Efficiency Improvement at Dahanu Thermal Power Station- a success story.

29 August 2012

Flow of Presentation

- Company Profile
- DTPS at Glance
- Plant Performance
- Approach for Efficiency Management
    - Performance Monitoring
    - Performance Review
    - Data Management and control
- Sustainability improvement Initiatives
- Use of Renewable Energy Resources
- Employees Involvement & Team Work
- Effectiveness in Reliability & Energy Efficiency Improvement

Company Profile

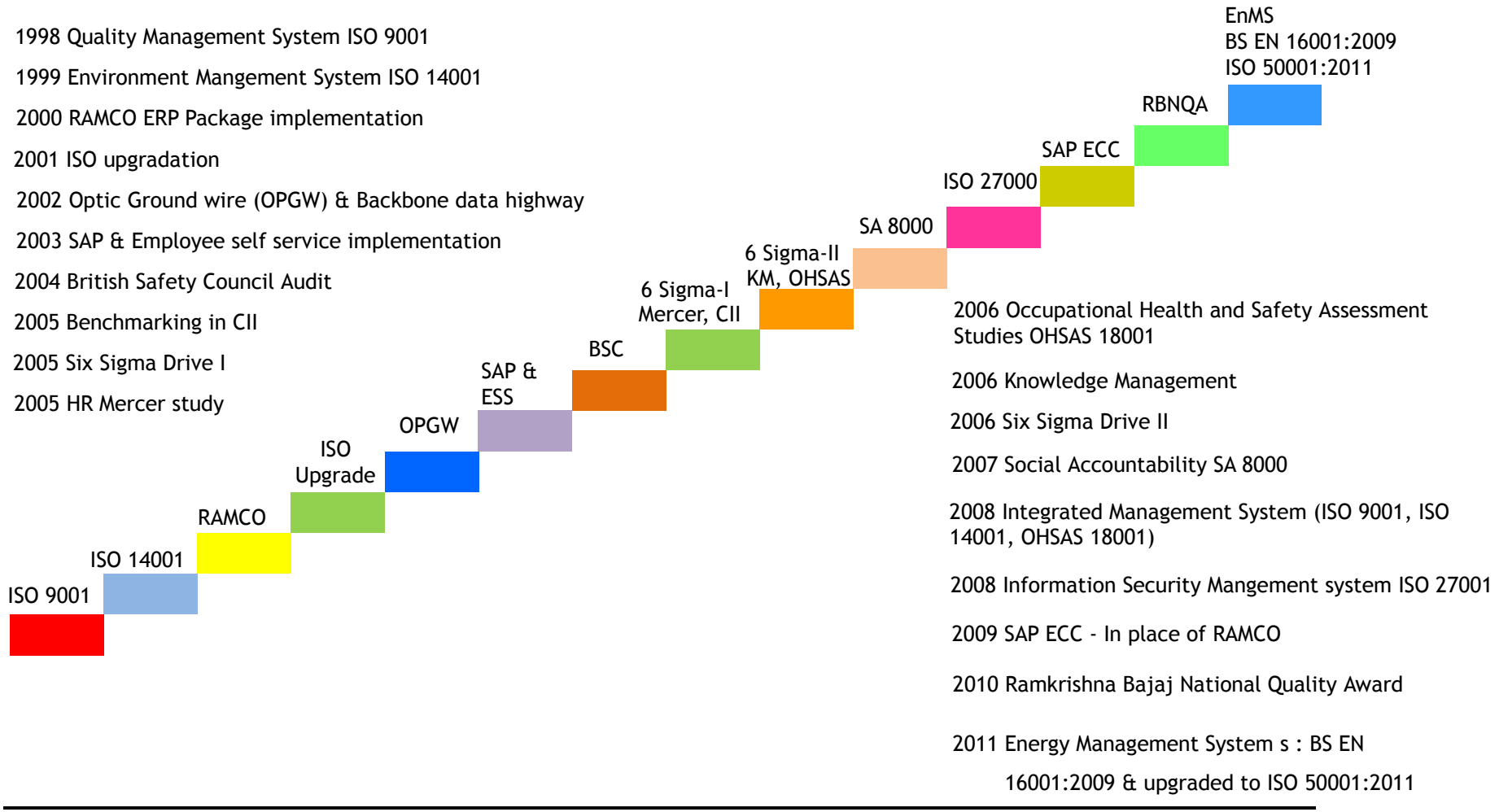
- Infrastructure
- Generation
- EPC
- Transmission
- Distribution
- Trading

R- Infra Emerged as Winner and Voted one of the India's 10 Most Admired Companies

DTPS at a Glance

Commercial Operation

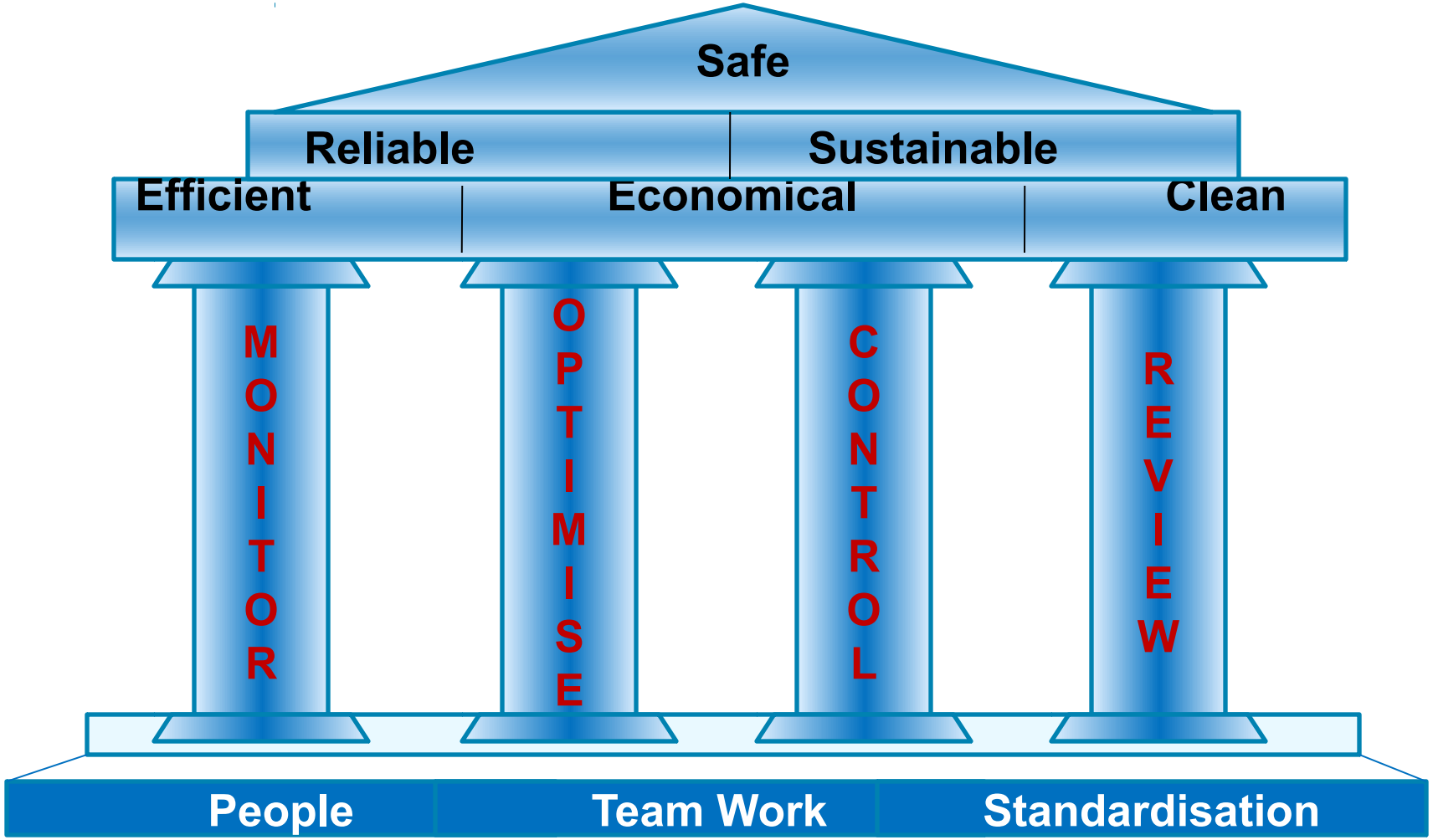
DTPS Milestones



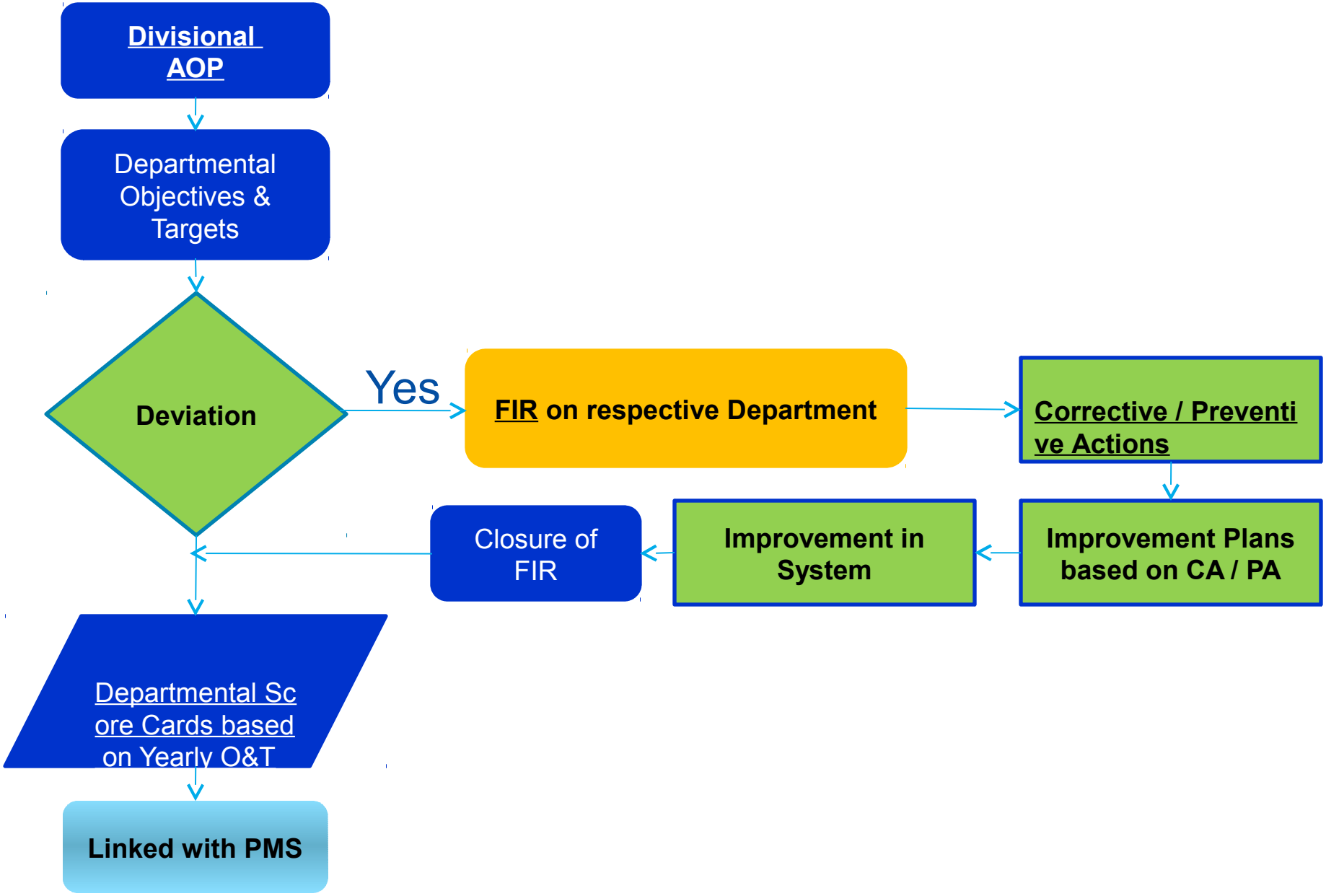
ISO 14001:2004

Continual improvement is ensured through improvement plans for IMS, ISMS, SA and EnMS

Working Philosophy



Monitoring for Sustenance



Objectives Of Monitoring System

Monitoring Facilities At DTPS

DTPS Web Portal

- Departmental websites
  - All departments
- System cell websites
  - IMS , ISMS, SA, EnMs, 6 Sigma
- Various Standards on site
  - BIS standards
  - ISO standards
- On line library information
- Legal (Acts, Notifications and Legal updates)

Performance Monitoring

Performance Monitoring

- **Heat Rate**
  - Boiler & Turbine Side Losses
- **Auxiliary Power Consumption**
  - Individual Auxiliary Power Consumption By Online EMS
- **Energy Audit**
  - Energy Auditing Of All Area As Per CEA Guideline
- **Plant Reliability**
  - Tripping & Event Analysis.
- **Pre & Pro Outage Survey**
  - Testing Of All Equipment Before & After Overhaul & Estimation Of Gain

Performance Review

Meeting

Sustainability Improvement Initiatives

- Coal Management
- Overhaul Strategy
- Maintenance Philosophy
- Planned Maintenance

Coal Management

Coal	Auxiliary Power %	Heat Rate Kcal/kwh
F-Grade	9.5	2325
Wash coal	8.75	2305
Blended coal Wash + Imported	8.25	2290

Coal Management - Benefits

- Reduction in
  - Coal moisture
  - Coal consumption
  - ASH generation
  - Wear and tear
  - Auxiliary power
  - Boiler tube leakages

Overhauling Strategy -Rolling Plan

Equipment	OEM Recommendation	DTPS Plan
HP Turbine	6 years	6 years
IP Turbine	5 years	4 years
LP Turbine	**5 years**	**2 years**
Generator	**4 years**	**2 years**
Exciter	**4 years**	**2 years**
Boiler		2 years
Power Transformers	7 years	6 years
HT Motors	-	4 years

Overhauling Strategy -Rolling Plan Benefits

Initial observations

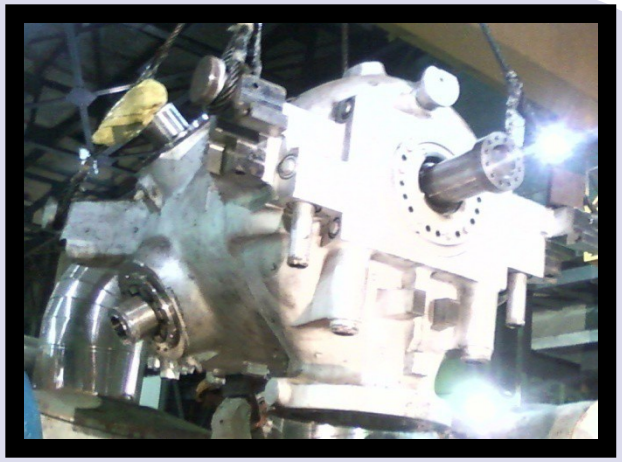
- ❑ Many surprises
  - LPT - Blade looseness, minor deposits, rubbing of rotor, sealing fin damages
  - Generator - Hot spots, core looseness, stator core bar cracks, wedge looseness, H2 leakage from current carrying bolts & terminal bushings.
  - Exciter & PMG damages, oil leakages

Benefits

- ❑ No surprises – No major defect
- ❑ Reduced Spare consumption
- ❑ Reduced overhaul time
- ❑ Efficient running of plant
- ❑ Less resources

Reduction in Overhaul time

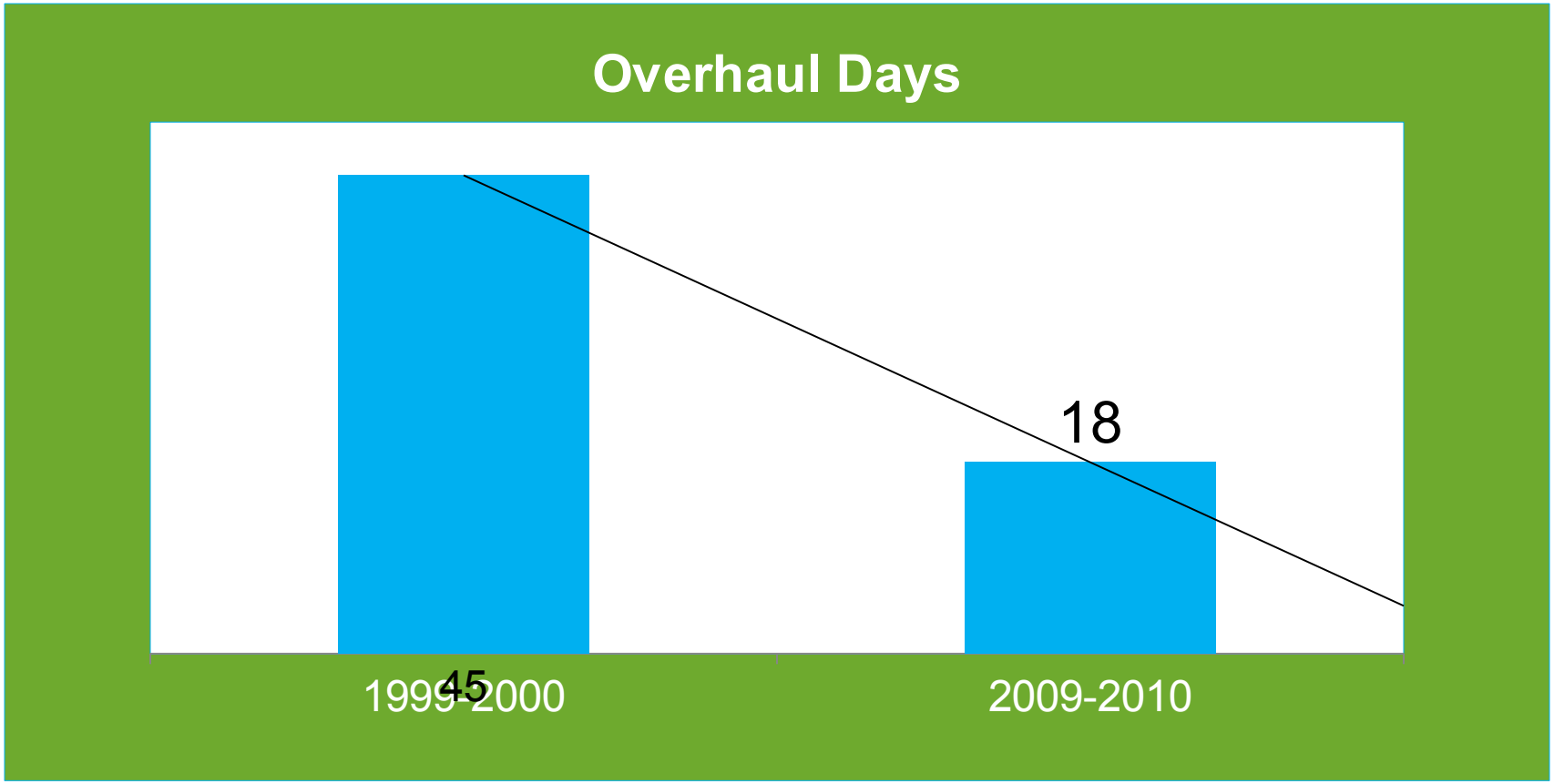
- Modular conceptualization
  - HP module
- Short shutdown opportunities
- Overhauling of redundant auxiliaries
- Standardized procedure for turbine cooling
- De-coupling of Generator,



Reduction in Overhaul time

- New technology - Induction heaters, Quick erect type aluminum boiler scaffolding, LFET etc.
- Extra bigger size manhole for boiler
- Project management software
- Round the clock working – 2 shifts

Reduction in Overhaul time



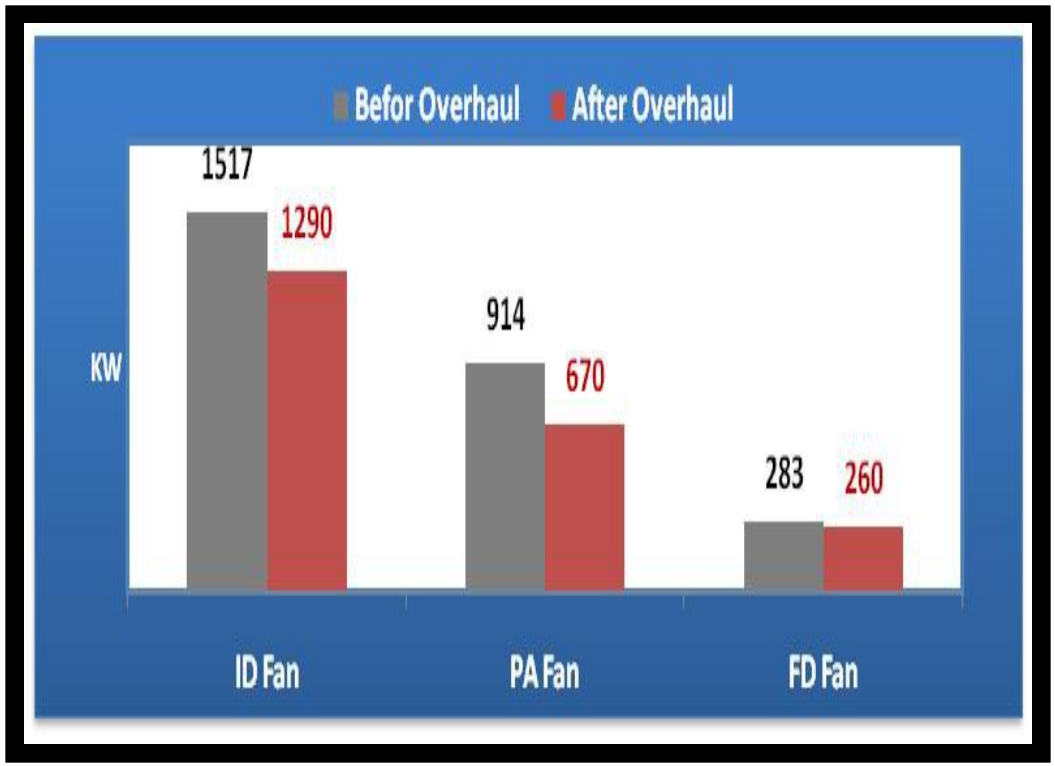
Additional efficient generation of - 162 Million units /year

Maintenance Philosophy

Opportunity Based Maintenance

Short shutdown Defects

Arresting Duct Leakages in Opportunity



Before and after Fan Kw

Condenser Vacuum Improvement

Condenser Vacuum Improvement Helium Leak Detection Test

Vacuum is maintained over design value of -0.9 ksc

Efficiency Based Maintenance

Energy deviation concept

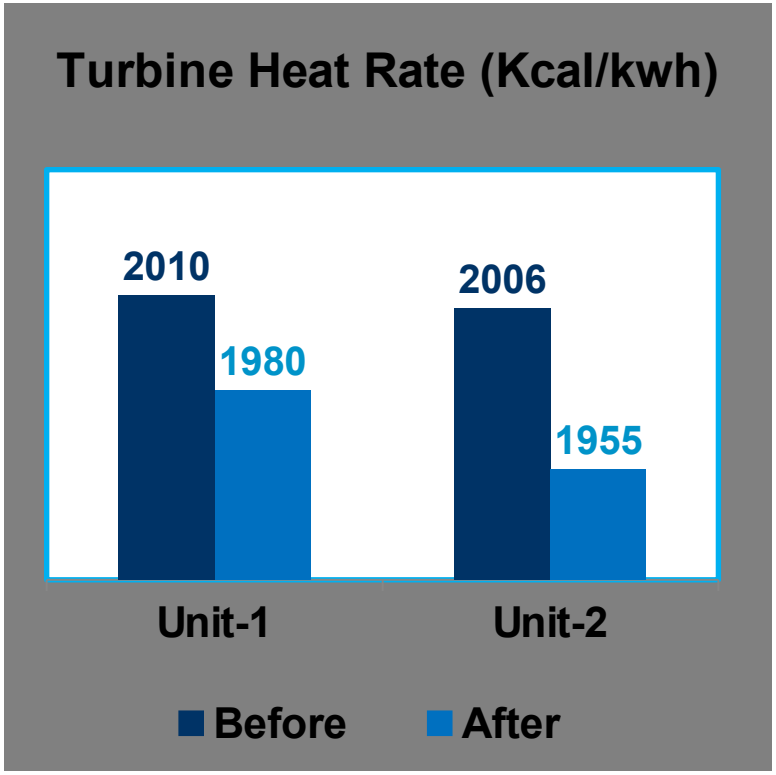
Defects which affects the efficiency, auxiliary power are given top priority e.g. HP heaters, Condenser, Duct rectification, APH Seals rectification, Mill Performance

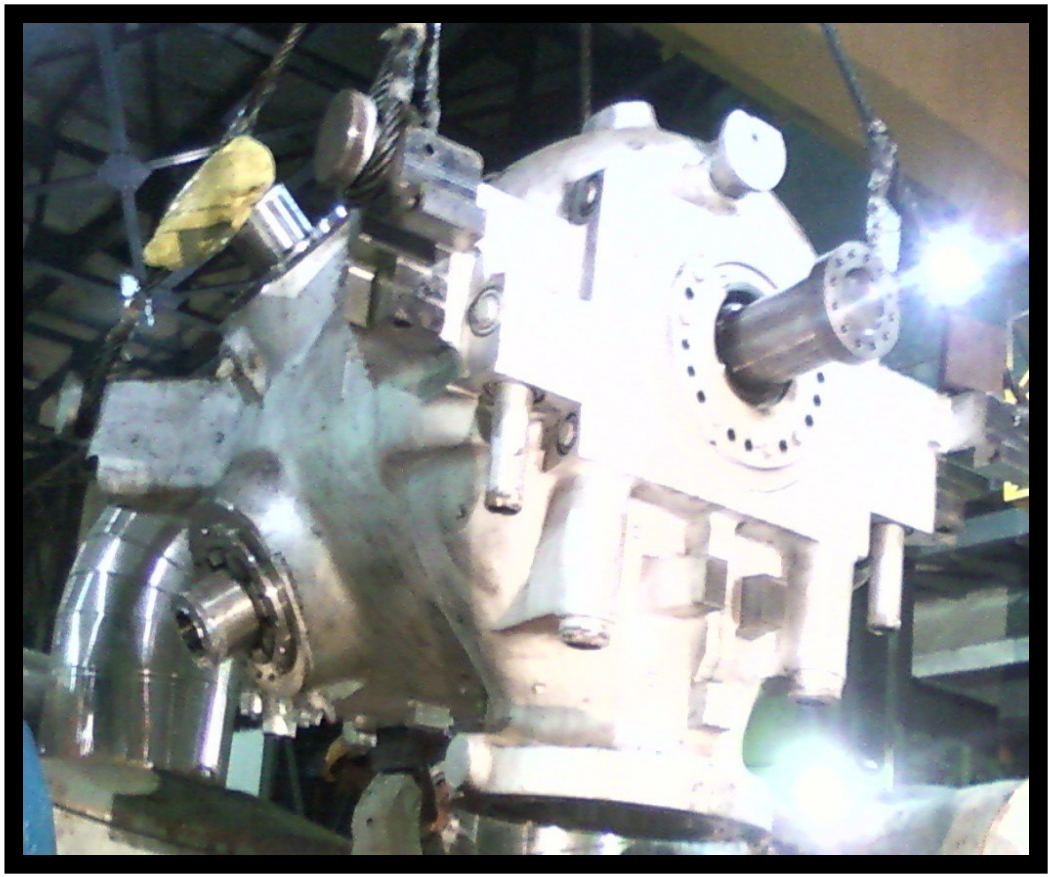
Major Initiatives

- HP module replacement
- BFP cartridge replacement
- Coal mill liners replacement
- APH basket replacement
- Installation of CEP VFD
- Reduction in startup time
- Reduction in oil consumption
- Reduction in DM make-up
- Smart soot blower operations
- Daily Energy Deviation Monitoring

HP module replacement

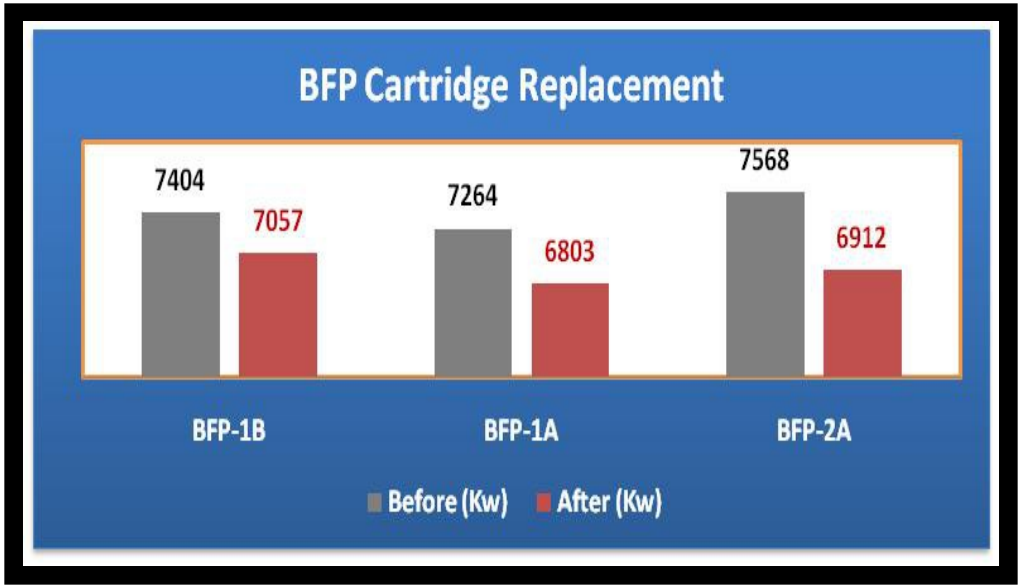
- HP module Replacement

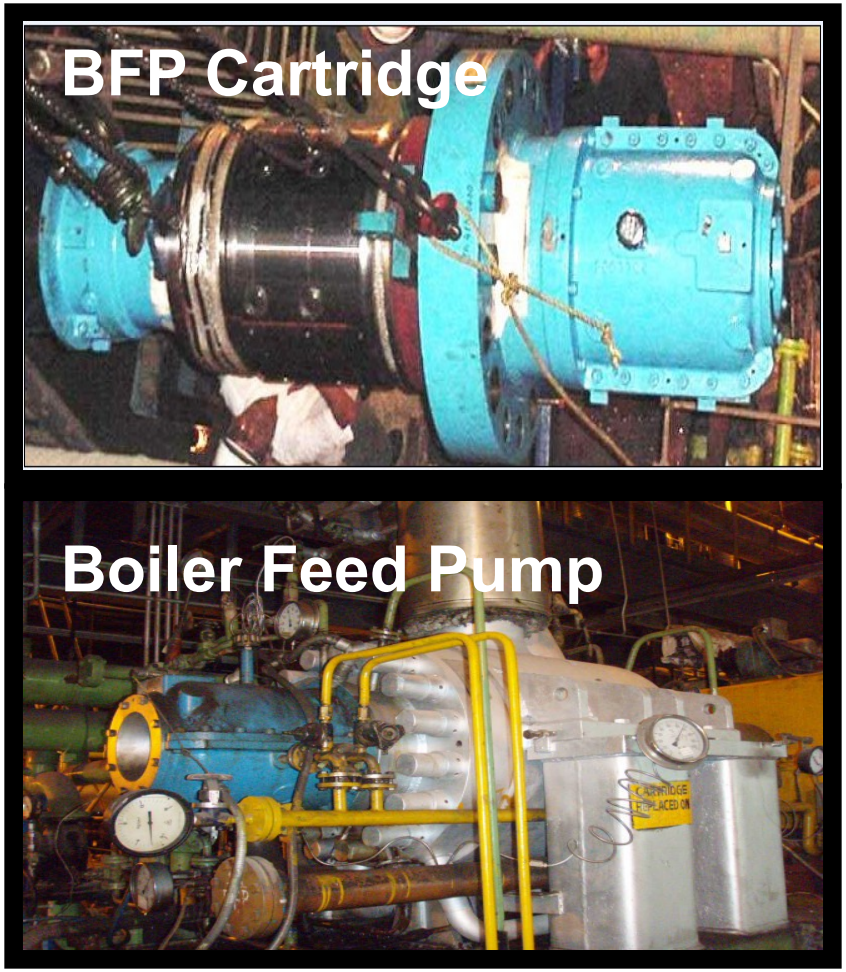




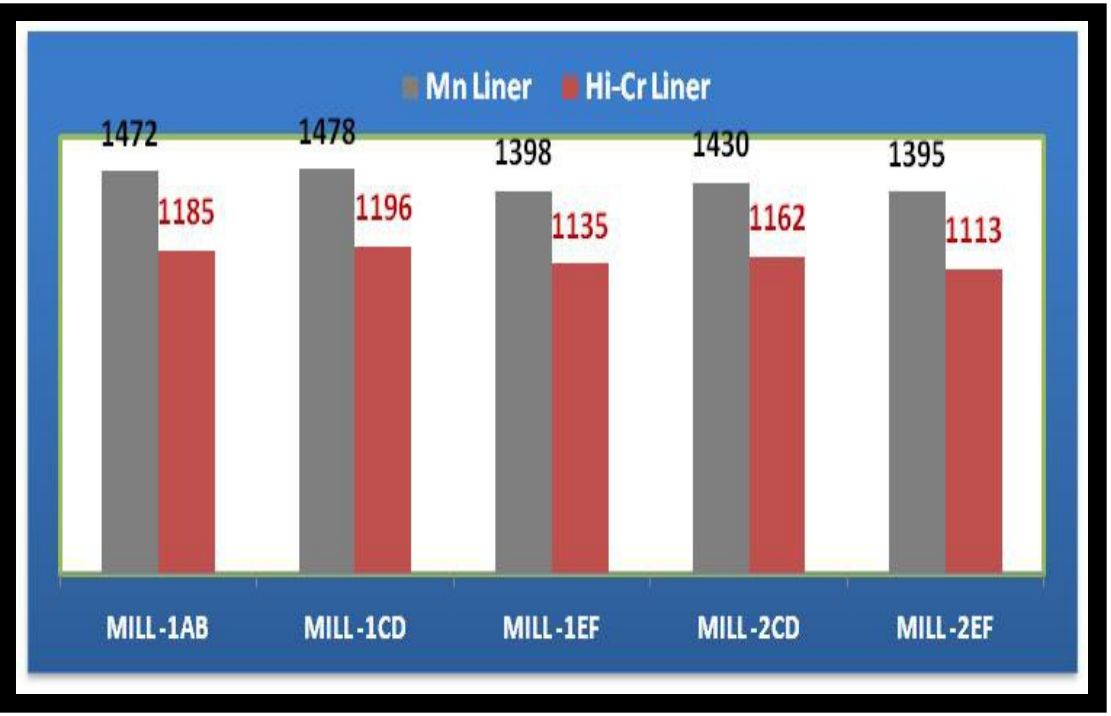
BFP cartridge replacement

Boiler Feed Pump	Saving Achieved
Performance Based BFP cartridge Replacement (serviced cartridge)	BFP-1A = 461 kw BFP-2A = 656 Kw BFP-1B = 347 Kw



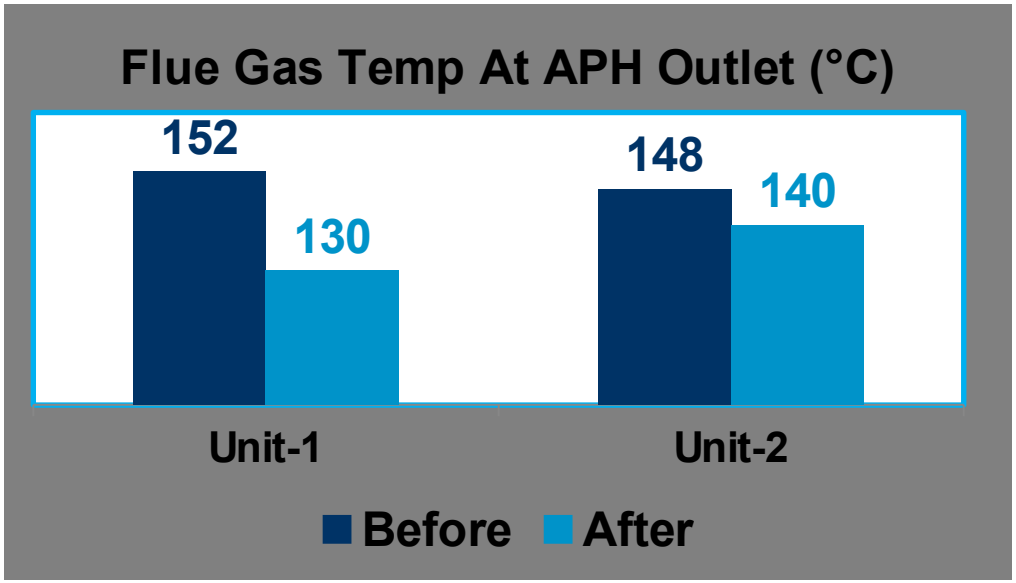


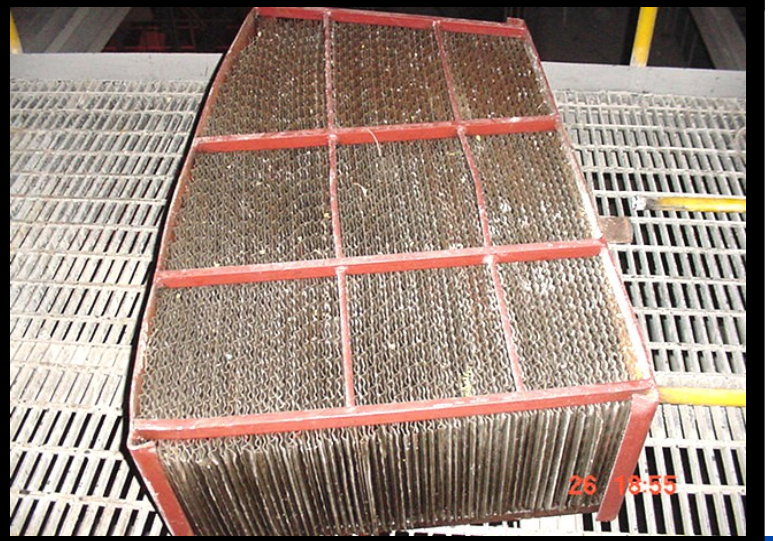
Replacement of liners by Hi-Crome Liner



Before and after Mill Kw

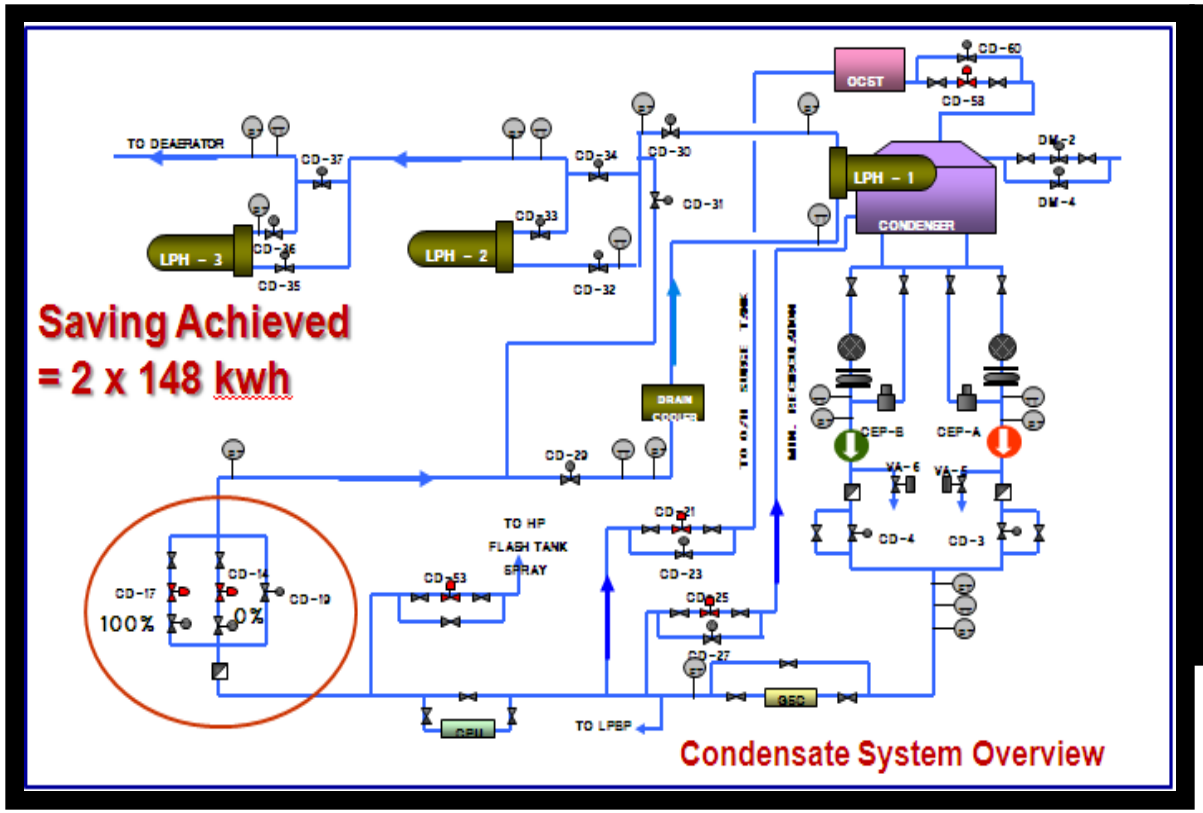
APH basket replacement

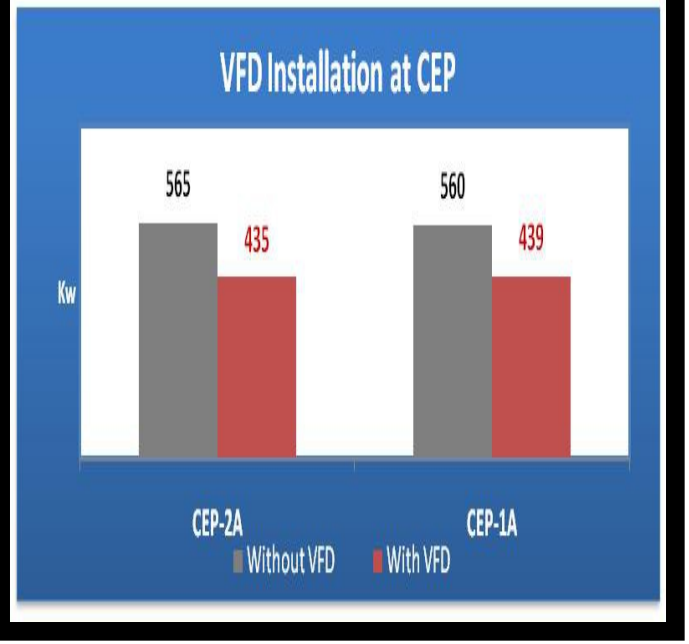




Installation of CEP VFD

Before and after CEP Kw





Total 12 Nos. Of VFD Are Installed In Different Application

Energy Saving 622 Kw

Reduction In Warm Start Up Time

High Cycle Time

Average 10 hrs

Standardisation of procedure	Defined Roles and Responsibility
	Standardization of Parallel – Sequential Activities
Change in operation Philosophy	Condensate Dumping
	Parallel operation of Both CPU
	Use of RIM Phones to all
Innovative Approach	Replacement of HFO with LDO
	Replacement of Oil ignitors with HEA
	Use of Instrument air for OIL atomization

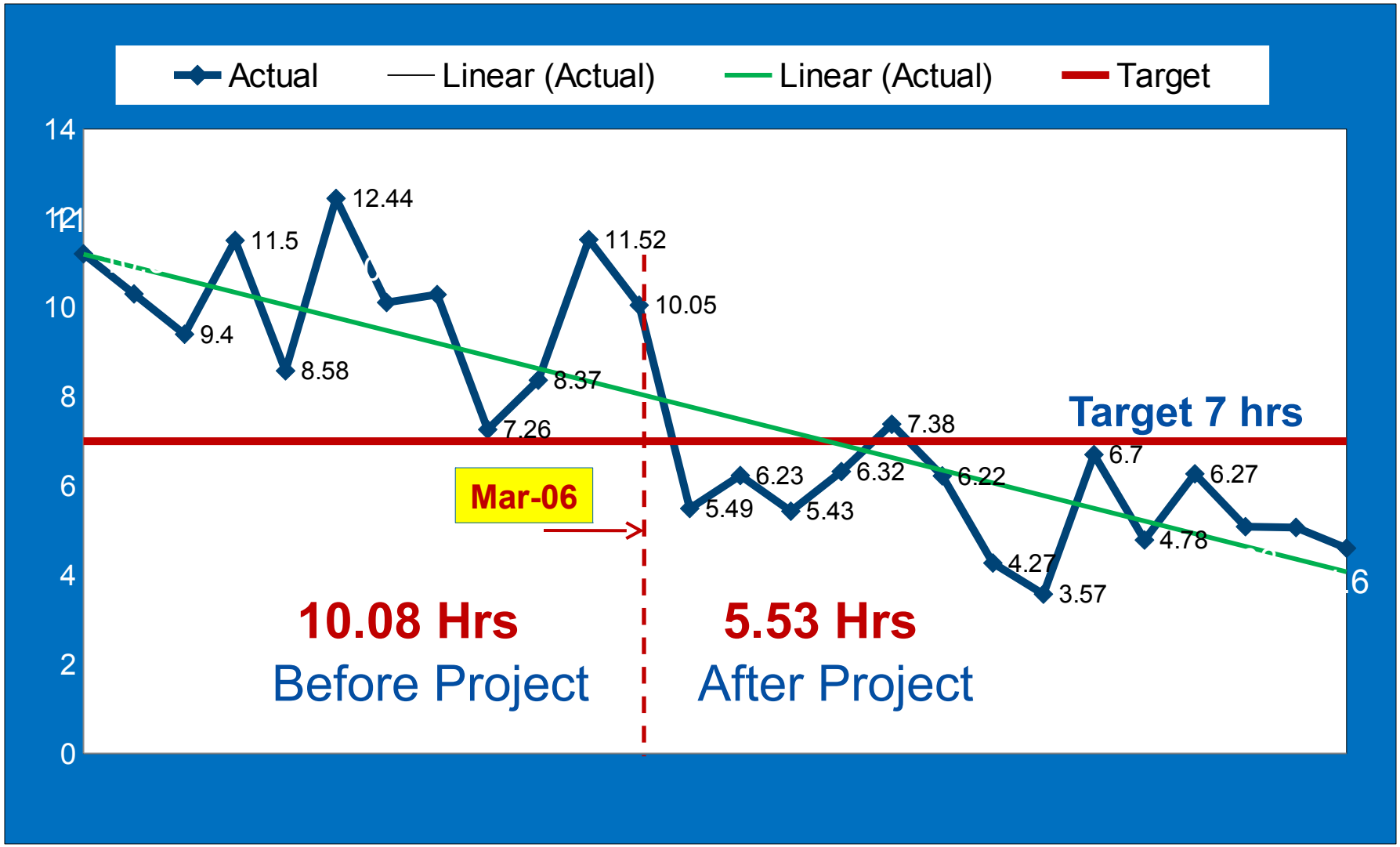
SOP

Review

Reduction in Cycle Time

Target 7 hrs

Reduction In Start up time



Reduction In Start up time - Benefits

Direct Benefits Per Warm Start-up	Reduction in Start-up time	4.55 hrs
	Reduction in Oil consumption	16 kl
	Increase in Generation	1.14 Mus

Indirect Benefits:

Reduction in

- Auxiliary power consumption
- DM water consumption
- Customer dis-satisfaction

QCI – D. L. Shah Award on Economics of Quality Commendation Award Under Large Scale Manufacturing Unit

Reduction In Oil consumption

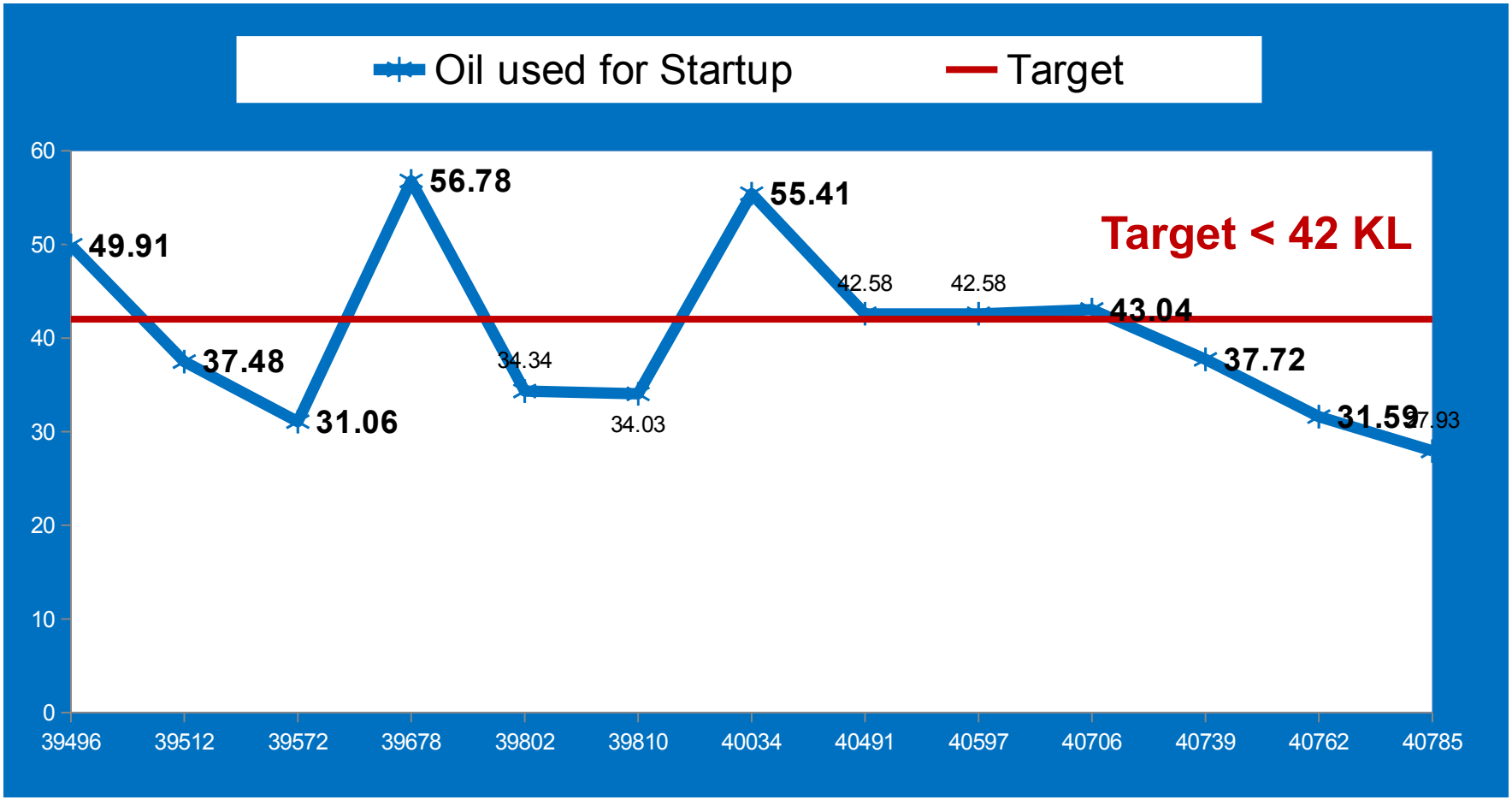
High Specific Oil

Standardisation of procedure	Defined Roles and Responsibility
	Standardization of Parallel – Sequential Activities
Change in operation Philosophy	Change in OIL guns trial schedule
	Monitoring OIL pressure during Startup
	Use of SCAPH
	Dearator initial heating

Reduction in Specific OIL

Target < 42 KL – Warm Start-up

Reduction In Oil consumption



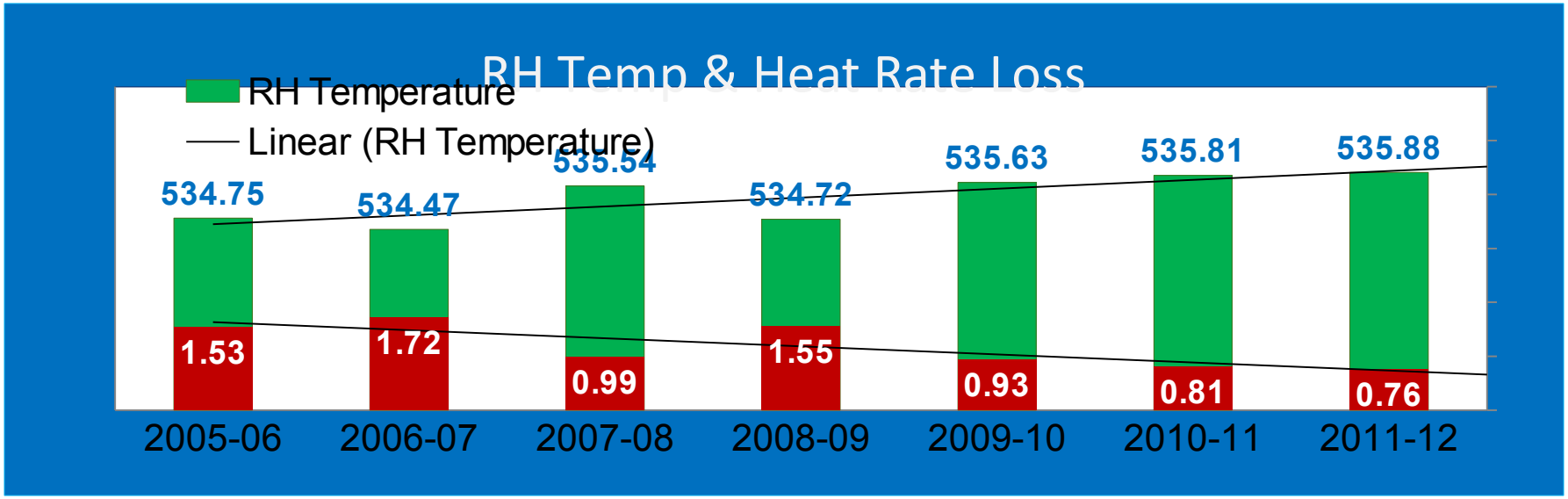
DM makeup reduction

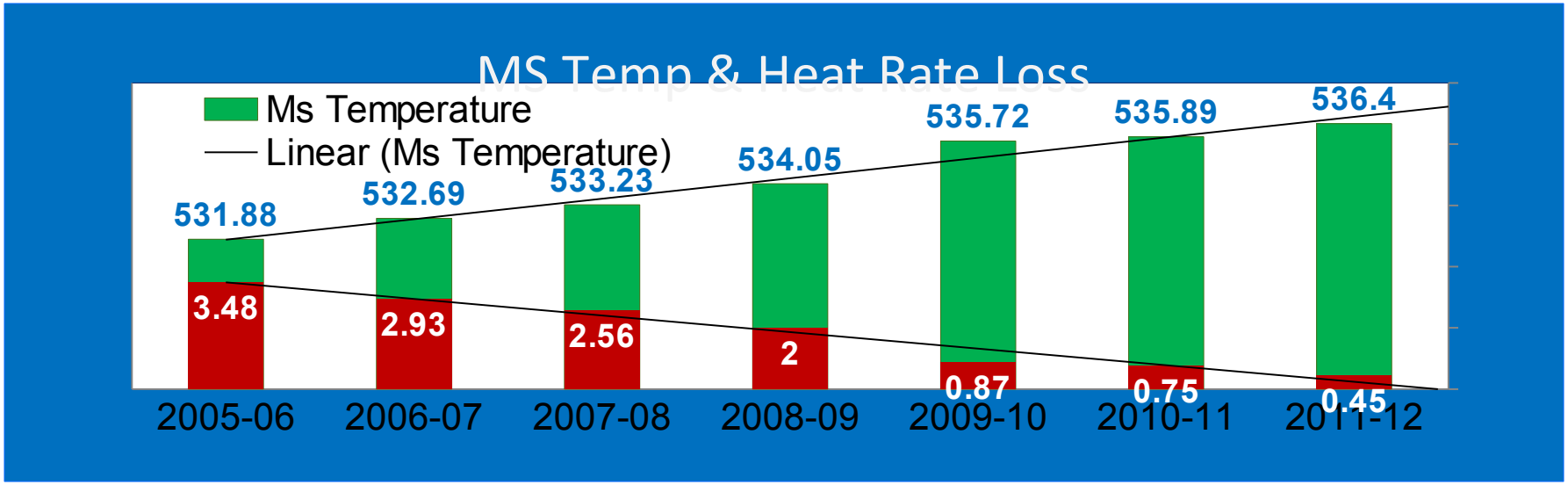
- Optimization of Soot Blowers operation
- SOP for Identification of Leakages
- Optimization of VAM operation
- Fuel switching from HFO to LDO

Reduction in DM water Loss

Every 1 % increase in DM make up causes heat rate loss of 10 KCal/kwh.

Smart soot blower operations - Results





Installation of Magna Drive Coupling

Magna Drive Coupling - Couplings transmits torque from

Benefits of Magna Drive Coupling

Savings (Rs. Lacs)	Investments (Rs. Lacs)
0.01	3.5

Daily Energy Deviation Report

RELIANCE

"RELIANCE INFRASTRUCTURE LIMITED"

DTPS
2 X 250 MW

DAILY "ENERGY" DEVIATION REPORT

FORMAT NO: 10.1.1B

HT Auxiliaries	Average as on Date (2011-12)	Base Value	Operating value	Operational Control	Maintenance Control	Ru		2-Aug-11	2-Aug-11	2-Aug-11	
UNIT	Kw	kw									
TURBIN											
BFP - 1A	6967										
BFP - 1B	7074		>7100 - 7350	>7350 - 7450	>7450						
BFP - 2A	7034										
BFP - 2B	7209										
CEP-1A	516										
CEP-1B	440				>620						
CEP-2A	438										
CEP-2B	538										
ECW - 1A	298										
ECW - 1B	308					24.0				0.06	
ECW - 1C	307	305	- 330	- 355	>355	16.1	304	-1	0.23	0.45	0.04
ECW - 2A	318					11.9	316	11	0.24	0.35	0.03
ECW - 2B	307					24.0	304	-1	0.23	0.68	0.06
ECW - 2C	304					12.1	303	-2	0.23	0.34	0.03
TURBINE TOTAL(Kw)		16420		3.13			16942	-88		36.40	3.12

Average Power Consumption Rate As On Date

Maintenance Control:

This control includes

- ✓ Detail Analysis Of Problems
- ✓ Solution In Terms Of New Alternative Technology
- ✓ Repair or Replacement.

Monthly Building Energy Deviation Report

RELIANCE

DTPS
2 X 250 Mw

"RELIANCE INFRASTRUCTURE LIMITED"

MONTHLY BUILDING "ENERGY" DEVIATION REPORT

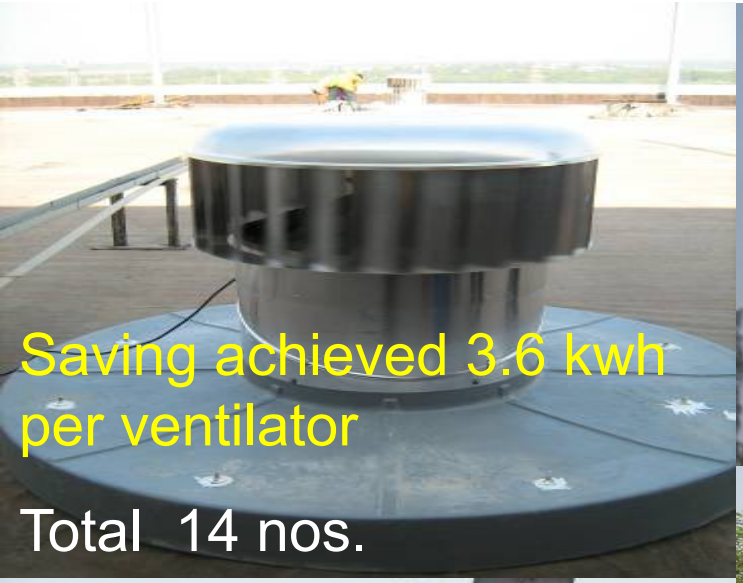
FORMAT NO: 10.1.3B

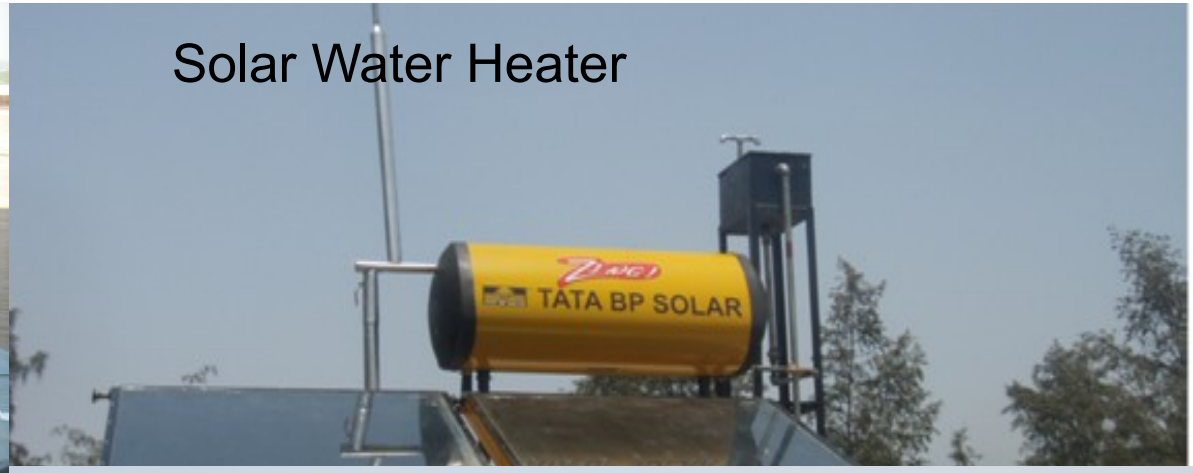
Jul-12

Plant Buildings	Average as on Date (2012-13)	Base Value	Operating value	Operational Control	Maintenance Control	Actual Value	Deviation w. r. to Base Value
	kWh	kWh	kWh	kWh	kWh	kWh	kWh
Fire station	1645	1990	>1990 - 2110	>2110 - 2216	>2216	1654	-336
OH centre	663	782	>782 - 1049	>1049 - 1102	>1102	623	-159
Security Office	2641	2325	>2325 - 2888	>2888 - 3032	>3032	2295	-30
ADM	15213	14088	>14088- 18280	>18280 - 19194	>19194	12997	-1091
Main store	5623	6463	>6463 - 7760	>7760 - 8148	>8148	5070	-1393
Canteen	7166	8224	>8224 - 13040	>13040 - 13692	>13692	6810	-1414
DM Plant	1492	2320	>2320 - 2688	>2688 - 2822	>2822	1807	-513

All Buildings Of Plant Are Covered Under Monitoring

Energy Conservation Projects





Employees Involvement
&
Team Work

Employees Involvement

Conductance '3L' Life learning Program With BEE

O&M Conference for group companies

Employees Involvement & Team Work

Energy Management Cell “Awareness drive“

- Training for all employees
  - By Internal faculty
  - By External Faculty
- Celebration of Energy Conservation week
  - Energy conservation walk involving all employees
  - Create awareness among local school children about energy conservation through Film show & competition
  - Display of energy conservation posters
  - Exhibition on energy conservation

Improvement plans implemented

- Quality Improvement plans: 767 Nos.
- Environment Improvement plans: 75 Nos.
- Safety Improvement plans: 178 Nos.
- Energy Improvement plan : 58 Nos.
- Total – 1020+ Improvement Plans

Six Sigma Initiatives

- Over 15 O&M related six sigma projects are implemented

Example

- Reduction in start-up time
- Reduction in Heat rate losses
- Auxiliary Power reduction
- Reduction in Overhaul time
- 100% auto loops controls
- Condenser vacuum improvement
- Reliability improvement of cooling water pumps

Simulator

- Technical Training center at DTPS has facility of 250 MW simulator customized with HAIL
- Simulator facility is used for R & D
  - GET training
  - Refresher course
  - Checking of LOGIC before any modification
  - Optimization of operations related to efficiency improvement

Effectiveness in Reliability & Efficiency Improvement

Benefits

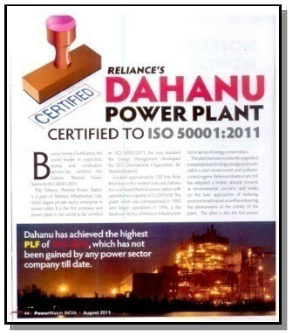
Heat rate less than 2300 Kcal/

Availability more than 96 %

PLF more than 100 %

Loading factor more than 104 %

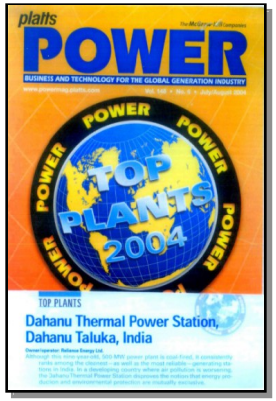
Conclusion


CERTIFIED
RELIANCE'S
DAHANU
POWER PLANT
CERTIFIED TO ISO 50001:2011
Dahanu has achieved the highest PLF of , which has not been gained by any power sector company till date.


CII
NATIONAL WATER MANAGEMENT AWARD 2001
CII
NATIONAL WATER MANAGEMENT AWARD 2008

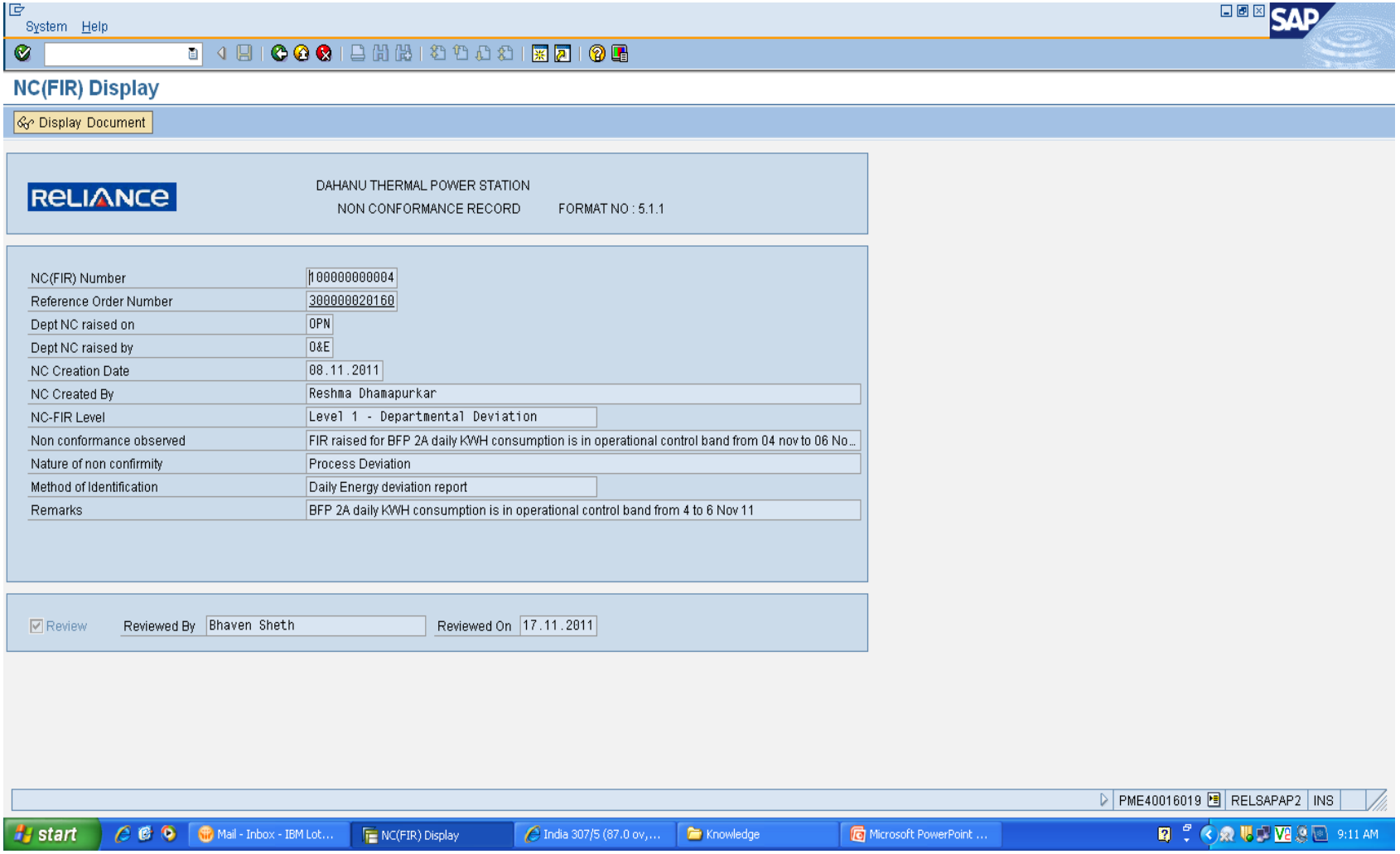

INC RAMKRISHNA BAJAJ NATIONAL QUALITY AWARD


CII
NATIONAL ENERGY MANAGEMENT AWARD 2010
RELIANCE INFRASTRUCTURE LIMITED
DAHANU THERMAL POWER STATION

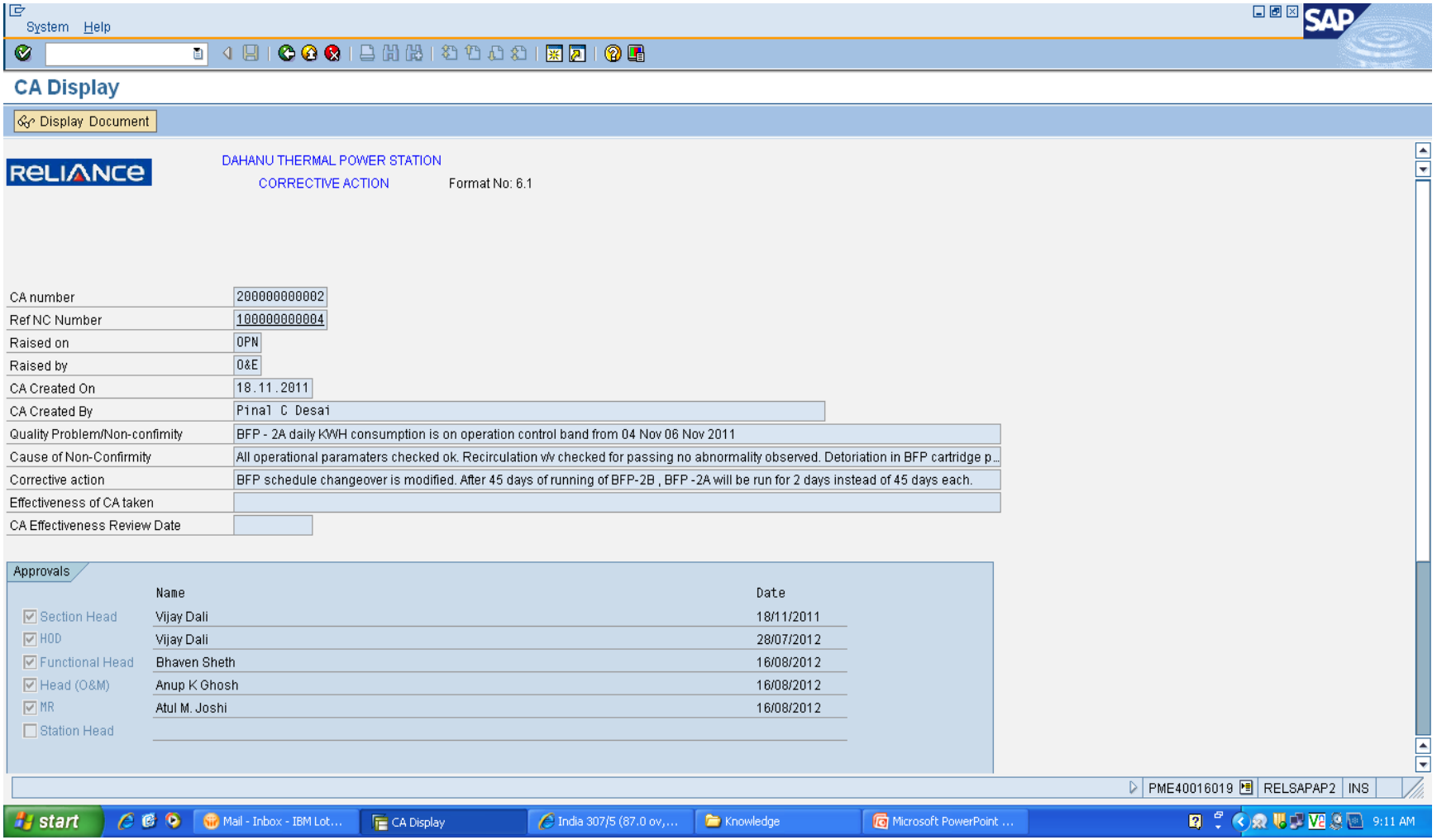

platts
POWER
BUSINESS AND TECHNOLOGY FOR THE GLOBAL GENERATION INDUSTRY
POWER
TOP PLANTS
2004
TOP PLANTS
Dahanu Thermal Power Station,
Dahanu Taluka, India

Thank You

NC raising in SAP system:



Corrective action against NC raised:



Sr. No	Objective	KPI	Weightage	Annual Target	F.Y.2012-13			Apr-12	May-12	Jun-12	Jul-12	Cummulative
					Good	Very Good	Excellent					
					4	4.5	5					
1	External Stakeholder/Customer		20									
A	Delivering uninturpted & reliable power		17									
a1	Availability	%	15	95.75	94.93	95.21	95.75	96.8	96.38	97.21	100	97.61
a1.1	Unplanned Outage	Days	2	3.5	5	4.5	3.5	0.95	1.12	0.84	0.00	2.92
B	Economical Operation		3									
b1	Optimize O & M cost (R&M,A&G and Staff Cost)	₹ Crores	3	110	114	112	110	6.75	8.7	17.51	7.85	32.64
2	Financial Perspective		30									
A	Maximise generation		25									
a1	Generation	Mus	15	4380	4262	4295	4380	364.515	374.681	365.474	388.33	1493
a2	Planned Outage	Days	5	12	13.5	13	12	0	0	0	0	0
a3	Loading Factor	%	5	104.5	102.5	103	104.5	104.6	104.51	104.43	104.39	104.48
B	Reduction in Operation Cost		5									
b1	Sp oil Consumption	ml/KWh	2	0.2	0.24	0.22	0.2	0.099	0.123	0.096	0	0.079
b2	Sp. Coal Consumption (Considering 3650 Kcal/kg GCV on as fired basis)	Kg/Kwh	1	0.63	0.64	0.635	0.63	0.632	0.634	0.635	0.635	0.634
b3	DM makeup	%	1	0.38	0.42	0.4	0.38	0.52	0.312	0.345	0.254	0.356
b4	Inventory Control - Material procurement to Utilisation Ratio	Ratio	1	0.9	1	0.95	0.9	0.55	0.53	0.57	0.77	0.77

3	Process / Operational Excellence		40									
A	Reliable and Efficient Operation		18									
a1	PLF	%	12	100.00	97.30	98.06	100.00	101.25	100.72	101.52	104.39	**101.98**
a2	Heat Rate	kcal/ Kwh	3	2300	2315	2310	2300	2296	2291	2295	2289	**2293**
a3	Aux Power including FGD/grinding Unit	%	3	9	9.1	9.05	9	8.841	8.813	8.754	8.763	**8.794**
B	Environment performance		4									
b1	Stack emission - S02	TPD	1	5	8.04	6	5	4.1	3.9	3.9	4	**3.98**
b2	Stack emission- Nox	PPM	1	90	110	100	90	77.9	71.9	68.75	64.15	**70.68**
b3	Stack emission-TPM	mg/NM3	1	60	75	70	60	46	46.95	46.65	39.25	**44.71**
b4	Ash Utilisation	%	1	81.5	78	80	81.25	86.32	86.75	87	83.02	**85.77**
C	OH & S Performance		5									
c1	Potential Risk Identification	Nos.	2	25	15	20	25	3	11	8	8	30
c2	Near Miss / First Aid	Nos.	1	0	0	0	0	0	0	0	0	**0**
c3	Reportable Accident	Nos.	2	0	0	0	0	0	0	0	0	**0**
D	Sustainable Development		7									
d1	Quality improvement Plan	Nos	1	30	20	25	30	1	0	0	0	**1**
d2	Safety Improvement Plan	Nos	1	25	15	20	25	1	0	0	0	**1**
d3	Environment mangement plan	Nos	1	5	3	4	5	1	0	0	0	**1**
d4	Energy mangement Plan(No. of Energy conservation Projects)	Nos	1	5	3	4	5	1	0	0	0	**1**
d5	System Audits (Management)	Nos	1	12	8	10	12	0	0	1	0	**1**
d6	No of CSR initaives	Nos	1	8	5	6	8	1	2	1	0	**4**
d7	Employee participation in social activity	Mandays	1	250	200	225	250	15	17.125	63.875	9.875	**105.875**
E	Technological Upgradation		2									
e1	Introduction to new technology	Nos	1	5	3	4	5	0	0	0	0	**0**
e2	Innovation	Nos.	1	5	3	4	5	0	0	0	0	**0**
F	Green Initiatives		4									
f1	Tree plantation	Acres	1	15	5	10	15	2	6	0.5	0.5	**9**
f2	Energy Conservation	MUs	1	6	5	5.5	6	0.495	0.572	0.552	0.575	**2.194**
f3	Sp. CO2 Emmission	mtCO2/MWH	1	1	1.05	1.05	1	0.932	0.92	0.9	0.9	**0.913**
f4	Water Conservation Projects	Nos.	1	6	4	5	6	0	0	0	0	**0**

D	People Development		10									
A	Develop Skill & Trained manpower		5									
a1	Knowledge Sharing Sessions	Nos	1	24	20	22	24	2	2	3	2	9
a2	Training for group/other companies	Nos.	1	8	3	5	8	0	1	0	0	1
a3	Organisation of Seminars & Conferance	Nos	1	4	2	3	4	1	1	2	0	4
a4	Training for DTPS employees to enhance their skill	Manhrs/ employee	2	48	38	40	48	2.34	6.12	12.41	17.89	17.89
B	Foster Brand Image		3									
b1	Organization of school/college student and invitees visits	No.	1	1800	1200	1500	1800	243	59	76	71	449
b3	Participation in various awards and recognition including Paper presentation	Nos.	1	12	8	10	12	4	2	3	3	12
b4	Facilitation to college students / apprentice for internship project	Nos.	1	50	40	45	50	2	34	43	0	79
C	Support Services to other Power projects		2									
c1	Deputation	Mandays	1	2000	1500	1500	2000	483	481	477	430	1871
c2	Expert services compliance	Mandays	1	35	24	25	35	2	8	40	0	50
Total Weightage			100									

RELIANCE Energy
Anil Dhirubhai Ambani Group

Year 2010-11

Performance Card

Department : Control & Instrumentation

Divisional Objectives	Dept. Objectives	Target	Achieve-ment	Comments
Deliver reliable and quality products and services to all customers at competitive costs, with focus on customer care – thereby creating superior value for all stakeholders.	A) Reduce the Unplanned Non - Availability of critical equipments	Non-availability < 0.020%	(Nil) **Achieved**	Excellent, keep it up.
	B) To ensure timely completion of maintenance jobs.	PM work order closure 100%.	(100%) **Achieved**	Excellent, keep it up.
	C) Keep unplanned maintenance lower by better maintenance planning.	Ratio of planned to Total Work orders (>95%)	(98.17%) **Achieved**	Excellent, keep it up
	Minimization of Generation loss due to under performance of critical equipments.	Minimization of Gen, loss on account of equipment Non-availability < 0.20 MUs	(0.0737 MUs) **Achieved**	Excellent, keep it up.
	Reduction of number of trips on account of equipments or operational failures	Trips: < 2 Nos	(Nil) **Achieved**	Excellent, keep it up.
	Reduce O&M Cost	To keep O&M expenses at budgeted value 215 Lacs	(125.69 Lacs) **Achieved**	Excellent, keep it up.
	Reduction in Non-moving Items (%)	100%	(100%) **Achieved**	Excellent, keep it up
	Work Orders Age (Days)	< 10 Days	(3 Days) **Achieved**	Excellent, keep it up.
	Knowledge Sharing Sessions Conducted	> 1 Nos	(3 Nos) **Achieved**	Excellent, keep it up & Stretch target for next year
	% Participation for Knowledge Sharing Sessions	50%	(85%) **Achieved**	Excellent, keep it up.
Deliver reliable and quality products and services to all customers	Internal Customer Satisfaction	> 95%	(94.10%) **Not Achieved**	Needs to improvement

RELIANCE Energy
Anil Dhirubhai Ambani Group

Year 2010-11

Performance Card

Department : Control & Instrumentation

Divisional Objectives	Dept. Objectives	Target	Rating	Comments
Prevention of pollution, injury and ill health	Reduction in occurrence of accidents.	Zero reportable accidents.	(Nil) **Achieved**	Excellent, keep it up.
	Activity based Safety Training in man hrs / worker / year	100 Manhrs	(661 Man hrs) **Achieved**	Excellent, keep it up & Stretch target for next year
	House keeping in %	(>80%)	(89%) **Achieved**	Excellent, keep it up.
	Safety Violation	Nil	(Nil) **Achieved**	Excellent, keep it up.
	Mock Drills	1 No	(1 No) **Achieved**	Excellent, keep it up & Stretch target for next year.
	Waste Cotton (Waste Return Qty. / Issued Qty.)	100%	(100%) **Achieved**	Excellent, keep it up.
	Identification of Potential Risks	5 Nos	(9 Nos) **Achieved**	Excellent, keep it up & Stretch target for next year.
Comply with all relevant legislative, regulatory and other requirements.	Reduction in Overtime - No. of cases of OT > 12 Hours / Week	Nil	(Nil) **Achieved**	Excellent, keep it up.
Be amongst the most admired & trusted integrated Electricity generating Utility in the world.	Participation in CSR Activities	46 Man days	(74 Man days) **Achieved**	Excellent, keep it up & Stretch target for next year

Key Area for Improvement:

1) Internal customer Satisfaction to be improved.
2) Expenses need to be reviewed in terms of service / spares for cost reduction.

Head (O&M): _____ Date: 01/04/2011

Station Head: _____ Date: 01/04/2011

Heat Rate Monitoring

Kcal/Kwh

Heat Rate Reporting

Deviation Analysis Report (Daily)

DEVIATION ANALYSIS REPORT
10.1.1A
DAHANU THERMAL POWER STATION
(2 x 250 MW)

A. HEAT RATE LOSSES CALCULATION (KCAL/KWH) 21-Sep-2011

Plant Performance Indices

Unit Wise Heat Rate And Losses

Generation Loss Classifications

Environment Parameters

Critical Process Parameters

REASONS :

D.	DM MAKE UP (%)	TARGET	0.37	0.37	0.37
		ACTUAL	0.28	0.28	0.28

REASONS :

E.	ECW MAKE UP (M^3)	TARGET	10	10	20

Monthly Performance Test Report Summary

RELIANCE

MONTHLY PERFORMANCE TEST REPORT

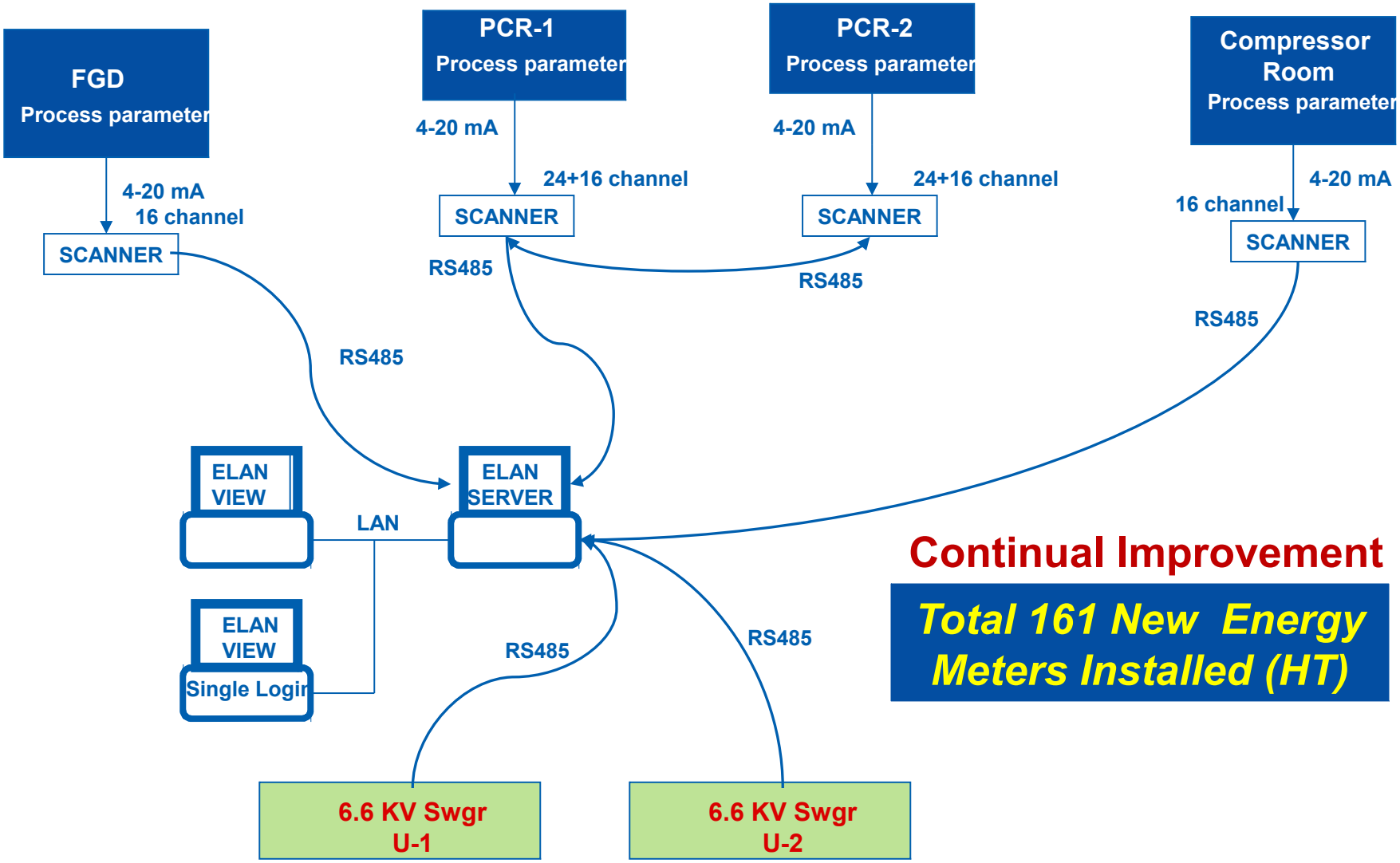
DAHANU THERMAL POWER STATION 2 X 250 MW

UNIT - 1 (WITH ZERO % DM MAKEUP) DATE: 26-Apr-11

SR NO	CONTENTS	UNIT	DESIGN	ACTUAL	CORRECTED
1	TG HEAT RATE	Kcal/kwh	1948	1994	1969
2	UNIT HEAT RATE	Kcal/kwh	2209	2293	2224
3	BOILER EFFICIENCY	%	88.21	86.96	88.55
4	CYCLE EFFICIENCY	%	38.93	37.51	38.68
5	HP TURBINE EFFICIENCY	%	89.50	90.63	-
6	IP TURBINE EFFICIENCY	%	92.60	88.21	-
7	LP TURBINE EFFICIENCY	%	88.25	83.86	-

Kwh

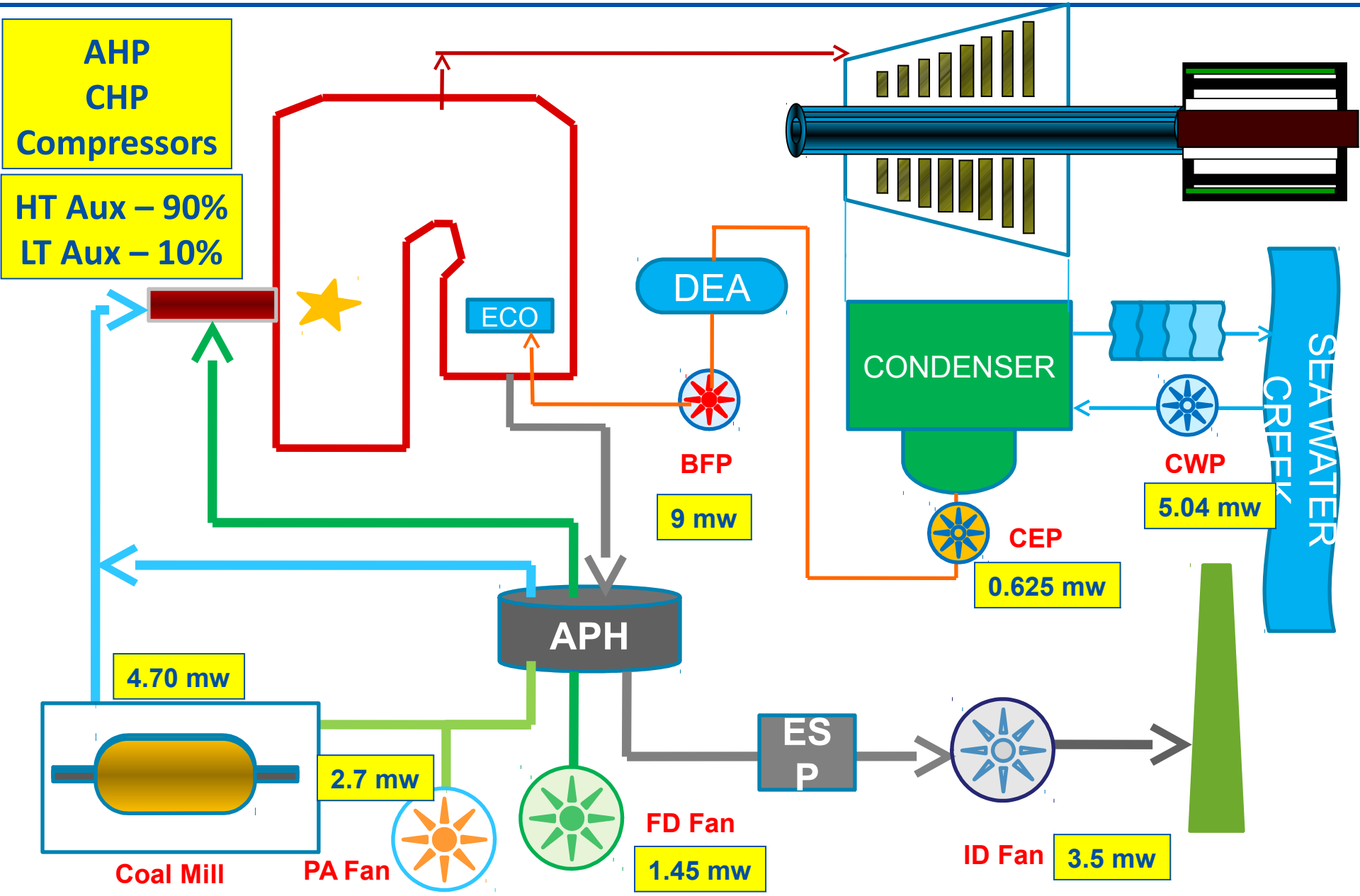
Online Energy Monitoring System



Continual Improvement

Total 161 New Energy Meters Installed (HT)

Area wise focus for Energy Conservation



Energy Auditing

Energy Auditing As Per CEA Guideline

System Is Divided Into 15 Sub-systems
(Boiler, Turbine, Pumps, Fans, Condenser Etc.)

Separate Energy Management Cell Is Formed To Co-ordinate Energy Audit Activities

Plant Reliability

Pre-Outage & Post-Outage Survey

ESP efficiency test
Electrical Problem Identification
Performance Related Observations
Calculation Of Benefits From Overhaul
ESP efficiency test
Electrical Problem Identification

Improvement plan 18.1 format in SAP: