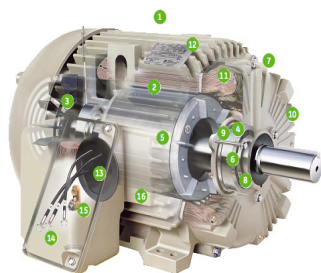


DETAILED PROJECT REPORT ON ENERGY EFFICIENT MOTOR (45 kW EEF 1) HOWRAH CLUSTER



Bureau of Energy Efficiency

Prepared By



Reviewed By



ENERGY EFFICIENT MOTORS OF 45 kW RATING

**HOWRAH GALVANIZING
AND WIRE DRAWING CLUSTER**

BEE, 2010

Detailed Project Report on Energy Efficient Motors (45 kW)

Galvanizing and Wire Drawing SME Cluster,

Howrah, West Bengal (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: ***HWR/WDG/EFF/09***

For more information

Bureau of Energy Efficiency
Ministry of Power, Government of India
4th Floor, Sewa Bhawan, Sector - 1
R. K. Puram, New Delhi -110066

Ph: +91 11 26179699 Fax: 11 26178352
Email: jsood@beenet.in
pktiwari@beenet.in
WEB: www.bee-india.nic.in

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Dr. Ajay Mathur, Director General, BEE

Smt. Abha Shukla, Secretary, BEE

Shri Jitendra Sood, Energy Economist, BEE

Shri Pawan Kumar Tiwari, Advisor (SME), BEE

Shri Rajeev Yadav, Project Economist, BEE

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**Indian Institute of Social Welfare and Business
Management Kolkata**

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List of Abbreviation

BEE	Bureau of Energy Efficiency
CDM	Clean Development Mechanism
DPR	Detailed Project Report
DSCR	Debt Service Coverage Ratio
GHG	Green House Gases
GWh	Giga Watt Hours
IRR	Internal Rate of Return
MT	Million Ton
MW	Mega Watt
NPV	Net Present Value
ROI	Return on Investment
SCM	Standard Cubic Meter
SHC Coal	Semi Hard Coke Coal
SIDBI	Small Industrial Development Bank of India
MoMSME	Ministry of Micro Small and Medium Enterprises

EXECUTIVE SUMMARY

Indian Institute of School Welfare and Business management (IISWBM), Kolkata is executing BEE-SME program in the Galvanizing and Wire Drawing Cluster of Howrah, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

One of the identified sectors was Galvanizing and Wire-drawing cluster in Howrah district of West Bengal. There are about 100 SMEs in Galvanizing and Wire-drawing sector of Howrah Cluster comprising about 50% galvanizing units and 50% wire drawing units. These units are constantly under the threat of closure due to poor energy efficiency along with pollution issues and variability in demand. Improvement in energy efficiency would largely ensure sustainable growth of the sector, which needs a mechanism to identify technology and techniques for improving energy efficiency in these highly unorganized and so far uncared industrial units.

Motors are an integral part of any unit in this cluster. However, those motors are typically of the conventional type with low maximum efficiency. Use of energy efficient motors which have higher efficiency than existing motor and help in saving a lot of money for the units. The replicability potential of the energy efficient motors is as high as 90 in the Howrah cluster. It may also be noted that the replicability also applies to motors in the same unit.

Installation of proposed equipment i.e. installation of new energy efficient motor of 45 kW capacity to replace existing motor having low efficiency as well as higher capacity than the required would save about 7579 kWh electricity per year.

This DPR highlights the details of the study conducted for assessing the potential for installation new energy efficient motor, possible reduction in energy/production cost and its 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, sensitivity analysis for different scenarios 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:

S.No	Particular	Unit	Value
1	Project cost	₹(In lakh)	1.12
2	Electricity saving	kWh/year	7579
3	Monetary benefit	₹(In lakh)	0.49
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	year	2.29
6	NPV	₹ (In lakh)	0.68
7	IRR	%age	26.88
8	ROI	%age	25.58
9	DSCR	Ratio	1.75
10	Process down time	Days	7

The projected profitability and cash flow statements indicate that the project implementation i.e. installation of energy efficient motors will be financially viable and technically feasible solution for galvanizing and wire drawing cluster.

ABOUT BEE'S SME PROGRAM

The Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 25 selected SMEs clusters. Howrah Galvanizing and Wire Drawing Cluster is one of them. The SME Programme of BEE intends to enhance the awareness about energy efficiency in each cluster by funding/ subsidizing need based studies 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 the 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, and service providers for various reasons. To address this issue BEE has also undertaken capacity building of local service providers and entrepreneurs/ managers of the 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

The Galvanizing and Wire-drawing cluster in Howrah district of West Bengal is a very large cluster. There are about 100 SMEs in the Howrah Cluster and comprising of about 50% galvanizing units and 50% wire drawing units. The units are constantly under threat of closure due to poor energy efficiency along with pollution issues and variability in demand. Improvement in energy efficiency would largely ensure sustainable growth of the sector. It needs a mechanism to identify technology and techniques for improving energy efficiency in these highly unorganized and so far uncared industrial units.

The major raw materials for the Galvanizing industry are zinc, ammonium chloride, hydrochloric acid, and di-chromate powder. On the other hand, the raw materials used in Wire-drawing units are MS / Copper / Aluminium Wires of gauges varying from 14 to 4 gauge i.e. 1.6 to 5.1 mm dia., while Uni-Lab powder (of Predington company based in Bombay or Grommet-44 is used for lubrication).

The main form of energy used by the cluster units are grid electricity, Furnace Oil, SHC coal, LPG and Diesel oil. Major consumptions of energy are in the form of Furnace Oil and Diesel. Details of total energy consumption at Howrah cluster are furnished in Table 1.1a and 1.1b:

Table 1.1a Details of annual energy consumption in the wire drawing units

S. No	Type of Fuel	Unit	Value	% contribution
1	Electricity	GWh/year	2.24	76
2	Wood	Ton/year	300	5
3	LPG	Ton/year	70.5	19

Table 1.1b Details of annual energy consumption in the galvanizing units

S. No	Type of Fuel	Unit	Value	% contribution
1	Electricity	MWh/year	867.3	13
2	Diesel	kl/year	19.2	2
3	Furnace Oil	kl/year	731.7	62.5
4	SHC coal	Ton/year	1161	18.5
5	Wood	Ton/year	600	4

Classification of Units

The Galvanizing and Wire Drawing units can be broadly classified on the basis of the following criteria:

- 1) Product wise
- 2) Production capacity wise

Products Manufactured

The galvanizing units can be classified on the basis of products into five basis groups. Those are:

- a) Units producing transmission tower structures
- b) Units producing fastener items
- c) Units producing angles and channels
- d) Units working on scrap iron
- e) Units producing wires

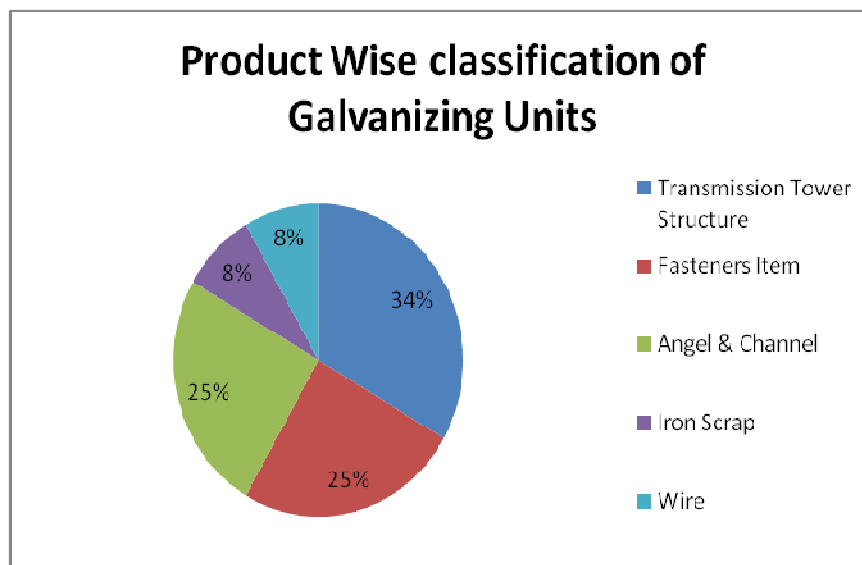


Figure 1.1: Product Wise Classification of Galvanizing Units

Similarly, the wire drawing units are mainly classified into the following categories on the basis of products manufactured as units, which produce:

- a) MS wire
- b) Copper Wire
- c) High carbon wire
- d) Aluminium wire

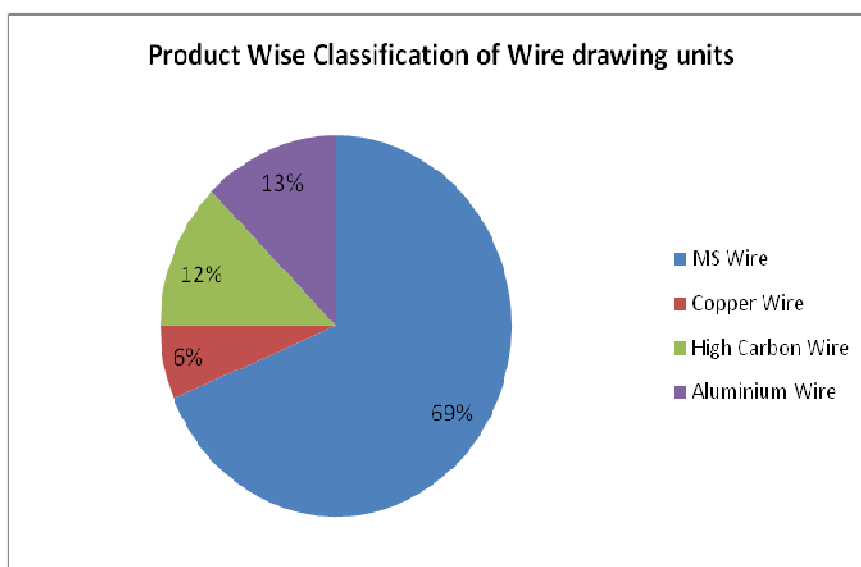


Figure 1.2: Product Wise Classification of Wire-drawing Units

Capacity wise production

In both Wiredrawing and Galvanizing units in Howrah, the production capacity has been found to vary more than 10 folds. In the units, where detailed audit has been performed, there are Wire-drawing units producing as low as 241 Ton/year to as high as 3500 Ton/year. Similarly, the production from Galvanizing units, where audit was performed, has been found to be within the range of 890 to 7500 Ton per annum. Both the Galvanizing and the Wire Drawing units have been classified on the basis of production into three categories, namely 1-500 TPA (calling micro scale), 500-1000 TPA (small scale) and above 1000 TPA (medium scale) capacities.

The distribution of units of Galvanizing and Wire Drawing industries have been depicted in figures 1.3 and 1.4 below:

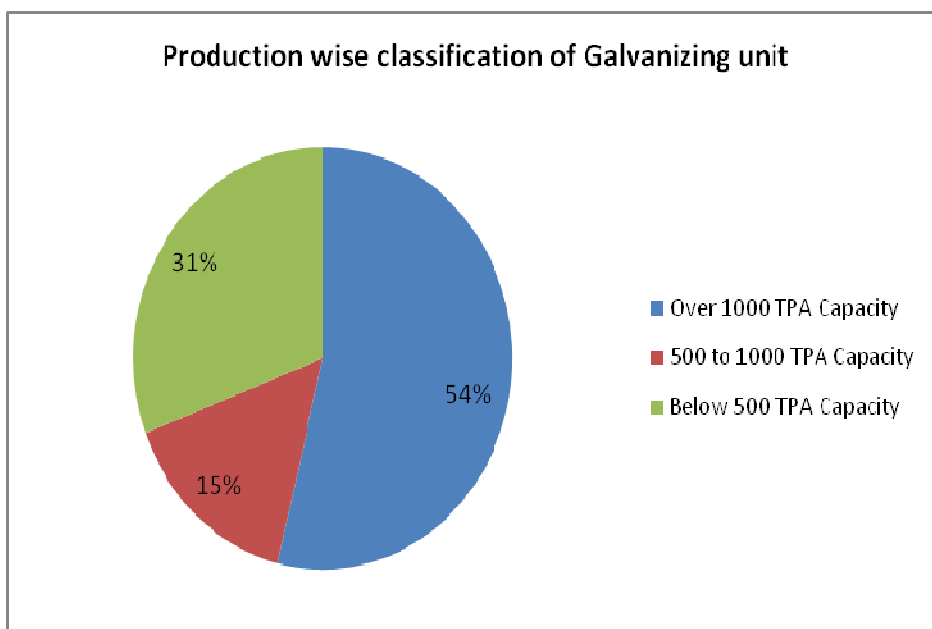


Figure 1.3: Production Wise Classification of Galvanizing Units

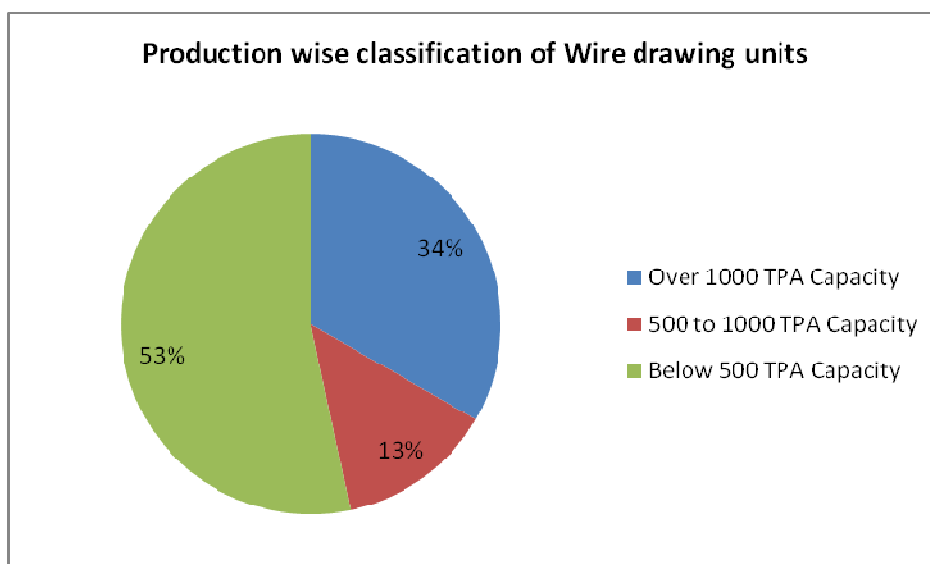


Figure 1.4: Production Wise Classification of Wire-drawing Units

Energy usages pattern

Average yearly electricity consumption in Wire Drawing unit ranges from 82 thousands to 7 lakh kWh depending on the size of the unit. In thermal energy, solid fuel such as wood and gaseous fuel like LPG are used in annealing furnaces in some of the units. The LPG consumption in a typical unit is about 135000 kg/year. The wood consumption in a typical unit is about 300 Ton/year.

Average monthly electricity consumption in a galvanizing unit ranges from 60 thousands to 3 lakh kWh depending on the size of the unit and type of operations performed. In thermal energy, furnace oil is primarily used in the galvanizing furnaces since it is reasonably cheap. The use of FO ranges from 0.5 to 4.5 lakh liters/year. The use of diesel oil ranges from 1.3 to 19.2 kilolitre/year and is used in either drying the job or pre-heating flux solution. SHC coal is also used for the purpose of drying the job and ranges from 1.5 to 8 lakh kg/year. Wood is used in some larger units which have facilities for running processes other than galvanizing. It can typically use 6 lakh kg/year of wood.

General production process for the wire drawing units

The wire about to be drawn is first put into an annealing furnace. The annealed wire is then put into drums for coiling wires. Thereafter, the wire is put through dies of various sizes interspersed by sets of coiler drums.

These drums are driven by electric motors that are of induction type. The chemical used for lubricating the wire through the die is mainly wire-drawing powder (as it is commonly termed in the wire-drawing industry). The finished products of MS Wires are stacked on a steeper from where finished goods are dispatched to the end customers, after dipping in to a rust-preventive oil solution, which protects the final product from corrosion for up to one-and-half month. The finished wire products are mainly supplied to downstream industries such as galvanizers, electrical manufactures and the local market.

General production process flow diagram for drawing wires is shown in Figure 1.5 below:

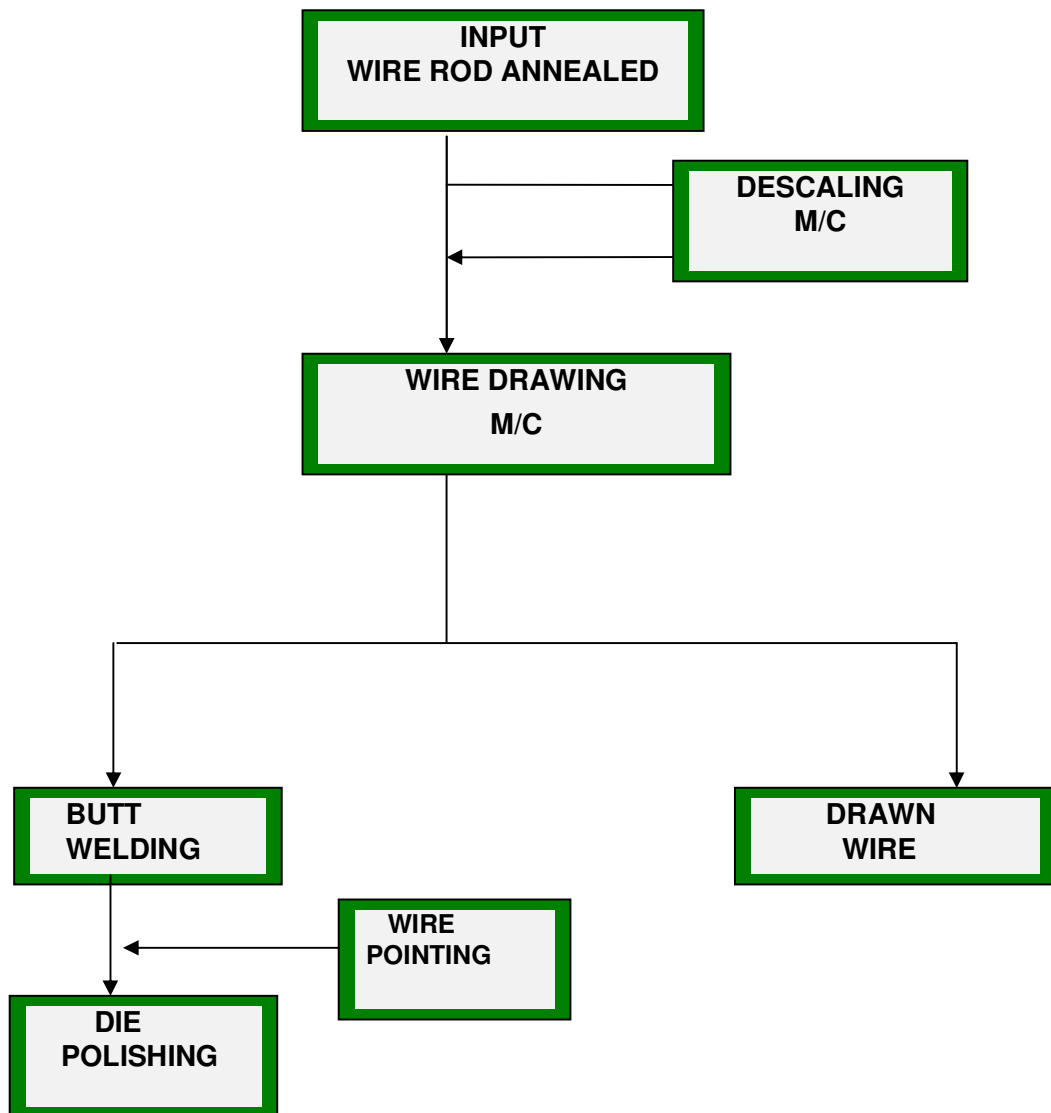


Figure 1.5 Process flow diagrams for a typical wire drawing unit

General production process for the galvanizing units

In a typical galvanizing unit, the production process involves seven stages as is shown in the schematic diagram in Fig 1.6. First the job or the raw material, which is to be galvanized is dipped in dilute acid solution and termed acid pickling. Then after the acid pickling process, the job is rinsed in plain water to remove any acid layer present on the job surface. Thereafter, the job is moved onto a SHC coal based drying bed for preheating and drying

purpose. This helps produce a uniform layer of zinc on the job surface when the job is dipped in the zinc bath. Then after the drying process is over, the job is dipped into the zinc bath for galvanizing where a layer of molten zinc is deposited uniformly over the job surface.

When the job is taken out of the zinc bath, ammonium chloride powder (the fluxing agent) is sprayed over the job to remove the impurities and other dust particles remaining over the surface. Then the job is dipped in plain cold water for cooling. This process is termed as water quenching. After completion of the water-quenching process, the job is dipped into dichromate solution to give a glazing effect to the job galvanized. The description of the above galvanizing process is depicted in the following process flow diagram.

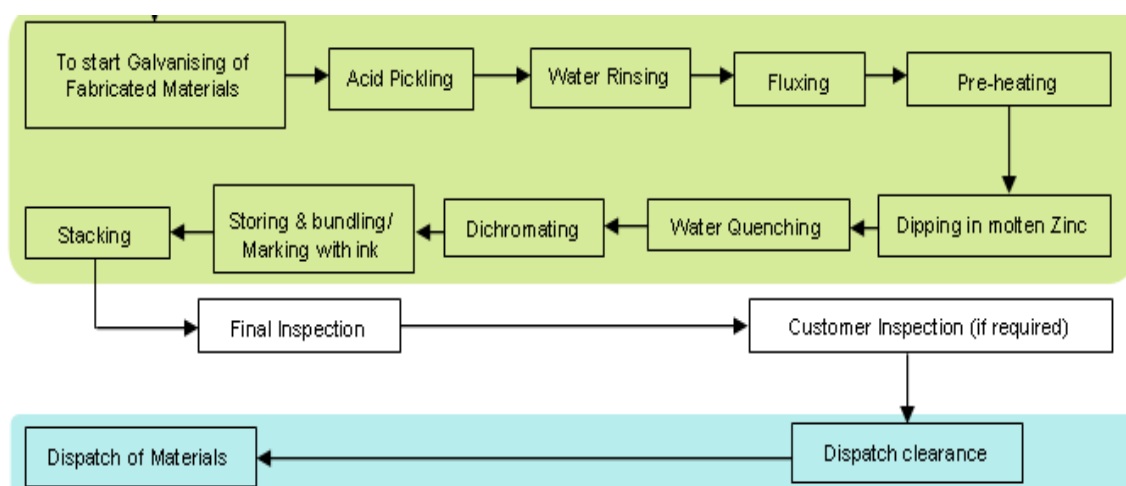


Fig 1.6: Process Flow diagram for a typical galvanizing unit

1.2 Energy performance in existing system

1.2.1 Fuel consumption

Average fuel and electricity consumption in typical wire drawing units is given in Table 1.2 and that of galvanizing units is given in Table 1.3. A small unit is defined to be a unit with production between 500 and 1000 TPA and medium to be greater than 1000 TPA. The micro units are defined to have capacity less than 500 TPA.

Only the larger wire drawing industries have furnaces and perform annealing. Among the wire drawing units audited, only one, which was also larger used wood for annealing. Further, most of the wire drawing units produces MS wires.

Table 1.2 Average fuel and electricity consumption in typical wire drawing units

Scale of Unit	Micro	Small	Medium		
Energy	Electricity (kWh/ yr)	Electricity (kWh/ yr)	Electricity (kWh/ yr)	LPG (Ton/yr)	Wood (Ton/yr)
MS wire	101486	209216	266889	NAp	300
Copper wire	NA	NA	295310	70.5	NA
High carbon wire	NA	NA	1088751	NA	NA
Aluminium wire	NA	NA	266889	NA	NA

Table 1.3 Average fuel and electricity consumption in typical galvanizing units

Scale of Unit	Small			Medium				
Energy	Electricity	Furnace Oil	Diesel Oil	Electricity	Furnace Oil	Diesel Oil	SHC coal	Wood
	(kWh/ yr)	(l/yr)	(l/yr)	(kWh/ yr)	(l/yr)	(l/yr)	(kg/yr)	(kg/yr)
Transmission Tower Structure	NA	NA	NA	59346	85195	NA	NA	NA
Fasteners Item	107670	132000	19200	109883	112500	NA	21000	NA
Angle & Channel	NA	NA	NA	35491	165000	NA	150000	NA
Wire	NA	NA	NA	302013	165000	7040	NA	600000

1.2.2 Average annual production

Annual production in terms of TPA is taken in case of wire drawing units. The micro units are defined to have production less than 500 TPA, small to be between 500 and 1000 TPA and medium to have production higher than 1000 TPA.

Table 1.4 Typical average annual production in wire drawing units

S. No.	Type of Industry	Production (in TPA)		
		Micro scale	Small scale	Medium scale
1	MS wire	100	NA	1969
2	Copper wire	NA	NA	4320
3	High carbon wire	NA	NA	3750
4	Aluminium wire	100	NA	3650

Table 1.5 Typical average annual production in galvanizing units

S. No.	Type of Industry	Production (in TPA)		
		Micro scale	Small scale	Medium scale
1	Transmission Tower Structure	NA	NA	1969
2	Fasteners Item	200	890	4320
3	Angel & Channel	150	NA	3750
4	Wire	NA	NA	3650

1.2.3 Specific energy consumption

Specific energy consumption both electrical and thermal energy per Ton of production for galvanizing and wire drawing units are furnished in Table 1.6 below:

Table 1.6: Specific Energy Consumption in Galvanizing and Wire-drawing Units

Process		Unit	Specific Energy Consumption		
			Min	Max	Average
Galvanizing	Electrical	kWh/Ton	5.12	120	46.15
	Thermal	kCal/Ton	200370	579600	385978
Wire Drawing	Electrical	kWh/Ton	30	868	308
	Thermal	kCal/Ton	135	511	323

1.3 Existing technology/equipment

1.3.1 Description of existing technology

Motors are the driving force for all wire-drawing machines, as shown in Figure 1.5. Standard motors have lower efficiency than energy efficient motor of EFF1 class as per IS-12615 and also given in Annexure – 10. Further, it has been observed that, almost all the units are using standard motors and re-wind them from the local service providers who are not considering the efficiency issue, but only the operation of the motor even with higher consumption of electricity for the same output. Every such rewinding can lead to reduction of efficiency by 2 to 5% depending on the size of the motor and in case of 45 kW motor, it could be as high as 3%, as shown in Annexure – 10. In a wire drawing plant, the electricity cost is about 5% of total cost and the rest of it is the cost of raw material (wires) that would be drawn. However, in a typical unit, the electricity cost is about ₹ 4-35 lakh.

Motors are used in a variety of applications in the wire drawing industry, of which the primary one is to turn the spindles where wires of various sizes are coiled up. The spindles maintain the tension to pull the wire through the dies. The typical motors used at present in the galvanizing and wire drawing units are normal motors. Their ratings vary from 0.55 kW to 112 kW.

Existing Motors specifications for the cluster are shown in Table 1.7 below;

Table 1.7 Typical specifications of present motors

S. No.	Parameters	Detail
1	Manufacturer	SIMENS, KIRLOSKAR and also many from local fabricators
2	Capacity	0.55 kW to 112 kW
3	Efficiency	64% to 92.5%
4	Operation	Continuous
5	Motor type	Induction motor
6	Voltage ratings	415 V +/- 10 V, 3 Phase, 50 Hz +/- 5%.
7	Ambient temperature max	50 Deg C
8	Number of poles	4
9	Speed	1440 rpm

In some areas of Howrah, such as, Jangalpur, electricity is supplied by the West Bengal State Electricity Distribution Company Limited (WBSEDCL) at the following tariff rates:

Energy charges

Table 1.8 Electricity charges for WBSEDCL

S. No.	Unit consumed, kWh	Energy Charges, ₹/kWh
1	Upto 500	4.63
2	Next 1500	5.81
3	Above 2000	6.07

Contract demand charges is Rs. 15/kVA. Thus the energy charge for a typical unit with contract demand of 49 kVA and average monthly energy consumption of 9157 kWh is Rs. 6.50 / kWh.

In some areas of Howrah, such as, Liluah, electricity is supplied by CESC at the following tariff rates:

Table 1.9 Electricity charges for CESC

S. No.	Unit consumed, kWh	Energy Charges, ₹ /kWh
1	For first 500	4.43
2	For next 1500	4.87
3	For next 1500	5.20
4	For above 3500	5.49

Contract demand charges is ₹ 15/kVA. Thus the energy charge for a typical unit with contract demand of 71.8 kVA and average monthly energy consumption of 8972 kWh is ₹ 5.40 / kWh.

1.3.2 Role in process

The motors turn the spindles to pull the wires through the dies. Hence, these are the heart of the drawing process. However, the ones used in the units are of the conventional type and at present provide upto 92.5% maximum efficiency.

1.4 Baseline establishment for existing technology

1.4.1 Design and operating parameters

The typical motors used at present in the galvanizing and wire drawing units are normal motors. Their ratings vary from 0.55 kW to 112 kW. The subject of the present DPR is however for 45 kW energy efficient (EFF1) motors.

Considering a 112.5 kW standard motor to be replaced by 45 kW energy efficient (EFF1) motor for present analysis, here are the specifications for it.

Table 1.10 Present motor specifications

S. No.	Parameter	Detail
1	Manufacturer	KIRLOSKAR
2	Operation	Continuous
3	Capacity	45 kW
4	Efficiency	84.28%
5	Motor type	Induction motor, slip ring
6	Voltage rating	415 V +/- 10 V, 3 Phase, 50 Hz +/- 5%.
7	Ambient temperature max	50 Deg C
8	Number of poles	4
9	Speed	1440 rpm
10	Insulation	Class B

Maximum efficiency of the 112.5 kW standard motor is 92.5% (IS 12615). The reduction is due to poor loading and poor quality rewinding as given in Annexure-10.

Electricity consumption in the motors depend on the following parameters

- Condition of the motor including bearings
- Number of times it has been rewind
- Quality of the components present.

Electricity requirement in the wire-drawing plant depends on the production. Detail of electricity consumption in a typical unit is given in Table 1.11 below:

Table 1.11 Electricity consumption at a typical wire drawing unit

S. No.	Energy Type	Unit	Value
1	Electricity	kWh/year	266889

1.4.2 Operating efficiency analysis

The Annexure-1 shows a typical set of ordinary motors present in a typical wire drawing unit and their respective efficiencies.

1.5 Barriers in adoption of proposed equipment

1.5.1 Technological barrier

In Howrah cluster, the technical understanding of the wire drawing process has been excellent with several committed technical personnel having detailed know-how of the processes involved. Some of them are also visiting countries like China and European ones to find the best possible technological solutions to meet the challenges in their units. Indeed, there is committed effort on the part of the management in such units to grasp alterations, which may give them benefits, however, with the caveat that the advantages be proven without any doubt.

People are generally reluctant to invest in an experimental scheme particularly if the sufficient savings are not guaranteed. Hence, finding the first person, who is willing to implement a change is still a challenge. 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

Discussions of financial issues with the units concluded that they are not scared of investments. The larger units are confident of financing their own alterations while the smaller units are certain to find good schemes from the banks to fund their respective efficiency measures. However, the good part of the discussions was that more and more units are taking energy conservation measures seriously and willing to go to the distance. A mention must be made of SIDBI, whose schemes have attracted attention and can play a catalytic role in the implementation of the measures.

1.5.3 Skilled manpower

Technical personnel employed in the units are generally skilled works but not engineers. Thus, the production process remains traditional. This is one of the main hindrances in adopting newer technology. Specialized training among the workforce and local experts can circumvent the problem significantly. Effective dissemination can enhance replication potential in the various units. The gains obtained by one plant can inspire other units to follow suit.

2. PROPOSED EQUIPMENT FOR ENERGY EFFICIENCY IMPROVEMENT

2.1 Description of proposed equipment

2.1.1 Detailed of proposed equipment

Energy-efficient motors (EEM) are the ones in which design improvements are incorporated specifically to increase operating efficiency over motors of standard design. Design improvements focus on reducing intrinsic motor losses. Improvements include the use of lower-loss silicon steel, a longer core (to increase active material), thicker wires (to reduce resistance), thinner laminations, smaller air gap between stator and rotor, copper instead of aluminum bars in the rotor, superior bearings and a smaller fan, etc.

Energy-efficient motors now available in India operate with efficiencies that are typically 2.4 to 9 percentage points higher than standard motors. In keeping with the stipulation of the BIS, energy-efficient motors are designed to operate without loss in efficiency at loads between 75% and 100% of rated capacity. This may result in major benefits in varying load applications. The power factor is about the same or may be higher than for standard motors. Furthermore, energy-efficient motors have lower operating temperatures and noise levels, greater ability to accelerate higher-inertia loads, and are less affected by supply voltage fluctuations.

2.1.2 Equipment/ technology specification

The energy efficient motors that need to be used depend upon necessity. Some are of 2 kW rating and some as high as 90 kW. Detailed technical specifications of energy efficient motors are furnished in Table 2.1 below:

Table 2.1 Technical specification of a typical Energy Efficient Motor

S. No.	Parameter	Detail
1	Manufacturer	KIRLOSKAR
2	Model	SC225M
3	Operation	Continuous
4	Capacity	45 kW
5	Efficiency	93.9%
6	Motor type	Induction motor
7	Voltage rating	415 V +/- 10 V, 3 Phase, 50 Hz +/- 5%.
8	Ambient temperature max	50 Deg C

S. No.	Parameter	Detail
9	Max altitude	1000 m above MSL
10	Number of poles	4
11	Speed	1440 rpm

2.1.3 Integration with existing equipment

The motors used in the units are at present the conventional ones with lower maximum efficiency of about 84.28% (IS 12615). Further, the loading of those motors are also low in general. For that low loading and poor quality rewinding the efficiency become 84.28%. Hence, those have to be downsized to reduce the energy bill in any case. While doing that, buying and installing energy efficient motors would certainly help by making a maximum efficiency of 93.9% available.

The following are the reasons for selection of this technology

- Maximum efficiency goes up to 93.9%
- It will reduce the total operating energy cost of the plant.
- It reduces the GHG emissions
- This project is also applicable for getting the carbon credit benefits.

2.1.4 Superiority over existing system

Use of this technology reduces the amount of electricity consumed by the unit.

2.1.5 Source of equipment

There are many vendors for such technology. It has successfully been adopted and implemented throughout the country and benefits reaped have been established beyond doubt. There are no concerns of scarcity of such devices and the prices are reasonable as well.

2.1.6 Availability of technology/equipment

Suppliers of this technology are available at local level as well as at international level very easily. Many of the suppliers took initiative in reaching out to the industry representatives and informing them about the utility of such devices.

2.1.7 Service providers

Details of technology service providers are shown in Annexure-7.

2.1.8 Terms and conditions in sales of equipment

50% of the charges would have to be paid upfront and the rest along with the taxes would have to be paid while sending the proforma invoice prior to dispatch. Further, the warranty period extends upto 12 months from the point of delivery for any inherent manufacturing defect or faulty workmanship.

2.1.9 Process down time

The down time might hardly be 6-7 days for the installation of the motors.

2.2 Life cycle assessment and risks analysis

Life of the equipment is about 15 years. Risk involves in the installation of proposed project are mainly in getting the size of the motor right. If the load is calculated wrongly and the motor is oversized, the efficiency would still remain poor. On the other hand, if the rating of the installed motor is too low, it can simply burn out.

2.3 Suitable unit for Implementation of proposed technology

Suitable unit for implementation of this technology are vitrified unit having the production capacity of about 2700 Ton/yr and having total electrical consumption of about 266889 kWh/yr.

3. ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical benefit

3.1.1 Fuel saving

Since the primary source of energy in a motor is electricity, the suggested technology does not contribute to fuel savings.

3.1.2 Electricity saving

After implementation of project, the unit would consume about 7579 kWh/yr of less electricity. As the cost of electricity rises, the monetary savings would only rise.

3.1.3 Improvement in product quality

The quality of the product would still remain the same. It shall have no impact on the way wires are drawn but merely make the process more efficient.

3.1.4 Increase in production

The production will remain the same as in present.

3.1.5 Reduction in raw material

Raw material consumption would also remain same even after the implementation of the proposed technology.

3.1.6 Reduction in other losses

Since in the primary mode, the unused energy is dissipated via heat, which can wear out, say, the bearing of the motor more quickly, while motors that are more efficient would increase the longevity of the device. Further, right sized and more efficient motors would require less cooling and thereby reduces the dependence on the cooling apparatus like fans and chilled fluids. Thus, it has more indirect benefits.

3.2 Monetary benefits

The monetary benefits of the unit are mainly due to reduction in the electricity consumption by 7579 kWh/yr. This amounts to monetary savings of Rs. 49,263 per year. A detailed estimate of the saving has been provided in the table 3.1 below;

Table 3.1 Energy and monetary benefit

S.No	Parameter	Unit	Value
1	Electricity consumption in unit for existing motor	kWh/year	120120
2	Cost of electricity consumption	₹ /year	6.50
3	Savings in electricity by using energy efficient motors	kWh/year	7579
4	Monetary savings due to electricity savings	₹ /year	49263
5	Total monetary benefit	₹ /year	49263

Further details of total monetary benefit are given in Annexure-3.

3.3 Social benefits

3.3.1 Improvement in working environment

Reduction in electricity consumption would probably not change the working environment apart from making the management happier.

3.3.2 Improvement in workers skill

The workers would probably not find too much of a difference in the day to day operation of the device. Hence, their skills are probably going to be unaffected.

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

The measure helps in reducing CO₂ emission since it demands less electricity off the grid. An estimate suggests that a saving of 7579 kWh/yr of electricity reduces 6.5 ton of CO₂ equivalent.

3.4.3 Reduction in other emissions like SO_x

Significant amount of SO_x will be reduced amounting to 19 kg/yr due to reduction in energy consumption, as 0.002541 kg of SO_x would be reduced for a reduction of 1 kWh of electricity.

4 INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of project

4.1.1 Equipment cost

Cost of an energy efficient motor of 45 kW rating is ₹ 87,000/- as per the quotation provided by the vendor given in Annexure 8.

4.1.2 Erection, commissioning and other misc. cost

The tax and installation costs could amount to a further ₹ 25,000/-. Detail of project cost is furnished in Table 4.1 below;

Table 4.1 Details of proposed technology project cost

S.No	Particular	Unit	Value
1	Cost of system	₹	87000
2	Taxes & Installation cost	₹	25000
3	Total cost	₹ (in lakh)	1.12

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

Total entrepreneur's contribution for replacing normal motors in the unit with energy efficient motors is about ₹ 0.28 lakh.

4.2.2 Loan amount.

There are loans available for buying such equipments from SIDBI and from the MSME of the Government of India, which have 25% subsidy in some schemes. However, the amount required to be invested is usually not that high to require loans. Total loan amount is Rs. 0.84 lakh.

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 (Interest rate chart of SIDBI is shown in annexure 9). The loan tenure is 5 years excluding initial moratorium period is 6 months from the date of first disbursement of loan.

4.3 Financial indicators

4.3.1 Cash flow analysis

Profitability and cash flow statements have been worked out for a period of 8 years. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below.

The project is expected to achieve monetary savings.

- The Operation and Maintenance cost is estimated at 4% of the cost of total project with 5% increase in every year as escalations.
- Interest on term loan is estimated at 11%.
- Depreciation is provided as per the rates provided in the companies act.

Considering the above mentioned assumptions, the net cash accruals starting with ₹ 0.32 in the first year operation and gradually increases to ₹ 1.45 at the end of eighth year.

4.3.2 Simple payback period

The total cost of implementing the proposed technology is ₹ 1.12 and monetary savings is ₹ 0.49. Hence, the simple payback period works out to be 2.29 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment works out to be ₹ 0.68 lakh.

4.3.4 Internal rate of return (IRR)

The IRR for the project is 26.88 %.

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 25.58 %.

Details of financial indicator are shown in Table 4.2 below:

Table 4.2 Financial indicators of proposed technology/equipment

S.No	Particulars	Unit	Value
1	Simple Pay Back period	Month	27
2	IRR	%age	26.88
3	NPV	Rs. in lakh	0.68
4	ROI	%age	25.58%
5	DSCR	Ratio	1.75

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 4.3 below:

Table 4.3 Sensitivity analysis at different scenarios

<i>Particulars</i>	<i>IRR(% age)</i>	<i>NPV(Rs. in lakh)</i>	<i>ROI (%age)</i>	<i>DSCR</i>
Normal	26.88	0.68	25.58	1.75
5% increase in fuel savings	29.06	0.77	25.58	1.84
5% decrease in fuel savings	24.67	0.58	25.27	1.66

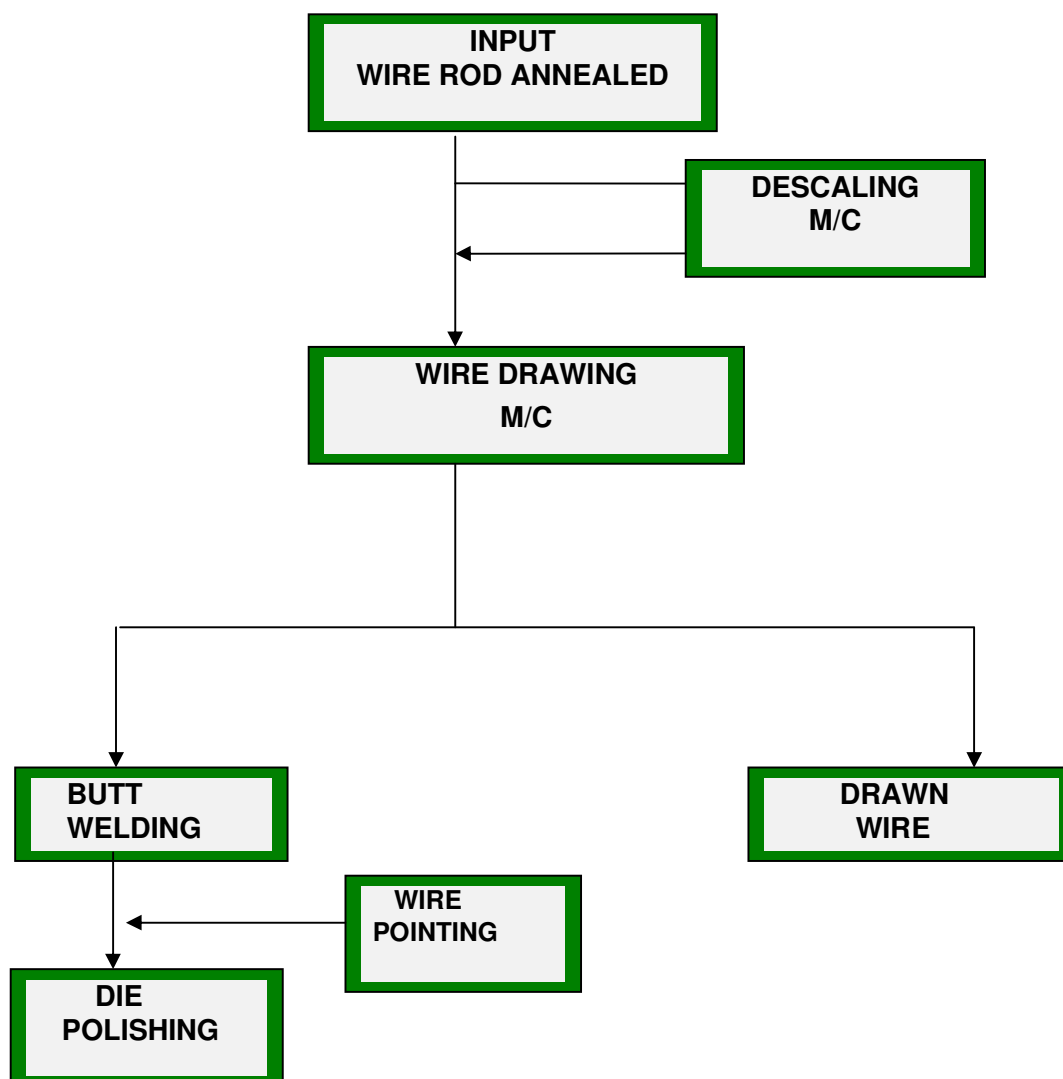
4.5 Procurement and implementation schedule

Time required for Procurement and implementation of proposed project are about four months shown in Annexure 6.

ANNEXURE**Annexure -1: Energy audit data used for baseline establishment**

S.No.	Particulars	Unit	Value
1	Motor name	Slip ring machine	
2	Rated capacity	Hp	150
3	Rated capacity	kW	112.5
4	Measured current	Amp	87
5	Measured voltage	Volt	388
6	Measured power factor	-	0.60
7	Measured power	kW	35
8	Percentage loading	%age	31
9	Operating hour	Hr	12
10	Operating days	Days	286
11	Estimated electricity consumption	kWh/year	120120

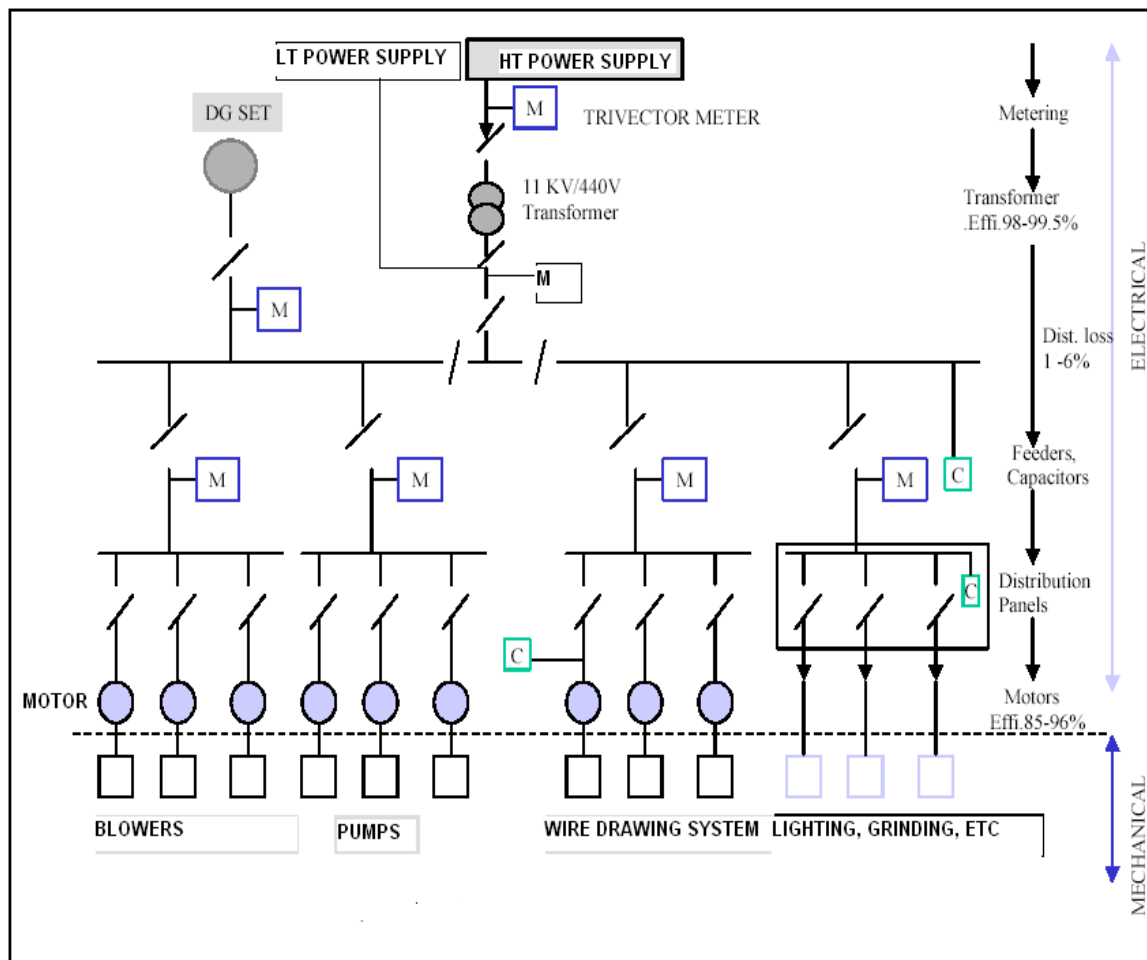
Annexure -2: Process flow diagram after project implementation



Annexure -3: Detailed technology assessment report

SI No	Particular	Unit	Motor Name
			Slip ring machine
1	Rated power	HP	150
2	Rated power	kW	112.5
3	Actual power	kW	35
4	Loading	%age	31
5	Present Efficiency	%age	84.28
6	Expected efficiency of EEM	%age	93.9
7	Hours per year	hr/yr	2860
8	Suggested power required	kW	32.35
9	Recommended size of EE Motor	kW	45
10	Reduction in power	kW	2.65
11	Cost of electricity	₹/kWh	6.5
12	Power savings	kWh/yr	7579
13	Savings	₹/Yr	49263
14	Investment	₹	112000
15	Estimated Life	Yrs	15
16	Payback Period	Yrs	2.29

Annexure -4 Drawings for proposed electrical & civil works



Annexure -5: Detailed financial analysis**Assumption**

Name of the Technology	Energy Efficient Motor (EFF 1)		
Rated Capacity	45 kW		
Details	Unit	Value	Basis
Installed Capacity	kW	45	Feasibility Study
Life	yr	15	Assumed
No of working days	Days	230	Feasibility Study
No of Shifts per day	Shifts	1	Feasibility Study
Proposed Investment			
Investment for 15 kW Energy Efficient Motors (EFF 1)	₹ in Lakh	0.87	
Other Cost	₹ in Lakh	0.25	
Total investment	₹ in Lakh	1.12	
Financing pattern			
Own Funds (Equity)	₹	0.28	
Loan Funds (Term Loan)	₹	0.84	
Loan Tenure	yr	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%/yr	10	SIDBI Lending rate
Estimation of Costs			
O & M Costs (% on Plant & Equip)	%	4	Feasibility Study
Annual Escalation	%	5	Feasibility Study
Estimation of Revenue			
Saving in Electricity	kWh/yr	7579	
Cost of Electricity	₹/ kWh	6.50	
St. line Depn.	% age	5.28	Indian Companies Act
Depreciation	% age	80	Income tax rule
Income Tax	% age	33.99	Income Tax rule

Estimation of Interest on Term Loan

Years	Opening Balance	Repayment	Closing Balance	Interest
1	0.84	0.03	0.81	0.10
2	0.81	0.09	0.73	0.08
3	0.73	0.14	0.59	0.07
4	0.59	0.18	0.41	0.05
5	0.41	0.24	0.17	0.03
6	0.17	0.16	0.01	0.01
		0.84		

WDV Depreciation

Particulars / years	1	2
Plant and Machinery		
Cost	1.12	0.22
Depreciation	0.90	0.18
WDV	0.22	0.04

Projected Profitability**. in Lakh**

Particulars / Years	1	2	3	4	5	6	7	8
Revenue through Savings								
Fuel savings	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Total Revenue (A)	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Expenses								
O & M Expenses	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06
Total Expenses (B)	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06
PBDIT (A)-(B)	0.45	0.45	0.44	0.44	0.44	0.44	0.43	0.43
Interest	0.10	0.08	0.07	0.05	0.03	0.01	-	-
PBDT	0.35	0.37	0.38	0.39	0.41	0.43	0.43	0.43
Depreciation	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
PBT	0.29	0.31	0.32	0.33	0.35	0.37	0.37	0.37
Income tax	-	0.06	0.13	0.13	0.14	0.15	0.15	0.15
Profit after tax (PAT)	0.29	0.24	0.19	0.20	0.21	0.22	0.23	0.22

Computation of Tax**₹ in Lakh**

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	0.29	0.31	0.32	0.33	0.35	0.37	0.37	0.37
Add: Book depreciation	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Less: WDV depreciation	0.90	0.18	-	-	-	-	-	-
Taxable profit	(0.55)	0.19	0.38	0.39	0.41	0.43	0.43	0.43
Income Tax	-	0.06	0.13	0.13	0.14	0.15	0.15	0.15

Projected Balance Sheet**₹ in Lakh**

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Reserves & Surplus (E)	0.29	0.54	0.72	0.92	1.13	1.36	1.58	1.81
Term Loans (F)	0.81	0.73	0.59	0.41	0.17	0.01	0.01	0.01
Total Liabilities D)+(E)+(F)	1.38	1.54	1.59	1.61	1.58	1.64	1.87	2.09
Assets								
Gross Fixed Assets	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
Less: Accm. Depreciation	0.06	0.12	0.18	0.24	0.30	0.35	0.41	0.47
Net Fixed Assets	1.06	1.00	0.94	0.88	0.82	0.77	0.71	0.65
Cash & Bank Balance	0.32	0.54	0.65	0.72	0.75	0.88	1.16	1.45
TOTAL ASSETS	1.38	1.54	1.59	1.61	1.58	1.64	1.87	2.09
Net Worth	0.57	0.82	1.00	1.20	1.41	1.64	1.86	2.09
Debt equity ratio	2.89	2.59	2.09	1.45	0.59	0.02	0.02	0.02

Projected Cash Flow:**₹ in Lakh**

Particulars / Years	0	1	2	3	4	5	6	7	8
Sources									
Share Capital	0.28	-	-	-	-	-	-	-	-
Term Loan	0.84								
Profit After tax		0.29	0.24	0.19	0.20	0.21	0.22	0.23	0.22
Depreciation		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Total Sources	1.12	0.35	0.30	0.25	0.26	0.27	0.28	0.29	0.28
Application									
Capital Expenditure	1.12								
Repayment of Loan	-	0.03	0.09	0.14	0.18	0.24	0.16	-	-
Total Application	1.12	0.03	0.09	0.14	0.18	0.24	0.16	-	-
Net Surplus	-	0.32	0.22	0.11	0.08	0.03	0.12	0.29	0.28
Add: Opening Balance	-	-	0.32	0.54	0.65	0.72	0.75	0.88	1.16
Closing Balance	-	0.32	0.54	0.65	0.72	0.75	0.88	1.16	1.45

Calculation of Internal Rate of Return**₹ in Lakh**

Particulars / Years	0	1	2	3	4	5	6	7	8
Profit after Tax		0.29	0.24	0.19	0.20	0.21	0.22	0.23	0.22
Depreciation		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Interest on Term Loan		0.10	0.08	0.07	0.05	0.03	0.01	-	-
Cash outflow	(1.12)	-	-	-	-	-	-	-	-
Net Cash flow	(1.12)	0.45	0.38	0.32	0.31	0.30	0.29	0.29	0.28
IRR (%/yr)	26.88%								
NPV	0.68								

Break Even Point**₹ in Lakh**

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.03	0.04	0.04	0.04	0.04	0.04	0.05	0.05
Sub Total (G)	0.03	0.04	0.04	0.04	0.04	0.04	0.05	0.05
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Interest on Term Loan	0.10	0.08	0.07	0.05	0.03	0.01	0.00	0.00
Depreciation (H)	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Sub Total (I)	0.17	0.15	0.14	0.12	0.10	0.08	0.07	0.07
Sales (J)	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Contribution (K)	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.45
Break Even Point (L= I/K)	36.60%	32.53%	30.39%	27.31%	22.73%	17.59%	16.56%	16.82%
Cash Break Even [(I)-(H))/K]	23.71%	19.60%	17.41%	14.28%	9.64%	4.44%	3.35%	3.54%
Break Even Sales (J)*(L)	0.18	0.16	0.15	0.13	0.11	0.09	0.08	0.08

Return on Investment**₹ in Lakh**

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	0.29	0.31	0.32	0.33	0.35	0.37	0.37	0.37	2.71
Net Worth	0.57	0.82	1.00	1.20	1.41	1.64	1.86	2.09	10.60
									25.58%

Debt Service Coverage Ratio**₹ in Lakh**

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	0.29	0.24	0.19	0.20	0.21	0.22	0.23	0.22	1.36
Depreciation	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.35
Interest on term loan	0.10	0.08	0.07	0.05	0.03	0.01	0.00	0.00	0.33
TOTAL (M)	0.45	0.38	0.32	0.31	0.30	0.29	0.29	0.28	2.04
Debt									
Interest on Term Loan	0.10	0.08	0.07	0.05	0.03	0.01	0.00	0.00	0.33
Repayment of Term Loan	0.03	0.09	0.14	0.18	0.24	0.16	0.00	0.00	0.84
TOTAL (N)	0.13	0.16	0.21	0.23	0.27	0.17	0.00	0.00	1.16
	3.51	2.34	1.52	1.33	1.11	1.75	0.00	0.00	1.75
Average DSCR (M/N)	1.75								

Annexure:-6 Procurement and implementation schedule

S. No.	Activities	Months			
		1	2	3	4
1	Delivery after placing order				
2	Erection & commissioning of EEM motors				
3	Cabling & elec-trical panel fitting				
4	Testing and trial				
5	On site operator training				

Break up of shutdown period of plant required for replacement of the motor.

S.No	Activity	Day
1	Installation of the device	7

Annexure -7: Details of technology service providers

S.No.	Name of Service Provider	Address	Contact Person and No.
1	Technosoft Consultancy Services	217, S. N Road, Dum dum, Kolkata- 55	Mr. Raju Saha 9230056795 contact.tcskolkata@gmail.com
2	Surendra & Company	11 Pullok Street, Kolkata -700 007	Mr. Surendra Mohta scoinfo@rediffmail.com Ph: (033) 22351769 Fax: 91-033-22355824
3	Siemens	Siemens Ltd 43, Shantipalli Rash Behari Connector E M By Pass, Kolkata -700042	Ms. Ipsita Ghosh Telephone- +91 33 2444 9228 Email : ipsita.ghosh@siemens.com
4	Bharat Bijlee	Electric Mansion 6th Floor Appasaheb Marathe Marg Prabhadevi Mumbai 400 025 T: +91 22 2430 6237 / 6071 Email: bblcorporate@bharatbijlee.com	Mr. R K Paul Senior General Manager – Marketing (Motor) M : +91 9810622768 Email : ravinder.paul@bharatbijlee.com

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

217, Shyamnagar Road, Dum Dum, Kolkata -700 055
 Phone : 033-645 29366 (Office)
 +91 9230056795 (Mobile)
 +91 9830056795 (Works)
 email : contact@tcskolkata.com / URL: www.tcskolkata.com

**Power-Process-Pollution Control Systems&Solutions****QUOTATION**

IISWBM	OUR REF.:TCS/IISWBM/ACM/10-11/01Q149 DATE : 18.01.11 YOUR REF.: <basudevroy@gmail.com> DATE : 14.01.11
Kind Attn. Mr. Basudev Roy Sub: Your requirement Energy efficient AC MOTOR. With reference to your enquiry we are pleased to quote hereunder our most competitive offer for your kind consideration & looking forward to your valuable order.	

S/N	PARTICULARS	QTY.	Price in Each(Rs.)
1.1	Kirloskar Electric make EFF 1 , 45kW, 4pole, 3PH, 415V AC, +/- 10%, 50HZ +/- 5% , TEFC Squirrel Cage Induction Motor, in Frame - SC225M, STANDARD -IS 325 , IP -55 , HORIZONTAL FOOT MOUNTING B3, INSL.CLAS-F with temp. rise limited to Class B , AMBNT.-50DEG.C.	01	87,000.00

2. Packing & forwarding : Extra to your account @ 2 % on basic order value **(Discounted.)**
 3. Taxes & duties : Extra at actual, ruling at the time of dispatch. However, the present rates are Central Excise Duty at 10.3 % and Central Sales Tax at 2% against Form -C or full tax or VAT 4%
 4. Freight & insurance charges : Extra at actual and to be borne by you (around @3% of SALE ORDER VALUE)
 5. Delivery : 12-14 weeks from the date of receipt of P.O with advance.
 6. Payment terms: 50% advance with P.O and balance along with Taxes & duties against Proforma Invoice prior to dispatch.
 7. Warranty: 12 months from the date of commissioning or 15 months from the date of dispatch, whichever is earlier, for any inherent manufacturing defect or faulty workmanship.
 8. Validity : 15 days from the above date, after which it is subject to our confirmation in writing.
 9. Errors : All clerical and typographical errors/omissions are subject to corrections
 NOTE : i) Delivery : If there be any delay for reasons beyond our control to be accepted.
 ii) Octroi / Town Duty / Entry Tax : If applicable will be charged extra at actual. Any service charges incurred on account of the same will also be to buyer's account.
 iii) Design, engineering, & supply for the quoted system as per the technical specification enclosed.
 iv) Complete supervision of commissioning of the quoted system. (Service Charge @ RS.3000.00/DAY)
 v) Installation of cables, civil work & electrical work is to customer's account.
 vi) utilities and installation requirements: to be arranged by the buyer
 vii) Material will be dispatched from KEC MYSORE on E1 transaction to Consignee Address.
 Assuring you of our best attention at all times & if you need any Technical / Commercial clarification please feel free to contact us.

OUR VAT NO. :19675353028 OUR CST NO. : 19675353222 OUR PAN NO. : AWLPS1095C	FOR Technosoft Consultancy & Services Authorized Signatory
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Associates of Industrial Electrical, Electronics & Automation group of
KIRLOSKAR ELECTRIC CO. LTD.

SURENDRA & CO.

ELECTRICAL & HARDWARE MERCHANTS

11, POLLOCK STREET, KOLKATA-700 001

Ph: (O) 2235-1769/0980/0026

Fax: (91) 033-2235-5824

e-mail: scoinfo@rediffmail.com

To,
M/S IISWBM
College Street west
Kolkata – 700 073

Dated: 21.01.2011

Dear Sir,

We quote our best rate for the following items :

DESCRIPTION	RATE
1. 45 KW X 1500 RPM TEFC MOTOR FRAME SIZE SE225M MAKE MARATHAN	@ Rs 122740/Each

ED G/P WILL BE PROVIDED

SALE TAX : 4% EXTRA

DELIVERY : 3-4 WEEKS

PAYMENT : AGAINST DELIVERY

F.O.R. : YOUR HOWRAH GODOWN

Thanking You,

For SURENDRA & CO.

(S.K. MOHTA)

IISWBM
Management House
College square west
Kolkata-700073

Name Ipsita Ghosh
Division Automation & Drives
Department KOL/I IA DT BT LV SALES
Telephone +91 33 2444 9228
Fax +91 33 24449013/17

E-mail ipsita.ghosh@siemens.com

Attn. Mr.D.Sarkar

Your letter dated Enquiry via email dt 14.01.11
Our reference KOL/I IADTBTLSALES/IISWBM
Date 27.01.2011

ANNEXURE III

Sub: Sub: Your Enquiry for L.T.Motor a/c IISWBM

Dear Sir,

With reference to your email enquiry dated 14.01.2011, we are pleased to submit our offer.

PRICED OFFER FOR MOTOR

Sl. No.	Rating (kW)	Pole	Frame	Motor Type	Unit Net Price EXW Thane (Rs.)	Qty	Total Net Price EXW Thane (Rs.)
1	15	4	160L	ISE0 166-4YL80	36,820	1	36,820
2	30	4	200L	ISE0 207-4YL80	68,080	1	68,080
3	45	4	225M	ISE0 223-4YL80	109,120	1	109,120
4	90	4	280M	ISE0 284-4YA80	209,950	1	209,950
TOTAL PRICE							4,23,970

Total Price: Rupees Four Lakhs twenty three thousand nine hundred and seventy only.

The prices quoted above are on Ex-works Kaiwa, Thane basis, duly packed, but exclusive of Excise Duty, CVD, E-Cess, S.H.E-Cess, ACVD, CST, Octroi, Entry Tax and all other taxes, duties & levies which may be imposed at the time of dispatch. Freight and Insurance shall have to be borne and arranged by you.

Extra charges:- Charges for testing shall be payable extra:

Routine Test Rs 7,000/- per motor.
Type Test Rs 15,000/- per motor.

We trust our offer meets with your requirement and look forward for your valued order at an early date.

Siemens Ltd.

V.V.Paranjape
Director

Office Address
Siemens Ltd.
43, Shantipalli,
Rash Behari Connector,
E.M. By Pass, Kolkata 700 042

Telephone +91 (033)
2444 9000
Fax +91 (033)
2444 9010

Registered Office: 130, Pandurang Budhkar Marg, Worli, Mumbai 400 018. Telephone +91 22 2498 7000. Fax +91 22 2498 7500.
Sales Offices: Ahmedabad, Bangalore, Chennai, Coimbatore, Hyderabad, Kolkata, Mumbai, New Delhi, Pune

(Form Ca/A&D11/01 C:\Documents and Settings\in215604\My Documents\ENQ OFFER 10-11\IISWBM\IISWBM\IISWBM_PRICE.doc)

Page 1 of 2

SIEMENS

Letter dated 27.01.2011
to IISWBM
Our reference KOL/IADTBTLSALES/IISWBM

Annexure II

COMMERCIAL TERMS AND CONDITIONS

Scope of Supply	<p>Supply shall be as per technical specifications given in the enclosed DATA Sheet Offer has been submitted from output point of view and based on KW rating. We do not have the driven equipment details for the existing motor. Hence, suitability for replacement can not be checked at our end. The same needs to be checked by the purchaser.</p> <p>Scope of supply shall be governed by supplier's offer and supplier's acceptance of purchaser's order.</p>
Validity	<p>Till 28th February 2011, after which the validity is subject to our written confirmation.</p>
Drawing/Data Sheet submission. /QAP Delivery	<p>We enclose Dimensional Drawing and Data Sheet for approval.</p> <p>Ex-works Kalwa, Thane, Maharastra, basis – 12-16 weeks from the date of receipt of approved data sheets / approved drawings / manufacturing clearance, whichever is later.</p> <p>In case delivery/dispatch of material by supplier is delayed for reason of purchaser not having given to supplier, instructions for delivery/dispatch of material, the date of supplier's notice to purchaser, of readiness of material for dispatch/delivery, shall be deemed to be the date of delivery. In such an event, agreed payment due on delivery shall be made forthwith by purchaser on supplier's request.</p> <p>The delivery period may stand revised in case of changes in order specifications.</p> <p>In case of delays in furnishing the inputs along with your LOI/Purchase Order or change in specs / drawings by you beyond the stipulated / agreed time schedule, the prices as well as delivery periods shall be subject to changes and shall be mutually discussed and agreed between us.</p> <p>Approval received on submission of drawings will be considered as your final approval of drawings for the equipment which will then be manufactured strictly according to the approved drawings. However, please note that corrected drawings as above will be resubmitted to you for your reference and records only. No further changes shall be accepted by us without repercussions on the stated delivery and prices.</p> <p>The timeframe for delivery of the equipment indicated above has been made in good faith, subject to Force Majeure conditions as mentioned in the Force Majeure clause below.</p> <p>The dispatch of our equipment shall be made by Road Transport only, for which we would engage our approved transport contractors. The material shall be dispatched on 'Freight to Pay' basis. Unloading of the equipment at the destination shall be the purchaser's responsibility.</p>
Price Basis	<p>The prices quoted in the Priced-Bid are Ex-works, Kalwa, Thane, Maharastra basis and as per the scope of supply mentioned in technical offer.</p>



SIEMENS

Letter dated 27.01.2011
to IISWBM
Our reference KOL/IADTBTLSALES/IISWBM

Packing charges are inclusive. Supplier shall pack equipment in suitable rail/road worthy packing as per supplier's standard practice.

Transit insurance to be arranged by the M/s IISWBM.

Any civil works, loading, unloading, lifting, shifting, unpacking at site, laying of cables, erection, etc. are excluded from our scope of work, unless specifically agreed upon.

Taxes and Duties :

The prices quoted in the Priced-Bid are Ex-works Kalwa, Thane, Maharashtra basis and inclusive of packing, forwarding charges and Freight. However Excise Duty, CVD, Educational and SHE Cess thereon, ACVD, Octroi, Entry Tax, CST / GST or any other tax/levy that may be imposed in future, shall be charged extra, at actual.

We shall dispatch the materials from our works to your plant for which necessary road permits have to be provided by you.

In the event of MODVAT benefits being availed by you/consignee, please specify the same in your order along with full particulars as required for proper issue of the Gate Pass in the name of the consignee. Please furnish details such as ECC code no., Excise Range, Division, Collectorate, Central Excise Regn. No., Local Sales Tax No., Central Sales Tax No., PAN no., in your Purchase Order itself to avoid any inconvenience.

Concessional rates of tax will be applicable according to the relevant tax laws in case you are furnishing sales tax forms. However, please check with us the sales tax forms that can be accepted by us in relation to the transaction prior to the placement of your order. Particulars of Sales tax declaration form, under which purchaser is entitled to partial / full exemption from Sales Tax, shall be given by purchaser in his purchase order so that correct sales tax can be charged in supplier's bill. This form shall be sent along with the order.

In the event of sale of goods not manufactured by us, price enhancement (PE) by the like percentage of Local/Central Sales Tax as applicable at the time of delivery will be charged.

Insurance

All types of Insurance will be arranged and costs of which will be borne directly by M/s IISWBM.
We would intimate the dispatch particulars within 72 hours from the date of dispatch by fax/email

Payment

20% of total ex-works price payable as interest-free advance and on submission of proforma invoice and advance bank guarantee of equivalent amount.

Balance 80% plus all taxes and duties payable against confirmed, irrevocable, divisible Letter of Credit from any Scheduled Bank in India, payable at sight without recourse to Siemens Ltd. The Letter of Credit is to be established within 4 months from the date of receipt of order.

For delay in payment beyond due date, we shall be charging interest @ 18 %, from the due date till the date of payment.

Bank Guarantees

If specifically agreed to by us, we shall furnish Bank Guarantees / bonds in the formats given by you provided the formats do not have any clauses that render the Bank

SIEMENS

Letter dated 27.01.2011
to IISWBM
Our reference KOL/I ADTBTLSALES/IISWBM

Guarantee / Bond open ended with respect to the amount or tenure. The formats should limit the maximum liability and the tenure to the amount and validity of the Bank Guarantee / Bond in each individual clause. Date of receipt of Notices / Demands / Lodgments of claims at our banker's / our premises within banking / working hours only will be treated as receipt of claims. All our Bank Guarantees / Bonds shall have reduction and return clauses. Any clauses inconsistent to the above conditions / detrimental to our interest and beyond our agreed terms and conditions shall be changed by us and same shall be accepted by you.

Performance Figures	The performance figures are subject to Tolerance as per the applicable Standards.
Inspection & Test.	<p>Routine Test Inspection as per approved QAP can be arranged at our works for both indigenously manufactured and imported motors.</p> <p>We shall given inspection call at least 15 days before the date of inspection, by a written notice confirming readiness of material for inspection.</p> <p>The cost of visit of your personnel for inspection shall be borne by you. In case you fail to attend the inspection within the time as above, the inspection shall deemed to have been carried out and we shall dispatch the equipment and shall be paid for the equipment as per the terms agreed.</p> <p>If during the changes, purchaser wish any changes, modifications other than which is agreed upon during order finalization shall be carried out depending upon the feasibility, which shall be analyzed by the supplier. Any cost additions due to such requirements shall be charged to the purchaser. Any change in the purchaser specifications shall have techno commercial changes in the offer as applicable.</p>
Guarantee	18 months from the date of dispatch or 12 months from the date of commissioning which ever is earlier, for delivery in India only. The equipments offered are covered by guarantee under proper use, for faulty material or workmanship. Purchaser shall inform supplier in writing, of any defect in equipment noticed during guarantee period. On receipt of purchaser's written notice, supplier shall at his option, replace or repair free - of - cost, equipment supplied by him. Purchaser shall not return the equipment to supplier before receiving supplier's confirmation to this effect. The equipment in such cases shall be returned to our works on freight to pay basis. The guarantee under this clause is subject to conditions that purchaser shall not have subjected the equipment to alteration, addition or repair by any one except supplier or his authorized representative.
Test Certificate and instruction manual.	We shall provide along with inspection call letter, routine test certificate for the motor. If required, type test certificate of motors of similar frame sizes shall give be provided. 1 copy of instruction manual shall be dispatched along with the motor. Charge for routine test for 1 motor is Rs: 5,000/- In case, type test is to be witnessed it shall be as per approved QAP and charge of Rs.10,000/- per motor would have to borne by the purchaser.
Supervision commissioning. Arbitration	<p>of M/s IISWBM would have to pay Rs 5,000/- extra per man day.</p> <p>All disputes / differences whatsoever, which shall arise between the parties hereto during the continuance of this agreement / contract or afterwards, touching this agreement / contract or the construction or application thereof or any clauses contained on the rights, duties, liabilities of either parties in connection therewith shall be referred to a sole arbitrator to be appointed with the consent of both the parties.</p>

SIEMENS

Letter dated 27.01.2011
to IISWBM
Our reference KOL/I IADTBLVSALES/IISWBM

The place of arbitration shall be at Mumbai and the arbitrator appointed shall have held the office of a judge of any Indian High Court or Supreme Court of India. In the event of the parties not being able to agree to a sole arbitrator within a period of 15 days from being called upon to agree such appointment, then in that event Siemens Ltd shall have the right to nominate such sole arbitrator with a similar qualification and his decision will be binding on the parties. Such arbitration proceedings will be held in consonance with the provisions of arbitration and conciliation act of 1996 or any statutory modification or reenactment thereof for the time being in force.

The language to be used in the arbitration proceedings shall be English. Only the competent Courts at Mumbai will have jurisdiction in respect of this Agreement.

Force Majeure

In the event of stoppage of work in any establishment of ours / our suppliers during the delivery period owing inter alia to war hostilities, acts of the public enemy, foreign enemies, rebellion, revolution, insurrection, riots and civil commotions, acts of state, go slow not foreseen, acts of terrorism, sabotage, fires, floods, power cuts, earthquake, tempests, explosions, epidemics or any acts of God, quarantine restrictions, strikes, lockouts, trade disputes, concerted action of workman, breakdowns, accidents, etc., as well as transport embargoes, failures or delays in transportation, Governmental decree and / or causes beyond our control, deliveries may be postponed or partially or wholly cancelled by us. Any additional cost on such account shall be borne by the purchaser.

No Other Warranty / Guarantee

We, Siemens Ltd., to the maximum extent permitted by applicable law disclaim all warranties / guaranties either expressed or implied (including, but not limited to implied warranty, merchantability and fitness for a particular purpose), other than what is expressly stated in this Offer.

No liability for damages:

We, Siemens Ltd. shall, to the maximum extent permitted by applicable law, in no event be liable for any damages whatsoever (including without limitation, special, incidental, consequential, direct or indirect damages, for personal injury, loss of business profits, business interruptions, loss of business information or any other pecuniary loss) arising out of the use of or inability to use the products / equipment / systems. In case, the products / systems supplied by us, we, Siemens Ltd. shall endeavor to initiate effective steps for rectification, immediately on being informed in writing about any such problem.

Reservation Clause :

"Siemens' obligation to fulfil this agreement is subject to the proviso that the fulfilment is not prevented by any impediments arising out of national and international foreign trade and customs requirements or any embargoes [or other sanctions]."

Destination Control/ Export Clause:

The offered equipment because of design and or end-use may require export documentation that is not included in our proposal (please refer to additional information shown on the delivery note and invoice). Goods labelled with "AL not equal to N" are subject to European or German export authorisation when being exported out of the EU. Goods labelled with "ECCN not equal to N" are subject to US re-export authorisation. Even without a label, or with label "AL: N" or "ECCN: N", authorisation may be required due to final end-use and destination for which the goods are to be used.

Legal Construction

The contract shall in all respects be construed after supplier's confirmation of purchaser's order and operated as Indian contract and in conformity with Indian law and shall be subject to Jurisdiction of Courts in India.

Annexure -9: SIDBI financing scheme for energy saving projects in MSME sector

S. No.	Parameter	Norms
1	Minimum Assistance	Rs.10 lakh
2	Minimum promoters contribution	25% for existing units 33% for new units
3	Debt Equity Ratio	Maximum 2.5 :1
4	Interest Rate	The project expenditure eligible for coverage under the Line will carry rate of interest of 11% p.a. payable monthly
5	Upfront fee	Non refundable upfront fee of 1% of sanctioned loan plus applicable service tax.
6	Security	First charge over assets acquired under the scheme; first/second charge over existing assets and collateral security as may be deemed necessary.
7	Asset coverage	Minimum Asset Coverage should be 1.4:1 for new units and 1.3:1 for existing units.
8	Repayment period	Need based. Normally, the repayment period does not extend beyond 7 years. However, longer repayment period of more than 7 years can be considered under the Line if considered necessary.

Source: <http://www.sidbi.in/energysaving.asp>

Annexure -10: Efficiency of electric motors

Motor Capacity	Standard motor (IS 8789)				Energy efficient motor (IS 12615)	
	Motor load *				EFF1	EFF2
kW	100%	75%	50%	25%	Motor load 100% to 60%	
0.37	64	64	64		73	
0.55	69	69	69		78	
1.1	73	73	73		83.8	76.2
1.5	76	76	76		85	78.2
2.2	79	79	79		86.4	81
3.7	83	83	83		88.3	84
5.5	84	84	84		89.2	85.7
7.5	85	85	85		90.1	87
11	84.5	84.5	84.5		91	88.4
15	85	85	85	74.28	91.8	89.4
18.5	86	86	86			
22	86.5	86.5	86.5		92.6	90.5
30	87.5	87.5	87.5	77.14	93.2	91.4
37	87.5	87.5	87.5	78.95	93.6	92
45	89	89	89		93.9	
55	89.5	89.5	89.5			
75	90	90	90			
90	91	91	91		95	
112.5	92.5	92.5	92.5	84.28		

The Impact of Rewinding on Motor Efficiency**

kW	HP	Impact on efficiency (%)
7.46	10	-6.0
14.92	20	-5.2
29.84	40	-4.4
37.3	50	-3.7
74.6	100	-2.1
89.52	120	-2.0
111.9	150	-1.8

** Source: The Impact of Rewinding on motor efficiency, by Jim Custodio, Page 38 as accessed in www.pump-zone.com.



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



**Indian Institute of Social
Welfare and Business
Management**

MANAGEMENT HOUSE

College Square West,
Kolkata – 700 073

Website: www.iiswbm.edu



India SME Technology Services Ltd

DFC Building, Plot No.37-38,

D-Block, Pankha Road,

Institutional Area, Janakpuri, New Delhi-110058

Tel: +91-11-28525534, Fax: +91-11-28525535

Website: www.techsmall.com