

WRITE UP ON ENERGY EFFICIENCY IMPROVEMENT PROJECTS FOR FY 04

1. Replacement of existing Air Compressor by Energy Efficient Compressor in Viscose

Background

High-energy consumption in Compressed Air System in Viscose Department

Observation made

Three numbers of 100 CFM capacity single stage compressors are running to meet the compressed air requirement for process, Bailing press and instruments.

Technical Analysis

Collective decision was taken to install a single Energy efficient non-lubricating compressor of Capacity 300 CFM to meet the requirement.

Power consumption in

1. Existing system : 51 KW
2. New System : 37 KW

Power saving : 336 Kwh/day

Financial Analysis

Total Investment	:	10.64 Lacs
Annual saving (@ Rs 2162/Ton of coal	:	Rs. 5.34 Lacs
Interest on Investment (@10% on 50% investment)	:	Rs. 0.53 Lacs
Net annual saving	:	Rs. 3.43 Lacs
ROI	:	27.26%
Pay back period	:	3.67 Years

Implementation

Cross-functional project team was formed and implemented the project as per Bar Chart with PDCA cycle and taken on line during preventive stoppage. Post project Performance was verified by project team and found be in line with expected savings.



2. Replacement of Deaerator cooling Tower with jet type fan less cooling tower in Viscose Department

Background

Coefficient of performance of existing cooling tower is reducing leading to high-energy consumption.

Observation made

Performance deterioration was due to aging of cooling tower. New fan less cooling tower technology was studied with supplier for feasibility.

Technical Analysis

Power consumption in

1. Existing system cooling tower	: 8.50 KW
2. New cooling Tower	: Nil
Power Saving	: 204 KWh/day
	: 1.85 Kwh/Ton of Fibre

Financial Analysis

Total Investment	:	Rs.7.61 Lacs
Annual saving @ Rs 4.0/Kwh	:	Rs.5.08 Lacs
Interest on Investment:	:	Rs. 0.38 Lacs

(@10% on 50% investment)

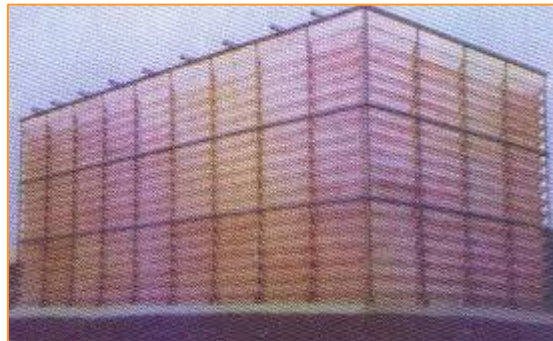
Net annual saving	:	Rs. 1.70 Lacs
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ROI	:	22.34%
Pay back period	:	4.48 Years

Implementation

Project expenses allocated in Capex04. Technology and material supplied by M/S Armec. Cross-functional project team implemented the project as per Gantt Chart and Responsibility Chart implemented project.

Photograph of fan less Cooling Tower



3. Replacement of Higher Head MSFE Feed pumps by Lower Head pump in Recovery Department

Background

During In-house Energy Audit it was observed that the MSFE feed pump head is higher than the process requirement.

Observation made

The rated duty conditions of MSFE pumps is 140 m³/Hr flow and 24 m head and are run at 200 m³/Hr , 18 m head. It was decided to match the pump to the process requirement.

Technical Analysis

Power consumption in

4. Existing system cooling tower : 64.73 KW

5. New cooling Tower : 46.56

Power Saving : 436 KWh/day
: 3.96 Kwh/Ton of fibre

Financial Analysis

Total Investment : Rs.16.60 Lacs

Annual saving @ Rs 4.0/Kwh : Rs.4.45 Lacs

Interest on Investment: : Rs. 0.83 Lacs

(@10% on 50% investment)

Net annual saving : Rs. 3.62 Lacs

ROI : 21.81%

Pay back period : 4.59 Years

Implementation

Project expenses allocated in Capex04. Pump was supplied by M/S BDK, Hubli. Pump was installed and taken on line during preventive stoppage. Performance monitored by department persons and is conforming to the expected savings.

4 Replacement of dilute Sulphuric Acid Pump by Energy efficient Pump in Acid Absorption Crystallizer (AAC) in Recovery Department

Background

During In-house Energy Audit it was observed that the Dilute Acid Pumps are operating with an efficiency of 55%.

Observation made

It was observed that the pumps are old, inefficient and needs replacement. In efficient pumps are replaced by Energy Efficient Microfinish make pumps with an efficiency of 79%.

Technical Analysis

Power consumption in

Existing Pump : 64.73 KW

New Pump : 46.56

Power Saving : 402 KWh/day
: 3.65 Kwh/Ton of fibre

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Financial Analysis

Total Investment	:	Rs.15.15 Lacs
Annual saving @ Rs 4.0/Kwh	:	Rs.3.59 Lacs
Interest on Investment: (@10% on 50% investment)	:	Rs. 0.76 Lacs
Net annual saving	:	Rs. 3.59 Lacs
ROI	:	23.70%
Pay back period	:	4.22 Years

Implementation

Project expenses allocated in Capex04. Pump was supplied by M/S BDK, Hubli. Pump was installed and taken on line during preventive stoppage. Performance monitored by department persons and is conforming to the expected pump efficiency & savings.

Replacement Existing oversized Waste Heat Boiler Feed water pumps by Proper size Energy efficient Pumps in Sulphuric Acid Plant

Background

During In-house Energy Audit it was observed that 50% of excess feed water is being bypassed back to the feed tank and pump efficiency was very at 55%.

Observation made

It was observed that the existing pump rated at 15m³/Hr flow, 160 m head is being operated at 7.0 m³/Hr flow, 160 m head. 50% of water is being bypassed to feed tank. It was concluded to match the pump capacity to the requirement with energy efficient pumps.

Technical Analysis

Power consumption in
Existing Pump : 8.0 KW
New Pump : 4.0 KW
Power Saving : 96 KWh/day

Financial Analysis

Total Investment	:	Rs.1.5 Lacs
Annual saving @ Rs 4.0/Kwh	:	Rs.1.40 Lacs
Interest on Investment: (@10% on 50% investment)	:	Rs. 0.08 Lacs
Net annual saving	:	Rs. 1.33 Lacs
ROI	:	88.7%
Pay back period	:	1.12 Years

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Implementation

Project expenses allocated in Capex04. Pump was supplied by M/S Grundfos. Pump was installed and taken on line during preventive stoppage. Performance monitored by department persons and is conforming to the expected pump efficiency & savings.

6. Direct flashing of Hot Sump Zone liquid in MSFEs for Heat Recovery

Background

Cellulose is regenerated in the form of filaments in a spin bath of weak sulphuric acid. In After treatment section, weak & hot acidic stream comes out after washing of the filaments. This acid stream was being recycled to the system.

Observation made

The hot acid stream was recycled to the system without effectively utilizing its heat. Concerned sectional manager observed the recycling system and identified the potential of waste heat recovery.

Technical Analysis

Collective decision was taken to divert the hot acidic stream to Multi Stage Flash Evaporator (MSFE) where it will be get flashed to recovery the waste heat.

Stream flow rate	:	6.0 m ³ /Hr
Temperature of liquid stream - 80°C		
Steam saving in MSFE by flashing of liquid from 80 to 49°C	:	5.0 Ton/Day

Financial Analysis

Total Investment	:	12.48 Lacs
Equivalent coal savings (@ C.V. 4249 Kcal/Kg)	:	247 Ton of Coal per annum
Annual saving (@ Rs 2162/Ton of coal)	:	Rs. 5.34 Lacs
Interest on Investment (@15% on 50% investment)	:	Rs. 0.96 Lacs
Net annual saving	:	Rs. 4.38 Lacs
ROI	:	34.11%
Pay back period	:	2.93 Years

Implementation

Cross functional project team was formed and implemented the project as per Bar Chart with PDCA cycle during fibre machine overhauling.

7. Reduction in Sulphuric Acid Plant System pressure on 200 HP Air Blower by various modifications and avoiding air bypass

Background

In the manufacturing of Sulphuric acid, 70% of power is consumed by 200 HP Air Blower, which supplies air to the system for oxidation processes. The specific energy consumption of Acid Plant was 52 KWH/Ton of Acid.

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Observation made

In comparison with similar Acid Plants, our specific energy consumption was much higher, leading to energy saving potential. Power drawn by Air Blower is mainly depends on the system pressure. After analyzing the pressure drop data across all units, its was revealed that the pressure drops across Hot Gas Filter and converter Bed # 3 were high. Excess air bypassing also observed from Air Blower.

Technical Analysis

On study of Hot Gas Filter design data, it was found that the surface area for filtration was less in old Conventional Filter. New cartridge type Hot Gas Filter was designed & developed which has surface area of filtration 3 times higher than old filter. With increased surface area, the pressure drop across new Filter estimated to be reduced by 50%.

In Converter Bed # 3, higher pressure drop was mainly due to the shape of the catalyst (Pellet Shape), which has less specific surface area of contact. By adopting hollow cylindrical shaped catalyst, pressure drop estimated to be reduced by 60%.

10% excess Air bypassing was resulting in 5% increase in power consumption. Providing correct size pulley excess air bypassing was eliminated.

Reduction in specific energy consumption : 6 Kwh/Ton Acid
Total reduction in energy consumption : 1,80,900 KWh per Annum
(@ 90 TPD prod & 335 days run per year)

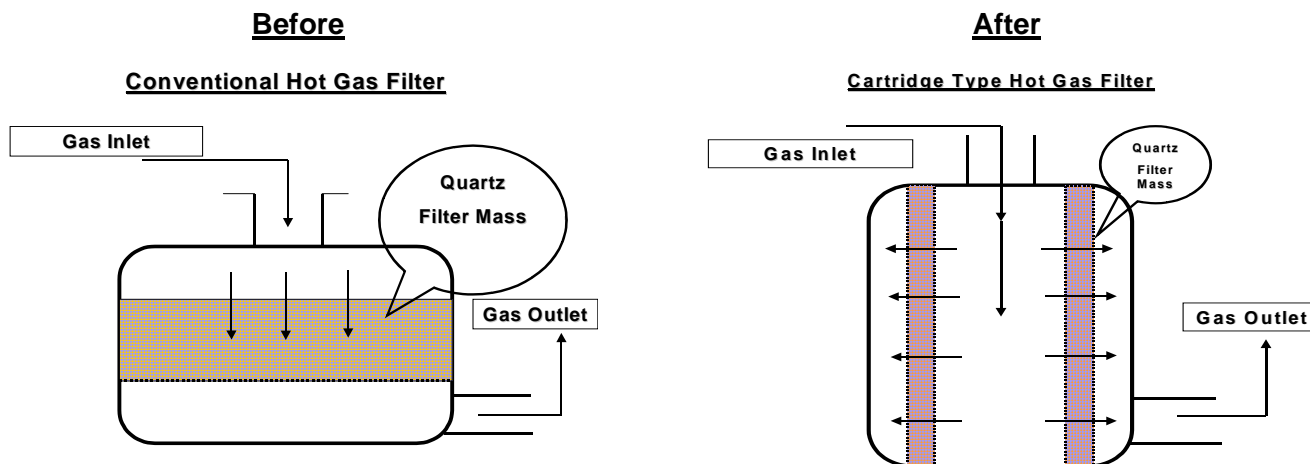
Financial Analysis

Total Investment : Rs.15.0 Lacs
Annual saving @ Rs 4.0/Kwh : Rs. 7.24 Lacs
Interest on Investment: : Rs. 1.12 Lacs
(@ 15% on 50% investment)
Net annual saving : Rs. 6.12 Lacs

ROI : 40.80%
Pay back period : 2.45 Years

Implementation

Project expenses allocated in Capex03 in Acid Plant overhauling account. Project was implemented by cross functional project team during Acid Plant Overhauling 2003 as per Grantt Chart and Responsibility Chart.



Photographs of New Cartridge Type Hot Gas Filter



8. Elimination of Pre Deaerator and B side Blender in Viscose Ripening Room

Background

Raw Viscose is pumped from Dissolver Blender to Receiving Tank in Ripening Room and from there to B side Blender. This Viscose is then pumped to Pre deaerators for removing air bubbles present in Viscose. Again after filtration the air bubbles are removed in in Flash deaerators having the same Vacuum.

Observation made

Both double pumping of Viscose from receiving tank to B side Blender and air removal in Pre deaerators before filtration can be avoided as air bubbles are being removed in Flash deaerators before pumping to Spinning machine. Trail was taken by running Pre-deaerator without Vacuum and found it was not affecting the Fibre quality.

Technical Analysis

Collective decision was was taken to eliminate B side Blender and Pre-deaerators.

Power consumption, KWh/day

Blender Transfer pump	: 90
Blender stirrer	: 70
A side PD pump	: 95
B side PD pump	: 95

Total Power saving : 350 KWh/day

Financial Analysis

Total Investment	:	Rs.10.80 Lacs
Power saving	:	350 Kwh/day
Annual saving @ Rs. 2.67/Kwh, Rs. in Lacs	:	Rs. 3.41 Lacs
Interest on Investment @ 15% on 50% investment	:	Rs. 0.81 Lacs
Net Annual saving	:	Rs. 2.60 Lacs
ROI	:	24.07%
Pay back period	:	4.15 years

Implementation

Project was implemented on in supervision of cross functional project team as per Grantt Chart along with PDCA cycle.

- Blender Transfer pump & Blender stirrer eliminated in the month of Mar'03
- A & B side PD pumps eliminated in the month of Aug'03

9. Energy Efficient HP steam based Vacuum Ejectors in place of LP steam based Ejectors for Viscose Dearation

Background

Function of Viscose Dearator is to remove trapped air bubbles from filtered Viscose before it is pumped to Spinning Machine for regeneration. LP based four stage Vacuum Ejector was used for this purpose.

Observation made

LP steam based four stage ejector was not able to create required Vacuum due to less steam pressure. Hence HP steam with reduced pressure of 3.0 Kg/cm² was being used and steam consumption was high.

Technical Analysis

Collective decision was taken to install two stage HP steam based Ejectors in place of LP steam based Ejectors.

	<u>LP steam based Ejector</u>	<u>HP steam based Ejector</u>
No. of stages	: 4	2
Steam Pressure, Kg/cm ²	: 3.0	11.0
Steam consumption, T/day	: 12	6.2

Steam saving : 5.8 Tons/day

Financial Analysis

Total Investment	:	Rs. 13.21 Lacs
Steam saving	:	5.8 T/day
Annual saving @ Rs.369 /T of steam	:	Rs. 7.81 Lacs
Interest on Investment @ 15% on 50% investment	:	Rs. 0.99 lacs
Net Annual saving	:	Rs. 6.82 lacs
ROI	:	51.63%
Pay back period	:	1.94 years

Implementation

Project was implemented in supervision of cross functional project team and system commissioned in the month of Apr'02

Photograph of HP Steam Based Vacuum Ejector



10. Rationalization of Refrigeration Section in Viscose Department

Background

Chilled water required for Viscose manufacturing is prepared in Refrigeration Section. The Refrigeration Equipment consists of 150 TR Ammonia Compressors (With 150 HP Motors) its acid stream was being recycled to the system.

Observation made

From Parato Analysis it was observed that 80% of power is being consumed by Compressor and Condenser pumps. By Cause & Effect analysis, various reasons were listed out. Failure Mode and Effect (FMEA) was carried out to identify causes having high Risk Priority Number (RPN).

Technical Analysis

1. All Chiller/Condenser tubes were cleaned by specialty Chemicals and high pressure water to remove fouling
2. Corroded MS Baffles of Chiller and Condenser end dummies replaces with SS Baffles to avoid bypassing.
3. Leaking Ammonia valves were replaced.
4. Visual indication provided to indicate Chiller expansion valve.
5. Hot water (42°C) of FD Condensers was diverted to separate cooling tower to reduce condenser water temperature.
6. One Chilled water pump was eliminated by directly taking chilled water from Chiller outlet to Dissolver and Blender jacket circulation.
7. Two simplex charge water pumps eliminated by directly taking charge water from Chiller circulation pump outlet.

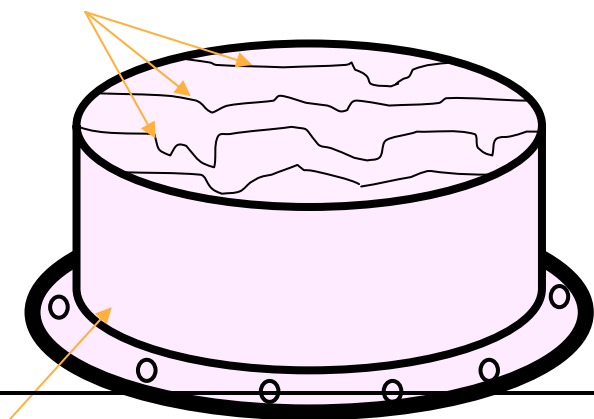
Financial Analysis

Total Investment	:	8.59 Lacs
Annual saving	:	Rs. 8.20 Lacs
Interest on Investment (@15% on 50% investment)	:	Rs. 0.64 Lacs
Net annual saving	:	Rs. 7.56 Lacs
ROI	:	88%
Pay back period	:	1.13 Years

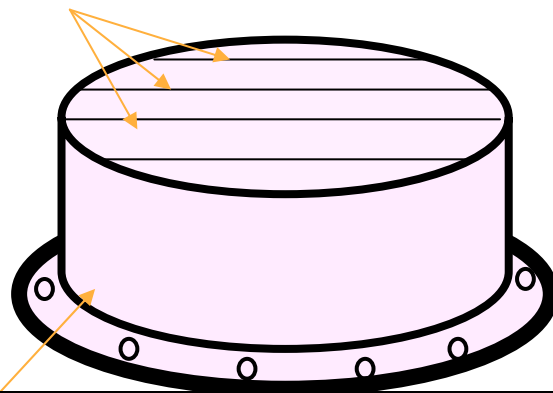
Implementation

Departmental Project team did all data analysis, identified the potential Energy conservation areas and activities. Recommended Counter measures were implemented in phase manner with out affecting the production and process

Corroded MS End Baffles of Chiller



New SS Baffle of Chiller



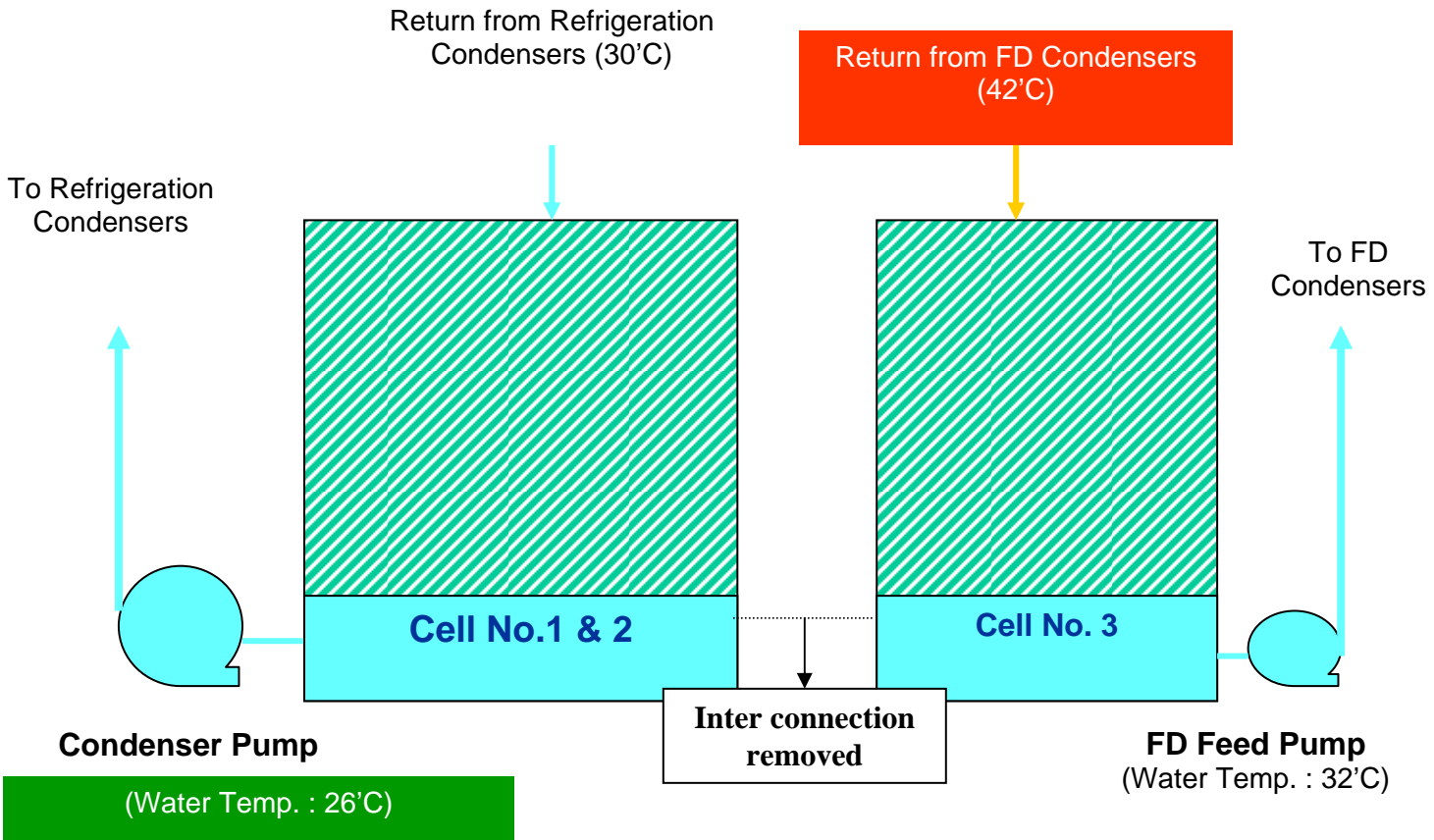
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Visual Indication of Expansion Valve Position



More than 3/4 th round opening indicates Less Ammonia in the System.

Diversion High Temperature water stream



Energy Efficiency Improvement Projects (2003–2004)

Sl No	Project description	Achievement of energy savings per year basis					Total (Rs.lakhs)	Investment incurred on the project (Rs. lakhs)
		Power	Fuels *			Total (fuel) in MkCal		
		(Lakhs KWh)	Coal (tonne)	F.Oil (KL)	Gas (lakhs m ³)			
1	Replacement of condenser pump with energy efficient pump	0.4					1.2	4.3
2	Elimination of A & B side blender in Viscose ripening room	1.3					3.4	11
3	Direct flashing of hot sump zone in MSFE for heat recovery		-			-		12.8
4	Installation of energy efficient ID fan in Power Plant	3.3	-			-	8.1	17.9
5	Replacement of Higher head pump in MSFE ffed pump by lower head pump in recovery dept	1.6	-			-	4.8	16.6
6	Replacement of dilute sulphuric acid plant by energy efficient pump in ACC in recovery dept	1.5				-	0.44	1.52
7	Replacement of multistage pump by energy efficient pump for boiler feed water in acid plant	0.6				-	0.14	0.41
	Sub Total	8.7					18.08	64.53

Not Applicable

Not Applicable

Energy Efficiency Improvement Projects (2001 – 2002)

Sl No	Project description	Achievement of energy savings per year basis					Investment incurred on the project (Rs. lakhs)	
		Power (Lakhs KWh)	Fuels *			Total (Rs.lakhs)		
			Coal (tonne)	F.Oil (KL)	Gas (lakhs m ³)			Total (fuel) in MkCal
1	Use of solid waste (Hard mass) with heat value for steam and power generation	-	193.34	Not Applicable	Not Applicable	871.00	3.97	0.00
2	Installation of float type traps I.p.o bucket type traps and modified spring loaded air type doors to minimize hot air leakage	-	53.05			239.00	1.08	1.00
3	Energy efficient flat belt I.p.o. of V belt drive for Air compressor drive system in Power Plant	0.09	-			-	0.23	0.77
4	Energy efficient diffuse stack assembly for Viscose, CS2 & Power Plant Cooling towers.	0.32	-			-	0.78	2.88
5	Elimination of Spray pump in Air washer through layout modification.	0.61	-			-	1.53	5.21
6	Elimination of Recovery Cooling Tower Spray pumps through layout modification	1.93	-			-	4.82	17.50
7	Increase of through put in alkcell Maturing drum for reduction equipment run hours.	0.73	-			-	1.76	6.50

Energy Efficiency Improvement Projects (2001 – 2002)

Sl No	Project description	Achievement of energy savings per year basis					Total (Rs.lakhs)	Investment incurred on the project (Rs. lakhs)
		Power	Fuels *			Total (fuel) in MkCal		
		(Lakhs KWh)	Coal (tonne)	F.Oil (KL)	Gas (lakhs m ³)			
8	Optimization of Multi Stage Flash Evaporator run hours	3.50	-	Not Applicable	Not Applicable	-	8.40	28.15
9	Belt Press I.p.o Vacuum Filters for Cellulosic Sludge in Effluent Treatment Plant.	2.28	-			-	5.48	2.90
10	Sub Total	9.46	246.39	-	-	1110.00	28.05	64.91

Energy Efficiency Improvement Projects (2002 – 2003)

Sl No	Project description	Achievement of energy savings per year basis					Total (Rs.lakhs)	Investment incurred on the project (Rs. lakhs)
		Power	Fuels *			Total (fuel) in MkCal		
		(Lakhs KWh)	Coal (tonne)	F.Oil (KL)	Gas (lakhs m ³)			
1	Energy efficient HP steam based vacuum ejectors in place of LP steam based ejectors for viscose deaeration	-	163.73	Not Applicable	Not Applicable	762.00	3.37	13.2
2	Energy efficient refrigeration type air dryer ipo desiccant air dryer.	0.37	-			-	0.089	0.30
3	Reductions in system back pressure on air blower by various modifications and by avoiding air bypass.	1.97	-			-	5.00	1.5.00
4	Direct flashing of sump zone liquid in MSFEs to recover heat	-	24.69			114.90	0.438	12.84
5	Elimination of Pre Deaerator and B side blender in Viscose ripening room	1.28	-			-	2.60	10.80
6	Rationalization of refrigeration running hours	3.42	-			-	8.20	8.59
7	Level controller for Desulf tank in After treatment	-	45.59			212	0.54	2.47
	Sub Total	7.04	234.01			-	-	1088.90
	Grand Total of 3 years	31.93	2309.43	-	-	10831.92	108.71	235.21

Energy saving measures achieved and implemented during 2003-04

Retrofitting /Minor Modifications of existing equipments – Low Investment options

- Replacement of Dryer fin heater condensate line bucket type trap with float type trap resulting in better condensate discharge and interruptions in process operations

Investment: Rs. 5 Lakhs

Saving/year: Rs 2 lakhs

- Replacement of damaged MSRL Condensate pipelines and fittings of Multi Stage Flash Evaporator to SS 316 to avoid leakages and frequent interruptions

Investment: Rs 3 Lakhs

Saving/year: Rs 25,000

- Attending on line steam leakages of steam headers without main line stoppages to avoid steam leakages

Investment: Rs. 2 Lakhs

Saving/year: Rs 3 Lakhs

- Chilled water line for CS2 recovery changed from SS to MS to avoid frequent stoppages and leakages.

Investment: Rs. 2 Lakhs

Saving/year: Rs 1 Lakhs

Replacement of 315 Nos. fluorescent tubes by E+

Investment: Rs 6 Lakhs

Saving/year: 1.5 Lakhs

Replacement /installation / Modernization of old and inefficient existing equipment and systems - High Investment options

- Revamping of Steam Distribution system in Spinning Machine dryer 1 and 2 for better drying and steam economy

Investment: Rs. 12 Lakhs

Saving/Year: Rs. 20 Lakhs

- Dryer Steam coil doors modified to arrest hot air leakages and replaced with SS for better reliability .

Investment: Rs.16 Lakhs

Saving/Year: Rs.2 Lakhs

- Up gradation of MSFE insulation system for new lines Vapor lines, flash pot vapor lines and spin bath lines

Investment: Rs.6 Lakhs

Saving/Year: Rs. 75,000

- Modification of Condensate recovery system by three stage flashing of Multi Stage Flash Evaporator for better heat Utilization

Investment: NIL

Saving/Year: Rs. 25,000

- Revamping of Steam distribution system in recovery by eliminating 50 mts of idle length in main distribution system

Investment: Rs. 1 Lakh

Saving/Year: Rs. 10,000

- Replacement of old and inefficient motors by efficient motors by identifying 50 Nos. in 2003-04

Investment: Rs. 14 Lakhs

Saving/Year: Rs. 9.8 Lakhs

- Installation of Variable speed drive for 15 equipments in the plant

Investment: Rs. 10 Lakhs

Saving/Year: Rs. 3.5 Lakhs

Replacement of 20-year-old Acid Storage tank due to reduced thickness

Investment: Rs. 10.80 Lakhs

Energy substitution /Switching measures

- Using solid wastes generated in Effluent treatment plant and CS2 plant for use in boilers for cost reduction in coal consumption.

Investment: NIL

Saving/Year: Rs. 2 Lakhs

Waste Heat Recovery Systems

- 85 C Sump zone direct flashing in Multi stage flash evaporators started for heat recovery

Investment: Rs.1 Lakh

Saving/Year: Rs. 50,000

- Mixed Charge lye system for Viscose preparation in simplex using Condensate for Spinning Dryer

Investment: Rs.20 Lakh

Saving/Year: Rs. 4.58 Lakhs

Process Monitoring and Controls

- Auto control valves for dryer steam lines in recovery, caustic heating system and Multi Stage Flash Evaporator Heater monitor.
- Optimization of fan speed by eliminating steam coils to reduce power consumption
- Level controller for Soft Finish Circulation tanks
-

Investment: Rs.12 Lakh

Saving/Year: Rs. 1.5 Lakh

Reduction of rejects in the production process

- Reduction in Viscose leakages by 80% change of MOC and design
- Reduction of Viscose leakage in Riping room by using hydraulic tightening system in place of Manual tightening

Investment: Rs.0.75 Lakh

Saving/Year: Rs. 0.15 Lakh

Reduction of Water consumption in the Plant

- Use of lean Spin bath for tow washing, preparation of Alum Solution and recycling of sump zone in Cutter ventury
- Reuse of gland sealing water in Recovery department

Investment: Rs.1 Lakh
Saving/Year: Rs. 0.3 Lakh

Recycling of Material

Recycling and Reuse of treated effluent for

1. Lime Slurry preparation
2. Ash Quenching in Power Plant
3. Washing of Tow Fibre
4. Cleaning in CS₂ and H₂SO₄ Plant

Investment: Rs.0.5 Lakh
Saving/Year: Rs. 0.25 Lakh

Reduction of transport fuel

- Replacement of old tipper and H M Tarex loader in coal yard for reliability and ensure continuous safe operation
- Replacement of old Fork lift at Raw materials to ensure safe and Continuous operation

Investment: Rs 60 Lakhs
Saving/Year: Rs. 3 Lakhs (Maintenance Expenses)

Human Resource Development for Energy Efficiency Improvement

Two Engineers being developed as Energy auditors during the current year

Two instrument engineers have been trained on DCS applications in Process Industry in Mar 2003

Weekly training programs to employees on Electrical and Instrument Maintenance activities.

Total Cost in 2003-04: 25 Lakhs
Annual Energy Cost in 2003-04: 4.8 Lakhs