DETAILED PROJECT REPORT
ON
AIR PRE HEATER & DRYING BED
HOWRAH CLUSTER











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Prepared By

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AIR PRE-HEATER AND DRYING BED FOR GALVANIZING AND ANNEALING FURNACES

HOWRAH GALVANIZING
AND WIRE DRAWING CLUSTER

BEE, 2010

Detailed Project Report on Air-Pre Heater and Drying Bed for Galvanizing and Annealing Furnaces

Galvanizing and Wire Drawing SME Cluster,

Howrah, West Bengal (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No: ***HWR/WDG/APH/01***

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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 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. Conventionally, the flue gas from these furnaces is simply allowed to escape, taking away a lot of unused heat. A part of the wasted heat maybe recovered by installing apparatus and could be used to heat the job in the drying bed replacing furnace oil which is in use presently. The rest of the wasted heat maybe recovered by installing apparatus like Air Pre-Heater where the secondary air to be used for combustion is pre-heated, thereby consuming less fuel. This DPR studies the implementation of such a scheme to save energy.

Installation or proposed technology i.e. installation of air pre heater and dyeing bed in the existing situation would lead fuel saving upto19083 litre furnace oil per year.

This DPR highlights the details of the study conducted for assessing the potential for installation of Air Pre Heater and Dyeing Bed, 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)	5.32
2	Furnace Oil saving	litre/year	19083
3	Monetary benefit	₹ (In lakh)	5.72
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	Years	0.93
6	NPV	₹ (In lakh)	15.91
7	IRR	%age	83.73
8	ROI	%age	28.99
9	DSCR	Ratio	4.40
9	Process down time	Days	5
10	CO_2 reduction	Ton /year	65

The projected profitability and cash flow statements indicate that the project implementation i.e. installation of drying bed as well as air pre heater 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 SMEs.

Capacity building of stakeholders in cluster on energy efficiency

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

Implementation of energy efficiency measures

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

Facilitation of innovative financing mechanisms for implementation of energy efficiency projects

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

1 INTRODUCTION

1.1 Brief Introduction about cluster

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 (of 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, 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	Coal	Ton/year	1161	18.5
5	Wood	Ton/year	600	4

Classification of Units

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

1) Product wise
2) Production capacity wise

Products Manufactured

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

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

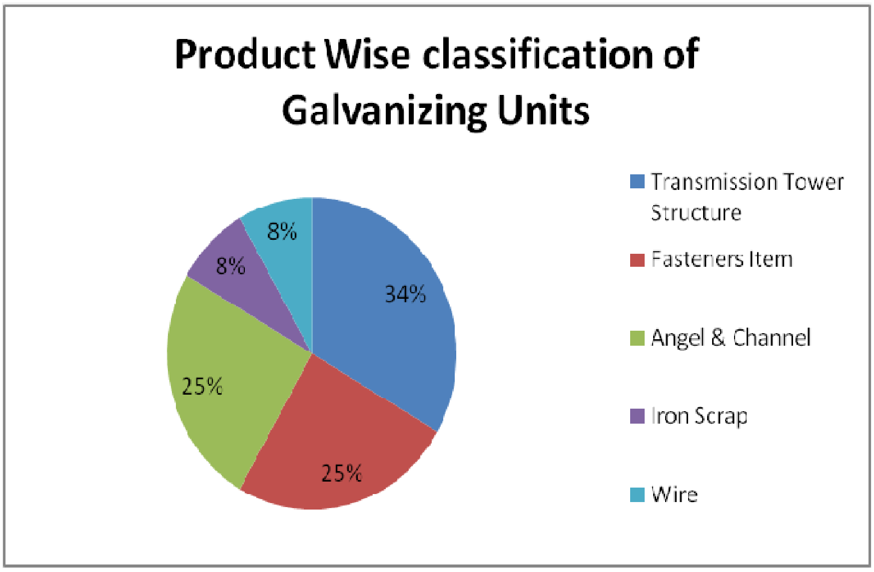


Figure 1.1: Product Wise Classification of Galvanizing Units

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

a) MS wire

b) Copper Wire

c) High carbon wire

d) Aluminium wire

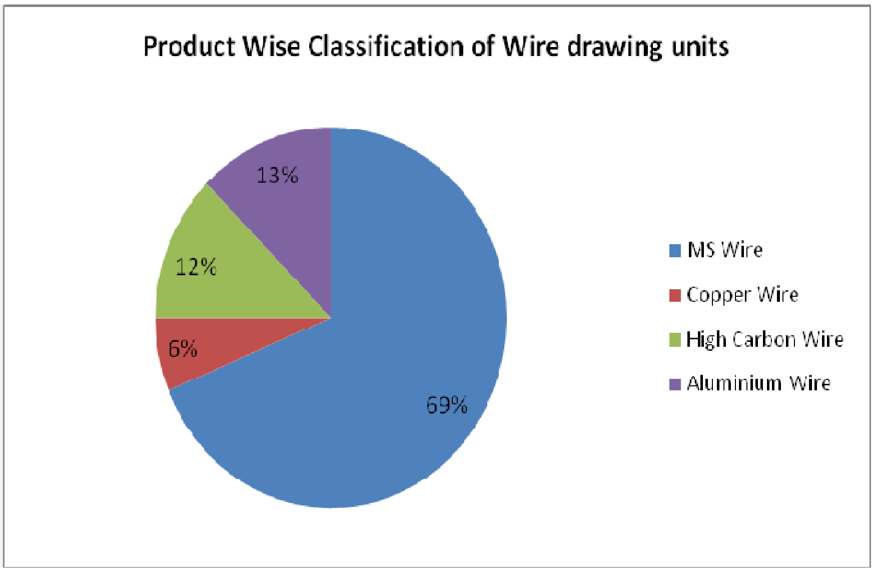


Figure 1.2: Product Wise Classification of Wire-drawing Units

Capacity wise production

In both Wiredrawing and Galvanizing units in Howrah, the production capacity has been found to vary more than 10 folds. In the units, where detailed audit has been performed, there are Wire-drawing units producing as low as 241 Ton/year to as high as 3500 Ton/year. Similarly, the production from Galvanizing units, where audit was performed, has been found to be within the range of 890 to 7500 Ton per annum. Both the Galvanizing and the Wire Drawing units have been classified on the basis of production into three categories, namely 1-500 TPA (calling micro scale), 500-1000 TPA (small scale) and above 1000 TPA (medium scale) capacities. 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 has been depicted in Figures 1.3 and 1.4 below:

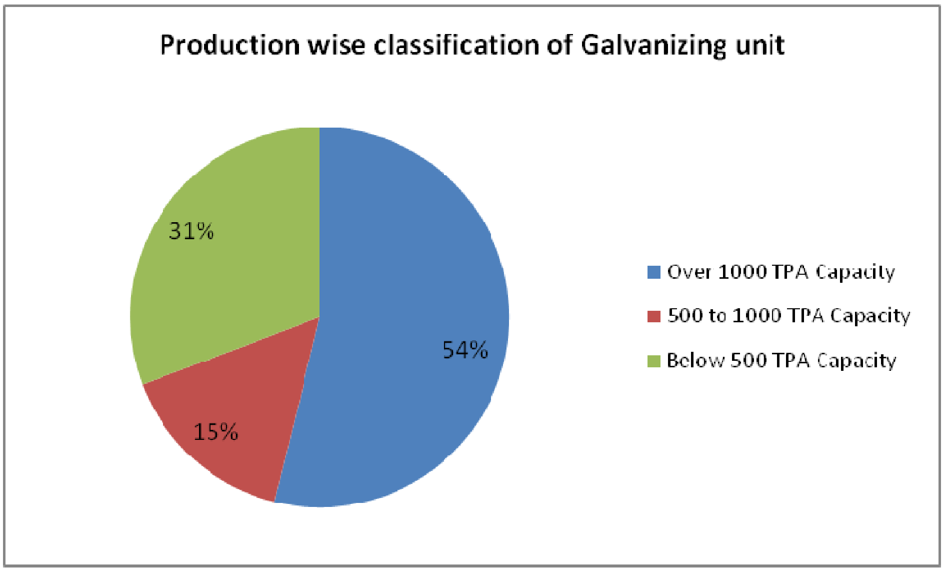


Figure 1.3: Production Wise Classification of Galvanizing Units

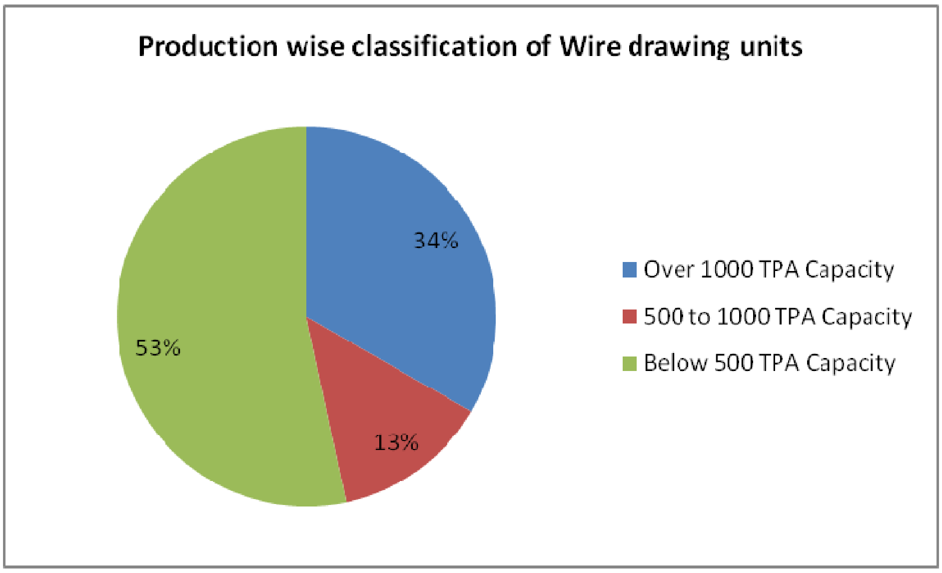


Figure 1.4: Production Wise Classification of Wire-drawing Units

Energy usages pattern

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

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

General production process for the wire drawing units

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

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

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

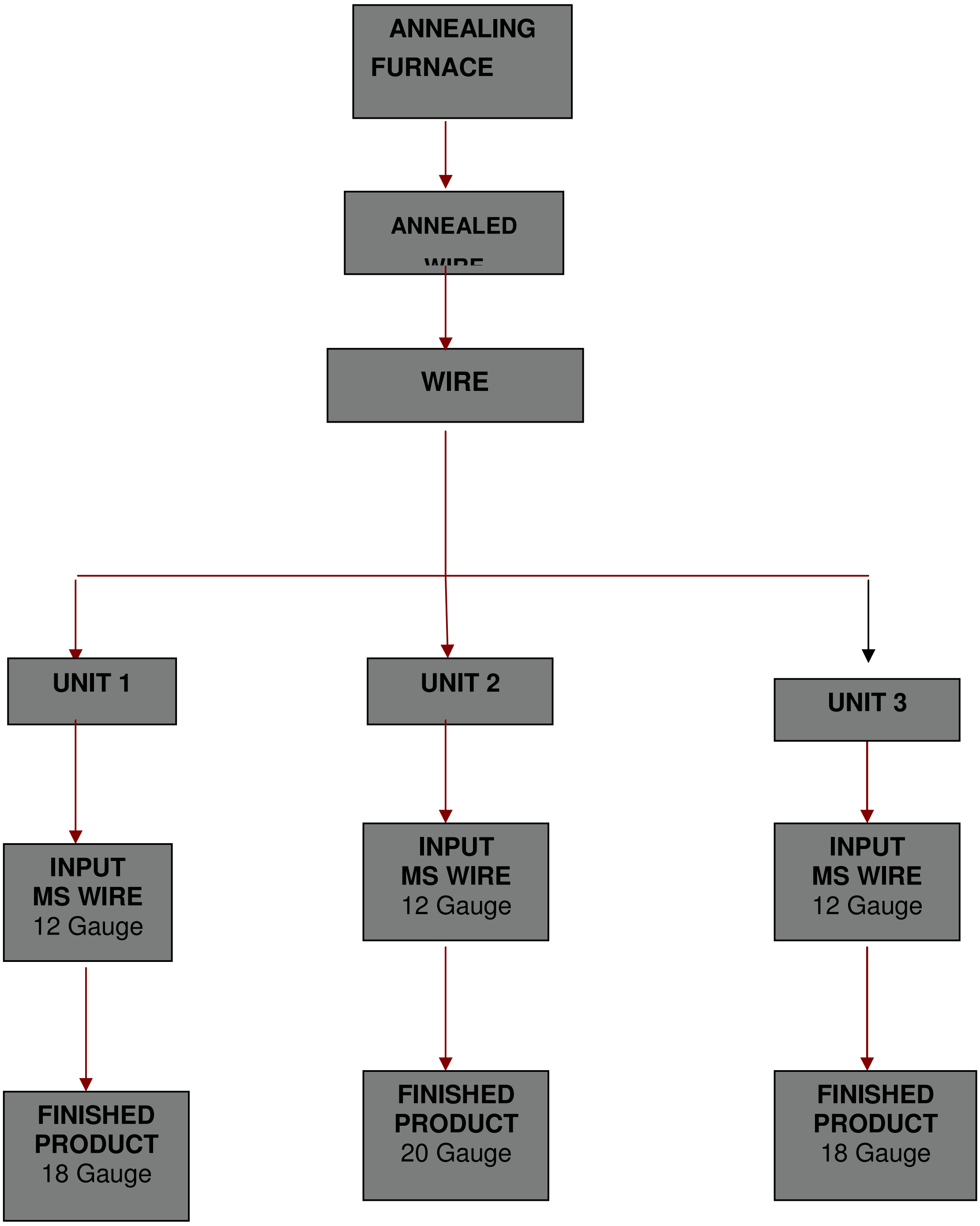


Figure 1.5 Process flow diagram for a typical wire drawing unit

General production process for the galvanizing units

In a typical galvanizing unit, the production process involves seven stages as is shown in the schematic diagram in Figure 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 or diesel based drying bed or flux solution for preheating and drying purpose. This helps produce a uniform layer of zinc on the job surface when the job is dipped in the zinc bath. Then after the drying process is over, the job is dipped into the zinc bath for galvanizing where a layer of molten zinc is deposited uniformly over the job surface.

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

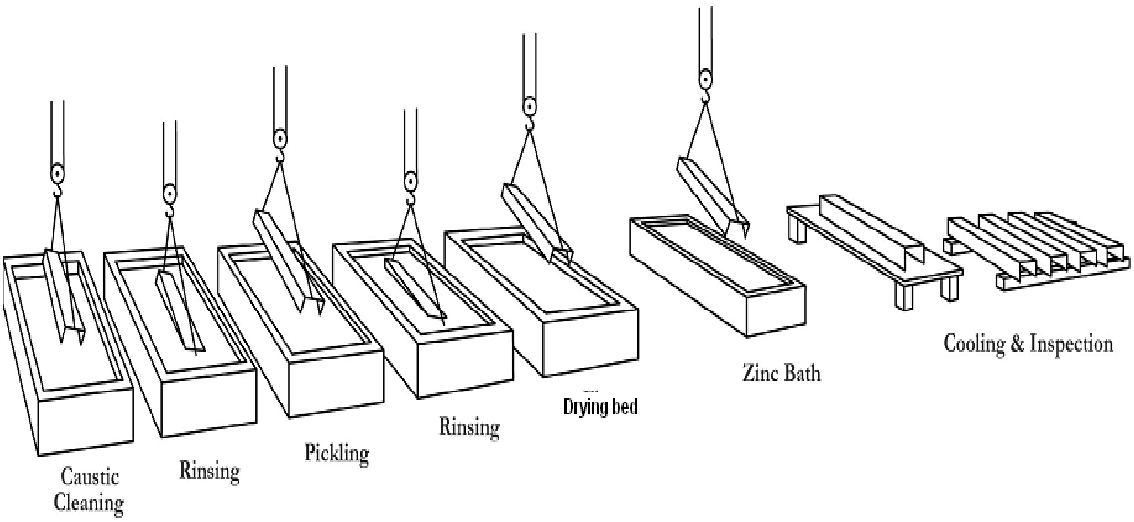


Fig 1.6: Process Flow diagram of galvanizing unit

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

Energy	Micro	Small	Medium		
Scale of Unit	Electricity	Electricity	Electricity	LPG	Wood
	kWh/ yr	kWh/ yr	kWh/ yr	Ton/yr	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
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)		
		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

In a galvanizing unit, furnace oil or coal is being used to heat the job in the drying bed The percentage of the cost of furnace oil among the entire fuel bill is about 91% and costs approximately Rs Rs.0. 30 lakh per year in a typical unit.

The primary use of the furnaces in galvanizing units is to melt zinc into which the job to be galvanized is dipped. IS: 2629 – 1985 suggests temperature of the zinc vat as 440 - 460 deg C. Before dipping into the galvanizing bath the job is dried in the drying bed.

Existing furnace and drying bed specifications are shown in Table 1.7 below.

Table 1.7 Cluster specifications of furnace and drying bed

S. No.	Parameter	Detail of furnace	Detail of drying bed
1	Manufacturer	Local	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	6.2 m X 1.5 m
3	Average fuel consumption	31 to 91 l/hr F.O.	3 to 27 l/hr F.O. or 6 to 83 kg/hr Coal
4	Temperature	460 to 490 deg C molten zinc	100 to 200 deg C
5	Typical wall temperature	90 to 150 deg C	90 to 150 deg C
6	Ambient temperature max	40 deg C	40 deg C

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 and diesel oil in a typical unit is ₹ 30/ltr and ₹ 37/ltr respectively.

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 Rs. 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 charge is ₹ 15/kVA. Thus the energy charge for a typical unit with contract demand of 35.6 kVA and average monthly energy consumption of 4946 kWh is ₹ 5.21 / 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. Before dipping into the galvanizing bath the job is dried in the drying bed.

1.4 Baseline establishment for existing technology

1.4.1 Design and operating parameters

The typical furnaces used at present in the galvanizing and wire drawing units provide temperatures of 460 to 500 deg C. The typical dimension of furnace is 104 inch X 96 inch X 39 inches.

Table 1.10 Present furnace and drying bed furnace specifications

S. No.	Parameter	Detail of zinc vat furnace	Detail of drying bed furnace
1	Manufacturer	Local	Local
2	Dimensions	104 inch X 96 inch X 39 inch	31 inch X 24 inch X 10 inch
3	Average fuel consumption	41 l/hr F.O.	27 l/hr F.O.
4	Temperature	465 deg C molten zinc	100 to 200 deg C
5	Temperature of the furnace	Up to 1200 deg C	500 deg C
6	Capacity	5 Ton zinc; 1.5 Ton per hour	1.5 Ton per hour
7	Typical wall temperature	90 deg C	90 deg C
8	Ambient temperature max	40 deg C	40 deg C

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

S. No.	Energy Type	Unit	Value
1	Electricity	kWh/yr	59346
2	Furnace Oil	litre/yr	105000

1.4.2 Operating efficiency analysis

Operating efficiency for a normal furnace is found to be in the range of 15 to 25%. Detail of calculations of efficiency by the direct and the indirect methods is furnished 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 employed in the units are generally skilled works but not engineers. Thus the production process remains traditional. This is one of the main hindrances in adopting newer technology. Specialized training among the workforce and local experts can circumvent the problem significantly. Effective dissemination can enhance replication potential in the various units. The gains obtained by one plant can inspire other units to follow suit.

2. PROPOSED EQUIPMENT FOR ENERGY EFFICENCY IMPROVEMENT

2.1 Description of proposed equipment

2.1.1 Details of proposed equipment

All the galvanizing units and some wire drawing units have one main furnace and one side furnace in them. The main furnace let flue gas out at temperatures of 400-600 ^{o}C which simply escape to the environment. The heat in the flue gas could be reused to completely bypass using fuel in the secondary furnaces. The flue gas line is designed in such a way as to circulate under the drying bed furnace, thereby heating it in the process. The temperature required at drying bed furnace would be such that the job temperature is above 80 deg and not more than 150 deg C. The rest of waste heat is utilizing in the air pre heater. If the secondary combustion air to the furnace is pre-heated using the Air Pre-Heater, the furnace requires less fuel.

2.1.2 Equipment/technology specification

The furnaces used typically dump flue gases at temperatures of 400-600 ^{o}C. The device to boil flux solution reuses this waste heat. After using the flue gas in boiling flux solution, it is used in the air pre heater.

Table 2.1 Technical specification of an air pre-heater

S. No	*Parameter*	*Detail*
1	Manufacturer	YANTRA SHILPA UDYOG (P) LTD.
2	Dimensions of APH	1 m x 1 m x 1.5 m
3	Chimney diameter	12 inch
4	Air mass flow rate	657 kg/hr
5	Temperature of fresh air at the APH inlet	30 deg C
6	Temperature of combustion air at the APH outlet	120 deg C
7	Typical temperature of flue gas going into APH	574 deg C
8	Typical temperature of flue gas coming out of APH	464 deg C
9	Expected improvement in efficiency	4.8 %

Table 2.2 Technical specification of the drying bed

S. No	Parameter	Detail
1	Manufacturer	YANTRA SHILPA UDYOG (P) LTD.
2	Dimensions of the drying bed	6.2 m x 1.5 m
3	Quantity of bed materials	500 – 1000 kg/hr
4	Mass flow of hot air required	200 – 250 kg/hr
5	Typical temperature of flue gas going into the drying bed	464 - 574 deg C
6	Typical temperature of flue gas coming out of the drying bed	300 - 350 deg C
7	Ambient temperature max	40 deg C

2.1.3 Integration with existing equipment

The flue gas coming out of the furnace could be circulated in a channel under the flux solution container. This apparatus could be installed separately and would not affect the operation of the furnace in any way. The rest of the flue gas after using in boiling flux solution vat, could be put into the inner channel of an Air Pre-Heater where the combustion air would circulate on the outer side.

The following are the reasons for selection of this technology

- It will reduce the total amount of fuel required.
- 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 fuel required due to use waste heat available in flue gas.

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 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 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 Performa 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 be five days for making changes to the flue gas line and install the drying bed and APH. 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 three years. Risk involves in the implementation of proposed project is to avoid any leaks on the inner channel to avoid mixing of the flue gas with the fresh air going in. Such leaks can affect the combustion process severely.

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 1712 Ton/year and having total furnace oil consumption of about 105000 litre/year.

3. ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical benefit

3.1.1 Fuel saving

Installing Air pre heater and the drying bed would save more than 4089 liters and 14994 liters of furnace oil respectively over a year. Presently only FO is being used to heat the job in the drying bed. Using the heat from flue gas in the drying bed would help in reducing the consumption of FO by 17 – 18%.

3.1.2 Electricity saving

This project does not affect the electricity consumption ***directly or indirectly.***

3.1.3 Improvement in product quality

The quality of the product would still remain the same. It shall have no impact on the galvanizing process but merely make it 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 is same even after the implementation of proposed technology.

3.1.6 Reduction in other losses

It does not effect on the modes of heat lost but merely recovers the heat dumped into the flue gas.

3.2 Monetary benefits

The monetary benefits of the unit are mainly due to reduction in the furnace oil consumption by 19083 litre/yr. This amounts to monetary savings of ₹ 5.72 lakh/yr. A detailed estimate of the saving has been provided in the Table 3.1.

3.3 Social benefits

3.3.1 Improvement in working environment

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

Table 3.1 Energy and monetary benefit

S.No	Parameter	Unit	Value
1	Present furnace oil consumption in a unit	litre/year	105000
2	Cost of furnace oil	₹/litre	30
3	Savings by using APH	litre/year	4089
4	Saving by using flue gas for the drying bed	litre/year	14994
5	Monetary savings due to APH and drying bed	₹/year	572508
6	Total monetary benefit	₹/year	572508

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

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 would be less effluent generation since there would less fuel burned in the furnace.

3.4.2 Reduction in GHG emission

The measure helps in reducing CO_2 emission since it reduces 21873 kg of FO annually which leads to the reduction of 65 Ton/yr of CO_2 as taking conversion factor of 77.37 kg CO_2/GJ.

3.4.3 Reduction in other emissions like SO_X

Significant amount of SO_X will be reduced amounting to 120 kg/yr due to reduction in FO consumption, as 0.006318 kg of SO_X would be reduced for a reduction of 1 kg of FO.

4 INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of project

4.1.1 Equipment cost

The cost of Air Pre Heater (APH) is ₹ 1.80 Lakh. The cost of the drying bed is Rs. 2.0 Lakh as per the quotation provided by the vendor also mention at the Annexure 8.

4.1.2 Erection, commissioning and other misc. cost

The installation & other costs could amount to a further ₹ 1.52 lakh. Detail of project cost is given in the Table 4.1 below:

Table 4.1 Details of proposed technology project cost

S.No	Particular	Unit	Value
1	Cost of APH and drying bed solution	₹ (In lakh)	3.8
2	Cost of Installation	₹ (In lakh)	0.90
3	Taxes & other misc. cost	₹ (In lakh)	0.62
4	Total cost	₹ (In lakh)	5.32

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

The total cost of the APH with drying bed is ₹ 5.32 lakh. The entrepreneur shall have to pay 25% of the total amount upfront i.e. ₹ 1.33 lakh. The rest could be arranged as loans.

4.2.2 Loan amount

Loan amount would be 75% i.e. Rs. 3.99 lakh. 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.

4.2.3 Terms & conditions of loan

The interest rate is considered at 10%, which is SIDBI's rate of interest for energy efficient projects (refer to annexure-9). The loan tenure is 5 years excluding initial moratorium period is 6 months from the date of first disbursement of loan.

4.3 Financial indicators

4.3.1 Cash flow analysis

Profitability and cash flow statements have been worked out for a period of 5 years excluding moratorium period of 6 months. 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 ₹ 5.72 lakh/yr.

- 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.

Considering the above mentioned assumptions, the net cash accruals starting with ₹ 4.42 lakh in the first year operation and gradually increases to ₹ 25.68 lakh at the end of eighth year.

4.3.2 Simple payback period

The total cost of implementing the proposed technology is ₹ 5.32 lakh and monetary savings is ₹ 5.72 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 ₹ 15.91 lakh.

4.3.4 Internal rate of return (IRR)

The Internal rate of return of the project would be 83.73%.

4.4 Return on investment (ROI)

The average return on investment of the project activity works out at 28.99%.

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	11
2	IRR	%age	83.73
3	NPV	₹(In lakh)	15.91
4	ROI	%age	28.99
5	DSCR	Ratio	4.40

4.5 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 (₹ in Lakh)	ROI (%age)	DSCR
Normal	83.73	15.91	28.99	4.40
5% increase in fuel savings	87.69	16.92	29.20	4.61
5% decrease in fuel savings	79.74	14.91	28.74	4.19

4.6 Procurement and implementation schedule

Procurement and implementation time required for implementation of proposed technology is about 9 weeks and their details are given in Annexure 6.

ANNEXURE

Annexure -1: Energy audit data used for baseline establishment

Calculation of efficiency of the furnace by the direct method

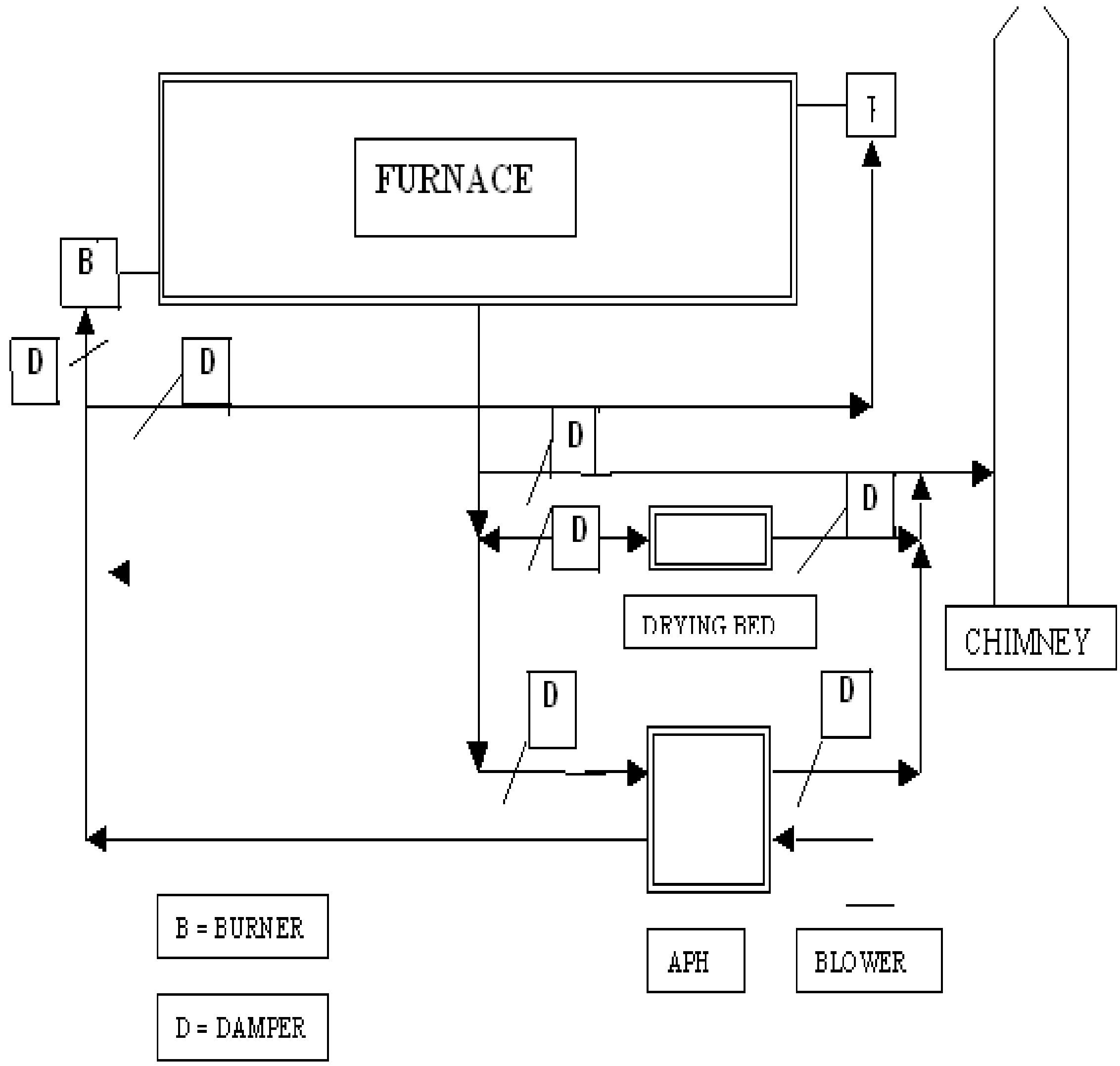
Particulars	Units	Values
Production	Ton/yr	1969.34
FO Consumption	litre/yr	105000
SG of FO	-	0.93
GCV of FO	kJ/kg	44100
Heat of FO (1 burner to drying bed + 4 burners to zinc bath)	kJ/yr	4306365000
Zinc VAT temperature	deg C	500
Heat taken by zinc (sensible + latent heat)	kJ/yr	39178050
Heat taken by iron	kJ/yr	395967316
Heat taken by Metals	kJ/MT	205392
Heat energy utilize (Output)	kJ/yr	435145366
Total Heat of FO (Input)	kJ/yr	4306365000
Efficiency (including preheat)	% age	10.10

Calculation of efficiency of furnace by the indirect method

Particulars	Units	Values
Flue gas temperature	deg C	574
Ambient temperature	deg C	40
Preheated air temperature	deg C	-
Specific gravity of FO	-	0.93
Average FO consumption	litre/hr	41
Average FO consumption	kg/hr	38.13
GCV of FO	kCal/kg	10500
Average oxygen percentage in flue gas	%age	5.8
Excess Air		38.16
Theoretical air required to burn 1 kg of oil	kg	15
Total air supplied	kg/kg of oil	20.72
Mass of fuel (1kg)	kg	1
Actual mass of air supplied/kg of fuel	kg/kg of oil	21.72
Specific heat of flue gas	kcal/kg/deg C	0.24
Temperature difference	deg C	496
Heat loss	kcal/kg of oil	2585.99
Heat loss in flue gas	% age	24.63
Moisture in 1kg of FO	kg/kg of FO	0.15
Flue gas temperature	deg C	576
Ambient temperature	deg C	40
Temperature difference	deg C	496

Evaporation loss due to moisture content in FO	%age	1.15
Amount of hydrogen in 1 kg of FO	kg/kg of FO	0.1123
Loss due to hydrogen present in fuel	% age	7.77
Area of surface of furnace walls	m2	48.94
Average temperature (Varying from 67 to 300 deg C)	deg C	110.43
Convective and Radiative heat transfer co-efficient	kCal/m2/hr	1219.29
Heat loss	kCal/hr	136283.79
Loss through furnace walls and heating oven top and side walls	%age	34.04
Unaccounted Heat loss	%age	15
Total Heat loss in %	%age	82.59
Efficiency (including preheat)	%age	17.41

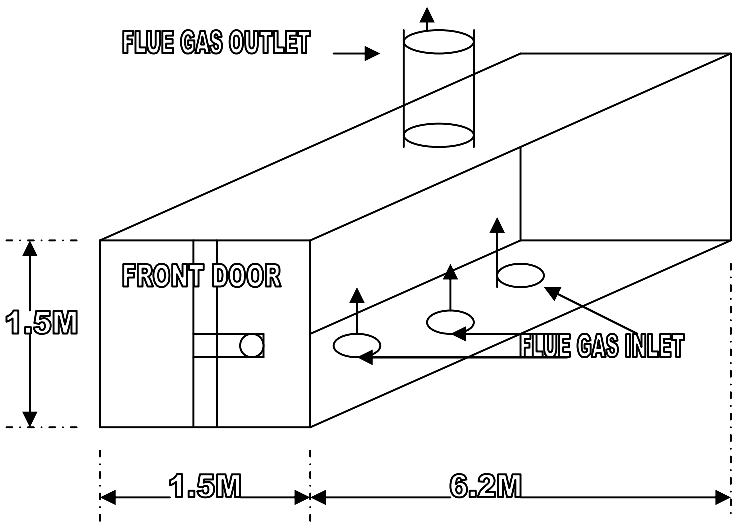
Annexure -2: Process flow diagram after project implementation



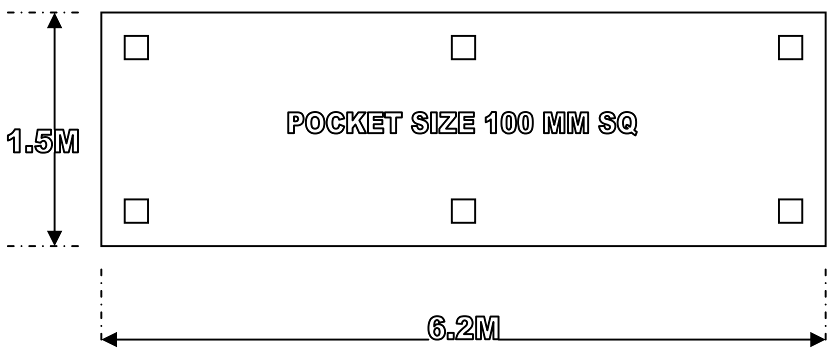
Annexure -3: Detailed technology assessment report

Particulars	Units	Value
Annual FO consumption cost	₹/yr	2555850
Temperature of the flue gas at APH inlet	deg C	574
The Temperature of the flue gas at APH outlet	deg C	464
Drop in temperature	deg C	110
Percentage fuel saving	%age	4.8
Savings due to APH	₹/yr	122680
Annual FO consumption cost	₹/yr	2555850
Savings percentage as per the average of six readings from Sun Steel	% age	17.6
Savings from the drying bed	₹/yr	449830
Total savings (APH + Drying Bed)	₹/yr	572510
Total investment (APH with drying bed)	₹	531940
Estimated life of system	Yrs	3
Simple payback	months	11

Annexure -4 Drawings for proposed electrical & civil works



GENERAL VIEW FOR DRYING BED



FOUNDATION LAYOUT FOR DRYING BED

Annexure -5: Detailed financial analysis

Assumption

Name of the Technology	Air pre-heater with drying bed		
Details	**Unit**	**Value**	**Basis**
Installed Capacity	kg/yr	657	Feasibility Study
No of working days	Days	300	Feasibility Study
No of Shifts per day	Shifts	1	Feasibility Study
Capacity Utilization Factor	%age	90	Feasibility Study
Proposed Investment			
Investment for Air Pre-heater	₹ in lakh	1.80	Feasibility Study
Investment for Drying Bed	₹ in lakh	2.00	
Cost of installation	₹ in lakh	0.90	
VAT 4 % will be charged	₹ in lakh	0.15	Feasibility Study
Packaging & forwarding	₹ in lakh	0.08	Feasibility Study
Excise duty (@ 10.3%) will be charged	₹ in lakh	0.39	
Total investment	₹ in lakh	**5.32**	
Financing pattern			
Own Funds (Equity)	₹ in lakh	1.33	Feasibility Study
Loan Funds (Term Loan)	₹ in lakh	3.99	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	%	5	Feasibility Study
Estimation of Revenue			
Fuel Saving (FO)	kg/yr	19083	
Cost of FO	₹/kg	30	
St. line Depn.	% age	5.28%	Indian Companies Act
Depreciation	% age	80	Income Tax Rules
Income Tax	% age	33.99	Income Tax Rules

Estimation of Interest on Term Loan

Years	Opening Balance	Repayment	Closing Balance	Interest
1	3.99	0.36	3.63	0.46
2	3.63	0.60	3.03	0.35
3	3.03	0.72	2.31	0.28
4	2.31	0.82	1.49	0.21
5	1.49	0.89	0.60	0.13
6	0.60	0.60	0.00	0.02
		3.99		

WDV Depreciation

Particulars / years	1	2
Plant and Machinery		
Cost	5.32	1.06
Depreciation	4.26	0.85
WDV	1.06	0.21

Projected Profitability Rs. (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Fuel savings	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72
Total Revenue (A)	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72
Expenses								
O & M Expenses	0.21	0.22	0.23	0.25	0.26	0.27	0.29	0.30
Total Expenses (B)	0.21	0.22	0.23	0.25	0.26	0.27	0.29	0.30
PBDIT (A)-(B)	5.51	5.50	5.49	5.48	5.47	5.45	5.44	5.43
Interest	0.46	0.35	0.28	0.21	0.13	0.02	-	-
PBDT	5.05	5.15	5.21	5.27	5.34	5.43	5.44	5.43
Depreciation	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
PBT	4.77	4.87	4.93	4.99	5.06	5.15	5.16	5.14
Income tax	0.27	1.46	1.77	1.79	1.82	1.85	1.85	1.84
Profit after tax (PAT)	4.50	3.41	3.16	3.20	3.24	3.30	3.31	3.30

Computation of Tax ₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	4.77	4.87	4.93	4.99	5.06	5.15	5.16	5.14
Add: Book depreciation	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Less: WDV depreciation	4.26	0.85	-	-	-	-	-	-
Taxable profit	0.80	4.30	5.21	5.27	5.34	5.43	5.44	5.43
Income Tax	0.27	1.46	1.77	1.79	1.82	1.85	1.85	1.84

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)	4.50	7.91	11.07	14.27	17.51	20.81	24.12	27.42
Term Loans (F)	3.63	3.03	2.31	1.49	0.60	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	9.46	12.27	14.71	17.08	19.44	22.14	25.45	28.75
Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32
Less Accm. depreciation	0.28	0.56	0.84	1.12	1.40	1.69	1.97	2.25
Net Fixed Assets	5.04	4.76	4.48	4.20	3.92	3.63	3.35	3.07
Cash & Bank Balance	4.42	7.51	10.23	12.89	15.52	18.51	22.10	25.68
TOTAL ASSETS	9.46	12.27	14.71	17.08	19.44	22.14	25.45	28.75
Net Worth	5.83	9.24	12.40	15.60	18.84	22.14	25.45	28.75
Debt Equity Ratio	2.73	2.28	1.74	1.12	0.45	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	3.99								
Profit After tax		4.50	3.41	3.16	3.20	3.24	3.30	3.31	3.30
Depreciation		0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Total Sources	5.32	4.78	3.69	3.44	3.48	3.53	3.58	3.59	3.58

Application									
Capital Expenditure	5.32								
Repayment Of Loan	-	0.36	0.60	0.72	0.82	0.89	0.60	-	-
Total Application	5.32	0.36	0.60	0.72	0.82	0.89	0.60	-	-
Net Surplus	-	4.42	3.09	2.72	2.66	2.64	2.98	3.59	3.58
Add: Opening Balance	-	-	4.42	7.51	10.23	12.89	15.52	18.51	22.10
Closing Balance	-	4.42	7.51	10.23	12.89	15.52	18.51	22.10	25.68

IRR

₹ (in lakh)

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		4.50	3.41	3.16	3.20	3.24	3.30	3.31	3.30
Depreciation		0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Interest on Term Loan		0.46	0.35	0.28	0.21	0.13	0.02	-	-
Cash outflow	(5.32)	-	-	-	-	-	-	-	-
Net Cash flow	(5.32)	5.24	4.04	3.72	3.69	3.65	3.61	3.59	3.58
IRR	83.73%								
NPV	15.91								

Break Even Point

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
Oper. & Maintenance Exp	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.22
Sub Total*(G)*	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.22
Fixed Expenses								
Oper. & Maintenance Exp	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07
Interest on Term Loan	0.46	0.35	0.28	0.21	0.13	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)	0.79	0.68	0.62	0.55	0.47	0.37	0.35	0.36
Sales (J)	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72
Contribution (K)	5.57	5.56	5.55	5.54	5.53	5.52	5.51	5.50
Break Even Point (L= G/I)	14.28%	12.31%	11.20%	9.95%	8.51%	6.75%	6.39%	6.47%
Cash Break Even {(I)-(H)}	9.23%	7.26%	6.14%	4.88%	3.43%	1.66%	1.29%	1.36%
Break Even Sales (J)*(L)	0.82	0.70	0.64	0.57	0.49	0.39	0.37	0.37

Return on Investment

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	4.77	4.87	4.93	4.99	5.06	5.15	5.16	5.14	40.07
Net Worth	5.83	9.24	12.40	15.60	18.84	22.14	25.45	28.75	138.26
									28.99%

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	4.50	3.41	3.16	3.20	3.24	3.30	3.31	3.30	20.81
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	0.35	0.28	0.21	0.13	0.02	0.00	0.00	1.45
Total (M)	5.24	4.04	3.72	3.69	3.65	3.61	3.59	3.58	23.95

DEBT

Interest on Term Loan	0.46	0.35	0.28	0.21	0.13	0.02	0.00	0.00	1.45
Repayment of Term Loan	0.36	0.60	0.72	0.82	0.89	0.60	0.00	0.00	3.99
Total (N)	0.82	0.95	1.00	1.03	1.02	0.62	0.00	0.00	5.44
	6.39	4.26	3.71	3.59	3.60	5.78	0.00	0.00	4.40
Average DSCR (M/N)	4.40								

Annexure:-6 Procurement and implementation schedule

S. No.	Activities	Weeks								
		1	2	3	4	5	6	7	8	9
1	Ordering the APH and boiling flux solution vat									
2	Replacing the flue gas pathway									
3	Installing the APH and boiling flux solution vat									

Break up of shutdown period of plant required for Operation of APH

S.No	Activity	Day
1	Prepare the pathway for the flue gas to go	2
2	Install the Air Pre-Heater and drying bed	3

Day wise break up of shut down period for installation of APH

S.No	Activity	Day				
		1	2	3	4	5
1	Marking the pathway for the flue gas					
2	Dismantling of existing pipeline					
3	New ducting & piping arrangement for flue gas					
4	Installation of APH					
5	Installation of drying bed					
6	Connect secondary air to APH					
7	Instrumentations and trial					0

Annexure -7: Details of technology service providers

S.No.	Name of Service Provider	Address	Contact Person and No.
1	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
2	Wesman Group of Companies	8, Mayfair Road, Kolkata - 700019	Mr. Arnab Ganguly Phone : 9433344999 Landline- 91-33-40020300/40020372 Fax 91-33-22816402/22908050 Email : arnab.ganguly@wesman.com
			(Tech. Director) 9831844880 - 5876/24455766 72832 ic@hotmail.com

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

YSU

WEB: www.hytsu.co.in

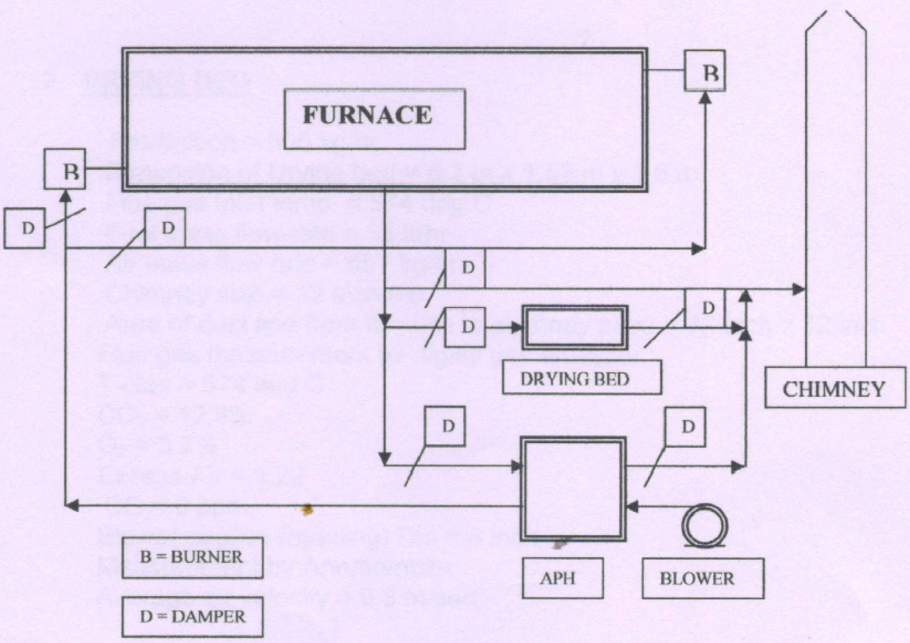
YANTRA SHILPA UDYOG (P) LTD.
12-B, AMRITALAL BOSE STREET, KOLKATA – 700 005.
PHONE: 91 – 33 – 2555 0316 / 2555 0539
FAX : 91 – 33 – 2555 1995.
EMAIL : htsu@cal3.vsnl.net.in

Our Ref YSU/31/ENQ/10-11 December 28, 2010

TO

Energy Management Department of MPSM
Indian Institute of Social Welfare & Business Management (IISWBM)
Management House; College Square West; Kolkata - 700 073, INDIA
Ph. 033 2241 3756/5792/8694/8695; Mob. 94331 53009;
Fax 033 22413975 (pp)
Email: binoykchoudhury@gmail.com; iiswbm@iiswbm.edu

SUB: OFFER FOR AIR PREHEATER + DRYING BED



YSU

WEB: www.hytsu.co.in

PRICE: Air Pre heater for combustion air of burner as above
Re. 3, 80, 000.00 (Three Lakh Eighty Thousand only) per Set

TERMS AND CONDITIONS:

PRICES:	Ex-Works, Kolkata.
PACKING & FORWARDING CHARGES:	2% Extra, at actual.
INSTALLATION	Rs. 90, 000.00 Lumpsum
VAT:	4% Extra, as applicable.
EXCISE DUTY:	Extra as applicable at the time of delivery.
PAYMENT:	30% of the value is to be paid as an advance along with order – balance before delivery against Proforma Invoice of each consignment.
DELIVERY:	2 months from the date of receipt of your firm Order clear in all respect both technically and commercially.
GUARANTEE:	We stand guarantee for any manufacturing defects of the aforesaid equipment for twelve Months from the date of delivery EXCEPT Wearable Parts and bought out components.
VALIDITY:	Our offer will remain valid for 30 days from the offered date.

Hope you will find our offer very much attractive both technically and commercially. We now look forward to receive your valued order at the earliest.

Thanking you,

Yours faithfully,
FOR YANTRA SHILPA UDYOG (P) LTD.

S. K. DUTTA
DIRECTOR.

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

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

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

Annexure -10: Calculation of savings

METHOD 1			
S. No	***Parameter***	***Unit***	***Value***
1	Air mas flow rate (m)	kg/hr	657
2	Temp. of Flue gas at APH inlet ($t_{1)}$	^{o}C	574
3	Temp. of flue gas from APH outlet (t_2)	^{o}C	464
4	Temp. difference (Δt)	^{o}C	110
5	Specific heat of combustion air (C_p)	kCal/(kg ^{o}C)	0.24
6	Heat savings	kCal/hr	$mxC_px\Delta t$=17344.8
7	GCV of Furnace Oil (FO)	kCal/kg	10500
8	FO savings	kg/hr	1.65
9	Cost of FO	Rs./litre	30
10	Specific gravity of FO	ρ	0.92
11	Operating hours / day	hr	10
12	Annual operating day	Day	300
13	Annual operating hours	hr	3000
14	Annual FO savings	kg/yr	4956
15	Annual cost savings	Rs./yr	161598

METHOD 2			
S. No	***Parameter***	***Unit***	***Value***
1	Air mas flow rate (m)	kg/hr	657
2	Temp. of flue gas at APH inlet (t_1)	°C	574
3	Temp. of flue gas at APH outlet (t_2)	°C	464
4	Drop in temp. (Δt)	°C	110
5	Specific heat of combustion air (C_p)	kCal/(kg °C)	0.23
6	Every 23 °C drop in temp. results in 1% fuel conservation		
7	Rise in Efficiency	%	Δt/23 °C=4.8
8	FO consumption	liter/hr	35
9	Cost of FO	Rs./litre	30
10	Operating hours	Hr/day	10
11	Annual operating day	Day	300
12	Annual operating hours	hr	3000
13	Annual FO consumption	liter/yr	105000
14	Annual cost of FO	Rs./yr	3150000
15	Annual FO savings	liter/yr	5040
16	Annual savings	Rs./yr	151200

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