Turning **insight** into **action**.

OSIsoft. USERS CONFERENCE 2011

Improving Equipment Availability and Reliability Through the PI System

Presented by **R.R. Mehta, General Manager – Instrumentation & Tech Services, UltraTech Cement Ltd., India**

Agenda

- Aditya Birla Group - Overview
- UltraTech Cement Ltd - Overview
- PI System at UltraTech Cement Ltd
- PI Server Architecture at Aditya Cement
- Various Application being used at Aditya Cement
- Performance calculations
- Performance data comparison with other units
- Conclusion & future plan

Who We Are

- India's first truly multinational corporation with revenues of US $ 29.2 bn
- 100 state-of-the-art manufacturing units and sectoral services in over 27 countries across 6 continents.
- Over 60 per cent revenues flow from operations outside India.
- Anchored by a workforce of 130,000 employees belonging to over 30 different nationalities.
- Voted the Best Employer in India and among the top 20 in Asia by the Hewitt-Economic Times and the Hewitt-Wall Street Journal Study 2007.
- Adjudged Asia Pacific Top Company for Leaders 2009 by Hewitt – Fortune

Australia | Bangladesh | Brazil | Canada | China Dubai | Egypt | France | Germany | Hungary | India Indonesia | Italy | Korea | Laos | Luxembourg Malaysia | Myanmar | Philippines | Singapore Switzerland | Thailand | UK | USA | Vietnam

Our Businesses

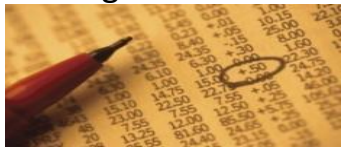

Acrylic Fibres


Agri Business


Carbon Black


Cement


Chemicals


Financial Services


Insulators


IT / ITES


Metals


Mining


Pulp & Fibre

Retail


Telecom

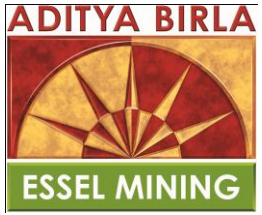

Textiles & Apparels

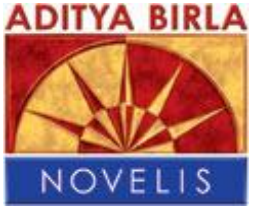

Trading

Our Businesses

- **Globally**
  - A metals powerhouse, with the world's largest aluminum rolling company
  - No. 1 in viscose staple fibre
  - Fourth largest producer of insulators
  - Eleventh largest producer of cement
  - Among the world's top 15 BPO companies
  - Among the best energy efficient fertilizer plants
- **India**
  - A premier branded garments player
  - Second largest player in viscose filament yarn
  - Second largest in Chlor – alkali sector
  - Second largest producer of cement
  - Among India's top 4 BPO companies
  - Among the top five mobile telephony players
  - A leading player in Life Insurance and Asset Management
  - Among the top three super-market chains in the retain business

Key Companies



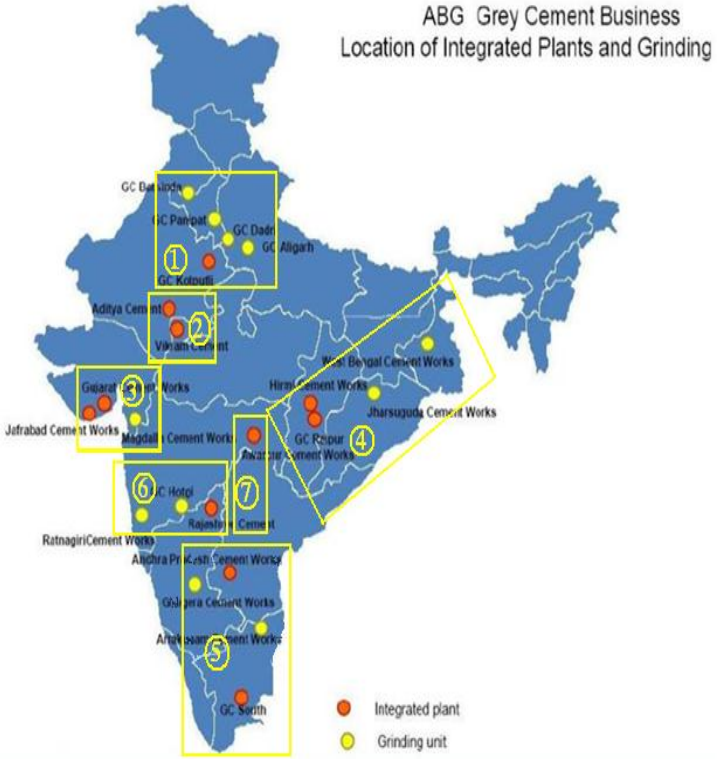


Key Brands

Our Valued Customers

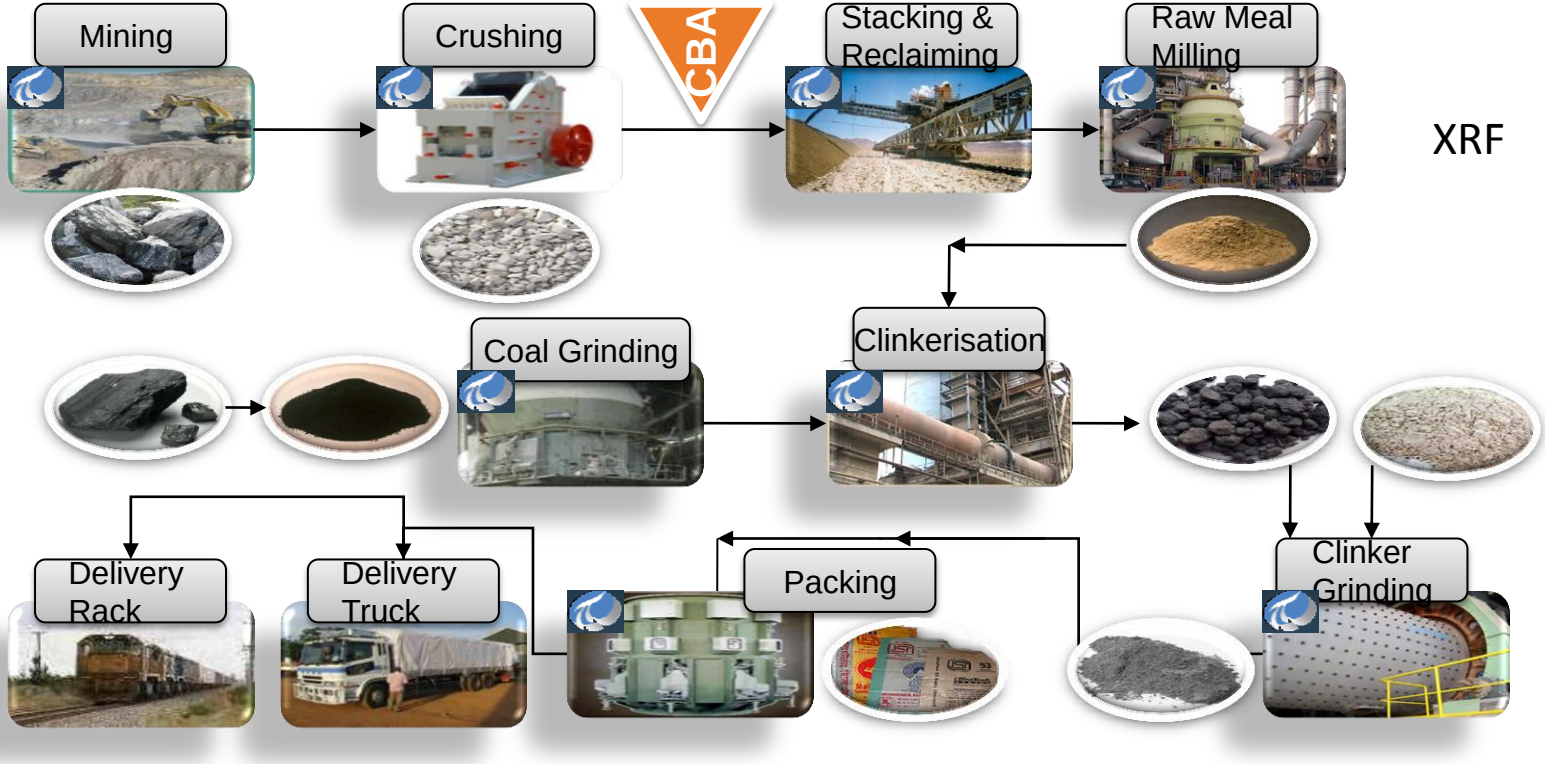
- Agfa-Gevaet
- Anheuser-Busch
- Ashtrom
- Bayer AG
- Benetton
- Bridgestone
- Cadbury
- Carrier
- Citibank
- Coca-Cola
- Colgate Palmolive
- Crown Cork & Seal
- Dockers
- DuPont
- Ford
- Fujifilm
- Geabtt
- General Electric
- General Motors
- Glaxo SmithKline
- Goodyear
- Haldia Petrochemicals
- Henkel
- Honda
- IFFCO
- JC Penny
- Kimberly Clarke
- Kodak
- Konica
- LG
- Lotte Aluminum
- Marks & Spencer
- Michelin
- Mitsui
- Mitsubishi
- Morgan Stanley
- Nestle
- Nissan
- Pepsi
- Pirelli
- Proctor & Gamble
- Ralph Lauren
- Rexam
- Ryerson Tull
- Sandler
- Sara Lee
- Schneider
- Scullers
- Siemens
- Suzlon
- Target
- Tata Chemicals
- Tetra Pak
- ThyssenKrupp
- Toyota
- Unilever
- 3M

UltraTech Cement Ltd.



- 51.8 million TPA of gray cement across 22 plants. (Largest Cement producing company in India)
- 0.55 million TPA of white cement.
- 504MW of captive thermal plants.
- 13.6 million cubic meters of ready-mix concrete across 70 plants
- Gray Cement, White Cement, RMC
- ETA Star – 3 MTPA of cement across 1 Integrated Plant + 4 grinding units in UAE, Bangladesh and Bahrain
- Serving market at India, UAE, other south Asian countries
- Sites across India
  - 12 integrated Plants
  - 11 Grinding units
  - 6 Bulk Terminals
  - 70 RMC units

Cement Process



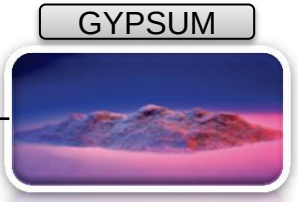
Types of Cement


LIMESTONE

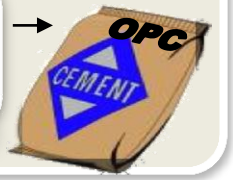

CRUSHED LS


RAW MEAL


CLINKER


GYPSUM

FLYASH




SLAG

OPC: ORDINARY PORTLAND
PPC: POZZALANA PORTLAND
PSC: PORTLAND SLAG

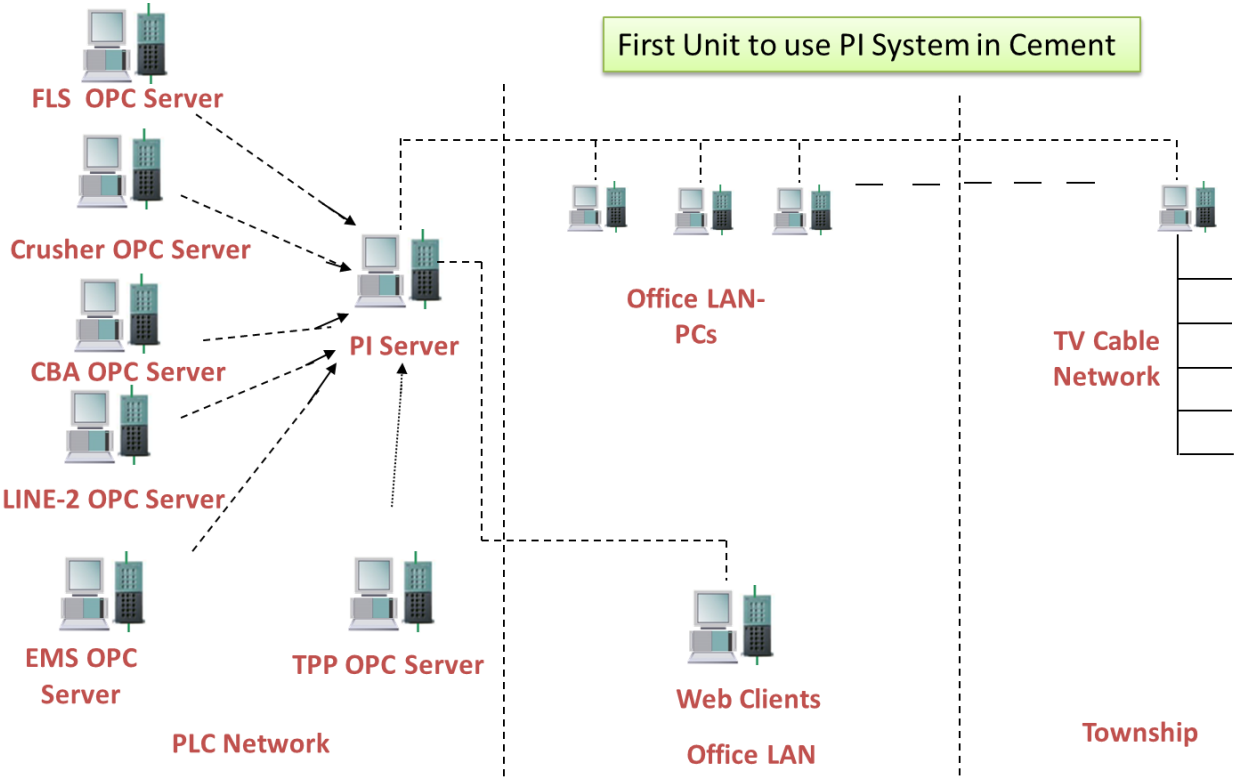
PI Server Installations at UltraTech Cement Units

- 11 integrated plants
- 10 grinding units
- All PI Server accessible from any location
- PI Server installed at new sites locations at KCW & 4 grinding units

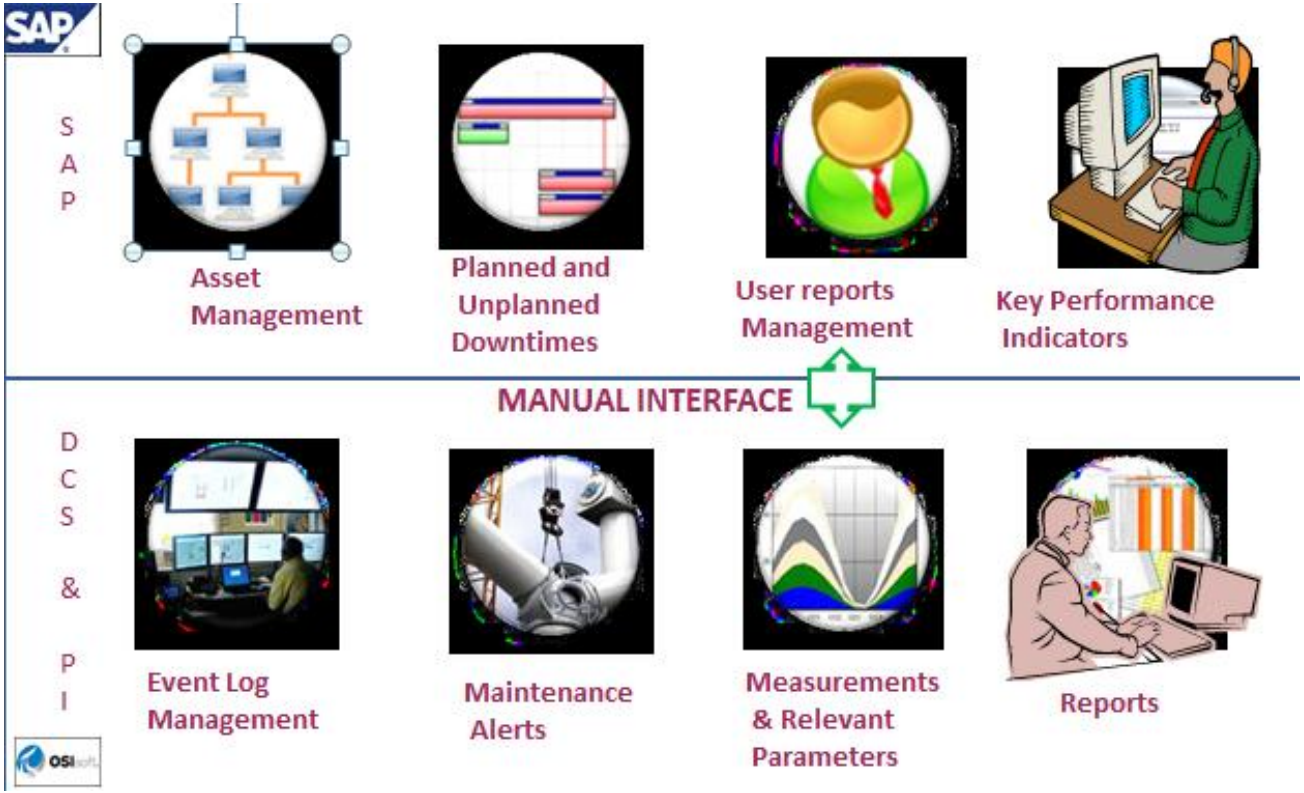
PI System Architecture Main Features

- More than 100k tags configured different site.
- More than 100 concurrent users.
- Connectivity with different plant system (SCADA or DCS) for each peripheral PI System
- PI OPC Interface, PI Modbus Interface,…
- more than 1k calculated tags using PI Performance Equation, PI Totalizer and PI ACE
- PI ProcessBook and PI DataLink
- Web Portal .NET developed, integrated with PI System via PI SDK

PI System Architecture at UltraTech Cement Ltd. Aditya Cement Works Shambhupura



Plant Maintenance Management



PI System Applications Used at UltraTech Cement

PI ProcessBook

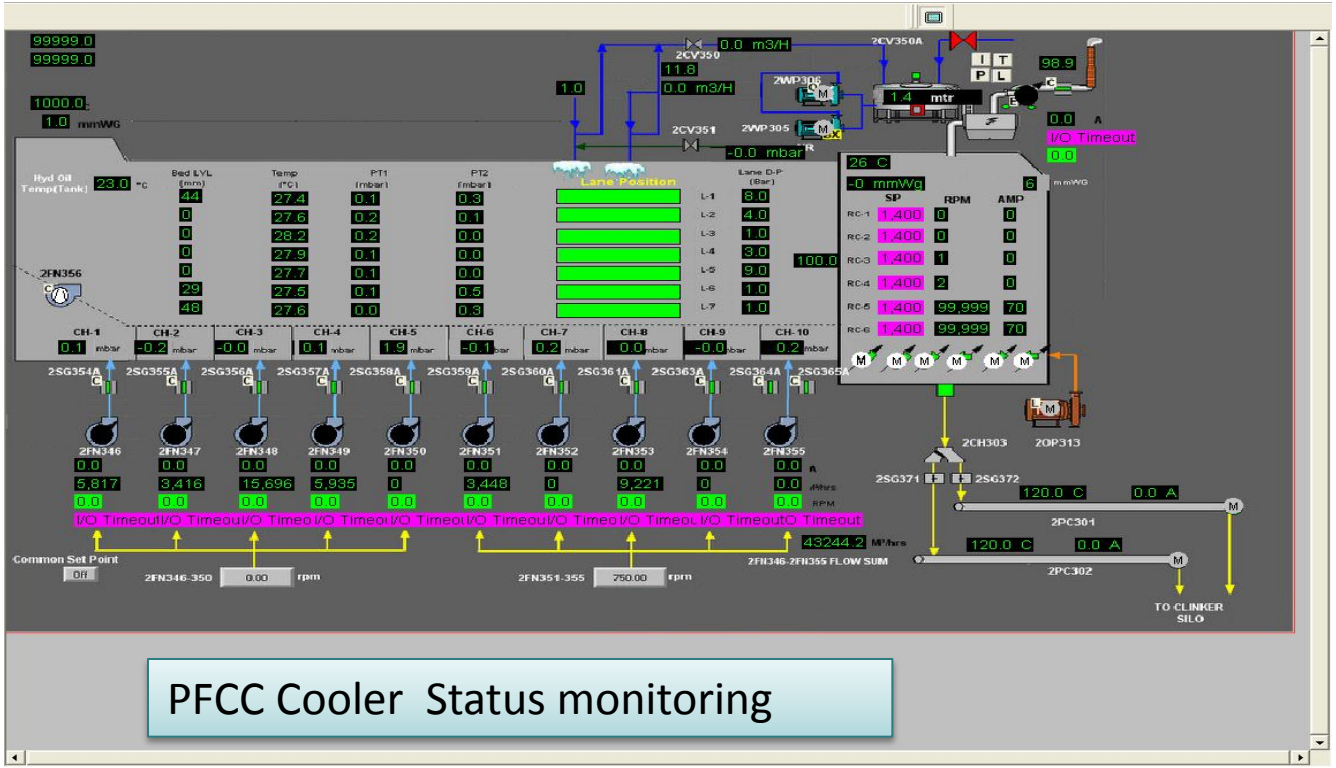
- 35 Standard Updated PI ProcessBook Screens Posted on web portal
- 175 Users can access PI System client application at AC.
- Various Production and Equipment Run Hour reports
- Logging of Quality parameters on PI Server

PI DataLink, Miniview

Application installed at users PC for monitoring of critical parameters

PI SMS prom, Auto email to respective individual on critical events with archiving & Time Stamp

PI ProcessBook Application

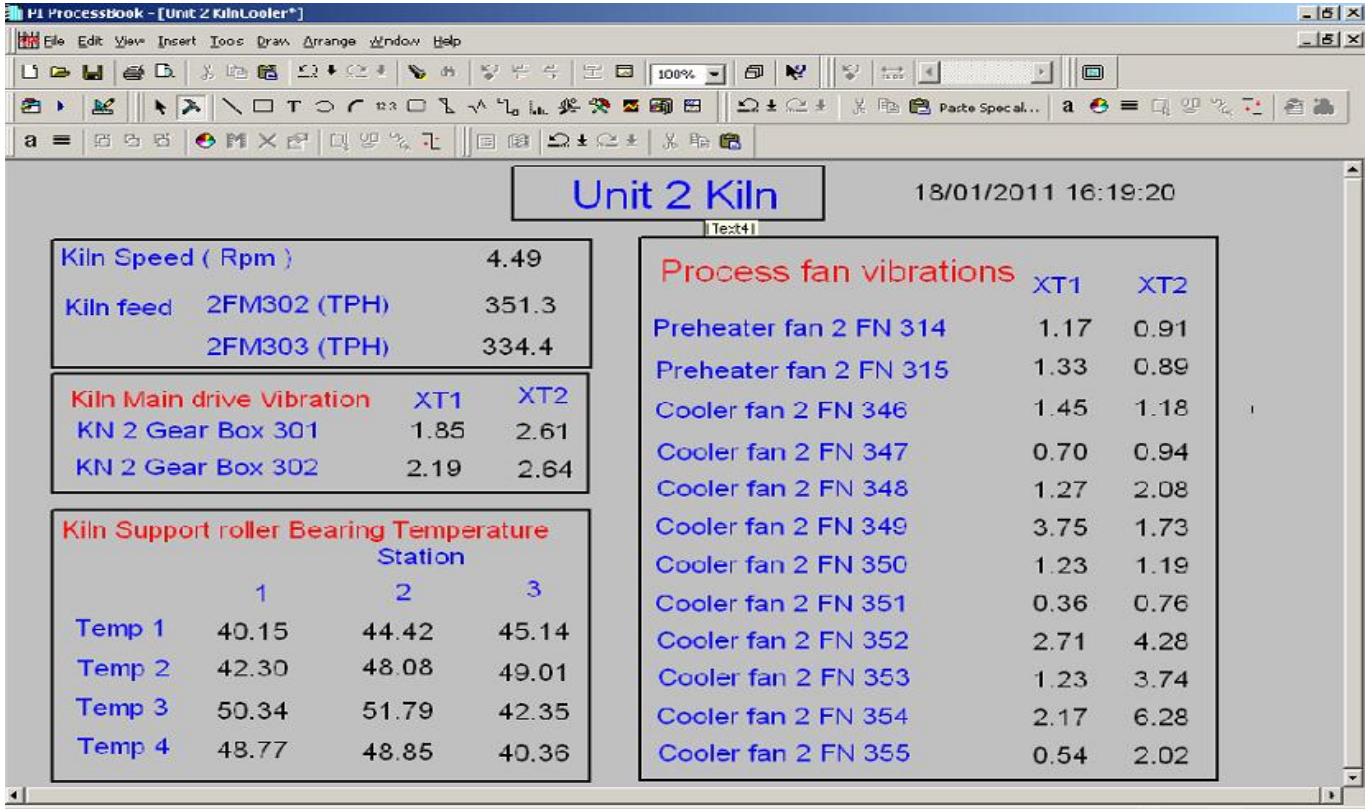


PFCC Cooler Status monitoring

Performance Calculations

- Logging of Quality parameters on PI Server
- Generation of various log sheet for operation
- Logging of Quality lab parameters
- Run Hours and Batch Counters report
- Bag Counter and Dispatch report
- Equipment condition monitoring
- Daily power and output analysis
- Shift Operator Performance report

Example 1: Condition Monitoring



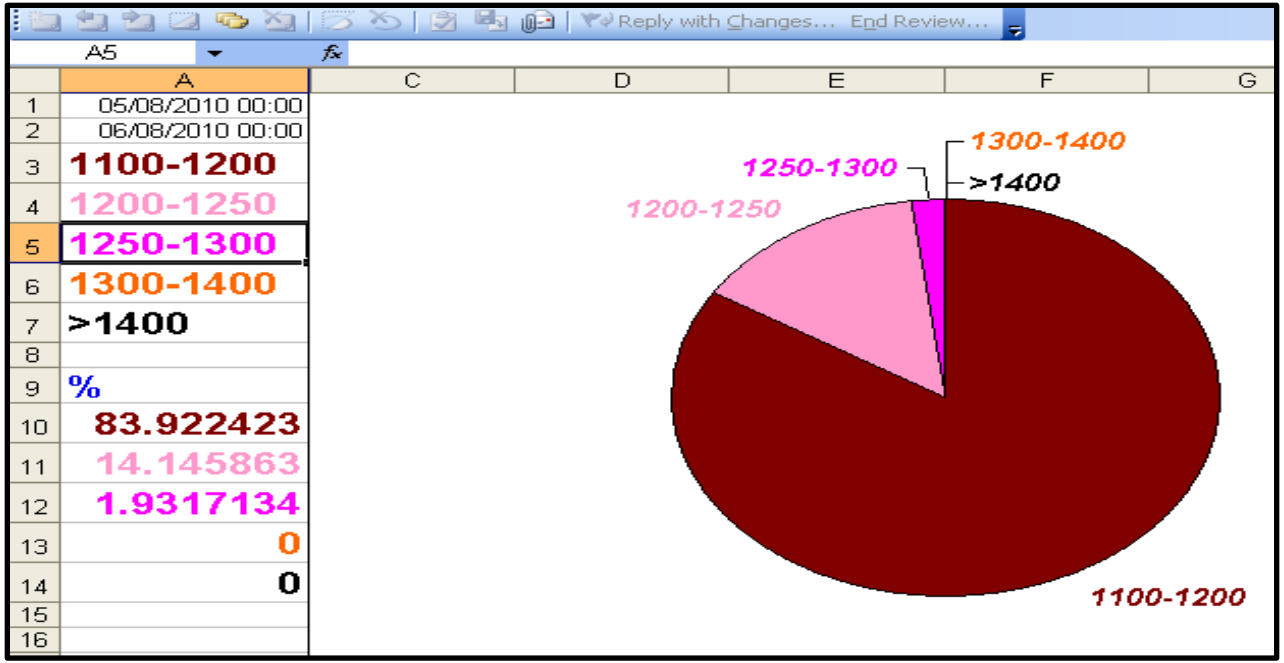
Example 2: Condition Monitoring

Kiln - Unit 1

Sl. No	PI Tag No	Descriptor	Eng Unit	Alarm 1	Alarm 2	Trip	Time of best achieved	Best achieved	1	2	3
Kiln support Rollers											
1	ACS KN TEMP KILN ROLLER1 1	KILN ROLLER BEARING STATION 1 TEMP-1	0C	55	68		13-Jan-10 11:42:39	41.5	45.6	47.1	45.9
2	ACS KN TEMP KILN ROLLER1 2	KILN ROLLER BEARING STATION 1 TEMP-2	0C	55	68		14-Jan-10 11:39:56	31.7	43.1	44.1	41.6
3	ACS KN TEMP KILN ROLLER1 3	KILN ROLLER BEARING STATION 1 TEMP-3	0C	55	68		14-Jan-10 11:39:56	33.3	43.2	45.8	42.8
4	ACS KN TEMP KILN ROLLER1 4	KILN ROLLER BEARING STATION 1 TEMP-4	0C	55	68		14-Jan-10 11:39:56	34.9	48.7	48.4	47.9
Kiln main drive & Girth gear											
5	ACS KN TEMP KN301 MTR DE BRG	KILN MTR 301 DE BRG	0C	75	95		08-Mar-10 07:31:48	40.5	49.3	49.4	48.1
6	ACS KN TEMP KN301 MTR NDE BRG	KILN MOTOR 301 NDE BRG TEMP	0C	85	95		14-Jan-10 03:09:28	40.2	62.1	62.3	59.2
7	ACS KN TEMP KN301 GB 1	KILN GEAR BOX TEMPERATURE - 1	0C	75	90		10-Jan-10 05:24:30	52.2	60.1	57.8	55.4
8	ACS KN TEMP KN301 GB 2	KILN GEAR BOX TEMPERATURE - 2	0C	75	90		07-Aug-10 16:19:43	47.6	45.3	44.0	42.5
9	ACS KN TEMP KN301 GB 3	KILN GEAR BOX TEMPERATURE - 3	0C	75	90		14-Jan-10 11:39:56	58.5	62.0	61.9	59.8
10	ACS KN TEMP KN301 GB 4	KILN GEAR BOX TEMPERATURE - 4	0C	75	90		14-Jan-10 11:39:56	58.7	64.6	64.9	63.6

Better Alarm 1 Alarm 2 Trip

Example 3: Quality Parameters Monitoring



- Burning Zone temp distribution on Max clinker production day 5 Aug 2010
- Helps while maintaining BZ temp for optimized production

Example 4: Shift Operator Performance Report

Date	SHIFT	NAME OF OPERATOR	RATE ACHIVED (TPH)			POWER (Kwh/MT)		
			OPC	PPC	T-40	OPC	PPC	T-40
08-Jun-10	A	Mr Ashish Sharma	247	253		26.78	26.52	
	B	Mr Devendra Pal Singh	249			26.71		
	C	Mr. Ghanshyam Mardni	261	253		25.43	26.83	
09-Jun-10	A	Mr Ashish Sharma	242	271		27.44	25.05	
	B	Mr Devendra Pal Singh	208	269	125	31.39	25.50	51.55
	C	Mr. Ghanshyam Mardni	251	260	123	26.80	25.84	52.73
10-Jun-10	A	Mr Ashish Sharma&Mr. Gautam Jain	247			25.95		
	B	Mr Devendra Pal Singh&Mr Mukesh Chaplot	255	257		26.05	25.83	
	C	Mr. Ghanshyam Mardni&Mr.Vinay Dodia		268			24.07	
11-Jun-10	A	Mr S Srivastava&Mr. Gautam Jain	261	259		25.17	23.50	
	B	Mr R.Kabra&Mr Mukesh Chaplot	289	267	136	22.09	23.30	46.69
	C	Mr Ashish Sharma&Mr Devendra Pal Singh	283	283	128	23.13	24.01	49.98

- Report rewards for the performance of the operator and sets new targets.

Example 5: Packing Plant Bag Counter Report

B3 22/09/2010

	B	C	D	F	J	L	M	Q	S	T	X	Z	AA	AE	AG	AH	AL	AN	AO
2	(dd/mm/yy)																		
3	September 22, 2010																		
5			Packing Plant Bag Counters																
6			September 22, 2010		BC802			BC812			BC822			BC832			BC834		
7	Belt	Total (Tons)	From	To	Counts	Mins	Rate	Counts	Mins	Rate	Counts	Mins	Rate	Counts	Mins	Rate	Counts	Mins	Rate
8	BC802	690.05	12:00 AM	01:00:00	876	48	18	881	48	18	0	0	####	0	0	###	0	0	###
9	BC812	961.7	1:00 AM	2:00 AM	1105	47	24	935	32	30	0	0	####	0	0	###	0	0	###
10	BC822	485	2:00 AM	3:00 AM	898	48	19	830	48	17	0	0	####	0	0	###	0	0	###
11	BC832	487.25	3:00 AM	4:00 AM	889	43	21	1242	50	25	0	0	####	0	0	###	0	0	###
12	BC834	105.15	4:00 AM	5:00 AM	743	35	21	1164	46	25	0	0	####	0	0	###	0	0	###
13			5:00 AM	6:00 AM	881	32	27	1007	40	25	0	0	####	0	0	###	0	0	###
14			6:00 AM	7:00 AM	880	47	19	883	41	21	0	0	####	226	24	10	0	0	###
15	Total Despatch 22-Sep		7:00 AM	8:00 AM	340	20	17	548	36	15	589	40	15	296	27	11	0	0	###
16	2729	Tons	8:00 AM	9:00 AM	223	14	16	1105	47	23	604	44	14	564	54	11	0	0	###
17			9:00 AM	10:00 AM	123	8	15	295	26	11	346	17	20	453	24	19	0	0	###
18	till last hour		10:00 AM	11:00 AM	33	5	6	413	34	12	0	0	####	0	0	###	0	0	###
19			11:00 AM	12:00 PM	1102	53	21	1237	53	23	0	0	####	0	0	###	478	30	16
20			12:00 PM	1:00 PM	651	33	19	757	46	17	549	45	12	571	43	13	55	5	11
21			1:00 PM	2:00 PM	546	19	28	817	43	19	558	34	17	1041	51	20	0	0	###
22			2:00 PM	3:00 PM	322	29	11	354	29	12	666	40	17	821	46	18	0	0	###
23			3:00 PM	4:00 PM	817	41	20	790	48	17	0	0	####	19	0	###	0	0	###
24			4:00 PM	5:00 PM	46	4	12	784	48	16	448	29	16	393	28	14	0	0	###
25			5:00 PM	6:00 PM	259	11	24	902	58	16	845	46	18	731	50	15	0	0	###
26			6:00 PM	7:00 PM	296	20	15	566	33	17	517	24	21	229	19	12	0	0	###
27			7:00 PM	8:00 PM	0	8	0	286	17	17	861	50	17	794	59	14	0	0	###
28			8:00 PM	9:00 PM	494	34	14	552	44	13	746	35	21	884	49	18	0	0	###
29			9:00 PM	10:00 PM	364	26	14	826	47	17	792	55	14	479	34	14	0	0	###
30			10:00 PM	11:00 PM	703	42	17	808	54	15	934	40	24	1025	49	21	779	44	18
31			11:00 PM	12:00 AM	1210	55	22	1252	60	21	1245	52	24	1219	53	23	791	45	18

- 10 Nos of PI Tags + PI DataLink features makes the report available on a single click, by entering date in a cell, history data can be called.

Example 6: Manual Discharged Bag Counter Report

Manual Discharged Bag Counter Report			
S.No.	Line 2 Packer Number	Yesterday	Today
1	2PK801	0	0
2	2PK802	64	1
3	2PK803	11	0
4	2PK804	31	27
5	2PK851	118	61
6	2PK852	246	83
7	2PK853	32	9
8	2PK854	187	60
Total (No. of Bags)		**689**	**241**

- Helps while maintaining and achieving six-sigma level
- History data can be called by altering date Excel formula

Case Study 1: Idle Running of Compressors

Analyzing parameters:

- Compressor running hours average taken for one month
- Header compressed air pressure average taken for one month

Observations:

- 5 Compressor running for more than 23 hrs average
- Average comp. Air pressure found to be above 6.0 kg/cm2

Action :

- 1 compressor taken in auto start and stop in PLC to maintain header pressure of 5.5 kg/cm2

Benefit :

- 100-125 Running Hrs saved in a month

Case Study 2: Kiln Feed Consistency

Analyzing parameters:

Clinker output rate found to be highest in July'10 (5078 TPD)

Team constituted to find out the reasons for such a high degree of consistency

Observations:

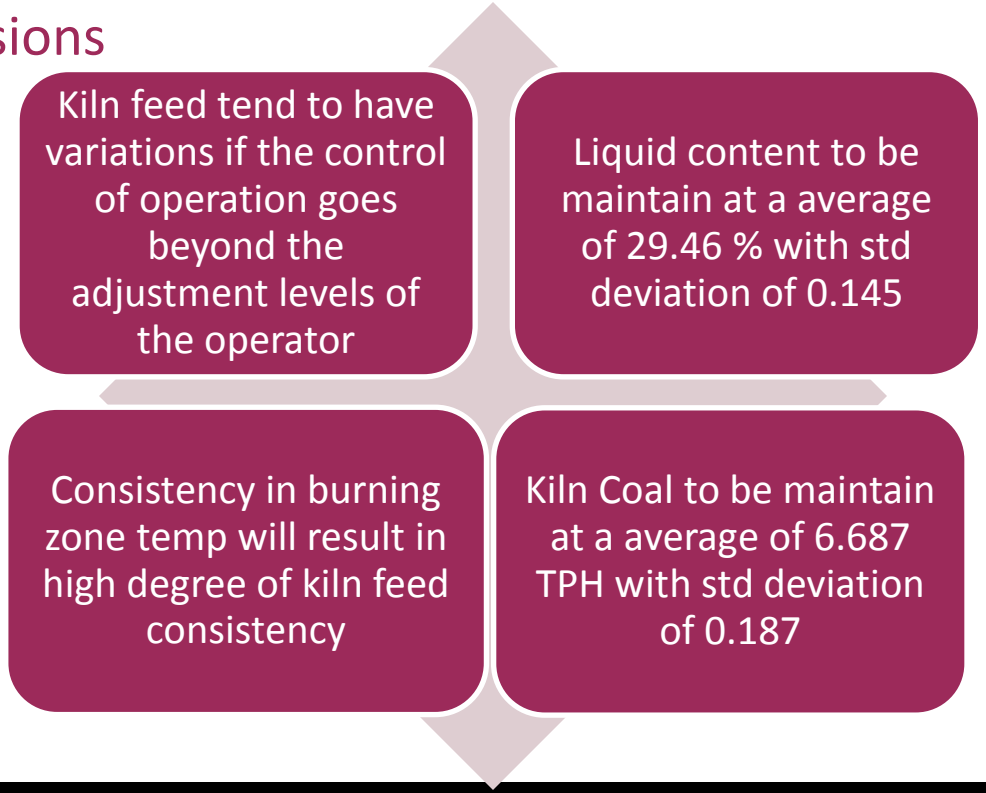
Feed increased gradually, Raw-mix designed for imported coal at PC firing

Process and Quality data collected from PI System to analyzing the performance

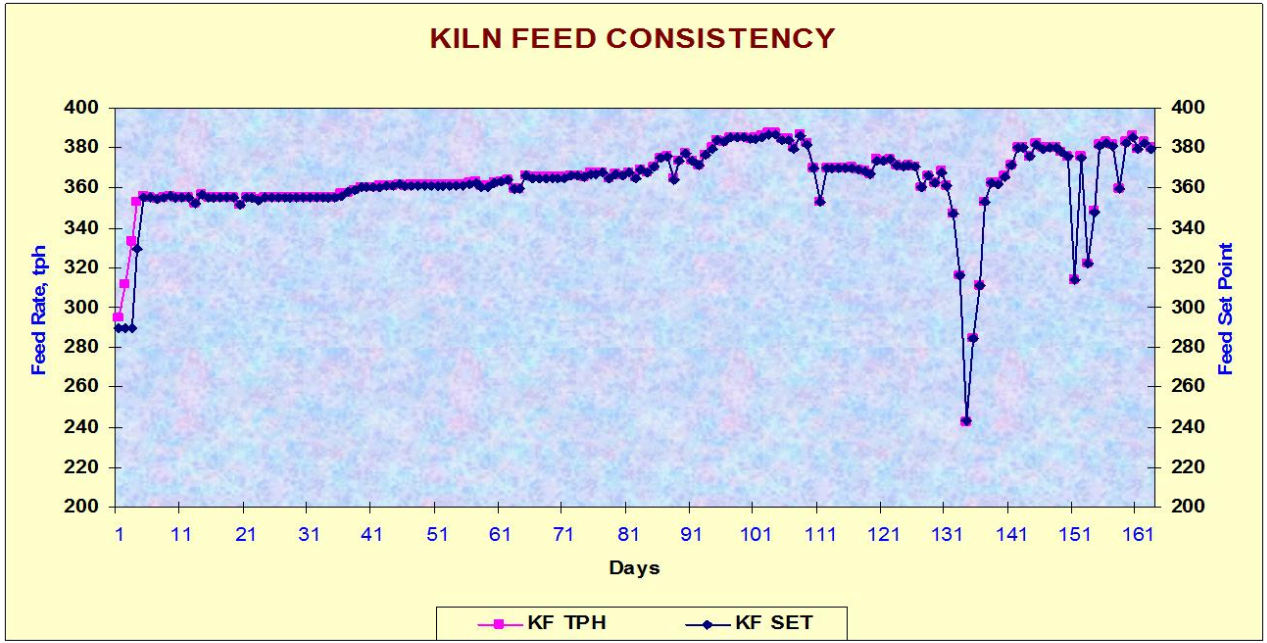
PI System used for analyzing the data and studying correlation.

Case Study 2: Kiln Feed Consistency

- Conclusions



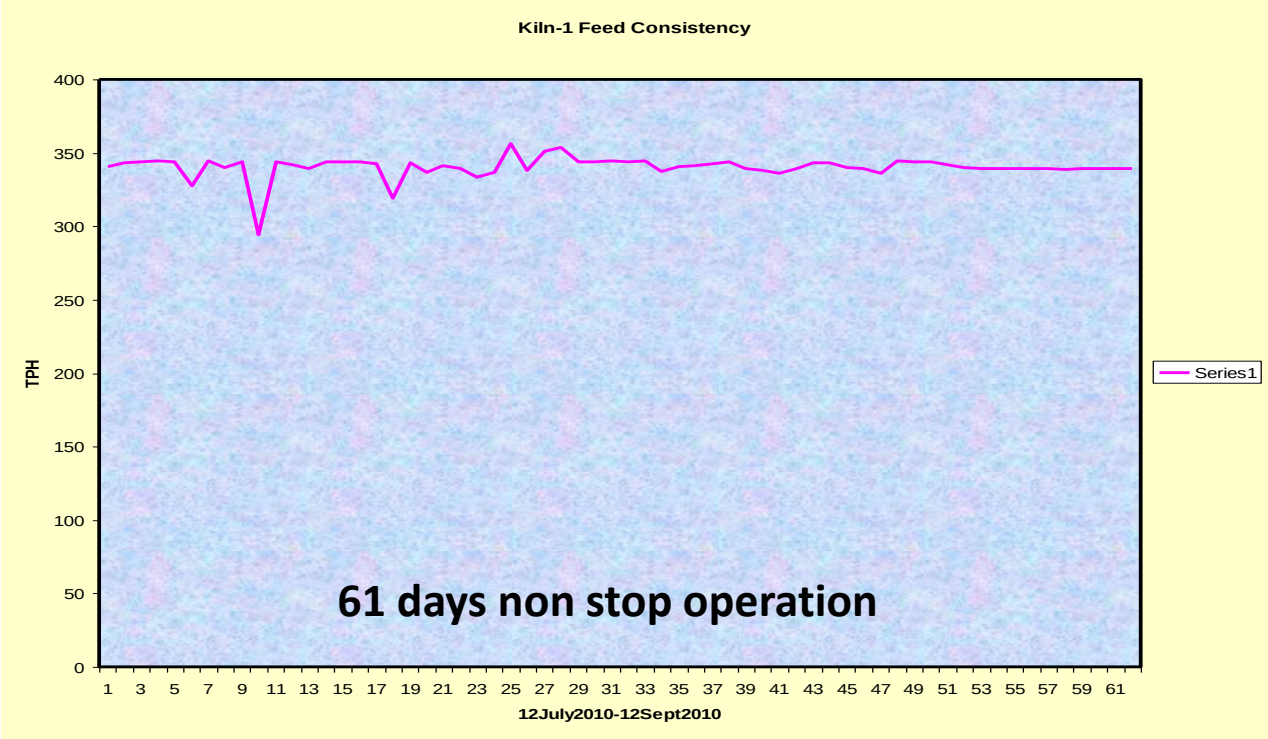
Case Study 2: Kiln Feed Consistency



161 days non stop operation

FY 08-09

Case Study 2: Kiln Feed Consistency

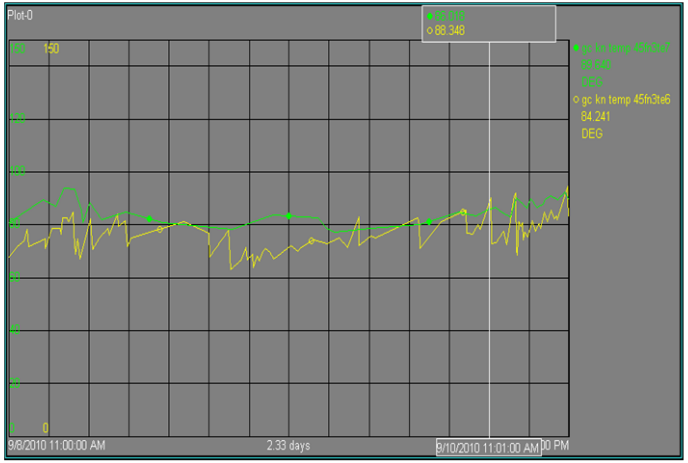


Case Study 3: Improving Equipment Availability and Reliability

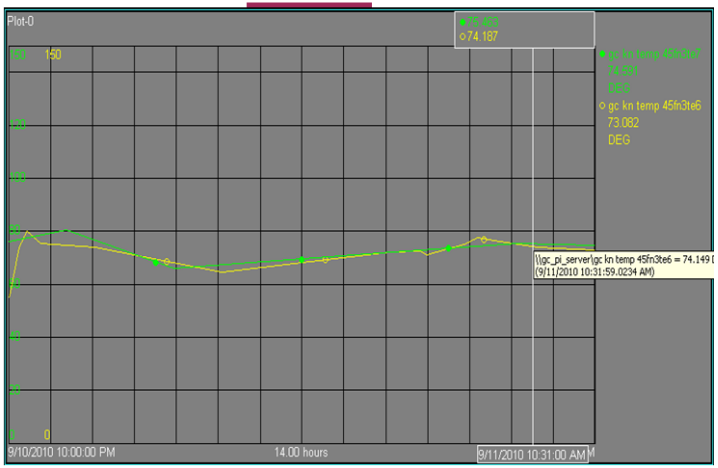
Occurrence: Unexpected behavior after plant shutdown

Observation: COOLER EXHAUST FAN BEARING TEMPERATURE HIGH

BEFORE



AFTER



Analyzing Parameters: Through PI System data was used to analyse the situation

Case Study 3: Improving Equipment Availability and Reliability

Possible Reason 1: Fan Balancing problem – No (Vibration Normal).

Possible Reason 2: Lubrication system problem – No.

Possible Reason 3: External Cooling (Water & Air) – Not Effective.

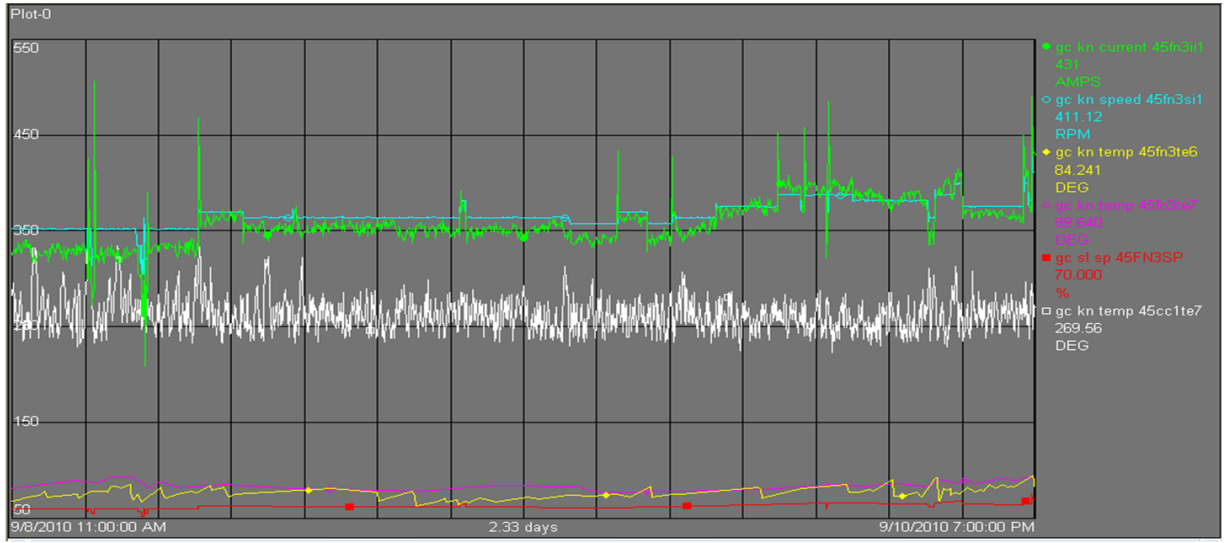
Possible Reason 4: Cooler Exhaust Temperature High – No.

WHAT WAS THE ACTUAL REASON FOR TEMPERATURE RISE?

PI System data was used to study the system .

Case Study 3: Improving Equipment Availability and Reliability

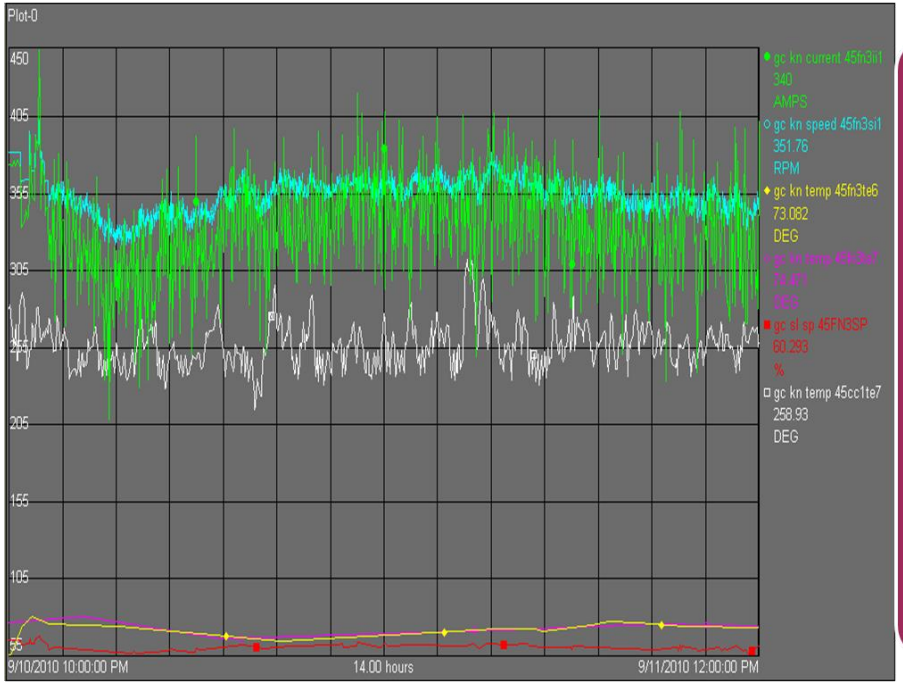
NEXT STEP: Data Analysis through PI ProcessBook



Conclusion: Though PI system only it was possible to analyze the system and overcome the problem. Additional air flow in system, due to damper opening up to 70% was causing process disturbances .

Case Study 3: Improving Equipment Availability and Reliability

RESULT: DATA ANALYSIS THROUGH PI ProcessBook



After calculation at Present gas temperature 250 C – 260 c the calculated gas density is 0.67 Kg/m^3, which ultimately increases the mass of gas.

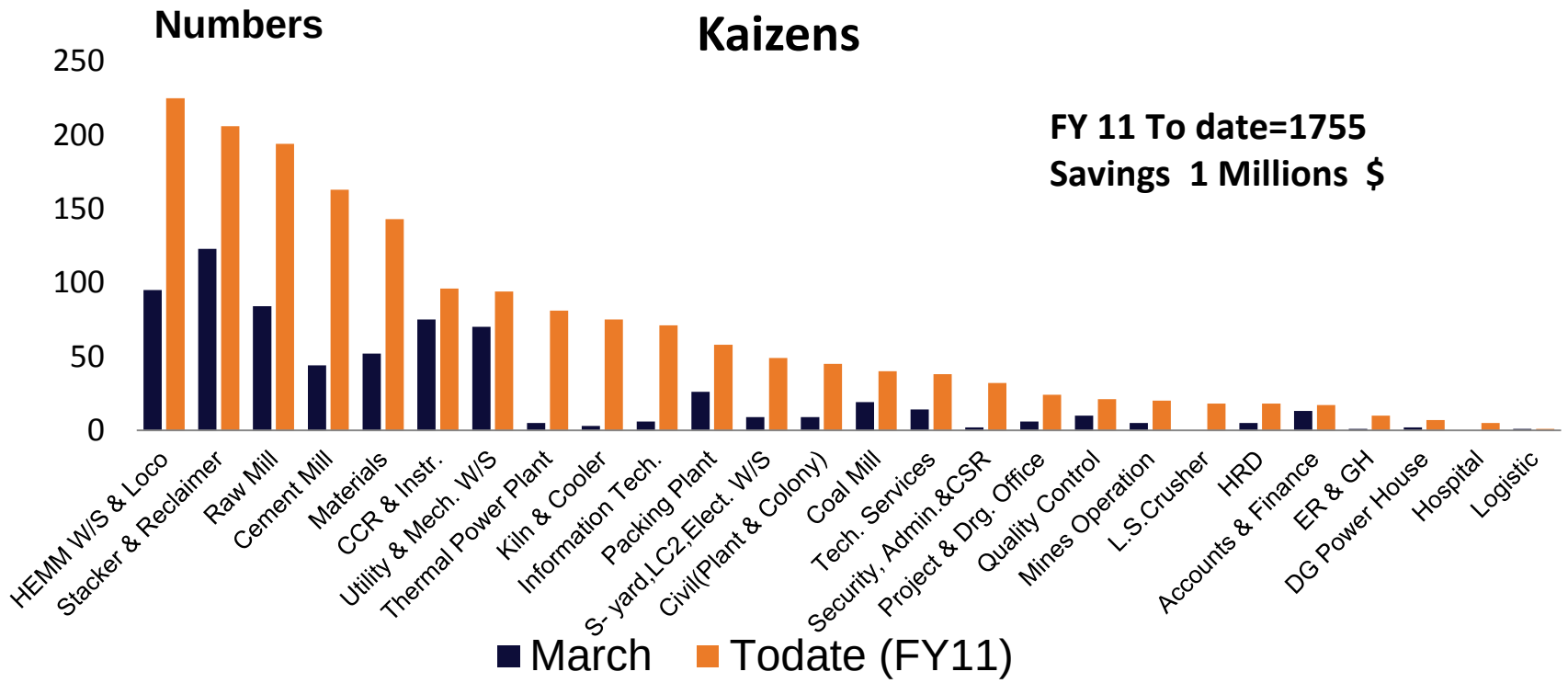
Case Study 3: Improving Equipment Availability and Reliability

RESULT: Data Analysis Through PI ProcessBook

DATE	8/9/10 TO 10/9/10	10/9/10 TO 11/9/10
TIME	11AM TO 7PM	10PM TO 12 PM
CURRENT	431	340
RPM	411	352
DE TEMP.	84 (with external cooling)	72
NDE TEMP.	89.9 (with external cooling)	74
GAS TEMP.	270	259
PID OPERATION	MANUAL	AUTO
EXT. COOLING	YES	NO
SET POINT (RPM)	70%	60.3%

Advantage: Through PI System data it was possible to study the **"System as a whole"**

Improvement Cases at Aditya Cement



Results and Performance Data

Performance data comparison with other units

Sl No	Index		Best in the World	Best in the Group	Lowest in the Group
5.	**Equipment Performance - Kiln**				
a.	Thermal Energy	kcal/kg of clinker (Based on fine coal)	APCW		NJFD
b.	Electrical Energy	kWh / tonne of clinker		APCW	ACW-I
c.	Specific Output	(Actual MT of Clinker*24/Running hrs)/ Kiln Int. Volume; TPD/m3	HCW		ACW-I
d.	Burning Zone Load	Gcal/m2h		APCW	ACW-I
e.	Cooler Grate Load	TPD/m2	HCW		NJFD
f.	Mean Time between Stops	Actual Running hrs/(No. of Total Stops > 5 mins.)	VC I		GCW-II
g.	Kiln Dust	mg/Nm3		GCW I	RC - II
h.	Cooler Dust	mg/Nm3		GS	RC - II
I.	CO2/tonne of Clinker (Raw Material & Fuel)	tonne	ACW II		NJFD
j.	CO2/tonne of Cement (Raw Material & Fuel)	tonne	GC		NJFD
k.	Clinker in Cement	%	GC		NJFD
l.	Overall Equipment Effectiveness	(Actual Specific Output/Median)* (Running hrs/hrs in a year)	GCW-I, HCW and RC-I		NJFD
m.	Refractory Consumption	Average Value (5 yrs)/Clinker production		VC	APCW

Performance data comparison with other units

1. Overall Rating

Star Ranking	2007-08	2008-09
4 Star	AC, VC, GC, GS, GCW, HCW and APCW	AC, VC, GS, GC, GCW, HCW and APCW
3 Star	RC and ACW	RC, ACW and NJFD

2.Energy Efficiency Rating

Star Ranking	2007-08	2008-09
5 Star	AC, VC and GC	VC
4 Star	GS, RC, GCW, HCW, ACW II, APCW	AC, GC, GCW, HCW, APCW, GS, RC and ACW
3 Star	ACW I and NJFD	NJFD

3.Kiln Reliability Rating (Mean Time between Stops)

Star Ranking	2007-08	2008-09
5 Star	AC and VC I/II/III	VC-I
4 Star	GC, ACW, HCW and APCW	AC, VC II/III, GS, GC, RC and ACW
3 Star	GS, RC I/II/III and GCW I/II	GCW-I, HCW and APCW

Conclusions

A PI System for data acquisition is the **first step towards a fully integrated PLANT MANAGEMENT SYSTEM**

Integrated solutions can be rapid go-live and allow full scalability for a complete information system throughout the company supplying data at plant level as well as management level and allowing full benchmarking capabilities

Through data management it is possible to thoroughly customize & adapt the most diverse business requirements (generation technology, processes, company, business, organization, geography, etc…) providing an integrated and homogeneous view.

Ultimately the business was able to drive through difficult economic recession phase.

Future Plan

3 NOS MAGA CEMENT PROJECTS AND 5 GRINDING UNITS ANOUNCED RECENTLY ANNOUNCED

RC IV at Rajshree cement , Karnataka

GCR 2 at Grasim Cement Raipur

ALL NEW PROJECTS TO HAVE INTEGRATED INFORMATION SYSTEMS FROM DAY 1

KARUR at **Tamilnadu**

Turning **insight** into **action**.

Thank you