Shree Digvijay Cement Co. Ltd.
Digvijaygram – Via Jamnagar (Gujarat)

Unit Profile:

Shree Digvijay Cement Company Limited (SDCCL), an Aditya Birla group company, established in the year 1946 is one of the pioneering companies in Cement Business in India. The Dry Process Plant of the company is having production capacity of 11 Lac MT clinker per annum. The plant is equipped with latest 18 MW Diesel Generating Sets commissioned in the year 1999.

SDCCL is producing seven different types of cement. This includes special purpose Cement like Oil Well Cement as Import substitution resulting in saving of valuable Foreign Currency. The other specific purpose products like Sleeper grade Cement, Sulphate Resistant Cement have premier share in the markets.

SDCCL also owns Jetty with a prestigious status of Two Star Export House. Company's Clinker and Cement has earned reputation in International Markets also. The company is proud recipient of various awards of international repute for its outstanding performance in Exports, productivity and Quality.

Energy Management Policy:

At SDCCL, our aim is

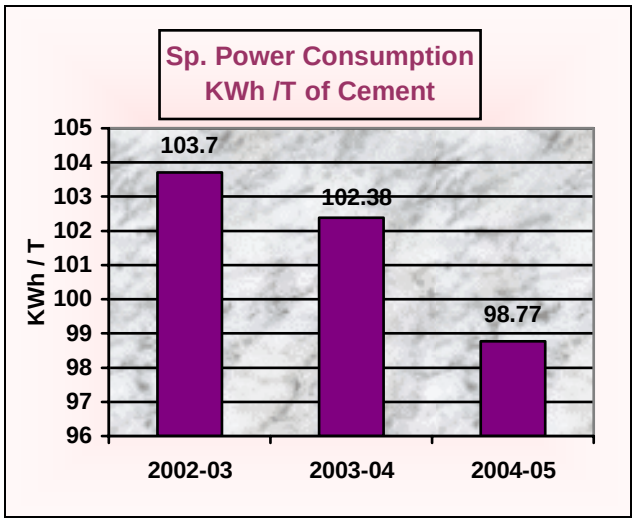
To optimally utilize various forms of Energy (Fuel & Power) in a cost effective manner, to ensure conservation of energy resources.

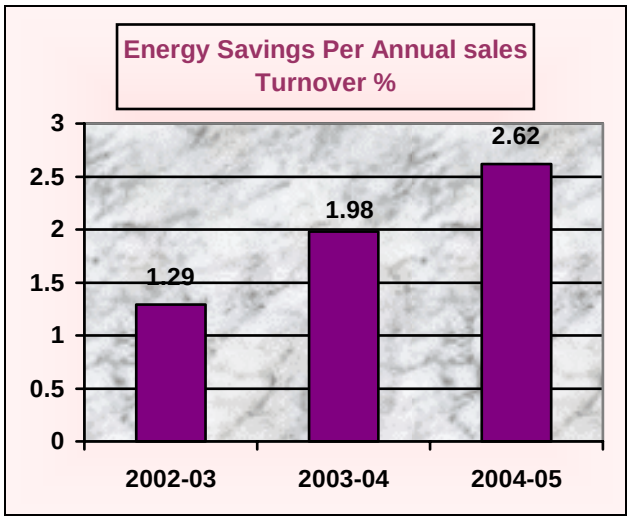
By Committed efforts to

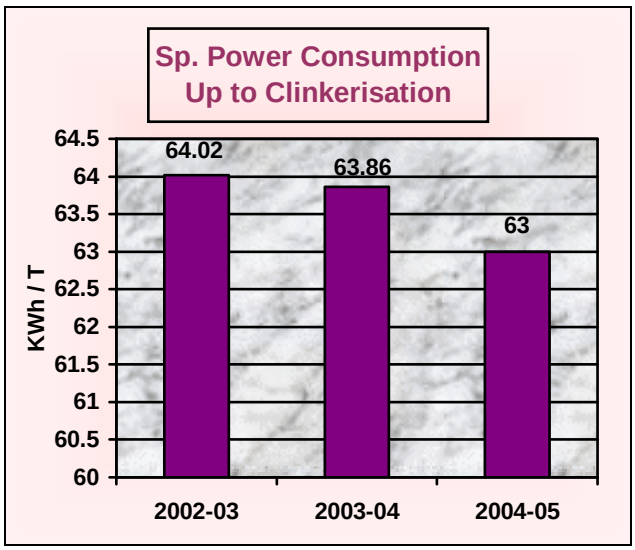
1. Reduce specific energy consumption by identifying potential areas of energy saving in the process.
2. Set energy consumption targets and monitor continuously.
3. Involve all the employees to work towards progressive improvement of targets of energy consumption.
4. Promote culture of awareness towards energy conservation in the organisation.
5. Implement innovative ideas for modification, improvement and up gradation of the equipment & process for optimizing energy consumption.

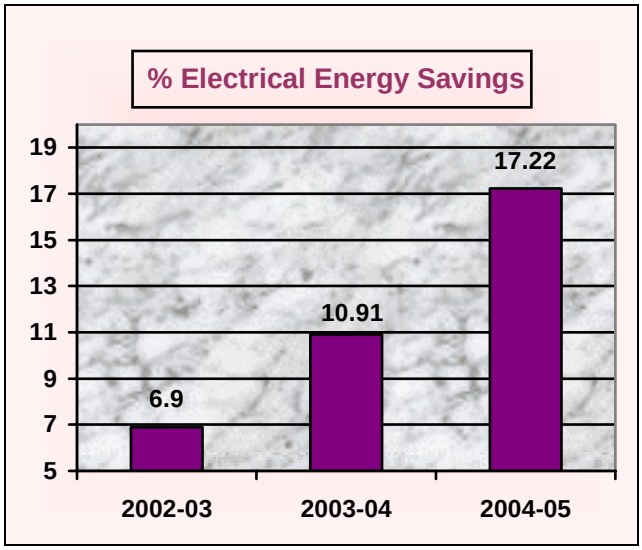
Energy Consumption Data:

S.No	Description	Measurement	2002-03	2003-04	2004-05
1	Annual Cement Production	MTs	721444	747607	765909
2	Total Electrical Energy Consumption	Lacs KWh	1033.87	930.24	922.94
3	Total Thermal Energy Consumption	Million Kcal	792111.82	678013.28	773553.29
4	Specific Electrical Energy Consumption	Kwh / T of Cement	103.7	102.38	98.77
5	Specific Thermal Energy Consumption	Kcal / kg of clinker	780.4	797.16	800.41
6	Total Sales turnover of the unit	Rs. Lacs	19722	16668	19862.2
7	Total Energy Cost	Rs. Lacs	6024.38	5674.64	7588.26
8	Energy as % of Total Manufacturing cost	%	50.28	52.69	57.45









Energy Conservation Organizational Set-Up:

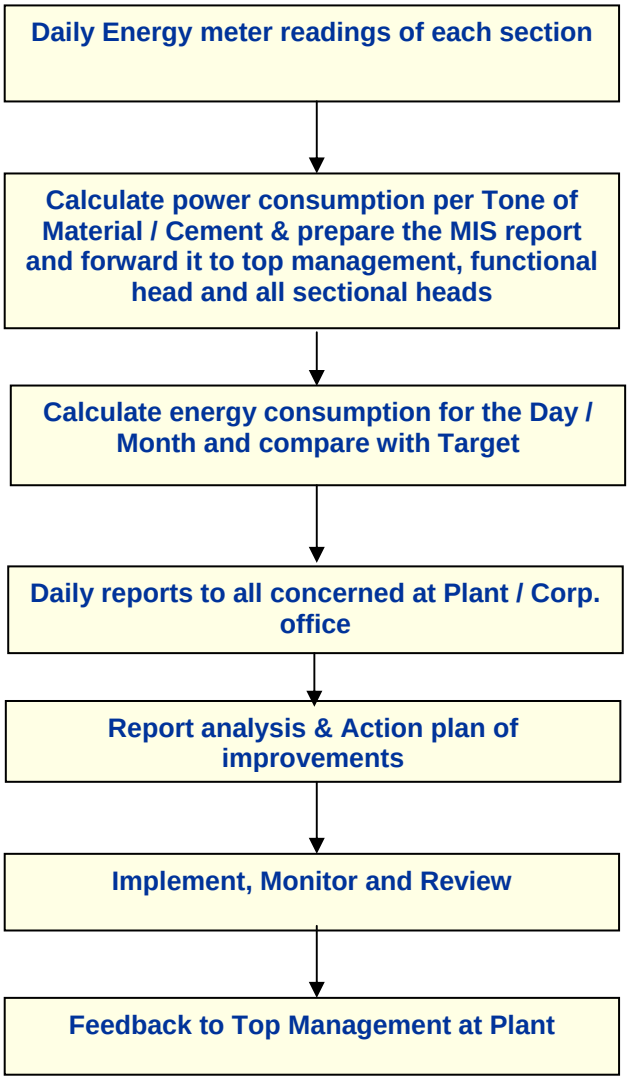
Macro Level Efforts:

Due to high cost of Energy in manufacturing process of Cement, high priority is laid by Management to conserve energy. Energy consumption parameters are daily analyzed and deliberated with floor level operating & supervisory staff by managerial staff. Daily, Monthly reports are prepared with emphasis on Energy by MIS Cell. Energy consumption is also compared with other Group Companies in the manufacture of same product at Plant management and corporate level. Development in any of Group Company or World over in the field of Energy conservation is relayed to each other. Also, suggestion scheme is implemented to get good suggestions from all levels. Our Unit's "Energy Policy" is attached herewith.

Micro Level Efforts:

With a view to create awareness & involve the people up to grass root level in Energy Conservation process, SDCCL has set-up a Task Force for Energy Conservation. These task forces are formed for each functional sections of the plant & they have Engineers, supervisors & workers as their members. A core team made of senior plant executives led by Energy Manager guides the task forces. The Task Forces identify, explore, plan, execute & monitor energy conservation efforts among their sections. All the teams carry out monthly meeting with the Unit Head to discuss the progress, ideas, problems, action plan & performance.

Energy Management System – Flow Chart:



Energy Conservation Achievements:

Major Energy Conservation Initiatives during 2004-05:

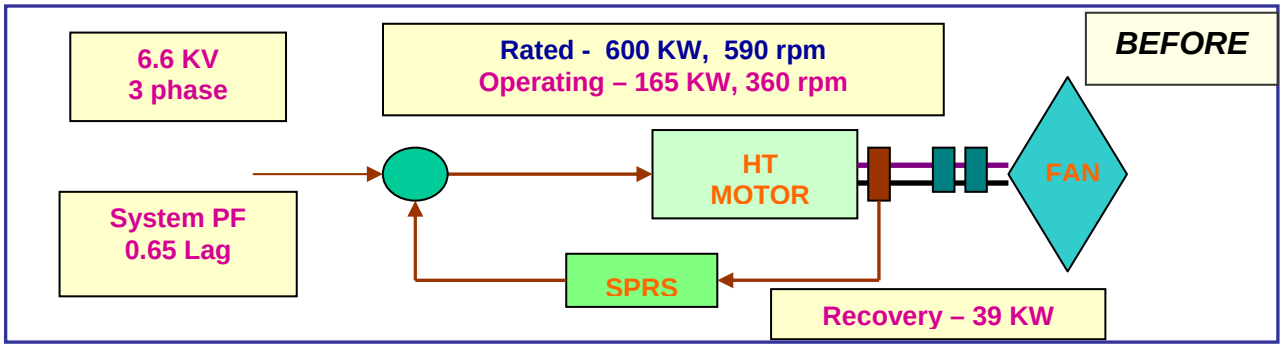
1. Efficiency improvement of cooler ID fan by replacing slip ring AC motor with DC drive:

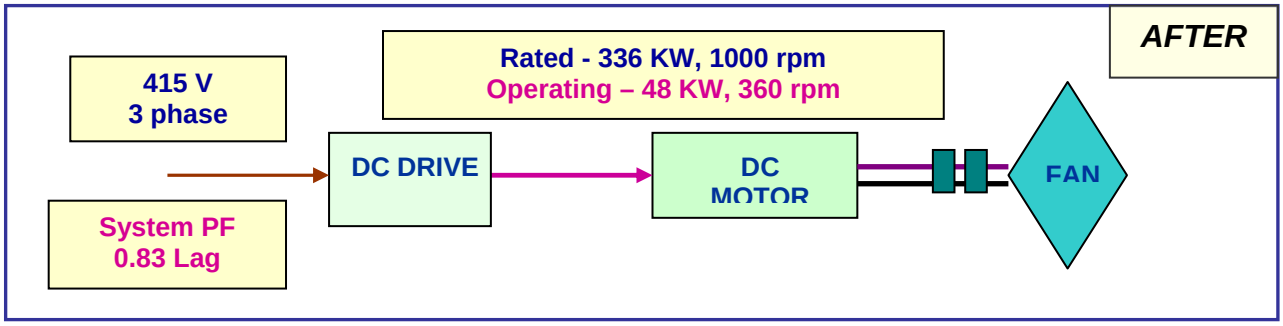
Problem Faced:

- High T & D losses due to poor power factor
- Minimum achievable speed – 60 %
- Flow control with damper resulting in power loss
- Liquid Rotor Resistance used for starting HT motor is maintenance prone
- Installed SPRS system is highly maintenance prone
- Poor overall system efficiency

Improvement Actions:

- Replaced 600 KW HT slip ring motor with a 336 KW DC motor
- Overhauled & Re-utilized the spare DC motor and drive of Wet Process Kiln
- Removed LRS & SPRS systems from circuit
- Eliminated the need of fan inlet damper





Benefits Achieved:

- Operating KVA reduced by 55 KVA / Hr; PF improved from 0.65 to 0.83 Lag
- Motor operating load reduced by 73 KW / Hr
- Speed control from 0% to 100 % speed achievable
- Power Saving by removing Fan inlet damper – 5 KW / Hr

Annual Saving – Rs. 32.63 Lacs

2. Re-engineering of SPRS System of Raw Mill Ex. Fan – 2270 KW:

Problem Faced:

- Power loss at fan as SPRS system not operative.
- System is obsolete & OEM unable to help in rectification.
- Ex. OEM expert failed to set right the system.
- Spares for SPRS too expensive & mostly not available.

Improvement Actions:

- Converted Digital control system into Analogue system to operate through PLC.
- Total design & modification done by in-house expertise.

Benefits Achieved:

- Fan is now possible to run up to 830 rpm with SPRS.
- Power recovery / saving of approx. 175 kW/Hr

Annual saving: Rs. 92 Lacs

3. Removal of Swirl damper from Pre Heater Cyclone String to stop false air ingress:

Problem Faced:

- Heavy false air ingress through swirl damper, diverting feed of kiln and Calciner strings.

Improvement Actions:

- Removed the swirl damper and packed the ducts air tight.

Benefits Achieved:

- False air ingress reduced by 1.5%
- Gain in specific power consumption & specific heat energy consumption.

Annual Saving – Rs. 27.28 Lacs

4. Replacement of Liquid Rotor Resistance (LRR) of PC & PH Fan motors with Grid Rotor Resistance (GRR):

Problem Faced:

- Higher power consumption during plant restart and while operating at low output levels.
- Pressure loss and power loss through fan inlet dampers
- No control of fan rpm above 90 % fan speed
- High electrolyte temperature when speed is below 75 %

Improvement Actions:

- LRR replaced with GRR
- Removed fan inlet dampers of PC & PH Fans

Benefits Achieved:

- Achieved fan speeds of 35 % during start-ups
- Finer control of motor rpm
- Increased Kiln production by 30 TPD
- Reduced maintenance cost

Annual Saving – Rs. 25.60 Lacs

5. Replacement of old & inefficient reciprocating compressors with screw compressors:

Problem Faced:

- Poor reliability & low efficiency of reciprocating compressors
- Higher lubricant & spares consumption
- High temperature of compressed air with high percentage of moisture
- Manual controls & no automation
- Problematic water cooling system

Improvement Actions:

- Installed 4 nos. air cooled Screw compressors in place of Reciprocating compressors

Benefits Achieved:

- High efficiency, highly reliable, auto control, low maintenance-prone compressors

Annual Saving – Rs. 35-40 Lacs

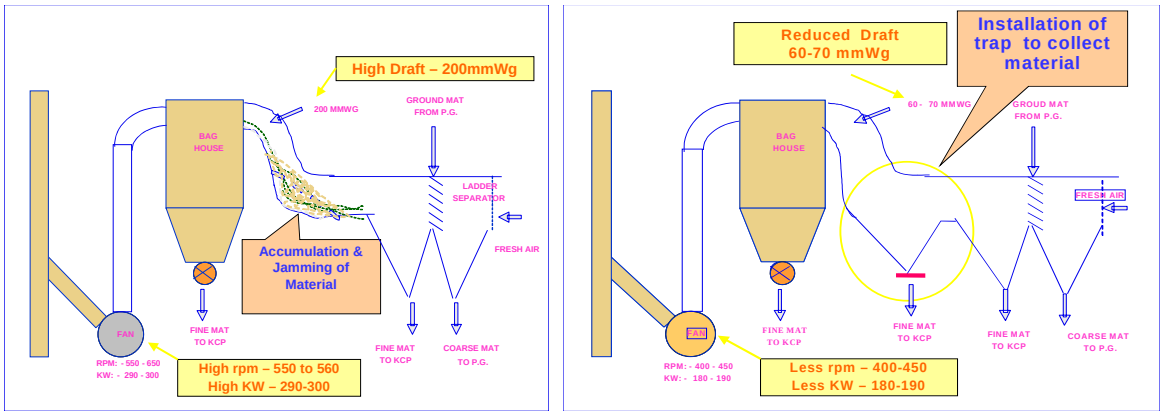
6. Modifications in Bag House Fan Inlet Duct & SPRS system for Bag House Fan Motor – 600 KW:

Problem Faced:

- Accumulation & jamming of material in inlet duct of bag house fan
- Due to partially blocked duct, fan operating at higher speed to create required draft
- High power consumption of Bag House fan Motor

Improvement Action:

- Installation of Hopper along with material discharge chute below ladder separator outlet duct to bag house
- Spare SPRS system of Cooler ID Fan incorporated successfully to control speed of Bag House Fan Motor



Benefits Achieved:

- Power consumption reduced from 300 KW/Hr to 157 KW/Hr
- Recovery of SPRS system – 50-60 KW / Hr

Annual Saving – Rs. 30.90 Lacs

7. Energy conservation in cooling fan motors PC & PH fan GRR:

Problems Faced:

- When motors runs on SPRS system, GRR cooling blower running idle
- Wasting of Power by 9 KW / Hr
- The cooling fans are operated by local PLC mounted on GRR for operational control

Improvement Actions:

- The cooling blower control was removed from local PLC
- Designed hardware logic to control operation of fans
- Designed interlock with SPRS system to stop cooling fans when HT motor runs on SPRS system

Benefits Achieved:

- The cooling blower stops when motor run in SPRS
- Power Saving – 9 KW / Hr
- Increase in life of cooling blower
- Reduction in maintenance of blowers

Annual Saving – Rs. 1.24 Lacs

8. Replacement of old & obsolete DC drive of Raw Material Belt 4A by VVVF drive:

Problems Faced:

- Frequent failure of DC motor interpole winding & Field rectifier
- Prolonged stoppage hours for replacement affecting production
- Inefficient speed control of the drive with PLC system
- Frequent start-stop of the motor resulting in stressful operation of motor
- Commutator of motor getting frequently carbonized; Very frequent maintenance needs & high maintenance cost

Improvement Actions:

- Replaced 75 KW, 1500 rpm DC drive with 75 KW, 1440 rpm VVVF drive
- The motor & VVVF panel available in spare is used – No fresh investment

Benefits Achieved:

- Production saving achieved by eliminating breakdown stoppage – Rs. 10 Lacs per annum
- Reduction in power consumption due to smooth control of motor speed – 4-5 KW
- Eliminated rewinding & maintenance cost of DC drive - Rs. 0.70 Lacs per annum

Annual Saving – Rs. 1.5 Lacs

Other Energy Conservation projects during 2004-05:

- High Efficiency Seperator for Vertical raw Mill
- Gearbox internals replacements for increasing Kiln rpm from 4.2 to 5.0
- Replacement of Kiln inlet seal with pneumatic seal; replacement of Kiln Outlet seal
- Replacement of Precollector cyclone of Coal Mill with high efficiency cyclone.
- Controller for maintaing DG Generation frequency at 49.2 Hz.
- Fuzzy Logic software system for optimized operation of Kiln, Cooler & Coal Mill
- Installation of VVVF drive for Cooler Fan No. 5 alongwith removal of fan damper.
- Incorporate Vortex breakers at bottom of Pre Heater cyclones.

The unit has achieved saving of Rs. 521.25 Lacs by implementing various energy conservation Projects / implementations during the year 2004-05.

Energy Conservation Plan & Targets:

Sr. No.	Energy Conservation Measures (Planned)	Anticipated savings in			Approx. investment (Rs.lakhs)	Project Commencement & Completion year
		Power U/T of Cem.	Heat Kcal/kg of cl.	Rs. Lakhs Per Annum		
1	Mechanized Fly-ash feeding system for KCP Cement Mill	2.0	--	65.00	60.00	2005-06
2	Replacement of Pre collector cyclone of Cement Mill with high efficiency cyclone.	0.3	--	10.00	10.00	2005-06
3	Deep bucket conveyor for clinker transport	1.0	--	34.00	200.00	2005-06
4	Cooler up-gradation with Pendulum cooler	--	20.0	0.37	200.00	2005-06
5	Replacement of PH, PC, ESP & R/M Ex Fan along with down comer duct enlargement.	0.5	--	17.00	150.00	2005-06
6	Vertical Raw Mill Reject Re-circulation	1.0	--	30.00	25.00	2005-06
7	Trimming of Coal Mill Exhaust Fan Impeller and subsequently operate at increased speed.	0.1	--	3.0	--	2005-06
8	Trimming of ESP Fan Impeller and modification in fan casing.	0.3	--	9.5	--	2005-06

9	Replacement of Worn out table liners of Raw mill Sealing of Separator	1.8	--	55.0	7.5	2005-06
10	Installation of permanent magnet at Raw Mill feeding circuit	0.1	--	3.0	3.0	2005-06
11	Reduction of false air ingress in Raw Mill circuit by 2% & in Kiln circuit by 1%	0.6	--	19.00	--	2005-06
12	Modification of TA duct at take off point at Cooler	0.3	--	9.00	--	2005-06
13	Up-gradation of drive & chain of elevator at Pregrinder outlet	1.6	--	50.00	30.00	2005-06
14	Replacement of grinding tyres at Pregrinder	1.1	--	32.00	25.00	2005-06
15	Modification of cooling water pipelines, replacement of obsolete & inefficient pumps & maintenance of old water pumps	0.2	--	6.0	3.00	2005-06
16	Reduction in miscellaneous power by continuous monitoring and optimize use	0.7	--	22.00	1.00	2005-06
17	Arresting leakage at various points and attending minor changes in Atlas Copco Screw Compressor in Cement Mill area.	0.2	--	6.00	--	2005-06
18	Up-gradation of Kiln Main Drive motor & panel	0.15	--	5.00	38.00	2005-06
19	Incorporate 400 KW DC motor & drive in Coal Mill Ex. Fan to eliminate slip losses of induction motor	0.18	--	5.5	--	2005-06

The unit has targeted to achieve sp. Power consumption of 90 KWh / T of cement & Sp. Heat consumption of 775 Kcal /kg of clinker by the end of the year 2006-07.

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Energy Conservation Projects

2004 - 05

Shree Digvijay Cement Co. Ltd.

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1

RE-ENGINEERING OF

SLIP POWER RECOVERY SYSTEM

FOR

RAW MILL EX. FAN

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BACKGROUND – SPRS SYSTEM

1995:

- SPRS system incorporated in Raw Mill fan in 1995.
- System specification – Digital Drive Kaskad 8D

1999:

- SPRS failed after the burning of feedback transformer.

2000:

- Procured new transformer & installed
- System didn't restart as problem existed in electronic cards.

Continuous loss of 160-170 kW/Hr of operation of Raw Mill

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EFFORTS AT PROBLEM SOLVING

Phase	Effort	Result
Phase - I	Replacement of faulty electronic cards by OEM	System Failed to restart
Phase - II	Engineers from group companies consulted	Problem unresolved
Phase - III	Consultant expert called for solution	Problem unresolved
Phase - IV	Proposal from L & T Automation for re-engineering of system	Project was not feasible on commercial terms

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EFFORTS AT PROBLEM SOLVING

Phase - V	Formation of Special Task Force Team within the company	Decision to modify system configuration from Digital to Analogue along with operating control system through PLC.
	Brainstorming sessions	Decided to use old available cards of PC fan.
		Design & Drawings developed in-house.

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EFFORTS AT PROBLEM SOLVING

Phase - VI	Re engineering	Re-designed & converted control circuit drawings Dismantled all the hardware & wiring & carried out rewiring as per the new drawing & configuration. Signals of few critical & safety related parameters were provided with interlocks through hardware as well as through PLC.

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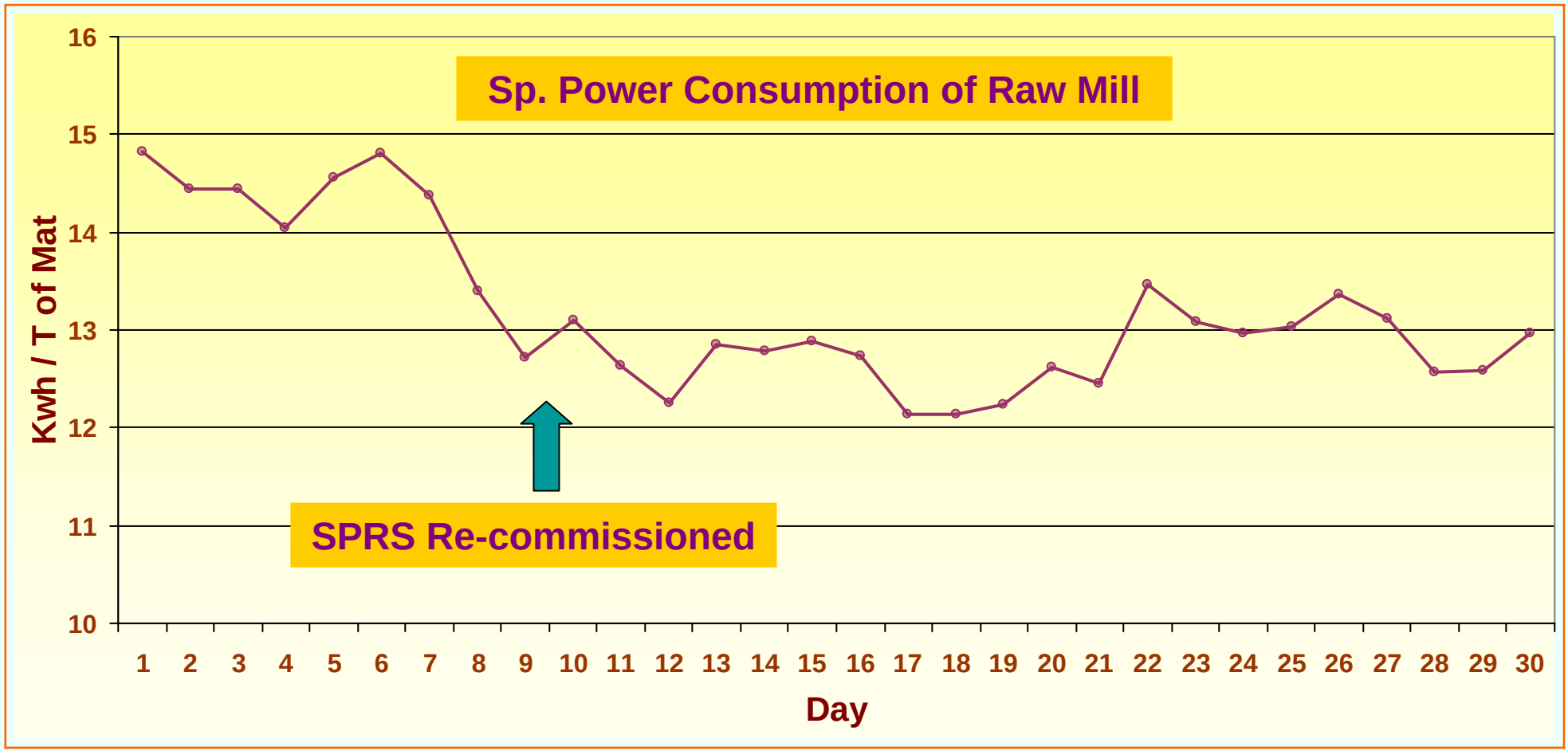
RESULTS

- System re-commissioned successfully
- The operating rpm of fan motor reduced from 970 up to 830.



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BENEFITS

- Power recovery of **175 kW/Hr** of operation of Raw Mill fan motor of 2270 kW.
- Sp. Power of Raw Mill reduced by **1.92** KWh / T of material
- Reduction in major maintenance of LRR – Once per year
- Saving in procurement cost of fixed & moving electrodes of LRR

ANNUAL SAVING - Rs.92.00 Lacs.

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2

EFFICIENCY IMPROVEMENT OF COOLER ID FAN BY REPLACING HT SLIP RING INDUCTION MOTOR WITH DC DRIVE

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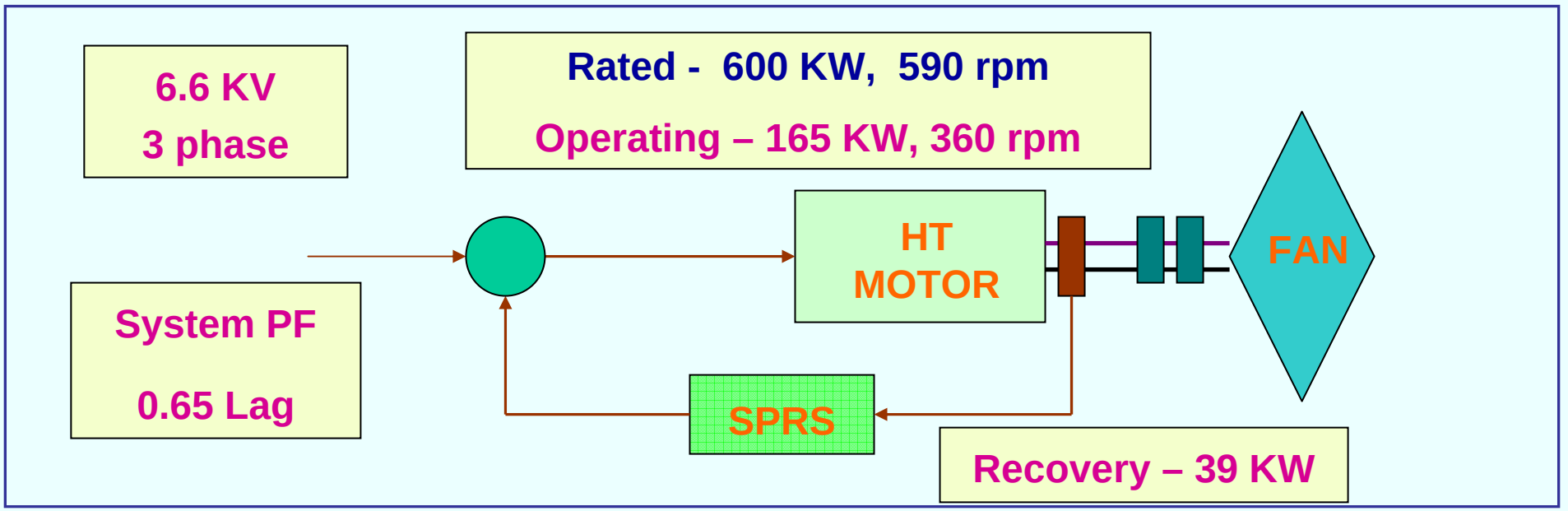
PROJECT BACKGROUND

Before Retrofit:

Poor overall efficiency of the ID Fan drive due to:

- HT slip ring motor operating at less than 25 % loading and at 60-65 % of rated speed
- Poor power factor due to slip power recovery system



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PROBLEMS & LOSSES

- High T & D losses due to poor power factor
- Minimum achievable speed – 60 %
- Flow control with damper resulting in power loss
- Liquid Rotor Resistance used for starting HT motor is maintenance prone
- Installed SPRS system is highly maintenance prone

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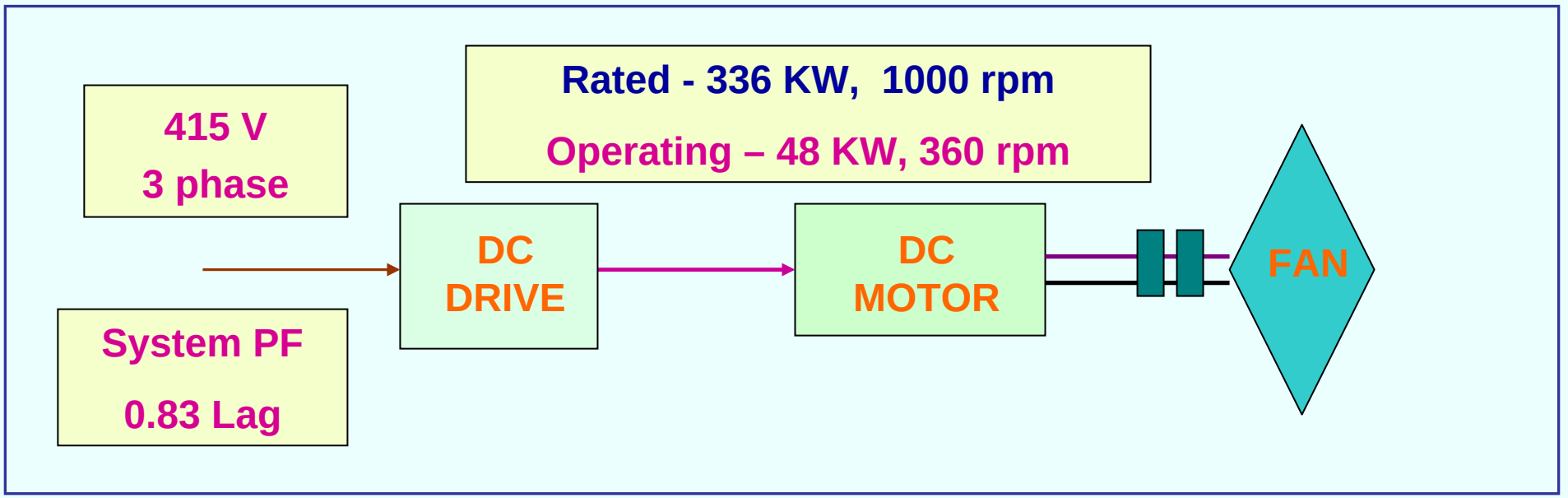
SYSTEM MODIFICATIONS

- Replaced 600 KW HT slip ring motor with a 336 KW DC motor
- Overhauled & Re-utilized the spare DC motor and drive of Wet Process Kiln
- Removed LRS & SPRS systems from circuit
- Eliminated the need of fan inlet damper



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BENEFITS

- Operating KVA reduced by **55 KVA / Hr**
- Operating PF improved from **0.65 to 0.83 Lag**
- Motor operating load reduced by **73 KW / Hr**
- Speed control made possible from **0% to 100 % speed**
- Power Saving of **5 KW / Hr** by removing Fan inlet damper

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SAVINGS ACHIEVED

Sl. No	Saving Description	Rs. (Lac)
1	By Power Factor Improvement	12.45
2	By Speed Control	18.79
3	By Fan inlet Damper	1.29
4	Maintenance cost of LRR	0.10
TOTAL SAVING		*32.63*

This saving has been achieved against total expenses of *Rs. 2.42 Lacs* incurred in system modifications

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3

MODIFICATIONS IN BAG HOUSE FAN INLET DUCT & SPRS SYSTEM FOR BAG HOUSE FAN MOTOR – 600 KW

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STEP – 1

MODIFICATION IN BAG HOUSE INLET DUCT

Bag House Fan:

- The 600 KW Bag house fan creates required draft for separation of material ground in Pregrinder

Problems & Losses :

- Accumulation & jamming of material in inlet duct of bag house fan
- Due to partially blocked duct, fan operating at higher speed to create required draft
- High power consumption of Bag House fan Motor

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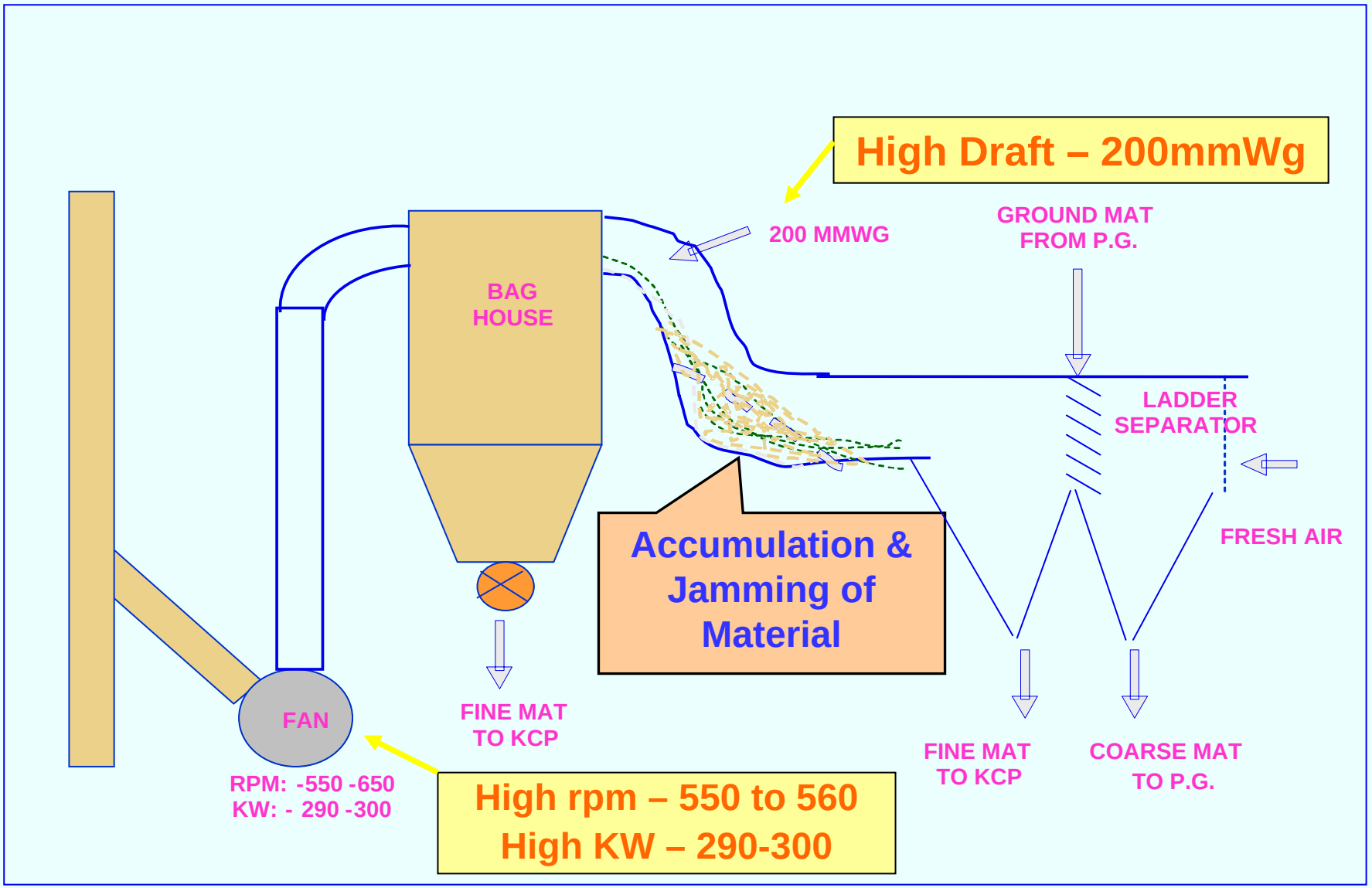
PG BAG HOUSE CIRCUIT

PROBLEM ANALYSIS



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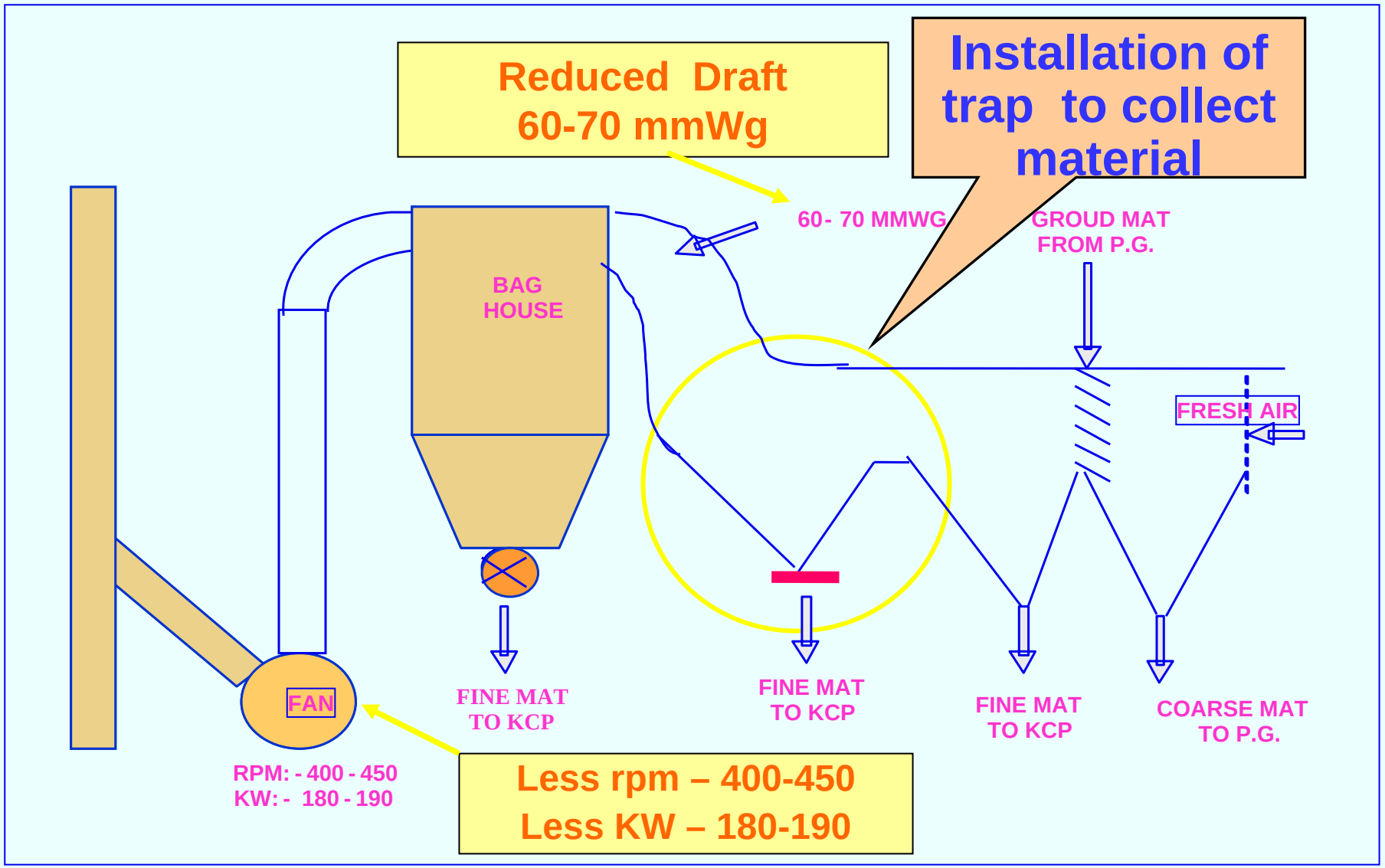
PG BAG HOUSE CIRCUIT
AFTER MODIFICATION



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STEP – 2

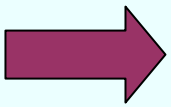
SPRS SYSTEM FOR MOTOR

Bag House Fan Motor:

- The 600 KW / 6.6 KV Bag house fan slip ring induction motor operate on Liquid Rotor Resistance
- Flow control by changing motor speed with LRR & by operating fan inlet damper

Problems & Losses :

- Power loss in rotor circuit
- Power Loss due to flow control by damper



Voltage	202
Current	195
KW	68.3
Frequency	13.4 Hz

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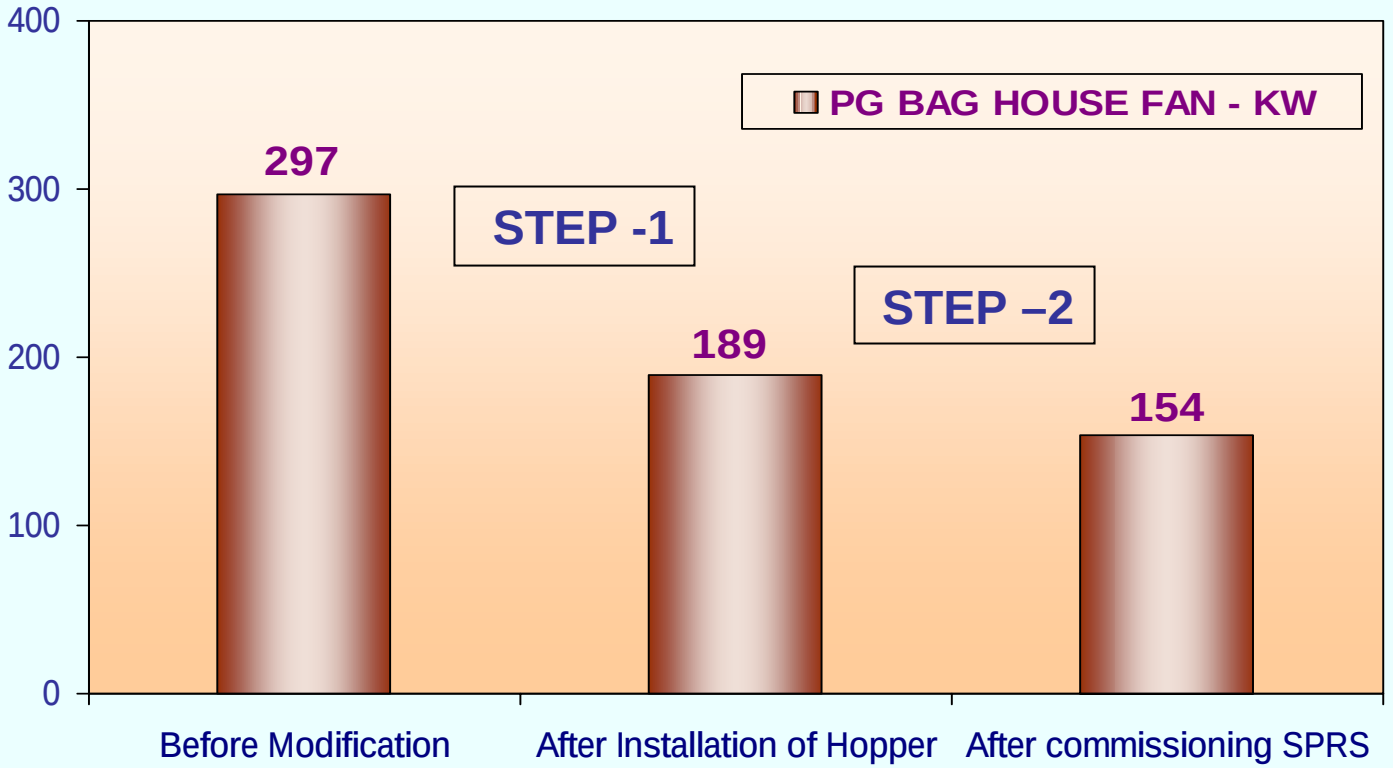
SYSTEM MODIFICATIONS

- Provided SPRS for 600 KW Bag House fan motor
- Re-utilized the spare SPRS system of CID Fan

RESULTS



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BENEFITS ACHIEVED

- Power consumption reduced from 300 KW to 157 KW
- Recovery of SPRS system – 50-60 KW

ANNUAL SAVING – Rs. 30.90 Lacs

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4

ENERGY CONSERVATION IN COOLING FAN MOTORS

PC FAN & PH FAN GRR

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PROJECT BACKGROUND

PC Fan Motor – 1250 KW; PH Fan Motor – 600 KW

- The slip ring induction motors run on Grid Rotor Resistance (GRR) or Slip Power recovery System (SPRS)

Problems & Losses :

- When motors runs on SPRS system, GRR cooling blower running idle
- Wasting of Power by 9 KW / Hr
- The cooling fans are operated by local PLC mounted on GRR for operational control

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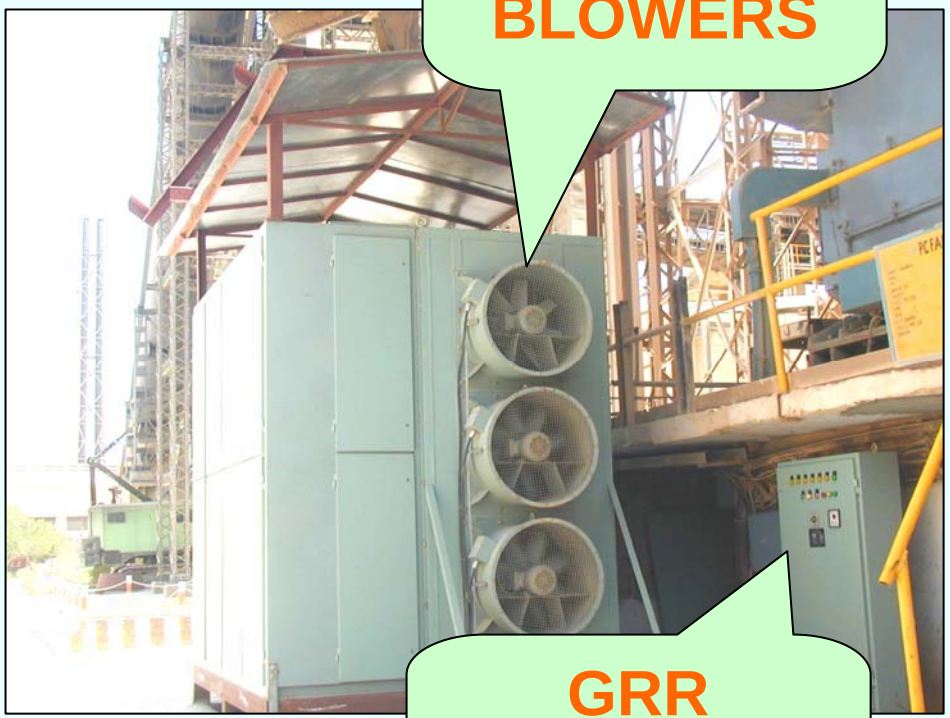
SYSTEM MODIFICATIONS

- The cooling blower control was removed from local PLC
- Designed hardware logic to control operation of fans
- Designed interlock with SPRS system to stop cooling fans when HT motor runs on SPRS system



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BENEFITS ACHIEVED

- The cooling blower stops when motor run in SPRS
- Power Saving – **9 KW / Hr**
- Increase in life of cooling blower
- Reduction in maintenance of blowers

ANNUAL SAVINGS – Rs. 1.24 Lacs

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5

REPLACEMENT OF OLD & OBSOLETE DC DRIVE OF RAW MATERIAL BELT 4A BY VVVF DRIVE

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PROJECT BACKGROUND

Raw Material Belt No.4:

- The belt carries Raw material from reclaimer to lime stone hopper
- The belt starts & stops as per low & high level of Lime Stone Hopper
- No. of starts – 6 to 7 per hour
- Belt driven by 75 KW, 1500 rpm DC drive

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PROBLEMS & LOSSES

- Frequent failure of DC motor interpole windings & Field rectifier
- Prolonged stoppage hours for replacement affecting production
- Inefficient speed control of the drive with PLC system
- Frequent start-stop of the motor resulting in stressful operation of motor
- Commutator of motor getting frequently carbonized; Very frequent maintenance needs & high maintenance cost

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SYSTEM MODIFICATIONS

Replaced 75 KW, 1500 rpm

DC drive with 75 KW, 1440

rpm VVVF drive

The motor & VVVF panel

available in spare is used –

No fresh investment

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BENEFITS ACHIEVED

- Saving in production loss achieved by eliminating breakdown stoppage – **Rs. 10 Lacs per annum**
- Reduction in power consumption due to smooth control of motor speed – **4-5 KW**
- Eliminated rewinding & maintenance cost of DC drive - **Rs. 0.70 Lacs per annum**

ANNUAL SAVINGS – Rs. 1.5 Lacs

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Thanks