DETAILED PROJECT REPORT
ON
INSTALLATION OF VARIABLE FREQUENCY DRIVE IN JET DYEING MACHINE PUMPS
(PALI TEXTILE CLUSTER)

Bureau of Energy Efficiency

Prepared by

Reviewed By

INSTALLATION OF VARIABLE FREQUENCY DRIVE IN JET DYEING MACHINE PUMPS

PALI TEXTILE CLUSTER

BEE, 2010

Detailed Project Report on Installation of Variable Frequency Drive In Jet Dyeing Machine Pumps

Textile SME Cluster, Pali, Rajasthan (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No: **PAL/TXT/VFJ/01**

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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.

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List of Abbreviations

- BEE - Bureau of Energy Efficiency
- DPR - Detailed Project Report
- DSCR - Debt Service Coverage Ratio
- GHG - Green House Gases
- HP - Horse Power
- 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
- VFD - Variable Frequency Drives
- 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, major flaw was observed in process control of Jet Dyeing Machine causing the Electricity Consumption increase more than 2 folds. The flaw is mainly connected with over sizing of equipment and also lack of process control devices. As per the study conducted, about 27600 kWh of electricity per year can be saved in every Jet dyeing machine by installation of VFD.

This DPR highlights the details of the study conducted for assessing the potential for installation of VFD in Jet Dyeing Machine pump, possible Energy saving and its monetary benefit, availability of the technologies/design, local service providers, technical features & proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, sensitivity analysis in different scenarios and schedule of Project Implementation.

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)	1.05
2	Electricity Saving	kWh/year	27600
3	Monetary benefit	₹ (in Lakh)	1.27
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	Months	10
6	NPV	₹ (in Lakh)	3.63
7	IRR	% age	93.44
8	ROI	% age	29.49
9	DSCR	ratio	4.76
10	CO_2 saving	MT	24
11	Process down time	Days	1-2

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.

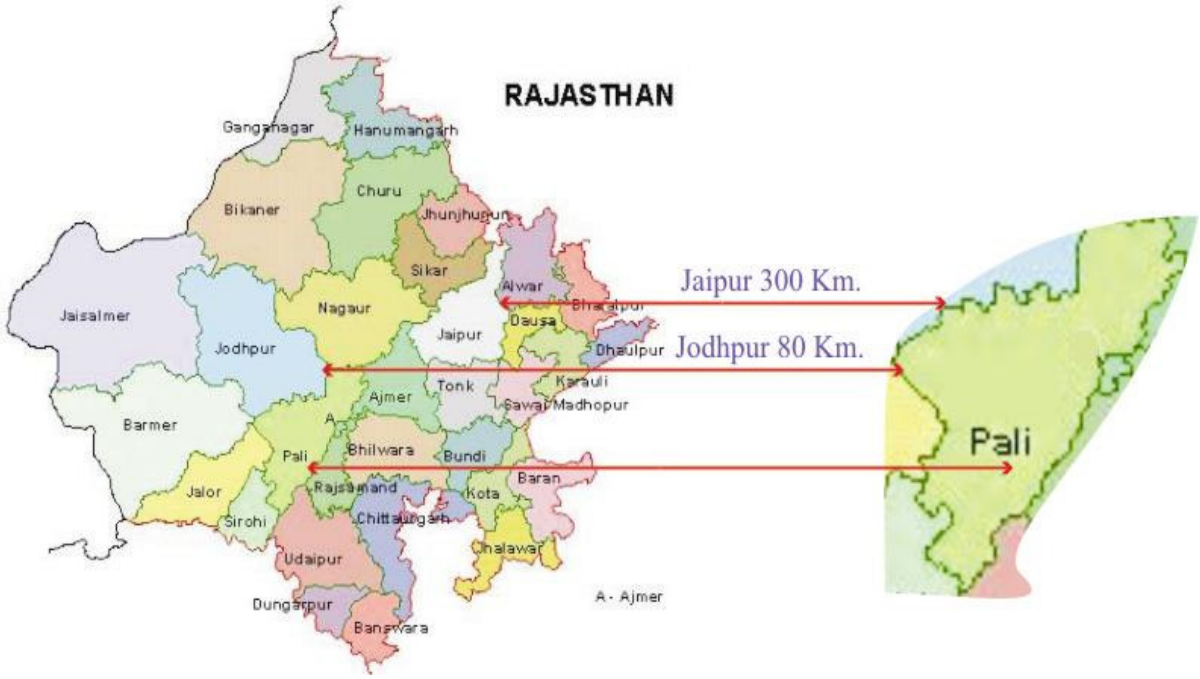

Fig. 1.1 – Pali – Geographical Map

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	kilolitre/year	89.6	0.3
6	Residual Pet coke	Mt/Yr	11820	36.6

1.1.1 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.

1.1.2 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 color men (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

1.1.3 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 are drawn below –

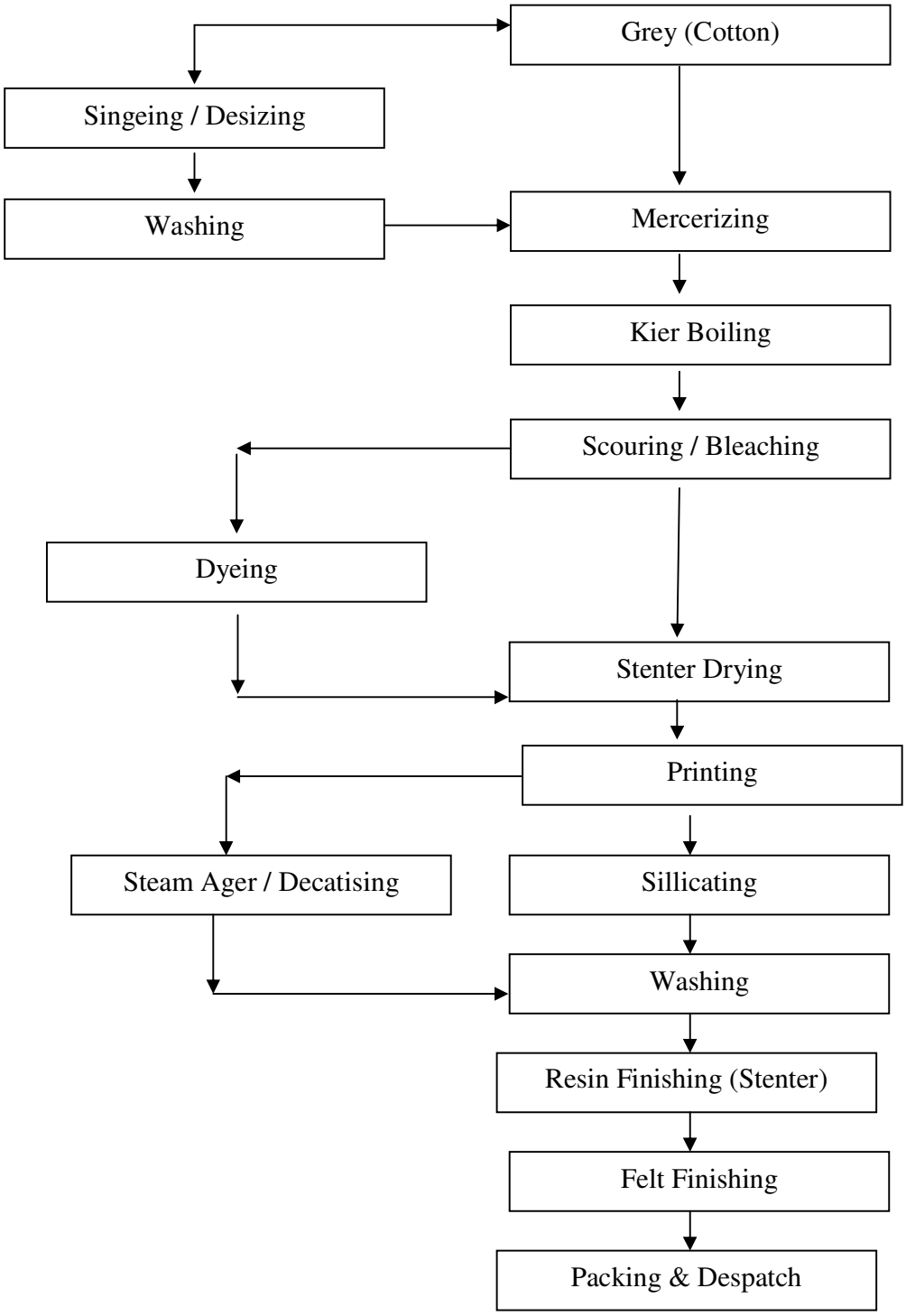

Fig. 1.2 – Process Flow Diagram of Cotton Dyeing and Printing

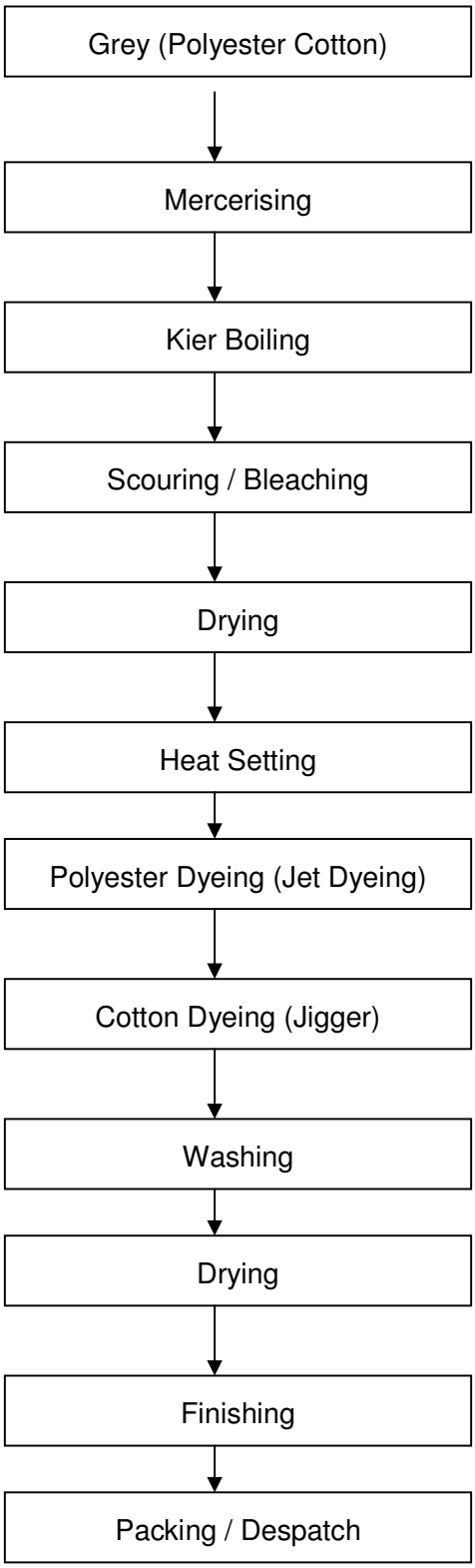

Fig. 1.3 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing

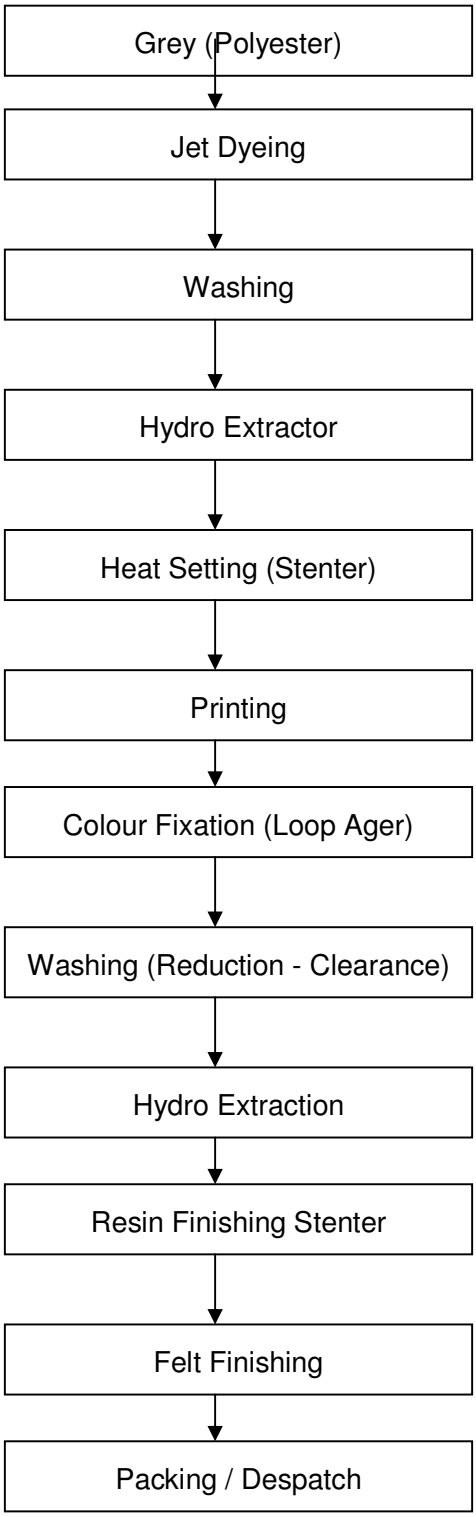

Fig. 1.4 – Process Flow Diagram of Polyester Printing and Finishing

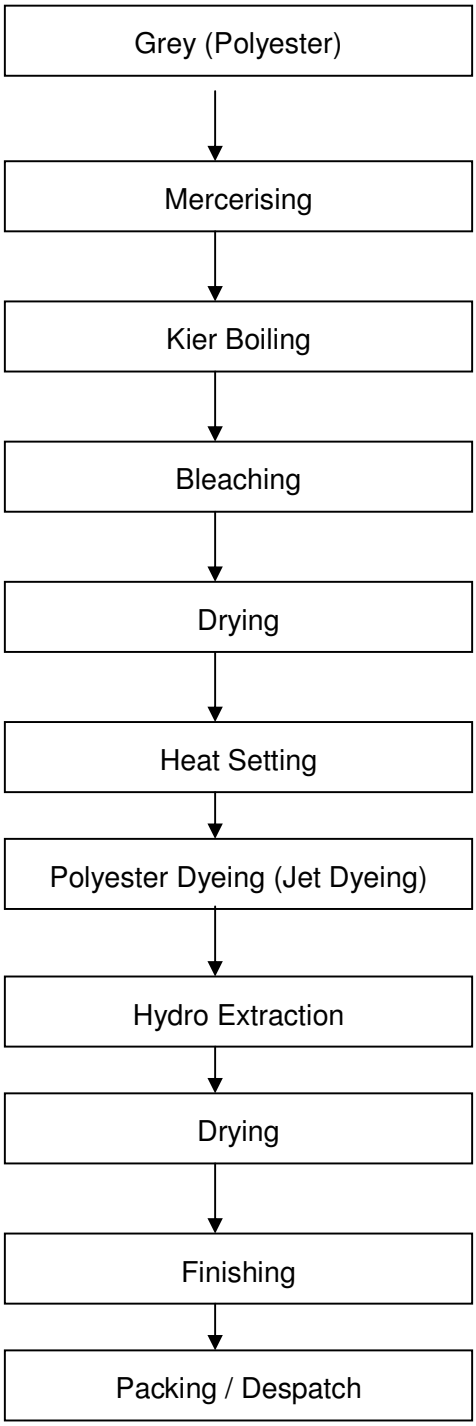

Fig. 1.5 – Process Flow Diagram of Polyester Cotton Dyeing and Finishing

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

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

Jet Dyeing Machine revolutionized Polyester dyeing as it works at a very low liquor ratio (1:4), produces very high order of color fastness and also reproducibility with precise control of the process. This triggered its adoption and almost all the units involved in dyeing of polyester or PC blend had to go for this. Presently, Pali Textile cluster has a population of over 150 Jet Dyeing Machines and all of these uses disperse dyes. Only one no. of closed jigger could be found which was used for Polyester Dyeing in the entire cluster.

It is a dyeing machine which dyes the cloth by forcibly contacting the jet flow of dyestuff solution. It executes efficient dyeing in such a manner that the tension on the cloth is decreased as much as possible, and that the cloth dyes evenly with a relatively small amount of dyestuff.

The sketch of a Jet Dyeing Machine is placed below. The various components of the machine are Stainless Steel Vessel, Pump, dye tank, piling motor, reel motor and Heat Exchanger. The pump motor in a typical 250 kg per batch size is of 10 HP and is the largest electrical load in the machine.

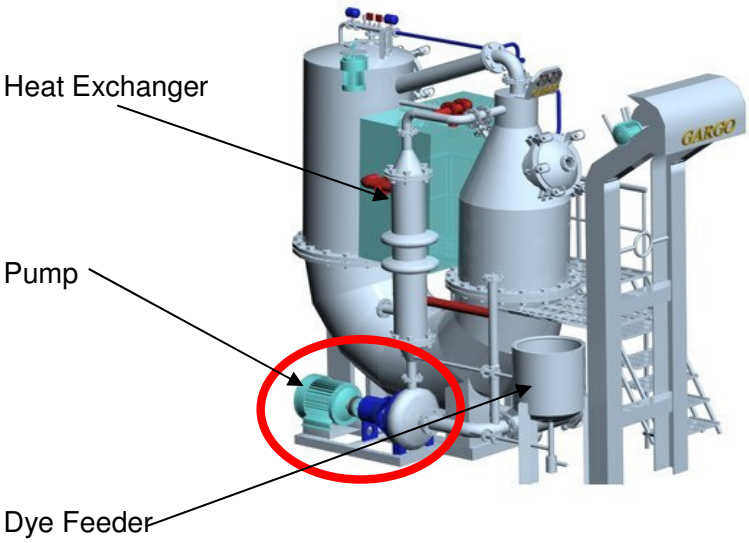

Fig. 1.6 – Sketch of Jet Dyeing Machine with location of pump

The pump is not only the largest electrical load but is also having the highest operating hour out of all the other motors available. In fact the pump remains operative as long as the machine operates except during loading and unloading. Typically, one dyeing cycle is of 3 hours duration with 10 minutes for loading and 10 minutes required for unloading. A typical dyeing cycle is appended below –

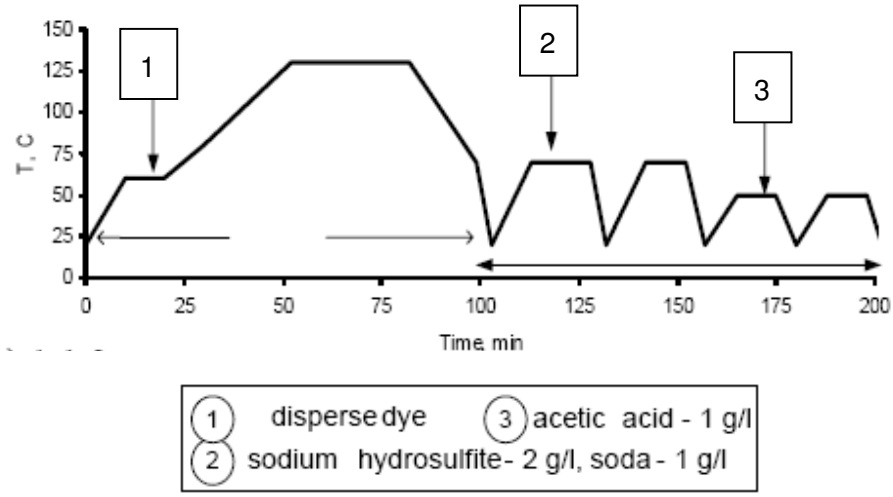

Fig 1.7 – Duty cycle of Jet Dyeing machine

Elaboration of the process is as below:-

- Set the dye bath with the above materials. Raise the temperature to 50℃ and run for 10 minutes.
- Dissolve the dyestuff with soft water at 50℃ and filter it.
- Add the dyestuff slowly in to the bath. Check the pH value to 5.5. to 6.
- Raise the temperature to 115℃ at 2℃ per minute and run 10 minutes.
- Raise the temperature further from 115℃ to 135℃ at 0.5℃ per minute.
- Hold for 45 to 60 minutes according to the depth of the shade.
- Lower the temperature to 80℃ and drain the bath.
- Do hot wash (70℃) for 10 minutes followed by cold wash.

Specification of Jet dyeing machine of different capacity is shown in Table 1.6 below:

Table 1.6 Specification of Jet dyeing machine of different capacity

Details	*Unit*	*Value*				
Fabric Loading Capacity	kg	60	100	150	250	350
Pressure Vessel Diameter	mm	600	700	870	935	1040
Liquor Ratio (1 :3) upto	litre	180	300	450	750	1050
Connected Power						
Main Pump Motor	HP	7.5	7.5	10	10	12.5
Piling Motor	HP	1	1	1	1	1
Take Off Reel Motor	HP	1	1	1	1	1
Max. Working Temp.	°C	140	140	140	140	140
Max. Working Pressure	kg/cm^2	4	4	4	4	
Heating Time (Average)30°C-130°C	Min	30	30	30	30	30
Cooling Time Average 130°C-85°C	Min	15	15	15	15	15
Steam Pressure Required	kg/cm^2	7	7	7	7	7
Water Pressure Required	kg/cm^2	2	2	2	2	2
Fabric Speed Upto	Mtr/Min	300	300	300	300	300
Floor Space Required						
Vessel length (A)	mm	1800	2300	2470	2535	2720
Total Length (B)	mm	3660	4260	4430	4495	4680
Vessel Width (C)	mm	600	700	870	935	1040
Total Width (D)	mm	2065	2165	2335	2400	2505
Height (E)	mm	2600	3100	3425	3425	3925

1.3.2 Role in process

Jet dyeing Machine is a versatile machine wherein polyester and blended fabric is dyed. All the processes required for dyeing is completed in the jet dyeing machine and the dyed fabric is then put to hydro extractor for water removal and then to stenter for heat setting and finishing.

Benchmarking for existing specific energy consumption

Energy consumption in Jet Dyeing machine would depend on following mentioned things

- Duration of each process and cycle
- Sizing of Pump
- Duty point of pump

1.3.3 Energy audit methodology

The following methodology was adopted to evaluate the performance of Jet dyeing machine which is shown in Fig. 1.8 below:

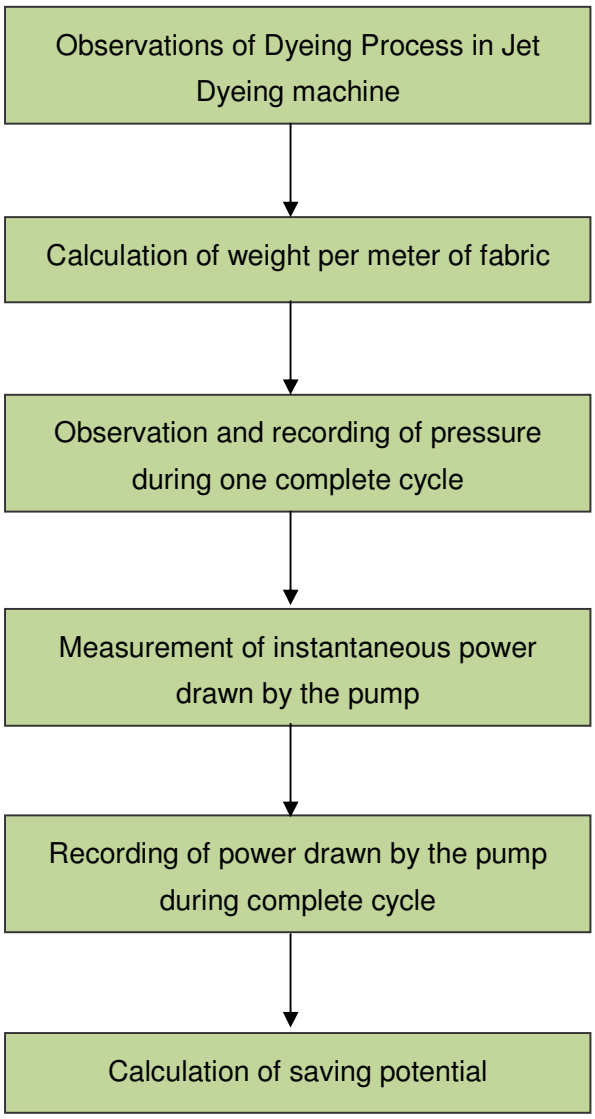

Fig. 1.8 Energy Audit methodologies

1.3.4 Design and operating parameters specification

The requirements of the disperse dyeing is that the fabric should be dyed at a temperature between 115 ^{o}C to 135 ^{o}C for sufficient period so that uniform dyeing occurs and also colour fastness is achieved. Higher pressure of 3.5 kg/cm^2 is required to ensure uniform dyeing of the fabric and also causes fabric movement whereas lower pressure of 1.5 kg/cm^2 is required for creating movement of the fabric during cycle other than dyeing cycle.

1.3.5 Operating efficiency analysis

As can be gathered from the typical specification of the Jet Dyeing Machine described in section 1.3.1, the pump happens to be the largest electrical load and the design head of the pump is 40 M (4.0 kg/cm^2). As per the discussions contained in the section 1.3.4, the pump operates most of the times at a pressure of 1.5 kg/cm^2. Also, dyeing of various qualities of fabric would need different pressures. Due to non availability of any mechanism for varying the pressure, the pump is made to operate on much more than the required pressure or is throttled to get the required pressure. In case of operating at higher pressure, electricity is unnecessarily wasted. However, in case of throttling, the duty point of the pump shifts and the efficiency also suffers.

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:-

1. Kick Off Seminar to create awareness
2. Energy Audit (Detailed and Preliminary) in over 78 units
3. Capability building and involvement of institutional financers, local service providers and also domestic equipment manufacturers.
4. Design and distribution of dissemination material containing most of the measures.
5. Design and distribution of Cluster Manual containing technology gap assessment and cost benefit analysis of proposed Energy Conservation measures.
6. 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, being generic in nature, is readily available.
- Non-availability of technology or aversion to adoption for any other reason does not seem to be the case here as most of the units in power process segment in Pali are already having VFDs in ID Fans, Stenter Fans etc. It is only lack of knowledge and comfort of proven guaranteed results that has been keeping the entrepreneurs away from adopting this technology.
- Jet Dyeing Machine manufacturers are offering the proposed technology as a standard add on to new systems. Even agencies working in optimization and control system for textile sector offer the product. However, the proposition is not being presented with guaranteed cost benefit analysis to the entrepreneurs. The entrepreneurs are in Micro, Small and medium sector and they do not have trained or educated manpower.
- 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 per machine which can be done from internal resources. However, the units have upto 6 Jet Dyeing machines and hence investment of ₹ 6 lakh in one go would be a problem.

- 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.
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- 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 to 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

Background

Most of the Jet Dyeing machines have pumps of larger capacity than actual requirement (suitable upto 500 gm/linear meter fabric). In practical use, nozzle flow is throttled by 50%. Furthermore, the output of pump of the Jet Dyeing Machine is pegged at 3.5 kg/cm^2 all through the cycle whereas this pressure is required for 55 minutes only in a cycle of 180 minutes.

Variable Frequency Drive

A variable frequency drive is an electronic controller that adjusts the speed of an electric motor by regulating the power being delivered. Variable-frequency drives provide continuous control, matching motor speed to the specific demands of the work being performed. Variable-frequency drives are an excellent choice for adjustable-speed drive users because they allow operators to fine-tune processes while reducing costs for energy and equipment maintenance.

VFDs have proven their worth in Energy Conservation especially in centrifugal machinery operating at varying load levels. Despite their internal consumption of upto 4%, the VFDs are very popular choice in Pumps, Blowers and other centrifugal applications serving variable demand due to their huge potential to save energy.

The system proposed is retro fitment of a VFD armed with PLC based control gear to the Jet Dyeing Machine so as to implement time based and requirement oriented change in RPM of the pump. The PLC based system can be integrated with existing control gear or can be installed as a package. The proposed system comes as a package through one of the manufacturers M/s SEMITRONICS and there may be other suppliers as well. All the jet dyeing machines have an existing control panel to ensure dyeing cycle and hence nothing more than the modular control system is required.

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 Jet Dyeing Machine without any modification to existing Machinery.

2.1.3 Superiority over existing equipment

The system would improve precision of control on the existing process and hence would yield better results on productivity as well as quality fronts.

2.1.4 Availability of equipment

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

2.1.5 Source of equipment

This technology has recently been implemented in one of the famous textile process house at Bhilwara and the results have been as per projections. Brochure from the same vendor has been enclosed. The equipment 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 given in Annexure 1.

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

The proposed system is independent of existing system and integration would need work as much as that needed to make an electricity connection. However, tuning of the system and performance monitoring would take maximum one day.

2.2 Life cycle assessment and risks analysis

The unit consists of VFD, PLCs, sensors, connections, contactors etc. There are no moving parts and hence deterioration is not a problem. However, bad power quality may lead to failure of the system. Being an electronic device, no problem is anticipated and the unit would go on working perpetually if better ambient is made available.

2.3 Suitable Unit for Implementation of Proposed Technology

The proposed system can be implemented in over 150 no. of Jet Dyeing Machines. Total potential for energy saving would be 50,85,450 kWh 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

No fuel saving is possible by implementation of the proposed system.

3.1.2 Electricity saving

The proposition would help save 27600 kWh of electricity per year in every jet dyeing machine and details of electricity saving is shown in Annexure 4.

3.1.3 Improvement in product quality

The system comes with precision process control protocol and hence product quality would certainly improve. The installation of proposed system would help improve reproducibility of shades and at the same type help produce absolute matching of shades. Also the product will have better colour fastness and uniform application of colour.

3.1.4 Increase in production

Precise process control will certainly improve production, However, the quantum of improvement will depend upon extant level of inefficiency.

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

The project would help optimize on consumption of dyes and would also reduce quantity of dye in the runoff.

3.2 Monetary benefits

The monetary saving arising out of implementation of proposed technology in one Jet machine would be ₹ 1.27 lakh per year. A detail of monetary benefit 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 electricity 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

The indirect benefit of implementation of the proposed system would accrue by way of optimization of Dye consumption and also wastage of Dye in run off. This would further reduce load of Effluent Treatment Plant.

3.4.2 Reduction in GHG emission

The equivalent saving in GHG emission for every Jet dyeing pump would be 24 MT CO_2 per year as per UNEP GHG Calculator.

3.4.3 Reduction in other emissions like SO_X

NIL

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 ₹ 1.0 lakh (0.825 lakh + excise + taxes and Cartage) as per the quotation from M/s SEMITRONICA attached as Annexure 7.

4.1.2 Erection, commissioning and other misc. cost

Erection & commissioning cost and other miscellaneous cost are about ₹ 0.05 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)	1.00
2	Erection & Commissioning cost	₹ (in Lakh)	0.05
3	**Total cost**	₹ (in Lakh)	1.05

4.2 Arrangements of funds

4.2.1 Entrepreneur's contribution

Entrepreneur will contribute 25% of the total project cost which is ₹ 0.26 lakh.

4.2.2 Loan amount.

Remaining 75% cost of the proposed project will be taken from the bank which is ₹ 0.79 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 ₹ 1.27 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-2.

4.3.2 Simple payback period

The total project cost of the proposed technology is 1.05 lakh and monetary savings due to reduction in Electricity & Fuel consumption is 1.27 lakh hence, the simple payback period works out to be 10 months.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10% works out to be ₹ 3.63 Lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 93.44%. 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 29.49%.

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	10
2	NPV	₹ (in lakh)	3.63
3	IRR	% age	93.44
4	ROI	% age	29.49
5	DSCR	ratio	4.76

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	89.03	3.41	29.28	4.53
Realistic	93.44	3.63	29.49	4.76
Optimistic	97.82	3.86	29.69	4.99

4.5 Procurement and Implementation Schedule

Total time period required for implementation of this technology is about 6 weeks and their details are given in Annexure 3.

ANNEXURE

Annexure -1: Information Brochure of equipment

CENTRALIZED COMPUTER CONTROL SYSTEM FOR FULLY AUTOMATIC OPERATION OF DYEING MACHINE

Demand for increased output from dyeing machinery and achieving of optimum quality but at same time reduction in production costs in order to meet difficulties in the current market situation has led in a very large way, to the introduction of automation in dyeing process to carry out process most economically.
Alongside reliability in processing, the time factor also plays important role. The shorter the dyeing operation, the more viable it is.
The SEMITRONIK TEMPERATURE PROGRAMMER Model PC/100 series optimises every dyeing process by means of individual control.

SEMITRONIK

COMPLETE AUTOMATION AND CENTRALISED CONTROL

The system entail a number of economic advantages for the textile dyeing industry.

- It optimises dyeing time and energy.
- Production capacity is increased.
- It eliminates uneven dyeing and complaints.
- It increases the reliability in production.
- Eliminates manual error.
- 3/4 dyeing machine can be operated by one operator.
- Dyeing process is rationalized.
- Ensure total automatic operation in between loading and unloading of dyeing machine such as :
  - Top / fibre / yarn dyeing machine
  - Hank dyeing machine
  - Jet dyeing / winch dyeing / overflow dyeing.
  - Jigger dyeing machines.

Reliability in operation and perfect reproduction of the dyeing cycles are ensured by several interlocks and alarm devices.
These devices indicate any error or omission of manoeuvres, alerts on insufficient supply of heating or cooling medium and hold time dyeing cycles at end of a main operation.

- Provision to retard OR advance the programme to store data on failure of power supply.
- FACILITY PROVIDED :
  To retard OR advance the programme.
- CONTROL MODE SELECTION :
  ON / OFF / PROPORTIONATE / 4-20 mA (Optional).
- To add one or more steps anywhere during programme without interfering the original programme stored in memory.
- To select automatically heating or cooling in case if actual temperature is higher or less than desired.
- A terminal connection is also an added feature as it offers the ability of central supervision, programming and data-logging of all connected units.
  Further more, efficiency reports can be elaborate, either individually for each unit or for all units at the same time.
- Supervisory computer communication for programming, scheduling, reporting.
- Signals for machine operator and dye kitchen personnel.

ALARM OPERATION IN CASE OF :

- Failure of liquid circulation pump during hold time with provision to stop heating or cooling until the moment pump is re-started hold time period will continue and heating and cooling will be re-started.
- When actual temperature is lower than minimum set temperature or sensor PT-100 is short circuited programme also stops and displays 'OP' specifying an open PT-100.
- When actual temperature is higher than maximum set temperature or sensor PT-100 is open circuited. Programme also stop.

THE DISPLAY FACILITY FOR

- Actual temperature
- Desired temperature
- Gradient
- Hold time
- Total time
- Programme number
- Step number etc.

CONTROL FOR

- Chemical and dye transfers from local or remote tanks.
- Recovery tank control.
- Blended water temperature.
- Pressure or differential pressure control.
- Jigger ends or passes.
- Selection of dosing control of liquid or solid chemicals.

PC - 150

PC - 160

SEMITRONIK

PROCESS CONTROL SYSTEMS FOR DYEING MACHINES

SUCH AS :

- For manual operation of dyeing machine with electrical accessories with temperature programmer for automatic dyeing temperature cycle control.
- With programmable logic controller for fully automatic operation of dyeing machine.

  THE SYSTEM WITH PROVISION FOR
  - Automatic parallel operation of dyeing machine with :
    - Addition/colour tank.
    - Stock tank.
    - Preparation tanks.
    - Colour kitchen with weighing terminal.
  - Master & Slave Control : Facility to dye same shade on number of dyeing machine under identical condition by master programmer.
  - Differential Pressure & Pressure Indicator and Control.
  - pH Indicator and Control : To synchronise the same with dyeing process for indication and control.
  - Dosing – Linear – Progressive / Regressive.
  - Serial Interface RS232 or RS485 for Central Computer for supervisory production data management & data storage with following facilities :
    - Bi-directional operation.
    - Colour matching computer.
    - Weighing terminal.
    - Store computer for automatic scheduling of production.
    - Generation of reports for analysis : (a) Graphical as well as (b) Digital.
    - Production data storage and software for data management.

PC - 700

CENTRALIZED COMPUTER CONTROL SYSTEM

For fully automatic operation of dyeing machine or group of dyeing machine. The system with link for :

- **Store :** To know order position and lot, shed, quality to be dyed and number of cone / cheese to be loaded and loading time.
- **Quality Control and Colour Matching Computer :** For obtaining details of recipe for shade to be dyed and programme to be loaded and sequence to be used for dyeing the given shade.
- **Drug Line Control :** To monitor the time, weight and quantity of dyestuff, chemicals and auxiliaries being added.
- **Dyeing Machine :** With colour tank, stock tank and preparation tanks for monitoring and controlling all process parameters.
  - With facility for :
    - Alarm operation in flash mode.
    - Print-out with deviation data.
    - Additional video terminal at required number of places.

Complete control system with PC/100 series including custom software and machine operating panels with numerous options such as :

- MIMIC DIAGRAM WITH LED INDICATION for :
  - Heating / cooling phase.
  - Failure of heating / cooling rate.
  - Hold time.
  - Heating / cooling ON/OFF.
  - Air pressurisation / depressurisation.
  - Fill.
  - Drain.
  - Pump direction.
  - Operator's call.
  - End of programme etc.
- Operating panel and software for addition of chemicals from the drug room.
- Auxiliary tank programme including filling and heating the auxiliary tank, and transferring liquor to and from the machine. This programme operates in parallel to the main programme.
- Automatic metered fill and overflow rinsing.
- Control of blend valve for filling to programmed temperature.

DOSING PROGRAMMER

- Programme identify check feature for ensuring compatibility between the dye programme and a programme number set by code switches on the machine panel.
- Numerical display for showing lot number, programme number, temperature, fabric speed, or other values for the information of the machine operator.
- Build-in software or hardware based Programmable Logic Controller for fully automatic operation of dyeing machine of any type & make & capacity.

FACILITY AVAILABLE

- INDIVIDUAL DYEING MACHINE OR GROUP OF DYEING MACHINES Interface PCB with software package to obtain graphical print-out of entire bleaching, scouring, dyeing and washing cycles with a facility to obtain details of data deviation on same graph through computer and printer for group of dyeing machines.

Normally, if dyeing result is not okay, it is known after fabric is unloaded and dried, for necessary correction, again same has to be loaded on the dyeing machine, correction has to be carried out and again to be unloaded and dried.

This unloading and drying process can be avoided, as deviation due to which same has resulted in re-dyeing can be obtained from graphical datas and without unloading dyeing correction can be done.

Thus installation of system :

- Increases the production.
- Reduces production cost.
- Eliminates manual error and labour.
- Reduces consumption of dyestuff, chemicals and auxiliaries.

SYSTEM is available to convert any type of existing dyeing machine into FULLY AUTOMATIC OPERATION.

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ACCESSORIES :

Such as :

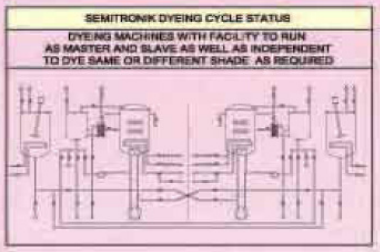
- Computer with diskettes and software for editing and data logging.
- Printer.
- Electro-pneumatic valves.
  - Pneumatically operated diaphragm control valve.
  - Cylinder operated valve.
  - Ball valve with pneumatic actuator.
- Pneumatic accessories such as :
  - Pressure gauge
  - Pressure regulator
  - Air filter
  - Lubricator
  - Nipples
  - Nylon tubing etc.
- Level controller :
  - Conductivity type
  - Magnetic float type
  - Differential pressure and air bubble type available with size & dimension of electrode to suit individual & specific requirement.

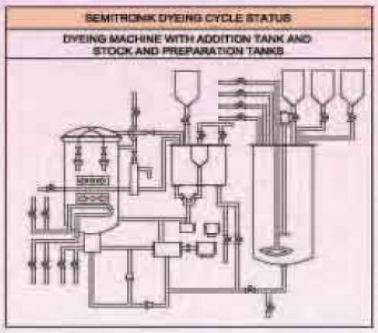
FINDS APPLICATION

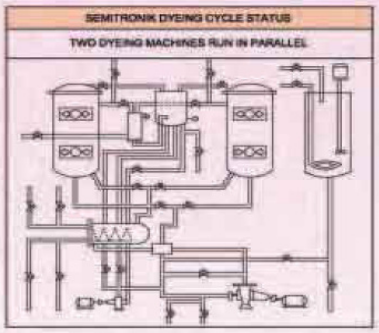
These automatic programmers are suitable for hank dyeing machines

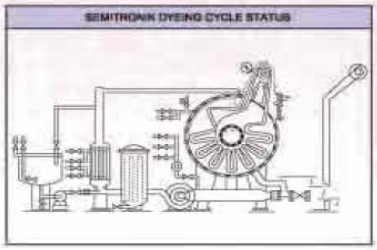
- Winch vats
- Jet dyeing machines
- Beam dyeing machine
- Rapid dyeing machine
- Top / fibre / yarn / fabric.

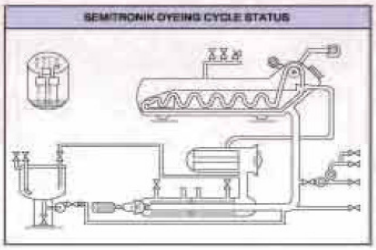
For programming batch process which require variable operating temperature for pre-set duration according to pre-established condition for paint coating plant installations for drying and treatment of building material. Woods seasons installation cutting vats for salted meats and numerous other processes will result in higher efficiency and output when provided with temperature programme controllers.

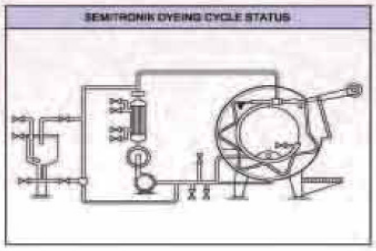












CENTRALISED DYEING AUTOMATION SYSTEM

WITH FACILITY TO HOOK-UP:

- Colour matching computer.
- Weighing terminal & process computer.
- Dosing-linear, progressive, regressive or as per clients requirement.
- Automatic liquid dispensing system.
- Parallel operation of dyeing machine with stock tank, preparation tanks, addition tanks.
- Master & slave operation.
- Level controller, electrical controls pneumatic accessories, control valves with pneumatic actuators for existing or new machines.
- pH indicator and controller.

OBJECTIVES

- Ensure reliable & repeatable performance.
- Optimize energy & water consumption, increase production.
- Eliminate production loss & hazards due to human errors.

COST EFFECTIVE INVESTMENT ON SEMITRONIK SYSTEMS PAYS BACK WITHIN A YEAR IN TERMS OF

- Savings on consumption of utilities.
- Increase in production, besides ensured safety from hazards.
- Elimination of re-dyeing.

SEMITRONIK

OUR STRENGTHS

- System expansion for multiple machines in master/slave or parallel configuration.
- System can be hooked up with Semitronik Temperature Programmer PC/100, PC/600. PLC output or non PLC or any make temperature programmer of any make dyeing machine.

OVERVIEW OF PROCESS COMPUTER SOFTWARE

- Process computer feature include:
  - Status monitoring.
  - Programme and status data storage.
  - Machine control.
  - Report generation for upto 32 machines.

STATUS MONITORING

- Status monitoring can be done in different styles.
- TEXTUAL DISPLAY
  Detailed information for 16 machine at a time and relay, valve, level control status for selected machine.
- VISUAL STATUS DISPLAY
  For dyeing cycle, dynamic status update for valves, level controls of a selected machine.
- GRAPHICAL DISPLAY
  Time vs. temperature graph for a machine on lot or time basis.

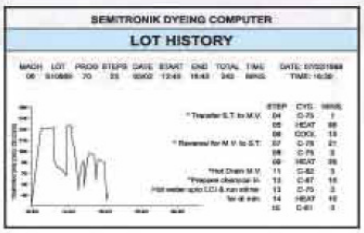
MACHINE CONTROL

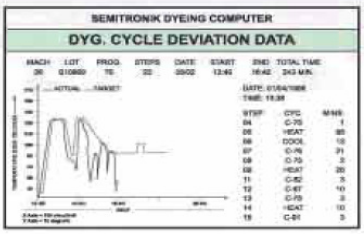
- Machine parameters such as :
  - Lots to be processed on machine
  - Status of machine
  - Details of dyeing programs can be defined.
- Dyeing programs can be started on machine, mirror images of these information is stored on disk for efficient data management.

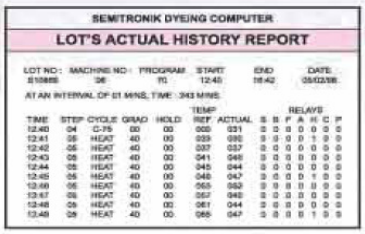
OVERVIEW OF PROCESS COMPUTER SOFTWARE

REPORT GENERATION :

- User defined reports for machine status data can be generated on lot and time basis.
- Program details for one or group of programs can be prepared for machine.
- Reports can be seen, saved to file or printed without losing a minute of data (Real-time activity).
- *Lot History*
  Textual and graphical.
- *Machine Track Report*
  Textile and graphical.
- *Program Details Report*
  Energy Consumption Report.







ENERGY IS LIFE
BEE
CONSERVE IT

DYEING AUTOMATION SYSTEM

PROCESS COMPUTER SOFTWARE
VERSION 1.3
(PC-600 SERIES)
DOS/WINDOW OS

Screens : Dyeing automation

- Start-up.
- Dyeing automation configuration.
- Dyeing automation system - hardware setup.
- Mimic diagram–dyeing automation with
  - Addition / expansion / colour tanks.
  - Stock tank.
  - Preparation tanks or dispensing tanks.
- Preview software.
- Lot history reports – graph and text mode.
- Machine track reports – graph and text mode.
- Program listing reports–text.
- Energy consumption report–text.
- Machine status.
- Machine scheduling.
- Program editor.

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SEMITRONIK DYEING COMPUTER
DYEING PROGRAMMER
MODEL : 600 SERIES

DATE: 13/02/1998 MAIN MENU TIME: 13:56

STATUS MONITOR
TEXT DISPLAY
MIMIC DISPLAY
GRAPH DISPLAY

REPORTS
LOT HISTORY (TEXTUAL)
LOT HISTORY (GRAPHICAL)
MACHINE TRACK REPORT (TEX)
MACHINE TRACK REPORT (GRA)
MACHINE PROGRAMS

MACHINE CONTROL
MACHINE SCHEDULING
MACHINE STATUS
PROGRAM EDITOR

MASTER CONTROL
START DATA COLLECTION
CHECK MACHINE STATUS
QUIT

SEMITRONIK DYEING COMPUTER
LOT'S ENERGY CONSUMPTION REPORT

LOT NO. : 510869 MACHINE NO. : 7E PROGRAM : 06 START : 12:40 DATE : 05/02/98 TOTAL : 243 MIN

ELECTRICAL CONSUMPTION
MAIN MOTOR 214.56 KG 158.84 KWH
INJECTOR PUMP 198.16 KG 4.92 KWH
STIRRER 14.64 KG 0.26 KWH
SUNDRIES 0.35 KWH
TOTAL 165.37 KWH

WATER CONSUMPTION
STOCK TANK 510... 2.7 TIMES 7200 LTS
COOLING CYCLE 19.56 KG 5400 LTS
TOTAL 12600 LTS

LOT'S TARGET PROGRAM
LOT NO. : 510869 MACHINE NO : 6 PROGRAM : 7E DATE : 05/02/98
STEP CYCLE REF GRAD HOLD CODE

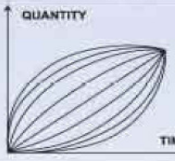
SEMITRONIK DYEING COMPUTER
DYEING PROGRAMMER MODEL : 600 SERIES
MACHINE STATUS

01	RUNNING	07	RUNNING
02	RUNNING	08	RUNNING
03	RUNNING	09	RUNNING
04	RUNNING	10	NOT LINKED
05	RUNNING	11	NOT LINKED
06	RUNNING		

STATUS: (R)UNNING, (N)OT LINKED

SEMITRONIK DYEING COMPUTER
DYEING MACHINE STATUS FOR A DAY
(24 HRS)

SEMITRONIK DYEING COMPUTER
DOSING STATUS



SEMITRONIK DYEING COMPUTER
PROGRAM DETAILS LISTING

MACHINE NO. 01 DATE: 01/04/1998 TIME: 13:44

PROGRAM NO. : 01

STEP	CYCLE	REF	GRAD	HOLD	CODE	PARA
01	C	300	00	00	55	01
02	C	300	00	00	76	01
03	C	300	00	01	25	01
04	U	110	88	15	00	00
05	U	128	78	29	00	00
06	D	105	50	20	00	00
07	U	100	20	30	00	00
08	D	380	10	05	00	00
09	D	340	20	00	00	00

PROGRAM NO. 05

STEP	CYCLE	REF	GRAD	HOLD	CODE	PARA
01	C	300	00	00	01	02
02	C	300	00	00	76	00

For further details, contact

SEMITRONIK

Since our policy is of continuous development and improvement, we reserve the right to supply product which may differ from those illustrated & described in this publication.

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Annexure -2: Detailed financial analysis

Assumption

Name of the Technology	**VFD FOR PUMP ON JET DYEING MACHINE**		
Rated Capacity	**NA**		
Details	***Unit***	***Value***	***Basis***
Installed Capacity			
No of working days	Days	300	Feasibility Study
No of Shifts per day	Shifts	1	
Capacity Utilization Factor	%age		
Proposed Investment			
Equipment cost	₹ (in lakh)	1.00	
Civil works, Erection and Commisioning	₹ (in lakh)	0.05	
Total Investment	₹ (in lakh)	1.05	
Financing pattern			
Own Funds (Equity)	₹ (in lakh)	0.26	
Loan Funds (Term Loan)	₹ (in lakh)	0.79	
Loan Tenure	years	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%age	10.00%	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	4.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Electricity saving	kWh/year	27600	
Cost	₹/kWh	4.6	
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 Loan

₹ (in lakh)

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	0.79	0.06	0.73	0.09
2	0.73	0.12	0.61	0.07
3	0.61	0.15	0.46	0.06
4	0.46	0.16	0.30	0.04
5	0.30	0.18	0.12	0.02
6	0.12	0.12	0.00	0.00
		0.79		

WDV Depreciation

₹ (in lakh)

Particulars / years	1	2
Plant and Machinery		
Cost	1.05	0.21
Depreciation	0.84	0.17
WDV	0.21	0.04

Projected Profitability

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Fuel savings	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
Total Revenue (A)	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
Expenses								
O & M Expenses	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06
Total Expenses (B)	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06
PBDIT (A)-(B)	1.23	1.23	1.22	1.22	1.22	1.22	1.21	1.21
Interest	0.09	0.07	0.06	0.04	0.02	0.00	-	-
PBDT	1.14	1.16	1.17	1.18	1.20	1.21	1.21	1.21
Depreciation	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
PBT	1.08	1.10	1.11	1.13	1.14	1.16	1.16	1.16
Income tax	0.10	0.34	0.40	0.40	0.41	0.41	0.41	0.41
Profit after tax (PAT)	0.98	0.77	0.72	0.72	0.73	0.74	0.75	0.74

Computation of Tax

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
rofit before tax	1.08	1.10	1.11	1.13	1.14	1.16	1.16	1.16
Add: Book depreciation	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Less: WDV depreciation	0.84	0.17	-	-	-	-	-	-
Taxable profit	0.30	0.99	1.17	1.18	1.20	1.21	1.21	1.21
Income Tax	0.10	0.34	0.40	0.40	0.41	0.41	0.41	0.41

Projected Balance Sheet

₹ (in lakh)

Particulars / Years	1	2	3	4	5	6	7	8
Liabilities								
Share Capital (D)	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
Reserves & Surplus (E)	0.98	1.75	2.46	3.19	3.92	4.66	5.41	6.15
Term Loans (F)	0.73	0.61	0.46	0.30	0.00	-0.04	-0.04	-0.04
Total Liabilities (D)+(E)+(F)	1.97	2.62	3.18	3.75	4.18	4.89	5.63	6.38

Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Less Accm. Depreciation	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44
Net Fixed Assets	0.99	0.94	0.88	0.83	0.77	0.72	0.66	0.61
Cash & Bank Balance	0.98	1.68	2.30	2.92	3.41	4.17	4.97	5.77
TOTAL ASSETS	1.97	2.62	3.18	3.75	4.18	4.89	5.63	6.38
Net Worth	1.24	2.01	2.72	3.45	4.18	4.93	5.67	6.42
Debt Equity Ratio	2.77	2.31	1.74	1.13	0.00	-0.15	-0.15	-0.15

Projected Cash Flow

₹ (in lakh)

Particulars / Years	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Sources									
Share Capital	0.26	-	-	-	-	-	-	-	-
Term Loan	0.79								
Profit After tax		0.98	0.77	0.72	0.72	0.73	0.74	0.75	0.74
Depreciation		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Total Sources	1.05	1.04	0.82	0.77	0.78	0.79	0.80	0.80	0.80
Application									
Capital Expenditure	1.05								
Repayment Of Loan	-	0.06	0.12	0.15	0.16	0.30	0.04	-	-
Total Application	1.05	0.06	0.12	0.15	0.16	0.30	0.04	-	-
Net Surplus	-	0.98	0.70	0.62	0.62	0.49	0.76	0.80	0.80
Add: Opening Balance	-	-	0.98	1.68	2.30	2.92	3.41	4.17	4.97
Closing Balance	-	0.98	1.68	2.30	2.92	3.41	4.17	4.97	5.77

IRR

₹ (in lakh)

Particulars / months	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Profit after Tax		0.98	0.77	0.72	0.72	0.73	0.74	0.75	0.74
Depreciation		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Interest on Term Loan		0.09	0.07	0.06	0.04	0.02	0.00	-	-
Cash outflow	(1.05)	-	-	-	-	-	-	-	-
Net Cash flow	(1.05)	1.13	0.89	0.83	0.82	0.81	0.80	0.80	0.80
IRR	93.44								

NPV	3.63

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	0.04	0.04	0.04	0.04	0.04
Sub Total*(G)*	0.03	0.03	0.03	0.04	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	0.07	0.06	0.04	0.02	0.00	0.00	0.00
Depreciation *(H)*	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Sub Total (I)	0.16	0.13	0.12	0.11	0.09	0.07	0.07	0.07
Sales (J)	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
Contribution (K)	1.24	1.24	1.23	1.23	1.23	1.23	1.23	1.23
Break Even Point (L= G/I)	12.67%	10.82%	9.88%	8.76%	7.44%	5.88%	5.66%	5.73%
Cash Break Even {(I)-(H)}	8.19%	6.33%	5.40%	4.26%	2.94%	1.37%	1.15%	1.21%
Break Even Sales (J)*(L)	0.16	0.14	0.13	0.11	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	1.08	1.10	1.11	1.13	1.14	1.16	1.16	1.16	9.03
Net Worth	1.24	2.01	2.72	3.45	4.18	4.93	5.67	6.42	30.62
									29.49%

Debt Service Coverage Ratio

₹ (in lakh)

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Cash Inflow									
Profit after Tax	0.98	0.77	0.72	0.72	0.73	0.74	0.75	0.74	4.66
Depreciation	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.33
Interest on Term Loan	0.09	0.07	0.06	0.04	0.02	0.00	0.00	0.00	0.28
Total (M)	1.13	0.89	0.83	0.82	0.81	0.80	0.80	0.80	5.28

DEBT

Interest on Term Loan	0.09	0.07	0.06	0.04	0.02	0.00	0.00	0.00	0.28
Repayment of Term Loan	0.06	0.12	0.15	0.16	0.30	0.04	0.00	0.00	0.83
Total (N)	0.15	0.19	0.21	0.20	0.32	0.04	0.00	0.00	1.11
	0.09	0.07	0.06	0.04	0.02	0.00	-	-	0.28
Average DSCR (M/N)	4.76								

Annexure -3: 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

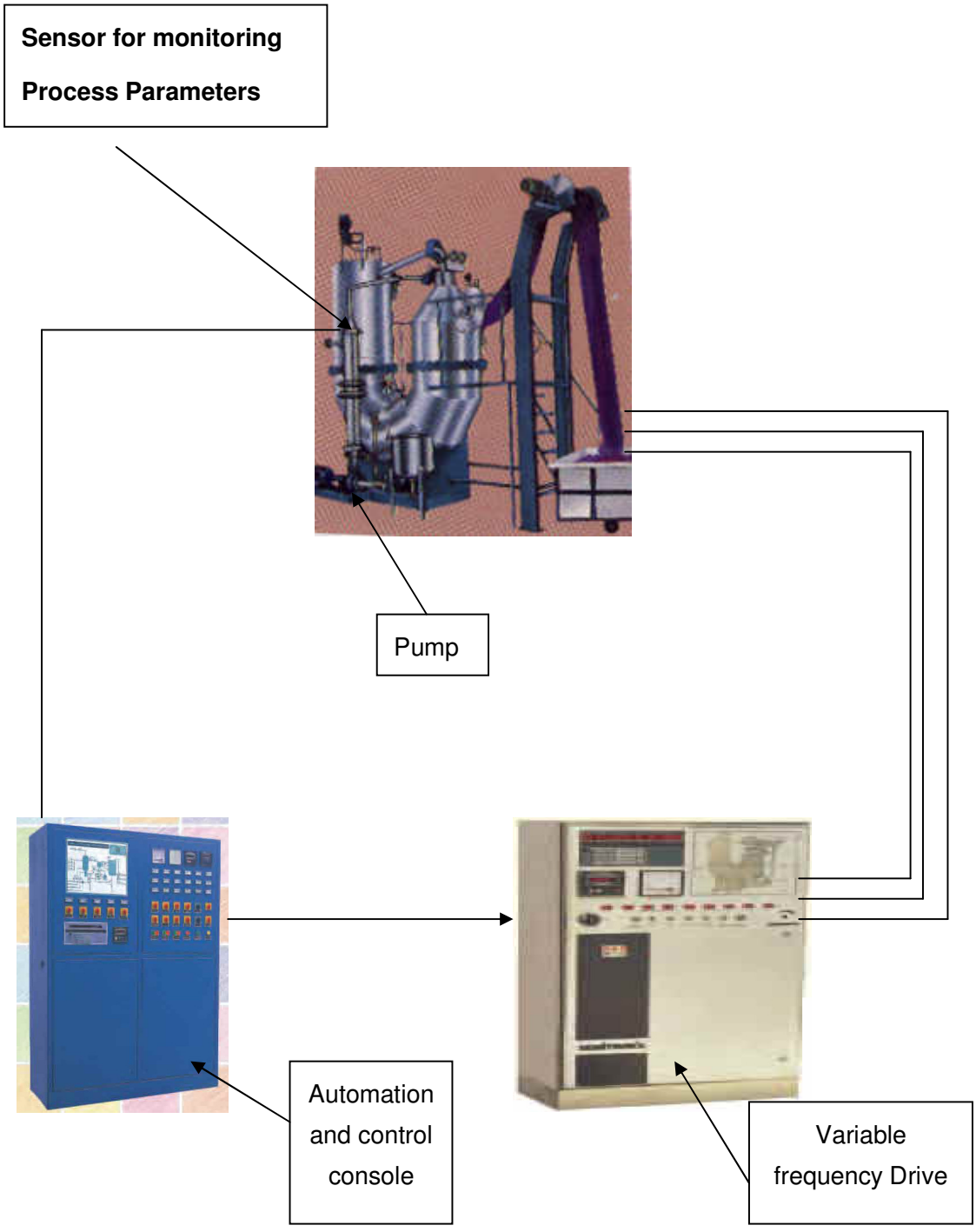
Calculation of Energy Saving Potential from installation of VFD in thermic fluid pump of Thermopac

Savings of Electricity by installing VFD in Thermic Fluid Pump			
Particulars		***Unit***	***Value***
1	Flow pressure before installation of VFD	kg/cm^2	3.5
2	Flow pressure after installation of VFD (proposed pressure)	kg/cm^2	1.5
3	Pressure ratio	ratio	2.33
4	Power drawn at 3.5 kg/cm^2 pressure	kW	8
5	Power drawn at 1.5 kg/cm^2 pressure (According to Affinity Law)	kW	2.25
6	Total operating hour	hr/day	8
7	Total operating days	Days	300
6	Saving in power based on Affinity Law	kWh/day	95.8
7	Yearly power saving	kWh/year	28750
7	Self electricity Consumption	%age	4
8	Self electricity Consumption	kWh/year	1150
9	Net electricity Savings	kWh/year	27600
10	Cost of electricity	₹/kWh	4.6
11	Monetary Equivalent	₹ (In lakh)/year	1.27
12	Investment	₹ (In lakh)	1.05
13	General Pay Back Period	Months	10

Annexure -5: Details of equipment service providers

S.No.	*Technology*	*Name of Service Provider*	*Address*	*Contact Person and No.*
1.	Installation of VFD in Jet Dyeing machine Pump	M/s SEMITRONICS	17 CD, Archana Industrial Estate, Rakhial Road, Ahmedabad 079-22741011	Mr. Parthav Shah
2	Pejawar Electronics	Pejaawar Electronics, Dealers of Mitsubishi and Messung brand VFDs and PLCs	57/59, Vishal Industrial Estate, Bhandup(W), Mumbai	
3	AUTOMATED CONTROL SYSTEM FOR DYEING MACHINE	M/s R.B. Electronic and Engineering Pvt. Ltd.	301, Kilfire House, C-17, Dalia Industrial Estate, Off New Link Road, Andheri (West), Mumbai 400053. India. TEL: 022 66921431 TELEFAX: 022 66921432 E-MAIL: texsales@eecindia.com, texsales@vsnl.com	

Annexure – 6 Typical arrangement drawings for proposed system



Annexure – 7 Quotation for Proposed Technology

October 18, 2010

Email to : M/s. PCRA, Jaipur

Email : kumars@pcra.org

Kind attn : Mr. Suman Kumar

Dear Sir,

Ref: Your email dated 18/10/2010

Reg: System for automatic operation of Jet dyeing machine

We are in receipt of your email as referred above and have noted the contents thereof.

Accordingly, we give below our offer for the same:

SYSTEM MODEL PC-160-PLC (FN DISPLAY based fully automatic controller

MICROPROCESSOR based complete circuitry lacquered PCB and IC on sockets neatly wired in a sturdy cabinet with non volatile memory; suitable to operate on 100 to 220V,+/- 10%, 50/60 c/s or as per requirement with following facility for :

Advance program

- **Password protection**
- Add one or more steps anywhere during program without interfering the original program stored in the memory
- **Battery backup** memory for user programs with storing capacity of 25 programs of 99 steps each.
- **ALARM OPERATION** Failure of desired heating or cooling rate or in case of end of program
- **DIGITAL DISPLAY** Seven segment LED digital display for all the parameters such as :

  a. Actual temperature

  b. Reference temperature

  c. Gradient

  d. Hold time

  e. Program no.

Controlled functions:-

a. Heating

b. Cooling

c. Pressurization

d. De-pressurization

e. Alarm

f. Spare

g. Drain

h. Fill

i. Temperature

j. Bath circulation

k. Circulation pump speed setting

l. Winch speed setting

m. Regulation of the rate of change of temperatures and holding times

The controller comes with additional logic I/O card of 8 inputs and 21 outputs

INVERTER : For programming variable Speed or RPM of motor of i) Main pump and (ii) Reel while Bleaching, Scouring, Dyeing and Washing cycles.

Sr. No.	Item	Price per pc (Rs.)
1.	Temperature programmer model PC/160 PLC with 12.5 HP Inverter.	**82,450/-**

(Further details given in attached catalog)

The above price is net, ex. works – Ahmedabad subject to:

* Packing/forwarding : 3.5% extra

* Taxes : 2% against `C' form

* Excise : As applicable at the time of delivery. At present 10.30%

* Delivery : within 3 / 4 weeks from the date of receipt of payment

* Payment : 30% advance along with order and balance against proforma invoice.

In case any more information is required, kindly feel free to contact us.

Your further advice in the matter would be highly appreciated.

With regards / thanks

N.J. Shah / Semitronik Instruments

Cc to : M/s. Kalani Agencies, Pali

ks

Bureau of Energy Efficiency (BEE)
(Ministry of Power, Government of India)
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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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