DETAILED PROJECT REPORT
ON
WASTE HEAT RECOVERY (1.5 kl/hr)
(SURAT TEXTILE CLUSTER)

ENERGY IS LIFE
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Bureau of Energy Efficiency

Prepared By

ZenithEnergy
Horizons Beyond Energy

Reviewed By

ISTSL

WASTE HEAT RECOVERY SYSTEM

(1.5 kl /hr)

SURAT TEXTILE CLUSTER

BEE, 2010
Detailed Project Report on Waste Heat Recovery System (1.5 kl /hr)
Textile SME Cluster, Surat, Gujrat (India)
New Delhi: Bureau of Energy Efficiency;
Detail Project Report No.: ***SRT/TXT/WHR/14***

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

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

Acknowledgement

We are sincerely thankful to the Bureau of Energy Efficiency, Ministry of Power, for giving us the opportunity to implement the 'BEE SME project in "Surat Textile Cluster, Surat". We express our sincere gratitude to all concerned officials for their support and guidance during the conduct of this exercise.

Dr. Ajay Mathur, Director General, BEE

Smt. Abha Shukla, Secretary, BEE

Shri Jitendra Sood, Energy Economist, BEE

Shri Pawan Kumar Tiwari, Advisor (SME), BEE

Shri Rajeev Yadav, Project Economist, BEE

Zenith Energy Services Pvt. Ltd. is also thankful to "Shri Mahesh Malpani, Chairman, PEPL and Surat Textile Manufacturers Association" 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 Surat Textile Cluster.

We take this opportunity to express our appreciation for the excellent support provided by Textile 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).

ZESPL is also thankful to all the SME owners, plant in charges and all workers of the SME units for their support during the energy use and technology audit studies and in implementation of the project objectives.

Zenith Energy Services Pvt. Ltd.

Hyderabad

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kWh	kilo Watt Hour
CETP	Common Effluent Treatment Plant
SME	Small and Medium Enterprises
GHG	Green House Gas
BEE	Bureau of Energy Efficiency
DPR	Detailed Project Report
O&M	Operational & Maintenance
NPV	Net Present Values
ROI	Return on Investment
IRR	Internal Rate of Return
DSCR	Debt Service Coverage Ratio
PBT	Profit Before Tax
PAT	Profit After Tax
SIDBI	Small Industries Development of India
WHR	Waste Heat Recovery
WHRS	Waste Heat Recovery System
MoMSME	Ministry of Micro Small and Medium Enterprises

EXECUTIVE SUMMARY

Zenith Energy Services Pvt. Ltd is executing BEE-SME program in Surat textile cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Surat textile cluster is one of the largest textile clusters in India; accordingly this cluster was chosen for energy efficiency improvements by implementing energy efficient measures/technologies, so as to facilitate maximum replication in other textile clusters in India.

The main energy forms used in the cluster units are electricity and fuel such as wood, coal, natural gas and other biomass product. Mostly used in boilers, thermopac, Jet dying, stenter, loop machine, scouring, bleaching, Jiggers, Jumbo, hydro extractor, small pumps and lighting.

Installation of Waste Heat Recovery System with Jet dying machine or Jigger or Jumbo will reduces fossil fuel consumption & production cost and also reduces the environmentally harmful green house gases emission.

Project implementation i.e. installation of waste heat recovery system will lead to reduction in fuel consumption by 97 tonne per annum however; this intervention will not have any effect on the existing consumption pattern of electricity fuel.

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)	3.11
2	Fuel saving	tonne / year	89
3	Monetary benefit	₹(in lakh)	3.38
4	Debit equity ratio	ratio	3:1
5	Simple payback period	years	1.08
6	NPV	₹(in lakh)	9.42
7	IRR	%age	84.28
8	ROI	%age	29.00
9	DSCR	ratio	4.47
10	Process down time	day	10

The projected profitability and cash flow statements indicate that the project implementation will be financially viable and technically feasible

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 25 selected SMEs clusters. Surat Textile Cluster is one of them. The BEE's SME Programme intends to enhance the energy efficiency awareness by funding / subsidizing need based studies in SME clusters 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 stake holders in cluster on energy efficiency

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

Implementation of energy efficiency measures

To implement the technology up-gradation projects in clusters, BEE have 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 About the Surat textile cluster

The products manufactured in Surat Textile Cluster are synthetic sarees and dress materials and the products are renowned in the country and abroad. The main raw material for the cluster units is grey cloth and is procured from local weaving units and agents. The cost of energy (electrical and thermal energy) as percentage of manufacturing cost varies between 12 and 15%.

Majority of the cluster units are of integrated type, where the raw material "grey cloth" is processed in-house to the final product like sarees and dress materials. Most of the units of the cluster are working on Job basis, where the textile agents will provide design and grey cloth and the unit's process as per design provided by the clients. The energy cost is next to the raw materials cost.

1.1.1 Production process

The main process operation for dyeing and printing process of synthetic sarees and dress materials adopted in cluster units are as follows:

Fabric pre-treatment

The main purpose of the fabric pre-treatment process is to remove oil, grease and other materials and to whiten the grey cloth though bleaching. The various process adopted in pre-treatment are scouring, bleaching and shrinking process.

Dyeing

Dyeing is the process of imparting colors to the material through a dye (color). In which a dye is applied to the substrate in a uniform manner to obtain an even shade with a performance and fastness appropriate to its final use. This process is mainly performed in Jet Dyeing Machines and Jigger machines.

Dyeing of fabric is carried out in jet dyeing machines. The temperature of the solution is raised to 50℃. Concentrated dyestuff solution is prepared separately and is added to the liquor. After the addition of dyes, the temperature is raised to 130℃ and maintained for about 60 minutes.

After whitening/dyeing, the fabric is unloaded from the machine and taken to the folding and rolling machines for improving the width of cloth, which gets shrunk during the washing and dyeing process.

Printing

In Surat cluster three types printing methods are used. Most of the units are use flat bed printing, rotary printing and some units follows hand printing. Hand printing is the

old method to print the fabric. The flat bed printing has provision for printing 10 to 14 colors simultaneously. The color print paste prepared is fed onto the screens from which it is transferred to the fabric fed in. The fabric after print paste transfer is passed through a drying chamber at 145℃. The dried and printed fabric is taken for further processing.

Drying and Finishing

After printing, the drying process is performed in loop machine, where the temperature is maintained between 130℃ to 170℃ for better colour setting. After passing through the loop machines, the printed fabric is washed in a series of normal water and hot water washing in the presence of chemicals for colour setting. After completion of the washing process, the printed and washed fabric is subjected to heat setting process in Stenter and then pressing and finishing treatments.

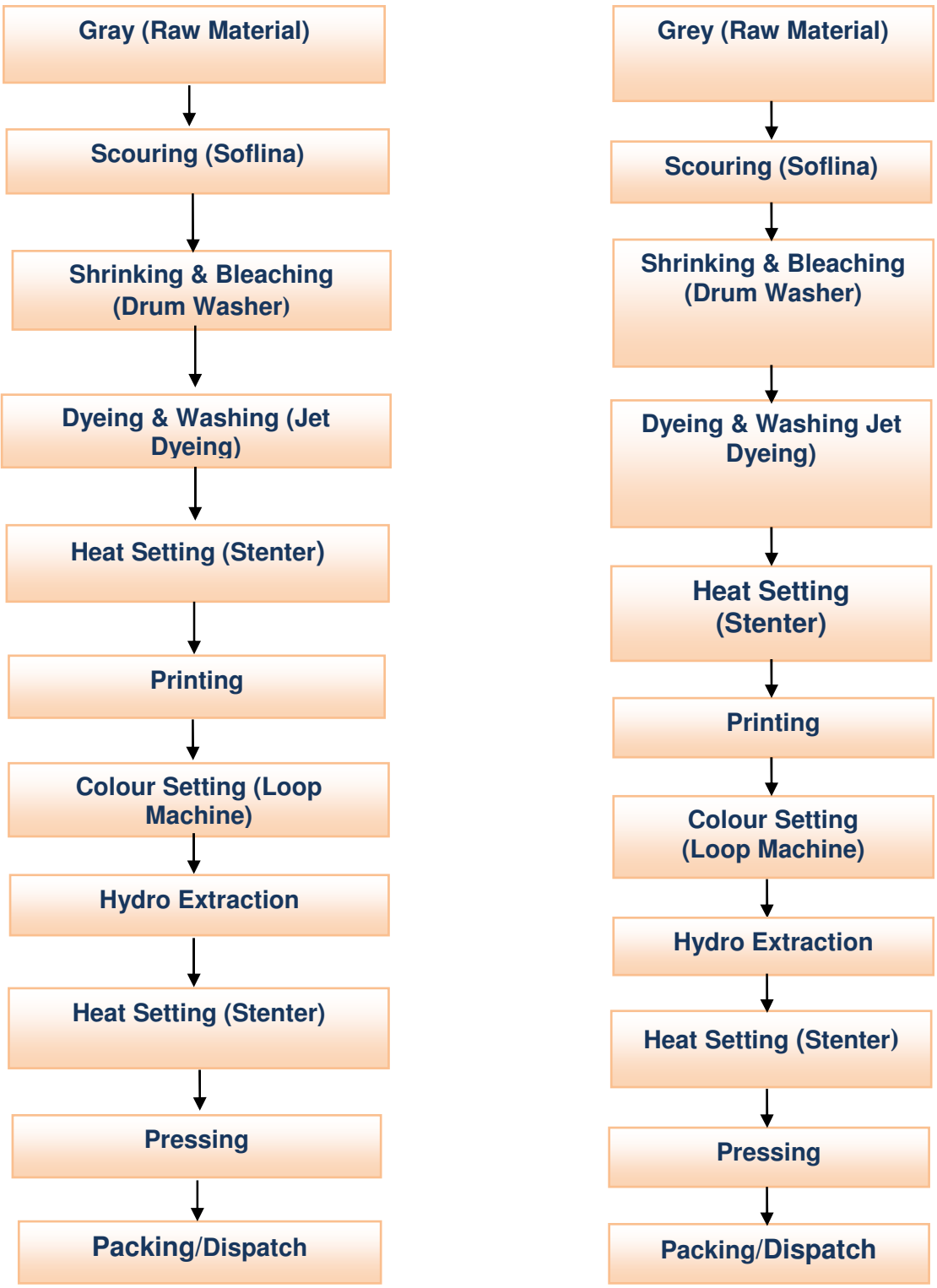


Figure 1.1 Process Flowchart of Surat Textile Cluster

1.2 Energy performance in existing situation

1.2.1 Fuel and electricity consumption of a typical unit

The main energy forms used in a typical unit in the cluster are electricity, coal/lignite and natural gas. Electricity is used for driving the prime movers of pumps, fans, stenter fans, ID and FD fans, conveyers, loop machines drives, lighting etc. Imported coal and lignite are used as fuel in boilers for steam generation and whereas natural gas is used as fuel in generators for electricity generation, stenters, printing and loop machines. The energy consumption of a typical unit in the cluster using local make pumps and having about 15 Jet machines is furnished in Table 1.1 below:

Table 1.1: Energy consumption of a typical unit

S.No	Details	Unit	Value
1	Coal/lignite consumption	tonne/year	1987
2	Grid electricity consumption	MWh/annum	751
3	Natural gas consumption	million SCM/year	0.216
4	Production (quantity processed)	meter(In lakh)/year	175

1.2.2 Average production by a typical unit in the cluster

The average production in a year in a typical unit is 175 lakh meters of final product.

1.3 Identification of technology/equipment to be upgraded

1.3.1 Existing/Conventional technology/equipment

There are 8 jet machines of various capacities ranging from 50 to 200 kg and all the jet machines are operated continuously for 24 hours in a day. At present, the drained hot water from the jet machines is drained to the CETP (Common Effluent Treatment Plant) at 90 oC without any heat recovery leading to wasteful of energy.

1.3.2 Role in process

The project activity is installation of waste heat recovery system (WHRS) and is additional equipment consists of heat exchangers, pipe lines, water tanks, valves for controlling the flow etc

1.4 Establishing the baseline

1.4.1 Design and operating parameters

About 31 kilolitres of hot water at 90 ^{o}C is drained to the CETP from all the jet machines in a day for typical unit having production capacity of 50,000 meters/day

1.4.2 Quantity of hot drained water

The drained water quantity of various jet machines of three cluster units and is furnished in Table 1.2 below

Table 1.2 Quantity of hot drained water of typical units

S. No	*Name of the unit*	*No. Jet Machines Capacity (nos)*	*Hot Water Drained (kl/day)*
1	Vitrag silk mills Pvt Ltd	8	31
2	Trishla silk mills Pvt Ltd	6 (5 Jet machines & 2 drum machines)	36
3	Tulsi Syntex Pvt Ltd	6 Jet machines & 5 drum machines	32

1.5 Barriers for proposed energy efficient equipment

1.5.1 Technological Barriers

The major technical barriers that prevented the implementation of the waste heat recovery system in the cluster are:

- Lack of awareness of the technology
- Dependence on local equipment suppliers, who doesn't have technical knowledge

1.5.2 Financial Barrier

The lack of awareness of the losses and monetary benefit

1.5.3 Skilled manpower

One local technical persons available at Surat takes care of about 5-10 textile units. Maintenance or repair work of major equipments of textile units like stenter, Jet Dyeing machine, Jigger machine etc, are generally taken care by the equipment suppliers itself.

1.5.4 Other barrier (If any)

Space availability for laying pipe lines and water storage tanks

2 TECHNOLOGY/EQUIPMENT FOR ENERGY EFFICIENCY IMPROVEMENTS

2.1 Detailed description of equipment selected

2.1.1 Description of equipment

The purpose of the waste heat recovery system consists of heat exchangers, hot and cold water tanks, pump for circulating water and distribution system. The drained water from jet machines is passed through one side of the shell and tube heat exchanger and cold water to be heated on other side. The drained water after recovering the heat is drained to the CETP. The hot fresh water is stored in the tank and is supplied to different sections of the plant.

The shell contains the tube bundles, and internal baffles, to direct the fluid in the shell over the tubes in two or multi pass system. The heat exchanger consists of series of tubes, where the jet machine drained hot water is passed through the tubes and fresh water to be heated in the shell and heat is absorbed by the water and can be used for the process requirement or can be used as boiler feed water.

2.1.2 Equipment specifications

The detailed drawing has been provided in the Annexure 4 as the equipment is fabricated and hence technical specifications were not provided.

2.1.3 Integration of equipment with existing equipment

The jet machines are the most commonly found equipment in the cluster units and considerable quantities of hot water is required and coloured water after dyeing process is completed drained and the temperature is found to be 90 ^{0}C. The studies were carried out in 75 industries, and all the units are draining hot water without any heat recovery.

Installing waste heat recovery system for recovering heat from the drained water for hot water generation will reduce the fuel consumption and generated hot water can be used in the process or as boiler feed water and hence reduces coal consumption.

2.1.4 Superiority over existing technology/equipment

- The proposed technology enhances the efficiency for the following reasons:
- The precious heat available in the drained hot water is utilized and hence reduces coal consumption
- The system will also reduce the process time
- By heating the water it is also helping to prevent thermal shock in boilers as reduces the load on the equipments

2.1.5 Availability of the proposed equipment

The proposed equipment is locally available.

2.1.6 Source of technology/equipment for the project

The technology is indigenously developed and this technology is adopted from the exhaust gases recovery through economizer.

2.1.7 Service/technology providers

The service providers are locally available and contact details of service providers are given in Annexure 7.

2.1.8 Terms and condition in sales of equipment.

The terms of sales of the equipment supplier are:

- 50% advance along with the order
- 50% against Performa invoice prior to dispatch

2.1.9 Process down time during implementation

The detail of process down time is provided in Annexure 6.

2.2 Life cycle assessment and risks analysis

The operational life of the proposed economizer is 15 years and no majors risks are identified, as the proposed equipment is additional to the existing system.

2.3 Suitable unit for implementation of proposed equipment

The waste heat recovery is designed such that the maximum amount of heat available in the hot drained water is recovered and suitable for all the unit where about 31000 liter hot water is drained per day.

3 ECONOMIC BENEFITS OF PROPOSED EQUIPMENT

3.1 Technical benefits

3.1.1 Fuel saving

The equivalent imported coal savings due to implementation of the waste heat recovery system for hot water generation is estimated at 89 tonne per annum. A Detail saving calculation is presented at Annexure1.

3.1.2 Electricity saving

The electricity consumption is increase due to installation of small motor pump to circulate the water but it is negligible with the total electricity consumption hence no electrical savings is envisaged.

3.1.3 Improvement in product quality

There is no significant impact on product quality ***directly or indirectly.***

3.1.4 Increase in production

As the hot water is generated by utilizing the waste heat available in the drained hot water and can be directly used for the process, hence, production may increase.

3.1.5 Reduction in raw material consumption

No significant impact on raw materials consumption ***directly or indirectly.***

3.1.6 Reduction in other losses

There is no significant reduction in other looses ***directly or indirectly.***

3.2 Monetary benefits

The monetary benefit by implementation of the waste heat recovery system is estimated as ₹ 3.38 lakh per annum due to reduction in coal consumption. Energy & monetary benefit analysis of waste heat recovery system are shown in Table 3.1 below

Table 3.1 Energy and Monetary Benefit due to Project Implementation

S. No.	*Particulars*	*Unit*	*Value*
1	Quantity of drained hot water available	liters/day	31000
2	Average quantity per day (80%)	liters/day	24800
3	Temperature of hot drain water	^{0}C	90
4	Temperature of hot drain water after WHR	^{0}C	50
5	Quantity of heat can be recovered	kCal/day	992000
6	Present Boiler efficiency	%	65

S. No.	Particulars	Unit	Value
7	Calorific value of fuel	kCal/kg	6000
8	Fuel saving per annum	Tonne/annum	89
9	Cost of fuel	₹/fuel	3800
10	Saving in rupees	₹ (lakh) /year	3.38

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

The project activity identified will utilize state-of-the-art technologies to ensure energy efficiency and energy conservation of non renewable fuels and the project activity reduce drained water temperature and hence improves working environment

3.3.2 Improvement in skill set of workers

The equipment selected for the implementation is new and energy efficient. The equipment implemented will create awareness among the workforce and improves the skill of the workers.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

There is no significant impact in effluent generation due to implementation of the project activity.

3.4.2 Reduction in GHG emission

The major GHG emission reduction source is CO_2. The technology will reduce fossil fuel consumption due to waste heat recovery of the waste drained water. The total emission reductions are estimated at 64 tonnes of CO_2 per annum due to implementation of the project activity.

3.4.3 Reduction in other emissions like SO_x

The equipment reduces the coal consumption and also reduces SO_x emissions.

4 IMPLEMENTATION OF PROPOSED EQUIPMENT

4.1 Cost of equipment implementation

4.1.1 Cost of equipment

The total cost of system is estimated at ₹ 3.00 lakh, which includes heat exchanger, hot and cold water tanks, water distribution lines, pump for water circulation etc.

4.1.2 Other costs

The total cost of implementation of the waste heat recovery is estimated at ₹ 3.11 lakh. The above cost includes cost of equipment / machinery, cost of fabrication (and/or) commissioning charges and the details are furnished below;

4.2 Arrangement of funds

Table 4.1 Details of Proposed Equipment Installation Cost

S. No	Particulars	Unit	Cost
1	Equipment Cost	₹ (In Lakh)	3.00
2	Erection & commissioning cost	₹ (In Lakh)	0.11
3	Interest during Implementation	₹ (In Lakh)	0.00
4	Total Cost	₹ (In Lakh)	3.11

4.2.1 Entrepreneur's contribution

The entrepreneur's contribution is 25% of total project cost, which works out at ₹ 0.78 lakh.

4.2.2 Loan amount

The term loan is 75% of the total project, which is ₹ 2.33 lakh.

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. 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

Considering the above discussed assumptions, the net cash accruals starting with ₹ 2.74 lakh in the first year operation gradually increases to ₹ 15.21 lakh at the end of eighth year.

4.3.2 Simple payback period

The total project cost of the proposed technology is ₹ 3.11 lakh and monetary savings due to reduction in coal consumption is ₹ 3.38 lakh and the simple payback period works out to be 13 months.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10.00% interest rate works out to be ₹ 9.42 lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 84.28%. Thus the project is financially viable.

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 29.00% for an investment of ₹ 3.11 lakh. The average debt service coverage ratio works out at 4.47.

4.4 Sensitivity analysis in realistic, pessimistic and optimistic scenarios

A sensitivity analysis has been worked out to ascertain how the project financials would behave in different situations like there is an increase in fuel savings or decrease in fuel savings. For the purpose of sensitive analysis, two scenarios are considered are.

- Increase in fuel savings by 5%
- Decrease in fuel savings by 5%

In each scenario, other inputs are assumed as constant. The financial indicators in each of the above situation are indicated along with standard indicators are shown in Table 4.2 below:

Table 4.2 Sensitivity analysis at different scenarios

Particulars	*IRR*	*NPV*	*ROI*	*DSCR*
Normal	84.28	9.42	29.00	4.47
5% decrease in fuel savings	80.26	8.82	28.76	4.26
5% increase in fuel savings	88.26	10.01	29.22	4.68

The project is highly sensitive to fuel savings, the debt service coverage ratio works out to be 4.26 times in worst scenario, which indicates the strength of the project.

4.5 Procurement and implementation schedule

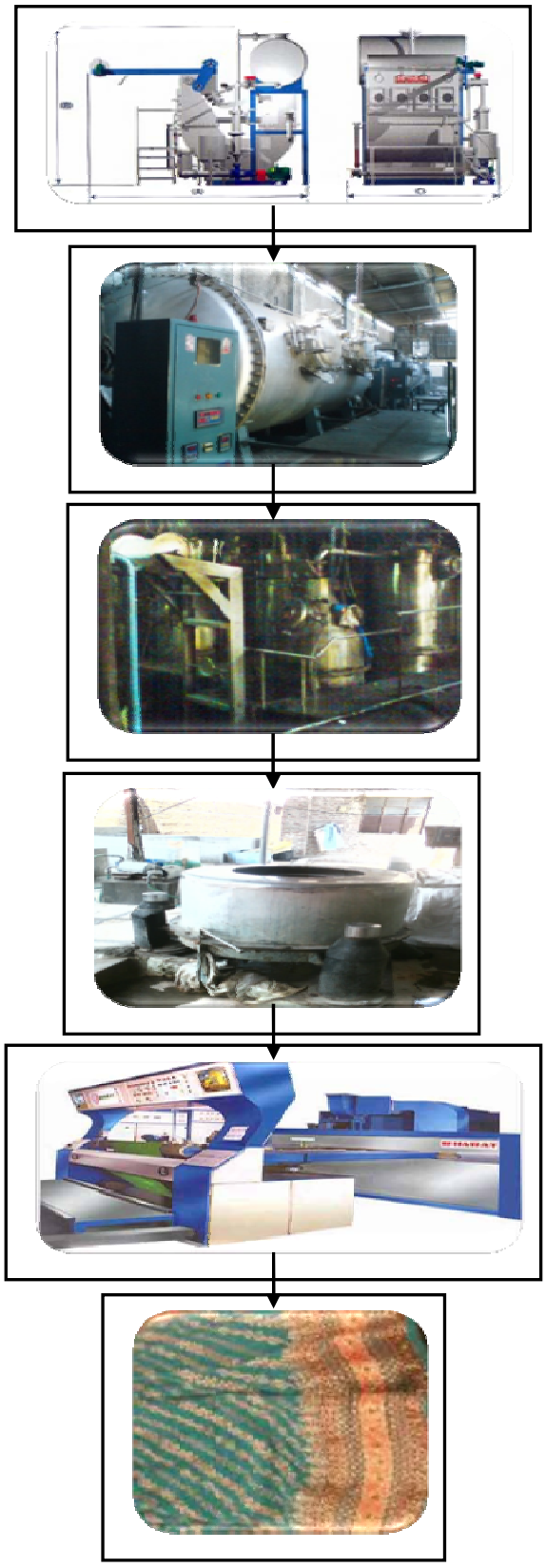
The project is expected to be completed in 10 weeks from the date of financial closure. The detailed schedule of project implementation is furnished in Annexure 7.

Annexure

Annexure 1 Energy audit report for baseline establishment

S No	Parameter	Units	Details
1	Quantity of hot water drained available	liters/day	31000
2.	Average quantity per day (80%)	liters/day	24800
3.	Temperature of hot drain water	^{0}C	90
4	Quantity of heat can be recovered	kCal/day	992000
5	Present Boiler efficiency	%age	65
6	Calorific value of fuel	kCal/kg	6000
7	Fuel savings per day	kg/day	254
8	Operating days per annum	days	350
9	Fuel saving per annum	Tonne/annum	89
10	Fuel cost	₹/tonne	3800
11	Monetary savings per annum	₹In lakh	3.38
12	Investment for tank, heat exchanger and pumping system	₹ In lakh	3.11
13	Payback period	Year	1.08

Annexure 2 Process flow diagram



Annexure 3 Technology Assessment Report – Waste Heat Recovery System

The jet machines are the most commonly found equipment in the cluster units and considerable quantities of hot water is required and colored water after dyeing process is completed drained and the temperature is found to be 90 ^{0}C. The studies were carried out in 75 industries, and all the units are draining hot water without any heat recovery.

Installing waste heat recovery system for recovering heat from the drained water for hot water generation will reduce the fuel consumption and hot water generated can be used in the process or as boiler feed water and hence reduces coal consumption

The proposed technology enhances the efficiency for the following reasons:

The precious heat available in the hot drained water is utilized and thus reduces coal consumption

The system will reduce the process time

By heating the water it is also helping to prevent thermal shock in boilers as reduces the load on the equipments

Reduces thermal pollutants to the atmosphere due to reduction in coal consumption

Basis for Selection of Equipment

The various factors influence the selection and sizing of the waste heat recovery system. The following were considered:

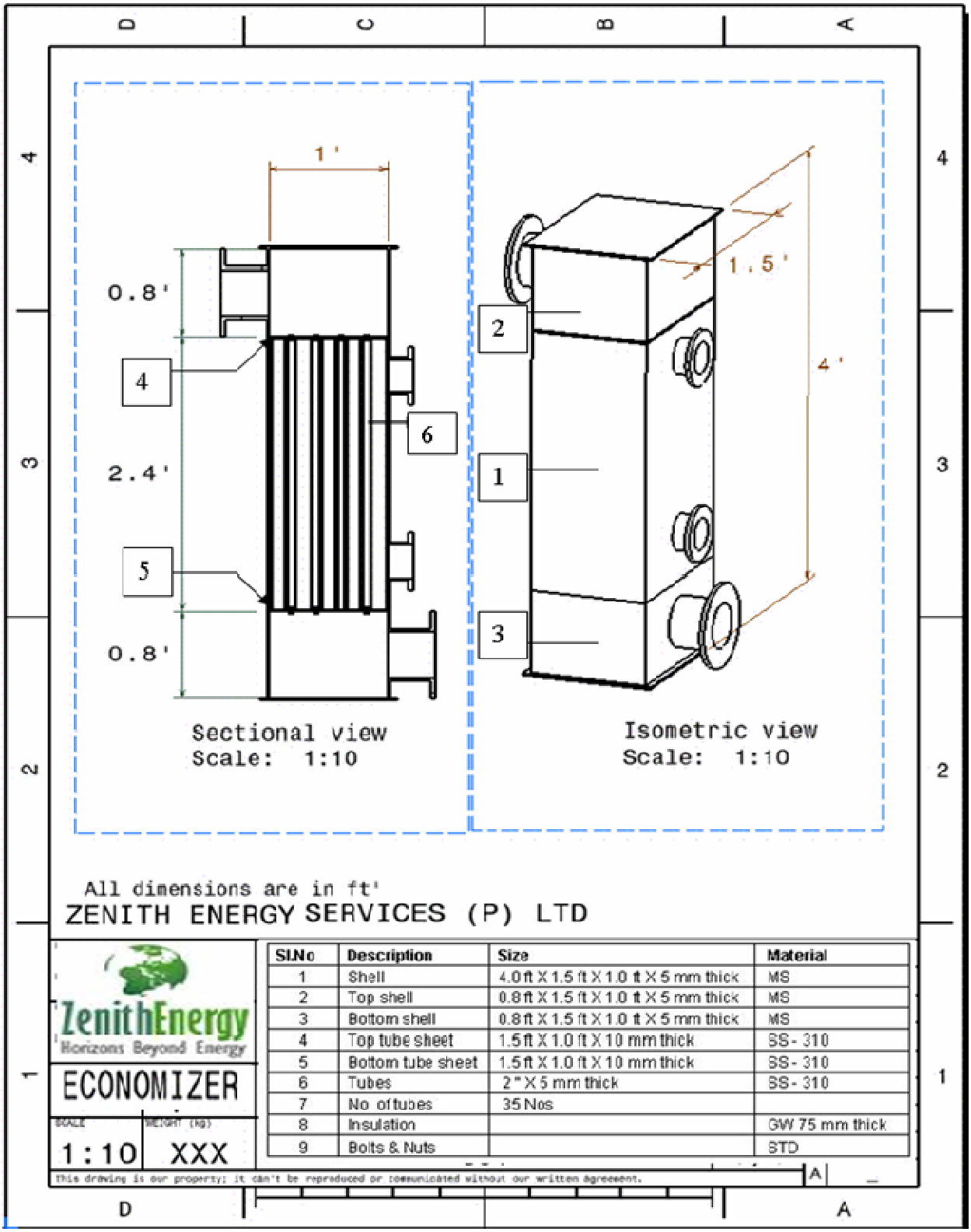
- Quantity of heat available in hot drained water

- Temperature of hot water required for the process and other allied applications

- Space availability

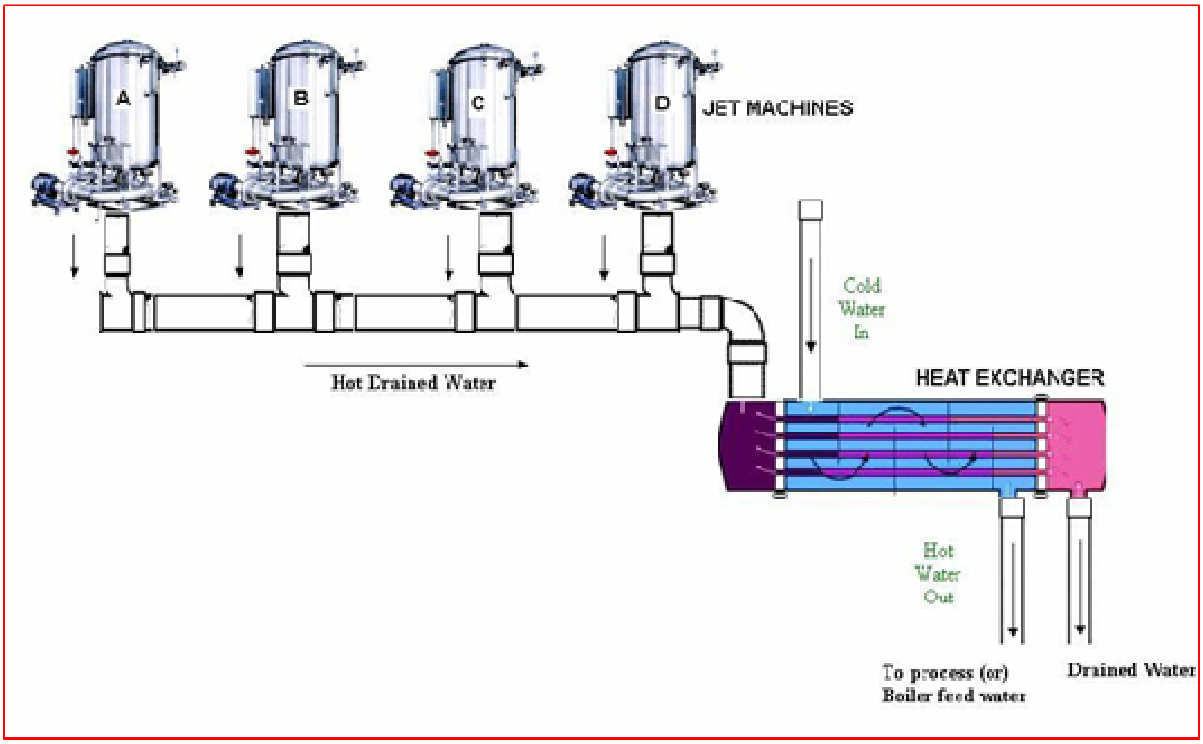
- Cost economics

Annexure 4 Drawings of proposed equipment



Sl.No	Description	Size	Material
1	Shell	4.0 ft X 1.5 ft X 1.0 t X 5 mm thick	MS
2	Top shell	0.8 ft X 1.5 ft X 1.0 t X 5 mm thick	MS
3	Bottom shell	0.8 ft X 1.5 ft X 1.0 t X 5 mm thick	MS
4	Top tube sheet	1.5 ft X 1.0 ft X 10 mm thick	SS- 310
5	Bottom tube sheet	1.5 ft X 1.0 ft X 10 mm thick	SS- 310
6	Tubes	2" X 5 mm thick	SS- 310
7	No of tubes	35 Nos	
8	Insulation		GW 75 mm thick
9	Bolts & Nuts		STD

Schematic diagram of waste heat recovery system



Annexure 5 Detailed financial calculations & analysis

Assumption

Name of the Technology	*Waste Heat Recovery System from hot drained water*		
Rated Capacity	*1.5 kl/hr*		
Details	*Unit*	*Value*	*Basis*
Installed Capacity	Kl/hr	1.5	
No of working days	Days	350	
No of Shifts per day	Shifts	3	
Proposed Investment			
Plant & Machinery	₹ (in lakh)	3.00	
Erection & Commissioning	₹ (in lakh)	0.11	
Total Investment	₹ (in lakh)	3.11	
Financing pattern			
Own Funds (Equity)	₹ (in lakh)	0.78	Feasibility Study
Loan Funds (Term Loan)	₹ (in lakh)	2.33	Feasibility Study
Loan Tenure	years	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%	10.00	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	4.00	Feasibility Study
Annual Escalation	%	5.00	Feasibility Study
Estimation of Revenue			
Coal Saving	Tons	89	
Cost	₹/Tons	3800	
St. line Depn.	%age	5.28	ndian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

Estimation of Interest on Term Loan *(₹in lakh)*

Years	*Opening Balance*	*Repayment*	*Closing Balance*	*Interest*
1	2.33	0.12	2.21	0.21
2	2.21	0.24	1.97	0.21
3	1.97	0.38	1.59	0.19
4	1.59	0.55	1.04	0.14
5	1.04	0.72	0.32	0.07
6	0.32	0.32	0.00	0.01
		2.33		

WDV Depreciation

Particulars / years	*1*	*2*
Plant and Machinery		
Cost	3.11	0.62
Depreciation	2.49	0.50
WDV	0.62	0.12

Projected Profitability

Particulars / Years	1	2	3	4	5	6	7	8
Revenue through Savings								
Fuel savings	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38
Total Revenue (A)	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38
Expenses								
O & M Expenses	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.18
Total Expenses (B)	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.18
PBDIT (A)-(B)	3.26	3.25	3.24	3.24	3.23	3.22	3.22	3.21
Interest	0.21	0.21	0.19	0.14	0.07	0.01	-	-
PBDT	3.05	3.04	3.06	3.10	3.16	3.21	3.22	3.21
Depreciation	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
PBT	2.88	2.88	2.89	2.94	2.99	3.05	3.05	3.04
Income tax	0.19	0.86	1.04	1.05	1.07	1.09	1.09	1.09
Profit after tax (PAT)	2.69	2.01	1.85	1.88	1.92	1.96	1.96	1.95

Computation of Tax ***₹ (in lakh)***

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	2.88	2.88	2.89	2.94	2.99	3.05	3.05	3.04
Add: Book depreciation	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Less: WDV depreciation	2.49	0.50	-	-	-	-	-	-
Taxable profit	0.56	2.54	3.06	3.10	3.16	3.21	3.22	3.21
Income Tax	0.19	0.86	1.04	1.05	1.07	1.09	1.09	1.09

Projected Balance Sheet ***₹(in lakh)***

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Reserves & Surplus (E)	2.69	4.70	6.56	8.44	10.36	12.32	14.28	16.23
Term Loans (F)	2.21	1.97	1.59	1.04	0.32	0.00	0.00	0.00
Total Liabilities D)+(E)+(F)	5.68	7.46	8.93	10.26	11.46	13.10	15.05	17.01
Assets								
Gross Fixed Assets	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
Less: Accm. Depreciation	0.16	0.33	0.49	0.66	0.82	0.99	1.15	1.31
Net Fixed Assets	2.95	2.78	2.62	2.45	2.29	2.13	1.96	1.80
Cash & Bank Balance	2.74	4.67	6.31	7.81	9.17	10.97	13.09	15.21
Total Assets	5.68	7.46	8.93	10.26	11.46	13.10	15.05	17.01
Net Worth	3.47	5.48	7.34	9.22	11.14	13.10	15.05	17.01
Dept equity ratio	2.85	2.54	2.05	1.34	0.42	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	0.78	-	-	-	-	-	-	-	-
Term Loan	2.33								
Profit After tax		2.69	2.01	1.85	1.88	1.92	1.96	1.96	1.95
Depreciation		0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Total Sources	3.11	2.86	2.18	2.02	2.05	2.08	2.12	2.12	2.12
Application									

Capital Expenditure	3.11								
Repayment of Loan	-	0.12	0.24	0.38	0.55	0.72	0.32	-	-
Total Application	3.11	0.12	0.24	0.38	0.55	0.72	0.32	-	-
Net Surplus	-	2.74	1.94	1.64	1.50	1.36	1.80	2.12	2.12
Add: Opening Balance	-	-	2.74	4.67	6.31	7.81	9.17	10.97	13.09
losing Balance	-	2.74	4.67	6.31	7.81	9.17	10.97	13.09	15.21

Calculation of Internal Rate of Return

₹(in lakh)

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Profit after Tax		2.69	2.01	1.85	1.88	1.92	1.96	1.96	1.95
Depreciation		0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Interest on Term Loan		0.21	0.21	0.19	0.14	0.07	0.01	-	-
Salvage/Realizable value					-	-	-	-	-
Cash outflow	(3.11)	-	-	-	-	-	-	-	-
Net Cash flow	(3.11)	3.07	2.39	2.21	2.18	2.16	2.13	2.12	2.12
IRR	84.28%								

NPV	9.42

Break Even Point

₹(in lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13
Sub Total (G)	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13
Fixed Expenses								
Oper. & Maintenance Exp	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04
Interest on Term Loan	0.21	0.21	0.19	0.14	0.07	0.01	0.00	0.00
Depreciation *(H)*	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Sub Total (I)	0.41	0.41	0.38	0.34	0.27	0.21	0.21	0.21
Sales (J)	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38
Contribution (K)	3.29	3.28	3.28	3.27	3.27	3.26	3.26	3.25
Break Even Point (L= G/I)	12.38 %	12.40 %	11.72 %	10.34 %	8.41 %	6.56 %	6.32 %	6.40 %
Cash Break Even {(I)-(H)}	7.38%	7.40%	6.71%	5.32%	3.38 %	1.52 %	1.28 %	1.35 %
Break Even Sales (J)*(L)	0.42	0.42	0.40	0.35	0.28	0.22	0.21	0.22

Return on Investment

₹(in lakh)

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Net Profit Before Taxes	2.88	2.88	2.89	2.94	2.99	3.05	3.05	3.04	23.72
Net Worth	3.47	5.48	7.34	9.22	11.14	13.10	15.05	17.01	81.81
									29.00%

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

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Cash Inflow									
Profit after Tax	2.69	2.01	1.85	1.88	1.92	1.96	1.96	1.95	12.32
Depreciation	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.99
Interest on Term Loan	0.21	0.21	0.19	0.14	0.07	0.01	0.00	0.00	0.83
Total (M)	3.07	2.39	2.21	2.18	2.16	2.13	2.12	2.12	14.13

Debt

Interest on Term Loan	0.21	0.21	0.19	0.14	0.07	0.01	0.00	0.00	0.83
Repayment of Term Loan	0.12	0.24	0.38	0.55	0.72	0.32	0.00	0.00	2.33
Total (N)	0.33	0.45	0.57	0.69	0.79	0.33	0.00	0.00	3.16
	9.25	5.30	3.90	3.17	2.72	6.39	0.00	0.00	4.47
Average DSCR (M/N)	4.47								

Annexure 6 Procurement and Implementation plan schedule

Project Implementation Schedule – Waste Heat Recovery System

S. No.	Activities	weeks							
		1	2	3	4	5	6	7/8	9/10
1	Placement of order and layout and design finalization								
2	Fabrication works								
3	laying pipelines and water tanks installation								
4	Commissioning and trial runs								

Process down Time

S. No.	Activities	days							
		1	2	3	4	5	6	7/8	9/10
1	Heat Exchangers , Pipe line distribution laying and pump installation								
2	Commissioning								
3	Trial runs								

Note: However, the process down time is considered for one week only, as lying of pipelines and installing water storage tanks doesn't require machines to stop.

Annexure 7 Details of equipment and service providers

Equipment details	*Source of technology*	*Service/technology providers*
Waste Heat Recovery System	Indigenous	**Devchand Engineers Pvt Ltd.** B8, Vanita Residency, Beside China Gate-2, Althan Neher Road, Surat-395 017 (Gujarat) India. Ph.: +91-261-2914383 info@devchandengineers.com **Usha Die Casting Inds** 7405/1, Rd. No. 73/c,Gidc Estate Sachin, Surat, Gujarat India http://www.blowersnfabricators.com **Fabtech Engineering Company** Shed No. 4314/3, 4314/4,Road No. 43-c,G.i.d.c. - Sachin, Surat, Gujarat India Heatex Industries Limited Block No 436, Palsana NH 8, Palsana, SURAT, Gujarat India

Annexure 8 Quotations or Techno-commercial bids for proposed equipment

S.R.ENTERPRISES

(INSTRUMENTATION DIVISION)

G-4, Global Enclave, Bhagyanagar colony, Opp: KPHB, Hyderabad-500 072

Tele / Fax: 040-2306 1973 Mobile: 94404 93650/ 9866771315

E-mail: srenterprise1999@rediffmail.com

QUOTATION : SRE/09-10/400
Customer Ref : Telecon

September 15, 2010

To
T Krishna
Zenith Energy Services Pvt Ltd
10-5-6/B, My Home Plaza,
Masabtank,
Hyderabad

QUOTATION FOR WASTE HEAT RECOVERY SYSTEM

Supply of heat exchangers (2 nos), water distribution lines and hot & cold water tanks (1,500 liters/hr capacity) inclusive of all taxes	Rs.3,00,000
Erection and commissioning charges	Rs. 11,000
Total	Rs.3,11,000

Bureau of Energy Efficiency (BEE)
(Ministry of Power, Government of India)
4th Floor, Sewa Bhawan, R. K. Puram, New Delhi – 110066
Ph.: +91 – 11 – 26179699 (5 Lines), Fax: +91 – 11 – 26178352
Websites: www.bee-india.nic.in, www.energymanagertraining.com

Zenith Energy Services Pvt. Ltd
10-5-6/B, My Home Plaza, Masab
Tank HYDERABAD, AP 500 028
Phone: 040 23376630, 31,
Fax No.040 23322517
Website: www.zenithenergy.com

India SME Technology Services Ltd
DFC Building, Plot No.37-38,
D-Block, Pankha Road,
Institutional Area, Janakpuri, New Delhi-110058
Tel: +91-11-28525534, Fax: +91-11-28525535
Website: www.techsmall.com