DETAILED PROJECT REPORT
ON
BIOMASS GASIFIER
REPLACING COAL
(HOWRAH CLUSTER)











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BIOMASS GASIFIER BY REPLACING COAL FURNACE FOR GALVANIZING

HOWRAH GALVANIZING AND WIRE DRAWING CLUSTER

BEE, 2010

Detailed Project Report on Biomass Gasifier by Replacing Coal Furnace for Galvanizing

Galvanizing and Wire Drawing SME Cluster,

Howrah, West Bengal (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: ***HWR/WDG/GCF/05***

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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
MoMSME	Ministry of Micro Small and Medium Enterprises
DPR	Detailed Project Report
GHG	Green House Gases
CDM	Clean Development Mechanism
DSCR	Debt Service Coverage Ratio
NPV	Net Present Value
IRR	Internal Rate of Return
ROI	Return on Investment
MW	Mega Watt
MoMMSE	Ministry of Micro Small and Medium enterprises
SIDBI	Small Industrial Development Bank of India
MT	Million Ton
NA	Not Applicable
SHC Coal	Semi Hard Coke Coal

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 clusters 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.

Some of the galvanizing units in the cluster use semi hard coke (SHC) coal for their process of galvanization. The furnaces are made in a very crude manner and are very inefficient, not mention very polluting. These furnaces can be replaced with an arrangement to use producer gas by gasifying bio-mass which would be much cleaner, not to mention having higher efficiency.

Installation of proposed technology i.e. use of producer gas generated by gasifier in place of coal fired would save about 840 ton coal per year in a typical unit as well as significant amount of GHG emission.

This DPR highlights the details of the study conducted for assessing the potential for installation of Bio-mass Gasifier in place of coal fired furnace for Galvenising, possible reduction in energy/production cost and its monetary benefit, availability of the technologies/design, local service providers, technical features and proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, sensitivity analysis for different scenarios and schedule of Project Implementation.

This bankable DPR also found eligible for subsidy scheme of MoMSME for “Technology and Quality Upgradation Support to Micro, Small and Medium Enterprises” under “National Manufacturing and Competitiveness Programme”. The key indicators of the DPR including the Project cost, debt equity ratio, monetary benefit and other necessary parameters are given in table:

S.No	Particular	Unit	Value
1	Project cost	₹(In lakh)	44.17
2	Coal consumption in base case Scenario	Tonne/ Annum	840
3	Wood Consumption in proposed case	Tonne/ Annum	1350
4	Electricity consumption in proposed case	kWh/Annum	82800
5	Monetary benefit	₹ (In lakh)	11.84
6	Debt equity ratio	Ratio	3:1
7	Simple payback period	year	3.73
8	NPV	₹ (Lakh)	2.85
9	IRR	%age	11.66
10	ROI	%age	19.21
11	DSCR	Ratio	1.28
12	Process down time	Days	14

The projected profitability and cash flow statements indicate that the project implementation i.e. installation of gasifier to use biomass for thermal applications 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 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

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 (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, SHC coal, LPG and Diesel oil. Major consumptions of energy are in the form of Furnace Oil and Diesel. Details of total energy consumption at Howrah cluster are furnished in Table 1.1a and 1.1b:

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

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

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

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

Classification of Units

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

1) Product wise
2) Production capacity wise

Products Manufactured

The galvanizing units can be classified on the basis of products into 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

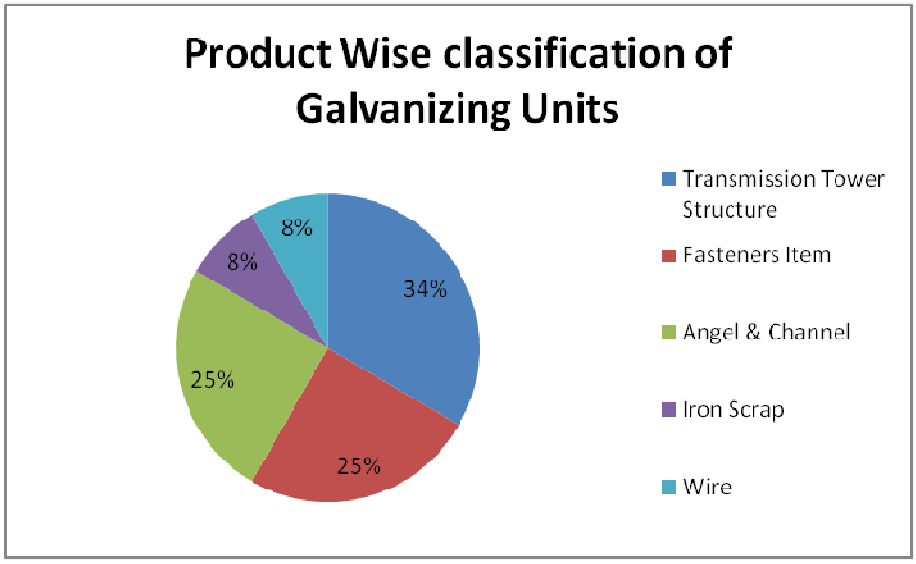


Figure 1.1: Product Wise Classification of Galvanizing Units

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

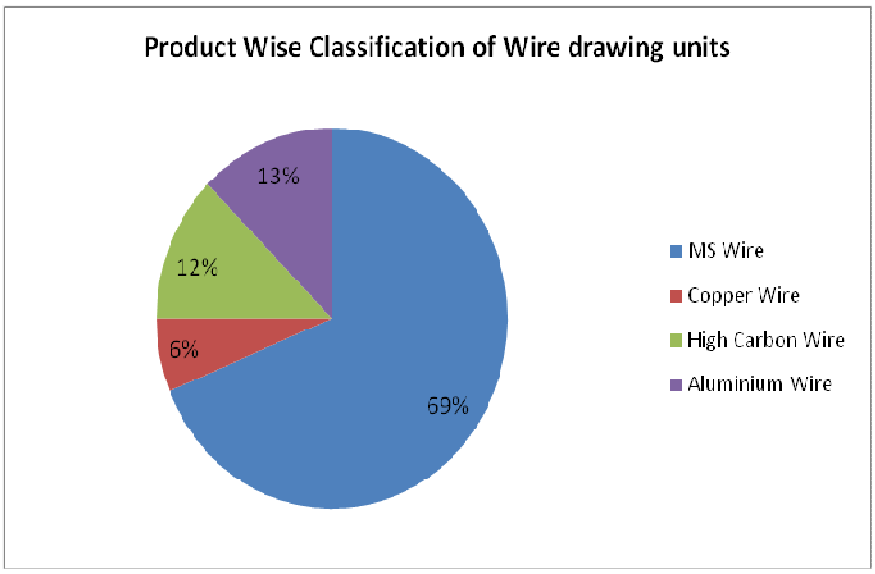


Figure 1.2: Product Wise Classification of Wire-drawing Units

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

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

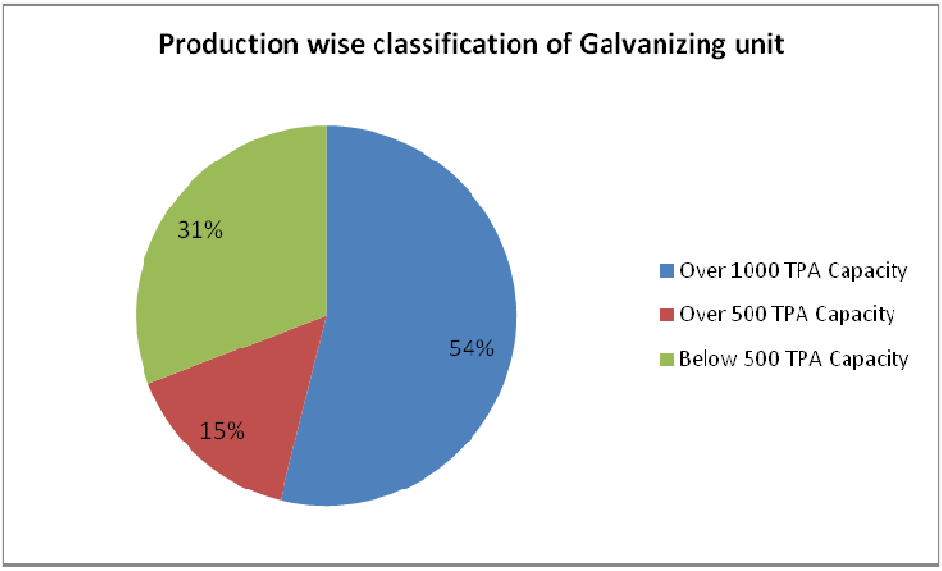


Figure 1.3: Production Wise Classification of Galvanizing Units

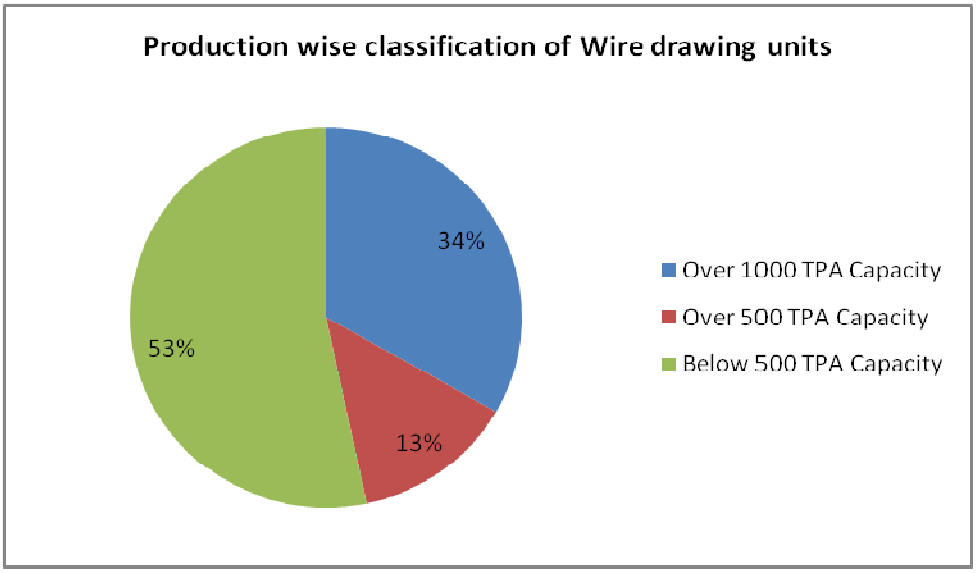


Figure 1.4: Production Wise Classification of Wire-drawing Units

Energy usages pattern

Average monthly electricity consumption in Wire Drawing unit ranges from 1 lakh to 2 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 25 Ton/month.

Average monthly electricity consumption in a galvanizing unit ranges from 0.3 lakh 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. The finished wire products are mainly supplied to downstream industries such as galvanizes, electrical manufactures and the local market.

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

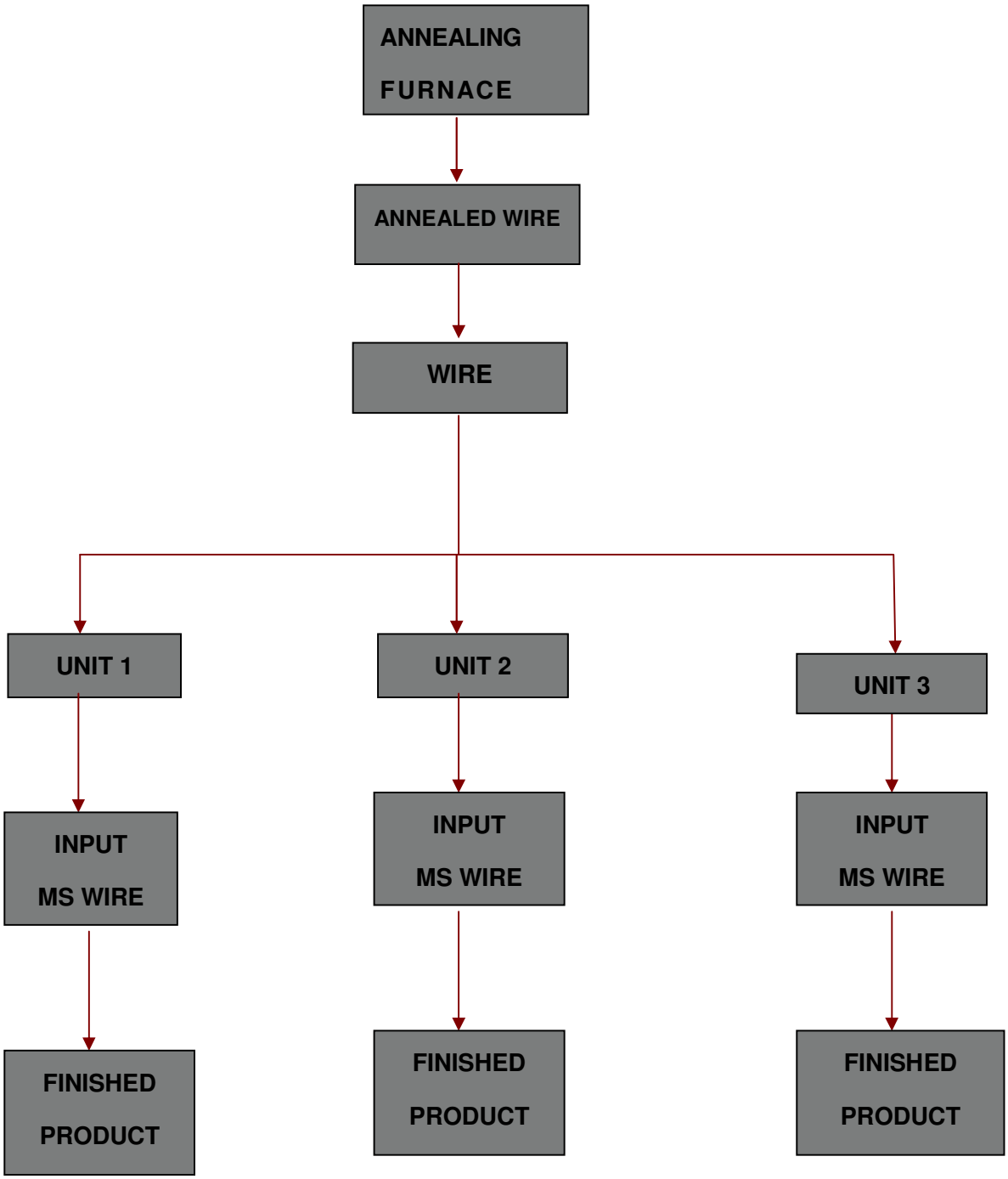


Figure 1.5 Process flow diagram for a typical wire drawing unit

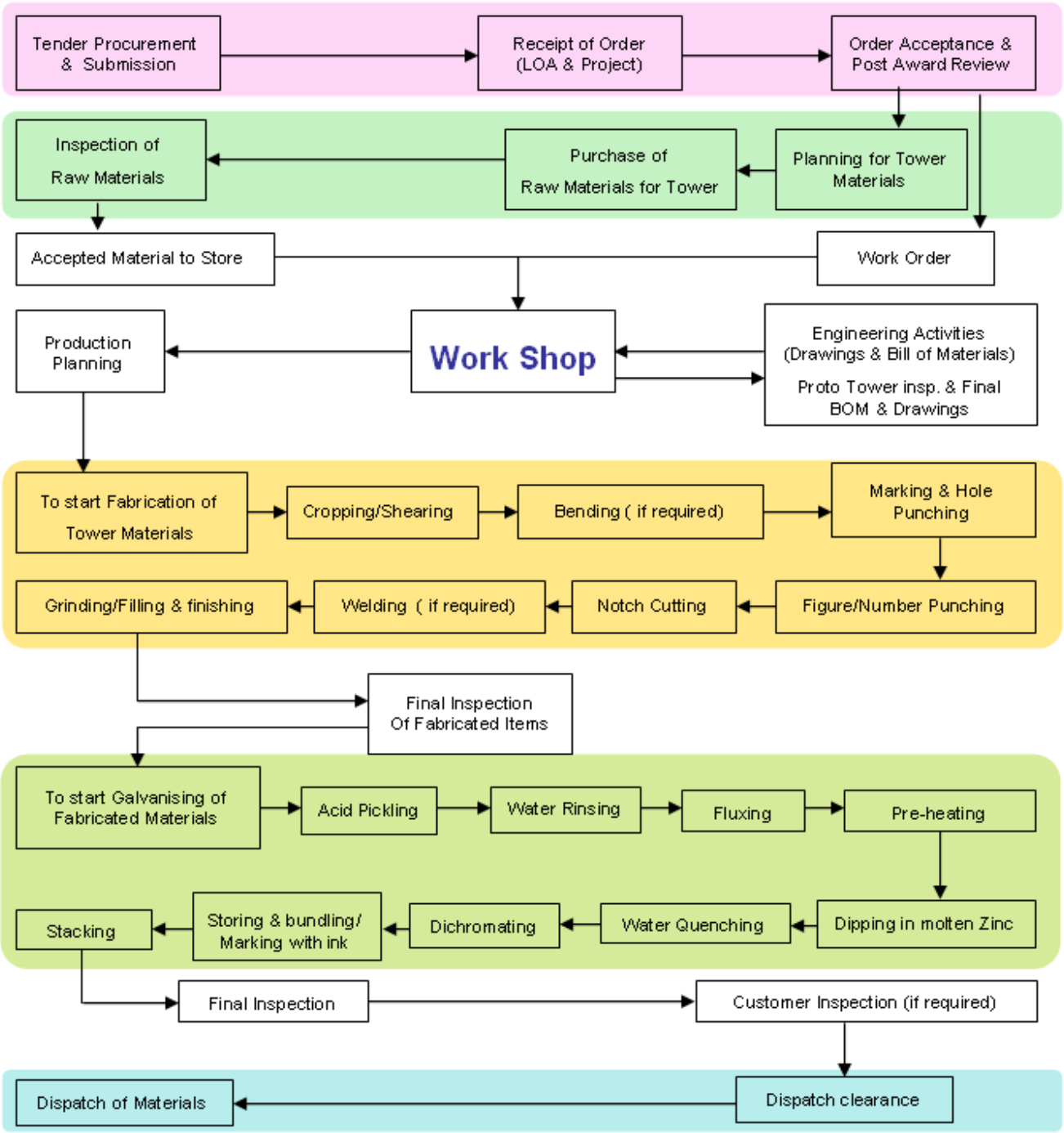


Fig 1.6: Process Flow diagram for a typical galvanizing unit

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 Fig 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 following process flow diagram.

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)*	*Wood (Ton/yr)*
MS wire	101486	209216	266889	NA	300
Copper wire	NA	NA	295310	70.5	NA
High carbon wire	NA	NA	1088751	NAp	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	NAp	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

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

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

Some of the galvanizing units use SHC coal as fuel for their process. For a typical unit, 600 Ton per year SHC coal is used in furnace and 240 Ton per year SHC coal is used in job pre-heating. This costs Rs. 5040000 per year in total.

All the galvanizing units in the Howrah cluster have furnaces to melt zinc. If the furnaces use biomass as a fuel for their production process instead of SHC coal, it can yield significant savings to the unit. Existing furnace specifications are shown in Table 1.7 below.

Table 1.7 Typical specifications of present furnaces

S. No.	*Parameter*	*Detail*
1	Manufacturer	Local
2	Dimensions	6.6 m x 0.9 m x 1.05 m
3	Average SHC coal consumption	233 kg/hr

S. No.	Parameter	Detail
4	Temperature of zinc vat	490 deg C
5	Ambient temperature max	40 deg C

At Howrah, electricity connection is taken from the Calcutta Electric Supply Company Limited at the following tariff rates

Energy charges

The cost of SHC coal in a typical unit is Rs. 6/kg.

Table 1.8 Electricity charges

S. No.	Contract Demand, kWh	Energy Charges, Rs./kWh
1	Upto 500	4.43
2	Next 1500	4.87
3	Next 1500	5.20
4	Above 3500	5.49

Demand Charges

Table 1.9 Demand charge

S. No.	Billing Demand, KVA	Demand Charges, Rs./KVA
1	For first 500	98
2	For next 500	139
3	For next 1500	208
4	Billing demand in Excess of 2500	237
5	Billing Demand Excess of contract demand	369

Therefore, total electricity charges (including the maximum demand charges & other taxes) is Rs. 5.6 per 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. The typical temperature of the zinc vat is 500 deg C.

1.4 Baseline establishment for existing technology

1.4.1 Design and operating parameters

The typical galvanizing furnaces used at present in the units provide temperatures of more than 900 deg C which is subsequently providing the necessary zinc melting temperature to the vat. The main furnace consumes 600 Ton of SHC coal per year. SHC coal is also burned at the rate of 240 Ton per year to dry the job before dipping in to zinc vat. Thus the total consumption of SHC coal is 840 Ton per year i.e. 233 kg/hr. The unit operates 300 days per year @ 12 hours per day.

Table 1.10 Present furnace specifications

S. No.	Parameter	Detail
1	Manufacturer	Local
2	Dimensions	6.6 m x 0.9 m x 1.05 m
3	Average SHC coal consumption	233 kg/hr
4	Temperature of zinc vat	490 deg C
5	Ambient temperature max	40 deg C

SHC coal 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 SHC coal

S. No.	Energy Type	Unit	Value
1	Electricity	kWh/year	38410
2	SHC coal	kg/yr	840000

1.4.2 Operating efficiency analysis

Operating efficiency for the furnace is found to be 16.46 %. 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.

Nobody wants to invest in an experimental scheme only to find later that the gains are too little to warrant such investments. 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 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

Some of the galvanizing units use coal as fuel. These units could instead use wood or rice straw in a biomass gasifier to generate producer gas which could then be brought to the furnace and burnt. Such a process would also be very clean since it would not produce SOx or NOx.

Process technology

The Gasification process technology is based on production of a highly combustible gas by controlled reactions of Biomass viz. rice husk, wood, palm nut shell etc. with air and water vapour.

In the Gasifier, the solid biomass fuel having moisture content not exceeding 20% and 25mm size is fed from the top, while the air and steam is fed from the bottom, and moves upward against the downward movement of the biomass fuel, and this process of gas generation is called Updraft principle.

A number of chain chemical reactions are believed to take place in the gas generator from the bottom to the top, a proper mixture of air water vapour pass through channel free compact fuel bed ensuring the following reactions to take place.

Oxidation Zone

$$C + O_2 = \quad CO_2 + \text{Heat}$$

Primary Reduction Zone

$$C + CO_2 = 2CO \sim \text{Heat}$$

$$C + H_2O = CO + H_2 \sim \text{Heat}$$

$$C + 2H_2O = CO_2 + 2H_2 \sim \text{Heat}$$

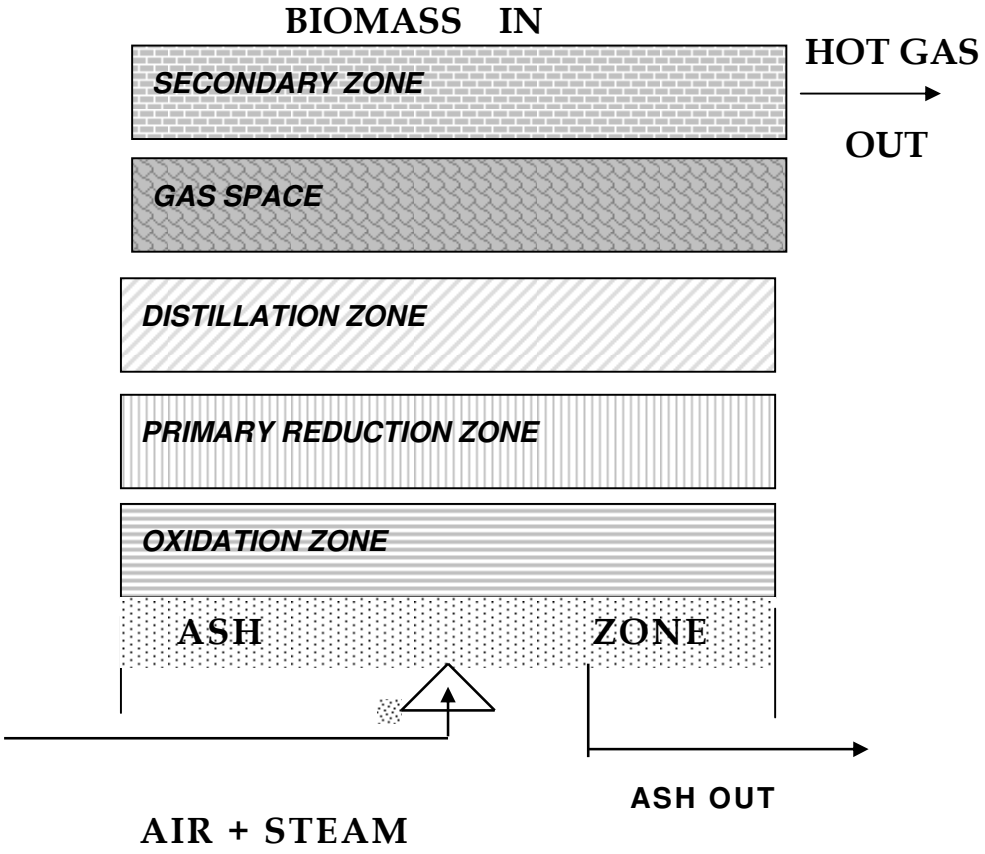
Secondary Reduction Zone

$$C + CO_2 = 2CO \sim \text{Heat}$$

$$CO + H_2O = CO_2 + H_2 \sim \text{Heat}$$

While the plant is under normal operation, following zones are believed to exist in the gasifier, as shown in the cross sectional view below :

Ash Zone: An exchange of heat takes place from hot ash to the entering air and water vapour and thus the hot process air enters the oxidation zone and the cooled ash leaves the system at the bottom to the water seal, generally maintained at about 600 m.m.w.g.



Oxidation Zone: It is a thin zone having the highest temperature (950^0C – 1100^0C) in the Gasifier due to the exothermic reaction.

Primary Reduction Zone: The heat released by the oxidation zone below is cooled down by the endothermic reactions in this zone with the formation of CO, H_2 and CO_2 by the interaction of C present in the fuel with O_2 and H_2O present in the process air.

Secondary Reduction Zone: It reduces further the temperature of the gas coming out of the zone below it due to the endothermic reactions with the production of CO by the interaction of C with CO_2 and simultaneous water gas reaction.

Distillation Zone: The heat of the up moving gas from the secondary reduction zone helps the distillation of the volatile matters present in the fuel with the evolution of high volatile

hydrocarbons which combine with the gas to enrich it in its calorific value and the temperature of the gas goes down further.

Composition of Gas : Though for different biomass fuels, there may be little variation in gas composition as well as the heating value, the gas composition and calorific value in general are as follows :-

CO_2 = 8 ~ 10%, O_2 = Less than 1.0%, CO = 24 ~ 26%,

CH_4 = 1.5 ~ 2%, N_2 = 54 ~ 56%, H_2 = 10 ~ 12%.

CV. (Gross) = 1200 ~ 1250 kCal/Normal cubic meter

Sp. Gravity = 0.92

Yield of Gas: 1.70 ~ 1.90 Normal cubic meter per kg of biomass.

Cleaning and cooling of gas: The producer gas thus generated is cooled and partly cleaned by collection through displacement of water. The gas is further cleaned by passing it through two stages of filters, viz. fine filter and check filter, which as normally made of Shaw-dust. After cooling and cleaning, the gas is having more CV per Nm^3 and suitable for use in engines as well as burners.

Figure 2.1: Bio Mass gasifier

2.1.2 Equipment/technology specification

Biomass gasifiers generate the producer gas which could be sent through pipelines into the furnace and burnt there.

Table 2.1 Technical specification of a biomass gasifier based furnace

S. No.	Parameter	Units	Detail
1	Manufacturer	-	Ankur Scientific Energy Technologies Pvt Ltd
2	Model	-	WBG-500
3	Rated Gas Flow	(Nm^3/hr)	1125
4	Average Gas Calorific Value	(kCal/Nm^3)	>1100
5	Rated Thermal Output	kCal/hr	1237500
6	Gasification temperature	deg C	1050-1100
7	Gasifier shed area	m^3	16.0 (L) x 8.0 (W) x 9.0 (H)
8	Cooling pond	m^2	5.0 (L) x 4.5 (B)
9	Max wood biomass consumption	kg/hr	450
10	Electricity consumption	kW/h	23
11	Ambient temperature max	deg C	40

Further details of the gasifier to generate producer gas from biomass are shown in Annexure - 8.

2.1.3 Integration with existing equipment

The gasifier could be installed at a different location and generated producer gas run through pipes into the furnace. There, it could be burnt to produce the heat required. The existing SHC coal fired furnace shall have to be remade to adapt to the use of producer gas and also to utilize the flue gas for drying of job before dipping in to the zinc vat. No chimney was found in the SHC coal fired furnace systems including the present case. Installation of chimney would help utilization of heat from the exhaust flue gas.

The following are the reasons for selection of this technology

- It will reduce the total amount of fuel required.
- Biomass (wood chips) being cheaper than SHC coal, would save money
- It reduces the GHG emissions and pollution because the combustion will be complete. Further the net emission would be zero for sustainable biomass use.

- This project is also applicable for getting the carbon credit benefits.
- A chimney could be installed and used for waste heat recovery and better control of draft.

2.1.4 Superiority over existing system

Use of this technology reduces the cost of fuel, not to mention the reduction in GHG and toxic gases.

2.1.5 Source of equipment

There are many vendors for such technology. Some of the names are mentioned in Annexure 7. 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 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 as a nonrefundable advance along with the purchase order. Another 30% shall have to be paid within 1 month of sending the purchase order. The remaining 20% shall have to be paid against proforma invoice but before the delivery as given in the Annexure 8.

2.1.9 Process down time

The down time might be 2 weeks for remaking the furnace from SHC coal fired to gas fired, along with drying bed and chimney, installing the biomass gasifier and taking the producer gas through a pipeline into the furnace. Detail of process down time is given in Annexure 6.

2.2 Life cycle assessment and risks analysis

Life of the equipment is about 10 years. Risk involved in the implementation of proposed project is the improper operation of the device due to lack of maintenance and formation of leaks on the producer gas bearing pipeline. This needs to be taken care of.

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 7500 Ton/yr and having total SHC coal consumption of about 840000 kg/yr. The unit is currently using SHC coal both for preheating and galvanizing.

3. ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical benefit

3.1.1 Fuel saving

Switching from SHC coal to biomass would replace about 840 ton of SHC coal per year with 1350 tonne of wood for the gasifier per year.

3.1.2 Electricity saving

Although electricty saving is not possible, the new biomass gasifier would increase an additional electrical load of 23 kW. The estimated annual consumption will be 82800 kWh.

3.1.3 Improvement in product quality

The quality of the product would be improved on account of better temperature regulation with the use of producer gas as fuel in place of SHC coal.

3.1.4 Increase in production

The production will increase upon better temperature regulation with the use of producer gas as fuel.

3.1.5 Reduction in raw material

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

3.1.6 Reduction in other losses

There is no significant reduction in other losses.

3.2 Monetary benefits

The monetary benefits of the unit are mainly due to the lower price of wood chips compared to SHC coal. This amounts to monetary savings of ₹ 11,84,076/ - per year. A detailed estimate of the saving has been provided in the table 3.1.

Table 3.1 Energy and monetary benefit

S.No	*Parameter*	*Unit*	*Value*
1	Present coal consumption in a unit	kg/year	840000
2	Cost of coal	₹ /kg	6.0
3	Monetary Savings in coal	₹ /year	5040000

S.No	Parameter	Unit	Value
4	Calorific value of wood	kcal/kg	2250
5	Calorific value of coal	kcal/kg	4000
6	Amount of wood chips consumed	kg /year	1350000
7	Cost of wood	₹ /kg	2.5
8	Cost of wood to be used in the unit	₹ /year	3375000
9	Amount of electricity required in the process (12 Hours operation) 23 kW/hr. Requirement	kWh	82800
10	Cost of electricity	₹ /kWh	5.08
11	Monetary cost of electricity in the process (300 working days)	₹ /year	420924
12	Cost of manpower	₹ /year	60000
13	Total monetary benefit	₹ /year	1184376

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

3.3 Social benefits

3.3.1 Improvement in working environment

Elimination of SHC coal consumption would probably make a cleaner working environment.

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. Producer gas burns more cleanly than SHC coal and produces less ash. The ash produced from wood could be used for fertilizers. 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 is 97 MT/yr, as 1.17 ton of CO_2 would be reduced for a reduction of 1 ton of coal consumption.

3.4.3 Reduction in other emissions like SO_X

Significant amount of SO_X will be reduced amounting to 7896 kg/yr due to reduction in energy consumption, as 0.0094 kg of SO_X would be reduced for a reduction of 1 kg of coal consumption.

4. INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of project

4.1.1 Equipment cost

The cost of materials for making this apparatus is ₹ 34.60 lakh as per the quotation provided in Annexure 8. This figure includes the cost of gasifier, the cooling tower and the producer gas burner with spark ignition as given in Table 4.1 below;

4.1.2 Erection, commissioning and other misc. cost

The installation costs could amount to a further ₹ 1.75 lakh. This figure includes the cost of building a new producer gas fired furnace, installation and commissioning and the relevant taxes as given in table 4.1 below:

Table 4.1 Details of proposed technology project cost

Particular	*Unit*	*Value*
'Ankur' Biomass Gasifier WBG-500 in Clean Gas Mode along with necessary accessories and auxiliaries	₹	2995000
Gasifier Cooling Tower	₹	385000
'Ankur' fully manual controlled producer gas burner with spark ignition	₹	80000
Installation and commissioning	₹	175000
CST @ 2 % of Material Cost against advance C-FORM, and in absence of C-FORM, 5% Tax will be charged	₹	164425
10.30% Service Tax on I & C	₹	18025
Cost of rebuilding furnace	₹	600000
Total investment	₹(In lakh)	44.17

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

The total cost of installing the device to boil flux solution is ₹ 44.17 lakh. The entrepreneur shall have to pay 25% of the total amount upfront ₹ 11.04 lakh. The rest could be arranged as loans.

4.2.2 Loan amount.

There are loans available for buying such equipments from SIDBI and from the MSME of the Government of India which have 25% subsidy in some schemes. Total loan amount is Rs. 33.13 lakh.

4.2.4 Terms & conditions of loan

The interest rate is considered at 10% which is SIDBI's rate of interest for energy efficient projects. The loan tenure is 7 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 10 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 ₹ 11.84 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 Rs. 44.17 lakh and monetary savings is Rs. 11.84 lakh/year. Hence the simple payback period works out to be 3.73 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment works out to be ₹ 2.85 lakh.

4.3.4 Internal rate of return (IRR)

The Internal rate of return of the project would be 11.66 %

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 19.21%.

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	Years	3.73
2	IRR	%age	11.66
3	NPV	₹in lakh	2.85
4	ROI	%age	19.21
5	DSCR	Ratio	1.28

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

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

Details of sensitivity analysis at different scenarios are shown in Table 4.3 below:

Table 4.3 Sensitivity analysis at different scenarios

Particulars	IRR	NPV	ROI	DSCR
	(%age)	(₹ in lakh)	(%age)	ratio
Normal	11.66	2.85	19.21	1.28
5% increase in fuel savings cost	13.72	6.48	19.80	1.38
5% decrease in fuel savings cost	9.53	0.79	18.48	1.18

4.5 Procurement and implementation schedule

Required procurement and implementation schedule for proposed project are about 6 weeks .detail of procurment and implementaion is shown in Annexure 6.

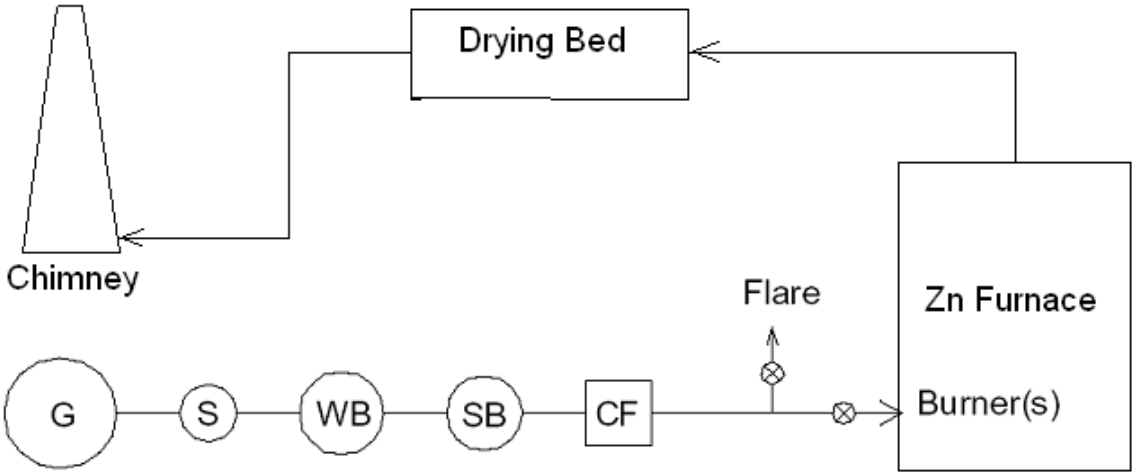
ANNEXURE

Annexure -1: Energy audit data used for baseline establishment

Calculation of efficiency of the furnace by the direct method

Description	*Unit*	*Excluding preheat value*	*Including preheat value*
Production	Ton/Year	7500	7500
Coal consumption (in furnace, excluding drying bed)	kg/Yr	600000	600000
GCV of coal	kJ/kg	16800	16800
Heat of coal	kJ/Yr	10080000000	10080000000
Coal consumption (in drying bed)	kg/Yr	- -	240000
Heat from coal for preheating	kJ/yr	- -	4032000000
Weight of zinc	Ton/yr	525	525
Weight of iron	Ton/yr	6975	6975
Zinc VAT temperature	deg C	695	695
Heat taken by zinc	kJ	182988750	189131250
Heat taken by iron	kJ	2037397500	2133652500
Total Heat taken by metals (output)	kJ/yr	2220386250	2322783750
Total heat of fuel (Input)	kJ/Yr	10080000000	14112000000
Efficiency	%age	22.03	16.46

Annexure -2: Process flow diagram after project implementation

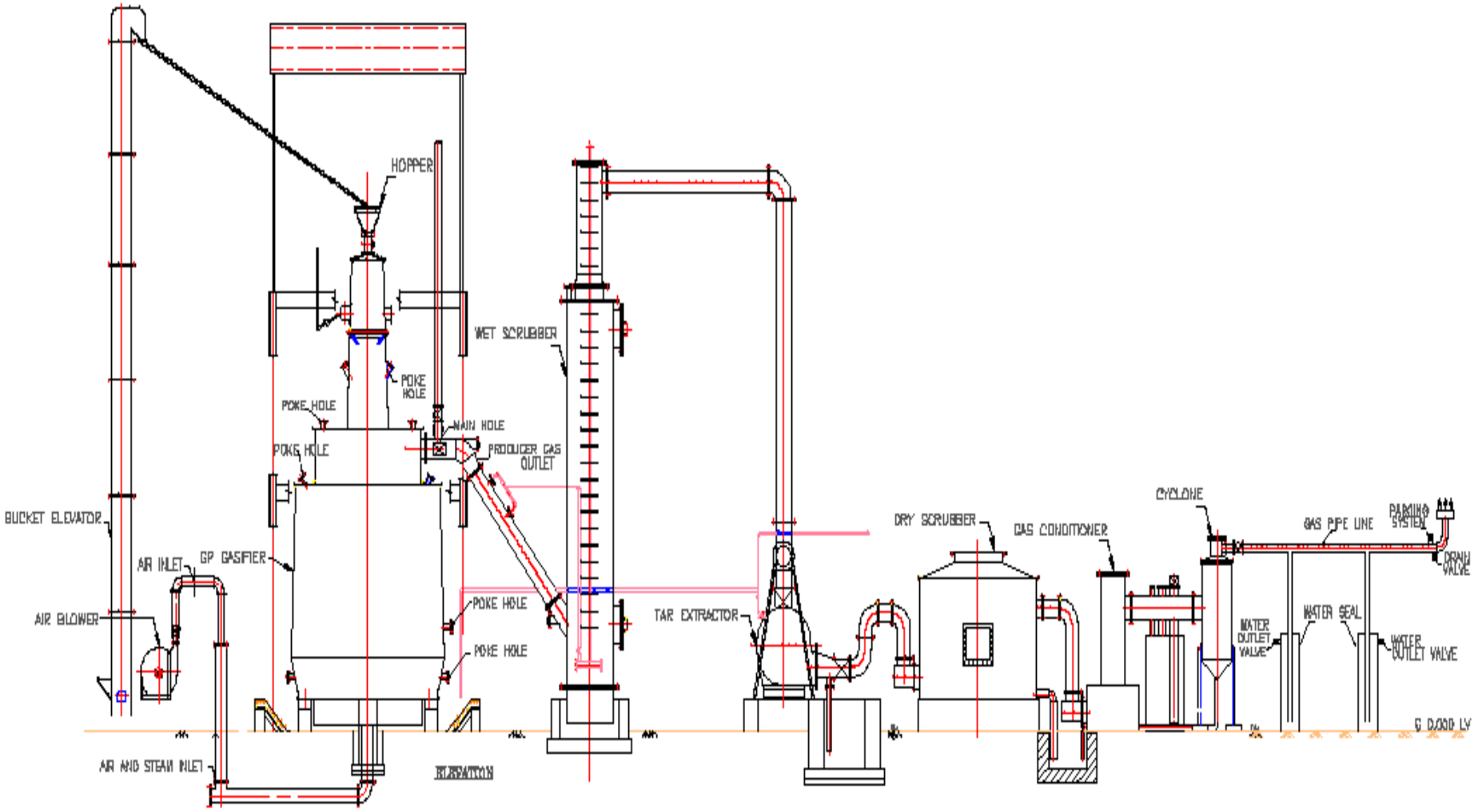


- G – Gasifier
- S – Scrubber
- WB – Wet Blower
- SB – Separation Box
- CF – Coarse Filter

Annexure -3: Detailed technology assessment report

Particular	Unit	Value
Production	Tonne/Year	7500
Present SHC coal consumption in a unit (Including drying)	Tonne/year	840
Total electricity load	kW	23
Total electricity consumption	kWh/year	82800
Cost of electricity consumption	₹/yr	420924
Cost of SHC coal in present system	₹/yr	5040000
Operation cost - manpower	₹/month	5000
Annaul manpower cost	₹/yr	60000
Amount of wood required by gasifier	kg/hr	375
Amount of wood required by gasifier	kg/yr	1350000
Cost of wood for the gasifer	₹/yr	3375000
Minimum savings	₹/yr	1184076
Cost of project	₹	4417000
Payback	yrs	3.73
Life of the system	yrs	10

Annexure – 4: Drawings for proposed electrical & civil works



FLOW DIAGRAM OF GP GASIFIER SYTEM FOR THERMAL ENERGY

Annexure - 5: Detailed financial analysis

Assumption

Name of the Technology	Bio mass Gasifier replacing Coal		
Details	**Unit**	**Value**	**Basis**
Installed Capacity	kCal/hr	1000000	
No of working days	Days	300	
No of Shifts per day	Shifts	1	12 hours
Proposed Investment			
Biomass Gasifier Replacing Coal	₹ in lakh	34.60	
Installation & Commissioning	₹ in lakh	1.75	
Other Cost	₹ in lakh	7.82	
Total investment	₹ in lakh	44.17	
Financing pattern			
Own Funds (Equity)	₹ in lakh	11.04	
Loan Funds (Term Loan)	₹ in lakh	33.13	
Loan Tenure	yr	7	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	90	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			
Savings due to fuel change	Rs. in lakh	16.65	
Cost of Electricity consumption	Rs. in lakh	4.20	
Cost of manpower	Rs. in lakh	0.60	
St. line Depn.	% age	5.28%	Indian Companies Act
IT Depreciation	% age	80.00%	Income Tax Rules
Income Tax	% age	33.99%	Income Tax

Estimation of Interest on Term **. (in lakh)**

Years	Opening Balance	Repayment	Closing Balance	Interest
1	33.13	2.10	31.03	3.83
2	31.03	4.20	26.83	2.91
3	26.83	4.40	22.43	2.49
4	22.43	4.60	17.83	2.04
5	17.83	4.80	13.03	1.57
6	13.03	5.10	7.93	1.08
7	7.93	5.20	2.73	0.56
8	2.73	2.73	0.00	0.08
		33.13		

WDV Depreciation **. (in lakh)**

Particulars / years	1	2
Plant and Machinery		
Cost	44.17	8.83
Depreciation	35.34	7.07
WDV	8.83	1.77

Projected Profitability

. (In lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Fuel savings	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84
Total Revenue (A)	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84
Expenses										
O & M Expenses	1.77	1.86	1.95	2.05	2.15	2.26	2.37	2.49	2.61	2.74
Total Expenses (B)	1.77	1.86	1.95	2.05	2.15	2.26	2.37	2.49	2.61	2.74
PBDIT (A)-(B)	10.07	9.99	9.89	9.80	9.69	9.59	9.47	9.35	9.23	9.10
Interest	3.83	2.91	2.49	2.04	1.57	1.08	0.56	0.08	-	-
PBDT	6.24	7.07	7.40	7.75	8.12	8.51	8.91	9.27	9.23	9.10
Depreciation	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
PBT	3.91	4.74	5.07	5.42	5.79	6.17	6.58	6.94	6.90	6.77
Income tax	-	0.00	2.52	2.64	2.76	2.89	3.03	3.15	3.14	3.09
Profit after tax (PAT)	3.91	4.74	2.55	2.79	3.03	3.28	3.55	3.79	3.76	3.67

Computation of Tax

. (in lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Profit before tax	3.91	4.74	5.07	5.42	5.79	6.17	6.58	6.94	6.90	6.77
Add: Book depreciation	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
Less: WDV depreciation	35.34	7.07	-	-	-	-	-	-	-	-
Taxable profit	(29.10)	0.01	7.40	7.75	8.12	8.51	8.91	9.27	9.23	9.10
Income Tax	-	0.00	2.52	2.64	2.76	2.89	3.03	3.15	3.14	3.09

Projected Balance Sheet

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Liabilities										
Share Capital (D)	11.04	11.04	11.04	11.04	11.04	11.04	11.04	11.04	11.04	11.04
Reserves & Surplus (E)	3.91	8.65	11.20	13.99	17.02	20.30	23.85	27.64	31.40	35.08
Term Loans (F)	31.03	26.83	22.43	17.83	13.03	7.93	2.73	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	45.98	46.52	44.68	42.86	41.09	39.28	37.63	38.69	42.45	46.12
Assets	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Gross Fixed Assets	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
Less Accm. depreciation	2.33	4.66	7.00	9.33	11.66	13.99	16.33	18.66	20.99	23.32
Net Fixed Assets	41.84	39.51	37.18	34.84	32.51	30.18	27.85	25.52	23.18	20.85
Cash & Bank Balance	4.14	7.01	7.50	8.02	8.58	9.10	9.78	13.17	19.26	25.27
TOTAL ASSETS	45.98	46.52	44.68	42.86	41.09	39.28	37.63	38.69	42.45	46.12
Net Worth	14.95	19.69	22.25	25.03	28.06	31.35	34.90	38.69	42.45	46.12
Debt Equity Ratio	2.81	2.43	2.03	1.61	1.18	0.72	0.25	0.00	0.00	0.00

Projected Cash Flow

. (in lakh)

Particulars / Years	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Sources											
Share Capital	11.04	-	-	-	-	-	-	-	-	-	-
Term Loan	33.13										
Profit After tax		3.91	4.74	2.55	2.79	3.03	3.28	3.55	3.79	3.76	3.67
Depreciation		2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
Total Sources	44.17	6.24	7.07	4.89	5.12	5.36	5.62	5.88	6.12	6.09	6.01
Application											
Capital Expenditure	44.17										

Repayment Of Loan	-	2.10	4.20	4.40	4.60	4.80	5.10	5.20	2.73	-	-
Total Application	44.17	2.10	4.20	4.40	4.60	4.80	5.10	5.20	2.73	-	-
Net Surplus	-	4.14	2.87	0.49	0.52	0.56	0.52	0.68	3.39	6.09	6.01
Add: Opening Balance	-	-	4.14	7.01	7.50	8.02	8.58	9.10	9.78	13.17	19.26
Closing Balance	-	4.14	7.01	7.50	8.02	8.58	9.10	9.78	13.17	19.26	25.27

IRR

. (in lakh)

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Profit after Tax		3.91	4.74	2.55	2.79	3.03	3.28	3.55	3.79	3.76	3.67
Depreciation		2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
Interest on Term Loan		3.83	2.91	2.49	2.04	1.57	1.08	0.56	0.08	-	-
Cash outflow	(44.17)	-	-	-	-	-	-	-	-	-	-
Net Cash flow	(44.17)	10.07	9.98	7.38	7.16	6.93	6.69	6.44	6.20	6.09	6.01
IRR	11.66%										
NPV	2.85										

Break Even Point

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Variable Expenses										
Oper. & Maintenance Exp (75%)	1.33	1.39	1.46	1.53	1.61	1.69	1.78	1.86	1.96	2.06
Sub Total(G)	1.33	1.39	1.46	1.53	1.61	1.69	1.78	1.86	1.96	2.06
Fixed Expenses										
Oper. & Maintenance Exp	0.44	0.46	0.49	0.51	0.54	0.56	0.59	0.62	0.65	0.69
Interest on Term Loan	3.83	2.91	2.49	2.04	1.57	1.08	0.56	0.08	0.00	0.00
Depreciation *(H)*	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
Sub Total (I)	6.61	5.71	5.31	4.88	4.44	3.97	3.49	3.03	2.99	3.02
Sales (J)	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84
Contribution (K)	10.52	10.45	10.38	10.31	10.23	10.15	10.06	9.98	9.88	9.78
Break Even Point (L= G/I)	62.83%	54.63%	51.15%	47.39%	43.38%	39.16%	34.65%	30.42%	30.20%	30.84%
Cash Break Even {(I)-(H)}	40.65%	32.30%	28.68%	24.76%	20.58%	16.18%	11.47%	7.04%	6.60%	7.00%
Break Even Sales (J)*(L)	7.44	6.47	6.06	5.61	5.14	4.64	4.10	3.60	3.58	3.65

Return on Investment

. (in lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***Total***
Net Profit Before Taxes	3.91	4.74	5.07	5.42	5.79	6.17	6.58	6.94	6.90	6.77	58.29
Net Worth	14.95	19.69	22.25	25.03	28.06	31.35	34.90	38.69	42.45	46.12	303.48
											19.21%

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

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***Total***
Cash Inflow											
Profit after Tax	3.91	4.74	2.55	2.79	3.03	3.28	3.55	3.79	3.76	3.67	27.64
Depreciation	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	18.66
Interest on Term Loan	3.83	2.91	2.49	2.04	1.57	1.08	0.56	0.08	0.00	0.00	14.56
Total (M)	10.07	9.98	7.38	7.16	6.93	6.69	6.44	6.20	6.09	6.01	60.86

DEBT

Interest on Term Loan	3.83	2.91	2.49	2.04	1.57	1.08	0.56	0.08	0.00	0.00	14.56
Repayment of Term Loan	2.10	4.20	4.40	4.60	4.80	5.10	5.20	2.73	0.00	0.00	33.13
Total (N)	5.93	7.11	6.89	6.64	6.37	6.18	5.76	2.81	0.00	0.00	47.69
	1.70	1.40	1.07	1.08	1.09	1.08	1.12	2.21	0.00	0.00	1.28
Average DSCR (M/N)	1.28										

Annexure:-6 Procurement and implementation schedule

S. No.	Activities	Weeks					
		1	2	3	4	5	6
1	Ordering the raw materials						
2	Replacing the flue gas pathway						
3	Making the new furnace						

Break up of shutdown period of plant required

S.No	Activity	Day
1	Prepare the pathway for the producer gas to go	7
2	Remake the furnace to suit burning the producer gas	14

Day wise break up of shut down period of galvanizing furnace operation

S.No	Activity	Day									
		1	2	3	4	5	6	7	8	9-13	14
1	Marking the pathway for the flue gas										
2	Dismantling of existing pipeline										
3	New ducting & piping arrangement for producer gas										
4	Installation of the new furnace using the producer gas										
5	Instrumentations and trial										

Annexure -7: Details of technology service providers

S.No.	Name of Service Provider	Address	Contact Person and No.
1	Ankur Scientific Energy Technologies Pvt Ltd	Near Navarachana School, Sama, Vadodara-390008	Ph-(0265) 2793098 Email: ascent@ankurscientific.com Website: www.ankurscientific.com
2	GP Grain Energy Systems Pvt Ltd	BH-114, Sector-II, Saltlake - 700091	Telefax: (033)23580114 / 23210809 Email: info@gpenergy.net Website: www.gpenergy.net
3	Bioresidue Energy Technology Pvt Ltd	S-2, Digvijay Apartments,1st Cross, Ganesha Block.Sultanpalya, R.T. Nagar PO Bangalore – 560 032	Mr. Amar Kumar Mobile: 94490 40961 Email : betpl@sify.com
4	OVN Bio Energy Pvt Ltd	Bt-1/90 mangolpuri Ind. Area, Phase-1, New Delhi-110083	Mr. Navin Raheja Tel: +91 11 27922603, +91 11 27911608 Mobile: 9891201000

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

Gaurav Patel **OFF / 10 – 11 / 37 / 877**

Business Development Group **December 24, 2010**

By E-mail

Mr. Soumen Achar

E-Mail: soumenachar143@gmail.com

Sub. : Offer for "Ankur" Biomass Gasifier model WBG-500 in Clean Gas Mode for Thermal Application

Ref. : Your email enquiry dated December 23, 2010

Dear Sir,

This has reference to your email enquiry dated December 23, 2010. With information provided to us, we are please to submit herewith following techno-commercial offer for your thermal application "Ankur" Biomass Gasifier Model WBG-500 in Clean Gas Mode for your Thermal requirement.

We have offered gasifier in WBG Series, where you can use woody biomass like any fire wood (Branches & Twigs), Coconut shells, Wood chips, Corn cobs, Bamboo pieces, Saw Dust (Not alone but upto 10% can be mixed with wood pieces and can be used in our Gasifier), groundnut shells, Cotton Stalk etc. Biomass should be used with moisture content less then 20%. For using any other Woody Biomass mentioned here, you would need to confirm with us prior to usage in our Gasifier.

The other useful information of Gasifier System offered as under:

Sr. No.	Parameters	WBG – 500
1.	Gasifier shed area in meters	16.0 (L) x 8.0 (W) x 9.0 (H)
2.	Cooling Pond in meters	5.0 (L) x 4.5 (W)
3.	Max. Wood Biomass consumption	450 kg per Hr
4.	Electricity consumption	23 KW per Hr

Please note the followings in above reference:

- The information given above is per system and indicative
- Cooling pond can be constructed in open area.
- Woody biomass Consumption is mentioned at Full Load.
- Electricity consumption is shown excluding Biomass Cutter usage & Biomass conveying system etc.

Ankur Scientific Energy Technologies Pvt. Ltd.

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Email: ascent@ankurscientific.com, ankur@ankurscientific.com; Website : www.ankurscientific.com
Factory: Vadodara-Savli Road, Near Village Gothda - 391 773 Ph: (02667) 222342 / 223343 Fax: (02667) 223342

For Automatic burners we are giving below the details of burner manufacturer. You may also contact them by giving all the details of your existing burner so that he will give you the quote for Automatic burner suitable for producer gas of Gasifier. If you know any burner manufacturer in your area who can supply the burners as per customer's requirement, you can suggest us so that we will take further necessary action.

Mr. C N Kamath – Director Combustion Concepts Pvt Ltd 106, Marudhar Industrial Premises Opp. Syndicate Bank, Panchal Udyog Nagar, Bhayandar (E) 401 105	Telefax: 022 2819 4288/2818 6904/2818 5088 Res: 022 2636 4928 e-mail: combcon@gmail.com
Mr. D. S. Bakshi, National Furnaces 21/731, Bakshi House, Faiz Road Karolbagh New Delhi – 110 005, Delhi, India website- www.nationalfurnaces.com , www.nationalfurnaces.net	Phone: +(91)-(11)-23637605 / 23510557 Fax: +(91)-(11)-23510557 Mobile: +(91)-9810071732 Email: natfur@rediffmail.com, sales@nationalfurnaces.com

Please find attached here with our most competitive techno-commercial proposal for "***Ankur" Biomass Gasifier Model WBG-500 in Clean Gas Mode for Thermal Application.***

Should you need any other information, please contact us. Thanking you and assuring our best attention at all times.

Yours truly,

For Ankur Scientific Energy Technologies Pvt. Ltd,

Gaurav Patel

(If you do not have enough free space to install the Gasifier as indicated above, please let us know your available area and our design people shall try to accommodate the Gasifier in your area.)

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COMMERCIAL OFFER

Customer: Mr. Soumen Achar, Kolkata E-Mail: soumenachar143@gmail.com	**Offer No.:** OFF/ 10 – 11 / 37 / 877 **Date** : December 24, 2010 **Ref No.** : Your email enquiry **Date** : December 24, 2010

'Ankur' Biomass Gasifier Model WBG-500 in Clean Gas Mode for Thermal Application

(Ex-Factory price in Indian Rupees)

Sr. No.	Item Description	Qty	Total Price
1.	'Ankur' Biomass Gasifier WBG-500 in Clean Gas Mode along with necessary accessories & auxiliaries	1 No.	2,995,000
2.	Moisture Meter (To check moisture contents in wood pieces)	1 No.	
3.	Gasifier Cooling Tower	Lump sum	385,000
4.	'Ankur' fully manual controlled producer gas burner with spark ignition.	1 No.	80,000
5.	Installation and Commissioning charges	Lump sum	175,000
Optional Items - Can be purchased by client if needed.			
6.	'Ankur' Automated – Multiblade biomass wood cutter (For Biomass sizing in to recommend cut – size pieces.)	2 Nos.	2 x 65,000 = 130,000
7.	Skip Charger with Automated double Door feed assembly. It is an automated biomass wood pieces conveying system through bucket elevators. To carry wood pieces from ground level to the top of Gasifier.	1 No.	350,000
8.	Dry Ash Char removal system	1 No.	375,000
9.	Water Treatment Plant	Lump sum	350,000
	CST @ 2 % of Material Cost against advance C-FORM, and in absence of C-FORM, 5% Tax will be charged.	**At actual**	
	Freight and Insurance	**At actual**	
	10.30% Service Tax on I & C	**At actual**	

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NOTE:

1. With our Biomass Gasifier system, you would need to use Producer Gas Burner.
2. We have mentioned the price for 1 No. burner
3. Total nos. of Burner requirement will depend upon your actual requirement. /application. Accordingly, total burner cost will depend upon that and will be charged.
4. Further, we will provide you Burner suitable to above Gasifier model as per our standards.
5. If you have any special size of burners or specific size etc, you will need to inform us.
6. Air Compressor or Combustion Air Blower for Burners will be in your scope.

Please Note:

 # Suitable arrangement for auxiliary power is to be done at your end.

SUBSIDY:

As per MNRE Subsidy policy for 2009-10, the applicable subsidy for WBG-500 for thermal application is Rs. 10 lacs (Rupees Ten Lac). For more details, please refer to the additional terms and conditions.

DEPRECIATION:

There is an accelerated depreciation of 80% on the project cost. If subsidy is availed, the depreciation is available on the project cost minus the subsidy.

TECHNICAL SPECIFICATIONS OF 'ANKUR' WBG-500 GASIFIER

Gasifier Model	WBG-500
Gasifier Type	Down Draft
Fuel Specifications	
Size (mm)	*Minimum:* Diameter (∅) – 10 mm; Length (L) – 10 mm
	Maximum: ∅ – 75 mm; L – 75 mm
Moisture Content (%)	< 20% (Wet Basis)
Gasifier Output	
Rated Gas Flow (Nm3/hr)	1,125
Average Gas Calorific Value (Kcal/Nm^3)	> 1,100
Rated Thermal Output (Kcal/hr)	1,237,500
Maximum Biomass Consumption (Kg/hr)	Maximum 450
Gasification Temp. (°C)	1050 - 1100
Indicative Gasification Efficiency (%)	
Hot Gas Mode (No Scrubbing)	> 85%
Cold Gas Mode (With Scrubbing)	> 75%
Temperature of Gas at Gasifier Outlet (°C)	300 to 500°C
Biomass Feeding	
Mode	Skip Charger/ Manual
Frequency	Every 12-15 minutes
Ash Removal	Continuous, through proprietary control and water seal/ Dry Ash Char Removal System
Gas Cooling ***(For Scrubbed and Ultra Clean Gas Modes)***	Venturi Scrubber / Promiser with water re-circulation
Gas Cleaning ***(For Ultra Clean Gas Mode)***	Through proprietary & patented fine filters
Start-Up	Through Scrubber Pump / Blower
Typical Gas Composition	CO - 19±3% H_2 -18±2% CO_2 - 8±3% CH_4 -Up to 3% N_2 - 50%

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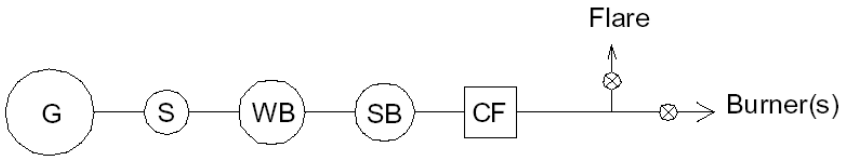
INDICATIVE SYSTEM SCHEMATIC FOR FBG-500 IN CLEAN GAS MODE:



Legend:

- G – Gasifier
- S – Scrubber
- WB – Wet Blower
- SB – Separation Box
- CF – Coarse Filter

PLEASE NOTE THAT THE PARALLEL LINE OF FILTERS IS NOT SHOWN HERE.

INDICATIVE DRAWING – SUBJECT TO CHANGE DUE TO CONSTANT DESIGN IMPROVEMENTS

TERMS AND CONDITIONS

Prices

- **The above prices quoted are on ex-our works Gothada, Dist. Baroda basis**.
- We will supply the system on FREIGHT TO-PAY BASIS. The unloading arrangement of Gasifier to ultimate site will have to be done by the client at their cost.
- Taxes, Freight, packing, Octroi, insurance and unloading charges are payable at actual.
- Just for your information, the systems currently do not have any excise.
- Erection and Commissioning charges will attract a service tax of 10.30%.
- At present, the CST is 2% against Form `C' or `D' and VAT is 5%. The Form `C' is to be sent along with your purchase order otherwise 5 % CST will be applicable.
- However, taxes and duties as applicable at the time of delivery of the equipment will be chargeable at actual.

Payment Terms: - 100% Payment before delivery (Total order value including taxes)

- **50% interest free and nonrefundable advance along with your purchase order**
- 30% within 1 months of Purchase order
- Balance 20% against Proforma invoice before delivery (This will include the balance Gasifier cost + Installation Charges to be paid before dispatch)

All the payment shall be made to us in either AT- PAR - Vadodara cheque or by Demand Draft payable Vadodara. The DD charges will be to your account. All Bank charges will have to be borne by you.

Our Bankers

State Bank of India, Specialized Commercial Branch, Race Course Circle, Baroda-390007

(1)	Our CC A/C No.	:- 30012008822
(2)	RTGS Code (IFS Code)	:- SBIN0004086
(3)	Branch Code	:- 04086
(4)	MICR Code	:- 390002032
(5)	Swift code	:- SBININBB115

General Conditions

- All the necessary way bills (road permits) are to be obtained by customer at their cost and sent to us well before agreed delivery date.
- All statutory permissions/ clearances etc are to be obtained by customer.

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- The safe custody of goods after receipt of material at site and during our warrantee period is to be arranged by customer at their own cost.

Additional terms and conditions for the subsidy

In order for the subsidy to be reimbursed, an application with a Detail Project Report (D.P.R.) with related documents will need to be submitted by you / the client to MNRE through the state nodal agency. Capital subsidy shall be provided on satisfactory completion of project on reimbursement basis through State Nodal Agencies for projects. The complete payment will need to be made to us directly and the capital subsidy would be released to you after successful installation and commissioning of the system.

We could make a Brief Project Report on behalf of you / the client & guide for the documentation related. You/ Client would need to submit this DP.R. to MNRE, Delhi through your State Nodal Agency. Further follow up will have to be done by you/client.

Our D.P.R. preparation charges are INR 30,000/-

We will not take responsibility for getting the project sanctioned since it is subject to prevailing central & state government policy and norms.

For your information, once the subsidy for the Gasifier system is sanctioned by MNRE, Delhi the following documents are to be maintained / produced by the user of Gasifier system

1. Joint commissioning report to be signed by representatives of the user agency, manufacturer / suppliers of the system and State Nodal Agency in the prescribed Performa.
2. Audited Statement of Expenses in respect of the project.
3. Copy of the Annual Maintenance Contract for five years after the guarantee period from the manufacturers/supplier
4. Copy of the performance report for 3 months.
5. Undertaking / affidavit from the beneficiary to keep the system operational at least for a period of 10 years and that the system will not be dismantled / disposed off and dislocated without prior permission of MNRE, New Delhi.
6. A brief note on the project savings and cost benefit analysis and a photo of the system operation
7. Pictures of the system at the premises with beneficiary and concerned officials of State Nodal Agency

Inspection

Our equipment shall be available for inspection at our works before dispatch. We would require one-week advance intimation of possible date of arrival of customer's representative for inspection at our works.

Force Majeure

Our company shall not be liable for failure of its performance guarantee or penalty, if and to the extent that, it's delay performance or other failure to perform its obligations under the contract in the event of Force Majeure condition. `Force Majeure' means an unforeseeable event beyond the control of company like fire, flood, epidemics, quarantine restrictions, earthquake, strikes, riots, state emergency etc. and not involving the company's fault or negligence.

Guarantee

"Ankur" Biomass Gasifiers are guaranteed for a period of 12 months from the date of installation or 15 months from the date of dispatch whichever is earlier. During this guarantee period, we undertake to rectify or replace, at our option, as soon as possible, all parts that are proved defective or unusable due to faulty material, design or workmanship. Any damage due to bad maintenance, non-observance of operating instructions, incorrect application etc., is excluded from the purview of this guarantee.

This guarantee does not cover the electrically operated components like motors etc. once their operation is demonstrated to be satisfactory during monitoring of the system. The guarantee also does not cover glass components.

Our responsibility for replacement of parts does not extend to the parts which are subject to natural wear and tear. This guarantee will become void if the purchaser or a third party, on behalf of the purchaser, carries out any repairs/alterations without our prior written approval or fails to put up the relevant plant at our disposal for sufficient time, should repairs or alterations be required at site.

We guarantee the performance of the engine, but the guarantee does extend to the engine if it does break down. Thus we suggest that the customer go in for a mechanical breakdown insurance breakdown to take care of this eventuality.

THE ABOVE GUARANTEE WILL BE VALID IF AND ONLY IF ALL PAYMENTS DUE TO US (AS PER THE PAYMENT TERMS) ARE PROMPTLY RECEIVED.

In Endeavor to service you as quickly and efficiently as possible we have adopted the following protocol:

- A site readiness form will be sent to you as soon as the system is dispatched. This will list the various items that need to be ready at your end for our people to quickly commission the system. Once this form comes back to use with the requisite information, we would plan a visit for our erection and commissioning people. Typically we would request you to give us at least a two week notice to plan this trip.

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- Once our people come over and the system is erected and commissioned as desired, please certify the same on our format. This will be a written document to be signed by client's concerned authorities and representative of 'Ankur'.
- The erection and commissioning charges charged to you offer you our manpower for a total of 15 man-days in the first year. Any extra days needed on account of site/ issues not controlled by us would be chargeable at INR 2500 per man-day (all inclusive).
- If service is required - after the 15 man-days available - we would charge INR 2500 per man-day for this. The charges would need to be paid in advance.
- All boarding and lodging charges will be to the customer's scope.

Delivery Period

Within 12-14 weeks from the date of receipt of confirmed order with advance, equipment shall be ready for dispatch at our works.

Validity

Our offer shall be valid for 30 days from the date of this offer. It is subject to our written confirmation thereafter.

Customer's Scope

- Producer gas ducting from Gasifier to Burner.
- All civil & foundation work as per our drawing.
- All accessories from generator terminals onward with necessary field cabling etc.
- Utilities like free potable water for ash pond/water seal of Gasifier and power connections to electrical equipment of Gasifier.
- Electrical Wiring/cabling for all Gasifier related accessories.
- Charcoal, biomass etc. for trials, commissioning and regular operations.
- Kindly ensure no metallic parts like nails etc. are fed into the Gasifier.
- All site specific piping, plumbing etc.
- Fabrication of suitable ladder and platform for the Gasifier.

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- Chain pulley blocks/jib cranes of 1.0 ton capacity for WBG-40/WBG-100/FBG-100 and 3 ton capacity for higher ratings for operational convenience and maintenance.
- Arrangement for gas cutting, welding and other site-specific works/facilities.
- Manual labour for lifting and shifting of Gasifier into position as also for all other activities involving manual labour during installation and commissioning.
- For Erection and Commissioning decent boarding and lodging will need to be provided by the customer. If we pay for this, the same will be debited to the customer's account.
- If you run the Gasifier system continuously for 12 hours, you may need parallel line of systems.
- Actual handling of ash/char from Gasifier area to final disposal/storage point will be in customer's scope.
- Natural Spray Cooling System of suitable rating with pump – piping etc. # this can be done at your end, we can provide you the drawings/ details etc for the same if so required.
- Since Gasifier being a new technology equipment, we advise clients to get properly acquainted with all operational aspects & optional items of Gasifier like biomass characteristic (recommended moisture level, its bulk density, size etc) as well as suitability of optional items like wood dryer, wood cutter etc and any other associated accessories.
- Producer Gas Burners if not procured from "Ankur" to be arranged by he client. Also, the Blowers or Air Compressor etc necessary for the application will be in client's Scope..

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TECHNICAL & COMMERCIAL PROPOSAL

Mr. Soumen Achar, Kolkata
Mob : 9088231862

FOR

GENERATION OF THERMAL ENERGY FROM WOOD

THROUGH GP BIOMASS GASIFICATION SYSTEM

MODEL : GP-450-WT

FOR

THERMAL USE

PREPARED BY

GP GREEN ENERGY SYSTEMS PVT. LTD.
BH-114, Sector – II, Salt Lake City; Kolkata – 700 091;
West Bengal; India; Telefax: +91-33-2321-0809 / 2358-0115
Email: info@gpenergy.net Website: http://gpenergy.net

PROPOSAL NO : GP/RD/Q-7/338 **DATE : 30/12/10** **REV.- 0**

CONTENTS

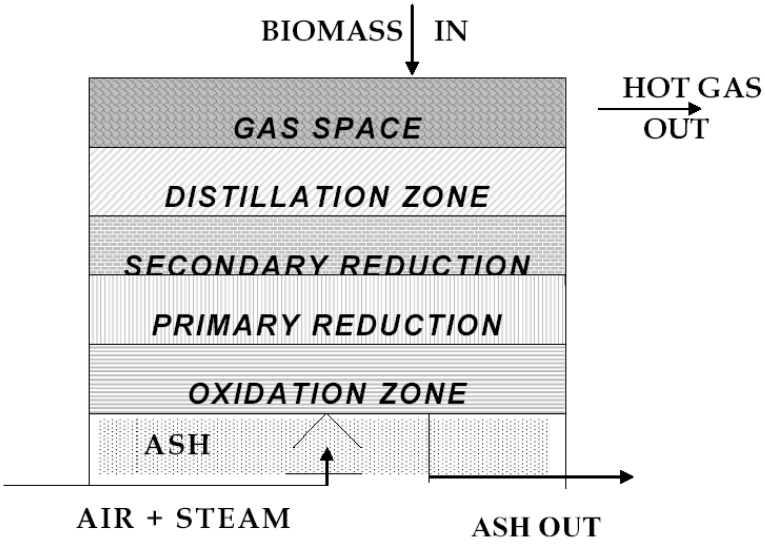
PROCESS DESCRIPTION

Our Gasification process is based on up-draught technology for production of a highly combustible gas by controlled reactions of Biomass viz. rice husk, wood, palm nut shell etc. with air and water vapour.

In the Gasifier, the solid biomass fuel having moisture content not exceeding 20% and 25mm size is fed from the top, while the air and steam is fed from the bottom, and moves upward against the downward movement of the biomass fuel, and this process of gas generation is called the Updraft principle.

A number of chain chemical reactions take place in the gas generator from the bottom to the top, a proper mixture of air & water vapor pass through compact fuel bed ensuring the reactions to take place.

While the plant is under normal operation, following zones exist in the gasifier, as shown in the cross sectional view below:



Composition of Gas : Though for different biomass fuels, there may be little variation in gas composition as well as the heating value, the gas composition and calorific value in general are as follows :-

CO_2 = 8 ~ 10%, O_2 = Less than 1.0%, CO = 24 ~ 26%,
CH_4 = 1.5 ~ 2%, N_2 = 54 ~ 56%, H_2 = 10 ~ 12%.

CV. (Gorss) = 1200 ~ 1250 K.cal/ Normal cubic meter
Sp. Gravity = 0.92
Yield of Gas = 1.7 ~ 1.9 Normal cubic meter per kg of biomass.

TECHNICAL SPECIFICATIONS

OF

GP GASIFICATION PLANT

Sl No	Description	Specification
1.	Model	**GP-450-WT**
2.	Fuel Mode	Wood Waste
3.	Energy Generation Capacity	12.37 lac Kcal/hr
4.	Fuel Required	400 Kg Wood Waste/Hour
5.	Biomass Specification	Moisture Content<20%
6.	Calorific Value of the Gas	1200-1250 Kcal / Nm^3
7.	Quantity of Gas Generated in Nm^3	850-900
8.	Auxiliary Power Required	25 HP (18.65KW)
9.	Ash Produced/ Hour in Kg	12 kg
10.	Thermal Efficiency of the System	72% - 75%
11.	Average Wood Consumption in Kg/Hr.	400
12.	Diesel Consumption at Full Load in Ltr./ Hr.	Nil
13.	Average Steam Consumption in Kg/ Hr. @ 2-4 Kg / cm^2 Pressure	130
14.	Average Water requirement in Ltr./ Day (Make-up)	900
15.	Maximum Thermal Output (Kcal / Hr.) in Lakh	12.37 Lac
16.	Average Area Requirement	70 ft x 35 ft (For Plant Only)
17.	Man Power requirement/ Shift	1 Skilled & 3 Un-Skilled
18.	Maximum Temperature can be obtained	1000 ^{0}C
19.	Gas Composition	CO_2 = 8-10% O_2<1% CO = 24-26% CH_4 = 1.5-2% N_2 = 54-56% H_2 = 10-12%

SCOPE OF SUPPLY

Our scope of supply shall consist of the following :-

A. Standard Equipments:

1.	Reactor Assembly	-	1 Set
2.	Skip Hoist for lifting Wood	-	1 Set
3.	Shed and Structure	-	1 Set
4.	Wet Scrubber	-	1 Set
5.	Dry Scrubber	-	1 Set
6.	Gas Exhauster cum Tar Extractor	-	1 Set
7.	Flare Tank	-	1 Set
8.	GP Cleaner	-	1 Set
9.	Air Blower	-	1 Set
10	Water Kettle (Where steam is not available at site)	-	1 Set
11.	Control Panel with accessories	-	1 Set

B. Accessories:

I) Refractory

1.	Refractory for inner lining of the Reactor	-	1 Lot

II) Instruments (Provided at every required point)

1. Gas temperature indicator.
2. Gas pressure indicator.
3. BST indicator.

III) Other Accessories

1.	Pump, Motor, Valves, Pipes, Fittings for water re-circulation	-	1 Lot
2.	Gas pipelines with flanges, bends etc.	-	1 Lot
3.	Electrodes for Site Fabrication	-	1 Lot
4.	Gaskets & Fasteners	-	1 Lot
5.	Mould Box	-	1 No
6.	All required tools & tackles for site work (Returnable)	-	1 Lot

EXCLUSIONS :

1. Land development.
2. License/ approval/ clearance from any govt. authority.
3. Gas line from **Terminal point** (see page 14) to utility point.
4. Sensors controls if required any.
5. Entire civil foundation work.
6. Project insurance during construction period.
7. Feed - stock (wood & like), Lube oil etc.
8. Transit Insurance of the Materials.
9. Unloading & Storing of Materials at site.
10. Man Power for operation of the Plant.
11. Any modification required for the existing Furnace.
12. Any other items not specified in the scope.
13. Dual Fuel Burner with accessories.
14. Biomass Ash handling and disposal system.
15. Supply of steam @ 5kg/cm².

EQUIPMENT DESCRIPTION

A. STANDARD EQUIPMENTS

SL	DESCRIPTION	QUANTITY
1	**Reactor Assembly** - MS plate fabricated vessel type body. - Includes fire brick lining internally. - Controlled air & steam distributor. - Fitted with Flap valve, hopper, inner bell, gas delivery pipe etc. - No of poke holes are fitted on the body for poking. - Man holes are provided on the body for easy access at the time of maintenance. - Water seal is provided at the bottom for safety. - Static Furnace is provided for burning of fuel. - Fitted with super structure assembly for proper operation & maintenance & inspection.	1 Set
2.	**Elevator/ Skip Hoist** M.S. Sheet Fabricated for automatic lifting of Bio mass -	1 Set
3.	**Shed & Structures** Operating shed and structure made out from M.S. angles and channels/joist to house the reactor with platform and stair case etc.	1 Set

STANDARD EQUIPMENTS (contd.)

SL.	DESCRIPTION	QUANTITY
4.	**Wet Scrubber** - MS cylindrical vessel type equipment. - Equipped with SS cup & cone valves inside. - Suspended on water seal for safety. - Inspection hole & monkey ladder is provided on the body.	1 Set
5.	**Dry Scrubber** - MS cylindrical vessel with manhole cover at the top. - Inspection doors are also provided. - Also included gas-tar separation arrangement. - Tar & water drained to a water seal.	1 Set
6.	**Gas Exhauster cum Tar Extractor** - SS impeller is provided to blow tar from gas. - Suitable MS body EN-8 shaft provided. - Equipped with flanged type coupling. - Suitable water spraying arrangement provided. - Suitable motor & accessories fitted with.	1 Set
7.	**Flare Tank** - MS fabricated body construction. - Suitable plug & socket arrangements are provided. - Rupture plates incorporated.	1 Set
8.	**GP Cleaner** - MS plate fabricated body construction. - Super cleans the Gas. - MS perforated gas distribution box provided inside.	1 Set
9.	**Air Blower** - Standard Centrifugal blower fan with adjustable dumper plate. - Suitable casing provided.	1 Set

STANDARD EQUIPMENTS (contd.)

SL	DESCRIPTION	QUANTITY
11.	**Control Panel with Accessories**	**1 Set**

- Suitable control panel with accessories provided for operation, control & safety.
- MS sheet fabricated body.
- Equipped with all necessary meters.
- Safety hooter is provided for alarming.
- Suitable cable is provided for energizing the plant.
- Additional features can be included on request.

STAND BY EQUIPMENTS

(Following equipments are recommended for uninterrupted operation of the Plant :-

1) Water re-circulating pump with motors - 1 Set

2) Gas Exhauster cum Tar Extractor - 1 Set

DRAWINGS & DOCUMENTS

The following drawings & documents will be supplied to you free of cost:

A. Within 4 weeks from the date of receipt of technically & commercially clear Purchase Order.

1. General Arrangement Drawing of the Plant - 1 Soft & 1 Hard

B. With Shipment of equipment:

1. Detailed Packing List - 1 Hard Copy
2. Operation & Maintenance Manual for the Plant - 1 Soft & 3 Hard
3. Operation & Maintenance for the BO Items (Original equipment manufacturer's manual) - 1 Set Each

PRICE SCHEDULE

The following is the Budgetary Offer for our Plant:	PRICE IN INR
1. 'GP' Gasifier plant Model No: **GP-450-WT** with required gas cleaning system for generation of clean gas for producing Thermal Energy **of 400 KW** consists of the equipments as per the 'Scope of Supply' list	Rs. 45.00 Lacs
(Rupees Forty Five Lacs Only)	
2. Cost of stand- by items viz. Pump, Motor, Mech. Blower for un- interrupted operation of the plant	Rs. 8.00 lacs
3. Cost of labour charges for Erection and Commission of the above plant	Rs. 3.00 lacs
Total --	**Rs. 56.00 lacs**

(Indian Rupees Fifty Six Lacs only)

COMMERCIAL TERMS & CONDITIONS

PACKING AND FORWARDING:

The equipment shall be packed as per GP Energy's standard practice. The prices offered include the charges for the packing & forwarding.

OCTROI DUTY AND LOCAL TAXES:

The prices offered herein do not include Octroi duty/Entry tax (if any), which is payable to the local authorities at destination. Buyer will pay such duties directly while receiving the equipment. In case GP Energy is called upon to pay these, Buyer will reimburse the same to GP Energy at actuals. Alternatively, in case Buyer is exempted from paying Octroi duty, Buyer shall give GP Energy suitable "Octroi exemption certificate" prior to despatch, to enable to clear the consignment without payment of Octroi duty.

VARIATION OR ADDITION IN SCOPE OF SUPPLY:

The scope of GP Energy's supply is restricted to as specified in the proposal. Any subsequent addition or alteration will be acceptable to GP Energy provided it is convenient to do so and the price and delivery period is suitably revised. Unless such revision is authorised from the Buyer within 15 days of our intimation, GP Energy shall be at liberty to suspend further work and recommence it only after fresh negotiation on prices and delivery period. The same will be the case if GP Energy is forced to suspend work for more than 15 days at Buyer's specific instructions or lack of instructions.

CHANGES IN WORK OR LAW:

If there is any change in the scope and/or nature of work, during the execution of this project, because of change in Indian Government's ruling or regulations or order, an adjustment in terms including, but not limited to, prices, deliveries, etc. shall be mutually agreed.
GP Energy is not obliged to proceed with the changes until they have received the Buyer's written approval of the proposed changes as well as adjustments, if any, in terms of the order.

PRICE ESCALATION CLAUSE:

The price quoted in the Price Schedule will vary as per the Price Escalation Clause.
The offer is made based on the prevailing market rates for the standard structural items & steel plates. Price will be revised at the time of the order. We shall accommodate maximum of +/- 2% price variation, beyond that upper limit price will be borne by the customer.

DELIVERY:

Within 20 Weeks from the date of LOI subject to the detailed Purchase Order comprising of scope, technical specifications and commercial terms shall be released within a maximum period of two weeks from the date of LOI.
The zero date of the order is the date GP Energy receives detailed Purchase Order & advance.
The delivery period mentioned in this proposal is given in good faith based on GP Energy's present commitments and is therefore subject to reconfirmation at the time of acceptance of PO.

DELAY IN COMPLETION:

If the completion of supply is delayed beyond the order date for reasons under Buyer's (and/or his consultant's) control, as listed out hereunder but not limited to them, GP Energy shall be entitled for readjustment in the period of completion by proportional days and the order will stand amended to that extent:

1. Delay in approval of final drawings beyond a period of 7 days from the date of submission by GP Energy.
2. Delay in inspection, if applicable, beyond the appointed date or delay in approval of test certificates, wherever required, beyond a period of 7 days from the date of submission by GP Energy.
3. Delay in release of despatch clearance or hold up of work due to Buyer's specific instructions or lack of instructions.
4. Delay in advance or progress payments to GP Energy beyond 7 days from due date.
5. Delay attributable to Force Majeure conditions, as described in detail under appropriate clause hereunder.

EXCESS MATERIALS:

Since GP Energy shall be sending to site a number of items for smooth and uninterrupted erection and commissioning, such items, which remain unutilized, will be GP Energy's property and will be removed by them.

COMMISSIONING

The equipments will be commissioned by our commissioning engineer(s) after thorough checking of the equipments. The equipments will be handed over after commissioning. If because of any reason, the handed over is delayed and the equipment is put into commercial use, the equipments will be considered & deemed to be commissioned & handed over from the date of commercial use.

WARRANTY FOR EQUIPMENTS:

GP Energy's liability in respect of any defect in or failure of equipment supplied by them or any loss, injury or damage attributable thereto, is limited to making good by replacement or repairs, defects, which appear therein, provided the equipment is commissioned by our engineers, operated and maintained in accordance with GP Energy's instructions, and arise totally from proven fault in design, materials or workmanship, within a period of 12 months from the date of commissioning of the equipment or 18 months from the date of last invoiced despatch, whichever is earlier, at the end of which period, all liability on GP Energy's part will cease.

This warranty is applicable under the following conditions:

1. Any replacements/repairs required under provisions of the above warranty will be carried out at GP Energy's option either at site or at their works. In the latter case, Buyer will send the defective parts to GP Energy's works at Buyer's cost & liability.

2. After repairs/replacement, warranty period for the entire equipment including replaced or repaired parts will be limited to the unexpired portion of the total warranty period.

3. For accessories and fittings not manufactured by GP Energy, but which form an integral part of the equipment supplied by them, the warranty will be co-terminus with the main equipment, irrespective of the warranty extended by their suppliers.

4. In respect of the equipment where despatch after readiness is delayed due to specific instructions or lack of instructions from Buyer, the warranty will be limited to 18 months from the date of readiness for despatch of equipment as notified by GP Energy.

5. Any other party on GP Energy's equipment during the warranty period, unless authorised by GP Energy in writing, will carry out no repairs or replacements.

6. The warranty obligations will be honored by GP Energy provided Buyer has fulfilled obligations under the order relating to release of due payments, etc.

The warranty period does not cover the following:

- Normal wear and tear
- Damages/defects arising out of wrong operation of the equipment by the Buyer and/or arising out of accidents, riots, fire, etc.

PAYMENT TERMS:

- 40% of the total contract value as advance along with technically commercially confirmed & corrected order.
-60% against Proforma Invoice before dispatch of goods.

DELAYS IN PAYMENT:

Any delay in payment to GP Energy beyond the due dates will entitle GP Energy to suspend further work under the order without any liability for delay in delivery and/or completion and to receive interest on the outstanding amount for the period of delay at a rate higher by two percent than the bank lending rate prevailing at that time.

CANCELLATION OF ORDER:

Buyer will not unilaterally cancel the order once GP Energy accepts it. In the event of the order being cancelled by Buyer with GP Energy's consent, Buyer will be liable to pay cancellation charges to GP Energy, either proportional to the order period up to the date of cancellation or the actual cost of work completed, whichever is higher, subject to the minimum of 20% of the value of order. Buyer will not have any claim over designs, drawings and materials lying with GP Energy, which, after cancellation of order, will become GP Energy's property.
Under no circumstances, cancellation of order is acceptable after expiry of 75% of order period.

INTERRUPTIONS:

Should GP Energy be subjected to interruption during the execution of the order on account of non- fulfillment of the Buyer's obligations or due to reasons attributable to the Buyer, the terms and conditions of this order shall be re-negotiated and mutually agreed upon. GP Energy is not obliged to resume the work until GP Energy has received the Buyer's written approval of the re-negotiated terms and conditions.

FORCE MAJEURE:

GP Energy shall be under no liability for delay in delivery/completion of work if GP Energy or its subcontractors/suppliers are prevented from discharging GP Energy's respective obligations under the order for causes beyond GP Energy's reasonable control, including but not limited to war [whether declared or not], invasion, acts of enemies, hostilities, riots, civil commotion, labour disturbance, strikes, lockouts, layoffs, mutiny, insurrection, rebellion, revolution, epidemics, accidents, sabotage, fire, earthquake, floods, Government orders and restrictions, legal enactments, delay or inability to obtain materials due to change in Import Policy or other statutory restrictions, lack of transport facilities, interruptions/restrictions in power supply, damage to or breakdown of plant, machinery and equipment, etc.

CONSEQUENTIAL DAMAGES:

Neither party shall at anytime be liable to the other for any loss of profits or any similar indirect damages, howsoever described, incurred or suffered by either party in respect of the project.

ARBITRATION:

In the event of any difference in the interpretation of these terms or dispute arising in executing the order, the same will be resolved by reference to two arbitrators under provision of Indian Arbitration & conciliation Act, 1996 and the seat of Arbitration shall be Kolkata.

JURISDICTION:

Any order arising out of GP Energy's present offer will be subject to jurisdiction of Law Courts in Kolkata.

SECRECY:

All data, specifications and drawings submitted by GP Energy as a part of the order are proprietary in nature and will not be passed on by the Buyer to any third party, for whatever reason, without GP Energy's written consent.

GOVERNING LAWS:

Indian Laws and Regulation shall govern execution of this project.

TERMINAL POINT:

Outlet flange of the Filter Box is the Terminal point of our plant. Gas pipeline beyond that point to the utility point is client's scope of supply.

CONSTRUCTION POWER & WATER

Required Power & water for construction at site to be provided by the client within 1 meter of our construction site.

GENERAL:

Any condition or other matters pertaining to this offer not expressly stipulated will be a matter of mutual discussions and agreement at the time of accepting the order.

VALIDITY OF OFFER

Our offer will remain valid for 30 days (Thirty days) from the date here off.

For GP Green Energy Systems Pvt. Ltd.

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