DETAILED PROJECT REPORT
ON
PROVISION OF INSULATION ON DUST COLLECTOR IN THERMOPAK
(PALI TEXTILE CLUSTER)

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PROVISION OF INSULATION ON DUST COLLECTOR IN THERMOPAC

PALI TEXTILE CLUSTER

BEE, 2010

Detailed Project Report on Provision For Installation of Dust Collector in Thermopac

Textile SME Cluster, Pali, Rajasthan (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: **PAL/TXT/DCT/04**

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We have received very encouraging feedback for the BEE SME Program in various SME Clusters. Therefore, it was decided to bring out the DPR for the benefits of SMEs. We sincerely thank the officials of BEE, Executing Agencies and ISTSL for all the support and cooperation extended for preparation of the DPR. We gracefully acknowledge the diligent efforts and commitments of all those who have contributed in preparation of the DPR.

CONTENTS

List of Annexures……………………………………………………………………..……….vii

List of Figures…………………………………………………………………………..…...vii

List of Tables…………………………………………………………………..……….......viii

List of abbreviations……………..……………………..………………..…..…...……………viii

Executive summary……………..……..……..………………….....…...………………………..ix

About Bee's SME Program…………………..…...………………..………………… ………….xi

1.0 INTRODUCTION 1

1.1 Brief Introduction about Cluster.. 1

1.1.1 Classification of Units 3

1.1.2 Production process of Textile dyeing and finishing.................................... 3

1.2 Energy performance in existing situation 8

1.2.1 Average production.. 8

1.2.2 Fuel consumption 8

1.2.3 Specific Energy Consumption (SEC) 8

1.3 Identification of technology/equipment..10

1.3.1 Description of technology/ equipment 10

1.3.2 Role in process..11

1.3.3 Energy audit methodology 11

1.3.4 Design and operating parameters specification 11

1.3.5 Operating efficiency analysis 13

1.4 Barriers in adoption of proposed technology/equipment 14

1.4.1 Technological Barrier..14

1.4.2 Financial Barrier 15

1.4.3 Skilled manpower 16

1.4.4 Other barrier (If any) 16

2.0 PROPOSED EQUIPMENT 17

2.1 Detailed description of technology proposed.. 17

2.1.1 Equipment specification 17

2.1.2 Suitability over existing equipment 17

2.1.3 Superiority over existing equipment 17

2.1.4 Availability of equipment 17

2.1.5 Source of equipment.. 17

2.1.6 Technical specification of equipment 17

2.1.7 Terms and conditions in sales of equipment 17

2.1.8 Process down time during implementation.. 18

2.2 Life cycle assessment and risks analysis 18

2.3 Suitable Unit for Implementation of Proposed Technology.. 18

3.0 ECONOMIC BENEFITS FROM PROPOSED EQUIPMENT 19

3.1 Technical benefit 19

3.1.1 Fuel saving 19

3.1.2 Electricity saving 19

3.1.3 Improvement in product quality 19

3.1.4 Increase in production 19

3.1.5 Reduction in raw material 19

3.1.6 Reduction in other losses.. 19

3.2 Monetary benefits 19

3.3 Social benefits 19

3.3.1 Improvement in working environment in the plant 19

3.3.2 Improvement in workers skill.. 19

3.4 Environmental benefits 20

3.4.1 Reduction in effluent generation 20

3.4.2 Reduction in GHG emission.. 20

3.4.3 Reduction in other emissions like SO_X 20
4.0 INSTALLATION OF PROPOSED EQUIPMENT 21
4.1 Cost of equipment implementation.....21
4.1.1 Equipments cost 21
4.1.2 Erection, commissioning and other misc. cost 21
4.2 Arrangements of funds 21
4.2.1 Entrepreneur's contribution.....21
4.2.2 Loan amount.....21
4.2.3 Terms & conditions of loan 21
4.3 Financial indicators.....21
4.3.1 Cash flow analysis.....21
4.3.2 Simple payback period 22
4.3.3 Net Present Value (NPV) 22
4.3.4 Internal rate of return (IRR).....22
4.3.5 Return on investment (ROI) 22
4.4 Sensitivity analysis.....23
4.5 Procurement and Implementation Schedule 23

List of Annexures

Annexure -1: Information Brochure....24

Annexure -2: Quotation 26

Annexure -3: Detail financial calculation....27

Annexure -4: Details of procurement and implementation 31

Annexure 4: Detailed equipment assessment report 32

Annexure -5: Details of equipment service providers....33

Annexure – 6 Typical arrangement drawings for proposed system....34

Annexure – 7 Technical specification 35

List of Figures

Fig. 1.1 – Pali – Geographical Map 1

Fig. 1.2 – Process Flow Diagram of Cotton Dyeing and Printing 4

Fig. 1.3 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing....5

Fig. 1.4 – Process Flow Diagram of Polyester Printing and Finishing 6

Fig. 1.5 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing....7

Fig. 1.6 – Sketch of thermic fluid heater with air pre heater and Dust Collector 10

Fig. 1.7 Energy Audit methodologies....11

Fig. 1.8 Sankey diagram of Thermopac....13

List of Tables

Table1.1 Details of annual energy consumption scenario at Pali Textile Cluster …………..2

Table 1.2 Annual productions from a typical unit 8

Table 1.3 Annual energy consumption 8

Table 1.4 Specific Energy Consumption Values 8

Table 1.5 Specific energy consumption at Pali cluster 9

Table 4.1 Details of proposed equipment installation cost 21

List of Abbreviations

- BEE - Bureau of Energy Efficiency
- DPR - Detailed Project Report
- DSCR - Debt Service Coverage Ratio
- FD - Forced Draft
- GHG - Green House Gases
- HP - Horse Power
- IBR - Indian Boiler Regulation
- IRR - Internal Rate of Return
- MoP - Ministry of Power
- MSME - Micro Small and Medium Enterprises
- NPV - Net Present Value
- ROI - Return On Investment
- SME - Small and Medium Enterprises
- TFH - Thermic Fluid Heater
- WHR - Waste Heat Recovery
- CERs - Certified Emission Reduction

EXECUTIVE SUMMARY

Pali has evolved as one of the most important production centers in the Textile Dyeing and Finishing sector despite there being nothing favorable for proliferation of a cluster. The place lacks all possible resources, from raw materials to fuels, Dyes & Chemicals and above all water which is the most important for processing of textiles. Today there are over 350 units in Pali alone and the production of all of these combined together crosses 5.5 million meter per day mark.

All the Industries in Pali cluster are in SME sector. These Industries process Manmade Fiber, Natural Fiber and blends. The units mainly process lower value clothes and the quality of fabric used is less than 100gm per RM. Few units have their own brand. Most of the units do job work for traders and the job works are also done process wise. Thus there are different units specializing in a particular process.

The process adopted by the units can be divided into three major classes –

a. Pre treatment
b. Dyeing and Printing
c. Finishing

The majority of units mainly do hand processing and a few (less than 20%) units do power processing. However, the output of the power process units far exceeds those of hand processing units.

Energy forms a major chunk of the processing cost with over 30% weightage in the cost basket. As per the preliminary and detailed energy audit findings, there exists potential of saving over 20% electricity and 30% fuel in the applications in power process industries with over all general pay back period of less than one year. Hand process industries are very less energy intensive, though, there also exists a saving potential of over 20%. The payback period in these industries is higher due to their working schedule and lower utilization of facilities.

The units in Pali cluster use disperse dyes for coloration of Polyester fabric or polyester contained in blends. Heat setting is necessary in these textiles and also finishing after Dyeing – Washing or Printing – Dye Fixation – Washing processes. Stenter is used for the two processes and this is very energy intensive process. Going by connected load and also by the absolute electricity consumption in textile dyeing and processing units, stenter happens to have a share upwards of 50%.

During Energy Audit, none of the dust collectors of Thermopacs were found to be insulated with suitable insulating materials. Even, awareness about the insulation of dust collector was very low.

Typically Thermopac consumes between 250 to 300 kg/hr RPC and saving potential due to better insulation of dust collector in Thermopac would be 23.56 MT RPC per year.

This DPR highlights the details of the study conducted for assessing the potential for better insulation of dust collector in Thermopac, possible Energy saving, and its monetary benefit, availability of the technologies/design, local service providers, technical features & proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, and schedule of Project Implementation.

Total investment required and financial indicators calculated such as monetary saving, IRR, NPV, DSCR and ROI etc for proposed technology is furnished in Table below:

S.No	***Particular***	***Unit***	***Value***
1	Project cost	₹ (in Lakh)	1.00
2	RPC saving	MT/year	23.56
3	Monetary benefit	₹ (in Lakh)	1.77
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	Months	7
6	NPV	₹ (in Lakh)	5.64
7	IRR	% age	149.78
8	ROI	% age	29.47
9	DSCR	ratio	7.38
10	CO_2 saving	MT	64
11	Procurement and implementation schedules	Weeks	6

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. Pali 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*:**

Activity 1: Energy Use and Technology Audit

The energy use technology studies would provide information on technology status, best operating practices, gaps in skills and knowledge on energy conservation opportunities, energy saving potential and new energy efficient technologies, etc for each of the sub sector in SMEs.

Activity 2: Capacity Building of Stake Holders in Cluster on Energy Efficiency

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

Activity 3: Implementation of Energy Efficiency Measures

To implement the technology up gradation projects in 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.

1.0 INTRODUCTION

1.1 Brief Introduction about Cluster

Pali is the District Head Quarter of the Pali District situated at a distance of approx. 300 KMs from Jaipur and 70 KMs from Jodhpur. Pali can also be reached from Ahmedabad via Abu Road and has direct train connectivity to Ahmedabad and Mumbai. The nearest airport having commercial flights plying is at Jodhpur. The map depicting Pali district and its distances from various towns is produced below in fig. 1.

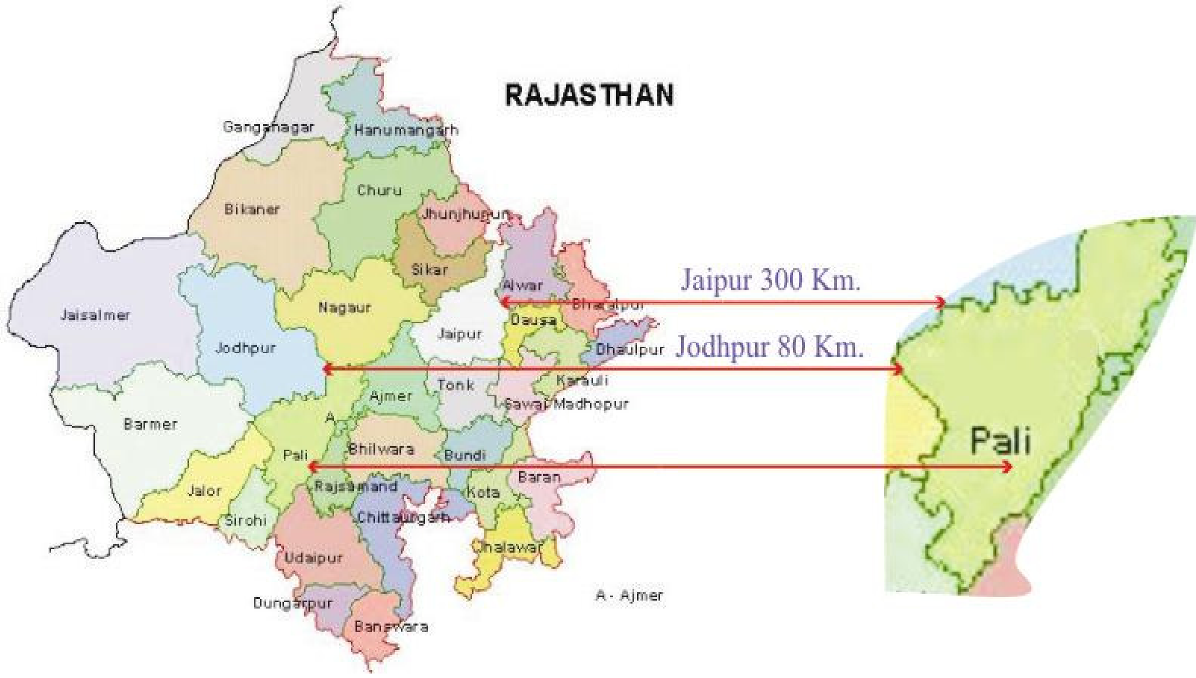


Fig. 1.1 – Pali – Geographical Map

Pali District is rich in minerals and the abundance of limestone deposits has made it home for 5 cement companies. There are several other SME units producing various lime based products. Despite there being non availability of requisite resources like raw material and consumables locally, a dense population of textiles dyeing and processing units has sprung up at Pali.

The Pali textile cluster is one of the biggest SME textile clusters in India having over 350 industries. The units in the cluster are mainly located in two Industrial Areas namely Industrial Area Phase I & Phase II and Mandia Road Industrial Area. Some of the units hitherto functioning in residential colonies are in the process of shifting to a new Industrial Area named Punayata Road Induatrial Area. Over 150 industries are in the process of setting up their facilities in the Punayata Road Industrial area.

Balotra, Jodhpur and Bhilwara are other textile clusters in Rajasthan. These clusters work on more or less similar processes and use same machines, though their output differs. Details of energy consumption scenario at Pali textile cluster are furnished in Table 1.1 below:

Table1.1 Details of annual energy consumption scenario at Pali Textile Cluster

S. No	Type of Fuel	Unit	Value	% contribution (KLOE)
1	Electricity	MWh /year	51.3	16.6
2	Firewood	MT/year	27161	25.6
3	Steam Coke	Tonne/year	2967	5
4	Lignite	MT/year	16635	15.7
5	Diesel	Klitre/year	89.6	0.3
6	Residual Pet coke	Mt/Yr	11820	36.6

Energy usages pattern

Electrical energy Usage

The Cluster has two types of units – Hand Process and Power Process. Hand Process units mainly process cotton and consume very less electricity. These units consume electricity in the range of 4000 kWh to 5000 kWh per month. The hand process units outsource the finishing to other power process units. Power process units are energy intensive units and consume electricity in the range of 100000 kWh to 300000 kWh per month. Various Electricity consuming equipments in the hand process units are Fans, Tube Lights, and Computers etc. Power Process units have Stenter, Jet Dyeing Machine, Loop Agers, Boiler and Thermopac auxiliaries, Flat Bed Printing Machines etc. Stenter happens to be the biggest Electricity guzzler.

Thermal Energy Usage

Hand process units in the cluster are mainly involved in Table Printing, Kier Boiling and Jig dyeing. Heat for the process is obtained from direct burning of wood. Some units also have open type stenter wherein heating is done by directly burning wood beneath the clothes. Power Process units mainly use Thermal Energy Stenters, Kiers, Jet Dyeing Machines, Sanforizers, Loop Agers, Mercerisers, Scouring, Reduction and Clearance etc. These units use Residual Pet Coke, Lignite, Coal and Wood in Boilers and Thermopacs to make heat usable in machines. Typical Power Process Units use 100 MT to 300 MT RPC (85 MTOE to 256 MTOE) per month. The hand process units use 3 MT to 15 MT wood per month.

1.1.1 Classification of Units

The Textile units in the Pali Cluster can be categorized into two types based on availability of machinery in the units –

- Hand Process Units and
- Power Process Units

Pali Textile Cluster mainly consists of hand process units and over 250 out of a total population of 350 units are hand process units. These units are mainly owned by artisans or traditional colormen (Rangrej).

On the basis of type of cloth processed, the units can be classified as

- Cotton (Natural fiber) Processing Units
- Synthetic clothes (Manmade fibers) Processing Units

Based on output, the units can be classified as

- Dyeing Units
- Printing units
- Finishing Units

Scale of Operation

Most of the units in the Pali textile cluster are micro units. All the units are in Micro, Small or Medium sector with none of the units being in large scale sector.

Products Manufactured

Different types of products manufactured in Pali Textile Cluster. The marketed products are:

- ✓ Sarees (Lower Price Range)
- ✓ Rubia Blouse Clothes
- ✓ Lungies
- ✓ Turbans
- ✓ African Prints

1.1.2 Production process of Textile dyeing and finishing

The process adopted in Textile Dyeing and Finishing depends upon the fabric processed. The processes are different for Cotton, Polyester and Blended fabrics. The process flow chart for different processes depending upon fabric processed with location of use of Thermopac in the process are drawn below –

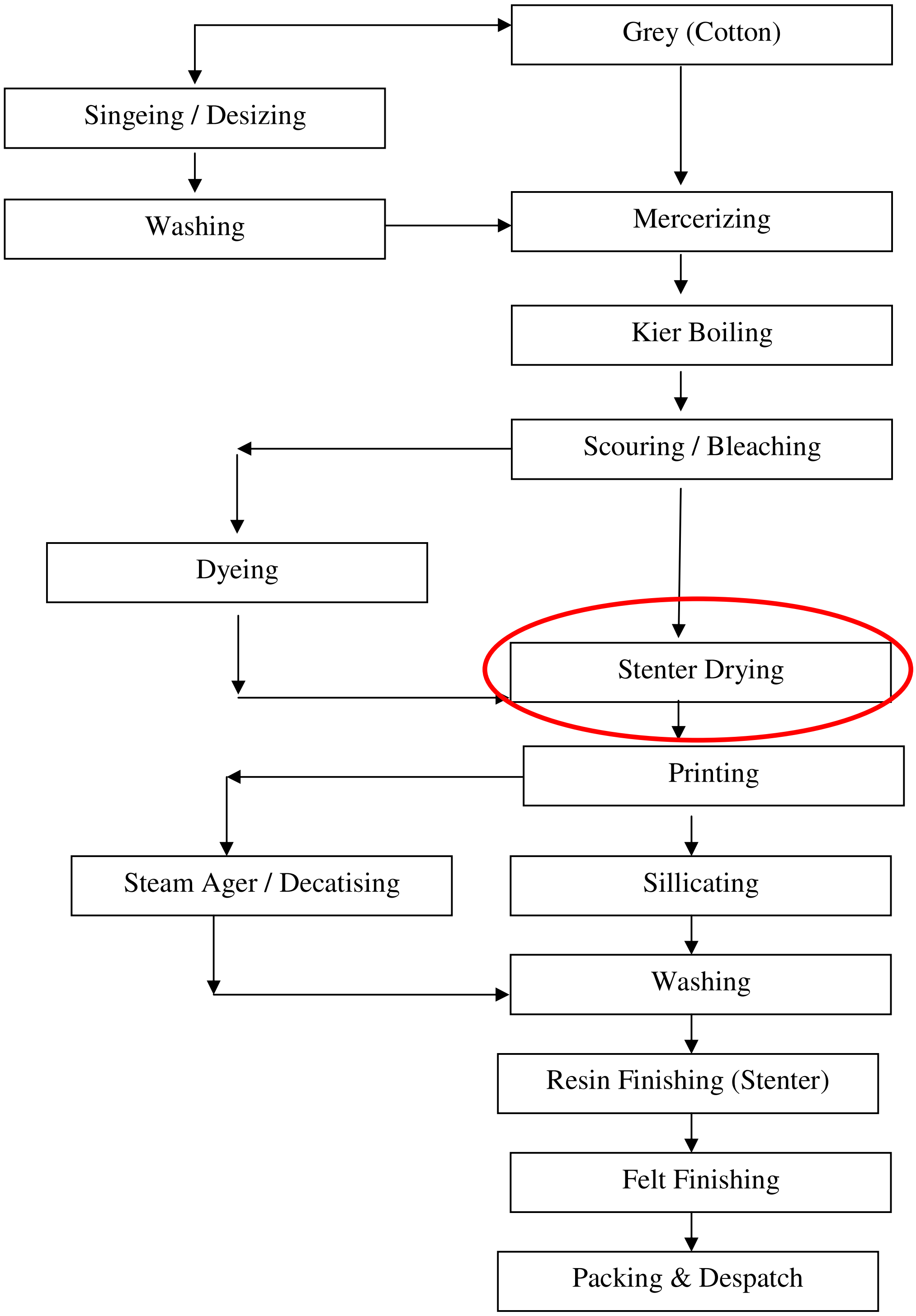


Fig. 1.2 – Process Flow Diagram of Cotton Dyeing and Printing

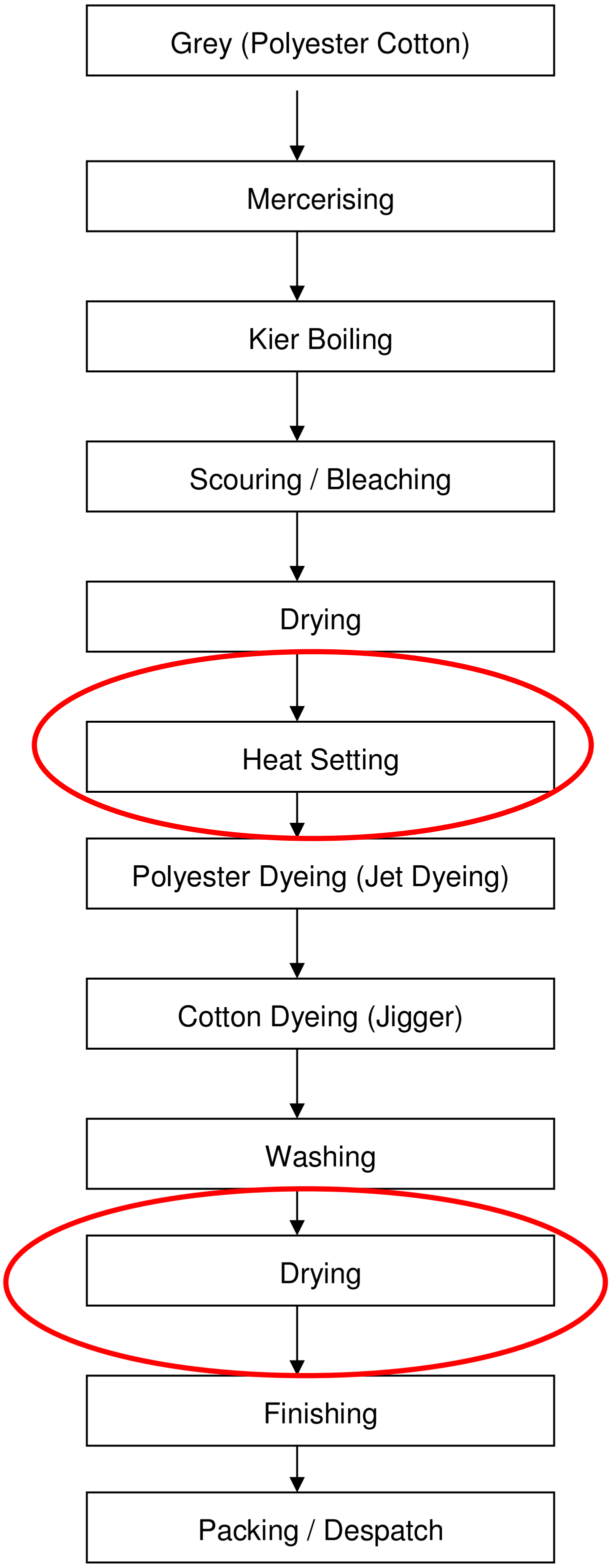


Fig. 1.3 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing

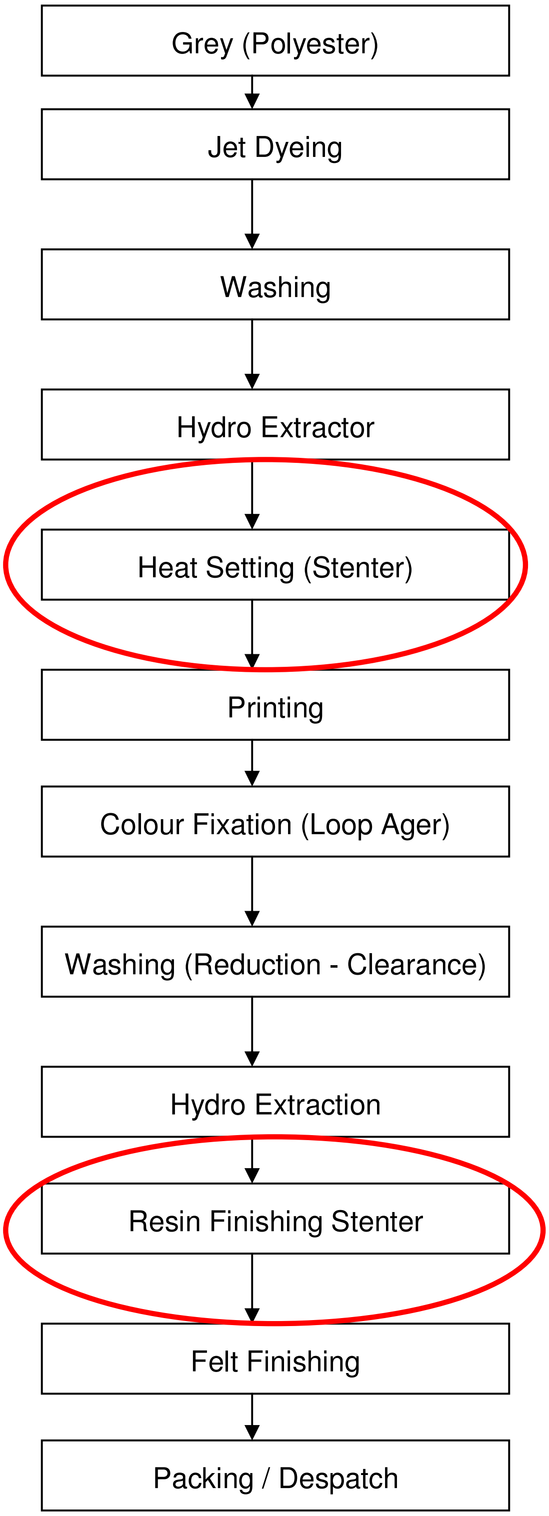


Fig. 1.4 – Process Flow Diagram of Polyester Printing and Finishing

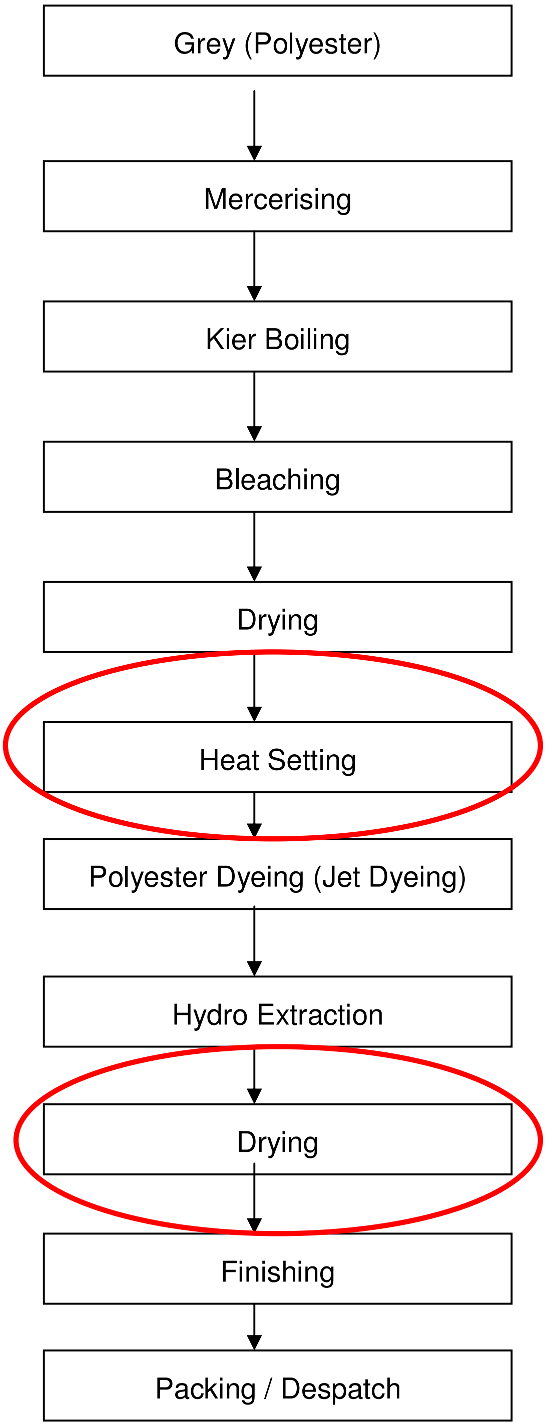


Fig. 1.5 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing

1.2 Energy performance in existing situation

1.2.1 Average production

A typical unit works 5 days a week and the daily production of these units are in the following Table 1.2 below:

Table 1.2 Annual productions from a typical unit

Type of product	*Production (RM/Day)*		
Scale of Unit	**Micro**	**Small**	**Medium**
Finished Fabric	10000	30000	100000

1.2.2 Fuel consumption

Energy consumption both electrical and thermal by a typical textile dyeing and processing unit in Pali cluster is given in table 1.3 below:

Table 1.3 Annual energy consumption

Energy	*Electricity (kWh per year)*			*Thermal Energy (MTOE per year)*		
Scale of Unit	Micro	Small	Medium	Micro	Small	Medium
Consumption	48000	360000	2400000	30	100	300

1.2.3 Specific Energy Consumption (SEC)

The benchmark available for different processes in textile dyeing and processing industry in UK is given in Table 1.4 below:

Table 1.4 Specific Energy Consumption Values

S.No.	*Machine*	*Process*	*Energy Required (GJ/Te)*
1	Desizing Unit	Desizing	1.0-3.5
2	Kier	Scouring/Bleaching	6.0-7.5
3	J-Box	Scouring	6.5-10.0
4	Open Width range	Scouring/Bleaching	3.0-7.0
5	Low Energy Steam Purge	Scouring/Bleaching	1.5-5.0
6	Jig / Winch	Scouring	5.0-7.0

S.No.	Machine	Process	Energy Required (GJ/Te)
7	Jig / Winch	Bleaching	3.0-6.5
8	Jig	Dyeing	1.5-7.0
9	Winch	Dyeing	6.0-17.0
10	Jet	Dyeing	3.5-16.0
11	Beam	Dyeing	7.5-12.5
12	Pad / batch	Dyeing	1.5-4.5
13	Continuous / Thermosol	Dyeing	7.0-20.0
14	Rotary Screen	Printing	2.5-8.5
15	Steam Cylinders	Drying	2.5-4.5
16	Stenter	Drying	2.5-7.5
17	Stenter	Heat Setting	4.0-9.0
18	Package / Yarn	Preparation / Dyeing (Cotton)	5.0-18.0
19	Continuous Hank	Scouring	3.0-5.0
20	Hank	Dyeing	10-16.0
21	Hank	Drying	4.5-6.5

SOURCE – CARBONTRUST UK

SEC in Pali Cluster

For the units involved in Processing of Polyester and printing it to make Saree, the Specific Energy Consumption was observed and furnished in Table 1.5 below:

Table 1.5 Specific energy consumption at Pali cluster

S.No	Particulars	SEC
1	Average Specific Electricity Consumption	1.2 kWh/kg (Best Observed Value – 0.95 kWh/kg)
2	Average Specific Thermal Energy Consumption	15000 kCal/kg (Best Observed Value – 10932 kCal/kg)

1.3 Identification of technology/equipment

1.3.1 Description of technology/ equipment

Process of Fabric Dyeing and Processing has been shown in Fig. 1.2 to 1.5. As is obvious, low temperature heating (Sub 100°C) is required in Scouring, Mercerising, bleaching, Jigger Dyeing for cotton, Reduction and Clearance. Also, higher temperatures are required in Jet Dyeing, Dye fixation and calendaring / Felt finishing. Stentering requires very high temperatures to the tune of 180°C. Heat for getting this temperature is supplied from a Thermic Fluid Heater (Thermopac). Capacity of Thermopacs available in Pali Textile Cluster ranges from 1, 00,000 kCal /hr to 2, 00,000 kCal/hr.

All the Thermopacs in the Pali Textile Cluster were designed to operate on pulverized lignite. Due to ban on Lignite supply from Gujarat, the units have shifted to RPC (Residual Pet Coke) supplied by Reliance industries Ltd.

For the purpose of fuel switching, the combustion was converted to bubbling fluidized bed and the lime bed was created to take care of high Sulphur content in the fuel. However, the conversion was done without engineering the system eroding combustion efficiency to lower levels.

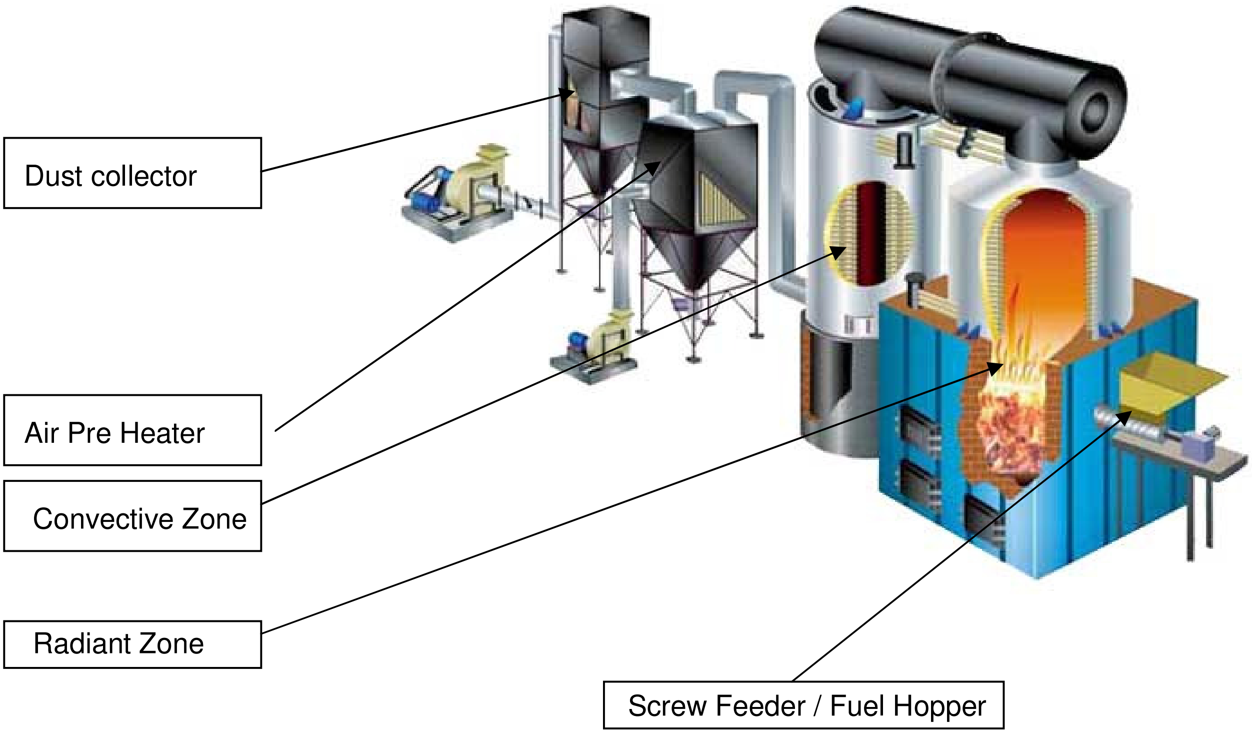


Fig. 1.6 – Sketch of thermic fluid heater with air pre heater and Dust Collector

1.3.2 Role in process

Temperature setting in a stenter chamber at Pali Cluster ranges from 180°C to 210°C. This temperature is achieved by circulating heated thermic fluid through heat exchangers and raising air temperature so that the desired temperature is achieved in the stenter. The set point for thermic fluid heater was observed to be from 235°C to 260°C.

The combustion system in Thermopac is fluidized bed and dust collector is used to collect fly ash which contains unburnt fuel. Also installation of Dust collector is required not only to comply with the Pollution Control Board norms but also to save the unburnt fuel getting released into atmosphere. It was further observed that the Dust collector was not insulated resulting in drop of temperature of the Flue Gas by 20°C. This drop in temperature of the Flue Gas can be avoided by insulation of the Dust Collector.

1.3.3 Energy audit methodology

The following methodology was adopted to evaluate the performance of Thermopac which is shown in Fig. 1.7.

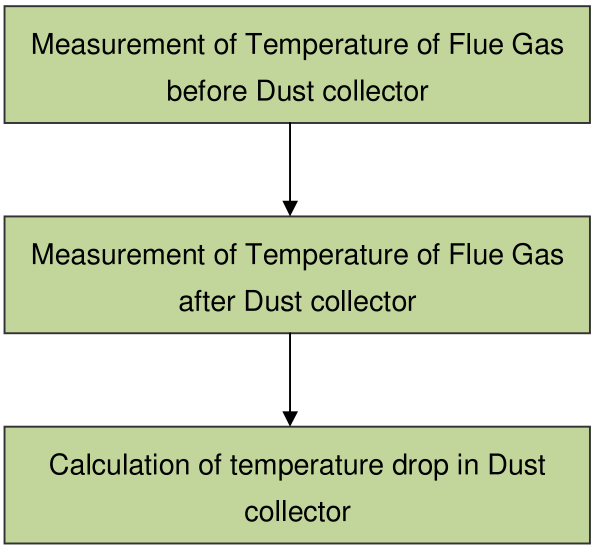


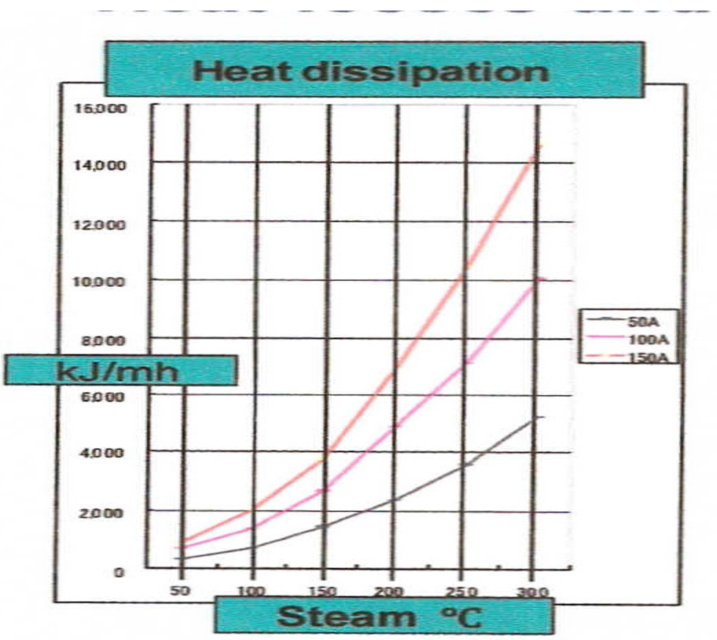
Fig. 1.7 Energy Audit methodologies

1.3.4 Design and operating parameters specification

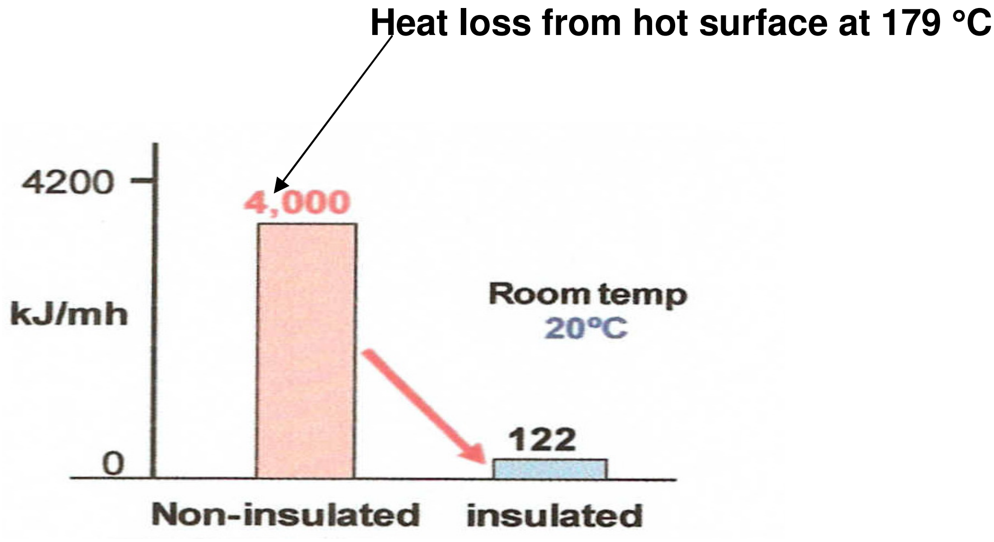
Design and operating parameter details are given below

DIFFERENCE IN TEMP. BETWEEN AMBIENT AND SURFACE ^0C	HEAT LOSS KCAL/M^2 HR.
25	340
40	600
100	1910
150	3225
200	5330

DIFFERENCE IN TEMP. BETWEEN AMBIENT AND SURFACE ^0C	HEAT LOSS KCAL/M^2 HR.
5	38
10	76
15	125
20	165



Heat Loss from a surface having temperature of 179°C without insulation and with 75 mm thick Calcium Silicate insulation



1.3.5 Operating efficiency analysis

The units in Pali cluster are not really aware of the ill effects of non recovering sensible heat from the Flue Gas and excess air in combustion. It was observed that the Flue Gas in Thermopac was leaving at temperature 250°C to 300 °C, thus giving enough opportunity to recover waste heat. A suitably designed air pre heater can be installed to recover heat from Flue Gas up to a temperature of 180 °C, in view of high Sulphur fuel used.

The Sankey diagram for Thermic Fluid Heater is as below in Fig. 1.8.

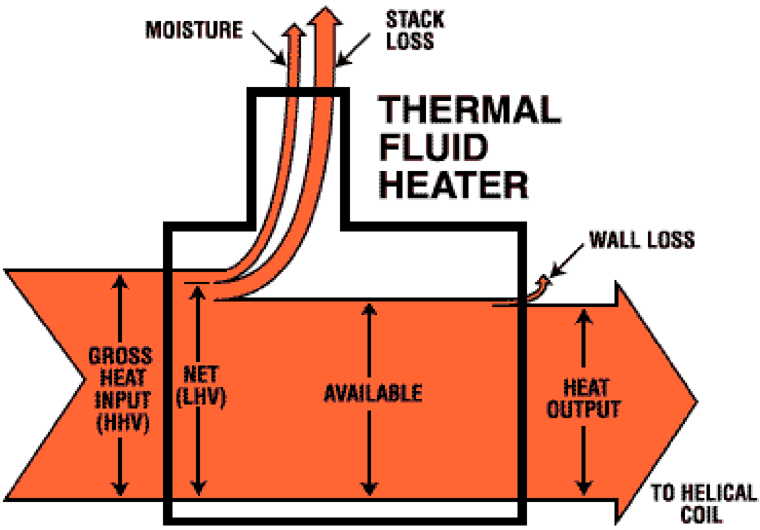


Fig. 1.8 Sankey diagram of Thermopac

It is obvious that loss of heat from various hot surfaces also reduces efficiency and any improvement in the heat lost in this manner contributes directly to the improvement in thermal efficiency. Properly insulation of the Dust Collector can help avoid loss of 20°C temperatures presently occurring in it and the heat thus conserved can be recovered in the Air Pre Heater. Hence overall fuel saving is possible through proposed technology.

1.4 Barriers in adoption of proposed technology/equipment

BEE promoted SME programme has the unique distinction of addressing all the identifiable barriers in adoption of Energy Efficiency Improvement technologies in SME sectors. Following actions have been taken in Pali Textile Cluster to remove the barriers:-

- Kick off Seminar to create awareness
- Energy Audit (Detailed and Preliminary) in over 78 units
- Capability building and involvement of institutional financers, local service providers and also domestic equipment manufacturers.
- Design and distribution of dissemination material containing most of the measures.
- Design and distribution of Cluster Manual containing technology gap assessment and cost benefit analysis of proposed Energy Conservation measures.
- Involvement of Industry Association, Department of Industries and local administration.

However, for the sake of identifying possible barriers to adoption of the proposed technologies, the following may be considered.

1.4.1 Technological Barrier

- The proposed technology was already installed in the cluster and is available readily.
- Non-availability of technology or aversion to adoption for any other reason does not seem to be the case for non adoption as the proposed system was already present in most of the Thermopacs. All the suppliers are offering the system as standard fitting. It is only lack of knowledge and comfort of proven guaranteed results that has been keeping the entrepreneurs away from adopting this technology.
- There is a severe paucity of quality technical consultants in the cluster. This also inhibits adoption of technology as there is nobody to convince the entrepreneurs.
- Non availability of local after sales service provider for the equipments is a major obstacle to adoption of any new and modern technology involving electronics.

- The majority of the textile unit owners / entrepreneurs do not have in-depth technical expertise nor do they have technically qualified manpower. This is a major barrier in acquiring knowledge about any innovation in the sector.
- The entrepreneurs in the MSME sector are averse to investment risks and tend to invest in proven technology only. Adoption of technology is higher in bigger units and these bigger units also become agents for demonstration and hence replication. Lack of any bigger unit in the cluster also is an impediment to adoption of newer technology.

1.4.2 Financial Barrier

- The applicability of the proposition is in power process units only. These units have very healthy financial position. Lack of finances is not the reason for non adoption of the proposed technology. However, availability of easy finances and also financial incentives would trigger and also accelerate adoption of the technology.
- Implementation of the proposed project activity requires approx. ₹ 1.0 lakh investment which can be done from internal resources.
- The investment decisions normally favour creation of additional facility and investment for Energy Efficiency Improvement features last in the priority of entrepreneurs. Consequently, interventions like the one undertaken by BEE are necessary for promoting adoption of technologies.
- The subjective approach of the banks in deciding on grant of loans to entrepreneurs and also lack of pre declared formalities required for availing loan is the biggest impediment. On adherence to a time bound dispensation of the loan application is also an obstacle as the a new document is asked for ever time the entrepreneur visits the bank and the bank would refuse in the last moment citing untenable reason leaving the entrepreneur in the lurch. Facilitating delivery of finances is more important than packaging the finances.
- Most of the units in Pali textile cluster are debt free enterprises and the situation is ideal for any bank or financial institution to do advances. With end to economic slow down within sight, the demands are likely to pick up and the units would require scaling up their operations and also perking up their facility to meet enhanced demand. The inherent benefit of increase in profitability by precise process control is also up for taking.

1.4.3 Skilled manpower

The cluster very badly needs skilled manpower. There is no trained Dye Master, no trained electrician, no trained boiler operator or no trained maintenance man. The existing manpower has grown by on the job learning and has learnt the traditional methods of dyeing and processing. Propagation of learning of new technology is absolutely necessary.

1.4.4 Other barrier (If any)

Creation of Energy Champions is necessary to trigger large-scale adoption of proposed technologies. This is possible by sponsoring adoption of such technologies through financial help and also mitigation of investment risks through a mechanism that guarantees the savings. An ESCO can as well be involved in the process.

2.0 PROPOSED EQUIPMENT

2.1 Detailed description of technology proposed

Presently, the dust collectors installed in Thermopacs in Pali have no insulation resulting in temperature drop of minimum 20°C. Here, the surface temperature of the dust collectors was observed to be more than 230°C. Provision of proper insulation will help avoid this temperature drop. This heat retained in the flue gas will then be recovered in the Air Pre heater installed later in the circuit.

Components of the proposed system

It is proposed to insulate the dust collector properly with rock wool mattress. The mattresses can be installed with cladding. Alternatively, insulation jackets can be installed which provide flexibility in terms of facility to remove it as and when required without any hassle.

2.1.1 Equipment specification

A complete brochure of the equipment is placed at Annexure 1.

2.1.2 Suitability over existing equipment

The proposed system can be retrofitted to existing Thermopac with literally modification.

2.1.3 Superiority over existing equipment

The system would minimise loss of heat from dust collector surfaces and hence equivalent savings in Fuel consumption would be recorded.

2.1.4 Availability of equipment

The system can be delivered within 3 to 4 weeks of placement of order through manufacturers in Jaipur or Ahmedabad.

2.1.5 Source of equipment

Several solutions like application of insulation cement, mineral fiber etc. can be used to get same results. The solution is of generic technology and is readily available indigenously without any complications related to patent or copyright.

2.1.6 Technical specification of equipment

Technical specification of proposed technology is attached at Annexure 7.

2.1.7 Terms and conditions in sales of equipment

No specific terms and conditions are attached to sale of the equipment.

2.1.8 Process down time during implementation

Installation of the proposed system would need no modification in the flue duct. Consequently, no down time is needed for making the system operational.

2.2 Life cycle assessment and risks analysis

The unit consists of non deteriorating materials and hence would go on serving till removed.

2.3 Suitable Unit for Implementation of Proposed Technology

The proposed system can be implemented in over 30 no Thermopacs in Pali. Total potential for energy saving would be 681.6 MT RPC (582.2 MTOE) per year if the proposition is implemented in all the machines.

3.0 ECONOMIC BENEFITS FROM PROPOSED EQUIPMENT

3.1 Technical benefit

3.1.1 Fuel saving

The proposition would help save 23.56 MT RPC fuel per year in every Thermopac. Further, details of fuel saving are given in Annexure 4.

3.1.2 Electricity saving

No electricity saving is possible

3.1.3 Improvement in product quality

None

3.1.4 Increase in production

None

3.1.5 Reduction in raw material

Raw material consumption is same even after the implementation of proposed technology.

3.1.6 Reduction in other losses

None

3.2 Monetary benefits

The monetary saving arising out of implementation of proposed technology in one Thermopac would be ₹ 1.76 lakh per year. Detail of monetary saving calculation is given in Annexure 4.

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

Proposed equipment reduces the GHG emission by reducing fuel consumption.

3.3.2 Improvement in workers skill

Not contributing to any improvement in skill sets of workers. However, the automation would eliminate human intervention in precision control of process thereby reducing workload of the frontline workers. No retrenchment of labor is envisaged because of implementation of the proposed system.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

None

3.4.2 Reduction in GHG emission

The equivalent saving in GHG emission for every Thermopac would be 64 MT per year as per UNEP GHG Calculator.

3.4.3 Reduction in other emissions like SO_X

Considerable reduction in emission of SO_X is anticipated as the fuel being used contains high 8% Sulphur.

4.0 INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of equipment implementation

4.1.1 Equipments cost

Cost of one set of equipment is about ₹ 0.84 lakh for 10 sq. mtr having per meter cost of ₹ 8465 (₹ 7980/- + 4% CST+ 2% Freight) as per the quotation from M/s Natraj Insulation. The quotation is attached as Annexure 2.

4.1.2 Erection, commissioning and other misc. cost

Erection & commissioning cost is about ₹ 0.16 lakh. A detail of project installation cost is given in Table 4.1 below:

Table 4.1 Details of proposed equipment installation cost

S.No	Particular	Unit	cost
1	Equipment cost	₹ (in Lakh)	0.84
2	Erection & Commissioning cost	₹ (in Lakh)	0.16
3	Other misc. cost	₹ (in Lakh)	Nil
4	**Total cost**	₹ (in Lakh)	**1.0**

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

Entrepreneur will contribute 25% of the total project cost which is ₹ 0.25 lakh.

4.2.2 Loan amount.

Remaining 75% cost of the proposed project will be taken from the bank which is ₹ 0.75 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

Profitability and cash flow statements have been worked out for a period of 8 years. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below. The cost of equipment considered is inclusive of hot water storage tanks also.

The project is expected to achieve monetary savings of ₹ 1.76 lakh per annum.

- 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.

Based on the above assumptions, profitability and cash flow statements have been prepared and calculated in Annexure-3.

4.3.2 Simple payback period

The total project cost of the proposed technology is 1.00 lakh and monetary savings due to reduction in Electricity & Fuel consumption is ₹ 1.76 lakh hence, the simple payback period works out to be around 7 months.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10% works out to be ₹ 5.64 Lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 149.78%. 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 29.47%.

Details of financial indicators are furnished in Table 4.2 below:

Table 4.2 Financial indicators of proposed technology

S.No.	Particular	Unit	Value
1	Simple payback period	Months	7
2	NPV	₹ (in lakh)	5.64
3	IRR	% age	149.78
4	ROI	% age	29.47
5	DSCR	ratio	7.38

4.4 Sensitivity analysis

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

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

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

Table 4.3 Sensitivity analysis in different scenario

Scenario	IRR (% age)	NPV (₹ in lakh)	ROI (% age)	DSCR
Pessimistic	141.36	5.30	29.43	7.00
Realistic	149.78	5.64	29.47	7.38
Optimistic	158.22	5.98	29.51	7.75

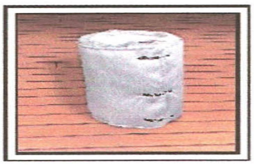
4.5 Procurement and Implementation Schedule

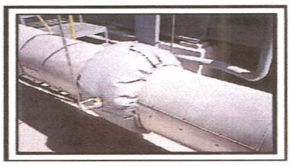
Total time period required for implementation of this technology is about 6 week and their details are given in Annexure 4.

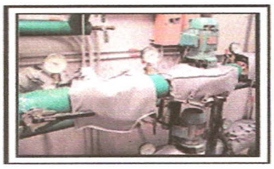
Annexure -1: Information Brochure

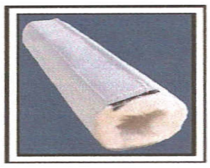
NATARAJ INSULATION

603, Silver Cascade, Bagikhana Road,
Vadodara 390 001. Tel.: 0265 301 3303
Telefax : 0265 - 2431491
E-@ :natarajinsulation@gmail.com/hotmail.com/yahoo.com









REMOVABLE / REUSABLE INSULATION COVERS

Typical industrial uses for removable insulation blankets are for Pipes, Barrels, Steam traps, heat exchangers, flex , valves, flanges, elbows and strainers.

Removable/Reusable blankets are used on those parts of the hot piping on process and steam lines where Maintenance and Inspection accessibility is necessary which the permanent insulators leave open and become the source of MAJOR ENERGY LOSS.

Once we understand your particular situation we will recommend a solution to provide:

Personnel Protection
• Asbestos Free
• Non Flammable
• Reduces Ambient Temperatures
• Insulation jackets can reduce temperatures as high as 600°C to acceptable Safety Levels for personnel protection.

Energy Savings
• Removable blankets reduce heat loss in areas that have been uneconomical to insulate with conventional insulation.
• Removable blankets are custom designed to wrap snugly around even the most complicated fittings and irregular surfaces.

Maintenance and Inspection Savings
specifically designed for maintenance and inspection. Our blankets can be removed and re-installed in minutes, even with inexperienced personnel. As they are reusable there is no need for new insulation every time.

OUTER AND INNER FABRIC: Impregnated fiberglass, 8 oz/square yard.Warp:17,Weft:14,Tensile strength 17 Kg/cm.

INSULATION: FIBREGLASS-MAT. 2" needled fiberglass mattress K-factor of 0.39 @ 300°F.

Contact for any enquiry: +9198250 40131 OR +9198250 37317.

EVERYTHING FOR THERMAL INSULATION. natarajinsulation@gmail.com

Elements of a Typical Blanket:

1. Envelope made of silicon, Teflon or fiberglass flame and temperature resistant cloth.

2. Fiberglass mat insulation

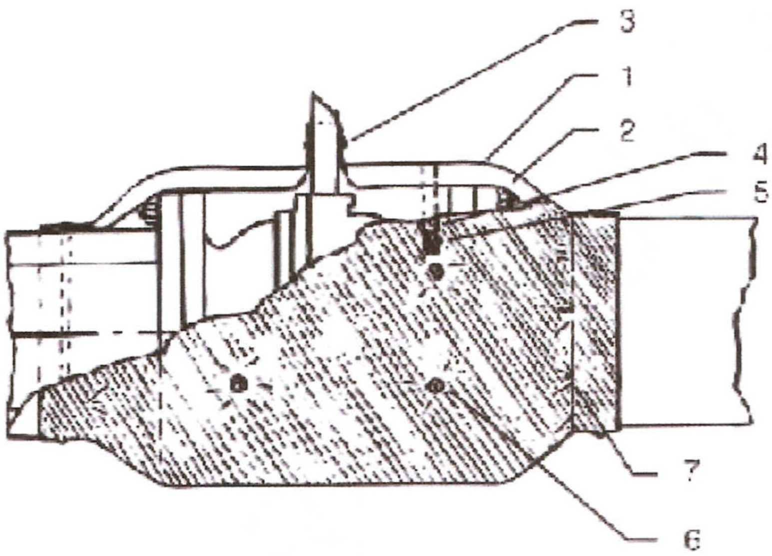
3. Nonflammable string

4. Stainless steel "D" ring

5. Nonflammable strap

6. Washer and pin

7. Kevlar or Nomex nonflammable thread



Annexure -2: Quotation

Messaging Service from
National Informatics Centre

Welcome Kumar Suman

Home Profile IM FM Log Out Help

Last login on Dec 12, 2010 3:52:17 PM from 59.95.179.127

Mail Calendar Address Book Options Current Folder: Inbox

Compose Printable

kumars@pcra.org
Inbox (64)
Drafts
ProbablySpam (1)
SentMail
TrashCan (7)
Manage Folders

Previous | Message 17 of 419 |

Delete Reply Reply All Forward Forward Inline Add Addresses
Close Move message to folder:

Subject	Quotation for Removable Insulation Jacket.
From	PARAG PANDIT <natarajinsulation@gmail.com>
Date	Tuesday, December 7, 2010 11:51 am
To	Kumar Suman <kumars@pcra.org>
Attachments	REMOVABLE REUSABLE INSULATION COVER.doc

Dear Mr. Kumar,

Please find the details of Removable type Insulation Jackets in an attached fi

- The cost for 4" Valve Jacket will be Rs.6250.00.
- The cost for plain jacket will be Rs.7980.00 per sq. mtr.

The details of material content is given in an attched file.

The cost is FOR Baroda-Gujarat. Taxes extra as applicable.
Payment: Against Proforma Invoice.
Delivery: 2 weeks on receipt of Payment.

Assuring you of the Best services.

Feel free to call me for any quaries.

Regards,

Paraag Pandit
Mbl: +919825040131

Annexure -3: Detail financial calculation

Assumption

Name of the Technology	Dust Collector Insulation in Thermopac		
Details	**Unit**	**Value**	**Basis**
Installed Capacity	Kg/hr	1000	Feasibility Study
No of working days	Days	300	Feasibility Study
No of Shifts per day	Shifts	3	Feasibility Study
Capacity Utilization Factor	%age	75	Feasibility Study
Proposed Investment			
Equipment cost	₹ in lakh	0.84	
Erection and commissioning	₹ in lakh	0.16	
Investment without IDC	₹ in lakh	0.00	
EPC cost	₹ in lakh	0.00	
Total investment	₹ in lakh	1.00	
Financing pattern			
Own Funds (Equity)	₹ in lakh	0.25	
Loan Funds (Term Loan)	₹ in lakh	0.75	
Loan Tenure	yr	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%/yr	10	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	4 %	Feasibility Study
Annual Escalation	% age	5 %	Feasibility Study
Estimation of Revenue			
Fuel saving (RPC)	Tonne	23.56	
Cost of fuel	`/tonne	7500	
St. line Depn.	% age	5.28%	Indian Companies Act
IT Depreciation	% age	100.00%	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	0.75	0.06	0.69	0.09
2	0.69	0.12	0.57	0.06
3	0.57	0.14	0.43	0.05
4	0.43	0.16	0.27	0.04
5	0.27	0.19	0.08	0.02
6	0.08	0.08	0.00	0.00
		0.75		

WDV Depreciation

₹ (in lakh)

Particulars / years	1
Plant and Machinery	
Cost	1.00
Depreciation	1.00
WDV	-

Projected Profitability

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Fuel savings	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77
Total Revenue (A)	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77
Expenses								
O & M Expenses	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06
Total Expenses (B)	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06
PBDIT (A)-(B)	1.73	1.73	1.72	1.72	1.72	1.72	1.71	1.71
Interest	0.09	0.06	0.05	0.04	0.02	0.00	-	-
PBDT	1.64	1.66	1.67	1.68	1.70	1.71	1.71	1.71
Depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
PBT	1.59	1.61	1.62	1.63	1.65	1.66	1.66	1.66
Income tax	-	0.56	0.57	0.57	0.58	0.58	0.58	0.58
Profit after tax (PAT)	1.59	1.04	1.05	1.06	1.07	1.08	1.08	1.08

Computation of Tax

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Profit before tax	1.59	1.61	1.62	1.63	1.65	1.66	1.66	1.66
Add: Book depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Less: WDV depreciation	1.00	-	-	-	-	-	-	-
Taxable profit	0.64	1.66	1.67	1.68	1.70	1.71	1.71	1.71
Income Tax	-	0.56	0.57	0.57	0.58	0.58	0.58	0.58

Projected Balance Sheet

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Reserves & Surplus (E)	1.59	2.63	3.68	4.74	5.81	6.89	7.96	9.04
Term Loans (F)	0.69	0.57	0.43	0.27	0.08	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	2.53	3.45	4.36	5.26	6.14	7.14	8.21	9.29

Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Less Accm. Depreciation	0.05	0.11	0.16	0.21	0.26	0.32	0.37	0.42
Net Fixed Assets	0.95	0.89	0.84	0.79	0.74	0.68	0.63	0.58
Cash & Bank Balance	1.58	2.56	3.52	4.47	5.40	6.45	7.58	8.71
TOTAL ASSETS	2.53	3.45	4.36	5.26	6.14	7.14	8.21	9.29
Net Worth	1.84	2.88	3.93	4.99	6.06	7.14	8.21	9.29
Debt Equity Ratio	2.76	2.28	1.72	1.08	0.32	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	0.25	-	-	-	-	-	-	-	-
Term Loan	0.75								
Profit After tax		1.59	1.04	1.05	1.06	1.07	1.08	1.08	1.08
Depreciation		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Sources	1.00	1.64	1.10	1.10	1.11	1.12	1.13	1.13	1.13
Application									
Capital Expenditure	1.00								
Repayment Of Loan	-	0.06	0.12	0.14	0.16	0.19	0.08	-	-
Total Application	1.00	0.06	0.12	0.14	0.16	0.19	0.08	-	-
Net Surplus	-	1.58	0.98	0.96	0.95	0.93	1.05	1.13	1.13
Add: Opening Balance	-	-	1.58	2.56	3.52	4.47	5.40	6.45	7.58
Closing Balance	-	1.58	2.56	3.52	4.47	5.40	6.45	7.58	8.71

IRR

₹ (in lakh)

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		1.59	1.04	1.05	1.06	1.07	1.08	1.08	1.08
Depreciation		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Interest on Term Loan		0.09	0.06	0.05	0.04	0.02	0.00	-	-
Cash outflow	(1.00)	-	-	-	-	-	-	-	-
Net Cash flow	(1.00)	1.73	1.16	1.15	1.15	1.14	1.13	1.13	1.13
IRR	149.48								

NPV	5.64

Break Even Point

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Sub Total(*G*)	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Interest on Term Loan	0.09	0.06	0.05	0.04	0.02	0.00	0.00	0.00
Depreciation *(H)*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sub Total (I)	0.15	0.13	0.12	0.10	0.09	0.07	0.07	0.07
Sales (J)	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77
Contribution (K)	1.74	1.74	1.73	1.73	1.73	1.73	1.73	1.72
Break Even Point (L= G/I)	8.60%	7.31%	6.65%	5.89%	4.92%	3.95%	3.83%	3.88%
Cash Break Even {(I)-(H)}	5.56%	4.27%	3.60%	2.84%	1.87%	0.90%	0.78%	0.82%
Break Even Sales (J)*(L)	0.15	0.13	0.12	0.10	0.09	0.07	0.07	0.07

Return on Investment

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	1.59	1.61	1.62	1.63	1.65	1.66	1.66	1.66	13.07
Net Worth	1.84	2.88	3.93	4.99	6.06	7.14	8.21	9.29	44.34
									29.47%

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	1.59	1.04	1.05	1.06	1.07	1.08	1.08	1.08	6.89
Depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.32
Interest on Term Loan	0.09	0.06	0.05	0.04	0.02	0.00	0.00	0.00	0.26
Total (M)	1.73	1.16	1.15	1.15	1.14	1.13	1.13	1.13	7.47

DEBT

Interest on Term Loan	0.09	0.06	0.05	0.04	0.02	0.00	0.00	0.00	0.26
Repayment of Term Loan	0.06	0.12	0.14	0.16	0.19	0.08	0.00	0.00	0.75
Total (N)	0.15	0.18	0.19	0.20	0.21	0.08	0.00	0.00	1.01
	11.79	6.32	6.03	5.81	5.43	13.70	-	-	7.38
Average DSCR (M/N)	7.38								

Annexure -4: Details of procurement and implementation

S. No.	Activities	Weeks					
		1	2	3	4	5	6
1	Order Placement						
2	Fabrication & Transportation.						
3	Installation and commissioning						

Annexure 4: Detailed equipment assessment report

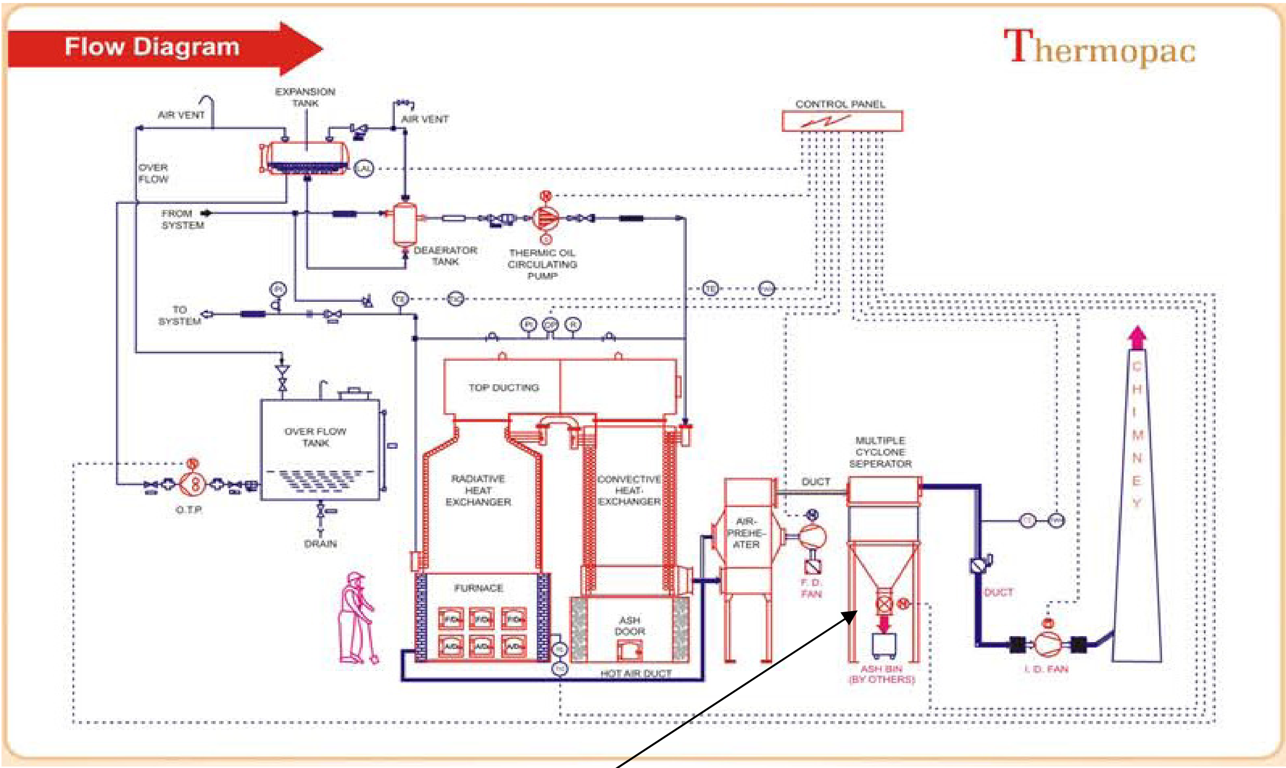
Calculation of Energy Saving Potential from insulation of Dust collector in Thermopac

S. No	Particular	Unit	Value
1	Fuel flow rate	Kg/hr	250
2	No. of operating hour per day	hr	20
3	Total operating days per year	days	300
4	Fuel consumption per year	MT	1500
5	Present flue gas exist temperature	^{0}C	231
6	Proposed flue gas exist temperature after insulation of dust collector	^{0}C	251
7	Specific heat capacity of flue gas	kCal/kg	0.23
8	Mass of air handled	Kg/kg of fuel	27
9	Heat saving due to insulation of dust collector	kCal/hr	32200
10	Heat saving due to insulation of dust collector	kCal/year	19,32,00,000
11	Calorific value of fuel	kCal/kg	8200
12	Equivalent fuel saving	MT per year	23.56
13	Cost of fuel	₹ / MT	7500
14	Total monetary saving per year	₹ in lakh	1.76
15	Total Investment	₹ in lakh	1.00
16	General Payback Period	Months	7

Annexure -5: Details of equipment service providers

S.No.	***Technology***	***Name of Service Provider***	***Address***	***Contact Person and No.***
1.	Provision of Insulation to Dust collector	M/s Natraj Insulation	G-755-756, Road No. 9F-2, VKIA Jaipur 9825040131	Mr. Parag Pandit
2	Provision of Insulation to Dust collector	M/s Loyds Insulation	Delhi Office	

Annexure – 6Typical arrangement drawings for proposed system



Dust Collector to be insulated

Annexure – 7 Technical specification

Particular	***Details***
Type	Insulation Jacket
Material of hot side	Fiber glass Insulation
Envelope	Silicon / Teflon
Area	10 m.sq

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

Petroleum conservation Research Association

(Under Ministry of Petroleum and Natural Gas)
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Ph. : +91-11- 26198856, Fax : +91-11-26109668
Website: www.pcra.org

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