22nd National Award for Excellence in Energy Management 2021

25 - 27 August 2021

NPL

Nabha Power Limited

2*700 MW Supercritical Thermal Power Plant
Rajpura, Punjab

Team:

Anand Saxena

Alfurqan Jahagirdar

Sushanth S

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AGENDA

1. Company Profile
2. Energy Data
3. Energy Benchmarking
4. Energy Projects Planned
5. ENCON Project 2019
6. ENCON Project 2020
7. ENCON Project 2021
8. Renewable Energy
9. Environment Management
10. Innovation
11. Teamwork & Monitoring
12. Awards & Recognitions

Company Profile

1

Nabha Power Limited

Top of Merit Order in Punjab

Plant Availability > 85%

One of the best heat rate in the country

(Design: 2205kcal/kWh)

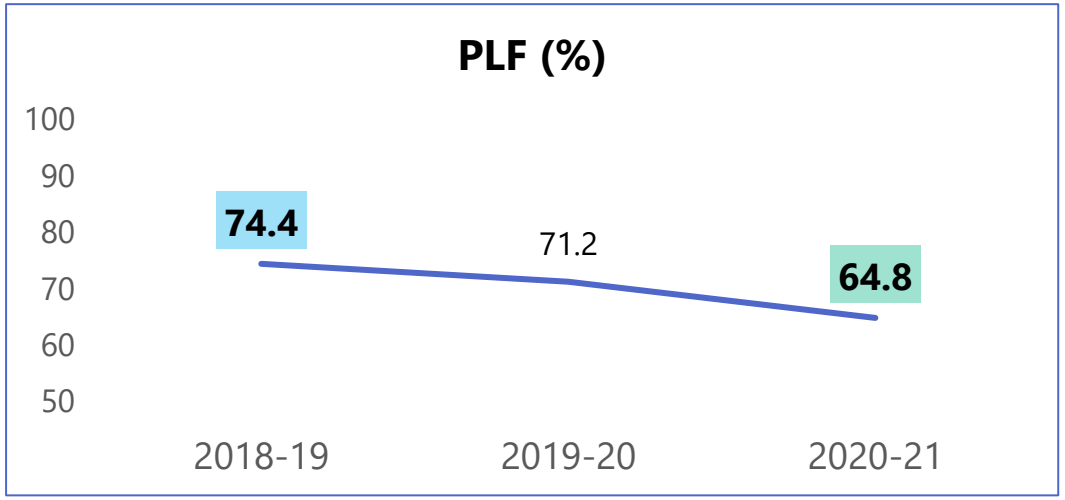
Super critical technology, Adv PM-Low Nox Burner, Zero Liquid discharge

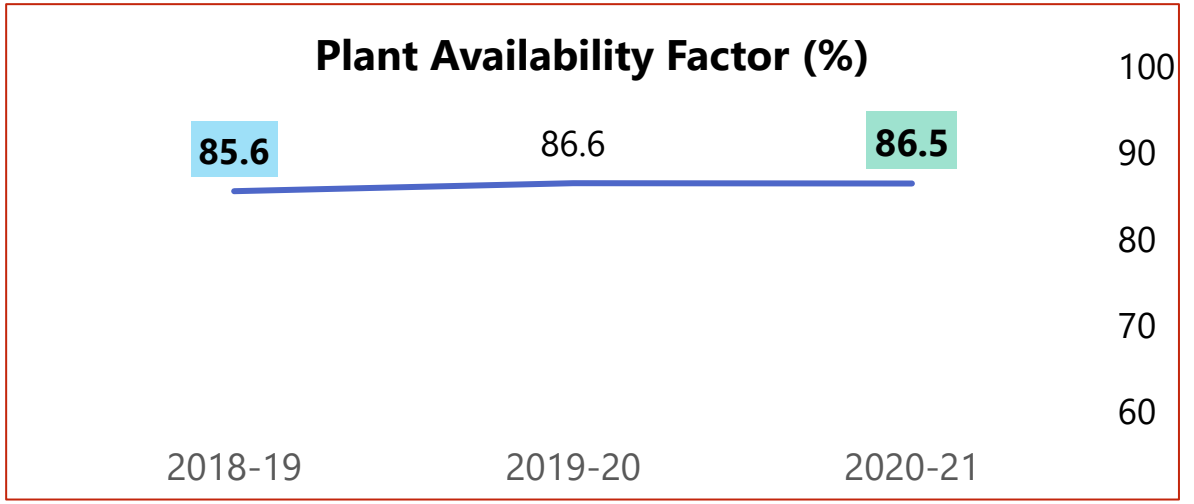
- Among the largest private investments in Punjab
- Contributes **50% (non-peak season) and 25% (peak season) of Punjab's own thermal generation**
- NPL is certified for **ISO 50001:2018 (Energy Management System), ISO 9001:2015 (QMS), ISO 14001:2015 (EMS), ISO 45001:2018 (OHSAS)**

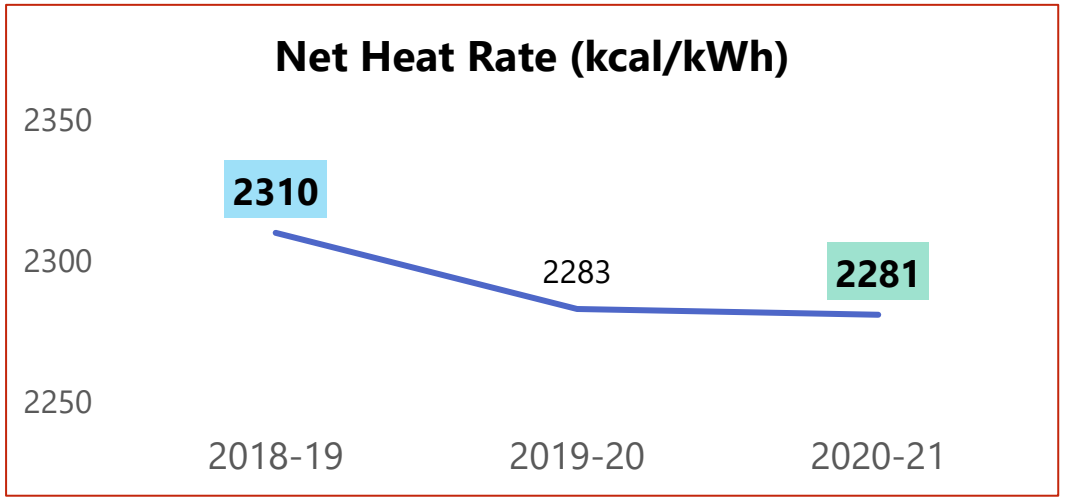
2 Station Performance FY 21

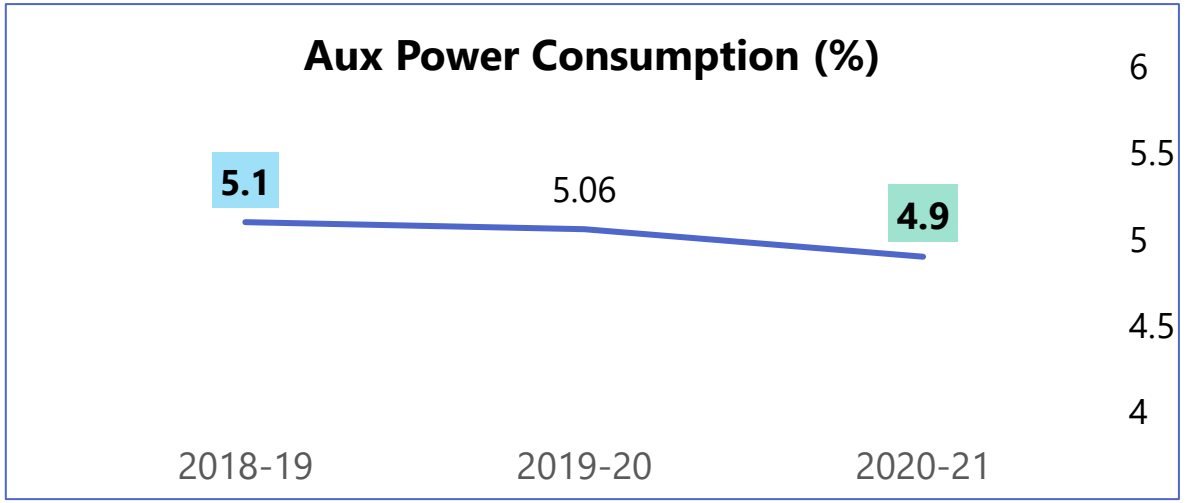
S No.	Description	Units	Values
1	Annual Generation	MUs	**7951**
2	PLF	%	**64.84**
3	Availability	%	**86.56**
4	Gross Heat Rate	Kcal/kWh	**2169**
5	Auxiliary Power	%	**4.9**
6	Boiler Efficiency	%	**88.6**
7	Turbine Heat Rate	Kcal/kWh	**1923**
8	DM Water Make-up	%	**0.375**
9	Sp. Raw Water Cons.	Cum/MWh	**1.78**
10	Sp. Oil Consumption	ml/kWh	**0.284**

2 Performance Data Y-O-Y









Energy Benchmarking

3

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Heat Rate (kcal/kWh)		APC (%)
	Nabha Power Limited	
2169		4.9
	Global Benchmark	
2048	Jhon Turk Jr, Arkansas, USA	-
	National Benchmark	
2119	CGPL, Tata Mundra	7.67
	J P Nigrie	
2175	Competitors	5.05
2250	**Reliance Sasan**	6.0

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4 Energy Projects Planned FY22

S No	Title of Project	Annual Electrical Saving (Million kWh)	Annual Thermal Saving (Million kcal)	Investment (Rs in Million)
1	CW pump internal coating	**1.4**	**0**	**1.2**
2	SCAPH Modification from Fixed design to Rotary design	**0.6**	**0**	**2.5**
3	Replacement of Existing Conventional lights of different rating LED lights	**0.6**	**0**	**4.2**
4	Replacement of High Energy drain valves with better design (32 Nos.)	**0**	**28,959**	**20**

ENCON Project FY 2019

5

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S No	Title of Project	Annual Electrical Saving (kWh)	Annual Thermal Saving (Million Kcal)	Total Annual Saving (Rs Million)	Investment (Rs Million)	Payback (Months)
1	Online SCAPH cleaning mechanism	**1,20,000**	**0**	**3.6**	**0**	**0**
2	Auto cut-off and cut-in logic implemented for ESP support plate insulator heater	**22,49,856**	**0**	**7.51**	**0.5**	**0**
3	Replacement of 2 Nos. WDC Valves with new design valves	**0**	**45,618**	**62.5**	**4.5**	**1**
4	Replacement of High Energy Drain Valve(4 Nos.)	**0**	**27,371**	**37.5**	**4.4**	**1**
5	VFD installation in LDO forwarding pump	**80,000**	**0**	**0.22**	**0.23**	**12**

ENCON Project FY 2019

5

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S No	Title of Project	Annual Electrical Saving (kWh)	Annual Thermal Saving (Million Kcal)	Total Annual Saving (Rs Million)	Investment (Rs Million)	Payback (Months)
6	Installation of steam traps in drain line of pre warming line of LP Bypass valve	**0**	**27,371**	**37.5**	**7.5**	**5**
7	Provision of NDCT makeup water through gravity line	**7,92,000**	**0**	**2.38**	**3**	**18**
8	Replacement of existing conventional lights with LED lights (Total 106 lights replaced)	**23,214**	**0**	**0.07**	**0.53**	**90**
9	Installation of zero loss automatic drain valves in plant instrument air line	**9298**	**0**	**0.02**	**0.23**	**138**
	Total	**32,74,366**	**1,00,361**	**151.3**	**20.5**	**2**

ENCON Project FY 2020

S No	Title of Project	Annual Electrical Saving (kWh)	Annual Thermal Saving (Million Kcal)	Total Annual Saving (Rs Million)	Investment (Rs Million)	Payback (Months)
1	Optimization of Dry Ash conveying velocity	**1,51,110**	**0**	**0.5**	**0**	**0**
2	Implementation of Magnetic grill & Magnetic Plate in dry ash conveying system	**9,97,058**	**0**	**3.33**	**0.75**	**3**
3	Optimization of ESP Hopper Heater	**54,43,200**	**0**	**18.18**	**0.17**	**0**
4	Optimization of compressed air network pressure set point using Intelligent Flow Controller	**2,56,960**	**0**	**0.86**	**0.56**	**8**
5	Replacement of 2 Nos. WDC Valves with new design valves	**0**	**43,786**	**62.5**	**4.5**	**1**

6 ENCON Project FY 2020

S No	Title of Project	Annual Electrical Saving (kWh)	Annual Thermal Saving (Million Kcal)	Total Annual Saving (Rs Million)	Investment (Rs Million)	Payback (Months)
6	CSU-1A screw conveyor replacement by Belt conveyor	**11,074**	**0**	**0.04**	**0.08**	**24**
7	Retrofitting of Conservative lights with LED lights	**1,72,800**	**0**	**0.58**	**0.84**	**17**
8	De-staging of RO water multistage pump	**1,83,960**	**0**	**0.61**	**0**	**0**
9	Use of natural light source during day-time	**4320**	**0**	**0.01**	**0.11**	**132**
10	Optimization of Chimney and ESP area Lights	**2,51,850**	**0**	**0.84**	**0.17**	**2**
	Total	**74,72,332**	**43,786**	**87.45**	**7.19**	**1**

ENCON Project FY 2021

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S No	Title of Project	Annual Electrical Saving (kWh)	Annual Thermal Saving (Million Kcal)	Total Annual Saving (Rs Million)	Investment (Rs Million)	Payback (Months)
1	SAC -1,2,3,4 Cooler radiator fan operation changed from time based to temperature base	**6600**	**0**	**0.02**	**0.06**	**36**
2	Replacement of Existing Conventional lights with LED (Total 798 No. replaced)	**2,31,877**	**0**	**0.75**	**0.53**	**8**
3	Overhaul of HIP & LP Turbine and High Energy drain valves (152 Nos.). Boiler Chemical Cleaning	**0**	**74,441**	**98.37**	**60.1**	**7**
4	Circulating Water pump 1B internal coating to reduce frictional losses	**13,70,160**	**0**	**4.45**	**0.85**	**2**
5	Stopping LDO pump during winter, providing heat tracing cable in suction line LDO pump	**73,440**	**0**	**0.24**	**0.47**	**23**

ENCON Project FY 2021

7

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S No	Title of Project	Annual Electrical Saving (kWh)	Annual Thermal Saving (Million Kcal)	Total Annual Saving (Rs Million)	Investment (Rs Million)	Payback (Months)
6	Stopping RO booster pump	**31,680**	**0**	**0.102**	**0**	**0**
7	Bypass AHP system while handling CMB water during cleanup activities	**15,600**	**0**	**0.05**	**0.02**	**5**
8	Direct utilization of potable water in CHP	**12,045**	**0**	**0.04**	**0**	**0**
	Total	**17,41,402**	**74,441**	**104.0**	**62.03**	**7**

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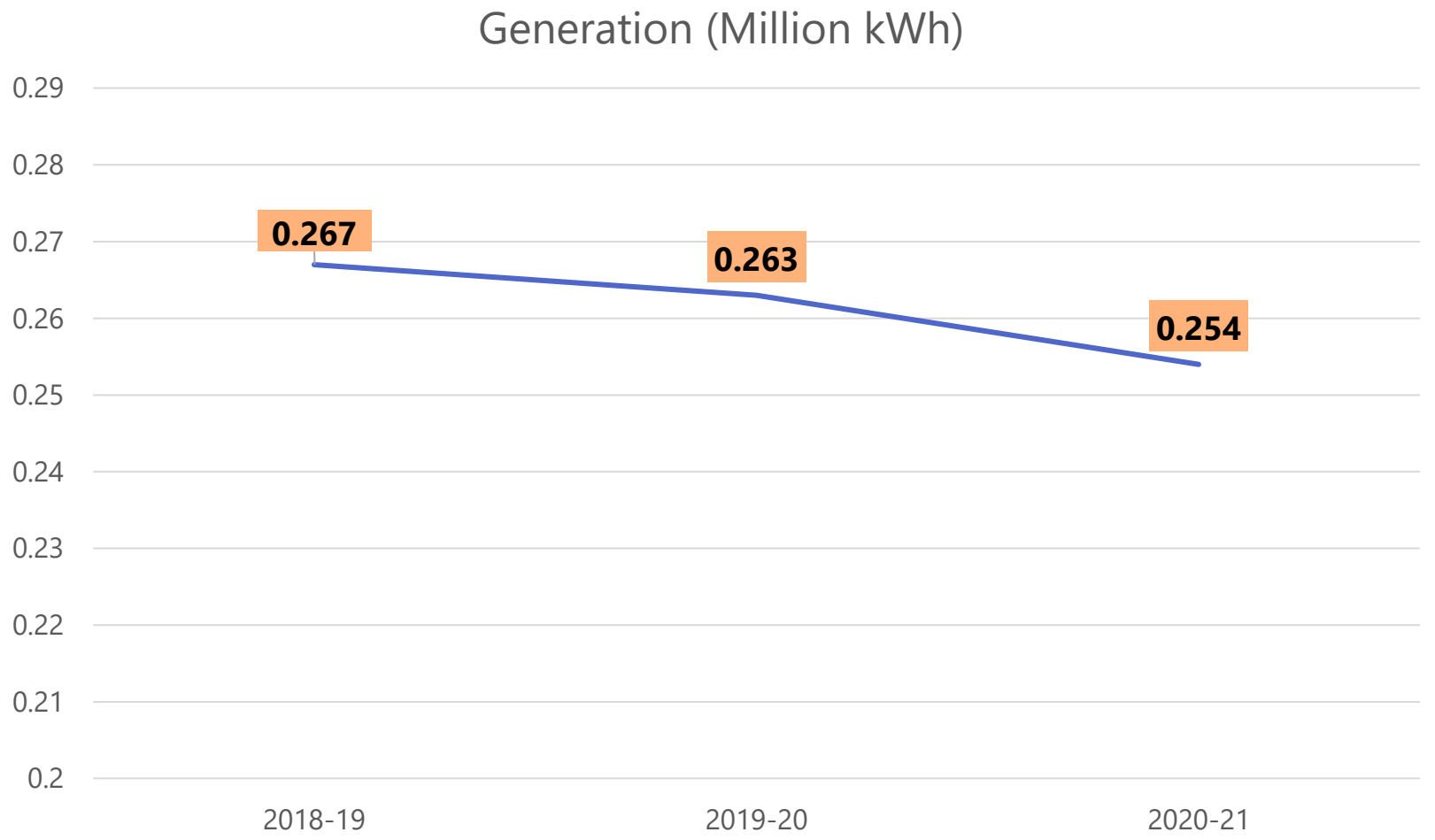
8 Renewable Energy (Solar)

Installed Capacity: **205 kW**



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ASH MANAGEMENT

	UOM	2018-19	2019-20	2020-21
Ash Stock in Plant (Yard + Pond)	LMT	**5.19**	**0.22**	**0.15**
Ash Generated	LMT	**14.39**	**12.85**	**14.20**
Ash Utilization	%	**91**	**140**	**100**
Ash Utilization in manufacturing	%	**87**	**135**	**95**
Ash Utilization in FA bricks	%	**4**	**5**	**5**
Ash Utilization in mines	%	**0**	**0**	**0**

FY 2020-21 **Ash Handled (Wet Mode) : 14.68 %** **Ash Handled (Dry Mode) : 85.32 %**

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STATUS OF FGD

FGD system Erection work in progress

Detail engineering nearing completion

Ordering of major equipment completed

Super-structure of all major buildings in progress

Flue can fabrication and Slip form work of Chimney-1 in progress

Emission Parameter

FY	Generation (MU)	CO2 emission kg/kWh	SOx (mg/Nm3)	NOx (mg/Nm3)	Particulate Matter (mg/Nm3)
2018-19	9123	0.85	1496	322	41.3
2019-20	8757	0.84	1507	323	41
2020-21	**7951**	**0.84**	**1442**	**300**	**41**

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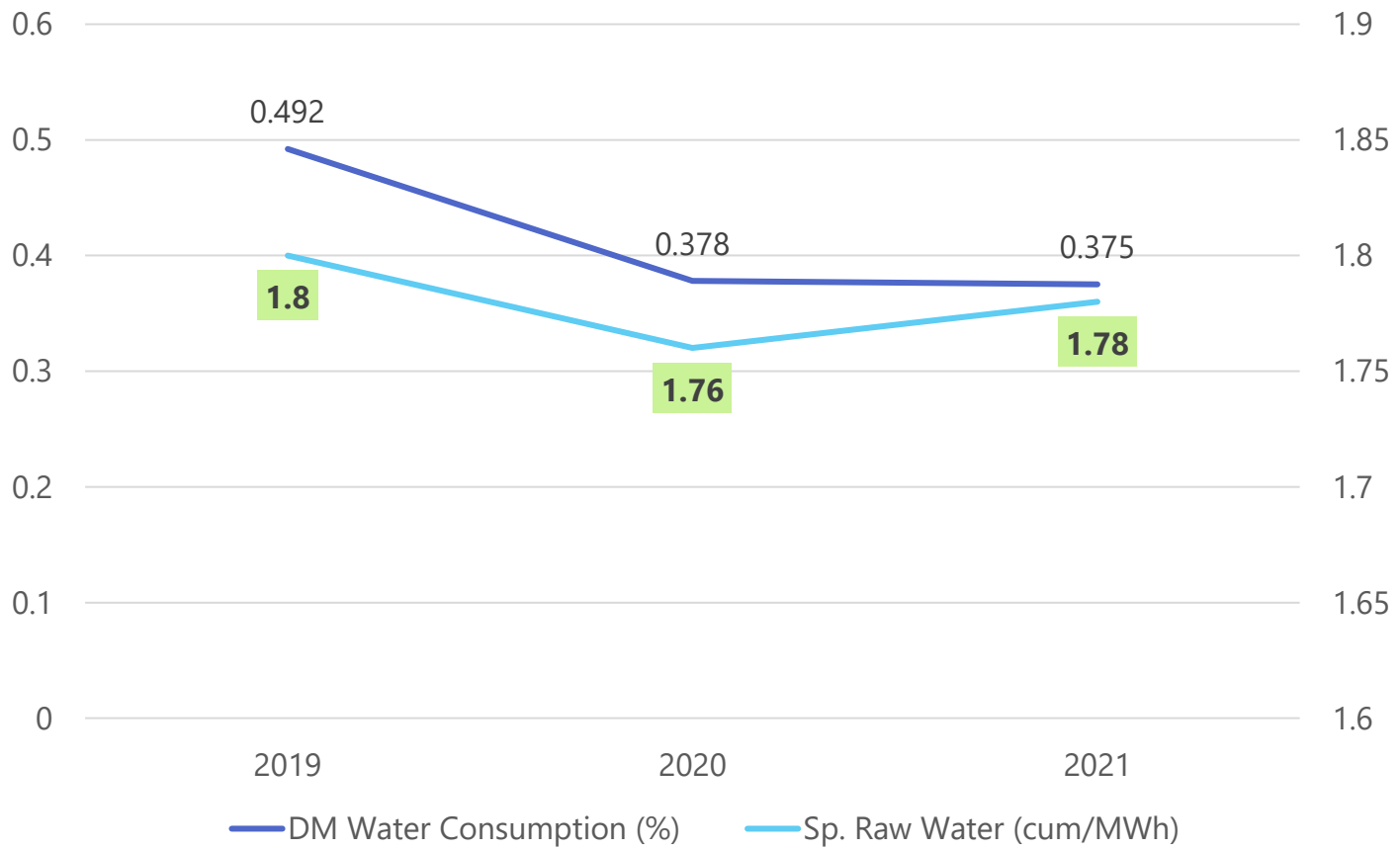
WATER CONSUMPTION

Zero Liquid Discharge plant



- Practice of Backwashing , for Dual Media filter and Activated Carbon Filter based on vessel DP & Outlet water quality.
  Saving - 12,000 m3/annum
- ETP RO reject water is used for DMF backwash.
- DM plant auto operation resulted in reduction of rinsing time.
  Savings: 12,500 m3/annum
- Desludging of Clarifier based on parameters in place of fix schedule.
  Savings: 30,000 m3/annum.
- Water usage for CPU vessel regeneration reduced by adopting better practices such as Increasing the air blowing time and reducing the resin washing time.
  Savings: 24,000 m3/annum

Best O&M Practices 9

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- Reliability Centred Maintenance (RCM) Implementation
- Implementation of Equipment health card for Critical Equpment
- Energy management system for daily energy performance monitoring wrt. benchmark
- MAXIMO ERP application – Logic forcing, classification of PTW.
- Vital Plant Parameter Application on Android & iOS platform
- Daily Boiler metal temperature online monitoring and automatic report generation

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In-House Development of SMART SOOT BLOWING SYSTEM

10 Innovation - I

- Understanding the Problem – Stakeholder Consultation
- Defining The Problem
- Identifying Applicable Resources – People & Tools – Software
- Preparing Roadmap, SOP & Checks
- Building Models & Testing
- Implementation Validation & Go-Live

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SMART SOOT BLOWING SYSTEM

10 Innovation - I

Category: B

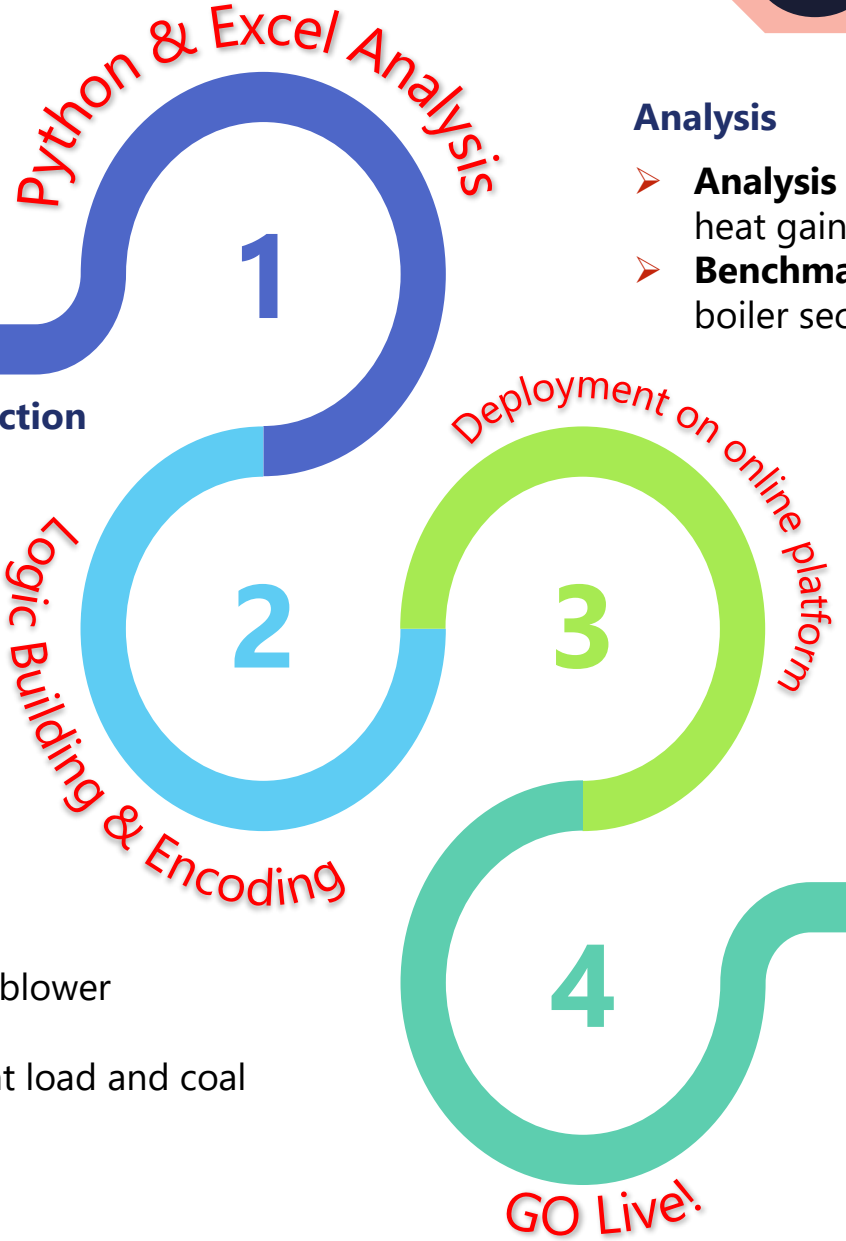
DATA COLLECTION & FACTOR SORTING

Analysis of OEM Recommendation & Data Collection

- **2 Yr** data collected
- Segregated based on seasons for analysis
- Study of OEM Soot blowing guideline

Analysis

- **Analysis of historical soot blowing frequency** based on heat gain analysis and maximizing **boiler efficiency**
- **Benchmarking of data** based on heat gain across each boiler sections



Development of Soot blowing logic

- **Conditional Logic development** for soot blower recommendation
- **Testing of logic with** real data for different load and coal flow conditions

Uploading and real time testing

- **User Dashboard** customization
- **Decision support system** for Control room operators
- **Testing**

SOLUTION

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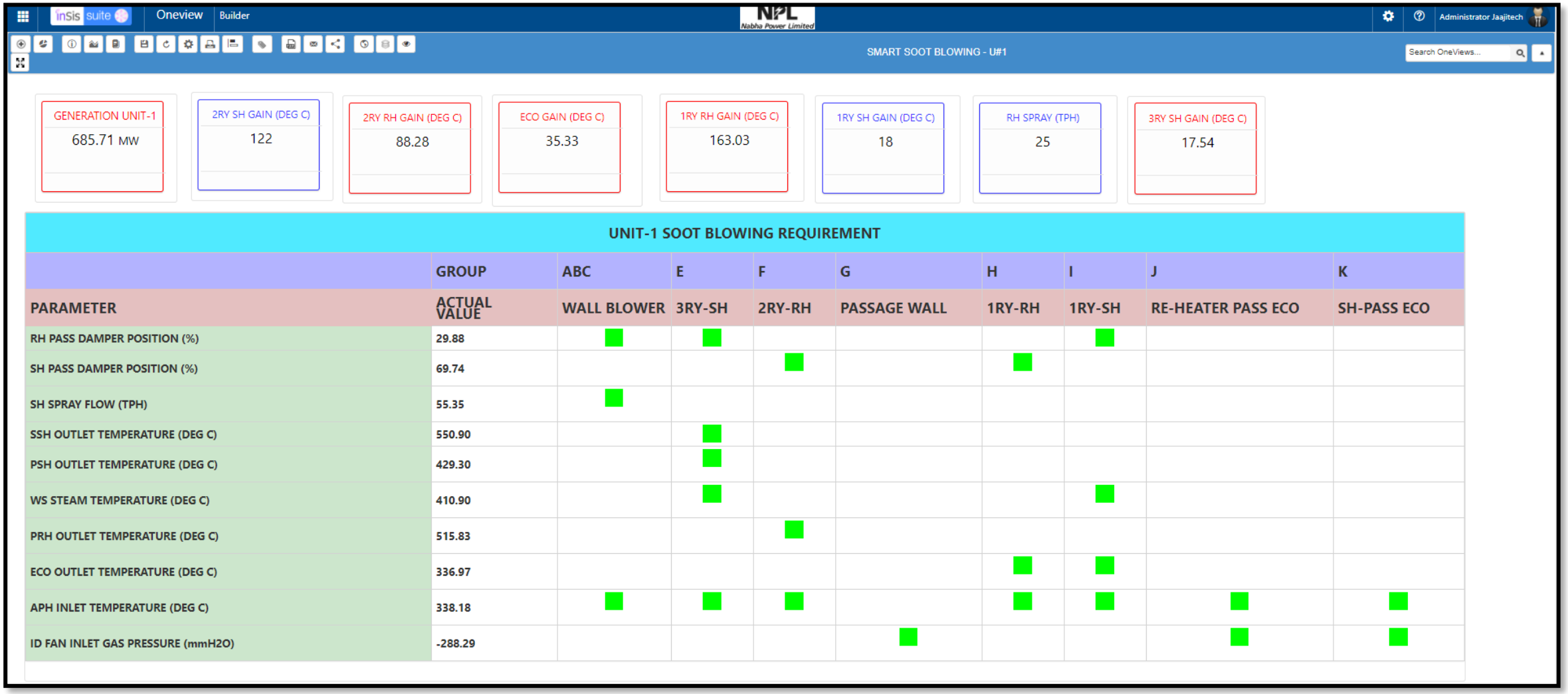
SMART SOOT BLOWING SYSTEM

10 Innovation - I

Category: B



UNIT-1 SOOT BLOWING REQUIREMENT

	GROUP	ABC	E	F	G	H	I	J	K
PARAMETER	ACTUAL VALUE	WALL BLOWER	3RY-SH	2RY-RH	PASSAGE WALL	1RY-RH	1RY-SH	RE-HEATER PASS ECO	SH-PASS ECO
RH PASS DAMPER POSITION (%)	29.88	■	■				■		
SH PASS DAMPER POSITION (%)	69.74			■		■			
SH SPRAY FLOW (TPH)	55.35	■							
SSH OUTLET TEMPERATURE (DEG C)	550.90		■						
PSH OUTLET TEMPERATURE (DEG C)	429.30		■						
WS STEAM TEMPERATURE (DEG C)	410.90		■				■		
PRH OUTLET TEMPERATURE (DEG C)	515.83			■					
ECO OUTLET TEMPERATURE (DEG C)	336.97					■	■		
APH INLET TEMPERATURE (DEG C)	338.18	■	■	■		■	■	■	■
ID FAN INLET GAS PRESSURE (mmH2O)	-288.29				■			■	■

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SMART SOOT BLOWING SYSTEM

10 Innovation - I

Category: B

Before:

- Exact heat gain and baseline values not known
- Manual time-based SB operation frequency

DESCRIPTION	CONDITION	UNIT	BASELINE CONDITION	MAXIMUM VALUES	MINIMUM VALUE	AVERAGE VALUES
RH PASS DAMPER	SMALL	%	**31**	48	20	31
SH PASS DAMPER	SMALL	%	**60**	80	52	68
SH SPRAY FLOW TOTAL	LARGE	TPH	**49**	124	0	41
SSH O/L TEMP	HIGH	Deg C	**549**	560	502	543
PSH O/L TEMP	HIGH	Deg C	**429**	436	411	424
WS STEAM TEMP	HIGH	Deg C	**409**	415	394	405

Condition	Wall Blower Soot Blowing Conditions
1	RH pass Damper position < 31 % **AND** Water Separator O/L temperature < 404 DegC
2	Total DSH Flow >49 TPH **AND** Water Separator O/L temperature < 404 DegC
3	RAPH Flue Gas I/L temperature > 345 DegC **AND** Water Separator O/L temperature < 404 DegC

After:

- Baseline data to maximize boiler heat gain generated
- Risk of Excessive soot blowing avoided
- Frequency optimized based on best operating point
- **DM water saving, Improved boiler efficiency & reliability (~Rs 10 Lakhs savings with zero investment)**

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UNIT START-UP TIME OPTIMIZATION

10 Innovation - II

Category: C

Start-up (Hours)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Unit Cold Start-up (Before)	Vacuum Pulling & Gland Steam Charging (3)			**DO Removal from Condensate & System LP& HP clean-up (12)**												Boiler Light-up & Hot Clean-up (3)			Pressurization to Synchronization (6)					
Unit Cold Start-up (after)	Vacuum Pulling & Gland Steam Charging (3)			**DO Removal from Condensate & System LP& HP clean-up (11)**											Boiler Light-up & Hot Clean-up (3)				Pressurization to Synchronization (6)					**1 Hr.**

Super-critical technology requires stringent water parameters during unit start-up

Changes as per new philosophy:

- During LP clean-up blow out process Hotwell level is kept low - **350 mm.**
- GSC R/C flow set point is increased to **950 TPH for effective and faster cleaning** of pipes with high water volume
- When **Fe < 250 ppb** is achieved in the system, immediately CPU is taken into service and condensate cycle clean-up is taken into recirculation mode
- Reduced clean-up duration by approx. **1 Hr ;** Water Handling Optimized
- Streamlined steam and water sampling by reducing bends in sampling lines to SWAS panel
- Reduces DM water consumption (approx. 500 CUM/start-up)

Plant Availability - INR 21 lakhs | **DM Water Savings – Rs 1 Lakhs**

DEVELOPMENT OF SINGLE WINDOW MONITORING TOOL IN DCS FOR PLANT AUTO STATUS/SAFE SHUTDOWN STATUS/MOV STATUS

10 Innovation - III

Category: C

Highlights:

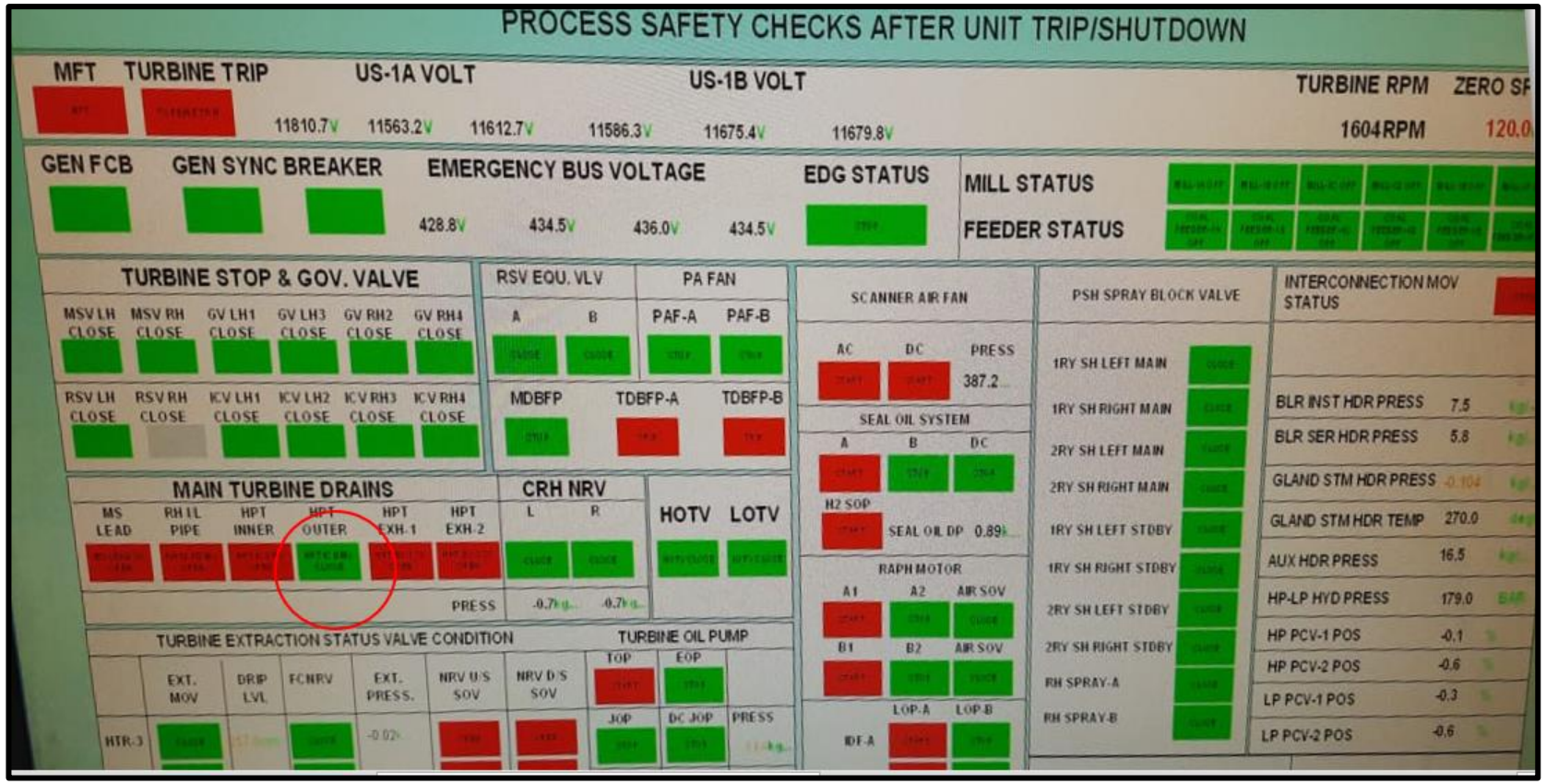
1. Safe shutdown of all critical equipment
2. To monitor plant auto operation status
3. To monitor of power supply status for all MOVs / Dampers / QCNRVs
4. This window provides quick overview of status of critical equipment, valve, MOV, QCNRVs and damper.
5. Operation engineer can take quick actions against any abnormality observed
6. Chances of missing-out any abnormality is minimized
7. Enhances plant reliability

DEVELOPMENT OF SINGLE WINDOW MONITORING TOOL IN DCS FOR PLANT AUTO STATUS/SAFE SHUTDOWN STATUS/MOV STATUS

10

Innovation - III

Category: C



Benefits:

1. Early diagnose of abnormal status of valves & equipments
2. Early Indication for shutdown maintenance
3. Risk of Plant Availability loss minimized

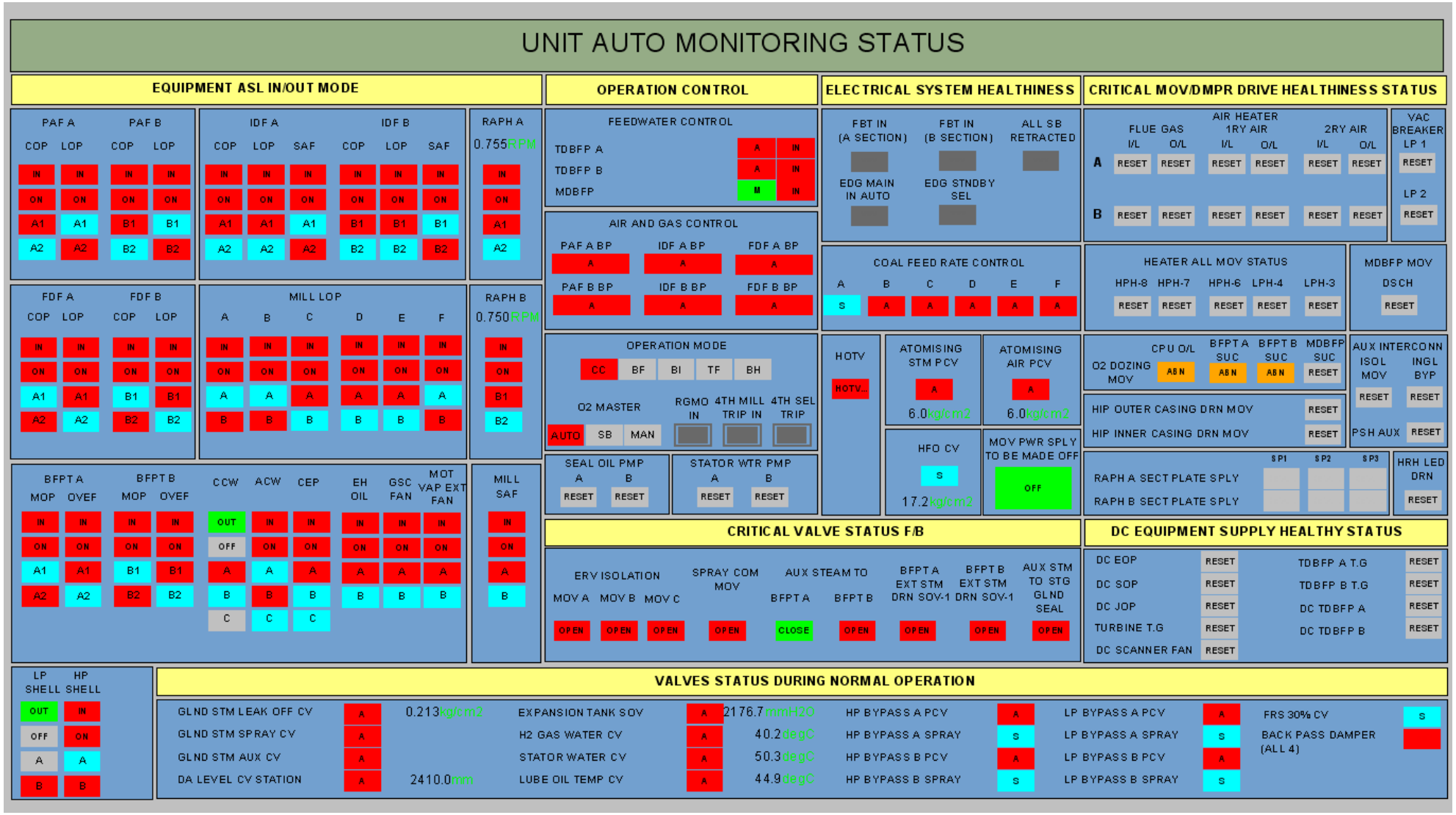
Historical Event: CRH NRV condition led to delay in unit start-up by 3 days

DEVELOPMENT OF SINGLE WINDOW MONITORING TOOL IN DCS FOR PLANT AUTO STATUS/SAFE SHUTDOWN STATUS/MOV STATUS

10

Innovation - III

Category: C



Teamwork & Monitoring

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PADO

To monitor real time performance and to do what-if analysis!!

MEETING

Chaired by CE once in a Month & Chaired by Head O&M fortnightly!!

BUDGET

Energy budgeting done during the start of every financial year!!

Systems and Practices

- System-wise and equipment-wise **efficiency and gap analysis done** (design vs actual)
- Mill Optimization module for **optimizing Mill height, burner tilt and tempering air** parameters
- **Automated** daily and monthly **report** generation
- What-if Analysis tool is used to **fine tune the process parameter**
- Extensive **Metal Temperature monitoring**
- Historical data extraction for **detailed analysis** and reporting
- Various other initiatives to **improve efficiency**
    - Monitoring of high energy valve passing
    - Design Modification
    - Process change
    - Efficiency improvement projects

- **Certificate of Merit by Government of India in NECA-2020**
- Twin awards from CII
  - **National Energy Leader, 2020,** for its progressive performance for second consecutive year in Energy Management (2 times in a row)
  - **Excellent Energy Efficiency Unit, 2020,** award for outstanding achievements in Energy Efficiency (4 times in a row)
- **Independent Power Producers of the year 2020 – India** award in the **Asian Power Awards 2020**
- Best thermal power generator by IPPAI (3 times in a row (2017-19)
- Recognized as **finalist at S&P Global Platts Global Energy Awards – 2020** under the category **"Award of Excellence-Power",** second time in a row.
- **Gold Recognition at CII's Outstanding Managers** Competition. **Theme** of the competition was **Power of Forecasting**

Thank You