

## **VIKRAM CEMENT – LINE-I**

(Unit of Grasim Industries Ltd.)

Vikramnagar; P.O. Khor; Distt.Neemuch (MP)

### **UNIT PROFILE**

Commissioned in 1985 Vikram Cement Line-I is one of the modern Cement Plants of Grasim Industries Ltd., of Aditya Birla Group. The capacity was enhanced to 0.75 Million Tonnes Per Annum from 0.5 Million Tonnes Per Annum in 1989. Vikram Cement Line-1 is equipped with the latest modern KHD Dry Process, Double Stream 5 stage preheater with separate precalciner for Kiln Pyro Processing, Vertical Raw Mill and Coal Mill of Loesche make and close circuit 2 chamber Cement Mill for grinding. Complete process control and instrumentation is computerized. 104% capacity utilisation was achieved in year 2003-2004. Line-I again upgraded from 5 Stage to 6 Stage Preheater by M/s KHD and production increased from 0.75 Million Ton to 0.90 Million Ton in March 2002.

Energy conservation has been the main thrust area and the following significantly proven, modern and innovative, major equipments have been installed.

01. Mechanical transport for Kiln Feed system (Bucket Elevator)
02. High efficiency Raw Mill fan with SPRS
03. Plant upgradation from 5 Stage to 6 Stage Preheater
04. Upgradation of Raw Mill Classifier.

In addition to the above energy conservation schemes and ideas that have been already implemented many are in pipeline/in the implementation stage.



**PLANT VIEW - VIKRAM CEMENT LINE-1 IS FIRST FROM LEFT**

With many feathers like TPM Excellence Award, ISO:14001 & ISO:9001 certification etc. in its cap, it is one of the most energy efficient plant of its type in the view of world standards. A list of important accreditation won by the unit is given below:

- ISO:9001 Certification – RWTUV, Germany – 1998
- Rajiv Gandhi National Quality Award – 1997
- ISO:14001 EMS Certification – DNV Rotterdam, Netherlands – 1997
- IMC Ramkrishna Bajaj National Quality Award (Certificate of Merit) – 1997
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- AV Birla Award for Outstanding Achievement – 1997
- TPM Excellence Award -1995 and TPM Consistency Award - 2001 (JIPM, Japan)
- British Safety Council Award - 1996, 1997, 1999 & 2000
- National Safety Council Award (MP Chapter)-1997, 1998 & 1999
- OHSAS 18001- Occupational Health & Safety Assessment Series - DNV, Netherlands – 2001
- Greentech Environment Excellence Award 2001
- SA 8000 – DNV – 2003
- Energy Efficiency in Indian Cement Industry by NCCBM – 2000
- Excellence Award Bharat Shell 2000
- Fuller Energy Award M.P. Chamber of CMA – 2000 & 2003

### **ENERGY CONSUMPTION**

Total energy input for manufacture of cement as percentage of manufacturing cost is about 40% of total cost. The cost of coal, diesel & furnace oil and electricity (purchased and self generated) are constantly rising.

Electrical energy has been brought down from 94.23 kWh/ton Cement in 2001-2002 to 88.21 kWh/ton Cement in 2003-2004.

Specific thermal energy consumption from 731 KCal/Kg clinker in 2001-2002 to 707 KCal/Kg clinker in 2003-2004.

Cement and clinker production vis a vis the cost of electrical energy and fuel for the last 3 years have been as given below:

	<b>2001-2002</b>	<b>2002-2003</b>	<b>2003-2004</b>
Cement production (Lac Ton)	9.30	9.48	9.32
Elect. energy cost (Rs. in lac)	2287.22	3527.20	3558.29
Clinker production (Lac Ton)	5.04	9.03	8.10*
Thermal energy cost (Rs.in lac)	1339.11	2066.61	2143.18

The thermal and electrical energy costs have been brought down inspite of increasing price of Coal, Furnace Oil/Diesel and Electrical.

**\*Less clinker production due to poor market**

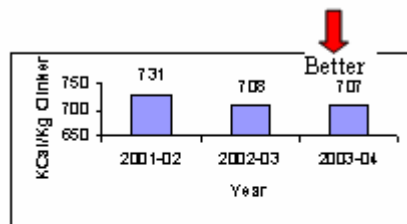
## **ENERGY CONSERVATION - ACHIEVEMENTS**

Energy conservation has been one of the main agenda of Vikram Cement since the commissioning of the plant.

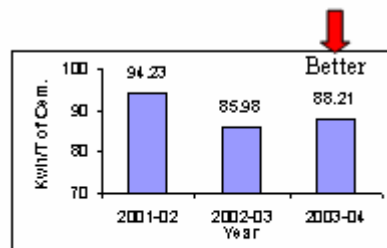
The reducing trend of the specific thermal energy consumption shown below is indicator of achievements.

Specific energy, specific power consumption	2001-2002	2002-2003	2003-2004
Specific power in Kwh/Ton cement	94.23	85.98	88.21*
Specific energy in KCal/Kg clinker	731	708	707

\*Higher power consumption in cement grinding due to high blaine blended cement and low production



**REDUCTION OF  
THERMAL ENERGY INPUT**



**REDUCTION OF  
ELECTRICAL ENERGY INPUT**

Petcoke is being used in increasing percentage as fuel by Vikram Cement. Due to poor grindability and finer grinding requirements, specific electrical energy consumption has increased, but the total cost has considerably come down.

The following major energy conservation schemes have been implemented during 2003-2004.

01. Water spray in Preheater downcomer duct
02. Upgradation of Packer
03. Motorised slide gate at Preheater
04. Removal of ventury in Raw Mill duct
05. GRR in sepol fan of Cement Mill

In addition to the above measures, plant upgradation and optimization has been done and many smaller energy conservation schemes have been implemented, under Kaizen, as a part of TPM implementation.

Regular heat balance studies and false air leakage monitoring help in maintaining the gain.

The thermal energy conservation schemes implemented since 2001-02 to 2003-2004 have resulted in saving of 24 Kcal/kg clinker.

Electrical energy have been reduced from 2001-02 to 2003-04 about 6 units/ton of cement.

### **Energy Conservation Plans and Target**

Various energy conservation schemes under implementation/active consideration at Vikram Cement are given below:

- On-line cross belt analyser for raw material
- On-line free lime analyser for reduction in cement grinding power
- Enhance production of blended cement
- Installation of Captive Thermal Power Plant for reduction of specific electrical energy consumption by frequency & voltage optimisation and cost of energy generation.
- Expert system for Raw Mill, Coal Mill, Kiln & Cement Mill
- OMEGA plates for cooler
- Coal Mill classifier upgradation
- DC drive in cooler ID fan

The target for the unit for 2004 – 2005 for specific thermal energy is 705 KCal/Kg Clinker and that for specific electrical energy consumption 86.0 Kwh/Tonne cement.

### **ENVIRONMENT & SAFETY**

Environment and safety are the priority areas for Vikram Cement. This is reflected by the list of credentials reproduced below:

We have set up our (EHS) Environment Health & Safety Policy. Vikram Cement adopted Environment Management System and got certified to ISO 14001:1996 in August 1997 and became 1<sup>st</sup> Cement Plant in India to get certified to EMS. Vikram Cement also implemented and got certified to OHSAS 18001:1999 in August 2001 and became one of 1<sup>st</sup> Cement Plant to certified OHSAS from DNV, Netherlands.

As further step in the drive to conserve environment and natural resources the unit has taken following steps:

01. Use of high Calorific Value petcoke to reduce the use of high grade limestone and increase the life of captive mines directly. Petcoke is waste product of Oil Refineries and creates disposal problems.
02. Reduction in coal grinding power and stable running of plant by installing separate grinding and handling system for petcoke

03. Mechanized Flyash Handling System and use of Flyash for high strength, high durability cement. This will reduce disposal problem of Thermal Power Plant and overall reduction in the use of energy for cement manufacture.
04. Large investment has been done for upgradation of plant capacity and reduction of pollution.
05. Energy conservation as well as water conservation schemes are being implemented.



### **GREEN BELT DEVELOPMENT**

Variety of fruit and other environment friendly trees have been planted over 5 - 7.2 hectares area. The number of trees planted upto 2003-2004 period is 1,74,720. Their survival rate of 85 to 90%. Tree plantation has been started since 1985 at the rate of more than 17000 tree per year.

Vikram Cement has qualified engineers, scientists and well equipped laboratory for environment monitoring on continuous basis and regular environment audits are carried out by them.

Full fledged Safety Department under Senior Manager(Safety) and Fire Department under Senior Manager(Security) at Vikram Cement. It has the following functions and they are implemented religiously :

- OHSAS 18001 - 1999 implementation
- SHE Policy, Safety Manuals
- Work Permit System. Regular Safety Audits, Safety Committee
- On Site Emergency Plan
- Regular Fire Drill.
- Modern fire Fighting System
- Fire Alarm System for all vital locations
- Celebration of Departmentwise SAFETY WEEK

**VIKRAM CEMENT – LINE-II**  
(Unit of Grasim Industries Ltd.)  
Vikramnagar; P.O. Khor; Distt.Neemuch (MP)

**UNIT PROFILE**

Commissioned in 1986 Vikram Cement Line-II is one of the modern Cement Plants of Grasim Industries Ltd., of Aditya Birla Group. The capacity was enhanced to 0.75 Million Tonnes Per Annum from 0.5 Million Tonnes Per Annum in 1990. Vikram Cement Line-2 is equipped with the latest modern KHD Dry Process, Double Stream 5 stage preheater with separate precalciner for Kiln Pyro Processing, Vertical Raw Mill and Coal Mill of Loesche make and close circuit 2 chamber Cement Mill of KHD for grinding. Complete process control and instrumentation is computerized. 91% capacity utilisation in 2003-2004. Line-II again upgraded from 5 Stage to 6 Stage Preheater by M/s KHD and production increased from 0.75 Million Ton to 0.9 Million Ton in August 2002.

Energy conservation has been the main thrust area and the following significantly proven, modern and innovative, major equipments have been installed.

01. Mechanical transport for Kiln Feed system (Bucket Elevator)
02. High efficiency Raw Mill fan with SPRS
03. Plant upgradation from 5 Stage to 6 Stage Preheater
04. Upgradation of Raw Mill Classifier.

In addition to the above energy conservation schemes and ideas that have been already implemented many are in pipeline/in the implementation stage.



**PLANT VIEW - VIKRAM CEMENT-LINE-2 IS SECOND FROM LEFT**

With many feathers like TPM Excellence Award, ISO:14001 & ISO:9001 certification etc. in its cap, it is one of the most energy efficient plant of its type in the view of world standards. A list of important accreditations won by the unit is given below:

- ISO:9001 Certification – RWTUV, Germany – 1998
- Rajiv Gandhi National Quality Award – 1997
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- OHSAS 18001- Occupational Health & Safety Assessment Series - DNV, Netherlands – 1999
- Greentech Environment Excellence Award 2001
- SA 8000 – DNV – 2003
- Energy Efficiency in Indian Cement Industry by NCCBM – 2000
- Excellence Award Bharat Shell 2000
- Fuller Energy Award M.P. Chamber of CMA – 2000 & 2003

### **ENERGY CONSUMPTION**

Total energy input for manufacture of cement as percentage of manufacturing cost is about 40% of total cost. The cost of coal, diesel & furnace oil and electricity (purchased and self generated) are constantly rising.

Electrical energy has been brought down from 91.89 kWh/Ton of Cement in 2001-02 to 89.67 kWh/Ton of Cement in 2003-2004 and specific thermal energy consumption from 728 KCal/Kg clinker in 2001-02 to 706 KCal/Kg clinker in 2003-2004.

Cement and clinker production vis a vis the cost of electrical energy and fuel for the last 3 years have been as given below:

	<b>2001-2002</b>	<b>2002-2003</b>	<b>2003-2004</b>
Cement production (Lac Ton)	6.0*	7.16*	8.23*
Elect. energy cost (Rs. in lac)	2266.99	2940.71	3345.96
Clinker production (Lac Ton)	7.37	7.82	9.07
Thermal energy cost (Rs.in lac)	1944.38	1802.72	2241.96

The thermal and electrical energy costs have been brought down inspite of increasing price of Coal, Furnace Oil/Diesel and Power

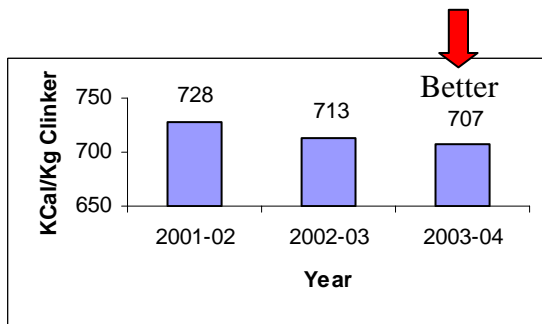
**\*Less cement production due to transfer of clinker to our Bhatinda Grinding Unit.**

## **ENERGY CONSERVATION - ACHIEVEMENTS**

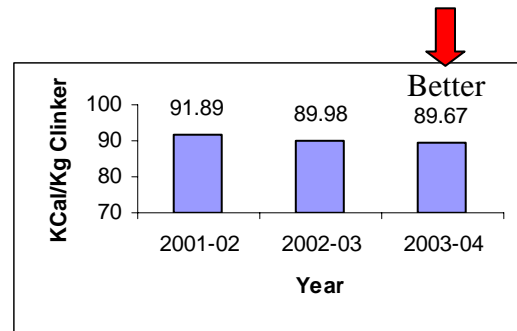
Energy conservation has been one of the main agenda of Vikram Cement Line-2 since the commissioning of the plant.

The reducing trend of the specific thermal energy consumption shown below is indicator of achievements.

Specific energy, specific power consumption	2001-2002	2002-2003	2003-2004
Specific power in Kwh/Ton cement	91.89	89.98	89.67
Specific energy in KCal/Kg clinker	728	713	707



### **REDUCTION OF THERMAL ENERGY INPUT**



### **REDUCTION OF ELECTRICAL ENERGY INPUT**

Petcoke is being used in increasing percentage as fuel by Vikram Cement Line-2. Due to poor grindability and finer grinding requirements, specific electrical energy consumption has increased, but the total cost has considerably come down.

The following major energy conservation schemes have been implemented during 2003-2004.

01. Water spray in Preheater downcomer duct
02. Upgradation of Packer
03. Motorised slide gate at Preheater
04. Removal of ventury in Raw Mill duct
05. GRR in sepol fan of Cement Mill
06. Coal Mill classifier upgradation

In addition to the above measures, plant optimization and upgradation has been done and many smaller energy conservation schemes have been implemented, under Kaizen, as a part of TPM implementation.

Regular heat balance studies and false air leakage monitoring help in maintaining the gain.

The thermal energy conservation schemes implemented since 2001-02 to 2003-2004 have resulted in saving of 21Kcal/Kg Clinker.

Electrical energy has been reduced from 2001-2002 to 2003-2004 about 2 unit/ton of cement.

### **Energy Conservation Plans and Target**

Various energy conservation schemes under implementation/active consideration at Vikram Cement Line-2 are given below:

- On-line cross belt analyser for raw material
- On-line free lime analyser for reduction in cement grinding power
- Enhance production of blended cement
- Water spray in Preheater Downcomer Duct
- Installation of Captive Thermal Power Plant for reduction of specific electrical energy consumption by frequency & voltage optimisation and cost of energy generation
- Expert system for Raw Mill, Coal Mill, Kiln & Cement Mill
- OMEGA plates for cooler
- DC drives in cooler ID fan

The target for the unit for 2004 – 2005 for specific thermal energy is 705 KCal/Kg Clinker and that for specific electrical energy consumption 87 Kwh/Ton cement.

### **ENVIRONMENT & SAFETY**

Environment and safety are the priority areas for Vikram Cement. This is reflected by the list of credentials reproduced below:

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As further step in the drive to conserve environment and natural resources the unit has taken following steps:

01. Use of high Calorific Value petcoke to reduce the use of high grade limestone and increase the life of captive mines directly. Petcoke is waste product of Oil Refineries and creates disposal problems.

02. Reduction in coal grinding power and stable running of plant by installing separate grinding and handling system for petcoke
03. Mechanized Flyash Handling System and use of Flyash for high strength, high durability cement. This will reduce disposal problem of Thermal Power Plant and overall reduction in the use of energy for cement manufacture.
04. Large investment has been planned for upgradation of plant capacity and reduction of pollution.



### **GREEN BELT DEVELOPMENT IN MINES & PLANT**

Variety of fruit and other environment friendly trees have been planted over 5 - 7.2 hectares area. The number of trees planted upto 2003-2004 period is 1,74,722. Their survival rate of 85 to 90%. Tree plantation has been started since 1985 at the rate of more than 16000 tree per year.

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- Work Permit System. Regular Safety Audits, Safety Committee
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- Regular Fire Drill.
- Modern fire Fighting System
- Fire Alarm System for all vital locations
- Celebration of Departmentwise SAFETY WEEK

**VIKRAM CEMENT – LINE- III**  
(Unit of Grasim Industries Ltd.)  
Vikramnagar; P.O. Khor; Distt.Neemuch (MP)

**UNIT PROFILE**

Commissioned in 1991 Vikram Cement Line-3 is one of the most modern Cement Plants of Grasim Industries Ltd., of Aditya Birla Group. Vikram Cement Line-3 is equipped with the latest modern Dry Process, Double Stream 6 stage preheater with inline precalciner for Kiln Pyro Processing. Close circuit ball mill with latest roll press and V-Separator technology. Vertical Coal Mill supplied by M/s KP, Germany and close circuit 2 chamber Cement Mill with latest technology roll press for grinding. Complete process control and instrumentation is computerized through FL Smith FUZZY LOGIC Controller.

Energy conservation has been the main thrust area and the following significantly proven, modern and innovative major equipments have been installed.

01. Mechanical transport for Kiln Feed in place of pneumatic transport system.
02. Variable speed drive for all clinker cooler fans.
03. Retrofitting of clinker cooler compartment-1 by IKN KIDS.
04. Upgradation of Raw Mill by installation of V-Separator.
05. Mechanical transport for raw meal

In addition to the large number of energy conservation schemes and ideas that have been already implemented many are in pipeline/under implementation.



**PLANT VIEW - VIKRAM CEMENT LINE- III**

With many feathers like TPM Excellence Award, ISO:14001 & ISO:9001 certifications etc. in it's cap, it is one of the most energy efficient plants of its kind in the view of world standards. A list of important accreditation won by the unit is given below:

- ISO:9001 Certification – RWTUV, Germany – 1998
- Rajiv Gandhi National Quality Award – 1997
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- Energy Efficiency in Indian Cement Industry by NCCBM – 2000
- Excellence Award Bharat Shell 2000
- Fuller Energy Award M.P. Chamber of CMA – 2000 & 2003

### **ENERGY CONSUMPTION**

Total energy input for manufacture of cement as percentage of manufacturing cost is about 40% and is having an increasing trend as the costs of coal, diesel & furnace oil and electricity (purchased and self generated) are constantly rising. Specific electrical and thermal energy consumption per ton of cement and clinker at the unit for 2003-2004 has been brought down considerably in last 3 years as given below:

Electrical energy has been brought down from 95.91 kWh/Ton Cement in 2001-2002 to 88.79 kWh/Ton Cement in 2003-2004.

Specific thermal energy consumption from 701 KCal/Kg clinker in 2001-02 to 699 KCal/Kg clinker in 2003-2004.

Cement and clinker production vis a vis the cost of electrical energy and fuel for the last 3 years have been as given below:

	<b>2001-2002</b>	<b>2002-2003</b>	<b>2003-2004</b>
Cement production (Lac Ton)	10.61	9.47	9.83
Elect. energy cost (Rs. in lac)	3333.05	4153.22	4619.08
Clinker production (Lac Ton)	11.80	11.57	11.84
Thermal energy cost (Rs.in lac)	2912.46	2607.61	2913.58

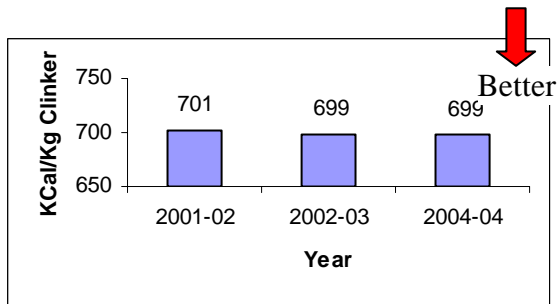
The rising trend in the prices of purchased energy inputs might have further crossed the above cost figures, but these have been kept under control by energy efficiency improvement projects, energy conservation measures and energy substitution as indicated by reduced specific energy consumption and cost above.

## **ENERGY CONSERVATION - ACHIEVEMENTS**

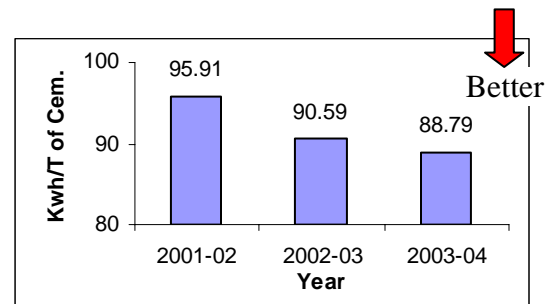
Energy conservation has been one of the main agenda of Vikram Cement Line-III since the commissioning of the plant. The reducing trend of the specific thermal and electrical energy consumption shown below is indicator of achievements.

Fuller Energy Award from MP Chamber of Cement for Second Best Maximum Reduction in 1998-99 in Electrical Energy Consumption per tonne of cement produced, over 1997-98 has been awarded to the unit in recognition of its achievements.

Specific energy, specific power consumption	2001-2002	2002-2003	2003-2004
Specific power in Kwh/Ton cement	95.91	90.59	88.79
Specific energy in KCal/Kg clinker	701	699	699



**REDUCTION OF  
THERMAL ENERGY INPUT**



**REDUCTION OF  
ELECTRICAL ENERGY INPUT**

The following major energy conservation schemes have been implemented during 03-04

01. Removal of unnecessary dampers and restrictions in fan ductings.
02. Bag house fan motor replacement with lower KW & rpm
03. Belt bucket elevator for raw meal feeding
04. Motorized slide gate at Preheater fan inlet.
05. Water spray system in Preheater top cyclone.

In addition to the above measures, plant optimization has been done and many smaller energy conservation schemes have been implemented, under Kaizen, as a part of TPM implementation.

Regular heat balance studies and false air leakage monitoring help in maintaining the gain.

The thermal energy conservation schemes implemented since 2001-2002 to 2003 – 2004 have resulted in saving of 2.0 Kcal/Kg Clinker.

Electrical energy have been reduced from 2001-2002 to 2003-2004 about 7 unit/ton of cement.

### **Energy Conservation Plans and Target**

Various energy conservation schemes under implementation/active consideration at Vikram Cement Line-III are given below:

- V-separator in Cement Mill grinding circuit.
- Water spray in Preheater top cyclone
- On-line free lime analyser for reduction in cement grinding power.
- Mechanical transport in place of pneumatic transport from Cement Mill to Cement Silo.
- Plant capacity enhancement
- Water spray at Raw Mill inlet
- Expert system for Raw Mill, Coal Mill, Kiln Cooler & Cement Mill

The target for the unit for 2004 – 2005 for specific thermal energy is 698 KCal/Kg Clinker and that for specific electrical energy consumption 89.80 Kwh/Tonne cement.

### **ENVIRONMENT & SAFETY**

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02. Reduction in coal grinding power and stable running of plant by installing separate grinding and handling system for petcoke

03. Mechanized Flyash Handling System and use of Flyash for high strength, high durability cement. This will reduce disposal problem of Thermal Power Plant and overall reduction in the use of energy for cement manufacture.
04. Large investment has been planned for upgradation of plant capacity and reduction of pollution.



### **GREEN BELT DEVELOPMENT IN PLANT**

Variety of fruit and other environment friendly trees have been planted over 5 - 7.2 hectares area. The number of trees planted upto 2003-2004 period is 1,74,000. Their survival rate of 85 to 90%. Tree plantation has been started since 1985 at the rate of more than 16000 tree per year.

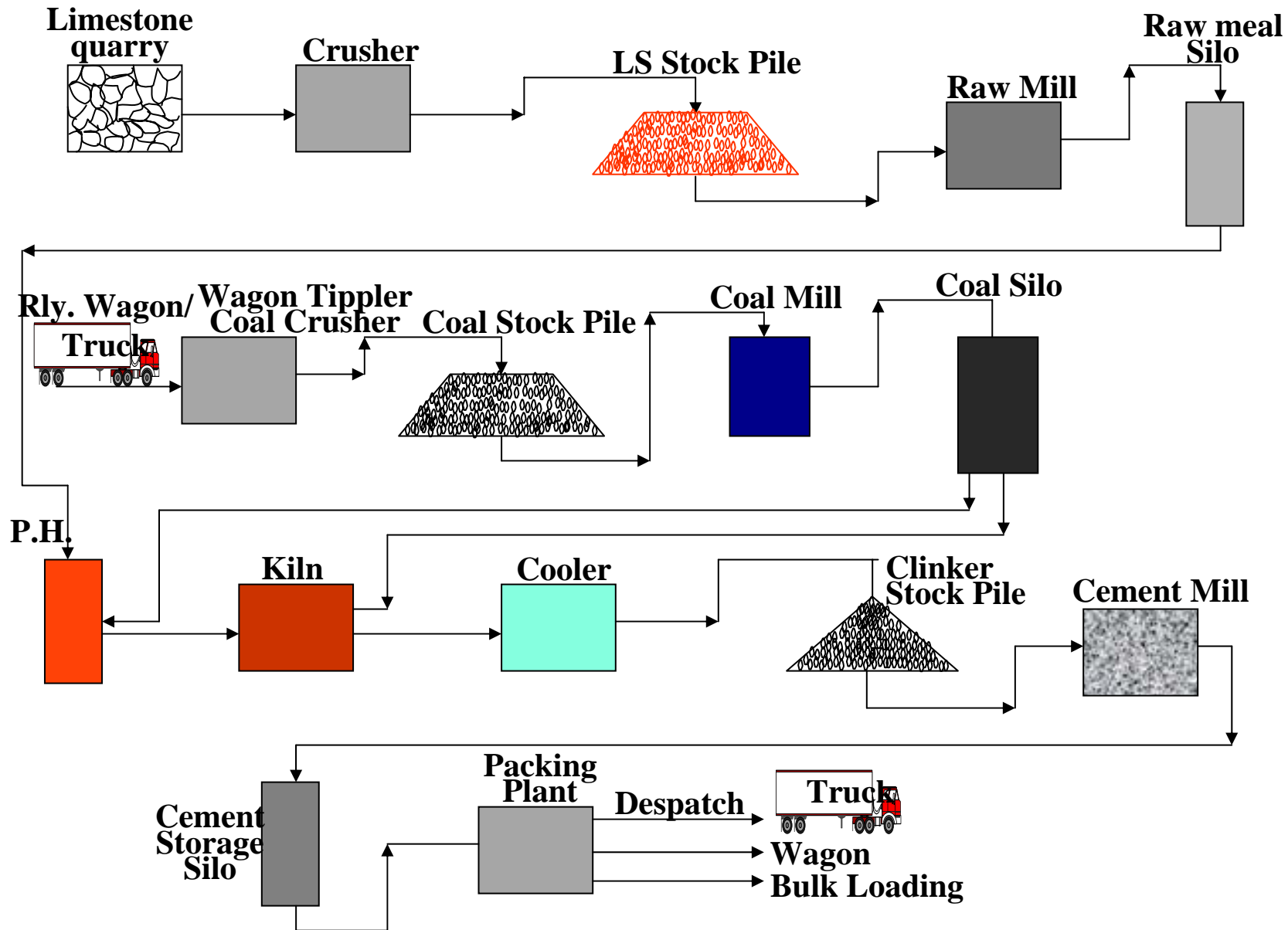
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- Regular Fire Drill.
- Modern fire Fighting System
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- Celebration of Departmentwise SAFETY WEEK

# VIKRAM CEMENT LINE-I

## PROCESS FLOW SHEET

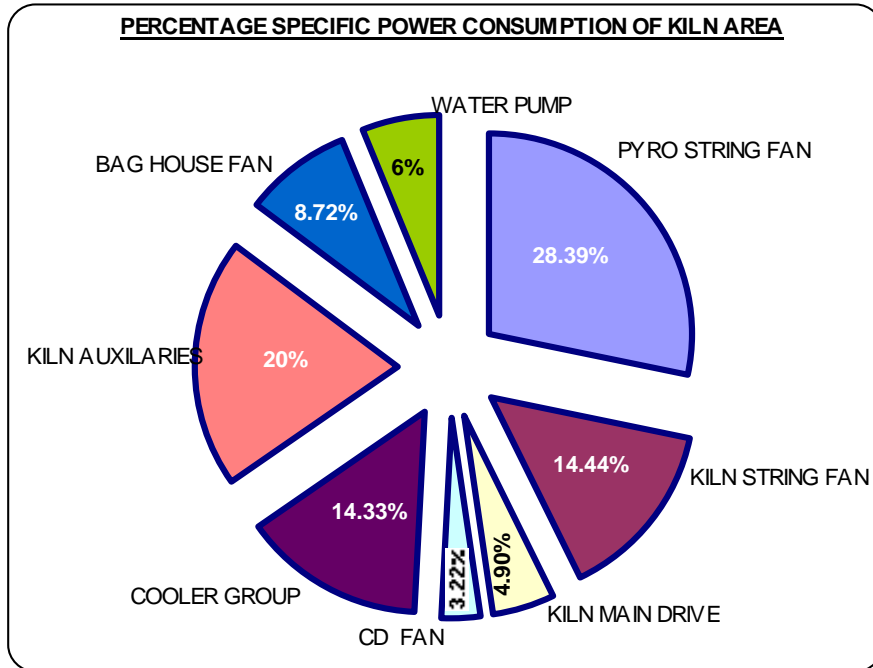


## THEME NAME

# REDUCTION OF POWER CONSUMPTION IN PYRO STRING PREHEATER FAN OF LINE-1 & II KILN

## 1. REASON FOR SELECTION OF THEME

HIGHER SPECIFIC POWER CONSUMPTION IN PYRO STRING FAN

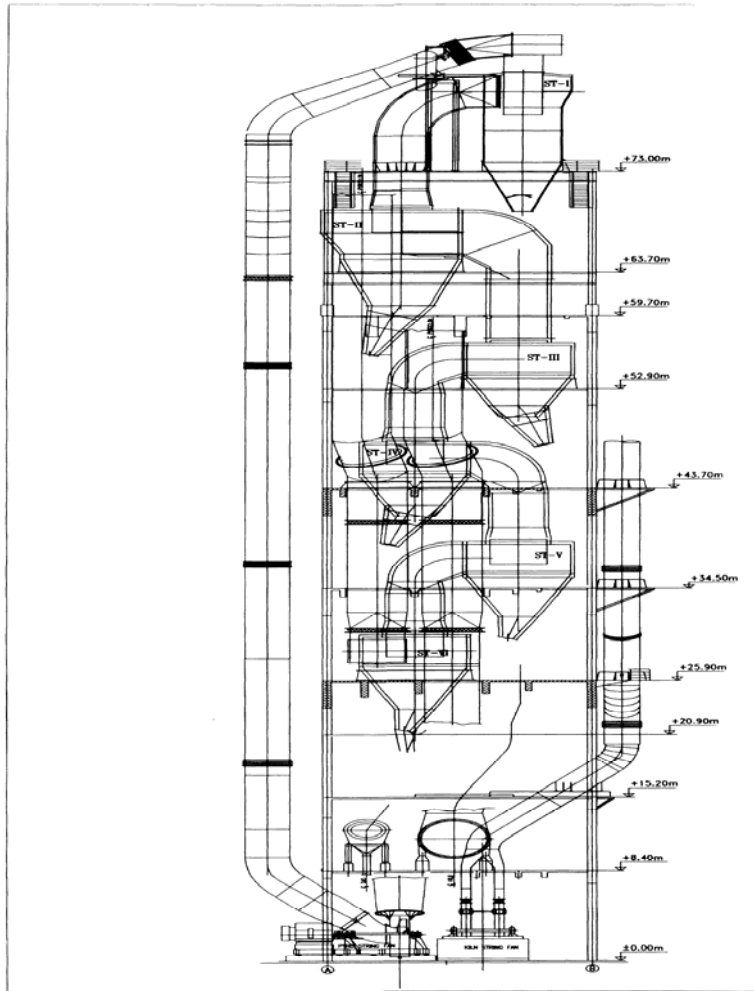


**HENCE IT WAS DECIDED TO REDUCE SPECIFIC POWER ON PYRO STRING FAN.**

## 2. PROBLEM FACED

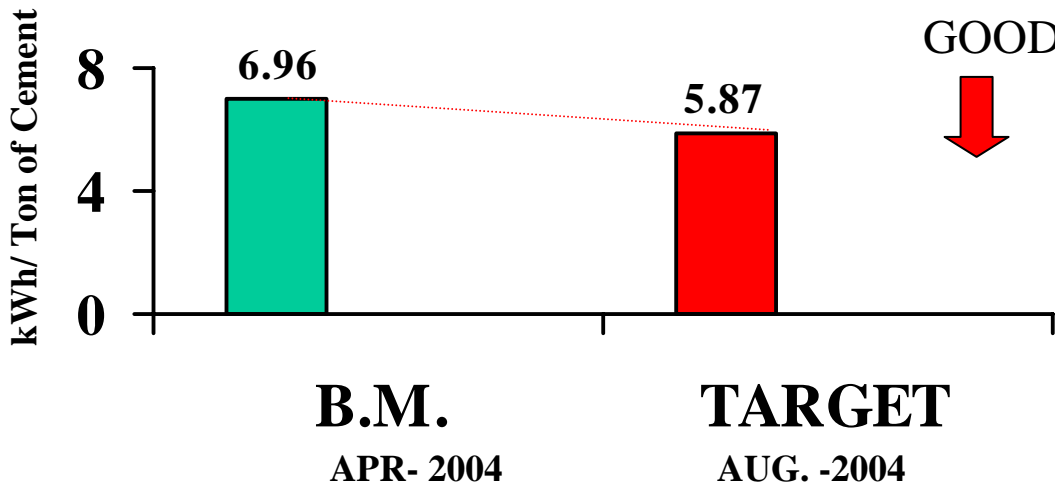
- HIGH SPECIFIC POWER AT PYRO STRING FAN BECAUSE OF HIGH GAS VOLUME AT HIGH EXIT GAS TEMPERATURE.
- LOW PREHEATER EXIT GAS TEMPERATURE IS REQUIRED FOR PET COCK GRINDING.

### 3. OUTLINE OF EQUIPMENT & PROCESSES



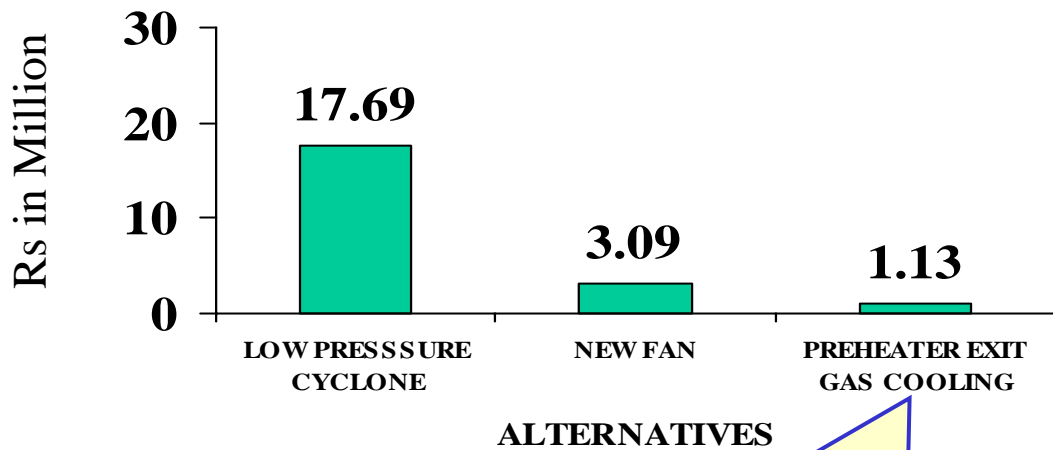
### 4. TARGET SETTING

#### PYRO STRING FAN SP. POWER CONSUMPTION



## 5. ANALYSIS

### ALTERNATIVES FOR REDUCTION POWER AT PREHEATER FAN



HENCE WE SELECT COOLING OPTION

**AS PER FAN LAW :**

$$V1/ T1 = V2 / T2 \text{ (AT CONSTANT PRESSURE)}$$

HENCE REDUCTION IN TEMPERATURE RESULTS IN REDUCTION IN FLOW (Q) THUS THE RPM OF THE FAN IS REDUCED.

$$\text{RPM}_{\text{initial}} (R_1) = 860 , \text{RPM}_{\text{final}} (R_2) = 810$$

$$\text{FAN POWER}_{\text{final}} = \text{POWER}_{\text{initial}} (R_1 / R_2)^3$$

$$= 130.42 \text{ kWh}$$

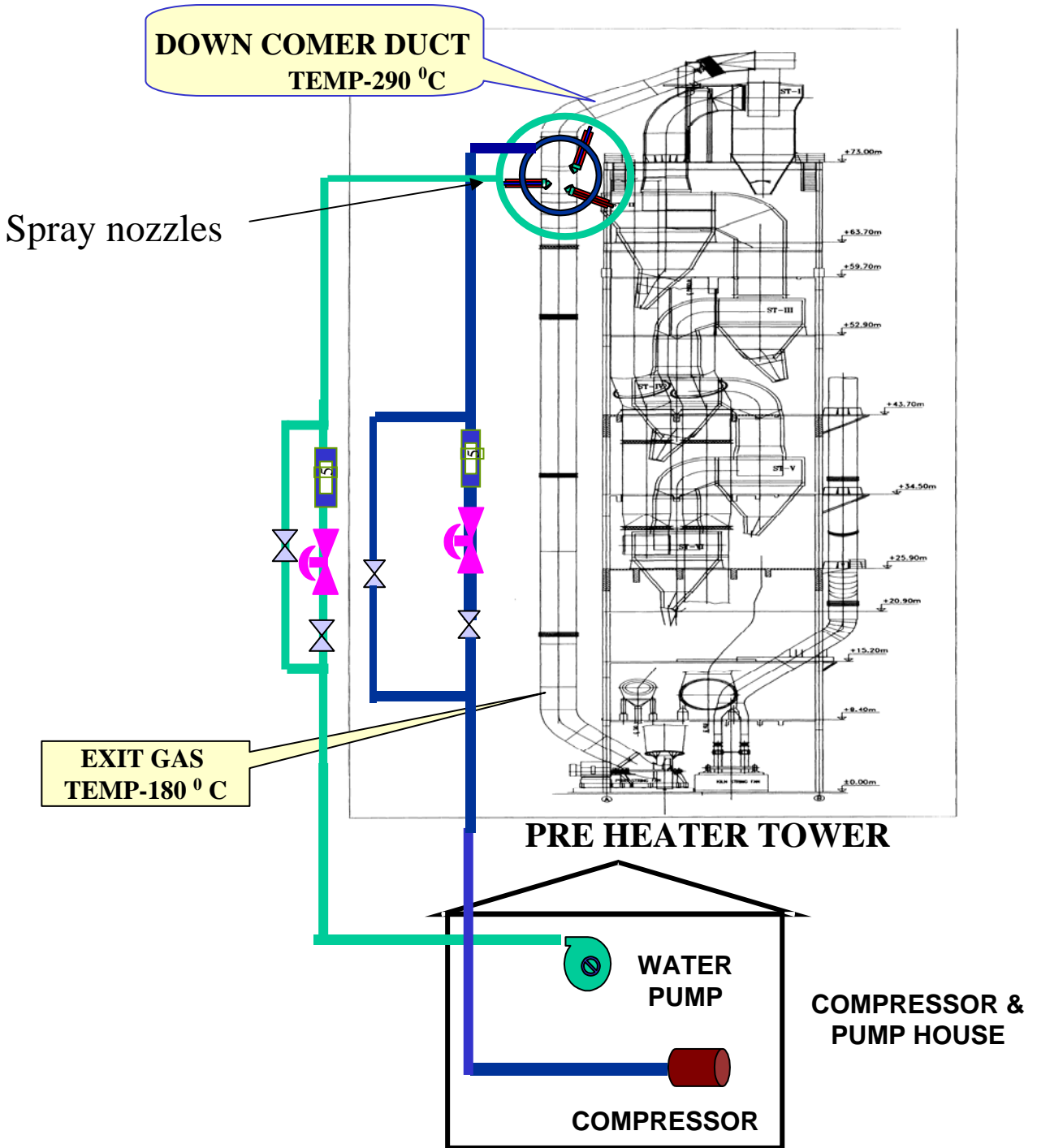
$$(1.08 \text{ kWh / Ton of cement.})$$

**FAN POWER CAN BE REDUCED BY COOLING THE PYROSTRING EXIT GAS TEMPERATURE AT CONSTANT PRODUCTION.**

## 7. KAIZEN CONTENT

**PROBLEM:** HIGH SPECIFIC POWER AT PYRO STRING FAN DUE TO HANDLING OF HIGH EXIT GAS TEMPERATURE.

**ACTIVITY :** EXIT GAS TEMPERATURE REDUCED BY WATER SPRAY IN DOWN COMER DUCT



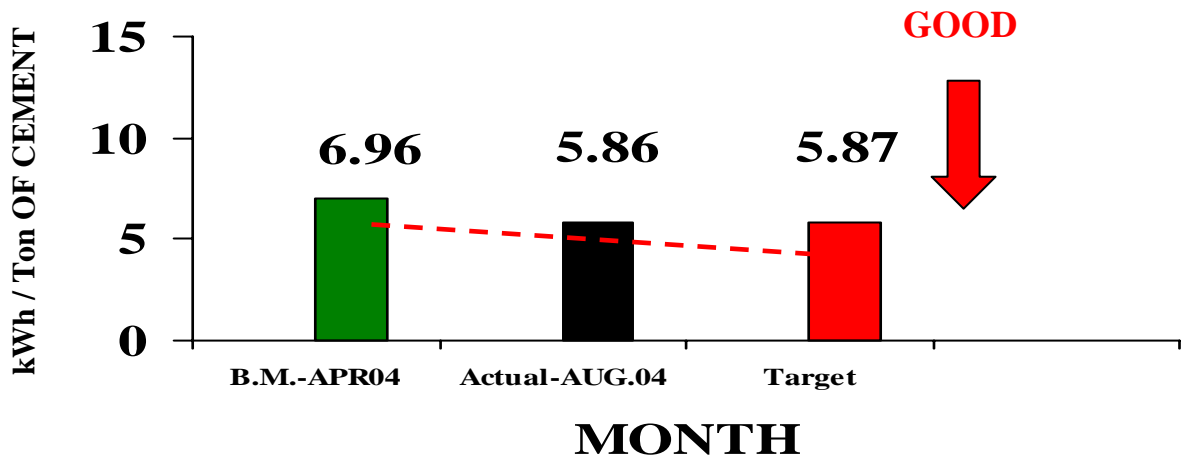
**EXIT GAS TEMPERATURE MEASURED :-**

**BEFORE KAIZEN 290<sup>0</sup> C**

**AFTER KAIZEN 180<sup>0</sup> C**

## 8. RESULTS

### SPECIFIC POWER OF PH FAN



### SAVING:-

A. SAVING (1.09 kWh / Ton OF CEMENT)  
= 1.09 X 2874 X 345 DAYS X 4.08 Rs./ kWh.  
= **Rs. 4.41 Million / Year.**

### ADDITIONAL BENEFITS: -

B. REDUCTION OF BREAK DOWN DUE TO FAN VIBRATION. (LAST 3 YEAR AVERAGE BREAK DOWN 6.25 HOURS WITH 2 FREQUENCY PER YEAR )

SAVING = 6.25Hrs.X 119.75TPH X Rs. 625/ Ton  
= **Rs.0.46 Million / Year.**

INSTALLATION COST = **Rs.18.00 Lacs**

TOTAL SAVING = **Rs. 48.7 Lacs / Year.**