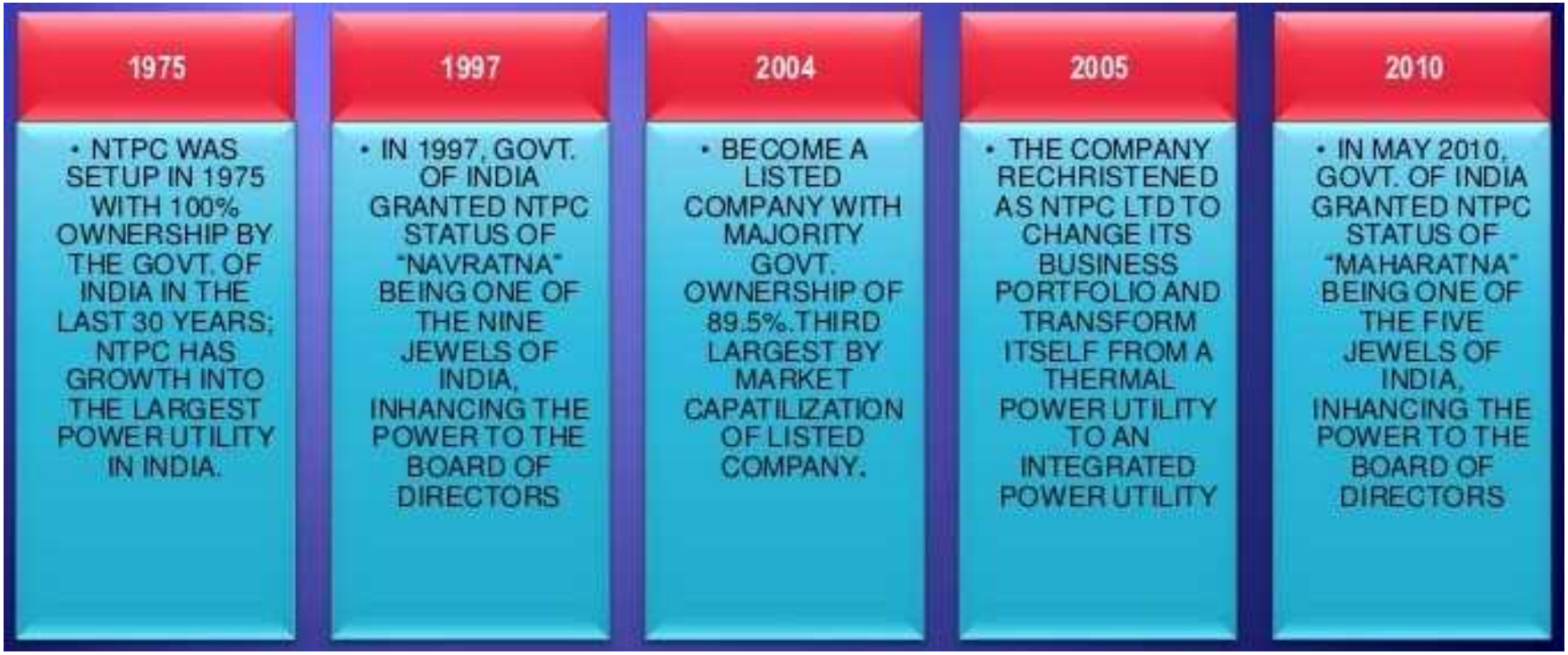
NTPC UNCHAHAR

EVOLUTION OF NTPC



In a study carried out by Great Place to Work and The Economic Times, NTPC has been adjudged as the Best Company to work in the Public Sector category for the year 2016

OPINION MAKER'S VIEW

"Unchahar Thermal Power Station was acquired by the NTPC LTD. from the Government of Uttar Pradesh. Performance was improved dramatically by using debottlenecking techniques.....

These dramatic results have been obtained under ordinary or even oppressive circumstances, and despite the absence of recognition by the system."

(Extract from the book "INDIA 2020 – A Vision for the New Millennium" authored by the former President of India – Dr A.P.J. Abdul Kalam.)

Our Team & Achievements

Team Members	P S Pandey Devesh Adhikari Ritesh Singh
Achievements	(i) Runners up in Project Level Professional Circle Conventions 2012-13, 2014-15, 2015-16 (ii) Case study on "Air Preheaters Reliability & Performance enhancement" presented at 12th Regional level PC, NTPC Tanda (iii) Case study on "Reduction of Auxiliary Power Consumption" presented at 14th Regional level PC, NRHQ Lucknow (iv) Case study on "Minimize Boiler Forced Outage & Draft Power" presented at 15th Regional level PC, NTPC Rihand

LOCATION

The site is located at a distance of approx. 3 km from Unchahar town on Allahabad-Raebarelli broad gauge section of Northern Railway. It is 35 km from Raebareli, 120 km from Lucknow and 90km from Allahabad on Lucknow-Allahabad Highway. Total land acquired so far is 2198 Acres.

MAJOR EVENTS

- The foundation stone of the project was laid by Late Smt. Indira Gandhi, the then Prime Minister on 27-06-1981.
- Unit # 1 & 2 in stage-I were commissioned by UPRVUN on 21-11-88 & 22-03-89 respectively.
- NTPC took over the project w.e.f. 13-02-1992 at a cost of 925 Crore.
- NTPC added unit # 3 & 4 in stage-II on 27-01-99 & 22-10-99 respectively.
- NTPC added unit # 5 as stage-III on 28-09-06.
- 10 MW of Solar Energy added on 31.03.2015

SALIENT FEATURE

- **CAPACITY: (1050 MW)**
  - **Installed Capacity stage-I : 2X210 MW**
  - **Installed Capacity stage-II : 2X210 MW**
  - **Installed Capacity stage-III : 1X210 MW**
- **POWER EVACUATION: 220 kv Transmission lines**
  - **Unchahar-Raebareli line 1 & 2 (UPPCL)**
  - **Unchahar-Raebareli line 3 (PGCIL)**
  - **Unchahar-Fatehpur line 1 & 2 (UPPCL)**
  - **Unchahar-Kanpur line 1,2,3 & 4 (PGCIL)**

SALIENT FEATURE

WATER SOURCES:

i) Sharda Sahayak Canal (Main source)

ii) Dalmau Pump Canal (During closure of Sharda Sahayak Canal)

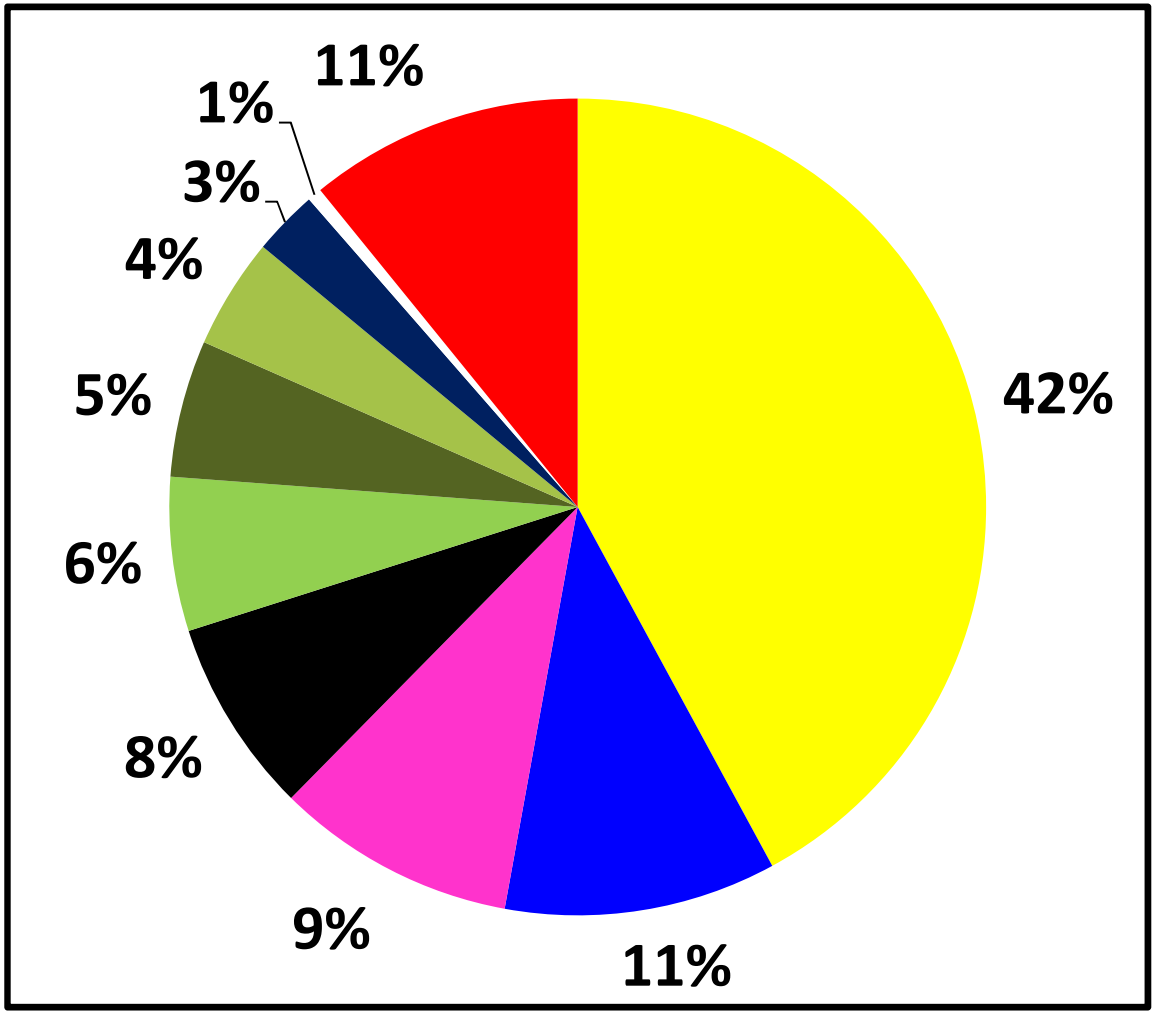
➢COAL:

- Reqmnt: 6.00 MMT per annum for 5x210MW.
- Sources: i) Central Coalfield Ltd(CCL)
  ii) Bharat Coking Coal Ltd(BCCL)
  iii) Eastern Coalfield Ltd (ECL)
  iv) Imported (as per allotment)
- FSA with CCL and BCCL

LAND AT UNCHAHAR

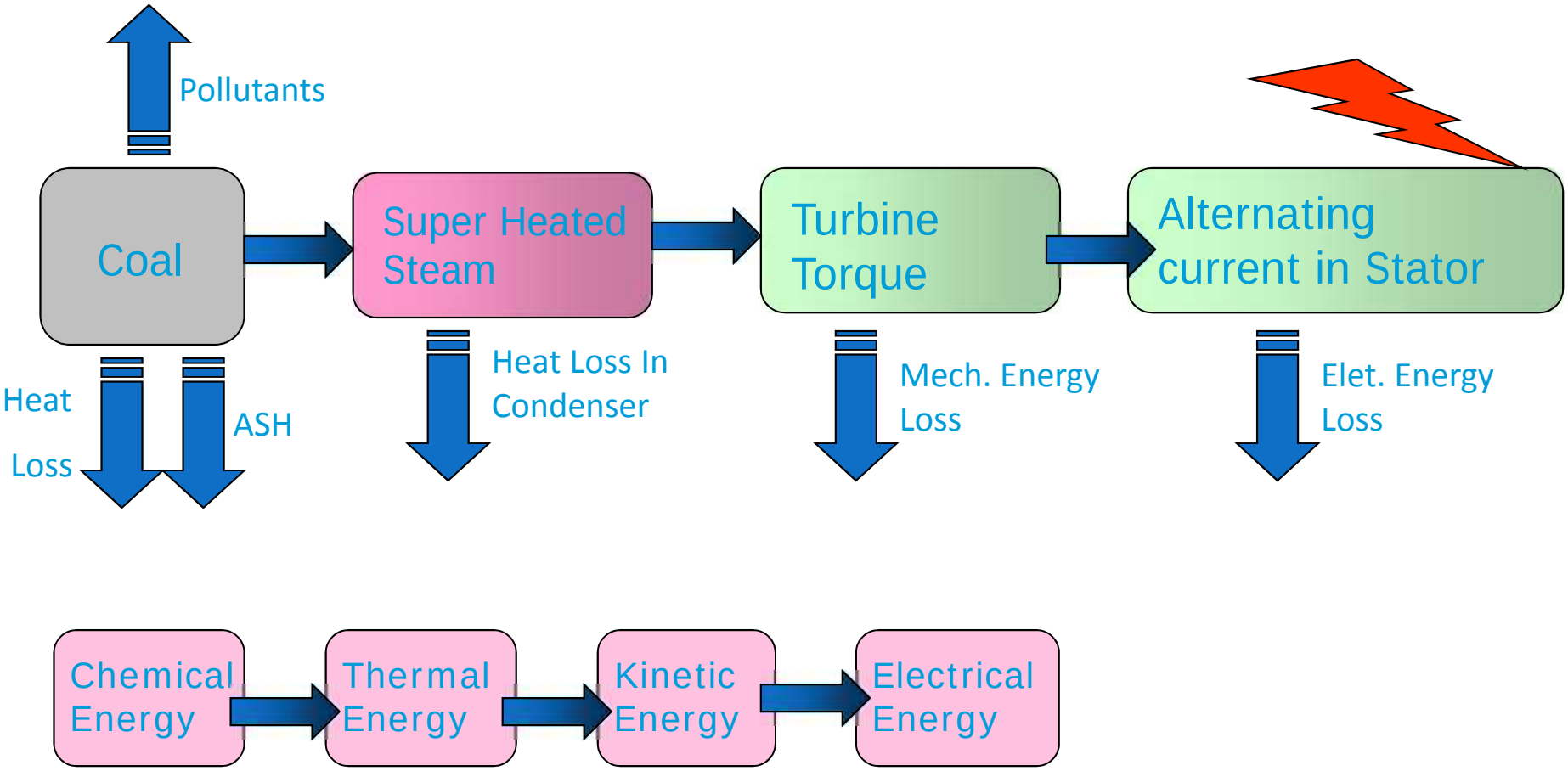
Particulars		Area (Acres)
Plant	:	981
Township	:	254
Area for Solar Plant	:	46
Arkha Ash Dyke + Corridor	:	673
Umran Ash Dyke + Corridor	:	244
TOTAL	:	2198

POWER ALLOCATION

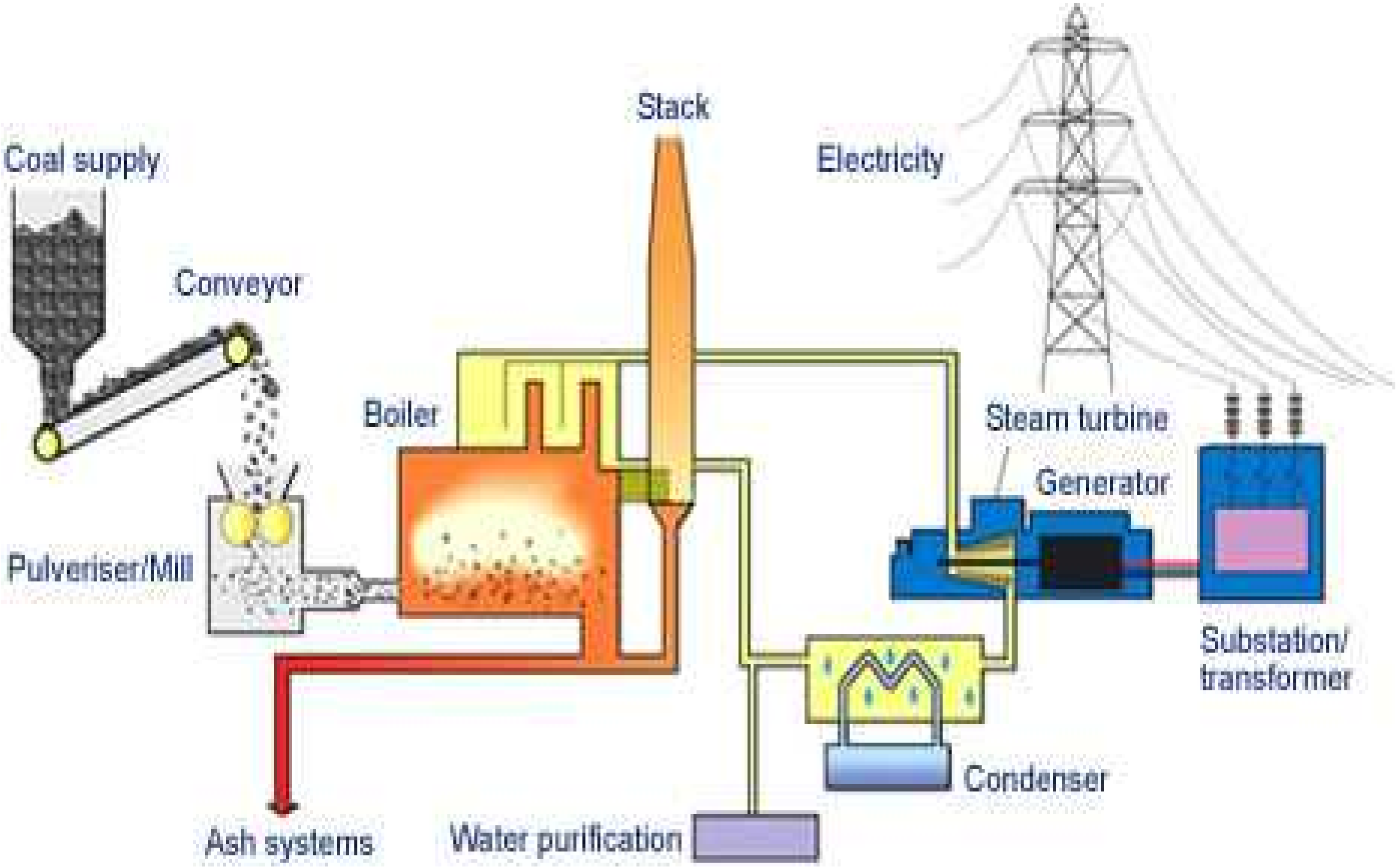


STATE	MW
UP	442
Punjab	113
Delhi	100
Rajasthan	81
Uttrakhand	64
J&K	57
Haryana	46
HP	27
Chandigarh	6
Unallocated	114
Total	1050

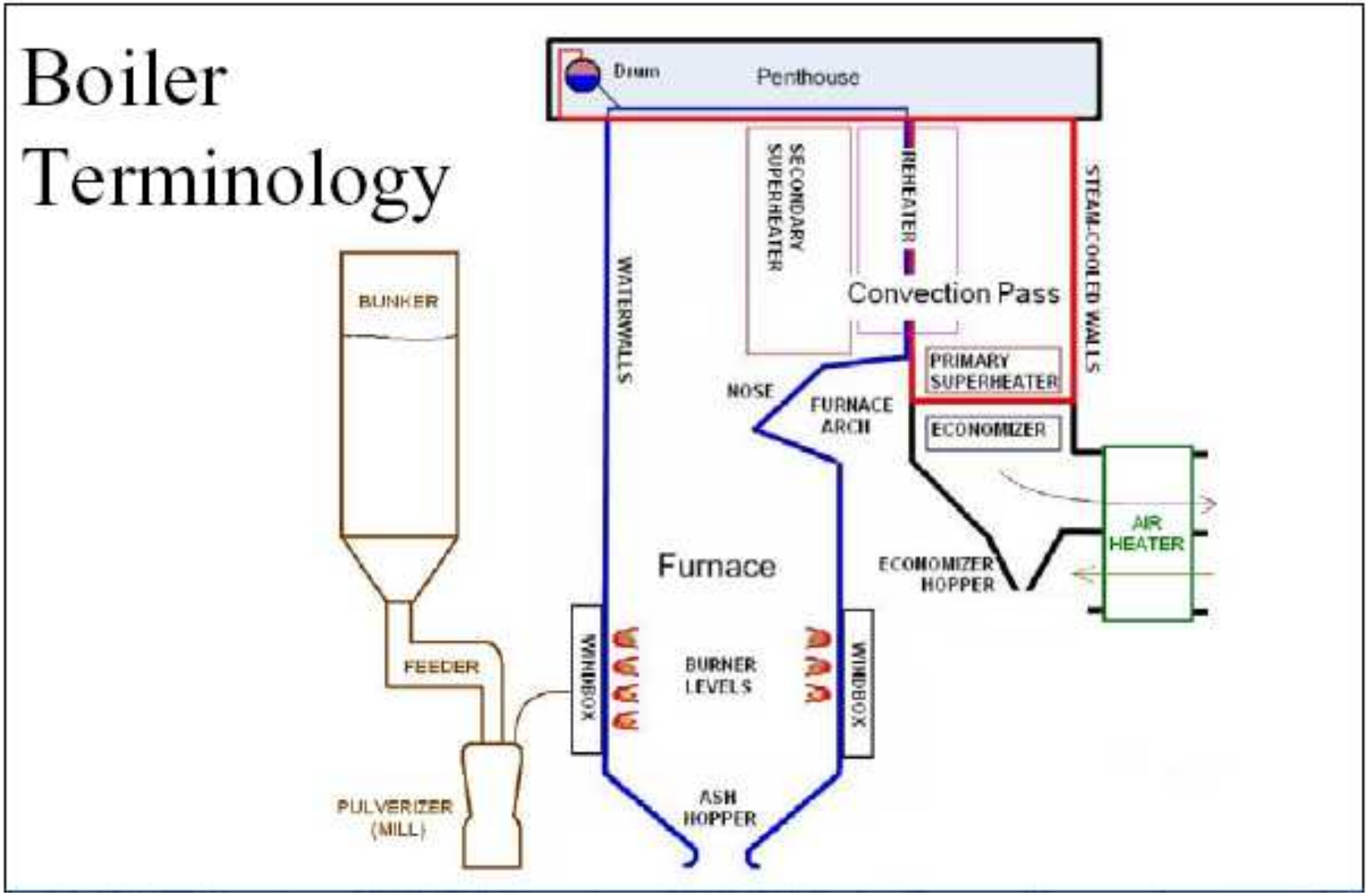
Coal to Electricity ..... Basics



Power Generation Process



Boiler Terminology



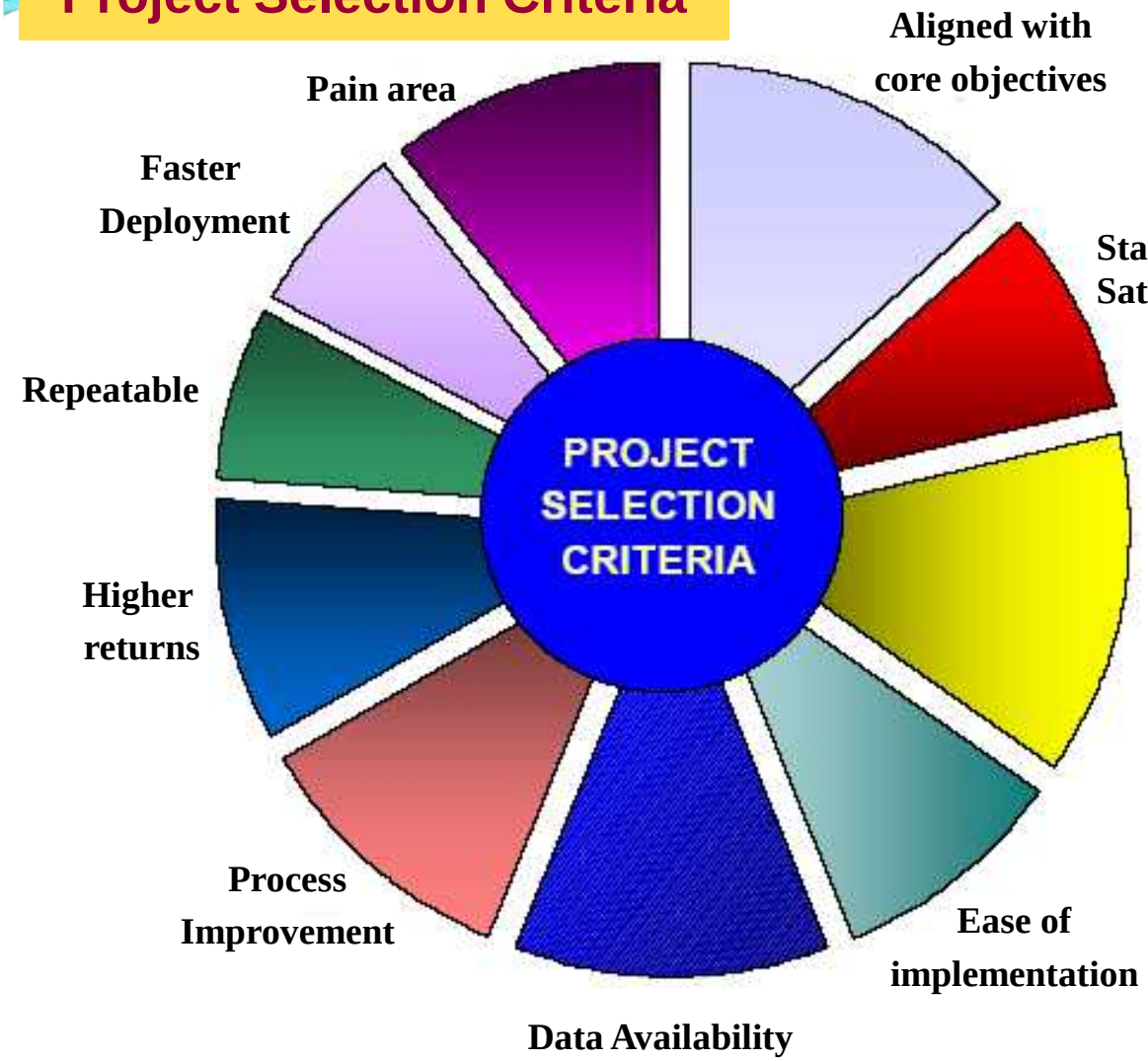
OBJECTIVE

"Minimize Boiler Forced Outage and draft power"

Road map

- ***Introduction***
- ***Reduction in Boiler Tube Leakage.***
  - ***Process improvement during overhauling.***
- ***Reduction in Draft Power.***
  - ***Auxiliary power reduction .***
- ***Saving & benefits.***

Project Selection Criteria



S. No.	Criteria	Weight
1	Aligned with core objectives	10
2	High probability of success	10
3	Data Availability	8
4	Pain area	8
5	Process Improvement	7
6	Higher returns	8
7	Repeatable	6
8	Faster Deployment	5
9	Stakeholder Satisfaction	7
10	Ease of implementation	6

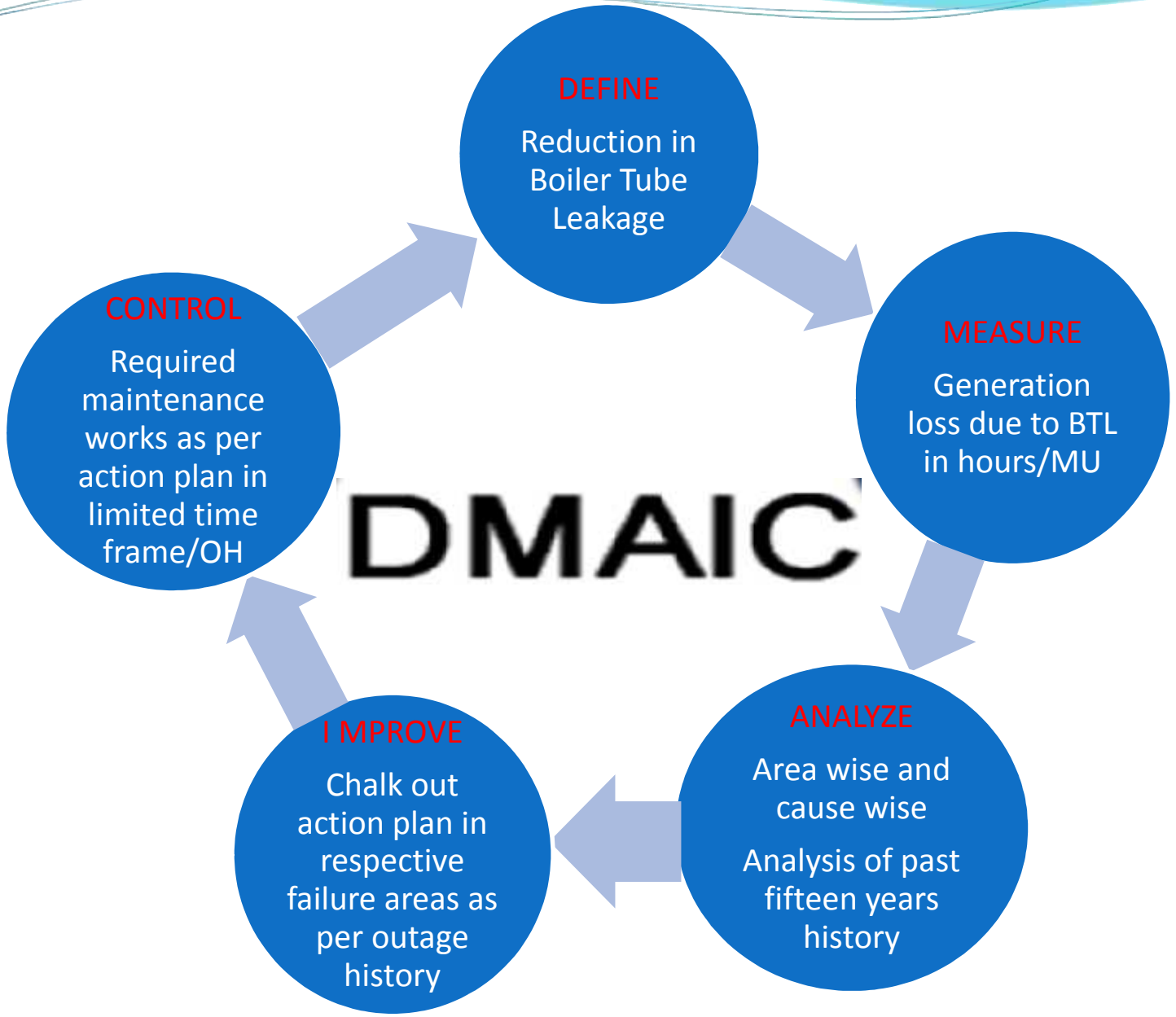
Major Areas of Boiler

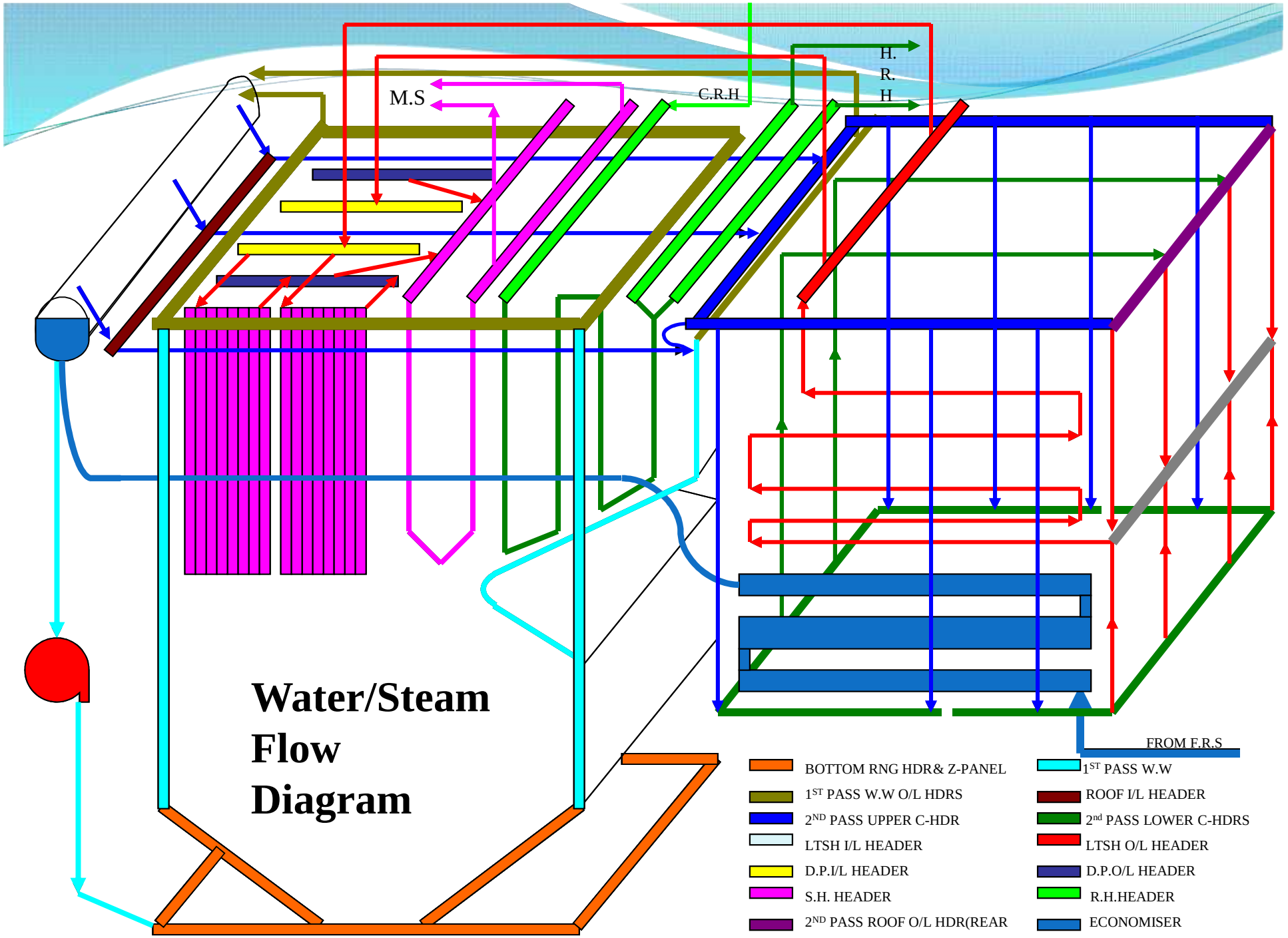
- Boiler & Auxiliaries in Coal based Thermal Power Plant has three main sub-areas:
- Pressure Parts: In this area boiler tube leakage is main cause of forced outage which leads to unit shutdown and generation loss
- Rotary Parts: In rotary parts area draft power consumption increases auxiliary power consumption and it has to be minimized
- Milling System: Milling system responsible for efficient coal pulverisation and its availability is main concern to minimize forced outage

Boiler performance factors

- Exit flue gas temp.
- Superheater / Reheater spray
- Excess Air in furnace
- Unburnt coal in Bottom ash / fly ash
- Aux. power consumed by Boiler auxiliaries
- Flue gas emission etc.
- Rated steam parameter (MS & HRH)

Reduction in Boiler Tube Leakage

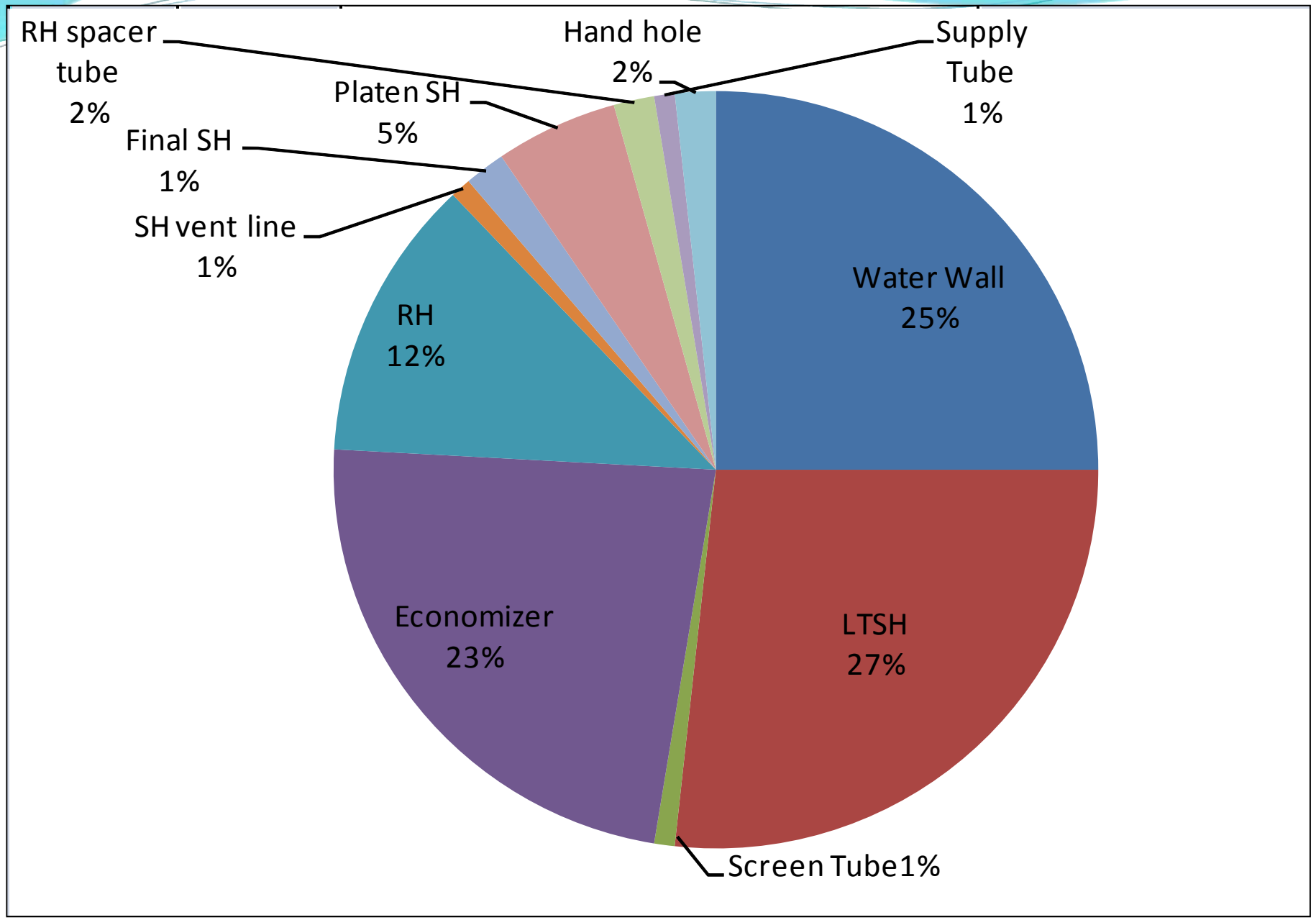

DEFINE
Reduction in Boiler Tube Leakage
MEASURE
Generation loss due to BTL in hours/MU
ANALYZE
Area wise and cause wise
Analysis of past fifteen years history
I MPROVE
Chalk out action plan in respective failure areas as per outage history
CONTROL
Required maintenance works as per action plan in limited time frame/OH
DMAIC


M.S
C.R.H
H.
R.
H
Water/Steam
Flow
Diagram
FROM F.R.S
BOTTOM RNG HDR& Z-PANEL
1ST PASS W.W O/L HDRS
2ND PASS UPPER C-HDR
LTSH I/L HEADER
D.P.I/L HEADER
S.H. HEADER
2ND PASS ROOF O/L HDR(REAR
1ST PASS W.W
ROOF I/L HEADER
2nd PASS LOWER C-HDRS
LTSH O/L HEADER
D.P.O/L HEADER
R.H.HEADER
ECONOMISER

BTL Area Wise 2000-01 to 2015-2016

Unit/ Area	WW	LTSH	Screen Tube	Eco	RH	Pent house	FSH	PSH	Supply Tube/ spacer	Hand Hole/ HDR Plug	Total
Unit-I	6	6	0	9	6	1	0	1	1	2	32
Unit-II	2	2	1	5	4	0	0	1	1	0	16
Unit-III	9	8	0	5	1	0	1	1	0	0	25
Unit-IV	9	7	0	5	1	0	1	2	1	0	26
Unit-V	3	8	0	3	2	0	0	1	0	0	17
Total	29	31	1	27	14	1	2	6	3	2	116

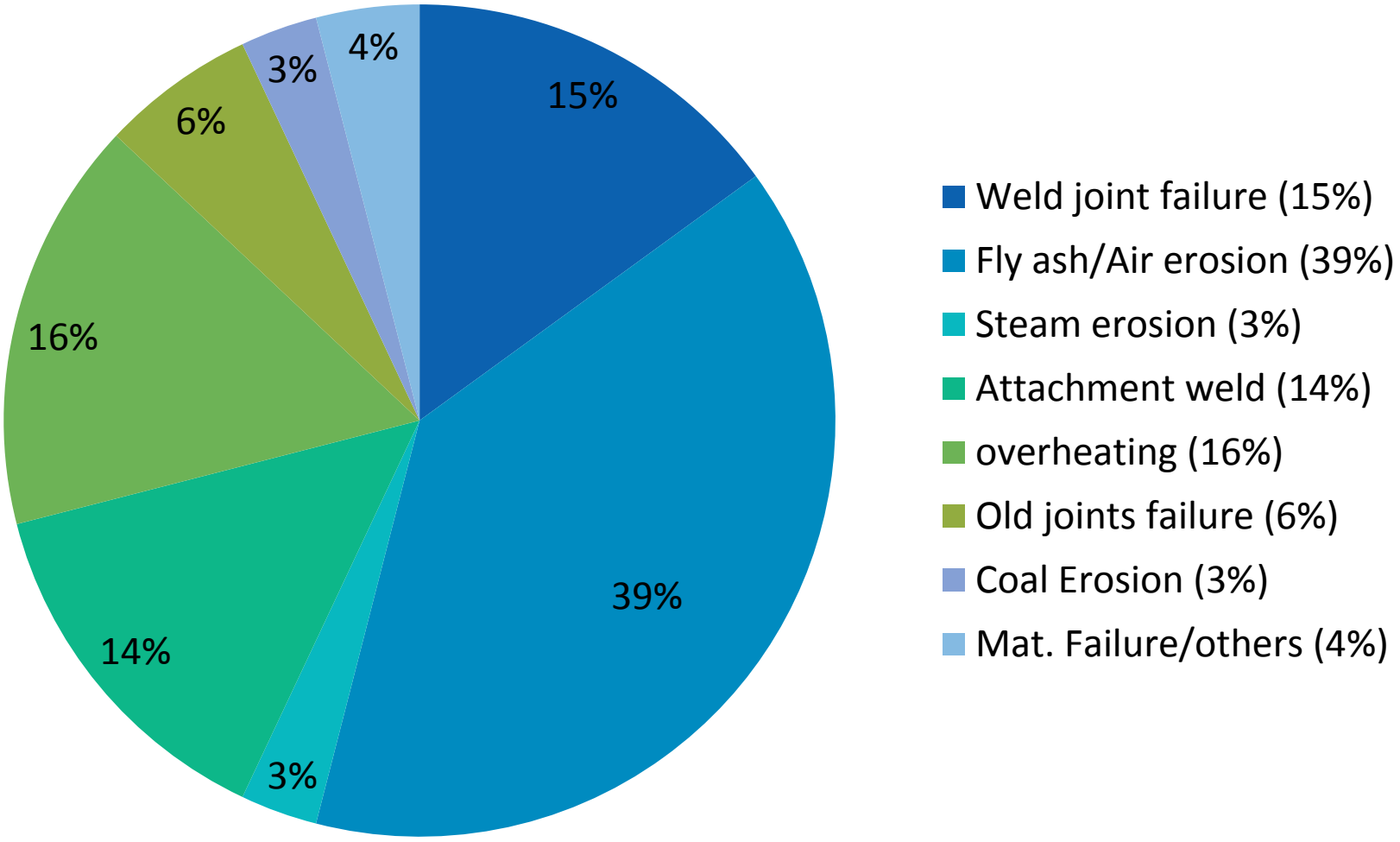
Area Wise BTL



BTL Cause Wise 2000-01 to 2015-16

Unit/ Area	Weld joint failure	Fly ash/Air erosion	Steam erosion	Attach ment weld	overhe ating	Old joints failure	Coal Erosi on	Mat. Failure/ others	Total
Unit-I	7	**11**	2	**2**	**6**	-	1	3	**32**
Unit-II	3	**3**	1	**1**	**4**	2	-	2	**16**
Unit-III	8	**7**	-	**6**	**2**	1	1	-	**25**
Unit-IV	-	**12**	1	**6**	**4**	3	-	1	**26**
Unit-V	-	**11**	-	**1**	**3**	1	1		**17**
Total	17	**45**	4	**16**	**19**	7	3	5	**116**

Cause Wise BTL



ANALYSIS OF FAILURE PRONE AREAS IN BOILER

Sl. NO	AREA	PROBABLE CAUSES OF FAILURE
1.	ECONOMISER	➢ FLY ASH EROSION. ➢ WELD JOINT FAILURE. ➢ MISALIGNMENT OF COILS
2.	LTSH	➢ LACK OF TUBES INSPECTION. ➢ DAMAGE OF LOCKING CLAMPS. ➢ MISALIGNMENT OF CASSETTE BAFFLES.
3.	WATER WALL	➢ SECONDARY AIR EROSION IN BURNER TRANSITION TUBES. ➢ WELD JOINT FAILURE. ➢ STEAM EROSION IN SB AREA.

PROCESS IMPROVEMENT

Sl. No	AREA	PROBABLE CAUSES OF FAILURE
1.	ECONOMISER	▪ *MAPPING OF BOILER TUBES THICKNESS DURING EACH OH* ▪ *COIL LOWERING DECISION BASED ON PAST MAPPING* ▪ *USAGE OF MODERN T&P FOR JOINTS* ▪ *PROPER ALIGNMENTS OF COILS*
2.	LTSH	▪ *RESTORATION OF LOCKING AND CLAMPS DURING EACH OH* ▪ *COIL LOWERING DECISION BASED ON PAST MAPPING* ▪ *USAGE OF MODERN T&P FOR JOINTS* ▪ *ALLIGNMENT AND LOCKING OF CASSETTE BAFFLES*
3.	WATER WALL	▪ *APPLICATION OF PLASTIC REFRACTORY.* ▪ *EROSION RESISTANT COATING IN EROSION PRONE AREA* ▪ *FIXING OF HALF TUBE SHIELDS IN SOOT BLOWER AREA* ▪ *TO ENSURE ALIGNMENT OF SOOT BLOWER SLEEVE* ▪ *FIN WELDING BY HP WELDER*

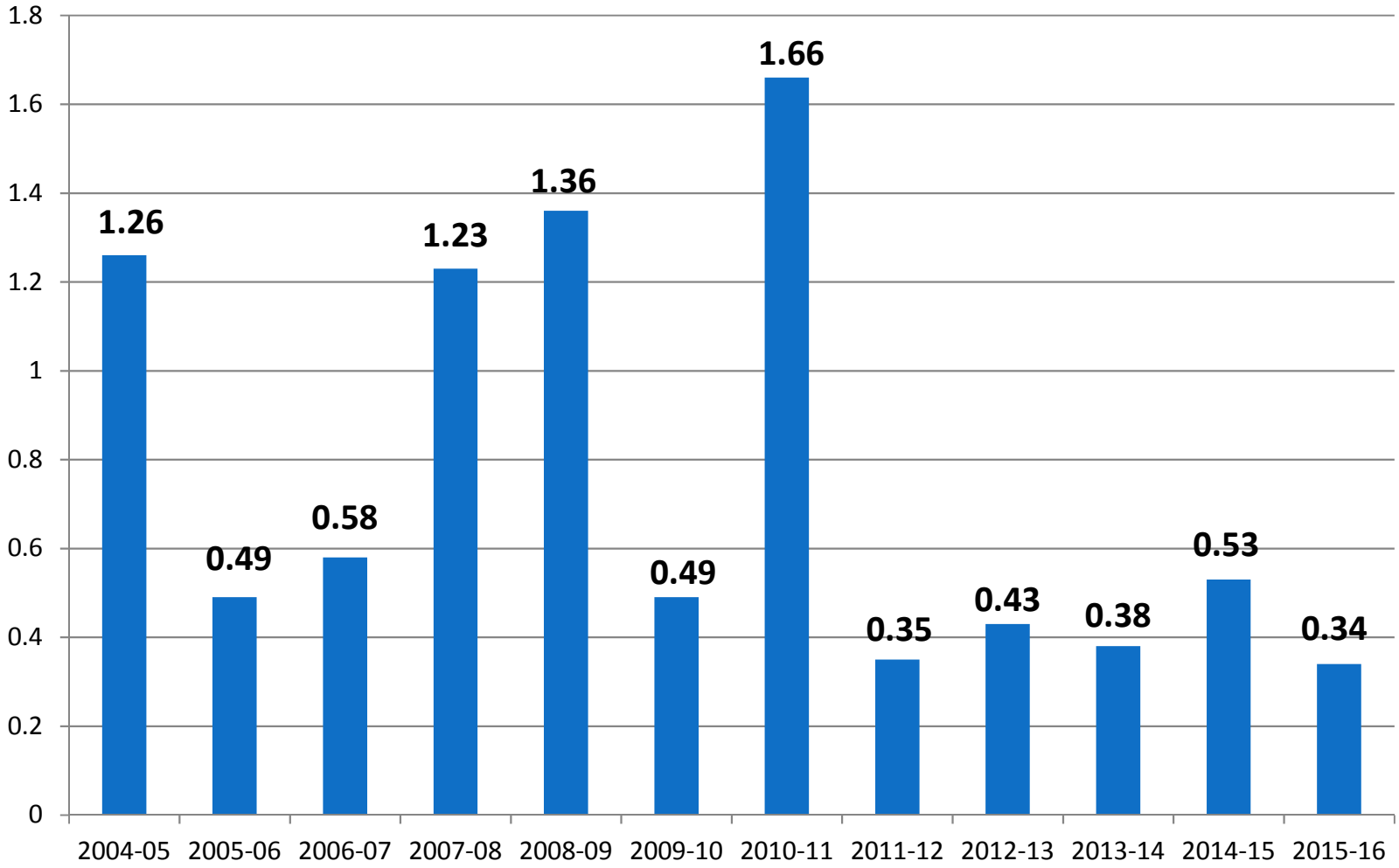
ERECTION/OLD JOINTS RADIOGRAPHY

YEAR	Unit#1	Unit#2	Unit#3	Unit#4	Unit#5
2006-07			227		
2007-08		1510		1070	
2008-09	682		210		94
2009-10		563	1017	565	
2010-11					785
2011-12	797	167		130	
2012-13			186		
2013-14					227
2014-15		244	225		
2015-16				176	396
TOTAL	1479	2484	1865	1765	1106

NUMBER OF TUBE LEAKAGES

YEAR	TOTAL TUBE LEAKAGES
2000-01	6
2001-02	4
2002-03	5
2003-04	10
2004-05	8
2005-06	5
2006-07	6
2007-08	13
2008-09	16
2009-10	6
2010-11	12
2011-12	3
2012-13	6
2013-14	5
2014-15	7
2015-16	4

Percentage availability loss due to BTL



Reduction in Draft Power

Auxiliary Power Consumption in Thermal Power Plant

- Power plant produces electrical energy and also consumes a substantial amount of energy in the form of Auxiliary consumption required for various plant equipments and services.
- Energy conservation in Power Utility is achieved mainly by-

1) **Operating the equipments at maximum efficiency.**

2) Reduction of Auxiliary Power Consumption (APC)

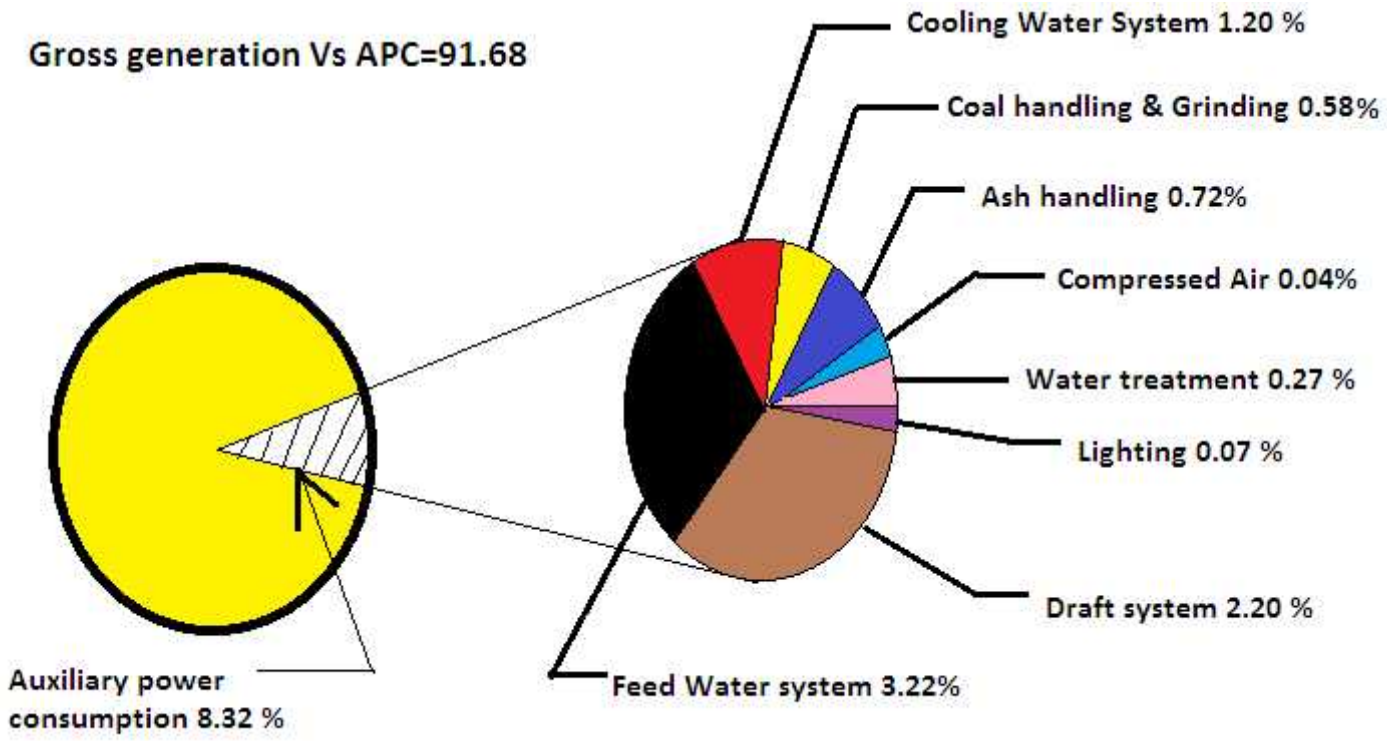
According to a study, if APC of a plant for is 8.17 % and this APC gets reduced only by 0.17 %, fresh capacity addition of about 120 MW can be achieved without any investment.

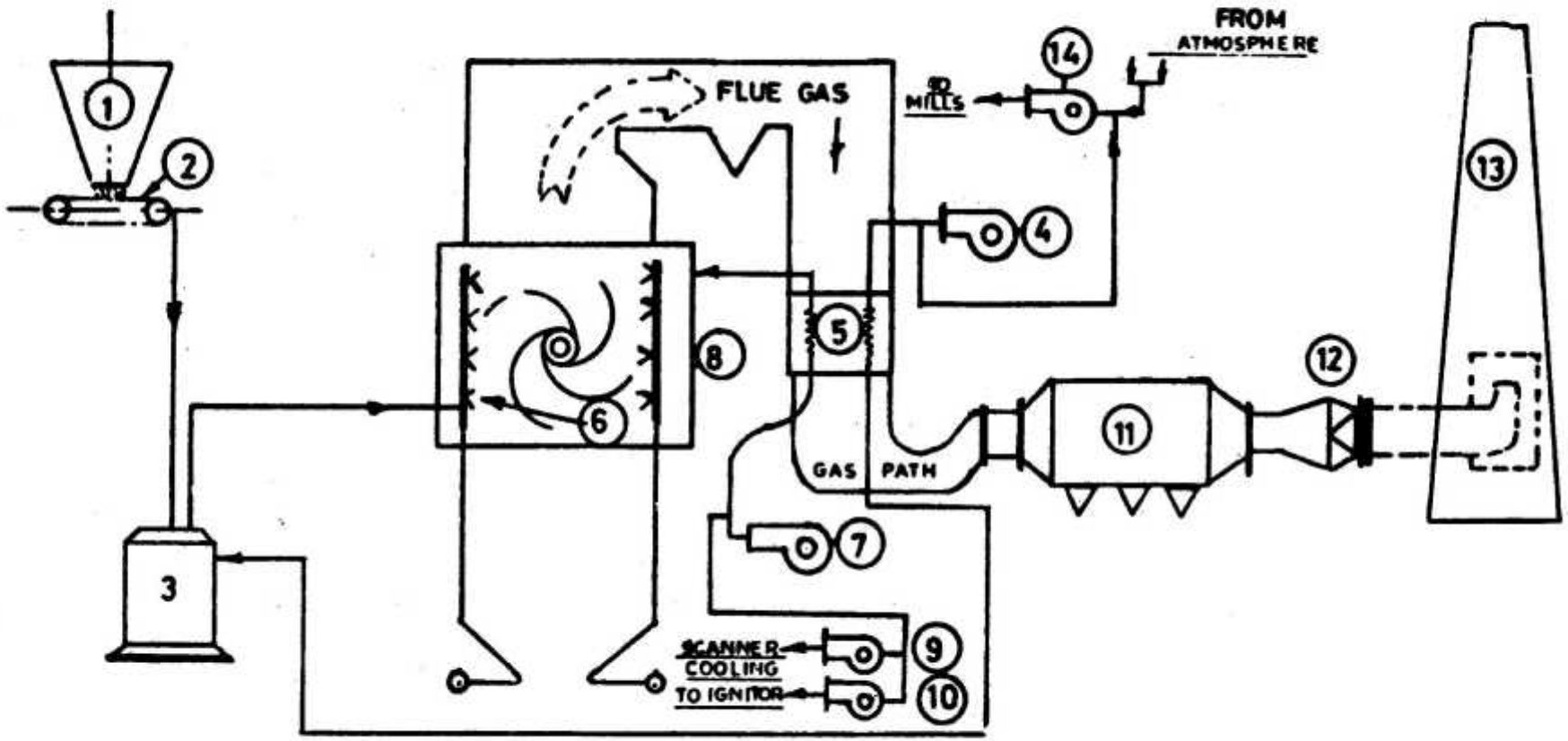
- The auxiliary power consumption plays a major role in enriching the energy efficiency of the thermal power plant. As per the norms APC should well within the 10%.
- As per CEA norms :-

CAPACITY (IN MW)	APC In %
500	6.13
250	8.80
210	**8.77**
195-200	7.67
100-200	10.32
< 100	10.31

- National Level APC :- 8.32 %
- Best APC is found at Sipat STPS of NTPC:- 5.04 %

Typical Breakup of APC in Thermal Power Plant





1.	COAL BUNKER	2.	FEEDER	3.	MILL
4.	P.A. FAN	5.	AIR PREHEATER	6.	BURNER
7.	F.D. FAN	8.	WIND BOX	9.	SCANNER FAN
10.	IGNITOR FAN	11.	ELECTROSTATIC PRECIPITATOR	12.	I.D. FAN
13.	CHIMNEY	14.	SEAL AIR FAN		

F ig No.-15 Arrangement Of Boiler Auxiliaries

Auxiliary Power Consumption at NTPC Unchahar

NTPC/UNCHAHAR

STATION PERFORMANCE REPORT

FIN. YEAR : 2016- 2017

Date of Report : 22-June-16 **Report Upto : 21-Jun-16** **21-Jun-15**

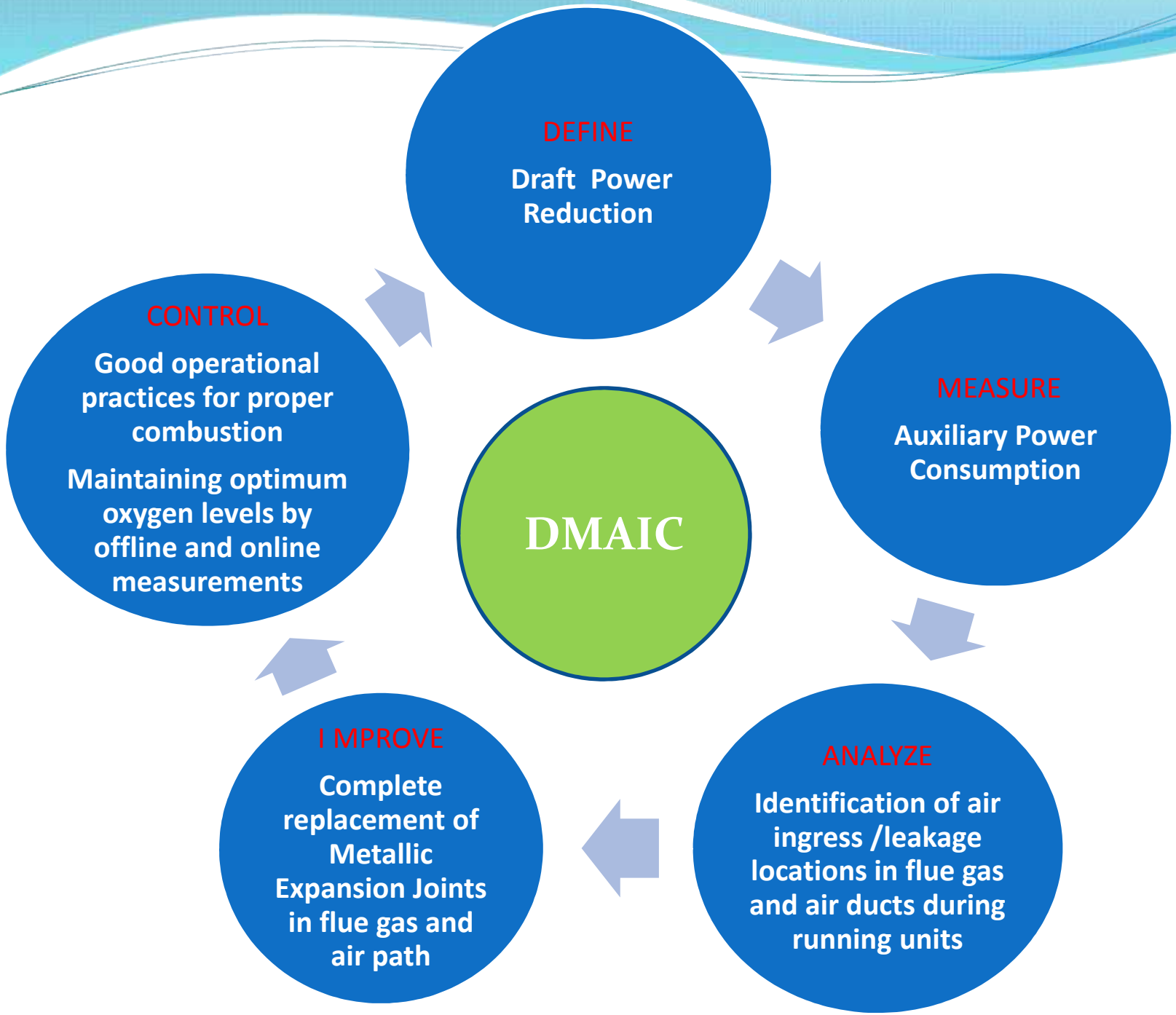
Description	Period	Unit	Unit-I	Unit-II	Stg-I	Unit-III	Unit-IV	Stg-II	Unit-V / Stg-III	Station	Station
Aux. Power Consumption	D	MUs	0.35054	0.35054	0.70108	0.40921	0.40921	0.81842	0.395403	1.9149028	1.82437
		%	7.41	7.36	7.38	8.85	8.72	8.79	8.60	**8.18**	8.49
	M	MUs	7.3455	7.3456	14.6911	7.6764	8.1769	15.8533	8.1865	38.7309	40.4129
		%	7.70	7.65	7.67	8.87	8.73	8.80	8.84	8.34	8.49
	FY	MUs	**118.7502**	**99.4995**	**218.2498**	**108.2280**	**120.4637**	**228.6917**	**113.7591**	**560.7007**	**571.5840**
		%	8.68	8.65	8.67	9.14	9.18	9.16	8.48	**8.82**	8.93

Factors affecting Auxiliary Power Consumption

- Unit Generation and Load Pattern
- Operational Efficiency of Plant Auxiliaries ,Service Auxiliaries and their reliability.
- Unit & Equipment startups / shutdowns.
- Age of plant
- Coal Quality

APC REDUCTION OPPORTUNITIES

- System & Equipment efficiency.
  - ➢Draft system APC reduction.
  - ➢Tube Mill APC reduction.
  - ➢Combustion efficiency.
  - ➢Milling system efficiency & reliability.
  - ➢Air Preheater leakages.
  - ➢On line monitoring of power consumption of various auxiliaries through PI server.
- Better O&M practices
- Energy audit and implementation of recommendations.
- Introduction of latest state of the art technologies on specific systems without waiting for R&M of the whole power plant.


DEFINE
Draft Power Reduction
MEASURE
Auxiliary Power Consumption
ANALYZE
Identification of air ingress /leakage locations in flue gas and air ducts during running units
I MPROVE
Complete replacement of Metallic Expansion Joints in flue gas and air path
CONTROL
Good operational practices for proper combustion
Maintaining optimum oxygen levels by offline and online measurements
DMAIC

Causes of higher draft power

- MEJ in service since commissioning of units.
- Air ingress through expansion joints.
- Repairing is not effective.
- Mill hot air duct expansion joints leakage leading to high PA header pressure.

Effects of higher draft power

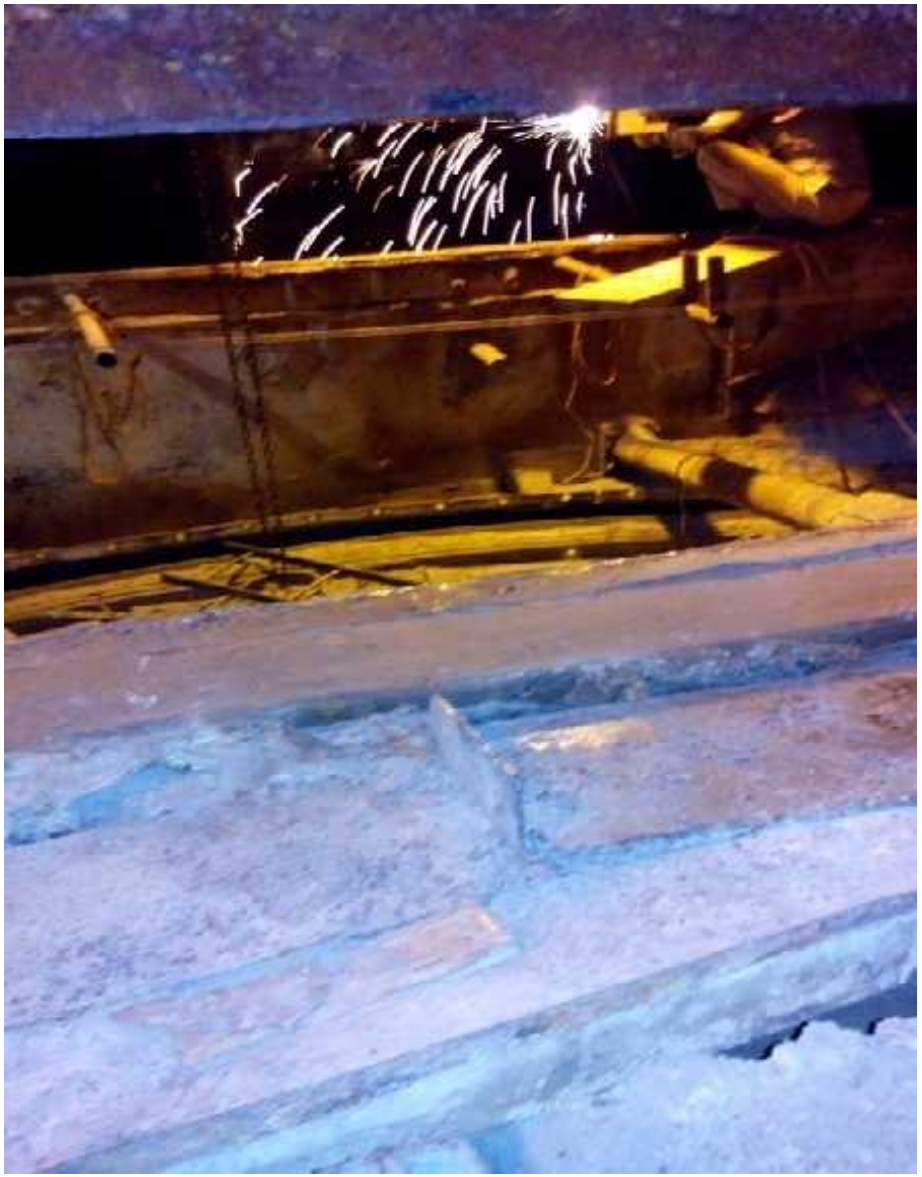
- Restriction on unit loading.
- Higher Auxiliary Power Consumption.
- High APH Guide bearing temperature.

MEJ REPLACEMENT IN ST-I UNITS

Sl No.	LOCATION	UNIT-2 (Sep-2014)	UNIT-1 (Sep-2015)
1	FLUE GAS PATH ,ECO OUTLET	2	2
2	FLUE GAS PATH ,APH INLET	2	2
3	FLUE GAS PATH (APH O/L-ESP I/L)	7	4
4	PRIMARY AIR PATH (HOT APH O/L)	2	2
5	PRIMARY AIR PATH APH-A/B OUTLET TO PA COMMON DUCT	4	NIL
6	WINDBOX	18	NIL
7	MILL HOT AIR DUCT (APH O/L TO MILL I/L)	16	16
	TOTAL	51	26

Lifting of Eco Outlet (Style-7) and APH Inlet(Style-5) MEJ

Cutting ,Locking and Edge preparation



Primary Hot Air APH Outlet MEJ Replacement

Mill inlet Metallic Expansion Joint (Style 3 & 4)

APH Outlet to ESP Inlet after APH Hopper MEJ Replaced

DRAFT POWER REDUCTION IN UNIT-2

DESCRIPTION	PRE O/H	POST O/H	GAIN
FD FAN-A (KW)	228	274	-46
FD FAN-B (KW)	274	301	-27
ID FAN-A (KW)	1289	941	348
ID FAN-B (KW)	1216	887	329
PA FAN-A (KW)	1005	960	45
PA FAN-B (KW)	1024	969	55
DRAFT POWER	5038	4334	704
GAIN (KW)	704		

DRAFT POWER REDUCTION IN UNIT-1

DESCRIPTION	PRE O/H (28.08.2015)	POST O/H (21.11.2015)	GAIN
LOAD	221 MW	220 MW	
AIR FLOW	800	844	
FD FAN-A (KW)	199	230	-31
FD FAN-B (KW)	176	193	-17
ID FAN-A (KW)	1491	1185	306
ID FAN-B (KW)	1328	1141	187
PA FAN-A (KW)	1205	1130	75
PA FAN-B (KW)	1210	1109	101
DRAFT POWER	5609	4988	621
GAIN (KW)	621		

Payback

DESCRIPTION	Unit-2	Unit-1
Reduction in Draft Power	700 KW	621 KW
Selling Price of Electricity	₹ 3.70	₹ 3.70
Saving due to APC Reduction/Day	700 x 24 x 3.70 = ₹ 62160/-	621 x 24 x 3.70 = ₹ 55144/-
Total Saving /Day	₹ 62160/-	₹ 55144/-
Saving per annum (@90% PLF)	₹ 2.04 Crore	₹ 1.81 Crore
Material Cost	₹ 34 Lacs	₹ 17 Lacs
Service Cost	₹ 30 Lacs	₹ 39 Lacs
Payback Period	0.313 Years (3.7 Months)	0.309 years (3.7 months)

Saving/ Benefits by Reduction in BTL

- *Average Unit Outage duration due to single BTL is 24 Hrs.(Approx.)*
- *Generation Loss in MU= 0.21*24 MU = 5.04 MU*
- *Average Cost /Unit= ₹ 3.70*
- *Net loss due to 24 Hrs Generation loss:*
  *₹ 3.70*5.04*1000000 = ₹ 186 Lac*
  = ₹ 1.86 Cr (Approx)

- *Average number of BTL during last 5 years=6.6*
- *Number of BTL in FY 2015-16 =4*
- *Net Saving =2.6*1.86*

= ₹ 4.83 Cr in 2015-16

Intangible Gains

- *Reliability of Boiler & Auxiliaries improved resulting in one of the highest DC among all NTPC stations in 2015-16*
- *Availability of Boiler increased*
- *ID Fan Loading reduced from 135-140 Amps. pre overhauling to 95-100 Amps. post overhauling*
- *PA Fan loading reduced*
- *Proper combustion of Coal in Furnace*
- *No restriction on Unit loading.*
- *Availability of Milling system increased*

NTPC Limited

(A Govt. of India Enterprise)

LETTER OF APPRECIATION

(as a team member)

Date: 07.11.2015

Shri Ritesh singh, (Emp No-008502)

Shri P.S Pandey (Emp no-058549)

Shri Devesh Adhikari (Emp no- 0101043)

The following work done by your team is noteworthy.

Unit-5 zero BTL first time since commissioning in 2007. Unit-5 overnauling was done in April-2015. Unit-5 recorded Zero BTL in year 2015-16. Unit-1 flue gas duct including Economizer outlet metallic expansion joints replaced first time since commissioning in year 1988. This major work leads to a appreciable draft power saving of 650 KW per day. Stage-1 mill RJ bearing consumption reduced drastically by improving maintenance practices. New practices involve, removal of worn out grinding roll by hydraulic jack instead of heating and regular servicing of RJ assembly.

I sincerely appreciate the good work done by you. I hope that you will continue to put in your sincere efforts in future also and spread the culture of team work amongst others.

With best wishes,

Yours Sincerely,

(SANJEEV KUMAR SHARMA)

ADD GENERAL MANAGER (BMD)

To

Name : Shri Ritesh singh, Sr Manager

Shri P.S Pandey. Dy Manager.

Shri Devesh Adhikari. Dy Manager.

Deptt. : **BMD**

Copy To: BUH/ED (Region)

GM(O&M)

Personal File


THANKS