

Gujarat Ambuja Cements Limited
Unit: Rabriyawas



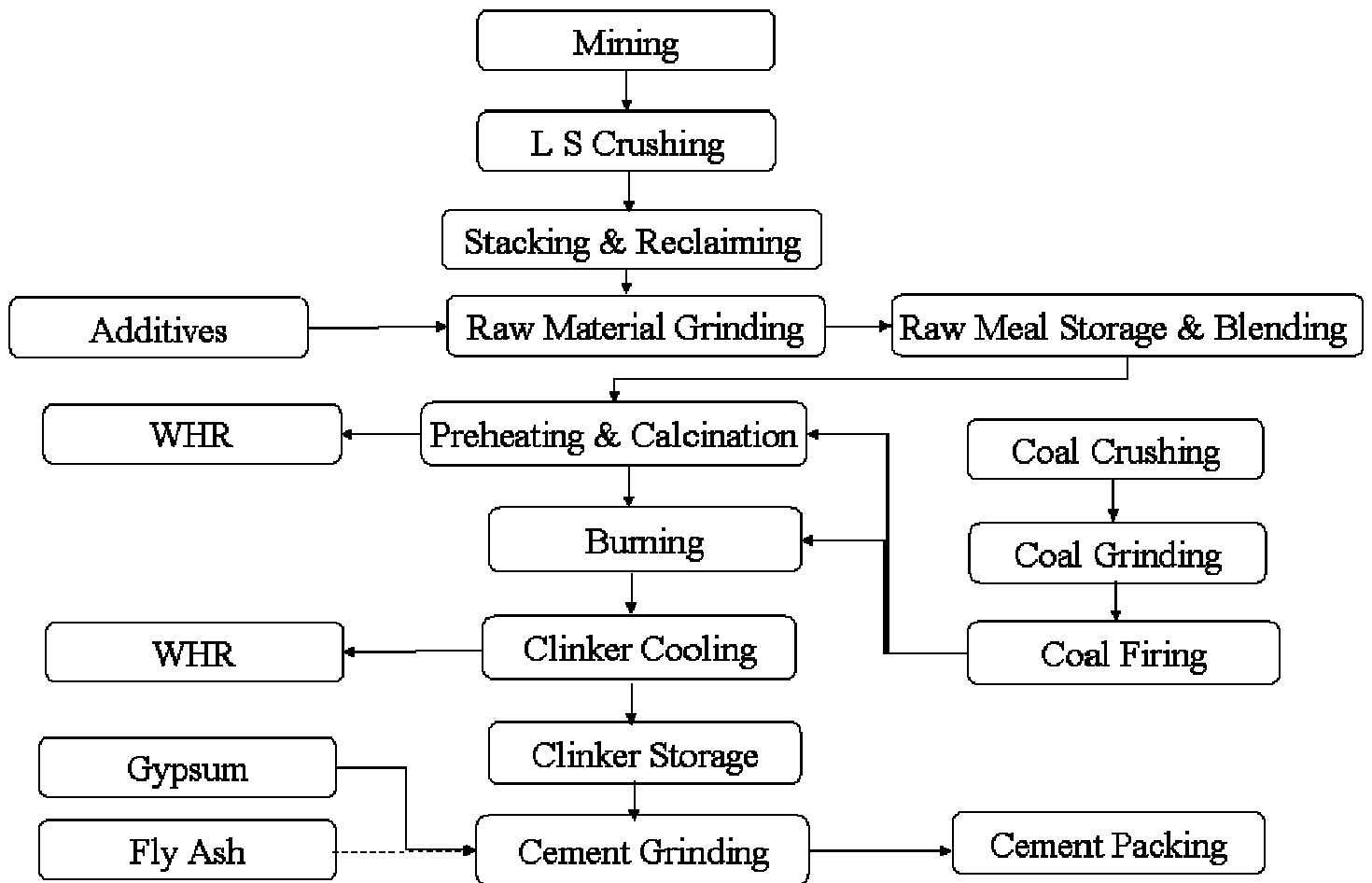
A Brief Profile of the Company:

- ◆ The Cement industry is one of the few industries in India which have achieved global competitiveness. India is the second largest cement producer in the world. The cement industry matches world standards, on all parameters. The quality of Indian cement compares with the internationally accepted British and American standards. Also, the industry's productivity, energy efficiency and environment standards are among the best in the world.
- ◆ This excellent performance is the reflection of the responsible and mature attitude of its major players. Their individual performance set an example for others to follow. Among those who played a major role in taking the cement industry to the present high position, one name shines bright.

“Ambuja Cement”

- ◆ Gujarat Ambuja Cements is a relatively young company in the industry. It began operations in 1986. But, in a short span of 18 years, it has set new benchmarks in every aspects of the cement business. From cement quality to power consumption and from marketing to environment management. Some of the main achievements are listed below:
 - Fastest project commissioning
 - Fastest stabilization of production
 - Highest productivity
 - Lowest power and coal consumption
 - Best environment management
 - Pioneering transportation of bulk cement by sea
 - Excellent product quality
 - Covering a strong brand
- ◆ In 1993, GACL setup a whole new way of transporting cement – bulk cement transportation by sea. It includes a dedicated port at the Gujarat plants and unloading terminals in Mumbai and Surat. All of them are fitted with mechanized conveying system. It also includes special bulk cement ships. GACL is also the largest exporter of Cement in India.
- ◆ GACL acquired 1.80 MTPA cement plant from the management of M/s DLF Cement Ltd. Rabriyawas, Rajasthan in the year 2000. Three waste heat recovery systems are installed in cement plant right from beginning to utilize waste gas heat temperature for heat-up of feed water for boiler.
- ◆ GACL, Rabriyawas unit **Received** “Second Best Improvement in Electrical Energy Performance” award for the year 02-03 from NCBM and “Excellence Award for Productivity” for the year 02-03 from Rajasthan State Productivity Council.
- ◆ GACL, Rabriyawas unit **Received “National Energy Conservation Award; 1st in Cement Sector”** for the year 03-04 from BEE, GOI.
- ◆ GACL, Rabriyawas unit has also successfully obtained certification of ISO 9001:2000 by BVQi.

Process Flow Chart:



Brief Cement Manufacturing Process:

Identified captive lime stones after assessing the required quality are drilled, blasted and transported to single impact crusher hopper, where 1m³ LS boulder is crushed by 700TPH impact crusher and converted to 70-100 mm sizes. The crushed limestones are transported to lime stone yard (capacity 2 x 60000 MT) through a series of belt conveyors and store in a pile through an automatic stacker machine up to a maximum capacity of 60000 MT. Once the pile known quantity & quality is achieved than reclaimers are used to reclaim stockpile material. By using stacker and Reclaimer machines, pre-blending takes place to minimize fluctuation in crusher limestone quality. Reclaimed pile LS stack is continuously reclaimed, when raw mill in operation and store in hopper (250 MT X 2) at raw mill section. Magnet separators are installed over the belt conveyors to remove any foreign materials if reported.

Additive materials like china- clay, purchased high-grade limestone and iron dust is also used as a corrective material. The additives materials are stored in separate identified yard and fed to feeding hopper through pay loader and then materials are transported in hoppers via a series of belt conveyors. All additives are stored in separate hoppers.

The proportionate ratio of LS and other additive materials after electronically weighing are conveyed to a vertical raw mill (capacity 340 TPH), where 70-100mm size LS materials are ground to very fine powder and residue of 90 μ & 212 μ is maintain at 20% and 4% respectively with the help of high efficient dynamic separator. Pre-conditioned hot gases from kiln-Preheater are utilized to dry up the material and swept the material to next conveying system. Cyclones, airslide and bucket elevators are deployed to transport the powder into CF silo. Around 4% water of total feed rate to mill is being sprayed on feed table to maintain require material bed layer.

Controlled Flow silo can store 20,000 MT fine powders, which is also known as kiln feed. In CF silo feeding, blending and extraction process took place simultaneously. Due to good halogenations in CF silo, fluctuations in inputs are minimized. The required feed to kiln for burning is being measured by an electronic weighing system (Solid Flow Meter) and fed to kiln PH cyclones. Half of the kiln feed is fed in one string and remaining in other string. Each string is having 6 nos. of cyclones thus made total 12 nos. of cyclones in pre-heater. Materials that are fed from top cyclone (cyclone # 1) finally entered in cyclone # 5 and then from both string cyclone # 5 it entered in inline- calciner and after achieving degree of calcinations (de-association of CaO from CaCO₃) it again fed to cyclone # 6, from where it entered in kiln for next process.

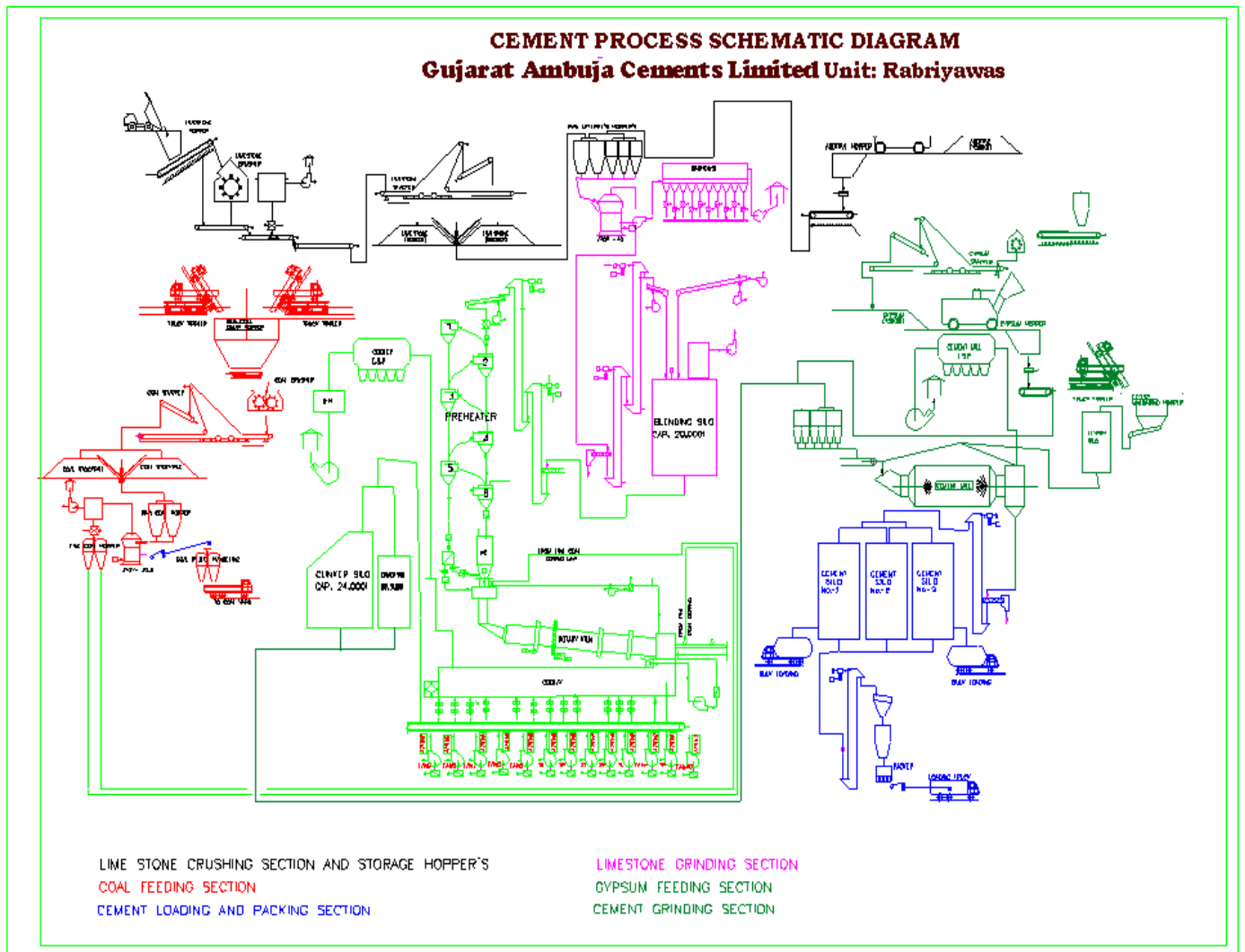
Hot gases when leaving cyclone # 1 are having around 340 °C. Hot gases are re-conditioned (reduction in temperature) for further utilization in raw mill & coal mill section. Re-conditioning of gases is being done through Waste Heat Recovery system (WHR), where proportionate heat is utilized by condensate water heat up, flowing from power plant. All gases after heat utilisation enter in baghouse, where fine dust particles are collected and again fed back into system.

Indigenous coal is ground in a vertical mill and being used in kiln & pre-calciner as a fuel. Around 60% pulverized fine coal is being fired at calciner, where material is 90% calcined before entering into rotary kiln. 40% pulverized fine coal is fired in kiln (4.55 m diameter & 68 m length) through multi channel swilax burner. Typically 1400 °C temperature is maintained in the kiln-burning zone to burnt limestone powder completely so that necessary chemical reactions can be performed ideally. The burnt powder is converted into black pieces known as clinker.

When clinker leave the kiln it fall on the grate cooler, where calculated fresh air is pumped with the help of 13 nos. fans and clinker temperature brought down from 1400 °C to 180 °C. Hot gases from cooler are used in kiln and calciner for coal combustion and remaining excess air after filtration through ESP, passes through WHR, where heat is recovered by water and clean air emit to the atmosphere. The cold clinker is then transported to clinker storage silo through DBC.

From clinker silo, clinker is extracted and transported to clinker hopper through apron & belt conveyors and stored in clinker hopper at cement mill section. In cement mill for OPC manufacturing around 94% of clinker and 6% gypsum are ground together in a ball mill. The fineness of cement is being controlled with a high efficiency sepax separator. Cement stored in different silo and packed through electronic packing machines. Dry fly ash is used during PPC manufacturing.

The whole process of control and operation is centralized from a single place called CCR. The process control and instrumentation are taken care by modern DC system. At every stage of process, on-line quality parameters are checked and analyzed through XRF & XRD machines for necessary corrective measures if any during in process stage. The company follows ISO 9001:2000 documentation procedure and guidelines at every stage of operation to ensure consistent quality of product.



Energy Consumption:

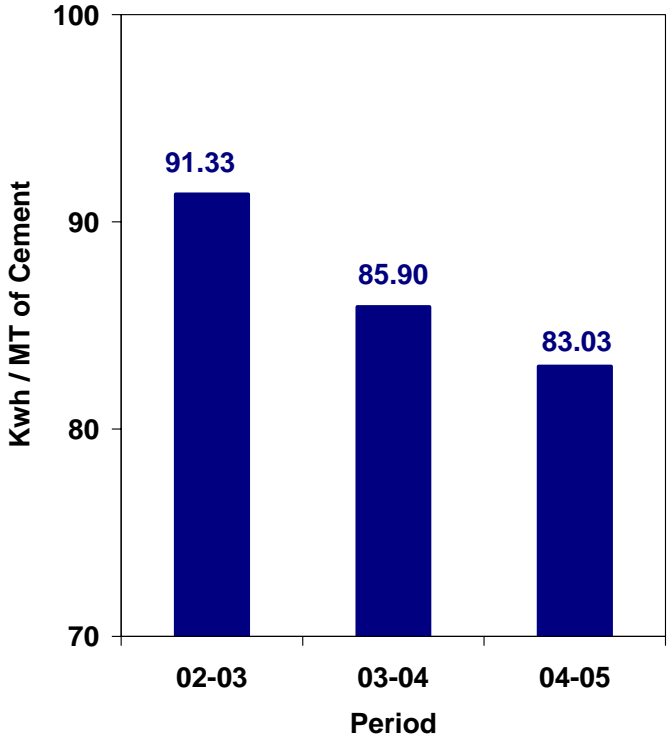
There has been a steady decreased in the Electrical & Thermal Energy consumption for equivalent cement due to the implementation of various energy conservation measures.

Description	UOM	02-03	03-04	04-05
Clinker Production	Lac MT	13.53	15.74	16.32
Cement Production	Lac MT	14.51	15.89	16.55
Specific Power Cons.	kWh/TC	91.33	85.90	83.03
Specific Heat Cons.	kCal/kg cl	721	711	710

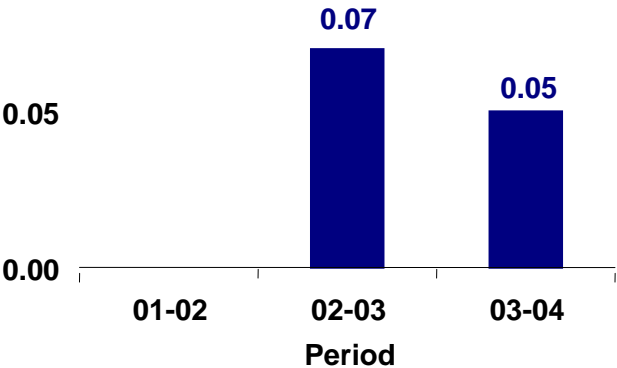
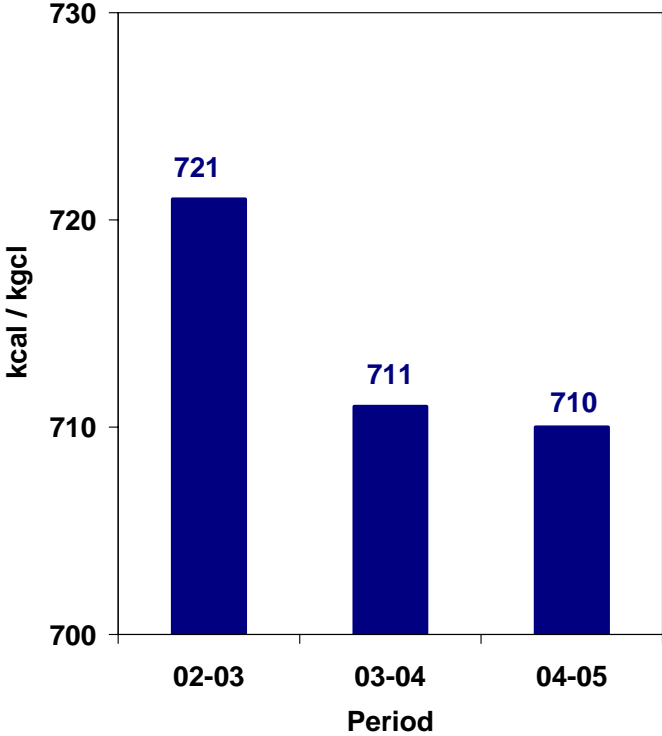
Year	Electricity		Thermal	
	Consumption (kWh/TC)	% Reduction over 01-02	Consumption (kCal/kgcl)	% Reduction over 01-02
02-03	91.33	9	721	2
03-04	85.90	14	711	3
04-05	83.03	2	710	0.14

Energy Consumption Trend:

Specific Power



Specific Heat Consumption



Energy Conservation Commitment, Policy & Setup:

Gujarat Ambuja Cements Limited is a multi-locational company where regular interaction on energy conservation is being carried out. The company appointed one General Manager (Energy) at corporate level. On annual basis each plant present energy performance data during Energy Meet held at various plant locations on rotation basis. Managing Director, Board of Directors, All plant Heads, Energy Managers & others are attending meet. The company’s energy profile consists of electricity, LDO (kiln heat-up), HFO (DG set), HSD (vehicles), coal, lignite & water also. Budget provisions are made exclusively for energy projects. Energy conservation action plans & progress are reviewed periodically. The importance of energy conservation emphasized through various forums.

• **Energy Management Policy:**

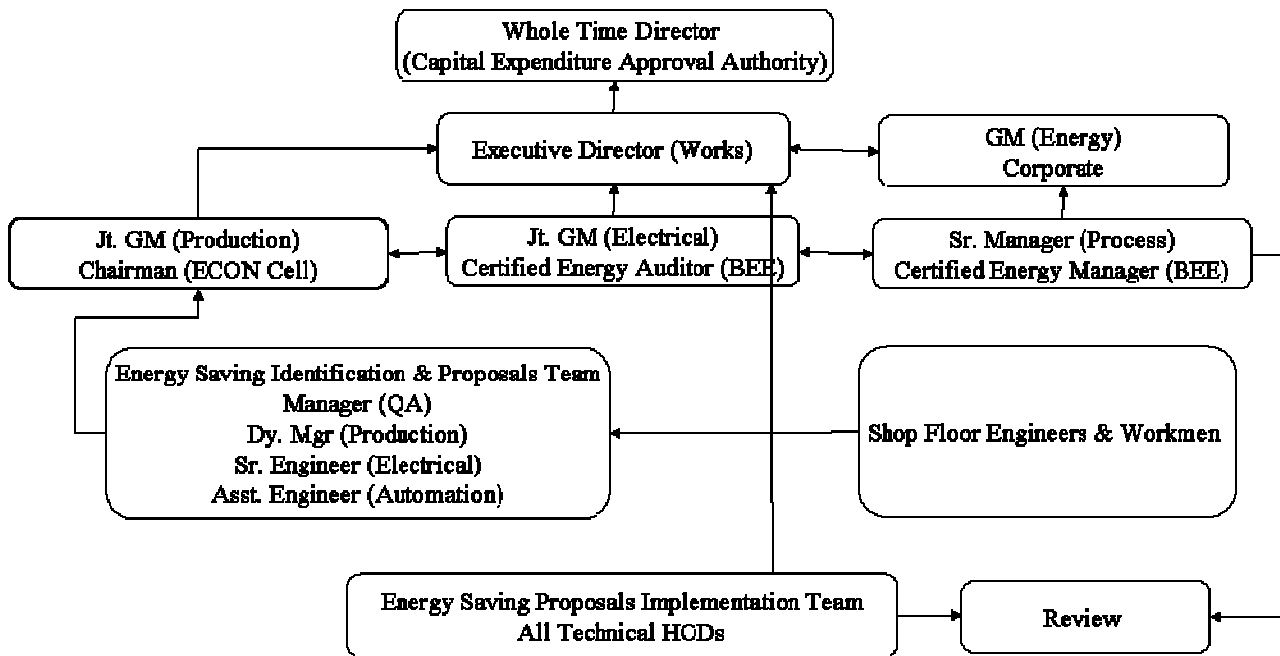
We are committed to conserve energy in cement manufacturing, power generation and related activities by optimization and efficient use of resources in a cost effective manner.

We are committed to reduce our energy consumption by 2% every year.

To accomplish this we shall:

- Create awareness and impart training to employees for energy conservation.
- Monitor energy consumption regularly in various departments, analyze the information and take necessary steps for continuous improvement through an effective energy management information system.
- Conduct Energy Audit to further identify potential areas and equipments for energy conservation.
- Implement innovative ideas / modifications for improvement and up-gradation of the equipments.
- Carry out on-going process optimization and diagnostic studies to maintain high productivity and capacity utilization to minimize specific energy consumption.

ECON Cell Structure:



Measures Taken to Reduce Energy Consumption during 04-05:

Cement Plant:

- Optimisation / balancing activities for water pump motor rating and cooling tower operation
Power consumption in 03-04: 2633734 KWH / 366 days = 7196 KWH/day
Power consumption in 04-05 (till may '05): 2312620 KWH / 335 days = 6903 KWH/day
Saving in power consumption = 7196 – 6903 = 293 kWh/day = 293 X 365 days X Rs.3.14/kWh = Rs.3.36 lacs/annum

Power Plant:

- ACC fan blades replacement with FRP blades (For 1 no. fan). Operating from 9.02.05 in fan #1.

After Fan # 1 Changing

Description	Air Flow Delivered (m ³ /hr)		Power Consumed (KW)	
	Original	After FRP Blades	Original	After FRP Blades
High speed	1453243	1838232	108.75	83.5
Low speed	471060	773625	14.57	11.47

Calculation at high speed:

- Incase in air volume = 384989 m³/hr
- Saving in power = 25.25 KW

(A) Considering 270 working days at high speed, unit saved = 25.25 X 6480 hrs. = 163620 KWH

Calculation at low speed:

- Incase in air volume = 302565 m³/hr
- Saving in power = 3.1 KW

(B) Considering 80 working days of running (in winter season) unit saved = 3.1 X 1920 hrs. = 5952 KWH

Total units saved in a year (A + B) = 163620 + 5952 = 169572 KWH

Saving = 169572 KWH X Rs.3.14/KWH = Rs.5.33 lacs

Cost of one fan = Rs.2.25 lacs

Pay back period = 2.25 / 5.33 = 5 months

Energy Conservation Plan & Targets for 05-06:

1.0 Target

1.1 Electrical:

Section	Sp. Power Cons. (kWh/MT of Cement)
Crusher	2.27
Raw mill	14.18
Kiln	23.93
Factory light	0.51
Cement mills	34.53
Packing Plant	0.83
Colony light	0.29
line losses	1.00
Total	77.54

1.2 Thermal:

Section	Sp. Heat Cons. (kCal/kg cl)
Sp. Heat consumption	705

2.0 Energy Conservation Plans (05-06):

- ❖ Installation of VVVF with new 150 KW motor & removal of inlet damper (2 nos.) at cooler WHR fresh air fan (R51 FN1)

A) Estimated saving:

70 KWH X 24 hours X 330 days X @ Rs. 2.95 / kWh = Rs.16.35 lac / annum

B) Project cost:

Cost of VVVF	:	8.00 lac
Input supply transformer for 12 pulse VVVF	:	4.00 lac
Motor (squirrel cage, 750 rpm delta) cost	:	2.56 lac
Power cable	:	0.80 lac
Misc. (Civil / Mech. Jobs & AC)	:	0.50 lac
Total	:	15.86 lac

C) Pay back : $\frac{15.86}{16.35} \times 12 = 11.64$ Months

ROI : 103%

- ❖ Modification of existing regenerative type air drier to refrigerant type (1 nos.) 24 m³/min.

Estimated saving: 9.75 lac

Project cost : 17.92

Pay back : $\frac{17.92}{9.75} \times 12 = 22$ Months

ROI : 54%

Power Plant:

- ❖ VVVF drive for FD fans (2 nos.)

At least 30% savings in FD2 & 35% savings in FD1 possible

Savings : (125 KW X 0.30) + (127 KW X 0.35) X 8000 hrs/yr X Rs.2.50/unit

Investment: 26.00 Lacs

Payback period: $26 \times 12 / 16.39 = 19$ months

- ❖ Replacement of ACC fans (6 Nos.) blade by energy efficient FRP blade in power plant

For 1 fan saving reported to Rs.5.33 lacs

Estimated saving for 6 fans: 30.04 lac / annum

Project cost : Rs.13.50 lac

Pay back : $\frac{13.50}{30.04} \times 12 = 5.39$ Months

- ❖ Installation of VVVF for operation of condensate extraction pump.

Auto control valve based on land of condensate pump

Discharge pressure varies from 10 – 17 kg/cm²

Indicates maximum required head = 10 kg/cm²

Install VFD to pump based on same control

At least 20% saving possible

Annual savings possible = 54 KW X 0.2 X 8000 hrs/yr X 2.40/unit

= Rs.2.16 lacs

Investment = Rs.4.00 lacs

Payback period = (Rs.2.16 lacs X 12) / Rs.4.00 lacs = 6.48 months say 7 months

- ❖ Installation of VVVF for ID fan.

Pressure developed by fan = 138 mmWC

Damper controlled – based on draught inside boiler

Pressure drop across damper = 70 mmWC

% Pressure drop = 50.2%

Power consumption of fan and pressure developed by fan.

Install variable frequency drive (VFD). The feed back is draught of boiler.

At least 35% savings in power consumption possible.

Annual savings = 102.6 KW X 0.35 X 8000 hrs/year X Rs.2.50/unit

= Rs.7.18 lacs

Investment = Rs.8.50 lacs

Payback period = (Rs.8.50 X 12) / Rs.7.18 = 14.1 months = 15 months

- ❖ 250 CFM refrigerant type air dryer in place of heat less air dryer.

Investment = Rs.3.00 lacs

At present we are having 250 cfm heatless air dryer of "Dhir Engineers" make for drying of instrumentation air. We intend to change it with a new refrigerated type air dryer, since it will be economical both power and money wise. Moreover party is willing to give a reduction of Rs 50,000 on the current price of Rs 2,28,000 through exchange offer.

The comparative cost analysis is given below:

Power consumption	Unit	Heatless air dryer	Refrigerant type air dryer
Direct power consumption	KW	0	1.865
Indirect power consumption (Due 12% purge loss)	KW	3.36	0
Total	KW	3.36	1.9

Power saving = 1.50 KWH = 13096.2 KWH / annum = @ Rs 3.14 per KWH = Rs. 41122 / annum

There will be additional saving due consumables required for effective operation of installed heatless type as given below

Activated alumina desiccant : Rs. 18000 for 150 kgs single fill

Activated Carbon desiccant : Rs. 3000 for 50 kgs single fill

N.R.V (2 nos) : Rs. 3200

Diaphragm rubber(3 nos) : Rs. 5400

Total : Rs 29600 in 3 years or Rs 0.51 lacs per year.

Net annual saving = Rs. 51122

As per company policy heatless air driers are replaced by "Paconnet" make refrigeration type driers in all the units.

- ❖ KSB make 100 tph indigenous Boiler feed pump - (1 no) in place of existing imported 47 tph x 2 feed pumps.
 Rated power for 100 tph pump = 270 KW
 Rated power for 02 nos. existing Sulzar make pump = 300 KW
 Saving per day = $(300 - 270) \times 24 = 720$ KWH
 Saving per year = $720 \times 330 = 237600$ KWH
At Rs. 3.14/KWH, saving per year = Rs. 7.50 lacs
 Total cost (including pump, motors, HT cables, civil works etc.) = Rs.15.00 lacs
 Payback period = $\text{Rs.15.00 lacs} / \text{Rs.7.50 lacs} = 2$ Years
 Ease in spare parts availability & cost.

- ❖ Fan less cooling tower
 Present cooling tower has got 2 nos. fans.
 Connected load = 11 KW each.
 Actual load = 8 KW each.
 Energy consumed per hour = $2 \times 8 = 16$ KWH.
 Energy consume per month = $16 \times 24 \times 30 = 11520$ KWH
 Energy consumed per year = $11250 \times 12 = 138240$

So with fan less cooling tower energy saving is 138240 kWh/year = $138240 \times 3.14 = \text{Rs.4.30 lacs}$
 Cost of fan less cooling tower = 10 lacs
 Pay back period = $10 / 4 = 2$ years 6 months

- ❖ ACC Module (2 nos.)
 Average generation per day for April, May, June = 3,30,000 KWH/DAY
 Rated generation = 3,60,000 KWH/DAY
 Loss per day = $30000 \text{ KWH/DAY} @ \text{Rs.3.14 / KWH} = 30000 \times 3.14 = \text{Rs.94,200}$
 Loss per month = Rs. 28 lacs
Considering 3 months of summer, loss per year = Rs. 84 lacs (Saving)
 Cost of two additional modules = Rs.300 lacs
 Pay back = $300 / 84 = 3$ years 6 months
 To improve vacuum from - 0.7 kg/ CM2 at 12 MW load to -0.83 kg/cm2 at 15 MW load in summer season (three months) and to eliminate reduction in generation.

- ❖ Replacement of fluorescent tubes by energy saving lights
 Suggested to replace HPMV lamps with HPSV lamps in identified areas in the plant, where colour property is not critical.
 Presently 46 X 250 W and 296 X 125 W HPMV are used in plant
 In first phase 20 nos. of 250 W and 150 nos. of 125 W planned.
Annual saving = $((125 \text{ W} \times 20 \text{ nos.}) + (55 \text{ W} \times 150 \text{ nos.}) \times 4000 \text{ hrs} \times \text{Rs.2.5/unit}$
= 25,000 + 82,500
= Rs.1.08

 Investment required = $((\text{Rs.1000/125W lamp} \times 20 \text{ nos.}) + (\text{Rs.800/70 W lamp} \times 150 \text{ nos.}))$
 = $\text{Rs.20,000} + \text{Rs.1,20,000} = \text{Rs.1.40}$