DETAILED PROJECT REPORT
ON
AIR FUEL RATIO CONTROL WITH OXYGEN SENSOR
HOWRAH CLUSTER

ENERGY IS LIFE
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Bureau of Energy Efficiency

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AIR FUEL RATIO CONTROL WITH OXYGEN SENSOR

HOWRAH GALVANIZING
AND WIRE DRAWING CLUSTER

BEE, 2010

Detailed Project Report on Air Fuel Ratio Control with Oxygen Sensor

Galvanizing and Wire Drawing SME Cluster,

Howrah, West Bengal (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: ***HWR/WDG/AFC/03***

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Indian Institute of Social Welfare and Business Management(IISWBM) is also thankful to District Industry Center(DIC), Howrah chamber of Commerce & Industry (HCCI), Bengal National Chamber of commerce & Industry(BNCCI), Federation of Small & Medium Industry(FOSMI) and West Bengal Renewable Energy Development Agency(WBREDA) for their valuable inputs, co-operation, support and identification of the units for energy use and technology audit studies and facilitating the implementation of BEE SME program in Howrah Galvanizing and Wire Drawing Cluster.

We take this opportunity to express our appreciation for the excellent support provided by Galvanizing and Wire Drawing Unit Owners, Local Service Providers, and Equipment Suppliers for their active involvement and their valuable inputs in making the program successful and in completion of the Detailed Project Report (DPR).

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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
IRR	Internal Rate of Return
MT	Million Ton
MW	Mega Watt
NPV	Net Present Value
ROI	Return on Investment
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. 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, which needs a mechanism to identify technology and techniques for improving energy efficiency in these highly unorganized and so far uncared for industrial units.

Every galvanizing unit of the cluster has furnaces to melt zinc. Even some of the wire-drawing units have furnaces to perform annealing. In the furnaces of the galvanizing units in the cluster, the supply of air for combustion is generally controlled manually. This process is very inefficient and leads to either wastage of energy upon too much excess air or incomplete combustion due to insufficient supply of air. Using an oxygen controller to measure the precise amount of air can optimise the usage of fuel and yielding significant savings.

Installation of Air fuel ratio controller with oxygen sensor for control of excess air in the existing furnace would lead to fuel saving upto 17400 litre of furnace oil per year.

This DPR highlights the details of the study conducted for assessing the potential for installation of air fuel controller with oxygen sensor, possible energy saving and its monetary benefit, availability of the technologies/design, local service providers, technical features & proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, sensitivity analysis in 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)	4.68
2	Fuel saving	kilolitre/year	17400
3	Monetary benefit	₹ (In lakh)	5.22
4	Debt equity ratio	Ratio	3:1
5	Simple payback period	Years	0.90
6	NPV	₹ (In lakh)	14.65
7	IRR	%age	86.62
8	ROI	%age	29.15
9	DSCR	Ratio	4.56
10	Process down time	Days	2

The projected profitability and cash flow statements indicate that the project implementation i.e. installation of air-fuel ratio controller to control excess-air 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 SMEs.

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

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

Activity 3: Implementation of energy efficiency measures

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

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

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

1 INTRODUCTION

1.1 Brief Introduction about cluster

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 this highly unorganized and so far uncared for 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 (Predington company based in Bombay) or Grommet–44 is used for lubrication (eg.).

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 Tables 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 5 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

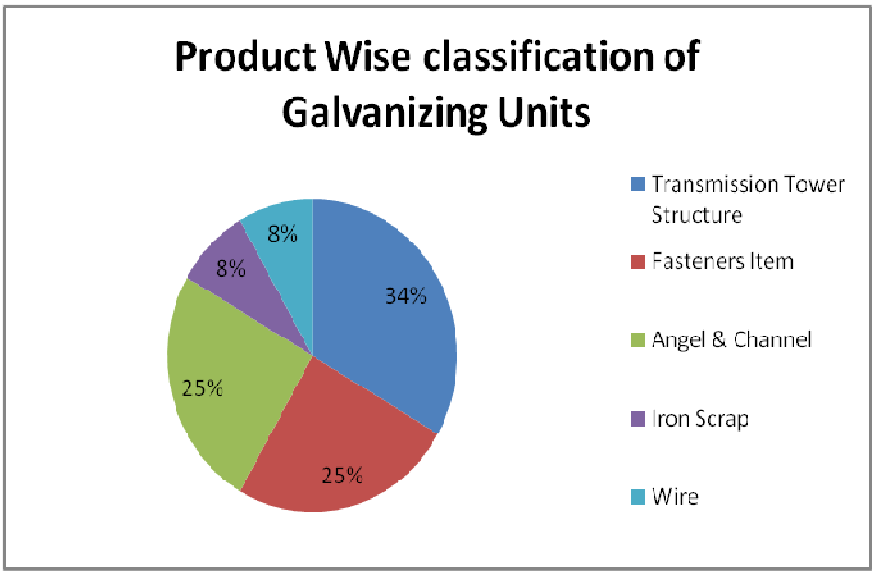


Figure 1.1 : Product Wise Classification of Galvanizing Units

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

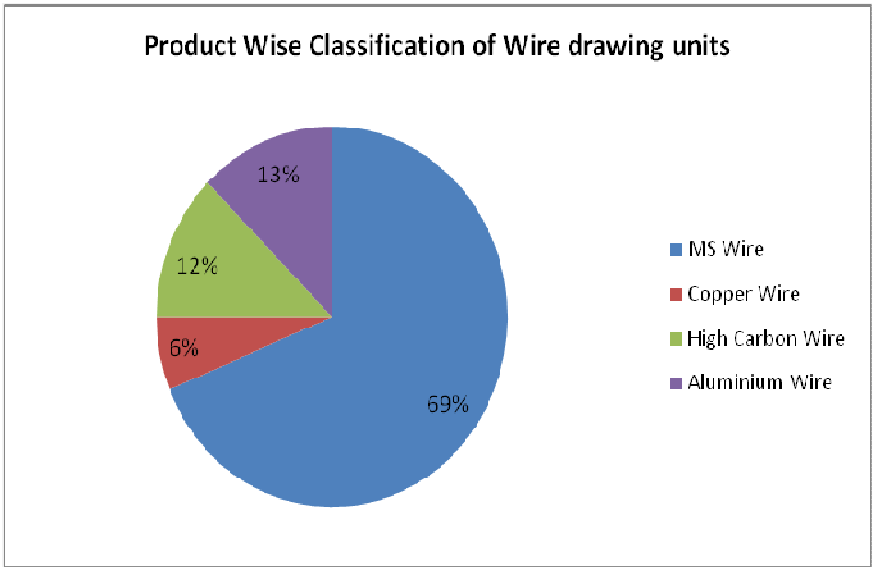


Figure 1.2: Product Wise Classification of Wire-drawing Units

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 small scale), 500-1000 TPA (medium scale) and above 1000 TPA (large scale) capacities.

The distribution of units of Galvanizing and Wire Drawing industries has been depicted in Figures 1.3 and 1.4.

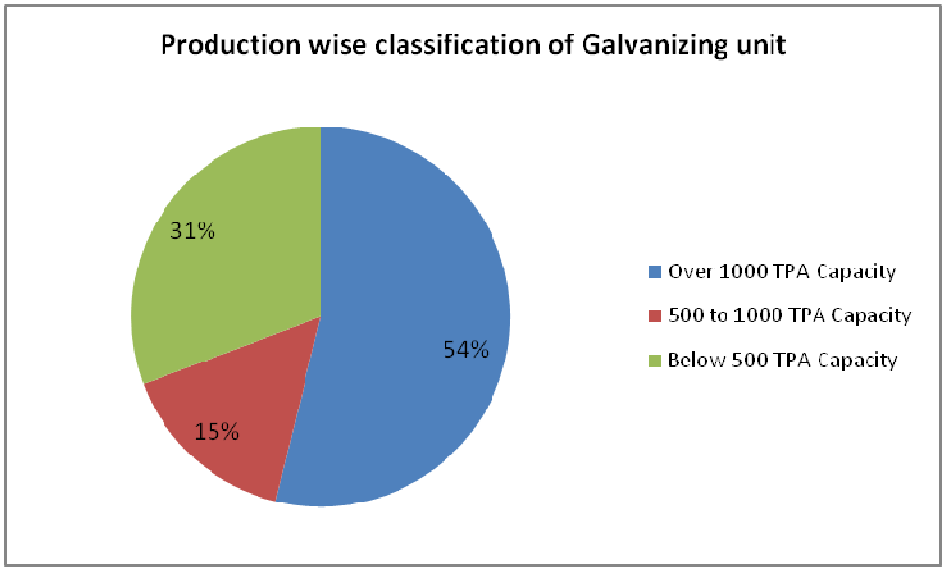


Figure 1.3: Production Wise Classification of Galvanizing Units

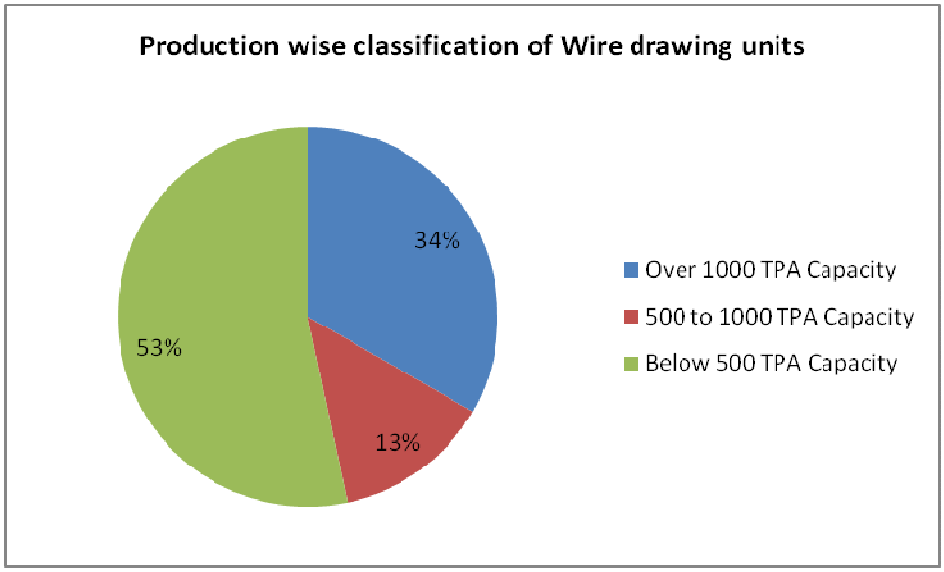


Figure 1.4: Production Wise Classification of Wire-drawing Units

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 wood consumption in a typical unit is about 300 Ton/year.

Average yearly 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/yr. 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/yr 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.

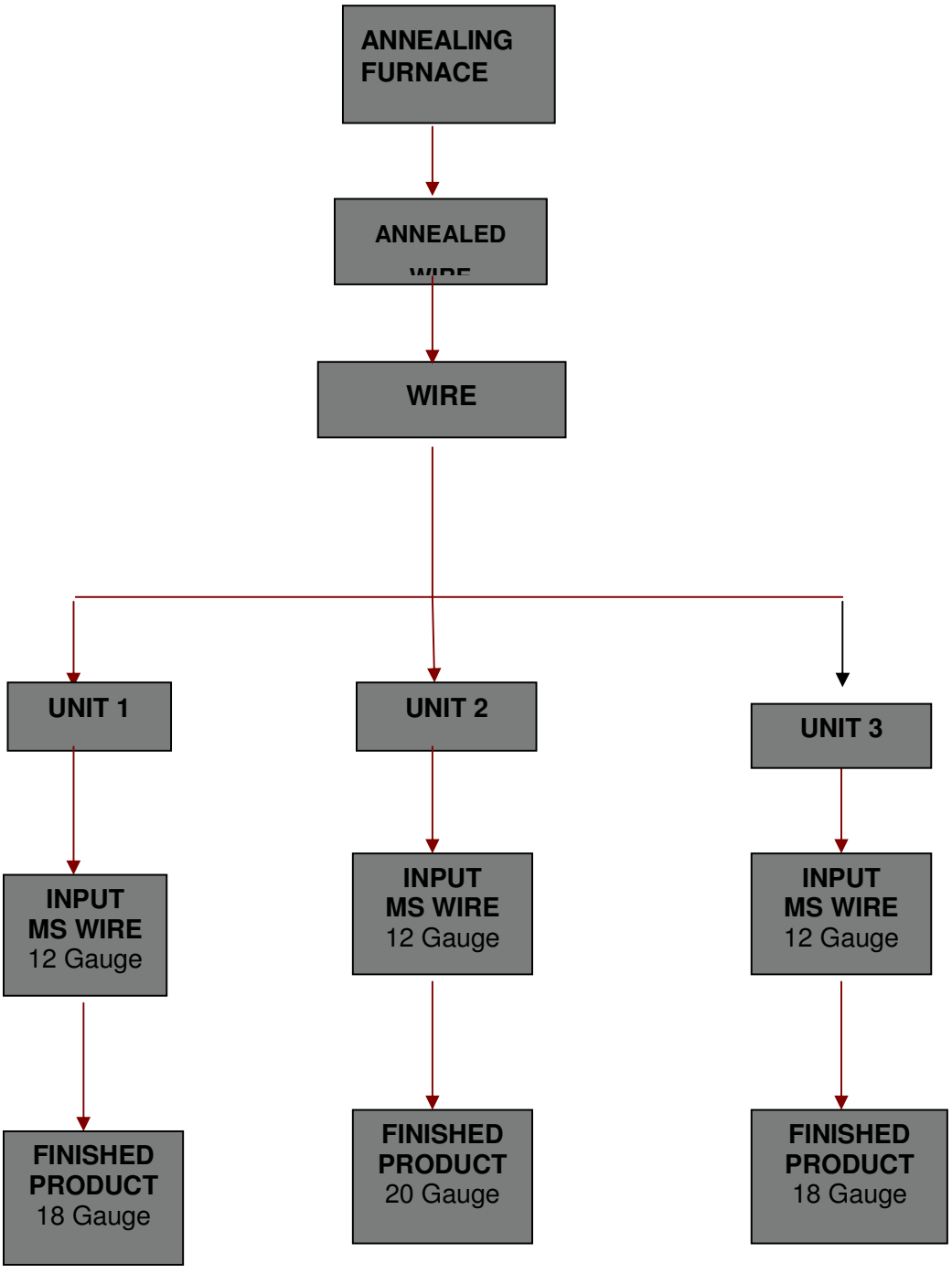


Figure 1.5 Process flow diagram of a typical wire drawing unit

General production process for the galvanizing units

In a typical galvanizing unit, the production process involves seven stages as is shown in a schematic diagram in Figure 1.6. First the job or the raw material that 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 the job. This process is termed as water quenching. After water-quenching process is completed 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 figure 1.6 process flow diagram.

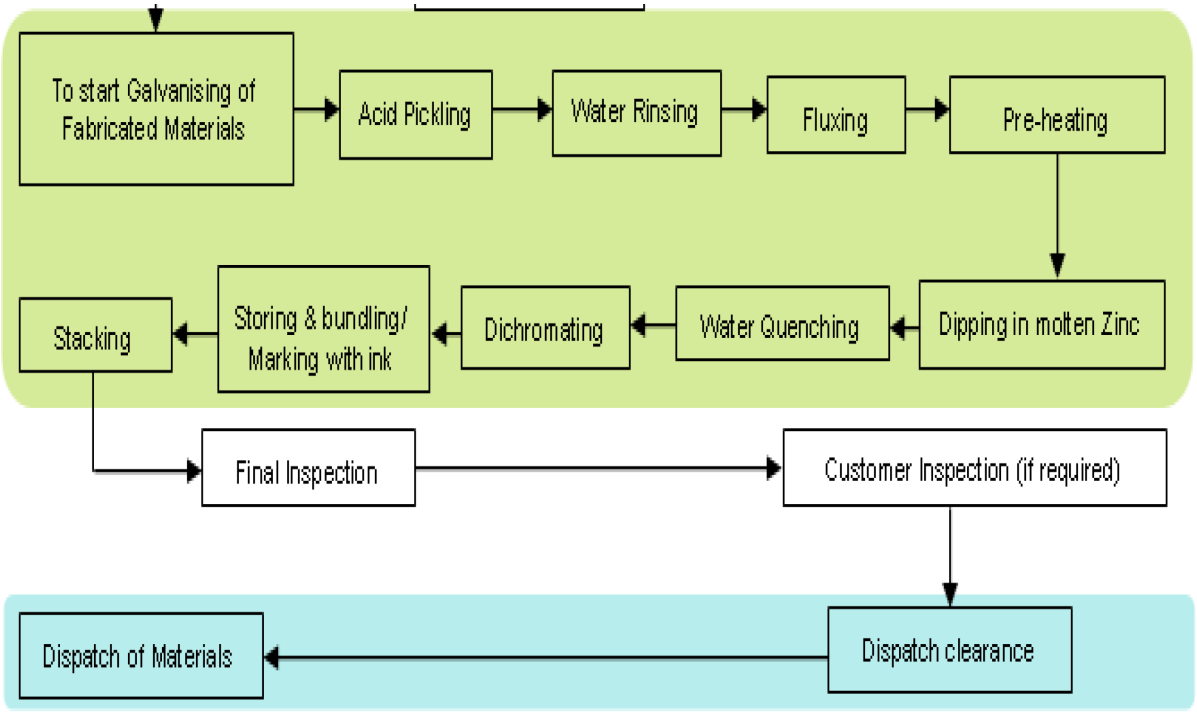


Fig 1.6: Process Flow diagram for a typical galvanizing unit

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 also 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)*	*Woof (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

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	600	2000
2	Copper wire	NA	NA	1000
3	High carbon wire	NA	NA	1000
4	Aluminium wire	100	NA	700

Table 1.5 Typical average annual production in galvanizing units

S. No.	Type of Industry	Production (in TPA)		
		Small scale	Medium scale	Large 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

Parameter		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

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

Every galvanizing unit and some wire drawing units have furnaces which rely on burning fuel, either furnace oil, SHC Coal or diesel to generate the heat required for melting zinc. Most use furnace oil where the fuel is sprayed as fine droplets through a burner and burnt. In a galvanizing unit, the percentage of the furnace oil cost among the entire fuel bill is 48% in a typical unit. The air for combustion is supplied through separate pipes but gets mixed at the burner. Existing furnace specifications are shown in Table 1.7 below.

Table 1.7 Cluster specifications of present furnaces

S. No.	*Parameter*	*Detail*
1	Manufacturer	Local
2	Dimensions	1.06 m x 0.66 m x 0.76 m to 6.8 m x 0.86 m x 0.86 m
3	Average FO consumption	31 to 41 l/hr
4	Temperature of zinc vat	460 to 480 deg C
5	Ambient temperature max	40 deg C
6	Number of hours in a day operational	12 to 24
7	Numbers of days in a year operational	150 to 320

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

The cost of furnace oil in a typical unit is . 29.75/ litre.

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 charge is . 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 . 6.03 / 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 Rs. 15/kVA. Thus the energy charge for a typical unit with contract demand of 32 kVA and average monthly energy consumption of 17435 kWh is Rs. 5.41 / kWh.

1.3.2 Role in process

Furnaces heat up the vats in which zinc is melted. The job to be galvanized is dipped in the molten zinc during the hot dip process. IS: 2629 – 1985 suggests temperature of the zinc vat as 440 - 460 deg C.

1.4 Baseline establishment for existing technology

1.4.1 Design and operating parameters

The typical galvanizing furnace provides a temperature of 460 to 480 deg C in the vat. This consumes furnace oil at the rate of 31litre/hr. The centrifugal blower (FD fan)driven by standard 15 kW motor supplies the necessary combustion air which is controlled by damper. Besides such inefficient technologies being used presently, the units also do not take

precaution for infiltration of atmospheric air in to the system. Since furnace operate in forced draft mode (there is no ID fan) and also the natural draft of the chimney is not utilized to the fullest extent, a negative pressure exists in it and infiltration takes place near the chimney base, while flue gas leaks to environment before that.

Table 1.10 Present furnace specifications

S. No.	Parameter	Detail
1	Manufacturer	Local
2	Dimensions	1.06 m x 0.66 m x 0.76 m
3	Average FO consumption	31 litre/hr
4	Temperature of zinc vat	467 deg C
5	Ambient temperature max	40 deg C
6	Number of hours in a day operational	12
7	Numbers of days in a year operational	300

Furnace oil consumption in the galvanizing furnaces depend on the following parameters

a) Condition of the walls and insulation

b) Size of the job to be galvanized

c) Amount of excess air provided for combustion.

d) Amount of zinc to be heated

Fuel requirement in the galvanizing plant depends on the production. Detail of fuel consumption in a typical unit is given in Table 1.11 below:

Table 1.11 Fuel consumption at a typical galvanizing unit using furnace oil

S. No.	Energy Type	Unit	Value
1	Electricity	kWh/year	109883
2	Furnace oil	litre/yr	112500
3	SHC Coal (for drying bed)	kg/yr	21000

1.4.2 Operating efficiency analysis

Operating efficiency for the furnace is found to be 19.28%. The calculations are shown in Annexure-1.

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 visiting countries like China and European ones to find the best possible technological solutions to 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 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 in employed in the units are generally skilled workers 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 EFFICENCY IMPROVEMENT

2.1 Description of proposed equipment

2.1.1 Details of proposed equipment

The suggested change measures the amount of oxygen in the flue gas and appropriately controls the speed of a blower that adjusts the amount of air supplied to the furnace for combustion. The VFD on the blower motor is programmable and changes the motor speed according to the set conditions.

2.1.2 Equipment/technology specification

The speed of the blower motors supplying air into the furnace is adjusted to optimize the amount of oxygen available for combustion.

Table 2.1 Technical specification of a excess air control using O_2 sensor

S. No.	Parameter	Units	Detail
1	Manufacturer	-	Technosoft Consultancy Services
2	Rating of blower motor	kW	15
3	Rating of fuel pump	HP	0.5
4	Oxygen analyser probe type	-	Zirconium
5	Length of oxygen probe	inch	18
6	Flow meter range	SCFH	0.1 to 5
7	Temperature range of O2 sensor	Deg C	0 to 800

Further details of the gasifier to control oxygen percentage in flue gas are shown in the Annexure-3.

2.1.3 Integration with existing equipment

The oxygen sensor can be installed in the path of the flue gas and the motor to the present blower replaced according to the new specifications. There shall be no alterations on the burner or the furnace itself.

The following are the reasons for selection of this technology:

- It will reduce the total amount of fuel required and saves money.
- It reduces the GHG emissions and pollution because the combustion will be complete.
- 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 fuel required, not to mention the reduction in GHG and toxic gases.

2.1.5 Source of equipment

Proposed technology has successfully been adopted and implemented throughout the country and benefits reaped 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 national level very easily. Such units supplied are found running in a number of applications for more than four decades in India.

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

The company seeks 50% of the amount to be paid along with P.O. and the balance with taxes against Performa Invoice prior to dispatch as given in the Annexure-8.

2.1.9 Process down time

The down time might be 2-3 days for installing the oxygen sensor and placing a VFD on the new blower motor. Detail of break up for process down time is given in Annexure 6.

2.2 Life cycle assessment and risks analysis

Life of the equipment is about 8 years. Risk involved in the implementation of proposed project is the loss of flue gas at the position of induction of the oxygen sensor. This needs to be plugged very carefully.

2.3 Suitable unit for Implementation of proposed technology

Suitable unit for implementation of this technology is a galvanizing unit having the production capacity of about 4320 Ton/yr and having total furnace oil consumption about112500 litre/year. The unit is currently using SHC Coal for preheating but furnace oil for galvanizing.

3. ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical benefit

3.1.1 Fuel saving

Installing the new system to detect the oxygen percentage in flue gas and adjust blower motor speed accordingly saves 17400 litre of furnace oil per year as shown in Annexure – 3.

3.1.2 Electricity saving

Electricity saving would be possible due to installation of proposed technology but on the safer side only fuel saving has been consider for calculating monetary benefit.

3.1.3 Improvement in product quality

The quality of the product would be improved on account of better heating.

3.1.4 Increase in production

The production will improve upon better combustion regulation from quality point of view and that may also lead to little improvement in quantity as well as the rejection/repetition decreases.

3.1.5 Reduction in raw material

The wastage of zinc during the process would be lower upon better combustion regulation.

3.1.6 Reduction in other losses

The other losses shall not be affected upon implementation of proposed technology.

3.2 Monetary benefits

The monetary benefits of the unit are mainly due to less fuel wastage upon optimized combustion of furnace oil. This amounts to monetary savings of ₹ 5,22,000 /yr. 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	Present FO consumption in a unit	litre/year	112500
2	Cost of FO	₹ /litre	30.00
3	Savings of FO	litre/yr	17400
4	Monetary savings due to decrease in fuel consumption	₹ /year	522000

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

3.3 Social benefits

3.3.1 Improvement in working environment

The working environment will improve due to prevention of leakage from base of chimney.

3.3.2 Improvement in workers skill

The workers have to be trained according to the needs of the system.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

There would be less effluent generation since there would less fuel burned in the furnace. Moreover, the generation of dross is reduced due to better temperature regulation.

3.4.2 Reduction in GHG emission

The measure helps in reducing CO_2 emission upon burning less fuel and making the combustion process more efficient. Total CO_2 emission reduction would be about 55 ton per year.

3.4.3 Reduction in other emissions like SO_X

Significant amount of SO_X and NO_x emission will be reduced due to less fuel burned in the new process.

4. INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of project

4.1.1 Equipment cost

The cost of materials for making this apparatus is ₹ 4.09 lakh**.** This figure includes the cost of the new (EFF1 and VFD duty) motor for blower with VFD, the oxygen sensor and accessories. Further details of the apparatus are given in Table 4.1 below:

4.1.2 Erection, commissioning and other misc. cost

The erection, commissioning and other miscellaneous costs could amount to a further ₹ 0.37. This figure includes the cost of installation and commissioning and the relevant taxes. Details of project costs are given in Table 4.1 below:

Table 4.1 Details of proposed technology project cost

Particular	*Cost (₹ In lakh)*
VVVF Drive panel along with VFD Duty Motors suitable for 15kW Blower application and ½HP Fuel Pump application in PID control mode along with feedback signal of Oxygen Analyzer through flue gas analysis.	1.40
Zirconia based In-situ Oxygen Analyzer system for Flue gas analysis	2.10
0.4% O2 balance nitrogen	0.15
8.0% O2 balance nitrogen	0.15
Auto calibration unit	0.22
Double stage SS regulator	0.072
Installation and commissioning	0.20
Packing and forwarding (2%)	0.085
Freight and insurance (3%)	0.13
VAT (4%)	0.17
Total Investment	4.68

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

The total cost of installing the device is ₹ 1.17 lakh. The entrepreneur shall have to pay 25% of the total amount upfront. The rest could be arranged as loans.

4.2.2 Loan amount.

The loan amount is ₹ 3.51 lakh and from the MSME of the Government of India, which have 25% subsidy in some schemes.

4.2.3 Terms & conditions of loan

The interest rate is considered at 10%, which is SIDBI's rate of interest for energy efficient projects as shown in Annexure-9. The loan tenure is 5 years excluding initial moratorium period for 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 as given in Annexure-4. 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 of ₹ 5.22 lakh/year.

- The Operation and Maintenance cost is estimated at 4% of 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 ₹ 4.68 lakh and monetary savings is ₹ 5.22 lakh/year. Hence the simple payback period works out to be 11 months.

4.3.3 Net Present Value (NPV)

The net present value of the investment works out to be ₹ 14.65 lakh.

4.3.4 Internal rate of return (IRR)

The Internal rate of return of the project would be 86.62 %

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 29.15%.

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	Months	11
2	IRR	%age	86.62
3	NPV	₹ (lakh)	14.65
4	ROI	%age	29.15
5	DSCR	Ratio	4.56

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 (%age)	NPV	ROI	DSCR
Normal	86.62	14.65	29.15	4.56
5% increase in fuel savings	90.70	15.56	29.36	4.78
5% decrease in fuel savings	82.50	13.73	28.92	4.34

4.5 Procurement and implementation schedule

Procurement and implementation schedule required for proposed project is 12 weeks and their detail is shown in Annexure 6.

ANNEXURE

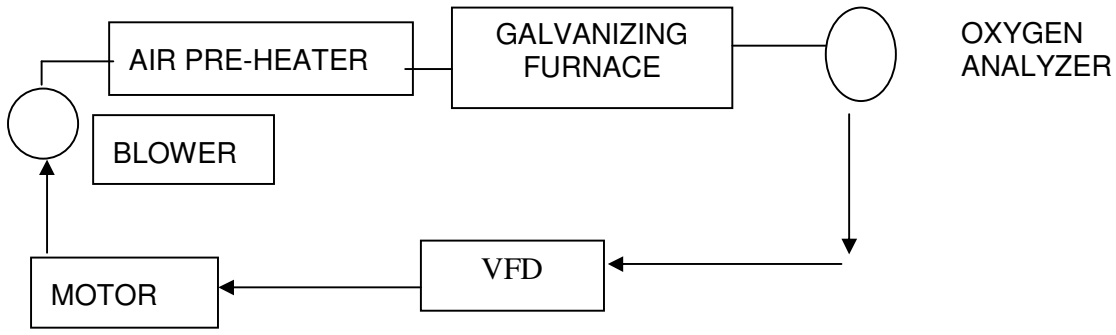
Annexure -1: Energy audit data used for baseline establishment

Calculation of efficiency of the furnace by the direct method

Particulars	Unit	Value
Production	Ton/Year	4320
FO Consumption	Litre/Yr	112500
SG of FO	-	0.93
GCV of FO	kJ/kg	44100
Heat of FO	kJ/Yr	4613962500
Zinc VAT temperature	deg C	467
Heat taken by zinc	kJ	82050192
Heat taken by iron	kJ	807617952
Heat taken by Metals	kJ	889668144
Total Heat of Fuel (FO)	kJ/Yr	4613962500
Efficiency	%age	19.28

Annexure -2: Process flow diagram after project implementation

.



Annexure -3: Detailed technology assessment report

Furnace Blower Calculations

Particular	Units	Value
Velocity of air	m/s	10.23
Diameter of blower	cm	15
Flow	m3/hr	650
Density of air	kg/m3	1.3
Mass Flow Rate of air	kg/hr	839
Flue gas mass flow rate (using anemometer)	kg/hr	867.6
Measured oxygen	% age	11
Excess air	% age	110
Actual air flow calculated	kg/hr	898.38
Flue gas mass flow rate (flue gas analysis)	kg/hr	926.9
Therefore take the average of the two flow rates		
Average Air Flow to Furnace	kg/hr	897.3
Oil Consumption Rate	litre/hr	31
Specific Gravity of Oil	-	0.92
Oil Consumption Rate	kg/hr	28.52
Flue Gas mass flow rate(Quantity of Air flow + fuel flow)	kg/hr	925.8
Assuming air fuel ratio	-	15
Stoichiometric Air Flow Rate	kg/hr	427.8
Actual excess air	%age	109.74
Considering 15% excess air of desired air)	kg/hr	492
%age excess air of desired air	%age	82.38
Temp of Flue Gas	deg C	520
Ambient Temp	deg C	40
C_P of Air	kCal/kg/deg C	0.24
Reduction in heat loss due to reduction of excess air into the furnace	kCal/hr	46690
Calorific Value of Oil (heat loss)	kCal/kg	10500

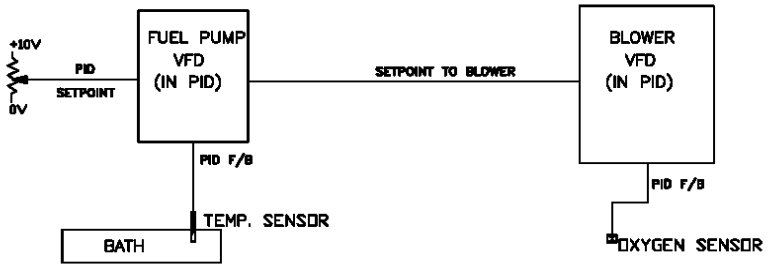
Particular	Units	Value
Equivalent oil saving	kg/hr	4.45
Equivalent oil saving	litre/hr	4.833
Working hours per day	Hrs	12
Working days per year	days	300
Savings potential	litre/ yr	17400
Cost of oil	₹ /litre	30.00
Savings Potential	₹ /yr	**522000**

Annexure -4 Drawings for proposed electrical & civil works

IF IN DOUBT ASK | DO NOT SCALE THE DRAWING | ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED

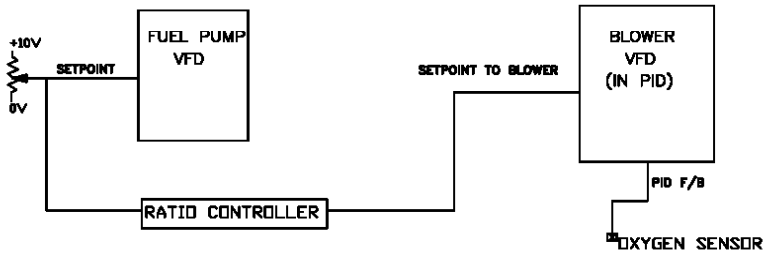
4 | 3 | 2 | 1

AUTOMATIC FUEL PUMP CONTROL



NOTE:- WITH FUEL PUMP IN MANUAL CONTROL MODE, THE PID FEEDBACK WILL BE ABSENT AND THE DRIVE WILL NOT BE IN PID.

MANUAL FUEL PUMP CONTROL



NOTE:- OXYGEN SENSOR FOR THE BLOWER VFD IS OPTIONAL

REV	ZONE	DCN No	BRIEF RECORD	SIGNATURE	DATE

	DRAWING No.	DATE	DCN No.
THIS SUPERSEDES			
SUPERSEDED BY			

CUSTOMER/OA No.	USED ON	SCALE	DRAWN		
TECHNOSOFT CONSULTANCY & SERVICES	AIR FUEL MIXTURE		CHECKED		
			APPROVED		

TITLE	DRG. No.
SINGLE LINE DIAGRAM	445XXX10 R
KIRLOSKAR ELECTRIC CO. LTD., MYSORE – 570 018 INDIA	SHEET No. OF

FORMAT No. 110 04 136 R0

Annexure -5: Detailed financial analysis

Assumption

Name of the Technology	*AIR FUEL RATIO CONTROL WITH OXYGEN SENSOR*		
Details	*Unit*	*Value*	*Basis*
Installed Capacity	kW (blower & fuel pump EFF1 motors)	15 and 0.5	Feasibility Study
No of working days	Days	300	Feasibility Study
No of Shifts per day	Shifts	1	Feasibility Study
Capacity Utilization Factor	%age	80	Feasibility Study
Proposed Investment			
Equipment cost	₹ (In lakh)	4.09	Feasibility Study
Cost of installation	₹ (In lakh)	0.20	Feasibility Study
Other cost	₹ (In lakh)	0.39	Feasibility Study
Total investment	₹ (In lakh)	4.68	Feasibility Study
Financing pattern			
Own Funds (Equity)	₹ (In lakh)	1.17	Feasibility Study
Loan Funds (Term Loan)	₹ (In lakh)	3.51	Assumed
Loan Tenure	yr	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%age	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 Furnace oil	liter/yr	17400	
Cost of FO	₹ / litre	30	
St. line Depn.	% age	5.28%	Indian Companies Act
Depreciation in the first year	% age	80	
Income Tax	% age	33.99	

Estimation of Interest on Term Loan

Years	*Opening Balance*	*Repayment*	*Closing Balance*	*Interest*
1	3.51	0.24	3.27	0.41
2	3.27	0.48	2.79	0.31
3	2.79	0.60	2.19	0.25
4	2.19	0.72	1.47	0.19
5	1.47	0.96	0.51	0.10
6	0.51	0.51	0.00	0.02
		3.51		

WDV Depreciation

Particulars / years	*1*	*2*
Plant and Machinery		
Cost	4.68	0.94
Depreciation	3.74	0.75
WDV	0.94	0.19

Projected Profitability **₹(in lakh)**

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Fuel savings	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
Total Revenue (A)	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
Expenses								
O & M Expenses	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26
Total Expenses (B)	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26
PBDIT (A)-(B)	5.03	5.02	5.01	5.00	4.99	4.98	4.97	4.96
Interest	0.41	0.31	0.25	0.19	0.10	0.02	-	-
PBDT	4.63	4.72	4.76	4.82	4.89	4.97	4.97	4.96
Depreciation	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
PBT	4.38	4.47	4.51	4.57	4.64	4.72	4.72	4.71
Income tax	0.30	1.35	1.62	1.64	1.66	1.69	1.69	1.68
Profit after tax (PAT)	4.08	3.12	2.90	2.93	2.98	3.03	3.03	3.02

Computation of Tax **₹ (in lakh)**

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Profit before tax	4.38	4.47	4.51	4.57	4.64	4.72	4.72	4.71
Add: Book depreciation	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Less: WDV depreciation	3.74	0.75	-	-	-	-	-	-
Taxable profit	0.88	3.97	4.76	4.82	4.89	4.97	4.97	4.96
Income Tax	0.30	1.35	1.62	1.64	1.66	1.69	1.69	1.68

Projected Balance Sheet

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Liabilities								
Share Capital (D)	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
Reserves & Surplus (E)	4.08	7.20	10.10	13.03	16.01	19.04	22.07	25.10
Term Loans (F)	3.27	2.79	2.19	1.47	0.51	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	8.52	11.16	13.46	15.67	17.69	20.21	23.24	26.27
Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68
Less Accm. depreciation	0.25	0.49	0.74	0.99	1.24	1.48	1.73	1.98
Net Fixed Assets	4.43	4.19	3.94	3.69	3.44	3.20	2.95	2.70
Cash & Bank Balance	4.09	6.98	9.52	11.98	14.25	17.01	20.29	23.57
TOTAL ASSETS	8.52	11.16	13.46	15.67	17.69	20.21	23.24	26.27
Net Worth	5.25	8.37	11.27	14.20	17.18	20.21	23.24	26.27
Debt Equity Ratio	2.79	2.38	1.87	1.26	0.44	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	1.17	-	-	-	-	-	-	-	-
Term Loan	3.51								
Profit After tax		4.08	3.12	2.90	2.93	2.98	3.03	3.03	3.02
Depreciation		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Sources	4.68	4.33	3.37	3.14	3.18	3.23	3.28	3.28	3.27
Application									
Capital Expenditure	4.68								
Repayment Of Loan	-	0.24	0.48	0.60	0.72	0.96	0.51	-	-
Total Application	4.68	0.24	0.48	0.60	0.72	0.96	0.51	-	-
Net Surplus	-	4.09	2.89	2.54	2.46	2.27	2.77	3.28	3.27
Add: Opening Balance	-	-	4.09	6.98	9.52	11.98	14.25	17.01	20.29
Closing Balance	-	4.09	6.98	9.52	11.98	14.25	17.01	20.29	23.57

IRR **₹ (in lakh)**

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		4.08	3.12	2.90	2.93	2.98	3.03	3.03	3.02
Depreciation		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Interest on Term Loan		0.41	0.31	0.25	0.19	0.10	0.02	-	-
Cash outflow	(4.68)	-	-	-	-	-	-	-	-
Net Cash flow	(4.68)	4.73	3.67	3.40	3.37	3.33	3.29	3.28	3.27
IRR	86.62%								
NPV	14.65								

Break Even Point

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
Oper. & Maintenance Exp	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.20
Sub Total*(G)*	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.20
Fixed Expenses								
Oper. & Maintenance Exp	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07
Interest on Term Loan	0.41	0.31	0.25	0.19	0.10	0.02	0.00	0.00
Depreciation *(H)*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sub Total (I)	0.70	0.60	0.55	0.49	0.41	0.32	0.31	0.31
Sales (J)	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
Contribution (K)	5.08	5.07	5.07	5.06	5.05	5.04	5.03	5.02
Break Even Point (L= G/I)	13.77%	11.86%	10.87%	9.64%	8.07%	6.39%	6.16%	6.23%
Cash Break Even {(I)-(H)}	8.91%	6.98%	5.99%	4.75%	3.18%	1.49%	1.25%	1.31%
Break Even Sales (J)*(L)	0.72	0.62	0.57	0.50	0.42	0.33	0.32	0.33

Return on Investment **₹ (in lakh)**

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	4.38	4.47	4.51	4.57	4.64	4.72	4.72	4.71	36.73
Net Worth	5.25	8.37	11.27	14.20	17.18	20.21	23.24	26.27	126.00
									29.15%

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Cash Inflow									
Profit after Tax	4.08	3.12	2.90	2.93	2.98	3.03	3.03	3.02	19.04
Depreciation	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.48
Interest on Term Loan	0.41	0.31	0.25	0.19	0.10	0.02	0.00	0.00	1.27
Total (M)	4.73	3.67	3.40	3.37	3.33	3.29	3.28	3.27	21.79

DEBT

Interest on Term Loan	0.41	0.31	0.25	0.19	0.10	0.02	0.00	0.00	1.27
Repayment of Term Loan	0.24	0.48	0.60	0.72	0.96	0.51	0.00	0.00	3.51
Total (N)	0.65	0.79	0.85	0.91	1.06	0.53	0.00	0.00	4.78
Average DSCR (M/N)	4.56								

Annexure:-6 Procurement and implementation schedule

S. No.	Activities	Weeks											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Ordering the raw materials & procurement												
2	Installing the oxygen sensor and the blower motor with VFD												
3	Checking the new apparatus												

Break up of shutdown period of plant required

S.No	Activity	Day
1	Installation of motor with VFD	1
2	Installation of oxygen analyser	2

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	Ambetronics Engineers Private Limited	+91-22-66995525, 28371143	Mr. Jai Mohan Jha lamtec@ambetronics.com
3	Yantra Shilpa Udyog (P) Ltd	12-B, Amritlal Bose Street, Kolkata-700 005	Mr. Swapan Kr. Dutta Phone : 91-33-2555 0316 / 2555 0539 Fax : 91-33-2555 1995 Email : htsu@cal3.vsnl.net.in Web : www.hytsu.co.in

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

Technosoft Consultancy & Services

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

ePower-Process-Pollution Control Systems&Solutions

QUOTATION

IISWBM Management House College Square West Kolkata - 700073	OUR REF.:TCS/IISWBM/ACDPM/**E1**/10-11/12Q133 DATE : 30.12.10 YOUR REF.: <basudevroy@gmail.com> DATE :

Kind Attn. Mr. Basudev Roy
Sub: Your requirement AC Drive Panel & 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	PARICULARS	Qty.	PRICE in each (Rs)
1.1	**Kirloskar Electric** make, VVVF Drive panel along with VFD Duty Motors suitable for 15kW Blower application along with ½HP Fuel Pump application in PID control mode along with feedback signal of Oxygen Analyzer through flue gas analysis. *Technical Specification as per ANNEXURE	1 set	**1,40,000.00**

2. Packing & Forwarding charges : Extra @2% on Basic Order Value. **(Discounted)**
3. Taxes & duties : Central Excise Duty, Cess on Excise duty and Sales tax are extra ruling at the time of supply. Presently ED is 10.3% and CST @2% against 'C' Form, OR Full Tax.
4. Freight & insurance charges : Extra at actual and to be borne by you.
5. Dispatch : 6-8 weeks from the date of receipt of P.O.
6. Payment Terms : 50% along with P.O. and balance with taxes against Proforma Invoice prior to dispatch.
7. Warranty : As per (product / component used in systems)manufacturer 12 months for any inherent manufacturing defect or faulty workmanship.
8. Validity : 7 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) Material will be dispatched from KEC Ex-factory, 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

Associates of Industrial Electrical, Electronics & Automation group of
KIRLOSKAR ELECTRIC CO. LTD.

ANNEXURE

TECHNICAL SPECIFICATION:-

PANEL

Kirloskar Electric make, FLOOR STANDING Steel Frame Base, Powder Coated **IP 52 Class Protection** Siemens Grey & Azure Blue colours, enclosure with filter-fitted-ventilators & HSC-fans, housing following accessories: -

Drive Modules (**Kirloskar Electric** make **TG600** model – **Input** - 415 VAC **±15%** , 47~63Hz ; **Output** - 0~rated Voltage , 0~600Hz ; Programmable Digital & Analog I/O and Relay O/P ; **Control mode** –suitable for Blower application ; **Overload Capacity** – suitable for Blower application ; **Starting Torque** – suitable for Blower application ;
Special Features : Energy Saving function ; Auto Torque Boost , Auto Carrier Frequency adjustment ; AVR function ; Pre-warning overload Alarm ; Password Protection ; Parameter Copy ; S-curve ensures smooth acceleration & deceleration ; Speed Trace function (catch-on fly)& Non-Stop Function while instantaneous power failure ; Simple PLC & Multi-Segments Speed Control function offers 16 segments speed control ; Quick / Jog function offers multi-function shortcut key defined by user ; Motor Auto Tuning & PID Control function offers precise process control; Fault History with System Status ; upto 29 functions for failure protection.
Environmental Conditions - Ambient Op. temp. **-10°C - +50°C** ; Humidity ≤95% Non-condensing ; Altitude On 1000m without derating.

Protections – appropriate for Control & Power Ckt., Input & output AC Reactor and Built-in DC Reactor appropriate designed to improve Power Factor & prevent the system damage result from sudden variation of Power Voltage or Harmonics generated.

Operational Features – Start, Stop, Flt-Rst, Lockable Speed-Set Pot with Dial Knob

Digital Multifunction Meter auto scroll type to display Input Voltage, Current & Frequency
Digital RPM Meter for Process Status.
Digital display unit Panel facia unit for system status monitoring.

Indicators - R, Y, B Control On, Inverter On and Inverter Trip indications
Alarm – Pre-warning overload & fault condition

Manual / Auto mode selection

Technosoft Consultancy & Services

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

ePower-Process-Pollution Control Systems&Solutions

QUOTATION

IISWBM Management House College Square West Kolkata - 700073	OUR REF.:TCS/IISWBM/OA/**E1**/10-11/12Q134 DATE : 30.12.10 YOUR REF.: <basudevroy@gmail.com> DATE :

Kind Attn. Mr. Basudev Roy
Sub: Your requirement Oxygen Analyzer
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	PARICULARS	PRICE in each (Rs)	Qty.	Amount (Rs.)
1.1	**Zirconia based In-situ Oxygen Analyzer system for Flue gas analysis** Separate type Zirconia Oxygen Converter Zirconia Oxygen Probe (18" length) with SS filter Interconnecting cable 6 meters Probe protector (18" length) Flow meter 0.1 to 2 SCFH Flow meter 0.1 to 5 SCFH	2,10,000.00	1SET	2,10,000.00
1.2	Installation & Commissioning charges	20,000.00	1 no	20,000.00
	Optional accessories			
1.3	Calibration Gas Cylinders			
	0.4% O2 balance nitrogen	15,000.00	1 no	15,000.00
	8.0% O2 balance nitrogen	15,000.00	1 no	15,000.00
1.4	Auto calibration unit	22,000.00	1 no	22,000.00
1.5	Double stage SS regulator	7,200.00	2 no	14,400.00
1.6	Extra 7 core cable (incase distance between probe and converter is more than 6 meters)	450.00/per meter		

2. Packing & Forwarding charges : Extra @2% on Basic Order Value.
3. Taxes & duties : As applicable during the time of dispatch.
4. Freight & insurance charges : Extra at actual and to be borne by you.
5. Dispatch : 12-14 weeks from the date of receipt of P.O.
6. Payment Terms : 50% along with P.O. and balance with taxes against Proforma Invoice prior to dispatch.
7. Warranty: As per (product/component used in systems)manufacturer 12 months for any inherent manufacturing defect or faulty workmanship
8. Validity : 7 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) Material will be dispatched from Maharashtra on E1 transaction to Consignee Address.
SCOPE OF SUPPLY :- A. Design, engineering, & supply for the quoted system as per the technical specification enclosed.
B. Complete supervision of installation & commissioning of the quoted system.
C. Installation of cables, civil work & electrical work is to your account.
D. **UTILITIES AND INSTALLATION REQUIREMENTS: TO BE ARRANGED BY THE BUYER**
Instrument air with regulator at the cabinet/shelter (2- 6 Bar, consumption 40 liters / minute)

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

Associates of Industrial Electrical, Electronics & Automation group of
KIRLOSKAR ELECTRIC CO. LTD.

Zirconia Flue gas Oxygen Analyzer System consists of

a) Separate type Zirconia Oxygen Converter 1 no

Specifications

- Microcontroller based unit
- 16x2 back-light LCD display and 4x2 keypad for user interface
- Auto & manual calibration facilities
- Oxygen measurement range: 0-10%, 0-25% & 0-100% programmable
- Repeatability: ± 0.5%
- Response: T90 less than 5 Sec
- Contact o/p: 4 points
- Ambient Temperature: up to 55 deg C
- Built-in multimeter for voltage & current measurement
- Display facility of cell temperature and emf
- Wall mounting and powder coated IP 65 enclosure as per the industrial standards
- One isolated and linear 4-20mA current output
- In-built PID controller
- Programmable events incase of sensor, heater, thermocouple & other failure
- IP65 standard.
- Power Supply 110 VAC, 50 Hz

b) Zirconia Oxygen Probe with dust filter 1 no

Specifications

- Oxygen measurement range : 0-10%, 0-25% & 0-100% programmable
- Insertion length : 18"
- Static system accuracy : 5% of reading
- Dynamic system accuracy : 1% of reading
- System response time : less than 3 seconds
- Sample gas temperature : 10 °C to 760 °C
- Ambient temperature : 0 °C to 55 °C
- Probe material : SS 316 L
- Installation : Flange mounting
- Power supply : 90 to 110 V Ac at 50 Hz.
- Power requirement : 150 Watts
- Reference air : Clean dry instrument quality air
- Calibration gas : minimum two oxygen concentrations between 0.40% and 20.95%
- Mounting : 90mm diameter insertion hole. Adapter plate to be welded or anchored on process wall.

Features

- Zirconium oxide sensor giving real time measurement of excess oxygen
- Insitu calibration facility
- Self cleaning unbreakable ceramic filter for maintenance free operation
- Completely field repairable
- Disc type sensor can withstand shocks better than thimble type sensors

c) Probe protector 18"

d) Interconnecting cable 6 meters

AMBETRONICS™
AN ISO 9001 : 2000 COMPANY

Ambetronics Engineers Pvt. Ltd.

Manufacturers of Process Control & Gas Detection Instruments & Automation System Integrator

17-B, Tarun Industrial Estate, Mogra Pada, New Nagardas Road, Andheri (East), Mumbai - 400069, India.
Tel.: +91-22-66995525, 28371143 • Fax: +91-22-28226570 • E-mail: sales@ambetronics.com • Web: www.ambetronics.com

MPSM (Energy Management)
Secretary AEE India Chapter & Energy Club
IISWBM, Management House
College Square West, Kolkata - 700 073, INDIA

Ref. : AEPL/PLD
Date : 22nd nov2010

Tel. : 94331 53009; Fax 033 22413975 (pp)
NOTE : pktiwari@beenet.in

Kind Attn. : **Mr. B K Choudhury, PhD (IIT)**

Sub. : **Your requirement of O2 analyzer.**

Dear Sir,

This refers to your email enquiry regarding above subject requirement. Thanks for the same.

We are a leading **ISO 9001:2000** certified company & reliable source with vast experience in the field of **Portable Gas detectors, Fixed type Online Gas Detection Systems & Pollution Monitoring Systems** providing standard and customized solutions for the safety monitoring against gas leak hazards for any plant / establishment / equipments.

We have proven professional expertise to execute the job on Turn-Key basis from design to commissioning with an efficient SERVICE AFTER SALES base. We undertake **Calibration Services** & **Annual Maintenance Contract** of all Indian / Imported Gas Detector, Analyzer and Transmitter.

Referring to your present requirement, we are pleased to submit our offer as below:

- **O2 analyzer**

We have some list of our satisfied user clients including such reputed names as **INDORAMA**, **GARDEN SILK**, **IOCL**, **POLLAD** and many more…

We are enclosing herewith relevant catalogue of the offered model.

Trust, you would find our enclosed quotation in order and look forward to the pleasure of receiving your valued order. Should you need any further clarification / information please feels free to get in touch with us.

Yours truly,
For **AMBETRONICS ENGINEERS PVT. LTD.**

Mr. Jay Mohan Jha
Mo: 09320657646
Encl.: ***Quotation***

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AN ISO 9001 : 2000 COMPANY

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17-B, Tarun Industrial Estate, Mogra Pada, New Nagardas Road, Andheri (East), Mumbai - 400069, India.
Tel.: +91-22-66995525, 28371143 • Fax: +91-22-28226570 • E-mail: sales@ambetronics.com • Web: www.ambetronics.com

MK/AM/02 REV.:1.1
w.e.f.01/072008

QUATATION

Client : Energy Management
Ref. : By phone, mail Date : 22nd nov, 2010

Sr. No.	Description	Qty.	Unit Price In Rs.	Amount In Rs.
1.	Lambda Probe LS 2-K, semi automatic calibration, Length: 500 mm **(ORDER CODE NO- 650R2030)**	1NO	159600.00	159600.00
2.	LT2 IN WALL MOUNTING CASE IN FOLLOWING VARIANT: FOR PROBE: LAMBDA-PROBE LS2 TYPE: SEMI AUTOMATIC CALIBRATION **DISPLAY: 657R0831/ R0833 INTERNAL** PRESSURE SENSOR: ABSOLUT & DIFFERENCE PRESSURE ANALOGUE OUTPUT 1: 657R0050 4...20mA ANALOGUE OUTPUT 2: WITHOUT ANALOGUE OUTPUT 3: WITHOUT ANALOGUE OUTPUT4: WITHOUT ANALOGUE INPUT 1: DIFFERENCE PRESSURE ANALOGUE INPUT 2: ABSOLUTE PRESSURE ANALOGUE INPUT 3: WITHOUT ANALOGUE INPUT 4: WITHOUT RM / LI / CONTROLLER / LOAD: WITHOUT EFFICIENCY: WITHOUT SUPPLY VOLTAGE: 230VAC REFERENCE AIR PUMP: WITHOUT CASE HEATING: WITHOUT CO-MONITORING / CONTROLLING: WITHOUT CALCULATIONS: WITHOUT LANGUAGE: ENGLISH/GERMAN SPECIAL CONFIGURATION: WITHOUT **(ORDER CODE NO- 657R102)**	1NO	283300.00	283300.00
	Grand Total			**442900.00**

Pump unit for reference air (20.96%) only
Necessary, if there is no instrument air available at the plant.

RUPEES: four lakh forty two thousands nine hundred only.

For **AMBETRONICS ENGINEERS PVT. LTD.**

Mr. Jay Mohan Jha
TEL.: 022-66995525, 26/ 28371143
FAX: 022-28226570, mob : 09320657646
EMAIL.: lamtec@ambetronics.com

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AN ISO 9001 : 2000 COMPANY

Ambetronics Engineers Pvt. Ltd.

Manufacturers of Process Control & Gas Detection Instruments & Automation System Integrator

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Tel.: +91-22-66995525, 28371143 • Fax: +91-22-28226570 • E-mail: sales@ambetronics.com • Web: www.ambetronics.com

MK/AM/02 REV.:1.1
w.e.f.01/072008

COMMERCIAL TERMS & CONDITIONS

1	PRICE	:	The price indicated is for supply of material ex-factory basis. Packing, Forwarding Freight, Insurance, Installation & commissioning shall be Extra to your account.
2	TAXES	:	12.5% VAT for instrument. 4% VAT for software in Maharashtra. CST 2% against form 'C' out of Maharashtra
3	SERVICE TAX	:	10.3% SERVICE Tax for calibration/ Installation/ Commissioning/ Repairing.
4	PACKAGING	:	Not applicable if you pick up from our factory in Andheri, (Mumbai). 1% for Wooden Packing charges shall be on order value for Transport, Export purpose.
5	FREIGHT	:	2% OR At actual borne by PURCHASER; Send your transport details.
6	INSURANCE	:	Goods will be dispatched only at owner's risk and if you want the goods to be insured the insurance charges to be born by you.
7	PAYMENT TERM	:	50% with PO & 50% against Proforma Invoice through DD.
8	BANK DETAILS	:	If the material is through bank then all the bank charges will be born by you. Please inform us complete postal address of your bankers. Our bank details are BANK OF INDIA, S.V.RD., ANDHERI (W), MUMBAI – 400 058
9	DELIVERY	:	3/4 weeks From the date of your Commercially & Technically clear purchase order.
10	INSPECTION	:	The goods will be offered for inspection at our factory. Please intimate us the date of inspection along with the order copy. Otherwise, we will assume that inspection has been waived & we will dispatch the material.
11	VALIDITY	:	60 days from date of submission.
12	WARRANTY	:	12 months from the date of delivery of the instrument against faulty material or manufacturing defects. (The Warranty does not include site support / repairs)
13	SERVICE AFTER SALES	:	The service support in warranty period & after warranty period is offered from our factory at Mumbai. In case if the service support is required at the site the same will be taken up on the chargeable basis.
14	DOCUMENTS SUPPLY ALOGN WITH MATERIAL	:	Operating Instrument Manual, Test & Calibration Certificate, Warranty Certificate will submit you along with the ordered material on dispatch.
	NOTE	:	Delivery & Quotation validity are subject to force Major Clauses (Government Actions, War, Disasters, Economy / Exchange, Crisis Etc.)

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

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