DETAILED PROJECT REPORT
ON
REPLACING 160 kW DC MOTOR BY 90 kW ENERGY EFFICIENT (EFF1) AC MOTOR WITH VFD
HOWRAH CLUSTER











Bureau of Energy Efficiency

Prepared By

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REPLACING 160 kW DC MOTOR BY 90 kW ENERGY EFFICIENT (EFF1) AC MOTOR WITH VFD

HOWRAH GALVANIZING AND WIRE DRAWING CLUSTER

BEE, 2010

Detailed Project Report on DC (160 kW) to AC Motor with VFD (90 kW)

Galvanizing and Wire Drawing SME Cluster,

Howrah, West Bengal (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: ***HWR/WDG/DCC/12***

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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
GT	Gas Turbine
GWh	Giga Watt Hours
IRR	Internal Rate of Return
MSME	Micro Small and Medium Enterprises
MT	Million Ton
MW	Mega Watt
NPV	Net Present Value
ROI	Return on Investment
SCM	Standard Cubic Meter
SHC Coal	Semi Hard Coke Coal
MoMSME	Ministry of Micro Small and Medium Enterprises
SIDBI	Small Industrial Development Bank of India

EXECUTIVE SUMMARY

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 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 even maximum operating efficiency much lower than the modern ones. This DPR highlights the energy, environmental, economic, and social benefits of replacing conventional DC motors by Energy Efficient (EFF1) AC motors with VFD which have higher maximum efficiency and help in saving a lot of money for the units. In a typical unit, savings generated due to the replacement of 160 kW DC motor by energy efficient (EFF1) motor of 90 kW with VFD is 25622 kWh/ year, which amounts to ₹ 209332 annually.

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)	5.34
2	Electricity saving	kWh/year	25622
3	Monetary benefit	₹(in lakh)	2.09
4	Simple payback period	year	2.56
5	NPV	₹ (in lakh)	2.22
6	IRR	%age	21.85
7	ROI	%age	24.91
8	DSCR	Ratio	1.59

S.No	Particular	Unit	Value
9	Process down time	Days	7

The details calculations of the above-mentioned financial parameters are available in Annexure-5.

The projected profitability and cash flow statements indicate that the project implementation i.e. replacing DC motor by AC motor with VFD 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:

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.

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.

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

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

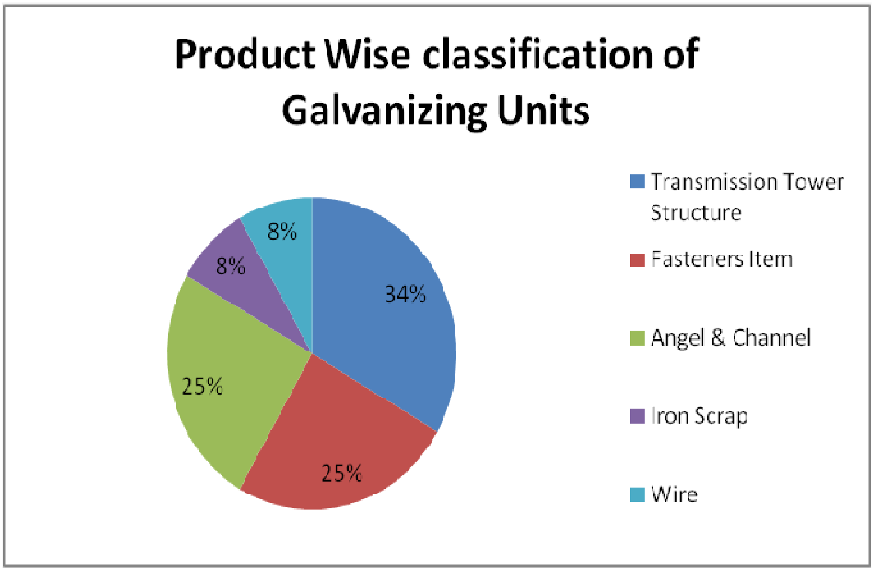


Figure 1.1: Product Wise Classification of Galvanizing Units

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

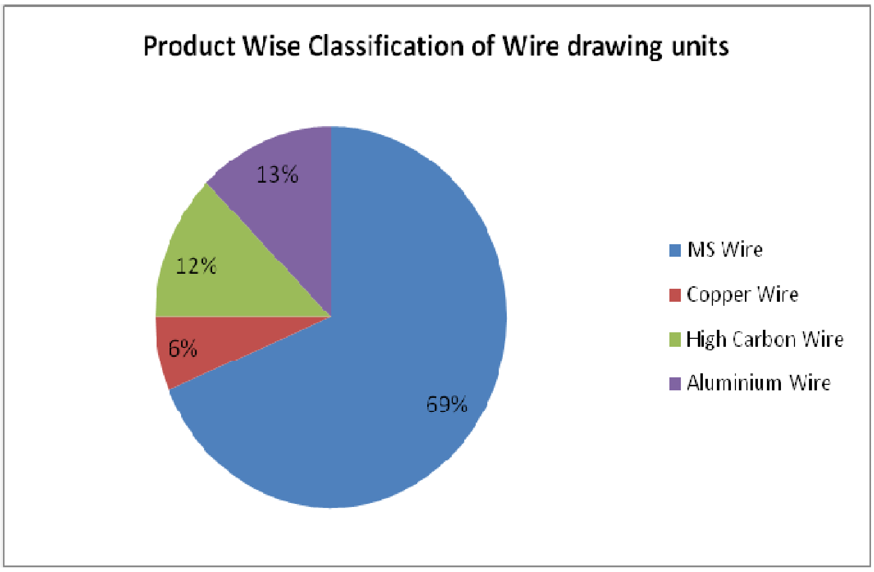


Figure 1.2: Product Wise Classification of Wire-drawing Units

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, viz. 1-500 TPA (micro scale), 500-1000 TPA (small scale) and above 1000 TPA (medium scale) capacities. It may be noted that this classification is purely based on the range of capacity that has been observed in the galvanizing and wire drawing sector in Howrah cluster and has no reference to the existing classification of micro, small and medium industries reported else where.

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

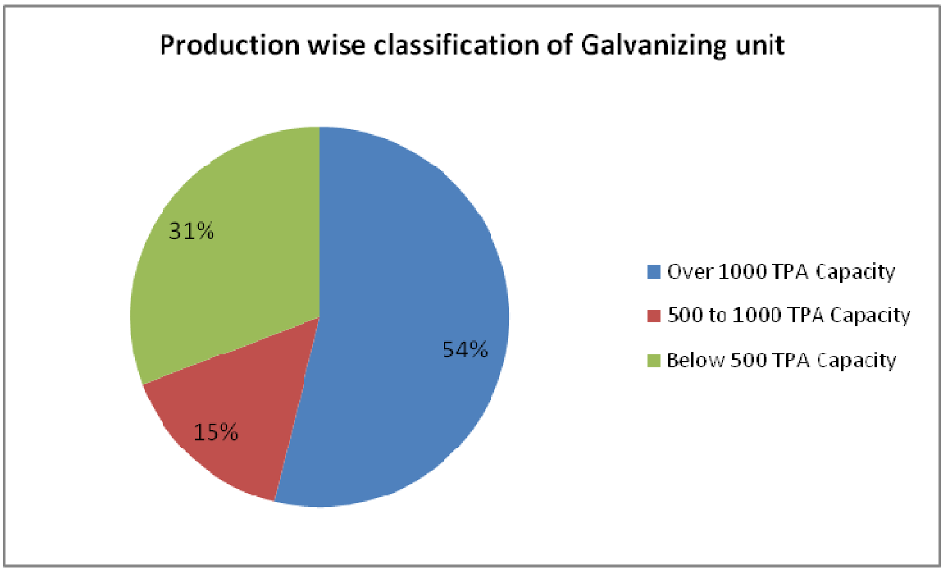


Figure 1.3: Production Wise Classification of Galvanizing Units

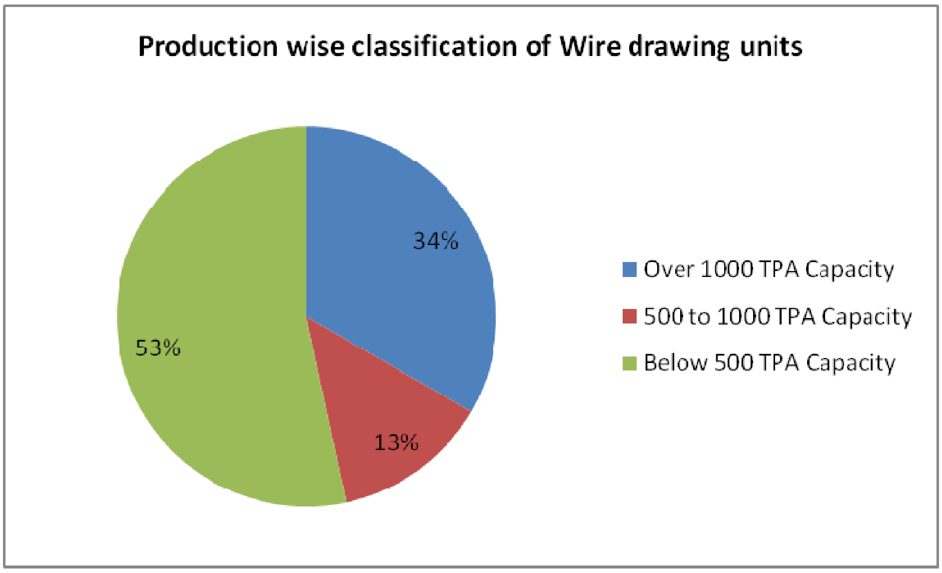


Figure 1.4: Production Wise Classification of Wire-drawing Units

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 kl/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.

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.

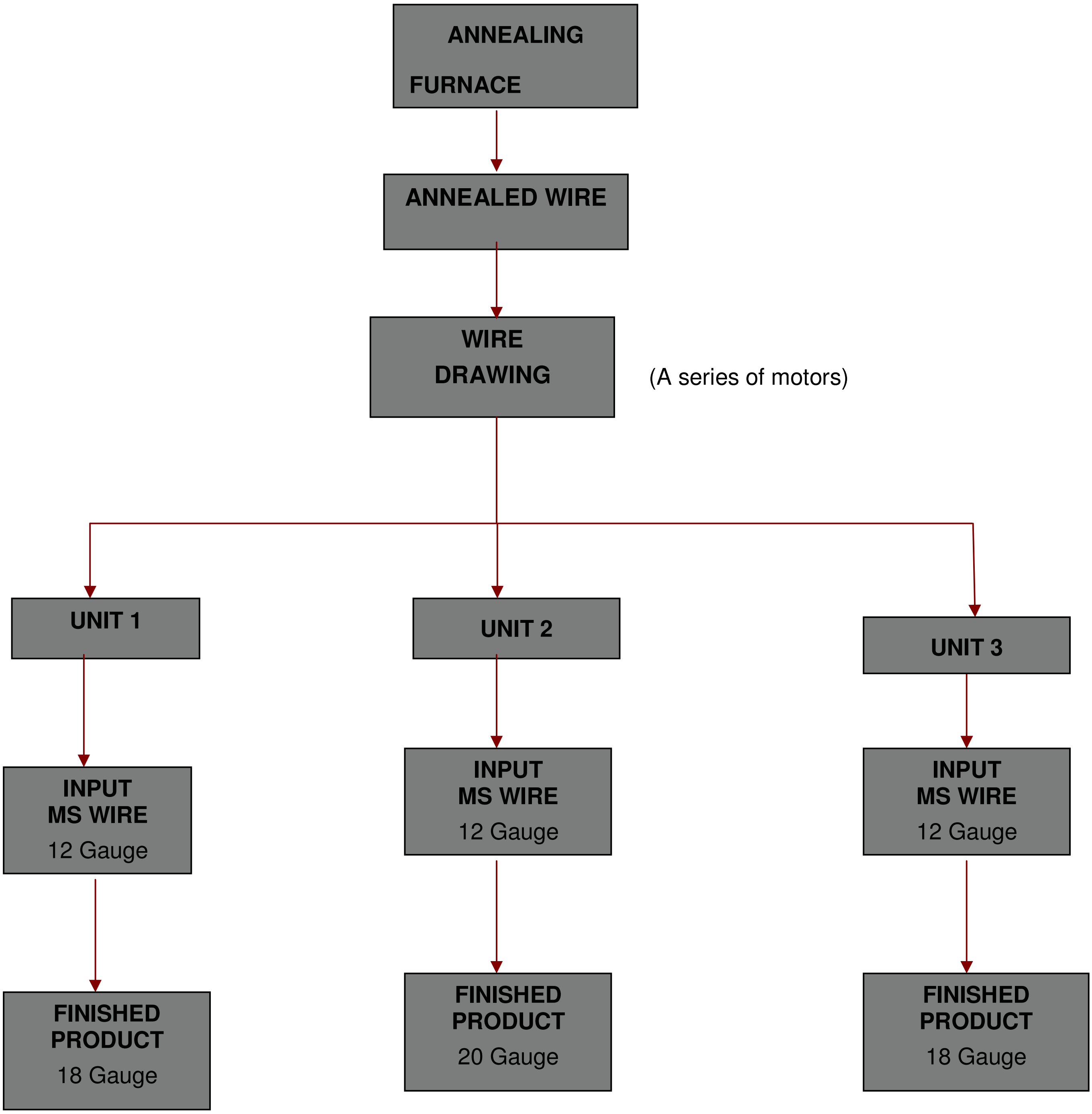
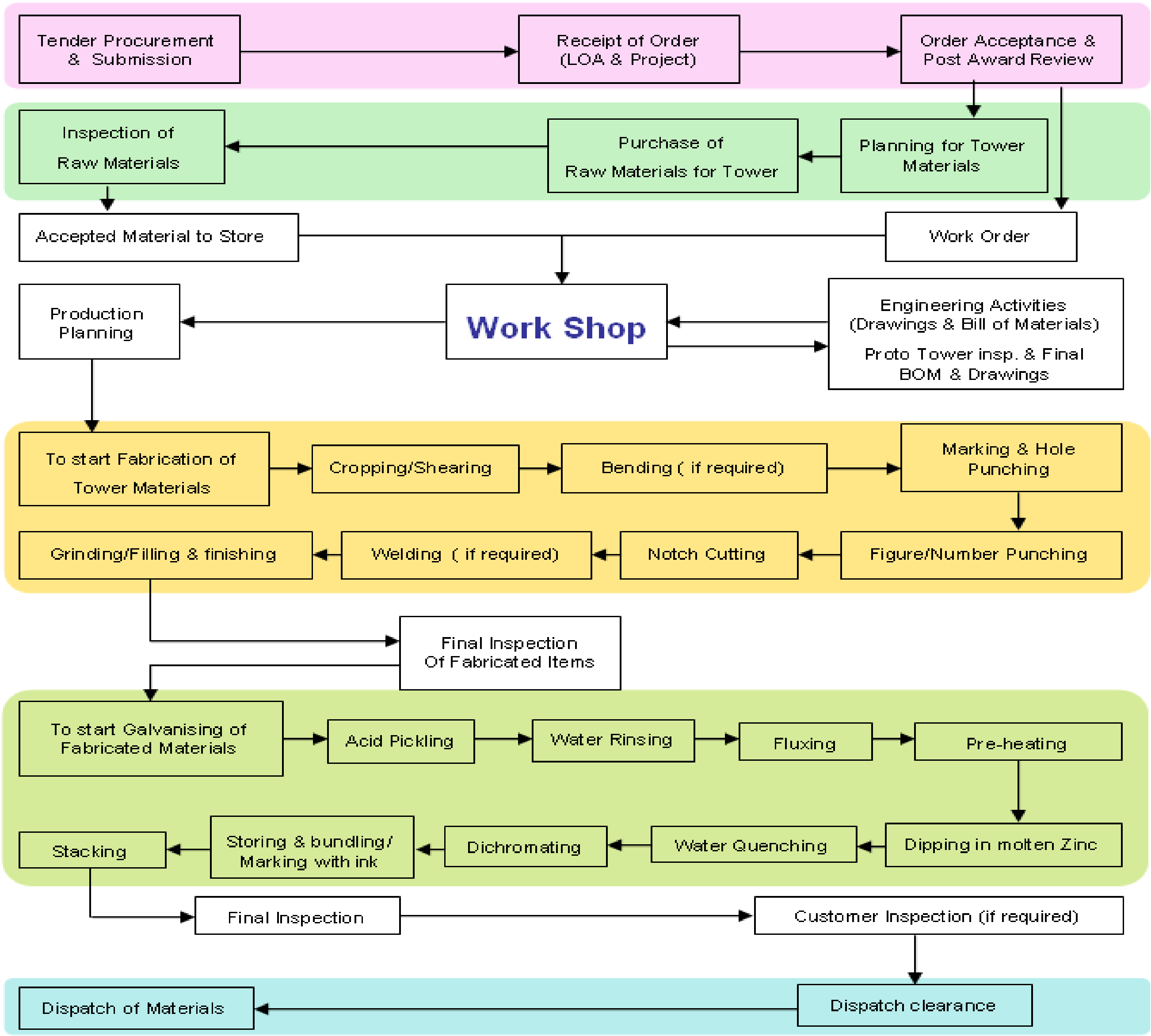


Figure 1.5 Process flow diagram for a typical wire drawing unit

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

Energy	*Micro*	*Small*	*Medium*		
Scale of Unit	*Electricity (kWh/ yr)*	*Electricity (kWh/ yr)*	*Electricity (kWh/ yr)*	*LPG (Ton/yr)*	*Wood (Ton/yr)*
MS wire	101486	209216	266889	NA	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

Energy	*Small*			*Medium*				
Scale of Unit	*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

Energy	Small			Medium				
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	890	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

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

Specific energy consumptions are found to vary widely for wire-drawing and galvanizing processes in the Howrah cluster as shown in the above table. This is because of the variation in size of units, size & type of job, fuels types and volume of process, as, for example, some of the Galvanizing units, manufacturing the microwave tower and high-tension electricity transmission towers, have extensive fabrication activity as a part of the process.

1.3 Existing technology/equipment

1.3.1 Description of existing technology

Extrusion process in wire-drawing units traditionally involve large DC motors (capacity range : 100 – 300 kW) as considerable variation of speed is necessary. Ingots of copper are generally used as raw material to pass through the specific die as per required size and shape of product depending upon customers' specification. The machine has rectifier, control system, gearing arrangement, different dies, cooling arrangement besides the DC motor. The DC motors have several disadvantages, as following:

1. Fast wearing out of the carbon rods used as contactors

2. Non-availability of energy efficient DC motors which are available in its AC counterpart (EFF1 category)

3. Low overall efficiency of the system with rectifier and control in DC drives with compared to VFD supported EFF1 AC motors.

As a result, the actual efficiency of DC motors are much lower by at least 2% than the full /part load rated value of its own. Moreover, all such systems found in the cluster are made in China and availability of the technical specifications is very limited. Because of the above, local maintenance and repair was difficult. In addition, the loading of the motor is very low about 27%. Apart from loading, power factor is also very low (0.3) at the input point of the DC drive where AC is supplied and get converted to DC for supplying power to the DC motor. Also, the average total harmonic distortion (THD) for voltage & current was found to be 13.3% & 31% respectively which is beyond the permissible limit which is 5% & 8% respectively for voltage & current as per the CEA regulations published in Gazette of India dated 21st February, 2007.

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	China Make
2	Capacity	160 kW
3	Rated Efficiency	89.9%
4	Rated Current	399 Amps
5	Motor type	DC motor
7	Ambient temperature max	40 Deg C
9	Speed	1500 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:

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

Recently introduced tariff includes a Fixed Charge of ₹ 15/kVA for LT supply up to 30 kVA contract demand. Demand charge is ₹ 220/kVA both for LT above 30 kVA contract demand and HT supply. Thus the energy charge for a typical unit with contract demand of 240 kVA and average monthly energy consumption of 24609 kWh is ₹ 6.11 / 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

Recently introduced tariff includes a Fixed Charge of ₹15/kVA for LT supply up to 30 kVA contract demand. Demand charge is ₹ 220/kVA both for LT above 30 kVA contract demand and HT supply. Thus the energy charge for a typical unit with contract demand of 71.8 kVA and average monthly energy consumption of 8972 kWh is ₹ 7.04 / kWh.

1.4 Baseline establishment for existing technology

1.4.1 Design and operating parameters

DC motors are used in some wire drawing units.Their ratings vary from 100 kW to 300 kW. The subject of the present DPR is however for 90 kW energy efficient (EFF1) AC to DC motor with VFD replacing a 160 kW standard DC motor. It has been found that the average loading of DC motors in use is 27% which is very low leading to lower operating efficiency. Apart from loading, power factor is also very low (0.3) measured at the input point of the DC drive where AC is supplied and get converted to DC for supplying power to the DC motor. Also, the average total harmonic distortion (THD) for voltage & current was found to be 13.3% & 31% in case of DC drives in use. So, to mitigate these problems, it has been recommended to downsize the motor with energy efficient (EFF1) AC motor of 160 kW with VFD. The specifications are given below.

Table 1.10 Present motor specifications

S. No.	Parameter	Detail
1	Manufacturer	L&T
2	Operation	Continuous
3	Capacity	90 kW
4	Efficiency	95%
5	Motor type	Induction motor
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	1500 rpm

Maximum efficiency of the 160 kW standard DC motor is 89.9%. The reduction is due to losses in rectifier, control system, and issues related to maintenance. Lower overall efficiency leads to higher electricity consumption.

Electricity requirement in the wire-drawing plant depends on the production. The specific energy consumption for the extrusion machine has been found to be 95 kWh/Ton.

Table 1.11 Electricity consumption at a typical wire drawing unit

S. No.	Energy Type	Unit	Value
1	Electricity	kWh/year	295310

1.4.2 Operating efficiency analysis

The Annexure-1 shows a typical set of ordinary DC 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. However, traditional thinking and applying what others in the business are doing is a trend found to be prevalent over innovative thoughts. The use of DC motors still exists in cluster, though modern trend is to use AC motors with VFD for speed control. Some of the chief executives of the wire-drawing units are visiting foreign countries such as China and countries in European Union to find the best possible technological solutions to the challenges in their units. One wire-drawing unit, for example, being suggested by their Chinese consultant, imported DC motors from China for extrusion purpose. 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 from DC motor to EFF1 AC motor with VFD would be the clue to widespread application of economically viable energy efficiency practices (in this case employing EFF1 AC motors in place of DC motors) in 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 since changing of 280 kW and 160 kW DC motors by suitable AC drives is not very popular, rather involves significant investment, the proposal was not much welcome.

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 or financing institutes 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. Even in case of financing, the trend is to go for only prevalent practice in the sector, for example, to use DC drives in extrusion machines without any second thought about its energy efficiency with compared to other alternatives, say, AC drives with VFD.

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. In wire-drawing units, say, for extrusion purpose, as Chinese machines are used, local service providers are not able to rectify any fault, even if that hinders the production. In absence of any training of factory personnel by the foreign supplier and also as all information whatever given being in Chinese, it is almost impossible to even try to rectify the fault. 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 EFFICENCY 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 60% 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.

It is therefore proposed to use AC motors with VFD control to combine the benefit of the energy efficient motors (EFF1 category, VFD duty) with the modern efficient control system using VFD.

2.1.2 Equipment/ technology specification

The energy efficient motors that need to be used depend upon necessity. Some are of 0.37 kW rating and some as high as 160 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	L&T
2	Operation	Continuous
3	Capacity	90 kW

S. No.	Parameter	Detail
4	Efficiency	95%
5	Motor type	Induction motor
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

Further details of EEM's are shown in Annexure-3.

2.1.3 Integration with existing equipment

The motors used in the units are at present are DC motors with efficiency of about 91.9%. The existing machine has rectifier, control system, gearing arrangement, different dies, cooling arrangement besides the DC motor. The DC motors have several disadvantages such as fast wearing out of the carbon rods used as contactors, non-availability of energy efficient motors, which are available in its AC counterpart, low overall efficiency of the system with rectifier and control. As a result, the actual efficiency of DC motors are much lower by at least 2% than the full/part load rated value. Moreover, the maintenance was done by local service provider who only repairs the machine irrespective of the quality & quantity of materials, which hampers the motors efficiency to a considerable amount. Hence, those factors have to be minimized to reduce the energy bill in any case. Therefore, buying and installing energy efficient motors would certainly help by making a maximum efficiency of 95% available.

The following are the reasons for selection of this technology

- Maximum efficiency goes up to 95%
- 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. Further, as the cost of electricity is on an upward trend, this is certainly profitable in the long run.

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 1000 Ton/yr and having total electrical consumption of about 295310 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 25622 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 25622 kWh/yr. This amounts to monetary savings of ₹ 209332 per year. A detailed estimate of the saving has been provided in the table 3.1.

Table 3.1 Energy and monetary benefit

S.No	Parameter	Unit	Value
1	Cost of electricity consumption	₹/kWh	8.17
2	Savings in electricity by using energy efficient motors AC motor	kWh/year	25622
3	Monetary savings due to electricity savings	₹ /year	209332

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 CO_2 emission since it demands less electricity off the grid. An estimate suggests that a saving of 25622 kWh/yr of electricity reduces 27 tonne of CO_2 equivalent as 1 kWh of electricity generates 1.05 kg of CO_2.

4 INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of project

4.1.1 a) Equipment cost

Cost of an energy efficient DC to AC motor of 90 kW rating with VFD is ₹ 5.66 lakh.

b) Resale value of the old DC motor

Resale value of the old DC motor of 160 kW is estimated to be ₹ 1.70 lakh as shown in Annexure 9.

4.1.2 Erection, commissioning and other misc. cost

The tax and installation costs could amount to a further ₹ 1.38 lakh.

Table 4.1 Details of proposed technology project cost

S.No	Particular	Unit	Value
1	Cost of system	₹(in lakh)	5.66
2	(+) Taxes & Installation cost	₹(in lakh)	1.38
3	(-) Resale value of old DC motor	₹(in lakh)	1.70
4	Total cost	₹(in lakh)	5.34

It may be noted that in case of new installation, the net investment would be actual price of proposed AC system less (–) the conventional DC system, which would be purchased in business as usual case. Thus the total cost would further be reduced.

4.2 Arrangements of funds

4.2.1 Entrepreneur’s contribution

The entrepreneur’s contribution for replacing DC motors in the unit with energy efficient AC motors is 25% of the project cost i.e., 25% of ₹ 5.34 lakh, which amounts to ₹ 1.33 lakh.

4.2.2 Loan amount

The loan amount will be 75% of the project cost i.e., 75% of ₹ 5.34 lakh, which amounts to ₹ 4.00 lakh.

4.2.3 Subsidy by Government

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.

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 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 10%.
- Depreciation is provided as per the rates provided in the companies act.

4.3.2 Simple payback period

The total cost of implementing the proposed technology is ₹ 5.34 lakh and monetary savings is ₹ 2.09 lakh. Hence, the simple payback period works out to be 2.56 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment works out to be ₹ 2.22 lakh.

4.3.4 Internal rate of return (IRR)

The IRR for the project is 21.85 %.

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 24.91 %.

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	31
2	IRR	%	21.85
3	NPV	₹	2.22
4	ROI	%	24.91
5	DSCR	Ratio	1.59

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

Particulars	IRR	NPV	ROI	DSCR
Normal	21.85	2.22	24.91	1.59
5% increase in fuel savings	23.87	2.62	25.22	1.67
5% decrease in fuel savings	19.81	1.82	24.56	1.50

4.5 Procurement and implementation schedule

Procurement and implementation schedule for proposed project are shown in Table 4.4 below.

Table 4.4 Procurement and implementation schedule

S. No.	Activities	Months		
		1	2	3
1	Delivery after placing order			
2	Erection & commissioning of DC to AC (EFF1) motors with VFD			
3	Cabling & electrical panel fitting			
4	Testing and trial			
5	On site operator training			

Table 4.5 Details of process down time

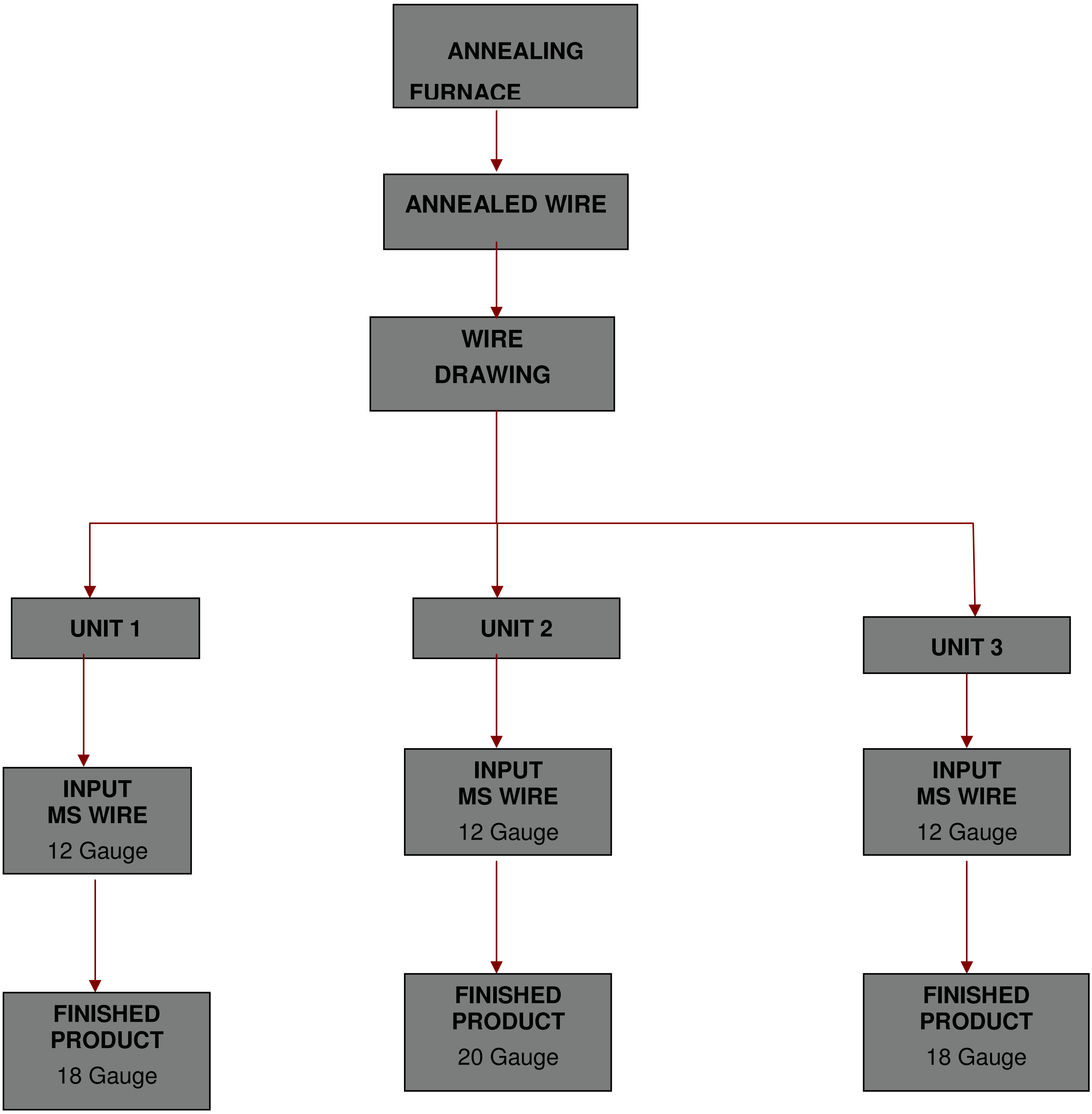
S. No.	Activities	Days						
		1	2	3	4	5	6	7
1	Erection & commissioning of DC to AC (EFF1) motors with VFD							
2	Cabling & electrical panel fitting							
3	Testing and trial							
4	On site operator training							

Annexure

Annexure -1: Energy audit data used for baseline establishment

	LIST OF MOTORS	RATED		MEASURED								
Sl no	Motor Name	HP	kW	Amp	Voltage	PF	KW	% Loading	Operating Hrs/day	Electricity ₹/kWh	Estimated Annual Consumption in kWh	Estimated Annual Expenditure in ₹
1	Extrusion machine	215	160	191.5	238	0.3	47.7	27	12	6.11	171688	1049014

Annexure -2: Process flow diagram after project implementation



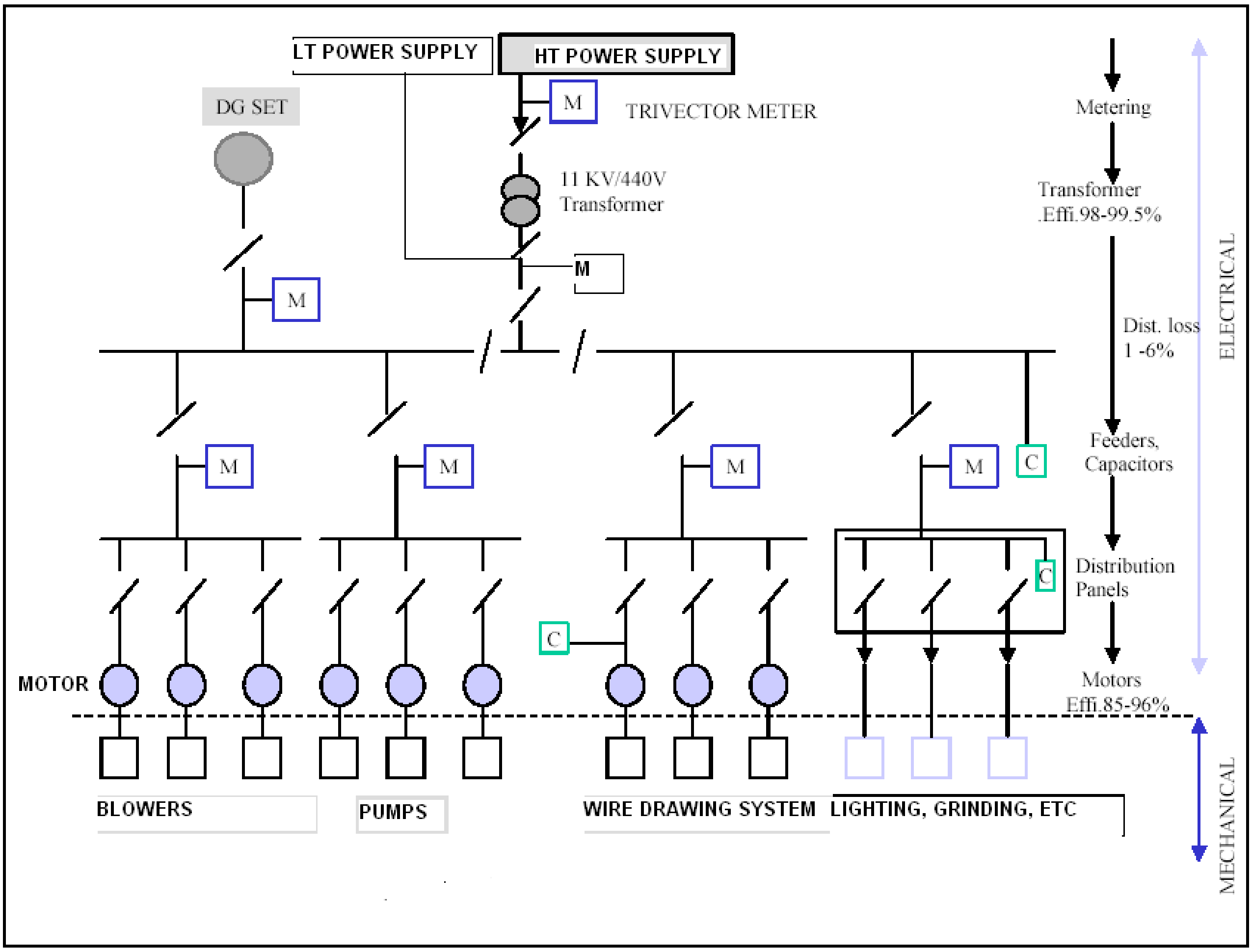
Annexure -3: Detailed technology assessment report

Sl No	Particular	Unit	Motor Name
			Extrusion machine
1	Rated power	HP	215
2	Rated power	kW	160
3	Power drawn at 27% loading	kW	47.7
4	Present Efficiency	%	85.7
5	Rated efficiency of DC to AC (EFF1) motor with VFD	%	95
6	Operational Days	Days/ Year	350
7	Hours per day	hr/day	12
8	Suggested power required at an improved loading of 45.4%	kW	43.0
9	Recommended size of DC to AC (EFF1) motor	kW	90
10	Reduction in power (Efficiency)	kW	4.7
11	Conversion Losses in DC Motor Circuit	%	6.0
12	Losses in VFD	%	3.0
13	Reduction in Losses	%	3.0
14	Reduction in power (Losses)	kW	1.4
15	Total Reduction in power (Efficiency & Losses)	kW	6.1
16	Cost of electricity	₹/kWh	8.17
17	Power savings	kWh/yr	25622
18	Savings	₹/Yr	209332
19	Investment	₹	533678
20	Estimated Life	Yrs	15

Sl No	Particular	Unit	Motor Name
21	Payback Period	Yrs	2.56

***Rs. 8.17/kWh is revised electricity rate as described in The Cluster manual.**

Annexure -4 Drawings for proposed electrical & civil works



Annexure -5: Detailed financial analysis

Assumption

Name of the Technology	Replacing DC to AC motor with VFD		
Details	**Unit**	**Value**	**Basis**
No of working days	Days	350	
No of Shifts per day	Shifts	1	
No. Of operating Hours per day	Hrs.	12	
Proposed Investment			
Equipment cost	₹ (In lakh)	5.66	
Taxes	₹ (In lakh)	1.38	
(-) Resale value of old motor	₹ (In lakh)	1.70	
Total investment	₹ (In lakh)	5.34	
Financing pattern			
Own Funds (Equity)	₹ (In lakh)	1.33	Feasibility Study
Loan Funds (Term Loan)	₹ (In lakh)	4.00	Feasibility Study
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	% age	5	Feasibility Study
Estimation of Revenue			
Saving in Electricity	kWh/Yr	25622	
Cost of Electricity	₹/ kWh	8.17	
St. line Depn.	% age	5.28	Indian Companies Act
Depreciation in the first year	% age	80	Income Tax Rules
Income Tax	% age	33.99	Income Tax

Estimation of Interest on Term Loan

Years	Opening Balance	Repayment	Closing Balance	Interest
1	4.00	0.30	3.70	0.46
2	3.70	0.60	3.10	0.34
3	3.10	0.72	2.38	0.28
4	2.38	0.88	1.50	0.20
5	1.50	0.96	0.54	0.11
6	0.54	0.54	0.00	0.02
		4.00		

WDV Depreciation

Particulars / years	1	2
Plant and Machinery		
Cost	5.34	1.07
Depreciation	4.27	0.85
WDV	1.07	0.21

Projected Profitability

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Fuel savings	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09
Total Revenue (A)	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09
Expenses								
O & M Expenses	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30
Total Expenses (B)	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30
PBDIT (A)-(B)	1.88	1.87	1.86	1.85	1.83	1.82	1.81	1.79
Interest	0.46	0.34	0.28	0.20	0.11	0.02	-	-
PBDT	1.42	1.53	1.58	1.65	1.73	1.80	1.81	1.79
Depreciation	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
PBT	1.14	1.24	1.30	1.36	1.45	1.52	1.53	1.51
Income tax	-	0.23	0.54	0.56	0.59	0.61	0.61	0.61
Profit after tax (PAT)	1.14	1.02	0.76	0.80	0.86	0.91	0.91	0.90

Computation of Tax

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	1.14	1.24	1.30	1.36	1.45	1.52	1.53	1.51
Add: Book depreciation	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Less: WDV depreciation	4.27	0.85	-	-	-	-	-	-
Taxable profit	(2.85)	0.67	1.58	1.65	1.73	1.80	1.81	1.79
Income Tax	-	0.23	0.54	0.56	0.59	0.61	0.61	0.61

Projected Balance Sheet

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
Reserves & Surplus (E)	1.14	2.15	2.91	3.72	4.58	5.49	6.40	7.30
Term Loans (F)	3.70	3.10	2.38	1.50	0.54	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	6.17	6.59	6.63	6.55	6.45	6.82	7.73	8.64

Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	5.34	5.34	5.34	5.34	5.34	5.34	5.34	5.34
Less Accm. depreciation	0.28	0.56	0.85	1.13	1.41	1.69	1.97	2.25
Net Fixed Assets	5.05	4.77	4.49	4.21	3.93	3.65	3.36	3.08
Cash & Bank Balance	1.12	1.82	2.14	2.34	2.52	3.18	4.37	5.55
TOTAL ASSETS	6.17	6.59	6.63	6.55	6.45	6.82	7.73	8.64
Net Worth	2.47	3.49	4.25	5.05	5.91	6.82	7.73	8.63
Debt Equity Ratio	2.78	2.33	1.79	1.13	0.41	0.00	0.00	0.00

Projected Cash Flow

₹ (in lakh)

Particulars / Years	0	1	2	3	4	5	6	7	8
Sources									
Share Capital	1.33	-	-	-	-	-	-	-	-
Term Loan	4.00								
Profit After tax		1.14	1.02	0.76	0.80	0.86	0.91	0.91	0.90
Depreciation		0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Total Sources	5.34	1.42	1.30	1.04	1.09	1.14	1.19	1.19	1.18
Application									
Capital Expenditure	5.34								
Repayment Of Loan	-	0.30	0.60	0.72	0.88	0.96	0.54	-	-
Total Application	5.34	0.30	0.60	0.72	0.88	0.96	0.54	-	-
Net Surplus	-	1.12	0.70	0.32	0.21	0.18	0.65	1.19	1.18
Add: Opening Balance	-	-	1.12	1.82	2.14	2.34	2.52	3.18	4.37
Closing Balance	-	1.12	1.82	2.14	2.34	2.52	3.18	4.37	5.55

IRR

₹ (in lakh)

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		1.14	1.02	0.76	0.80	0.86	0.91	0.91	0.90
Depreciation		0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Interest on Term Loan		0.46	0.34	0.28	0.20	0.11	0.02	-	-
Cash outflow	(5.34)	-	-	-	-	-	-	-	-
Net Cash flow	(5.34)	1.88	1.64	1.32	1.29	1.25	1.21	1.19	1.18
IRR	21.85%								

NPV	2.22

Break Even Point

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.16	0.17	0.18	0.19	0.19	0.20	0.21	0.23
Sub Total*(G)*	0.16	0.17	0.18	0.19	0.19	0.20	0.21	0.23
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.08
Interest on Term Loan	0.46	0.34	0.28	0.20	0.11	0.02	0.00	0.00
Depreciation *(H)*	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Sub Total (I)	0.80	0.68	0.62	0.54	0.45	0.37	0.35	0.36
Sales (J)	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09
Contribution (K)	1.93	1.93	1.92	1.91	1.90	1.89	1.88	1.87
Break Even Point (L= G/I)	41.24%	35.36%	32.25%	28.53%	23.88%	19.37%	18.80%	19.10%
Cash Break Even {(I)-(H)}	26.66%	20.72%	17.54%	13.77%	9.04%	4.45%	3.81%	4.02%
Break Even Sales (J)*(L)	0.86	0.74	0.68	0.60	0.50	0.41	0.39	0.40

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Return on Investment

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	1.14	1.24	1.30	1.36	1.45	1.52	1.53	1.51	11.05
Net Worth	2.47	3.49	4.25	5.05	5.91	6.82	7.73	8.63	44.35
									24.91%

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	1.14	1.02	0.76	0.80	0.86	0.91	0.91	0.90	5.49
Depreciation	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	1.69
Interest on Term Loan	0.46	0.34	0.28	0.20	0.11	0.02	0.00	0.00	1.41
Total (M)	1.88	1.64	1.32	1.29	1.25	1.21	1.19	1.18	8.58

DEBT

Interest on Term Loan	0.46	0.34	0.28	0.20	0.11	0.02	0.00	0.00	1.41
Repayment of Term Loan	0.30	0.60	0.72	0.88	0.96	0.54	0.00	0.00	4.00
Total (N)	0.76	0.94	1.00	1.08	1.07	0.56	0.00	0.00	5.41
	2.47	1.74	1.32	1.19	1.17	2.17	0.00	0.00	1.59
Average DSCR (M/N)	1.59								

Annexure:-6 Procurement and implementation schedule

S.No	**Activity**	**Day**
1	Procurement of the equipments	60
2	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 Mobile : 9230056795 / 9830056795 Email: contact@tcskolkata.com Website : www.tcskolkata.com
2	CGM equipments Pvt Ltd	176, Bidhan Sarani, Kolkata – 700 006	Mr. Suman Chatterjee Ph: (033) 6444551/51 Mobile : 9433002919 Email : cgmepl@gmail.com Website : www.cgmepl.com
3	Anurynan Marketing & Services	18, New Santoshpur Main Road, Kolkata-700 075	Mr Anjan Nath Ph:24166728 Mobile : 9830483597 Email : anath123@rediffmailmail.com Website : www.anuryan.com

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

C G M Equipments (P) Ltd.

CGM

Specialist in Energy Conservation

An ISO 9001:2000 Company

Ref: CGM/ IISWBM/ 202.00 2010-2011

Date: Thursday, January 20, 2011

M/s. IISWBM
KOLKATA

Dear Sir,

We are pleased submit our offer, for the MOTOR WITH VFD , technical details given by you,-------

SL NO	DESCRIPTION	Unit	Discount	Rate Rs.	QUANTITY IN NOS	Total Price Rs.
1.00	90 kw energy efficient Motor	no	50%	392,120.00	1.00	196,060.00
2.00	Allan Bradly make VFD for 90 kw motor	no	2%	377,000.00	1.00	369,460.00

TERMS & CONDITIONS:

1	PRICES	EX- works, Howrah
2	PACKING & FORWARDING	As per requirement
3	EXICE DUTY	Applicable @ 8.3% extra
4	INSTALLATION & COMMISSIONING	We will do the only programming part and comissioning of VFD. Cable and others are not in our scope. Charges will be Rs.5,000/-.
5	DELIVERY CHARGES	To pay basis
6	PAYMENT TERMS	50% advance and rest before delivery
7	SALES TAX	4% VAT
8	WARRANTEE	12 MONTHS FROM THE DATE OF SUPPLY AGAINST ANY MANUFACTURING DEFECTS.
9	DELIVERY PERIOD	6-8 weeks FROM THE DATE OF ORDER AND ADVANCE
10	JOB COMPLITION PERIOD	TO BE DECIDED AFTER ORDER
11	VALIDITY	30 DAYS
12	SERVICE TAX	10.3% extra for labour job / commissioning.

We look forward to receive your valued order at he earliest. Thanking and assuring our best of services.

Yours faithfully,

For, CGM Equipments (P) Ltd,

SUMAN CHATTERJEE
(Managing Director)
Mob: 09433002919

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Annexure -9: Quotation for the resale of old DC motors

1

Biplab Kumar Bisal, B.Sc, B.Tech, GDMM, MBA
Surveyor & Loss Assessor- SLA-72748/09-14
Valuer (certified) - Lic no-0392

C-41, Sonali Park
Kolkata-700 070
9433176452(M)

Report no- 01/10-11

Date-21/03/11

To
Dr. B. K. Choudhury
Associate Professor, Energy management
IISWBM, Management House
College square west, Kolkata-700 073

Sub # Calculation of payback period due to replacement of DC motor by AC motor.

Ref # your letter dated 17/03/11

Respected Sir
The captioned subject under reference may kindly be seen & based on information as available from your letter as well as discussion in your office chamber; valuation report is placed herein under for your kind information.

1) Name of the client- Extrusion plant in Howrah

2) Identification of client- IISWBM, Management House, Kolkata-700 073.

3) purpose of valuation- Calculation of payback period due to replacement of DC motor by AC motor for BEE SME project.

4) Date of valuation- 21/03/11

5) Items to be valued- a) 01 year old - 280 KW DC motor (present market value of same specification =382500/-)

b) 04 years old -160 KW DC motor (present market value of same specification = 261000/-)

Now serial no-a)-

Is to be replaced by one 160 KW energy efficient AC motor with VFD by Rs.1142161/- inclusive all taxes as present market value & existing DC motor to be sold in the local market as old one.

For serial no-b)-

Is to be replaced by one 90 KW energy efficient AC motor with VFD by Rs.703328/- inclusive all taxes as present market value & existing DC motor to be sold in the local market as old one.

6) Basis of information for valuation- as per letter dated 17/03/11 & table discussion

7) Saving (improvement of efficiency & power factor) by replacing DC motor with AC motor-

2

a) For 280 KW DC by 160 KW AC = 242927/-
b) for 160KW DC by 90KW AC = 172552/-

Report

During discussion it was given to understand that the DC motors in question have been running in good condition to deliver results for last 01 year & 04 years respectively without any loss, damage. Now these motors are to be replaced by AC motors & earlier one to be sold in the local market treating as old.

To find out resale value of 280 KW & 160 KW DC motors we have to calculate depreciation as the same earned due to normal wear & tear for being used for the years mentioned.

1) Depreciation- in respect of 280 KW DC motor(use for last 01 year)

Considering use, maintenance, usage etc as we understood depreciation may be incurred by the motor at best 08 % to arrive present market value which we think proper & reasonable.

So present market value = 382500.00 – 08 % x 382500.00 = 351900.00

Now Net investment due to replacement of the same by AC motor = 1142161.00 – 351900.00 = 790261.00.

Thus the present pay back period = net investment / saving = 790261.00 / 242927.00 = 3.253 years.

2) Depreciation in respect of 160 KW DC motor(use for last 04 year)

Considering use, maintenance, usage etc as we understood depreciation may be incurred by the motor at best 35% to arrive present market value which we think proper & reasonable.

So present market value = 261000.00 – 35% x 261000.00 = 169650.00

Now Net investment due to replacement of the same by AC motor = 703328.00 – 169650.00 = 533678.00.

Thus the present pay back period = net investment / saving = 533678.00 / 172552.00 = 3.092 years.

Note-

1) Value will vary with the purpose & date. This report is not to be referred if the purpose is different other than mentioned in the subject above.

2) Undersigned has no direct & indirect interest in the subject matter being valued.

With highest regards
Yours faithfully

(B. K. Bisal)

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