB80	174,270

4 - Pole 1500 rev/min				
Output		Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
kW	HP			
240VΔ / 415VY 50Hz				
0.12	0.16	63	1LA0 060-4YA80	6,250
0.18	0.25	63	1LA0 063-4YA80	6,590
0.25	0.35	71	1LA0 070-4YA80	6,700
0.37	0.5	71	1LA0 073-4YA80	6,950
0.55	0.75	80	1LA0 080-4YA80	7,690
0.75	1	80	1LA0 083-4YA80	7,770
1.1	1.5	90S	1LA0 090-4YA80	8,530
1.5	2	90L	1LA0 096-4YA80	9,280
415VΔ 50Hz				
2.2	3	100L	1LA0 106-4YA80	12,260
3	4	100L	1LA0 107-4YA80	12,530
3.7	5	112M	1LA0 113-4YA80	15,800
5.5	7.5	132S	1LA0 130-4YA80	21,690
7.5	10	132M	1LA0 133-4YA80	25,300
11	15	160M	1LA0 163-4YA80	40,190
15	20	160L	1LA0 166-4YA80	50,040
18.5	25	180M	1LA0 183-4YA80	70,760
22	30	180L	1LA0 186-4YA80	75,380
30	40	200L	1LA0 207-4YA80	101,860
37	50	225S	1LA0 221-4YA80	130,590
45	60	225M	1LA0 224-4YA80	158,460

Temperature rise limited to 75K & @ Temp. rise limited to 95K.

Note: Efficiency class will be stamped on the name-plates for motors covered under IS:12615 - 2004 only.

Money saving motors

CHAMPION Series. Degree of Prot. IP55, Ins Class 'F'. Ambient 50°C
415V ±10%, 50Hz ± 5%, combined ±10%. Prices for IMB3 (foot mounted) versions.

All our standard designs in frames 250 and above now conform to EFF1 as per standards

2 - Pole 3000 rev/min

Output		Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
kW	HP			
415VΔ 50Hz				
55	75	250M	1SE0 254-2YB80	234,020
75	100	280S	1SE0 281-2YB80	305,490
90	120	280M	1SE0 284-2YB80	353,940
110	150	315S	1SE0 311-2YC80	466,050
132	180	315M	1SE0 314-2YC80	573,240
160	215	315L	1SE0 318-2YC80	627,710
200	270	315L	1SE0 319-2YC80@	733,170
250	335	355L	1SE0 356-2YC80	820,100
315	425	355L	1SE0 357-2YC80#	904,840

4 - Pole 1500 rev/min

Output		Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
kW	HP			
415VΔ 50Hz				
55	75	250M	1SE0 254-4YA80	218,450
75	100	280S	1SE0 281-4YA80	279,570
90	120	280M	1SE0 284-4YA80	324,420
110	150	315S	1SE0 311-4YA80	408,600
132	180	315M	1SE0 314-4YA80	479,230
160	215	315L	1SE0 318-4YA80	535,790
200	270	315L	1SE0 319-4YA80@	685,150
250	335	355L	1SE0 356-4YB80	732,940
315	425	355L	1SE0 357-4YB80	862,680

6 - Pole 1000 rev/min

Output		Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
kW	HP			
415VΔ 50Hz				
37	50	250M	1SE0 254-6YA80	219,180
45	60	280S	1SE0 281-6YA80	280,850
55	75	280M	1SE0 284-6YA80	317,300
75	100	315S	1SE0 311-6YA80	390,540
90	120	315M	1SE0 314-6YA80	491,740
110	150	315L	1SE0 318-6YA80	548,060
132	180	315L	1SE0 319-6YB00	637,870
160	215	355L	1SE0 356-6YB80	694,580
200	270	355L	1SE0 357-6YB80	762,690
250	335	355L	1SE0 358-6YB80	822,000

8 - Pole 750 rev/min

Output		Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
kW	HP			
415VΔ 50Hz				
30	40	250M	1SE0 254-8YB80	223,590
37	50	280S	1SE0 281-8YB80	285,930
45	60	280M	1SE0 284-8YB80	331,610
55	75	315S	1SE0 311-8YB80	398,420
75	100	315M	1SE0 314-8YB80	501,410
90	120	315L	1SE0 318-8YB80	563,270
110	150	315L	1SE0 319-8YB80	593,050
132	180	355L	1SE0 356-8YB80	731,980
160	215	355L	1SE0 357-8YB80	807,950
200	270	355L	1SE0 358-8YB80	844,710

Temperature rise limited to 75K & @ Temp. rise limited to 95K.

Note: Efficiency class will be stamped on the name-plates for motors covered under IS:12615 - 2004 only.

CE

1PQ8 Series - Separately Cooled. Degree of Prot. IP55, Ins Class 'F'. 415V ±10%, 50Hz ± 5%, combined ±10%. Cooling IC 416.
Prices for IMB3 (foot mounted) versions. Amb. 40°C (Temp rise 105K)

2 - Pole 3000 rev/min			
Output kW	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz			
250	315	1PQ8 315-2PC70	982,720
315	315	1PQ8 317-2PC70	1,151,810
355	355	1PQ8 353-2PC70	1,401,320
400	355	1PQ8 355-2PC70	1,462,640
500	355	1PQ8 357-2PC70	1,585,870

4 - Pole 1500 rev/min			
Output kW	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz			
250	315	1PQ8 315-4PB70	892,600
315	315	1PQ8 317-4PB70	1,028,160
355	355	1PQ8 353-4PB70	1,176,970
400	355	1PQ8 355-4PB70	1,286,030
500	355	1PQ8 357-4PB70	1,460,090
560	400	1PQ8 403-4YP70	1,646,800
630	400	1PQ8 405-4PB70	1,798,310
675 *	400	1PQ8 407-4PB00	1,966,720
760 *	450	1PQ8 453-4PD00	on Enquiry
850 *	450	1PQ8 455-4PD00	on Enquiry
950 *	450	1PQ8 457-4PD00	on Enquiry
1060 *	500	1PQ8 458-4PD00	on Enquiry
1180 *	500	1PQ8 459-4PD00	on Enquiry

6 - Pole 1000 rev/min			
Output kW	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz			
200	315	1PQ8 315-6PB70	885,700
250	315	1PQ8 317-6PB70	944,860
315	355	1PQ8 355-6YP70	1,252,100
400	355	1PQ8 357-6PB70	1,432,560
450	400	1PQ8 403-6AD70	on Enquiry
500	400	1PQ8 405-6AD70	on Enquiry
560	400	1PQ8 407-6AD70	on Enquiry
630	450	1PQ8 453-6AD70	on Enquiry
670 *	450	1PQ8 455-6AD00	on Enquiry
760 *	450	1PQ8 457-6AD00	on Enquiry
850 *	500	1PQ8 458-6AD00	on Enquiry
950 *	500	1PQ8 459-6AD00	on Enquiry

New

8 - Pole 750 rev/min			
Output kW	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz			
160	315	1PQ8 315-8PB70	930,850
200	315	1PQ8 317-8PB70	967,510
250	355	1PQ8 355-8YP70	1,252,300
315	355	1PQ8 357-8PB70	1,428,540
355	400	1PQ8 403-8PD70	on Enquiry
400	400	1PQ8 405-8PD70	on Enquiry
450	450	1PQ8 407-8PD70	on Enquiry
500	450	1PQ8 453-8PD70	on Enquiry
560	450	1PQ8 455-8PD70	on Enquiry
630	450	1PQ8 457-8PD70	on Enquiry
670 *	500	1PQ8 458-8PD00	on Enquiry
750 *	500	1PQ8 459-8PD00	on Enquiry

ENERGY IS LIFE
BEE
CONSERVE IT

CE

1PQ0 Series - SEPARATELY COOLED. Degree of Prot. IP54, Ins Class 'F'. Ambient 50°C
415V ±10%, 50Hz ± 5%, combined ±10%. Prices for IMB3 (foot mounted) versions.
Cooling IC 416

2 - Pole 3000 rev/min

Output kW	Output HP	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz				
11	15	160M	1PQ0 164-2YC80	69,600
15	20	160M	1PQ0 165-2YC80#	76,120
18.5	25	160L	1PQ0 166-2YC80#	95,920
22	30	180M	1PQ0 183-2YA80#	106,450
30	40	200L	1PQ0 207-2YB80	148,890
37	50	200L	1PQ0 208-2YB80#	180,810
45	60	225M	1PQ0 223-2YB80	226,110
55	75	250M	1PQ0 254-2YB80	292,860
75	100	280S	1PQ0 281-2YB80	380,030
90	120	280M	1PQ0 284-2YB80	433,320
110	150	315S	1PQ0 311-2YC80	558,470
132	180	315M	1PQ0 314-2YC80	676,320
160	215	315L	1PQ0 318-2YC80	736,220
180	240	315L	1PQ0 319-2YC80@	860,740
250	335	355L	1PQ0 356-2YC80	962,800
315	425	355L	1PQ0 357-2YC80#	1,062,290

4 - Pole 1500 rev/min

Output kW	Output HP	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz				
11	15	160M	1PQ0 163-4YA80	68,880
15	20	160L	1PQ0 166-4YA80	79,730
18.5	25	180M	1PQ0 183-4YA80	103,260
22	30	180L	1PQ0 186-4YA80	108,360
30	40	200L	1PQ0 207-4YA80	145,700
37	50	225S	1PQ0 221-4YA80	178,040
45	60	225M	1PQ0 224-4YA80	208,710
55	75	250M	1PQ0 254-4YA80	275,730
75	100	280S	1PQ0 281-4YA80	351,540
90	120	280M	1PQ0 284-4YA80	400,840
110	150	315S	1PQ0 311-4YA80	495,280
132	180	315M	1PQ0 314-4YA80	572,950
160	215	315L	1PQ0 318-4YA80	635,140
180	240	315L	1PQ0 319-4YA80@	804,370
250	335	355L	1PQ0 356-4YB80	860,470
315	425	355L	1PQ0 357-4YB80	1,012,790

6 - Pole 1000 rev/min

Output kW	Output HP	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz				
7.5	10	160M	1PQ0 163-6YB80	70,280
11	15	160L	1PQ0 166-6YB80	81,380
15	20	180L	1PQ0 186-6YA80	106,870
18.5	25	200L	1PQ0 206-6YA80	139,830
22	30	200L	1PQ0 207-6YA80	148,920
30	40	225M	1PQ0 223-6YA80#	213,940
37	50	250M	1PQ0 254-6YA80	276,530
45	60	280S	1PQ0 281-6YA80	352,950
55	75	280M	1PQ0 284-6YA80	393,010
75	100	315S	1PQ0 311-6YA80	475,410
90	120	315M	1PQ0 314-6YA80	586,700
110	150	315L	1PQ0 318-6YA80	648,640
132	180	315L	1PQ0 319-6YB00	747,410
160	215	355L	1PQ0 356-6YB80	815,440
200	270	355L	1PQ0 357-6YB80	895,400
250	335	355L	1PQ0 358-6YB80	965,030

8 - Pole 750 rev/min

Output kW	Output HP	Frame size	Type reference (MLFB)	Unit MRP for standard motor Rs.
415VΔ 50Hz				
7.5	10	160L	1PQ0 166-8YB80	82,540
11	15	180L	1PQ0 186-8YB80	108,490
15	20	200L	1PQ0 207-8YB80	151,210
18.5	25	225S	1PQ0 220-8YB80	185,640
22	30	225M	1PQ0 223-8YB80	217,560
30	40	250M	1PQ0 254-8YB80	281,380
37	50	280S	1PQ0 281-8YB80	358,510
45	60	280M	1PQ0 284-8YB80	408,760
55	75	315S	1PQ0 311-8YB80	484,090
75	100	315M	1PQ0 314-8YB80	597,360
90	120	315L	1PQ0 318-8YB80	665,360
110	150	315L	1PQ0 319-8YB80	698,120
132	180	355L	1PQ0 356-8YB80	859,340
160	215	355L	1PQ0 357-8YB80	948,530
200	270	355L	1PQ0 358-8YB80	991,690

Temperature rise limited to 75K & @ Temp. rise limited to 95K.

The MRP is inclusive of the blower and inverter grade insulation scheme.

Insulated bearings are mandatory for 1PQ0 motors in frames 280 and above when operated in constant torque modes below 5Hz of frequency. Please refer to extras for Accessories & prices of insulated bearings.The insulated bearings are NOT included in these Prices.

690V Y Design available against requirement.Pls. Contact your nearest Sales Office

Superbreed. Degree of Prot. IP55, Ins Class 'F'. Ambient 45°C
415V ±10%, 50Hz ± 5%, combined ±10%. Prices for IMB3 (foot mounted) versions.

2 - Pole 3000 rev/min				
Output		Frame size	Type reference (MLFB)	Unit MRP for standard Motor Rs.
kW	HP			
240VΔ / 415VY 50Hz				
0.18	0.25	63	1LA0 060-2YA80	5,960
0.25	0.35	63	1LA0 063-2YA80	6,130
0.37	0.5	71	1LA0 070-2YA80	6,500
0.55	0.75	71	1LA0 073-2YA80	7,210
0.75	1	80	1LA0 080-2YA80	7,460
1.1	1.5	80	1LA0 083-2YA80	8,150
1.5	2	90S	1LA0 090-2YA80	9,040
2.2	3	90L	1LA0 096-2YA80	11,580
415VΔ 50Hz				
3.7	5	100L	1LA0 107-2YA80	14,260
5.5	7.5	112M	1LA0 114-2YA80	21,880
7.5	10	132S	1LA0 131-2YA80	24,170
9.3	12.5	132M	1LA0 133-2YA80	39,410
11	15	160M	1LA0 163-2YC80	42,210
15	20	160M	1LA0 164-2YC80	49,450
18.5	25	160L	1LA0 166-2YC80	67,110
22	30	180M	1LA0 183-2YA80	74,990
30	40	200L	1LA0 206-2YB80	106,360
37	50	200L	1LA0 207-2YB80	135,970
45	60	225M	1LA0 223-2YB80	174,270
55	75	250M	1LA0 253-2YB80	236,170
75	100	280S	1LA0 280-2YC80	308,300
90	120	280M	1LA0 283-2YC80	357,190
110	150	315S	1LA0 310-2YC80	470,330
132	180	315M	1LA0 313-2YC80	578,500
160	215	315L	1LA0 316-2YC80	633,470
200	270	315L	1LA0 317-2YC80	739,890
250	335	355L	1LA0 356-2YC80	820,100
315	425	355L	1LA0 357-2YC80	904,840

4 - Pole 1500 rev/min				
Output		Frame size	Type reference (MLFB)	Unit MRP for standard Motor Rs.
kW	HP			
240VΔ / 415VY 50Hz				
0.12	0.16	63	1LA0 060-4YA80	6,250
0.18	0.25	63	1LA0 063-4YA80	6,590
0.25	0.35	71	1LA0 070-4YA80	6,700
0.37	0.5	71	1LA0 073-4YA80	6,950
0.55	0.75	80	1LA0 080-4YA80	7,690
0.75	1	80	1LA0 083-4YA80	7,770
1.1	1.5	90S	1LA0 090-4YA80	8,530
1.5	2	90L	1LA0 096-4YA80	9,280
415VΔ 50Hz				
2.2	3	100L	1LA0 106-4YA80	12,280
3	4	100L	1LA0 107-4YA80	12,530
3.7	5	112M	1LA0 113-4YA80	15,800
5.5	7.5	132S	1LA0 130-4YA80	21,690
7.5	10	132M	1LA0 133-4YA80	25,300
11	15	160M	1LA0 163-4YA80	40,190
15	20	160L	1LA0 166-4YA80	50,040
18.5	25	180M	1LA0 183-4YA80	70,760
22	30	180L	1LA0 186-4YA80	75,380
30	40	200L	1LA0 207-4YA80	101,860
37	50	225S	1LA0 220-4YA80	130,590
45	60	225M	1LA0 223-4YA80	158,460
55	75	250M	1LA0 253-4YA80	220,450
75	100	280S	1LA0 280-4YA80	282,140
90	120	280M	1LA0 283-4YA80	327,390
110	150	315S	1LA0 310-4YA80	412,350
132	180	315M	1LA0 313-4YA80	483,630
160	215	315L	1LA0 316-4YA80	540,710
200	270	315L	1LA0 317-4YA80	691,440
250	335	355L	1LA0 356-4YB80	739,660
315	425	355L	1LA0 357-4YB80	870,600

For 63 - 132 frames - Last digit of order code to change based on construction type

Construction	IMB3	IMB5/V1	IMB14	IMV1 with Canopy	IMB35	IMB34
Last digit	0	1	2	4	6	7

Important Note: Please contact nearest sales office for availability of the product

EFF 2 CE

Superbreed. Degree of Prot. IP55, Ins Class 'F'. Ambient 45°C
415V ±10%, 50Hz ± 5%, combined ±10%. Prices for IMB3 (foot mounted) versions.

6 - Pole 1000 rev/min					8 - Pole 750 rev/min				
Output		Frame size	Type reference (MLFB)	Unit MRP for standard Motor Rs.	Output		Frame size	Type reference (MLFB)	Unit MRP for standard Motor Rs.
kW	HP				kW	HP			
240VΔ / 415VY 50Hz									
0.18	0.25	71	1LA0 070-6YA80	6,960					
0.25	0.35	71	1LA0 073-6YA80	7,220					
0.37	0.5	80	1LA0 080-6YA80	8,220					
0.55	0.75	80	1LA0 083-6YA80	8,470					
0.75	1	90S	1LA0 090-6YA80	9,050					
1.1	1.5	90L	1LA0 096-6YA80	9,990					
1.5	2	100L	1LA0 106-6YA80	13,310					
415VΔ 50Hz					**415VΔ 50Hz**				
2.2	3	112M	1LA0 113-6YA80	15,930					
3.7	5	132S	1LA0 131-6YA80	23,320					
5.5	7.5	132M	1LA0 134-6YA80	25,890	5.5	7.5	160M	1LA0 164-8YB80	41,330
7.5	10	160M	1LA0 163-6YB80	41,470	7.5	10	160L	1LA0 166-8YB80	52,610
11	15	160L	1LA0 166-6YB80	51,550	11	15	180L	1LA0 186-8YB80	75,520
15	20	180L	1LA0 186-6YA80	74,040	15	20	200L	1LA0 207-8YB80	106,880
18.5	25	200L	1LA0 206-6YA80	96,540	18.5	25	225S	1LA0 220-8YB80	137,480
22	30	200L	1LA0 207-6YA80	104,800	22	30	225M	1LA0 223-8YB80	166,530
30	40	225M	1LA0 223-6YA80	163,230	30	40	250M	1LA0 253-8YB80	225,640
37	50	250M	1LA0 253-6YA80	221,190	37	50	280S	1LA0 280-8YB80	288,550
45	60	280S	1LA0 280-6YA80	283,430	45	60	280M	1LA0 283-8YB80	334,650
55	75	280M	1LA0 283-6YA80	320,210	55	75	315S	1LA0 310-8YB80	402,070
75	100	315S	1LA0 310-6YA80	394,120	75	100	315M	1LA0 313-8YB80	506,010
90	120	315M	1LA0 313-6YA80	496,250	90	120	315L	1LA0 316-8YB80	568,440
110	150	315L	1LA0 316-6YA80	553,090	110	150	315L	1LA0 317-8YB80	598,490
132	180	315L	1LA0 317-6YA80	643,720	132	180	355L	1LA0 356-8YB80	738,690
160	215	355L	1LA0 356-6YB80	700,950	160	215	355L	1LA0 357-8YB80	815,360
200	270	355L	1LA0 357-6YB80	769,690	200	270	355L	1LA0 358-8YB80	852,460
250	335	355L	1LA0 358-6YB80	829,540					

For 63 - 132 frames - Last digit of order code to change based on construction type

Construction	IMB3	IMB5/V1	IMB14	IMV1 with Canopy	IMB35	IMB34
Last digit	0	1	2	4	6	7

Important Note: Please contact nearest sales office for availability of the product

For Project 3: Use of ON – OFF Controller system

SHIWKON DIGITEK PVT.LTD.

SHIWKÖN

Instrumentation & Controls

w w w . s h i w k o n . c o m

QUOTATION

To, **SEE – Tech Solutions Pvt. Ltd.** Nagpur	**Quat. No**.:SDPL/Q/09-10/1051
	Date.:29-March-2010
Ph. 09960344745	**Your Ref. No**. e-mail
Kind Attn: **Ms. Monika Chaudhari-Manager Projects**	**Date**. . 29-March-2010

Dear Mam,
We thankfully acknowledge the receipt of your above-mentioned enquiry regarding your requirements.
We are pleased to submit our best offer as under.

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Sr.No.	**Description**	**Price**
(1)	**Digital Microcontroller based Cyclic Timer having following facilities:** On-time settable: 0-99 min Off-time settable: 0-99 min Power supply: 230V Output: Relay contact- NO, NC Size: 96 x 96mm	**Rs. 1950/-**
(2)	**Clamp on Power Meter:** Make: Kusum-Meco Model: 2709 Capacity: 1000 A Other details as per Attached Catalogue	**Rs. 10,500/-**

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ENERGY IS LIFE BEE CONSERVE IT

Commercial Terms & Conditions:

Prices	:	Ex-works Ahmedabad
Packing & Forwarding	:	@ 2 %
Taxes	:	CST 2% extra as applicable
Delivery Period	:	Within 3 to 4 weeks
Mode of Dispatch	:	Through Courier
Freight/ Courier Charges	:	Extra as Applicable
Payment Terms	:	20 % Advance & Balance at the time of Delivery

Thanking you,

For, **SHIWKON DIGITEK PVT LTD.**
Hardik Patel
Director
98250 50706

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Works:Plot No.-12 , Ratnmani industrial Estate, Behind TNT Cargo, Sarkhej- Bavla Road, At : Changodar, Dist: Ahmedabad-382210

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