Council of Enviro Excellence

5th NATIONAL POWER-GEN ENERGY EFFICIENCY AWARDS-2026

5TH NATIONAL POWER-GEN ENERGY EFFICIENCY

SUMMIT AND AWARDS 2025

Enhancing Efficiency in Indian Thermal Power Plants

MPL'S INITIATIVE TOWARDS REDUCING NET STATION HEAT RATE AND SPECIFIC RAW WATER CONSUMPTION

MR. NITYA MONDA

MR. PANKAJ KUMAR SINGH

CEE 5th National Power-Gen Energy Efficiency Awards 2026

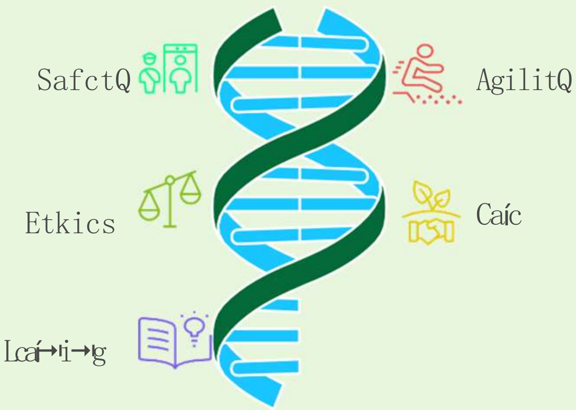
Maithon Power Limited

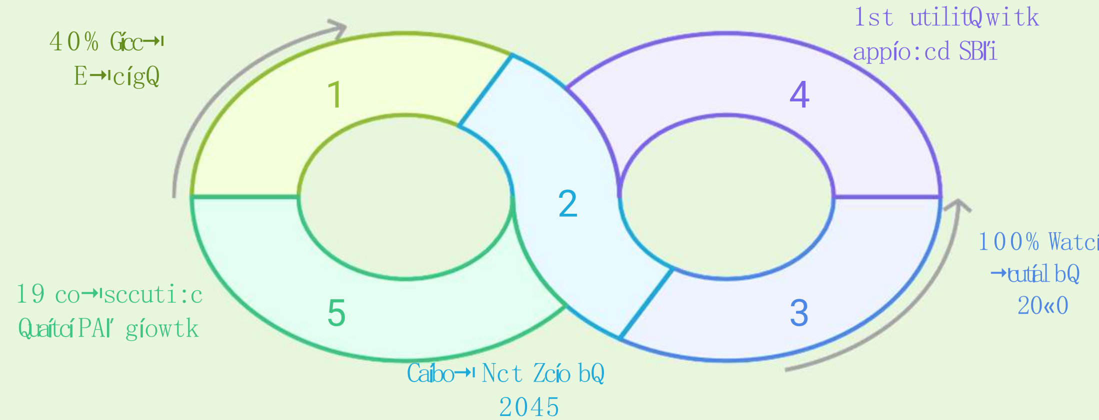
(A Joint Venture Company of TATA POWER & DVC)

Brief Introduction

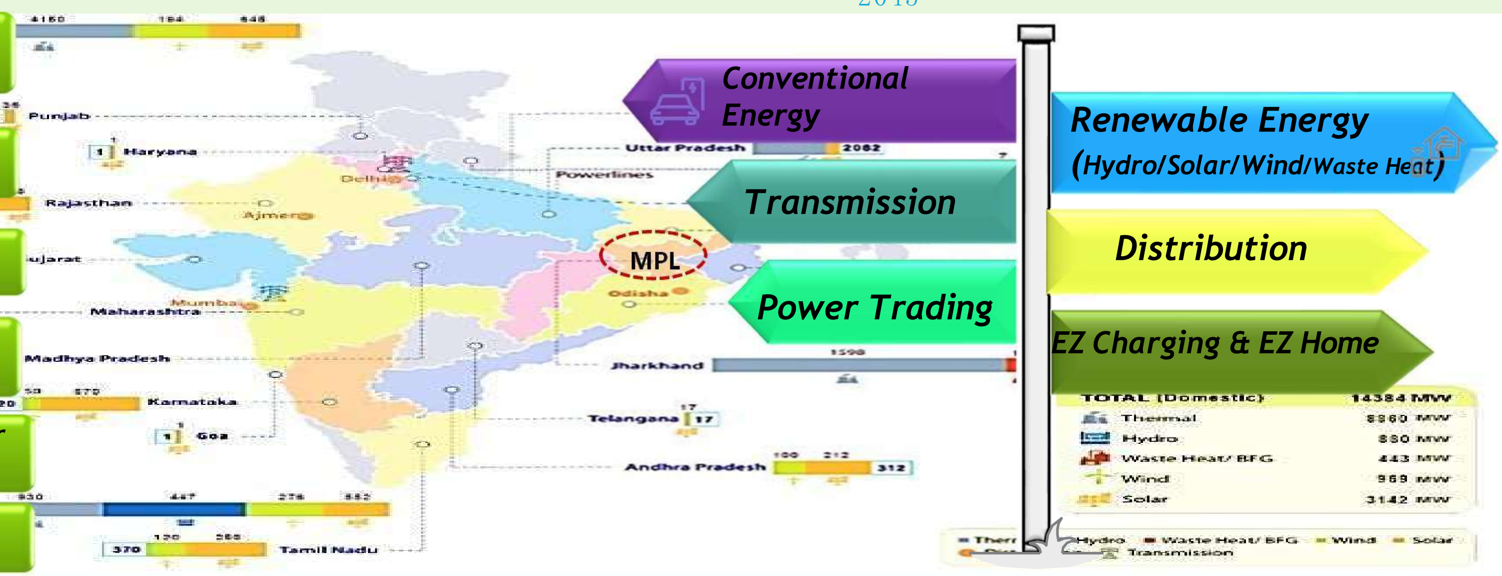
About Us: TATA Power

Empower A Billion Lives Through Sustainable, Affordable & Innovative Energy Solutions





- *India's 1st 500 MW Unit*
- *India's 1st 800 MW Supercritical*
- *India's 2nd , 3rd & 4th hydro*
- *India's 1st Public-Private Partnership venture plant (With*
- *1st Indian company to ship over 1 GW solar modules.*
- *India project executed 's 1st transmission with PPP financing*



Brief Introduction

About Us: Maithon Power Limited

MPL MAITHON POWER LIMITED

TATA POWER

Maithon Power Limited (2x525 MW) JV of Tata Power (74%) & DVC (26%)

ISO Certifications

ISO 9001: 2015 13.01.2014 09.01.2026	ISO 9001:2015
ISO 14001:2015 13.01.2014 09.01.2026	ISO 50001
ISO 45001:2018 13.01.2014 09.01.2026	ISO 45001:2018
ISO 22301:2019 31.08.2018 30.08.2024	ISO 22301:2019 (BCMS)
ISO 50001:2018 11.03.2019 09.03.2025	ISO 50001:2018
ISO 27001:2013 10.11.20121 09.11.2024	ISO 27001
ISO Standard Inception Validity	ISO

HPCL/IOCL Fuel Oil

CIL

BCCL : 1.84 MTPA

CCL : 1.975 MTPA

Coal : 4.5 MTPA

E-auction/Import

60%

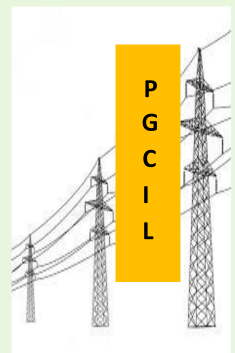
40%

Indwell BTG

Energo AHP

Energo CHP

Other O&M Associates



PGCIL

TPTCL

DVC (150MW)

WBSEDCL (300 MW)

TPDDL (300 MW)

KSEB (300 MW)

Regulatory & Governing Bodies

- Central Electricity Authority
- Central Electricity Regulatory Commission
- Ministry of Power
- Ministry of Coal
- Ministry of Environment & Forests
- Central Pollution Control Board
- Jharkhand State Pollution Control Board
- Govt Of Jharkhand
- National LDC
- Eastern Region load Dispatch Centre
- Indian Railways

MPL
MAITHON POWER LIMITED

Energy Consumption Overview

TATA POWER

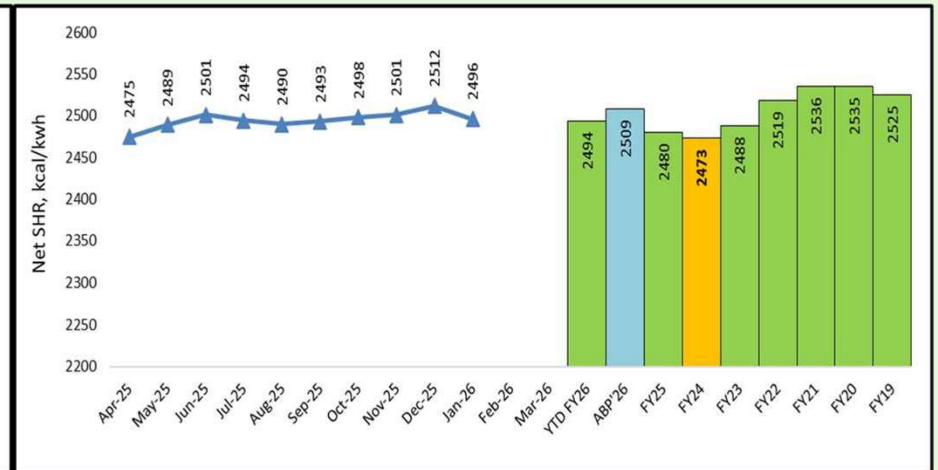
Energy Data	UoM	FY25
Annual Generation	MUs	7253
PLF	%	78.9
PAF	%	87.6
Station APC	%	5.64
Station GHR	kcal/kwh	2339.8
Boiler Efficiency *	%	85.3
Turbine Cycle Heat Rate *	kcal/kwh	1996
Raw Water Consumption	M3/Mwh	2.26
DM Water Consumption	%	0.80

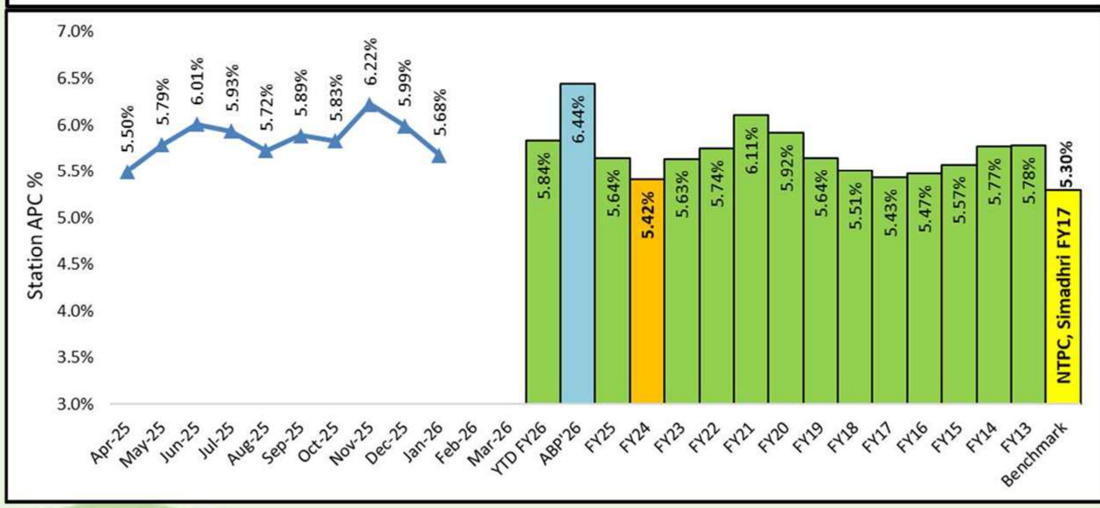
* Station

Highlights

- Successful completion of Major Overhauling of Unit-2 in Jan'25. Unit-2 gross heat rate reduced by 22 kcal/kwh.
- Effective ash utilization of 101% in FY25 including 57% gainful ash utilization.
- Installation of new De-NOx burners, SOFA system in U#2 during AOH in Jan'25 to reduce NOx emission w.r.t the Environmental Norms.
- Installation of Unit-1 FGD system to reduce the Sox emission w.r.t the Environmental Norms. COD declared in Jul'25.
- MPL Won Design Honor Award for "RG Hammer Design Modification" in Power Innovista 2024
- MPL won Gold Award in CII National Kaizen competition for the Laser project "Reduction of coal mill vibrations from 15 to 5 mm/s
- Won Platinum award in 9th CII National Competition on Digitalization, Robotics & Automation on the project "Optimization tool in Python for APC reduction" held on May'24.
- NSC 5-Star GOLD certificate received in Safety from NSC Mumbai. MPL rating improves to AA+ stable from AA stable.
- MPL Received Safety Shield Award- the highest Safety Award from NSCI. Won NSC Suraksha Puraskar in Power Generation Category.

HR and APC Trend

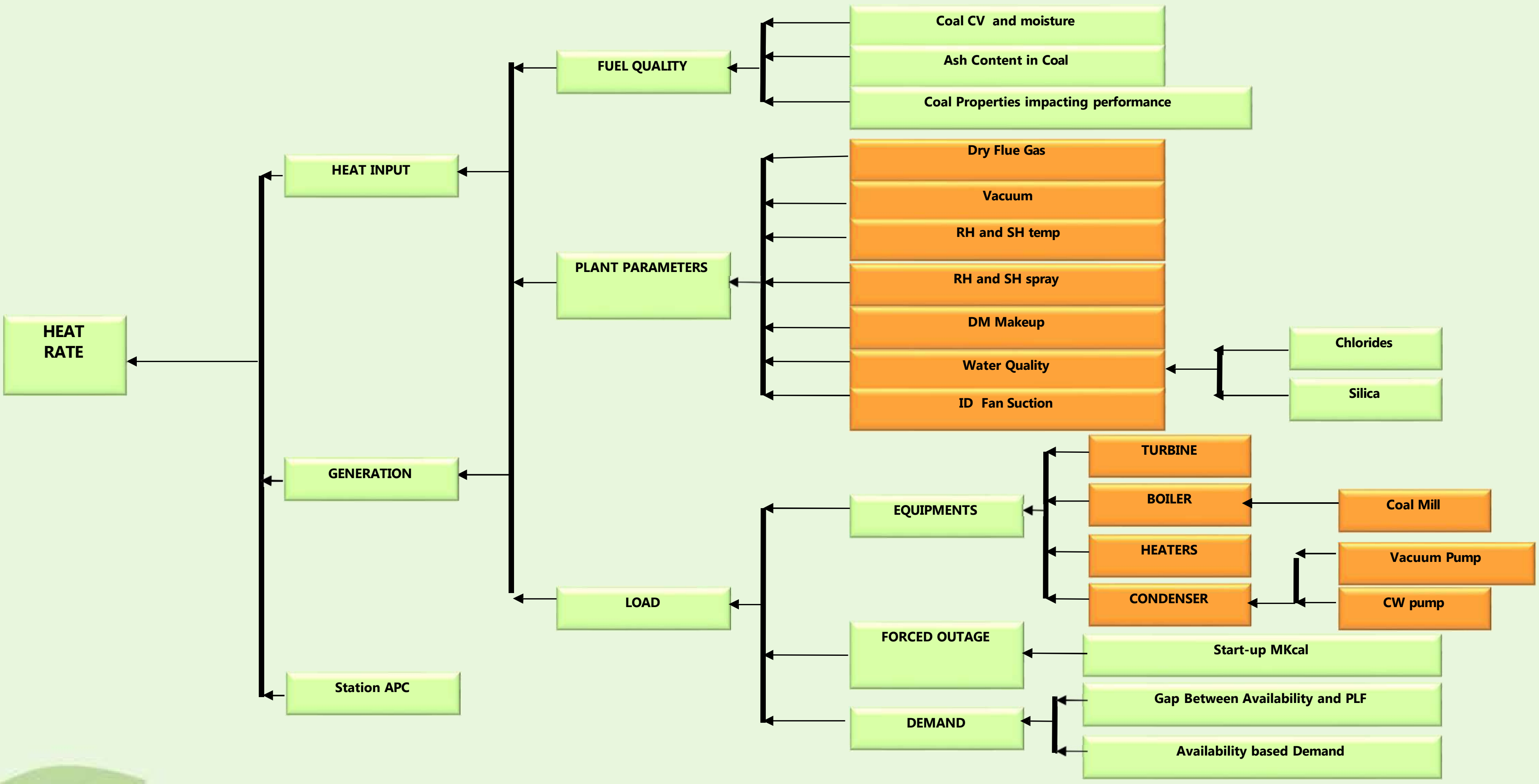




Objective of the project:-

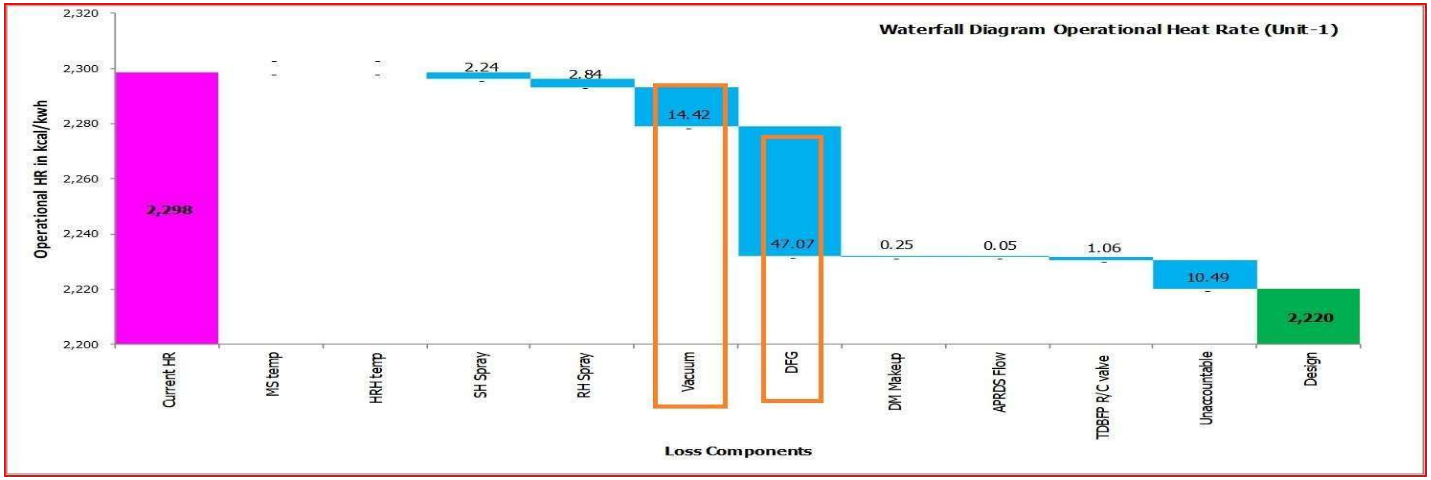
1. **Evaluate various strategies to improve the operational heat rate**
2. **Benchmark, Compare the operational Process & Parameters of similar plant**
3. **Identify the most cost-effective and environmentally friendly approaches**
4. **Adopt the best practices to achieve the Benchmark NSHR**

Key Operational Areas to Address



KPI Waterfall

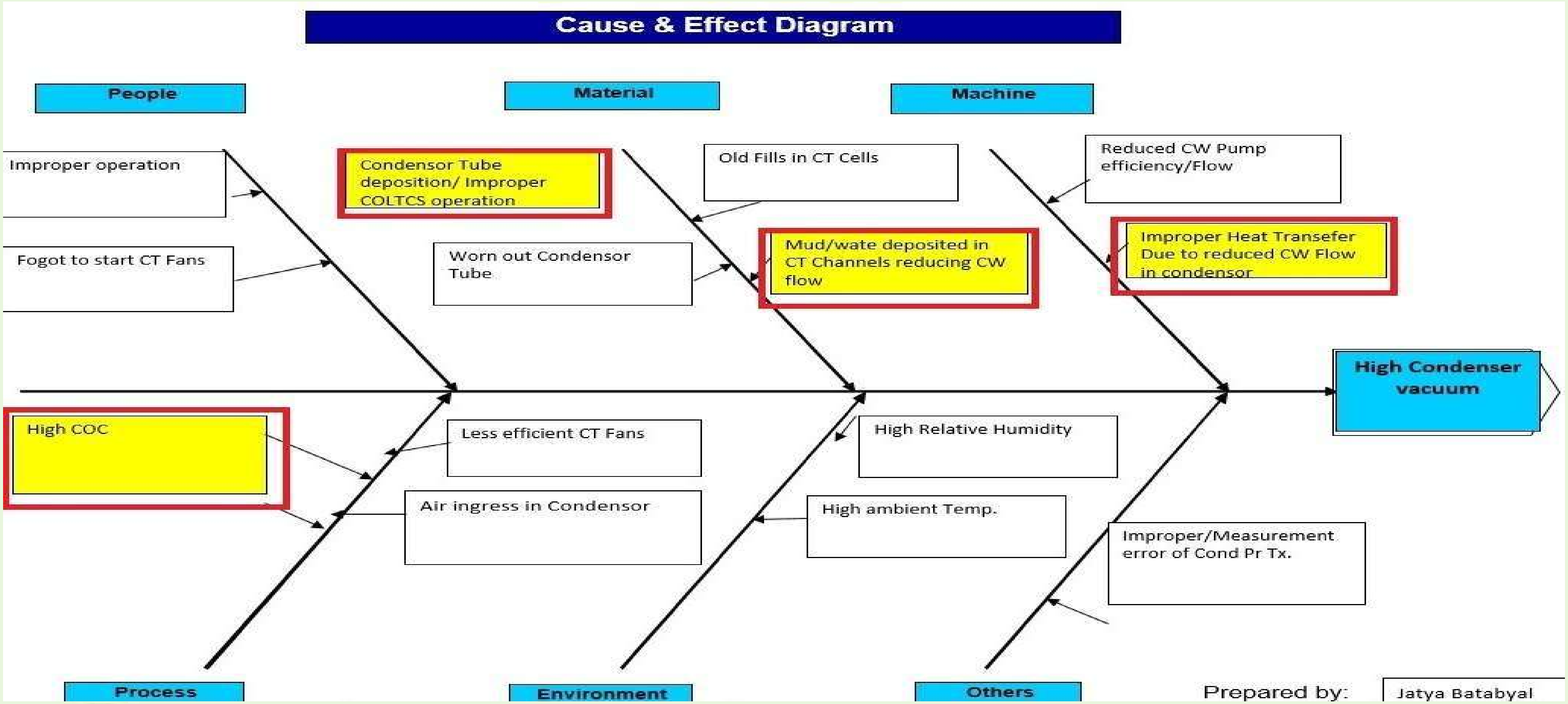
- SHR is depending on various plant operating factors and performance parameters like MS Temp, Condenser Vacuum, Boiler Efficiency etc.
- Accordingly, we have analyzed the key factors (losses) of SHR and prepare a waterfall diagram to understand the major losses areas.



- Based on above waterfall diagram, it is observed that (1) **higher Condenser Vacuum and (2)** higher Boiler **Dry Flue Gas Losses** are the key factors. If we can improve those factors, then target can be achieved.

Condenser Vacuum

Condenser Vacuum RCA



Condenser Vacuum Improvement Initiatives

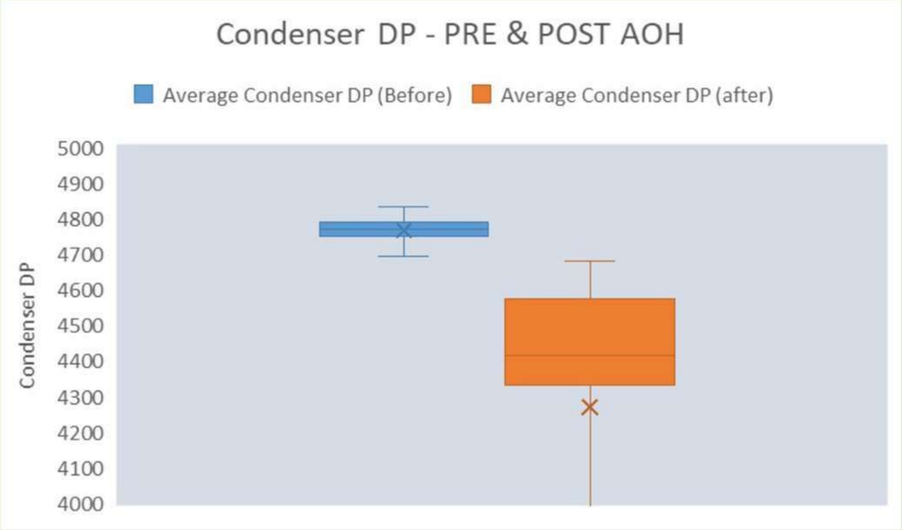
1. IDCT riser distribution pipes flushing and Nozzles cleaning

a. Cooling Water P/P discharge header pressure reduced
b. CW flow through condenser increased
c. Condenser vacuum improved

	Before	UoM	After
CW pump discharge press	1.86	kg/cm2	1.82
DT	11.3	degC	11.1
Assumed CW flow increased	1.77	%	
Condenser vacuum	0.1090	bar(a)	0.1080
Vacuum improved	0.0010	bar(a)	
HR loss	0.76	kcal/kwh	
Annual heat loss reduction @85% PLF	5942	Mkcal/year	
Annual Rupees/Mkcal	1050	Rs/Mkcal	
Annual savings	**0.62**	**Crs**	

2. Improvement of Unit 1 Condenser DP

a. SOP of COLTCS operation has been revised
b. U1 ball collecting screen has been modified
c. Before Unit-1 outage for AOH Condenser tubes and Fills chemical cleaning has been done. NALCO 73550 was dozed through COLTCS and NALCO 3DT121 was directly dozed in CT basin as defoaming agent
d. Condenser tubes has been done first time at 600bar high pressure jet
e. Condenser DP improved from 4750 to 4400mmWC



Condenser Vacuum Improvement Initiatives

3. IDCT Fills replacement

a. IDCT fills replacement by measuring its effectiveness
b. Condenser CW inlet temp improved
c. Condenser vacuum improved

Cooling Tower Fills Replacement Status (FY26):

U#1 CT	**1 (FY26)**	**3 (FY26)**	**5 (FY26)**	**7 (FY26)**	**9 (FY26)**	11 (FY24)	13 (FY24)	15 (FY24)	17 (FY24)	**19 (FY26)**	21 (FY25)
	2 (FY26)	4 (FY23)	6 (FY23)	8 (FY22)	10 (FY23)	12 (FY24)	14 (FY25)	16 (FY24)	18 (FY23)	20 (FY23)	22 (FY25)
U#2 CT	1 (FY24)	3 (FY24)	5 (FY24)	7 (FY24)	9 (FY25)	11 (FY25)	13 (FY25)	15 (FY25)	17 (FY25)	19 (FY25)	**21 (FY26)**
	2 (FY23)	4 (FY23)	6 (FY23)	8 (FY23)	10 (FY24)	12 (FY23)	14 (FY23)	16 (FY25)	18 (FY25)	20 (FY24)	22 (FY25)

Unit-1 Condenser Vacuum

	2020	2021	2022	2023	2024	2025
Jan	0.096	0.097	0.097	0.096	0.089	0.082
Feb	0.088	0.089	0.102	0.097	0.089	0.082
Mar	0.097	0.097	0.114	0.094	0.091	0.083
Apr	0.100	0.102	0.117	0.096	0.092	0.090
May	0.108	0.108	0.112	0.106	0.103	0.096
Jun	0.114	0.116	0.123	0.113	0.113	0.098
Jul	0.145	0.118	0.119	0.120	0.108	0.098
Aug	0.116	0.120	0.123	0.123	0.107	0.097
Sep	0.097	0.117	0.122	0.127	0.108	0.096
Oct	0.112	0.118	0.118	0.116	0.106	0.094
Nov	0.101	0.102	0.110	0.104	0.092	0.091
Dec	0.095	0.100	0.104	0.096	0.100	0.080

U_1 Condenser DT (Full Load)

	2019	2020	2021	2022	2023	2024	2025
Jan	10.2	10.6	11.1	10.8	11.2	10.8	10.2
Feb	10.3	11	10.3	11.0	10.8	10.7	10.5
Mar	10.5	10.9	10.5	10.7	10.2	10.5	10.5
Apr	10.9	10.9	10.6	10.7	10.3	10.6	10.6
May	10.3	10.9	10.6	10.5	10.6	10.6	10.7
Jun	10.4	11	10.6	10.6	10.8	10.8	10.7
Jul	10.5	11	10.5	10.6	11.1	10.6	10.5
Aug	10.5	11.1	10.5	10.6	11.3	10.6	10.6
Sep	10.5	11	10.5	10.7	11.1	10.7	11
Oct	10.7	11.1	10.6	10.9	10.8	10.6	10.5
Nov	10.5	11.1	10.5	11.0	10.8	10.5	10.1
Dec	10.5	11	10.7	11.1	10.8	10.2	10.0

U_1 CW inlet Temp

	2019	2020	2021	2022	2023	2024	2025
Jan	31.7	31.1	26.8	32.8	30.9	31.8	30.4
Feb	32.0	30.4	27.0	32.7	25.5	31.5	30.6
Mar	32.2	32.7	32.4	34.9	32.5	32.4	31.2
Apr	33.2	33.1	33.2	36.1	33.2	32.7	33.0
May	34.1	34.1	35.0	35.9	34.9	34.7	34.3
Jun	34.4	34.7	35.8	37.3	36.0	35.8	34.6
Jul	34.7	35.1	36.3	37.2	36.7	35.5	34.5
Aug	34.5	35.2	36.6	37.5	36.7	35.4	34.5
Sep	34.2	35.1	36.4	37.5	37.5	35.5	34.6
Oct	33.9	34.6	36.2	36.4	36.0	35.0	34.2
Nov	33.1	33.3	35.3	35.1	34.3	32.6	34.2
Dec	31.4	32.4	34.0	33.9	33.3	31.1	31.0

Unit-2 Condenser Vacuum

	2020	2021	2022	2023	2024	2025
Jan	0.095	0.089	0.095	0.102	0.093	0.083
Feb	0.094	0.089	0.097	0.099	0.093	0.084
Mar	0.096	0.099	0.092	0.096	0.096	0.084
Apr	0.104	0.105	0.116	0.100	0.099	0.090
May	0.109	0.106	0.114	0.110	0.109	0.096
Jun	0.112	0.112	0.123	0.116	0.115	0.098
Jul	0.111	0.115	0.120	0.121	0.114	0.098
Aug	0.110	0.121	0.123	0.126	0.110	0.097
Sep	0.111	0.115	0.123	0.128	0.112	0.096
Oct	0.109	0.112	0.120	0.123	0.110	0.092
Nov	0.100	0.102	0.107	0.106	0.101	0.089
Dec	0.092	0.101	0.101	0.099	0.098	0.085

U_2 Condenser DT (Full Load)

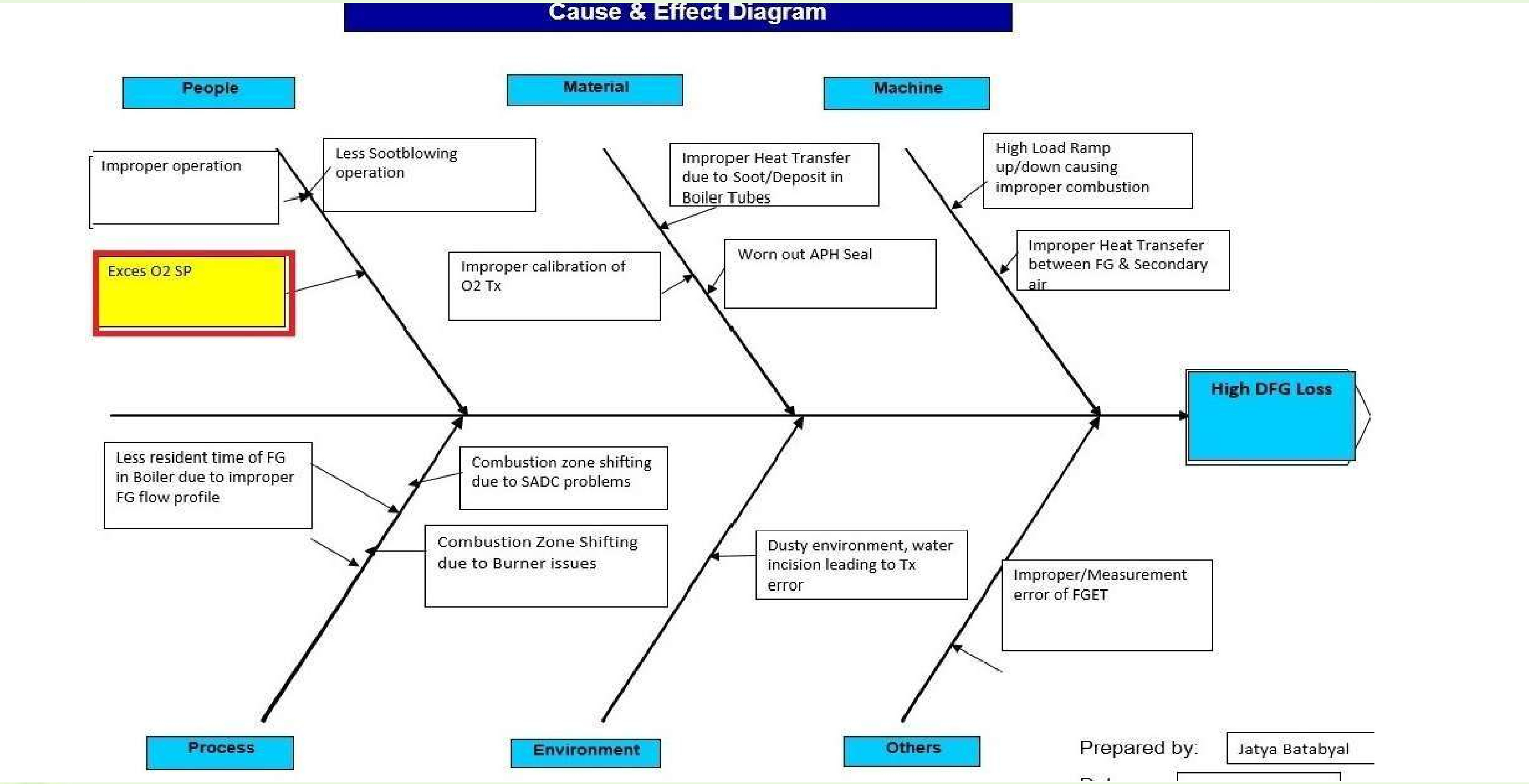
	2019	2020	2021	2022	2023	2024	2025
Jan	10.2	10.8	10.5	11.1	10.1	10.4	10.3
Feb	10.3	10.8	10.7	11.2	10.1	10.4	10.2
Mar	10.2	10.7	10.7	10.2	10.1	10.4	10.2
Apr	10.3	10.8	10.7	10.3	10	10.6	10.1
May	10.4	10.8	10.8	10.2	10.1	10.6	10.2
Jun	10.5	10.9	11.1	10.3	10.3	10.5	10.2
Jul	10.6	10.6	11	10.3	10.4	10.6	10.1
Aug	10.7	10.7	10.9	10.2	10.5	10.6	10.2
Sep	10.8	10.7	10.9	10.3	10.6	10.6	10.1
Oct	10.7	10.9	11.1	10.5	10.6	10.7	10.1
Nov	10.6	10.7	10.9	10.2	10.4	10.8	9.8
Dec	10.7	10.5	11	10	10.3	10.6	8.8

U-2 CW inlet temp

	2019	2020	2021	2022	2023	2024	2025
Jan	31.7	31.2	30.0	32.8	34.2	32.6	30.4
Feb	32.0	30.6	30.9	32.8	33.0	32.2	30.7
Mar	32.1	31.2	32.5	30.2	33.0	32.8	31.3
Apr	33.2	33.2	33.2	36.2	33.7	33.3	33.1
May	34.0	34.2	35.0	35.9	35.4	35.1	34.2
Jun	33.9	34.7	35.8	37.4	36.2	36.1	34.5
Jul	31.7	35.2	36.3	37.3	37.1	35.7	34.4
Aug	34.5	35.2	36.5	37.6	37.1	35.7	34.5
Sep	34.1	35.1	36.4	37.6	38.2	35.9	34.6
Oct	33.7	34.6	36.3	36.5	36.5	35.3	34.3
Nov	33.1	33.2	35.2	35.2	34.9	33.0	33.3
Dec	31.4	32.5	34.1	34.2	33.9	30.0	34.1

DFG Loss Reduction initiatives

Root Cause Analysis of High DFG loss

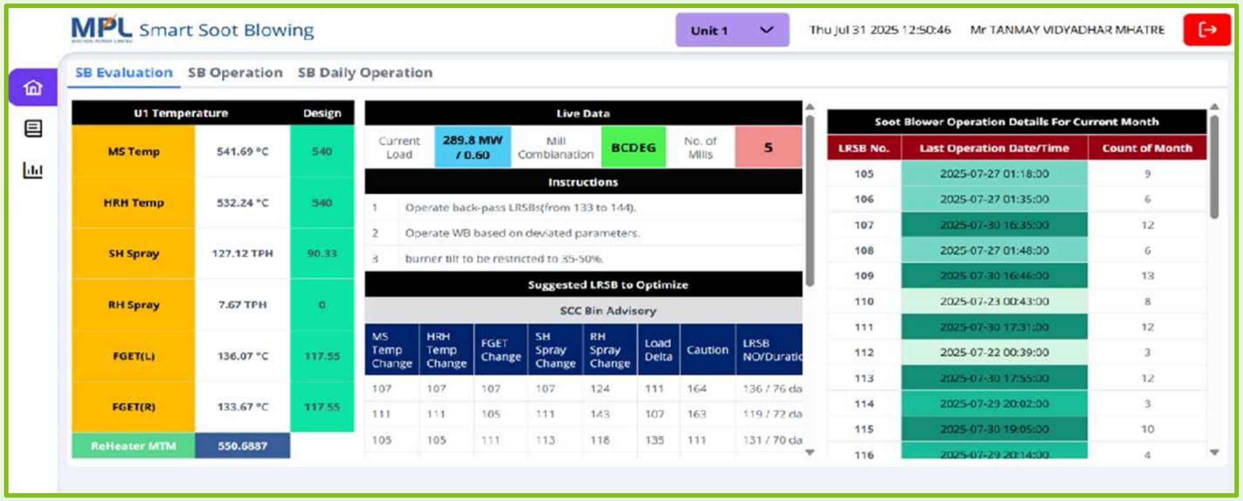


DFG Loss Reduction Initiatives

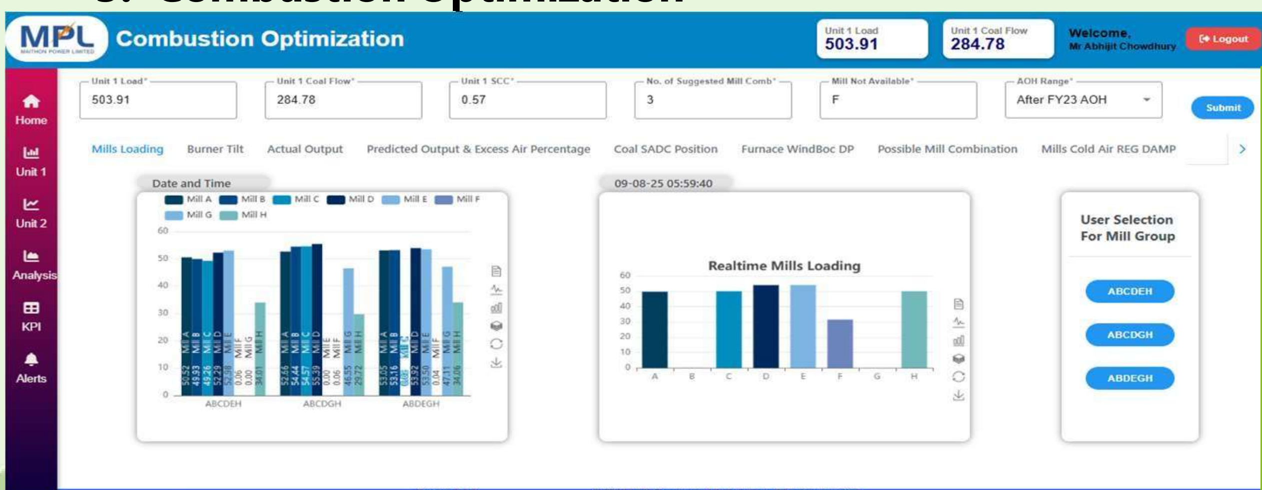
1. **Excess Oxygen Trimming at Economizer Outlet**
   a. Excess Oxygen at Eco O/L trimmed from 3.56% to 3.3 to 3.1%
   b. Reduced DFG loss reduced from 4.7% to 4.6% to 4.5% at same FGET
   c. Improvement in Boiler efficiency ~0.2%
   d. Improvement in Heat Rate ~5Kcal/KWhr

Savings by Boiler Flue Gas excess Oxygen trimming			
	Before	UoM	After
O2% before trimming	3.56	%	
O2% after trimming		%	3.1
Excess air	20.41	%	17.64
Theoretical air required for complete combustion	6.37	kg/kg of coal	6.37
Actual mass of excess air	7.67	kg/kg of coal	7.51
Mass of dry flue gas	7.33	kg/kg of coal	7.30
DFG loss	4.70	%	4.5
TGHR	1945	kcal/kwh	1945
Boiler efficiency improved			0.2%
Improvement in GHR @85% PLF		Kcal/KWhr	**~5Kcal/KWhr**

2. Smart Boiler Soot Blowing Advisory Tool



3. Combustion Optimization

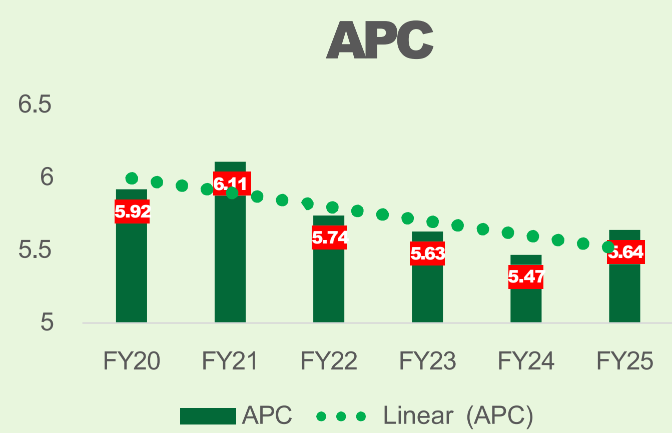


Recommendations:
Suggests which Wall Blowers to operate based on current Mill Combination, Load, SH Spray Change, RH Spray Change. RH MTM Spray Change, MS Temp Change, FGET Change and HRH Temp Change
Suggests top10 optimization strategies for LRSB based on current Mill Combination, Load, SH Spray Change, RH Spray Change. RH MTM Spray Change, MS Temp Change, FGET Change and HRH Temp Change.
Performance Improvements: Offers suggestions to optimize key parameters, including:
Load
Main Steam (MS) Temperature
Hot Reheat (HRH) Temperature
Superheater (SH) Spray
Reheater (RH) Spray
Flue Gas Exit Temperature (FGET) - Left and Right

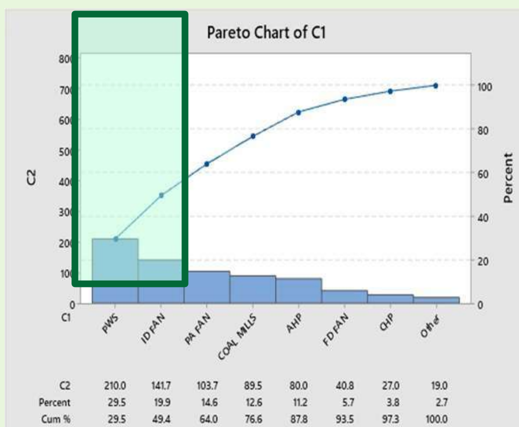
Project Outcome

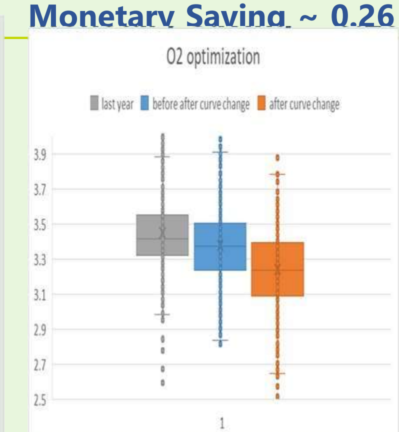
- Descriptive Analysis of Output Parameters has been Done
- Correlation Study between Output and Input KPIs Done
- Variation with Mill Combination and Standard Scaling (Z Score) conversion Done to conduct multivariate analysis
- Both unit models have been deployed. Heat Rate improvement by **1.72 kcal/kWh. Savings of Rs 36.47 lac with 50:50 benefit sharing with customers**

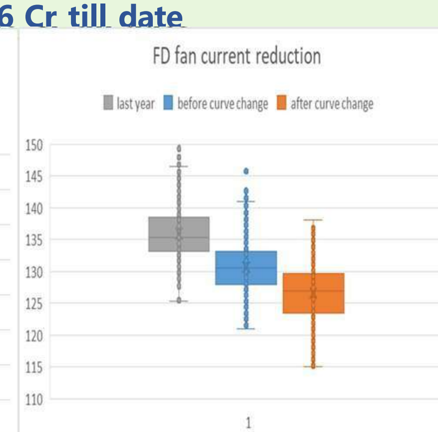
APC Reduction Projects- FY26



SL No	Description /Action proposed	Action taken	Status
1	Reduction of O2% gradually up to 3.30% looking after other boiler parameter like MS/HRH temp, LOI.	**Adopted from DVC Mejia**, Oxygen trimming from 3.56% to 3.1% achieved at Full Load. Excess Air reduced from 21.1% to 17.64 %. **Saving ~ 0.31 MU** **Monetary Saving ~ 0.1 Cr till date**	Completed
2	Replacement of CT fans with Energy-Efficient FRP blade assembly.	**Adopted from DVC Mejia,** New Procurement of 8 sets of Energy Efficient IDCT Blade Hub and Blades with suitable matching of MPL's Existing Gearbox and motor Assembly completed **Savings ~ 0.87 MU** **Monetary Saving ~ 0.26 Cr till date**	16 out of 44 Fan blades were replaced.





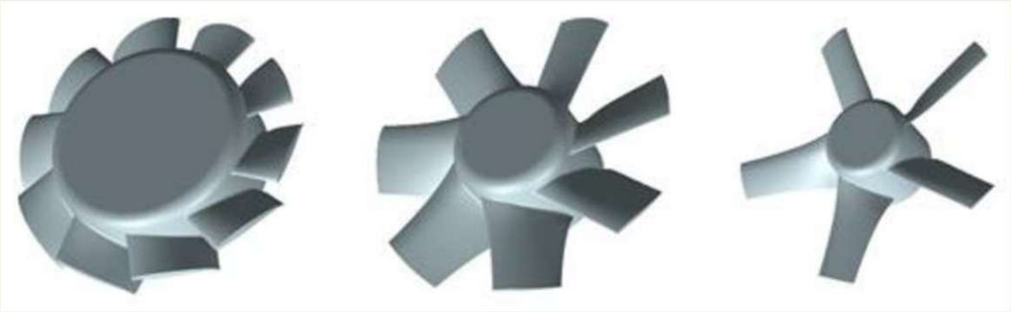


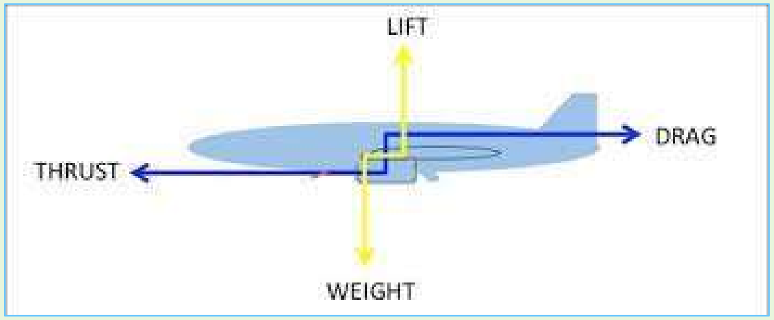
APC Optimization

Energy Efficient Blade at IDCT Fan

Energy Efficient Blade at IDCT Fan

- **In FY 26, Maithon Power Limited** installed **16 advanced blade–hub assemblies** featuring a **reduced hub diameter**, **long FRP blades**, and an **optimized aero foil profile**.
- These **engineering enhancements** improved **aerodynamic efficiency**, reduced **drag force**, and increased the **effective swept area**, enabling higher cooling performance at lower power input.
- The upgrade delivered up to **25% energy reduction**, yielding nearly **₹1 crore annual savings**.





- **Reduced hub diameter** increases effective blade surface area, enabling **higher air delivery at lower power** for the same air output.
- **Drag forces are curtailed to <15%** (earlier >20%), resulting in a **significant reduction in power draw to ~52 kW from 75 kW**

Optimization Of Specific Raw Water Consumption

Sustainability – Net Zero Commitment

TATA POWER Commitment: Leadership with Care

- ❖ Carbon Net Zero by 2045
- ❖ **Water Neutrality by 2030**
- ❖ Zero waste to landfill before 2030
- ❖ No net loss of biodiversity

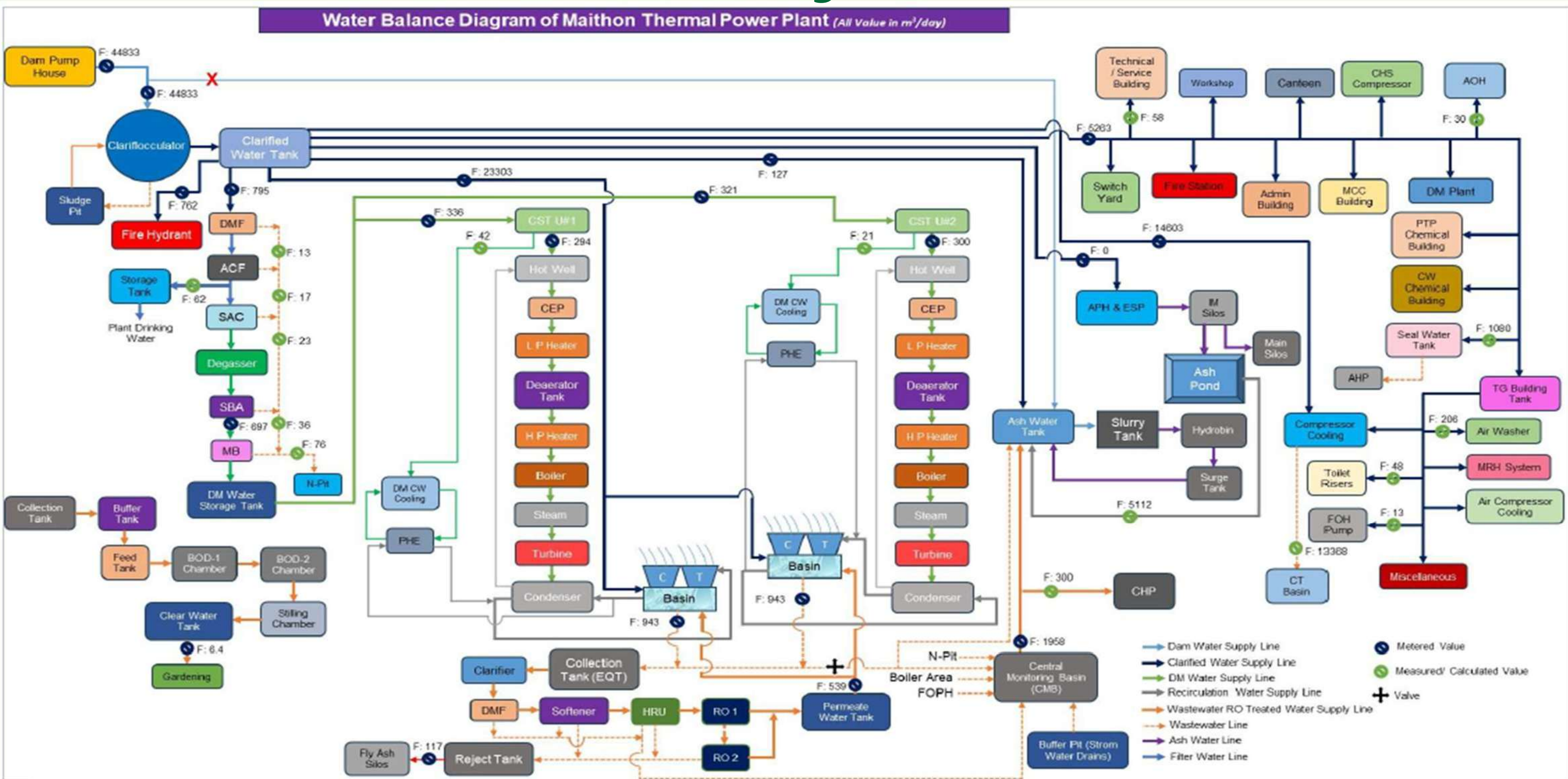
2024-25
Recovery of Rainwater @ 10 KLH in rainy season

2026-27
Use of Sewage water @ 20-50 MLD

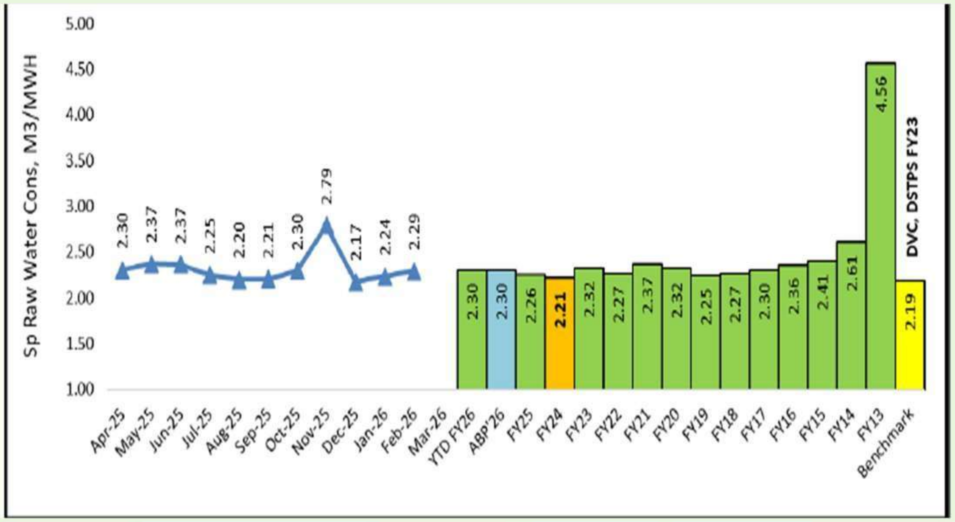
2028-29
- Maximize use of FGD wastewater

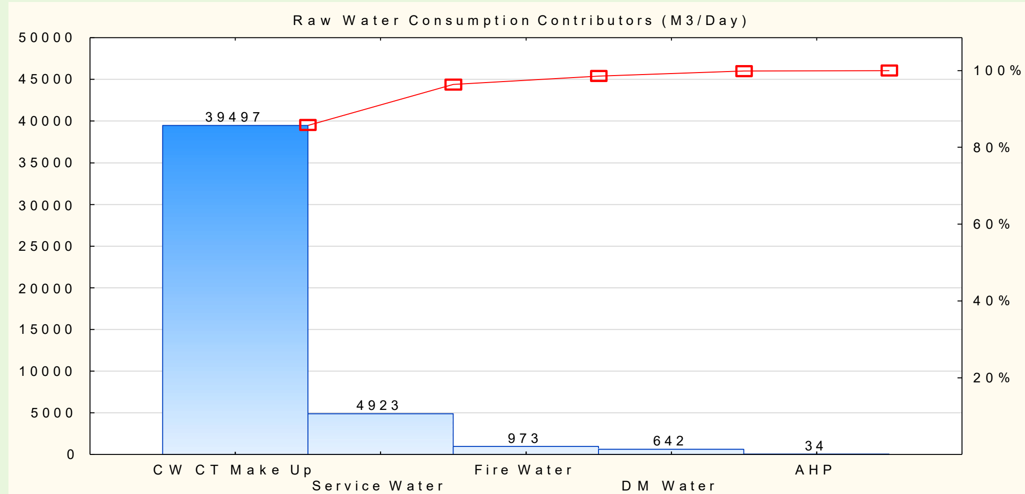
Water Neutrality by 2030

Water Balance Diagram of MPL



Specific Raw Water Consumption Trend

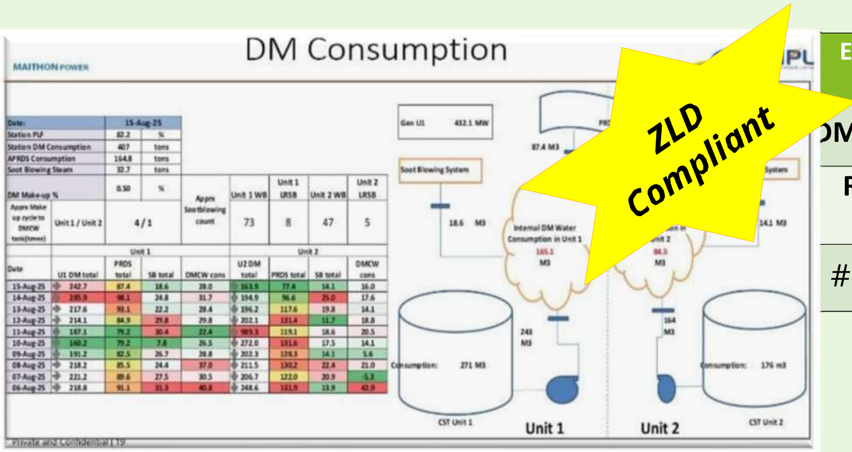




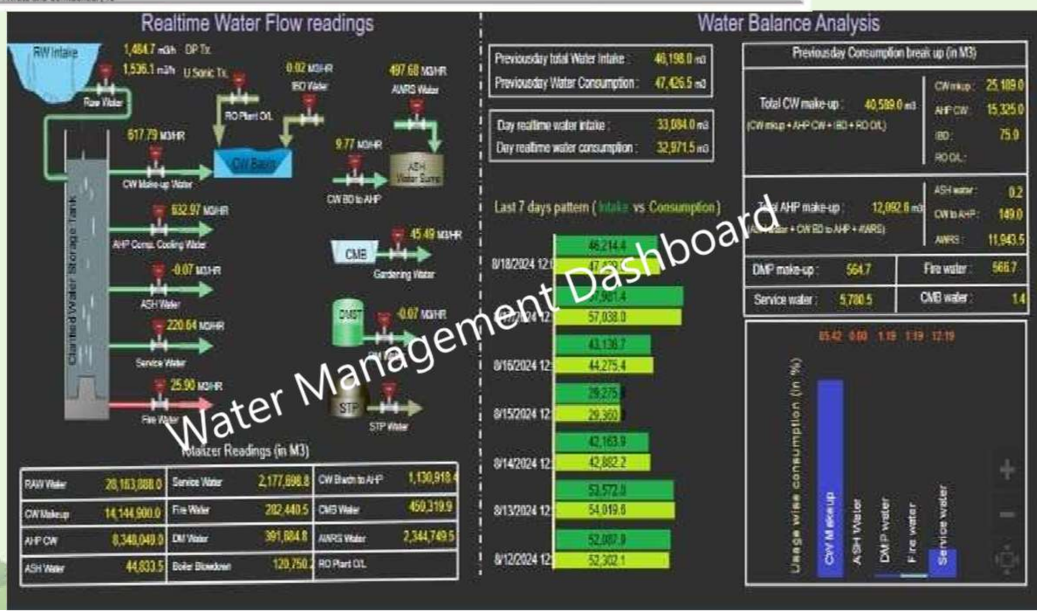
Water Management

ENVIRONMENT MANAGEMENT - WATER	UoM	FY23	FY24	FY25
DM water Consumption of Plant	%	0.79	0.79	0.80
Raw Water Consumption of Plant	M3/MWH	2.32	2.21	2.26*

includes Start-up DM water loss; * includes FGD project construction



- Automated Alert-mail triggered
- Plant Storm Water Recovery System
- R-R-R
- Lower Operating Cost
- Sustainability



Best Practices for CW MAKEUP Water Reduction

Before

- Aged / inefficient drift eliminators
- Higher drift losses and chemical carryover
- Increased cooling tower make-up water requirement

Drift Eliminator Replacement for Drift Loss Reduction

After

- **Drift loss reduced to ~0.002%** of circulating water from ~0.004%
- Reduction in **make-up water consumption of** 346896 M3/ Year.
- Reduced chemical loss and improved cooling tower efficiency

Best Practices for CW MAKEUP Water reduction

Rainwater Recovery from Storm Gate for Process Reuse

❖ Challenges:

-During the rainy season, a significant quantity of storm water was lost through the plant storm gate
-Untapped rainwater resulted in avoidable freshwater consumption and discharge

❖ Best Practice Implemented

-Constructed a **three-layer settling and filtration structure** to use storm water from the plant storm gate
-Enabled **stage-wise settling of impurities** to improve water quality
-Installed **solar-powered sump pump** to transfer treated water to RO plant for treatment.
- Treated RO water is used in CW makeup leading to reduction in freshwater intake.

Water Optimization Projects Implemented

Automation of IBD Pit Pump for Safe, Efficient & Sustainable Water Management

Auto level-based cut-in and cut-out of the IBD pit pump avoids pit overflow, enabling water reuse and preventing unsafe discharge of hot water to the plant drainage system.

Minimization of DM Makeup Wate during Unit Shutdowns through Process Optimization

Analysis of Unit-2 shutdown data revealed that desynchronization at drum pressure below 65 kg/cm² significantly reduces drum water temperature and uncontrolled filling/draining, resulting in a DM makeup water reduction of **~63 T per shutdown**. This optimized shutdown practice ensures effective water conservation, improving process stability and asset protection. (Total savings will be = ₹3.44 lakh /year-including APC of MDBFP)

Optimization of Soot Blowing Operation for Steam, Water & Heat Rate Reduction

Increased soot blowing to control RH metal temperature led to excessive consumption of high-enthalpy steam, increasing station DM water consumption and heat rate. To address this, a WB/LRSB selection logic was implemented wherein selection of Wall Blowers automatically closes LRSB drain valves and vice versa, thereby eliminating steam wastage from idle drains. With safety interlocks included, this modification resulted in annual savings of 13,599 tones of soot blowing steam and equivalent DM water, delivering a net cost saving of ₹1.14 crore per year (including HR saving)

Water Optimization Projects Implemented

Smart Boiler Blowdown Scheduling for DM Water Conservation

- Load-wise chloride analysis showed faster chloride reduction during blowdown at higher unit loads.
- Weekly CBD schedule was shifted to higher-load days and duration reduced by 1 hrs.
- DM water consumption reduced by 50 T per blowdown event.
- Associated energy loss from drum water dumping was eliminated.
- Annual savings of ₹12.7 lakh, contributing to DM water conservation and water neutrality goals.

Metal RH Temperature-Based Selective Soot Blowing

Optimizati n of Soot Blowing

Heat Ra

- Earlier, all soot blowers were operated daily as a fixed practice, irrespective of actual boiler heat transfer condition leading to high steam consumption.
- Automation logic developed based on real-time boiler metal RH temperature to operate only required soot blowers.
- This condition-based approach optimizes heat transfer, saves steam, and significantly reduces DM water consumption.

Awards & Achievements

49th CII National Kaizen Gold Award

CII National Award for Excellence in Energy

Safety Shield Award from NSCI

CEE 4th National Pow-Gen Water Management Award - 2026

MAITHON POWER LIMITED

Disclaimer: The contents of this presentation are private & confidential. Please do not duplicate, circulate or distribute without prior permission.

Thank You!

Name Nitya Mondal (Group Head – Operation) & Pankaj K Singh (Lead CRE- OPN)
Email :nitya.mondal@tatapower.com & pankaj.singh@tatapower.com
Mobile :9204781488 / 9973074503