



***Nabha Power Limited***

**23<sup>rd</sup>**

**National Award for 2022**

**Excellence in Energy Management**

**23 – 26 August 2022**

**2\*700 MW Supercritical Thermal Power Plant  
Rajpura, Punjab**

***Team:***

***Anand Saxena – Sr. DGM***

***Alfurqan Jahagirdar - Manager***

***Mukul Kabra – Assistant Manager***



# AGENDA

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## Company Profile

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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

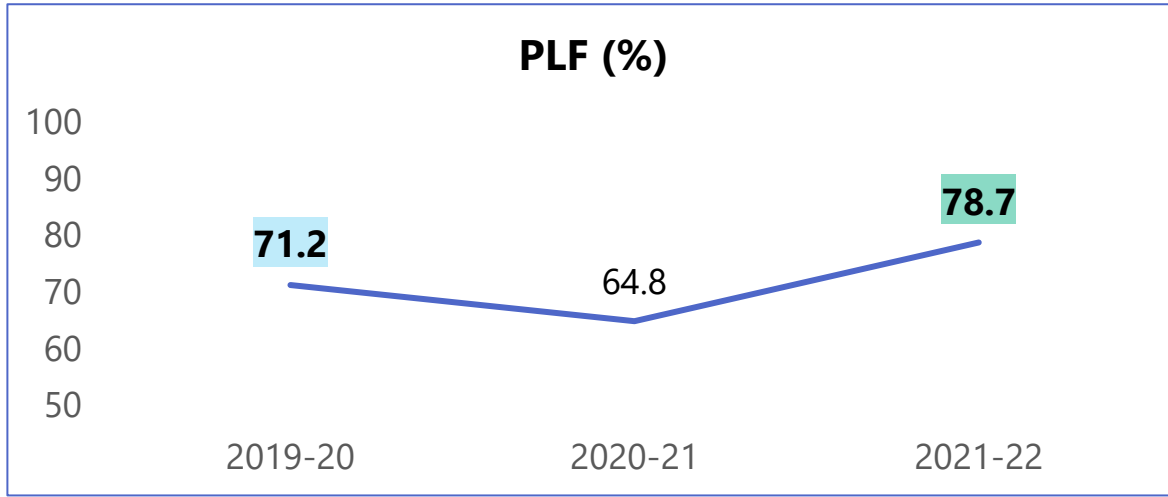
- **Lowest cost of generation** among the thermal power plants in the State of Punjab
- **Constitutes ~25%** of the total installed thermal generation capacity, it has **contributed ~40%** to the thermal energy generated within Punjab
- NPL is certified for **ISO 50001:2018 (Energy Management System), ISO 9001:2015 (QMS), ISO 14001:2015 (EMS), ISO 45001:2018 (OHSAS), ISO 17025:2017 (NABL accreditation for Coal lab)**



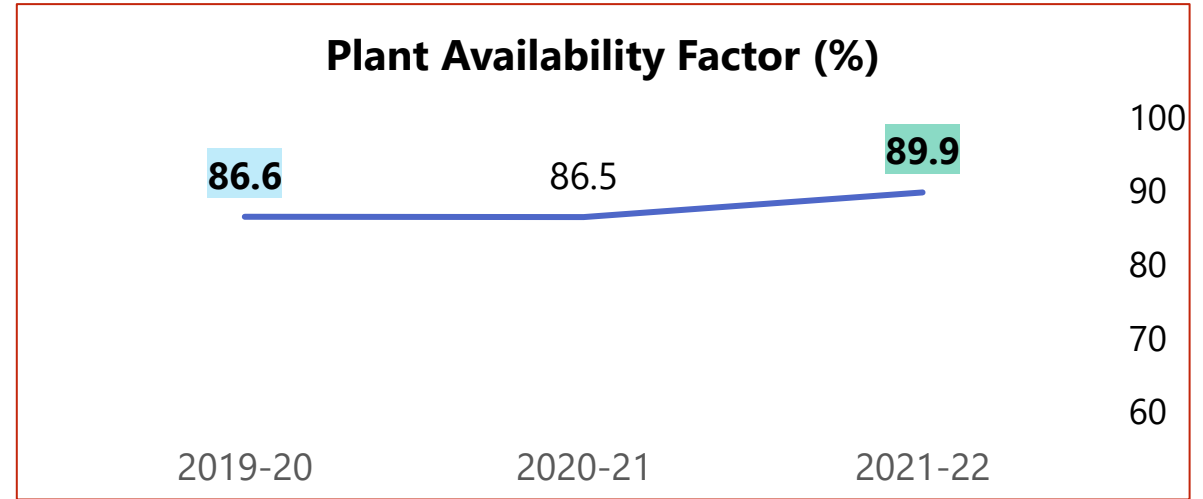
S No.	Description	Units	Values
1	Annual Generation	MUs	<b>9654</b>
2	PLF	%	<b>78.72</b>
3	Availability	%	<b>89.87</b>
4	Gross Heat Rate	Kcal/kWh	<b>2192</b>
5	Auxiliary Power	%	<b>4.82</b>
6	Boiler Efficiency	%	<b>88.15</b>
7	Turbine Heat Rate	Kcal/kWh	<b>1932</b>
8	DM Water Make-up	%	<b>0.39</b>
9	Sp. Raw Water Cons.	Cum/MWh	<b>1.85</b>
10	Sp. Oil Consumption	ml/kWh	<b>0.124</b>



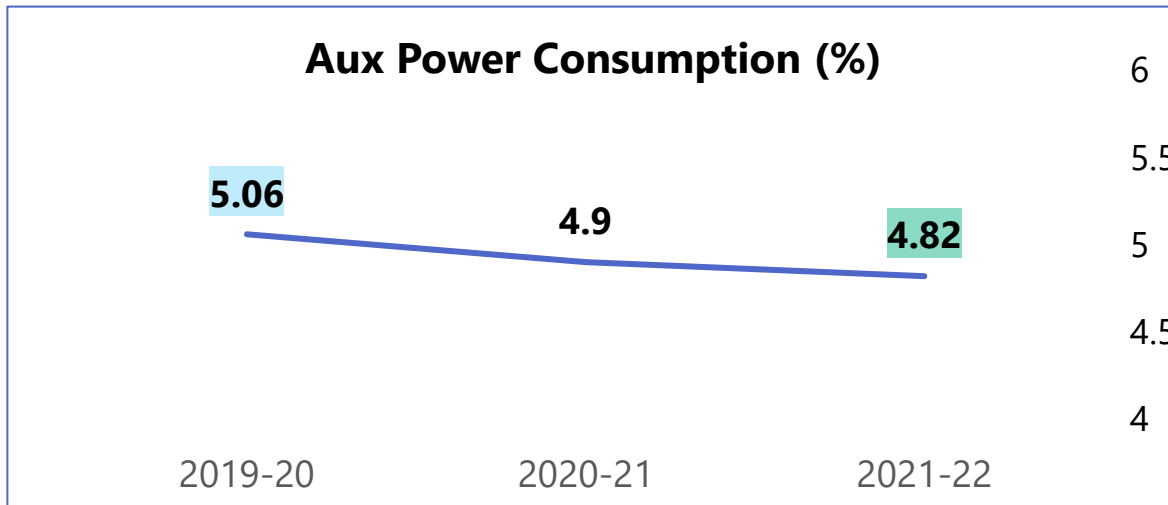
### PLF (%)



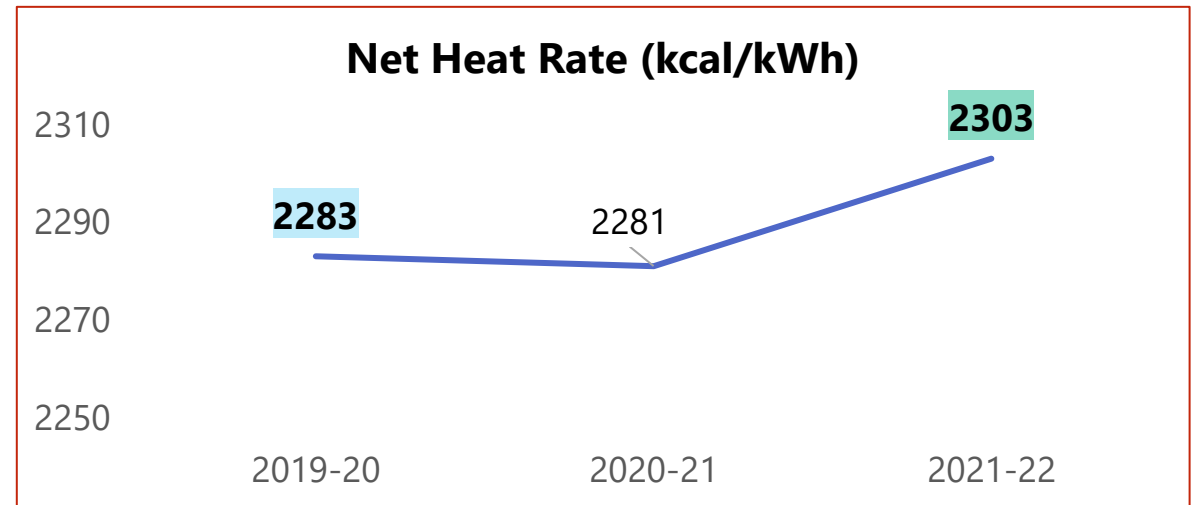
### Plant Availability Factor (%)



### Aux Power Consumption (%)



### Net Heat Rate (kcal/kWh)



\* Reason for increased in Heat Rate : ROM coal Firing & COH deferment due to high energy demand in state of Punjab, post covid economic revival.



## Internal Benchmarking

Energy Pls	Target Value FY-23 (@ 73% PLF)
Gross Heat Rate (Kcal/kWh)	2171
Aux Power Consumption(%)	4.7
DM Makeup (%)	0.38

## Our Short Term Plan

To close the Financial year by achieving the Internal target value through:

- Efficient & Reliable Operation
- Efficient Energy Monitoring
- Implementation of ENCON Projects in Pipeline
- Exploring New Opportunities and Using Latest Technologies

## Our Long Term Plan

To continually improve the station performance by adopting best O&M practices, efficient Operation and by use of energy efficient products and services

## External Benchmarking (GHR & APC)

### National

Competitor-1	Competitor-2	Competitor-3
JP Nigrie	Reliance Sasan	TSPL, Vedanta
5.09 %	5.98 %	7.17 %
2182 kcal/kWh	2250 kcal/kWh	2262 kcal/kWh

### International

Jhon Turk Jr, Arkansas, USA
-
2048 kcal/kWh



## “Steps to Sustainability”

- Flue gas Desulphurization system installation
- 100 % Ash Utilization
- Boiler – RAPH basket replacement with better design
- RCM Implementation
- Equipment health & condition monitoring through ERP system
- Long Term Overhaul Plan

## “Projects in Implementation Phase”

- CW pump internal coating – **2 LU annual Saving**
- SCAPH Modification from Fixed design to Rotary design – **2.7 LU annual Savings**
- Replacement of Existing Conventional lights of different rating LED lights – **4.5 LU annual Savings**
- Replacing TDBFP Recirculation valves internals with better design valve – **1.5 kcal/kWh**

## “Projects in feasibility Stage”

- Modification of Mill Seal Air Fan IGV manual operation to auto operation
- Optimisation of compressed air network pressure set point
- Optimization of Main steam & HRH steam temperature at part load
- Flue Gas Exit temperature optimization



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	11 Nos. of high energy drain valves replaced with better design valves in Unit-1.	0	41,928	57.3	6.20	1.3
2	Servicing of HP/IP/LP turbine, boiler chemical cleaning & 16 Nos. of high energy drain valves replaced with better design valves in Unit-2.	0	46,733	63.4	30.1	5.7
3	Replacement of Existing Conventional lights with LED	3,55,614	0	1.1	1.91	20.7
4	CWP-2A pump internal coating	2,29,000	0	0.7	0.85	14.6
5	CWP-2B pump impeller replacement & internal coating	7,73,665	0	2.4	0.85	4.2





# ENCON Project FY 2022

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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	Stoppage of Eco hopper deashing pump	2,95,099	0	0.9	0.04	0.5
7	Stoppage of 01 No. of BALP pump*	1,14,646	0	0.4	0.00	NA
8	SCAPH modification	2,67,960	0	0.8	0.10	1.4
9	Impeller trimming of RO feed to DMF pump*	1,35,000	0	0.4	0.01	0.3
10	Impeller trimming of RO LP pump*	97,000	0	0.3	0.01	0.4
<b>Total</b>		<b>22,67,954</b>	<b>88,661</b>	<b>127.8</b>	<b>40.2</b>	<b>3.8</b>

\* Projects implemented through KAIZEN



## ENCON Project FY20 to FY22

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Year	No. of Energy Saving Projects	Investments (INR Million)	Electrical Saving (Million kWh)	Thermal Saving (Million Kcal)	Saving (INR Million)
FY 2019-20	10	7.2	7.47	43,786	87.5
FY 2020-21	08	62.0	1.74	74,441	104.0
FY 2021-22	10	40.2	2.27	88,661	127.8

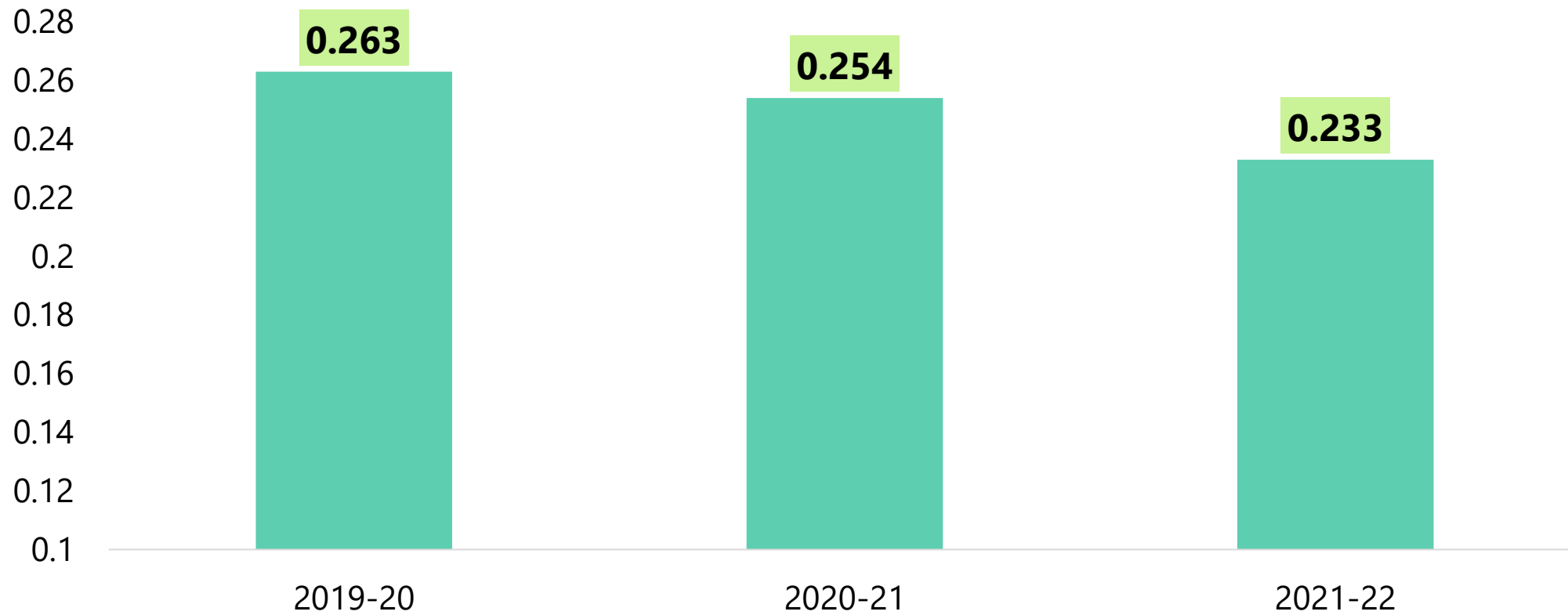


## Renewable Energy (Solar)

7

Installed Capacity: 205 kW

### Generation (Million kWh)





## Environment Management

8

### ASH MANAGEMENT

	UOM	2019-20	2020-21	2021-22
Ash Stock in Plant (Yard + Pond)	LMT	0.22	0.15	0.13
Ash Generated	LMT	12.85	14.20	19.55
Ash Utilization	%	140	100	100
Ash Utilization in manufacturing	%	135	95	79
Ash Utilization in FA bricks	%	5	5	5
Ash Utilization for Roads Pavements	%	0	0	16

**FY 2021-22**

**Ash Handled (Wet Mode) : 15.15 %**

**Ash Handled (Dry Mode) : 84.85 %**



## Environment Management

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### BEST PRACTICES IN ASH UTILIZATION

Installation of Fly ash bag packing machine to cater the need of buyer with limited requirement

Ensured complete automation of fly ash disposal operations

Facilitation of bulk transportation of Fly Ash through closed Bulkers and ensured loading of Fly ash in environment friendly manner

Maintained Zero fugitive emission during disposal of fly ash

Records of Ash disposal and buyer performance maintained through ERP



## Environment Management

8

## STATUS OF FGD

Wet limestone type FGD erection and equipment installation work in progress.

Super structure work of all buildings is in progress.

Both chimneys RCC shell has been completed, flue can erection is in progress.

Supply of all major equipment completed.

Overall project completion achieved ~75%

### Emission Parameter

FY	Generation (MU)	CO2 emission kg/kWh	SOx (mg/Nm3)	NOx (mg/Nm3)	Particulate Matter (mg/Nm3)
2019-20	8757	0.84	1507	323	41
2020-21	<b>7951</b>	0.84	1442	300	41
<b>2021-22</b>	<b>9654</b>	<b>0.86</b>	<b>1435</b>	<b>280</b>	<b>42</b>

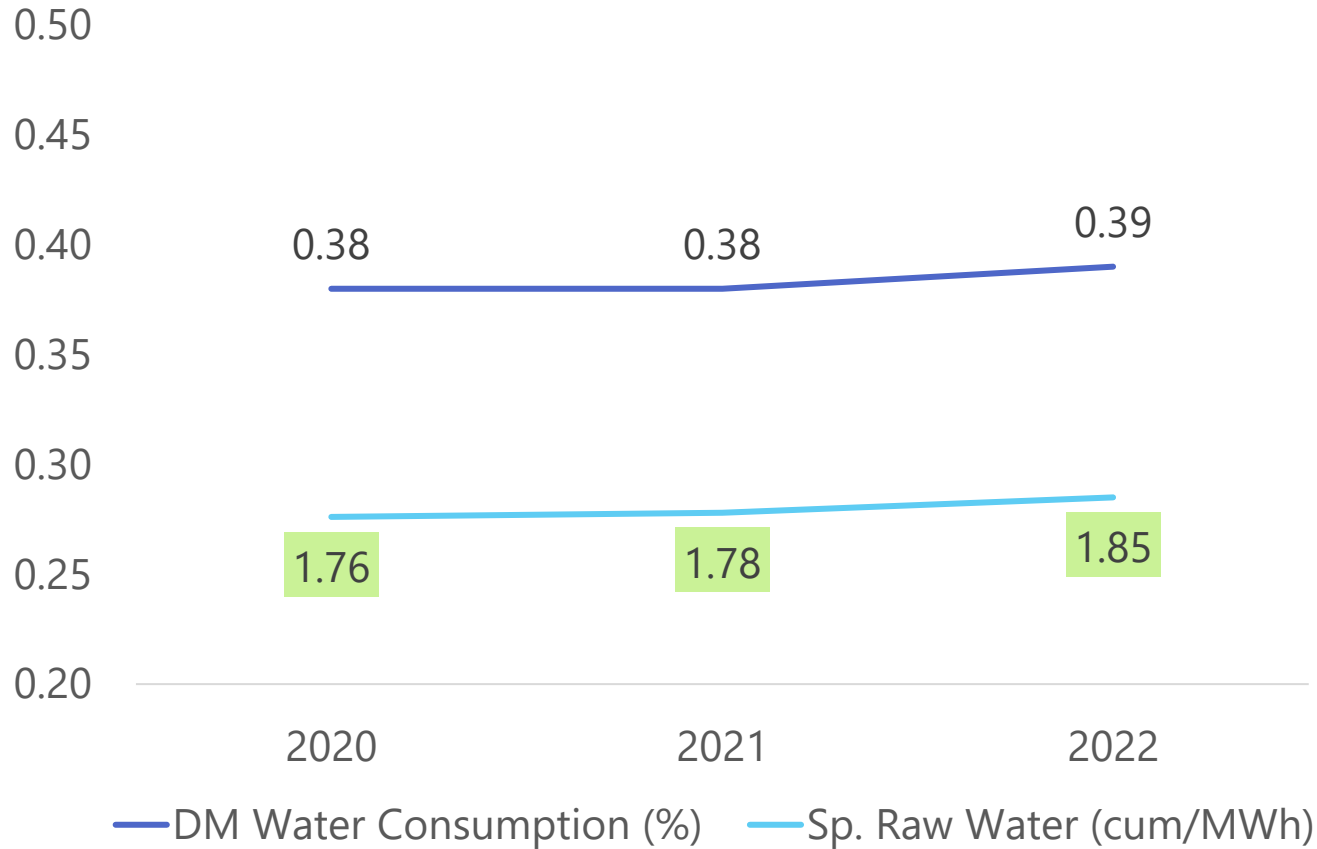


# Environment Management

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## WATER CONSUMPTION

*Zero Liquid Discharge plant*



### Best Practices

- Enhanced ETP recovery from **70% to 78%** by recycling Ultra filtration (UF) & RO Wastewater – Water Savings of **533 m3/Day**
- Conducted **Water Audit** to identify the new areas for improving water efficiency
- Reusing of PT Plant Clarifier sludge water – Water Savings of **150 m3/Day**
- DM Plant OBR improvement- from designed 18 Hrs to **20 Hrs** by installation of Online concentration analyzers & improving supervision & thus reduced regeneration & Backwash wastewater – Water savings **100 m3/Day**



## Best Practices

9

**RELIABILITY CENTRED MAINTENANCE (RCM) IMPLEMENTATION**

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

**DEVELOPMENT OF INTEGRATED DASHBOARD FOR BUDGET MONITORING**

**MAXIMO ERP APPLICATION- LOGIC FORCING, CLASSIFICATION OF PTW & REPORTING OF HSE ACTIVITIES**

**DEVELOPMENT OF INHOUSE SMART SOOTBLOWING SYSTEM**

**DAILY BOILER METAL TEMPERATURE ONLINE MONITORING AND AUTOMATIC REPORT GENERATION**

**ULTRASONIC TECHNOLOGY FOR AIR LEAK DETECTION, ELECTRICAL INSPECTION, VALVE INSPECTION, AND BEARING CONDITION MONITORING**





# Coal Planning to Firing Model



Coal despatched from mine



Coal received at Plant Site



## Coal from Multiple Coal Mines

- Varied Quality and Pricing

## Transportation over ~1500 Km

- Freight Rate varies with distance

## Unloading & Storage at Coal Yard

- Unloaded using wagon tippers
- Stacked in heaps (GCV basis)

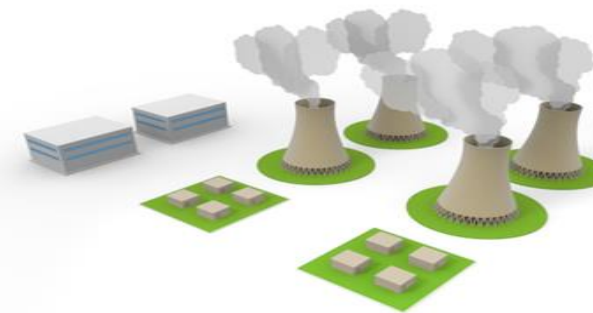
~3000 Cr (75%) towards payment of coal costs

EBITDA



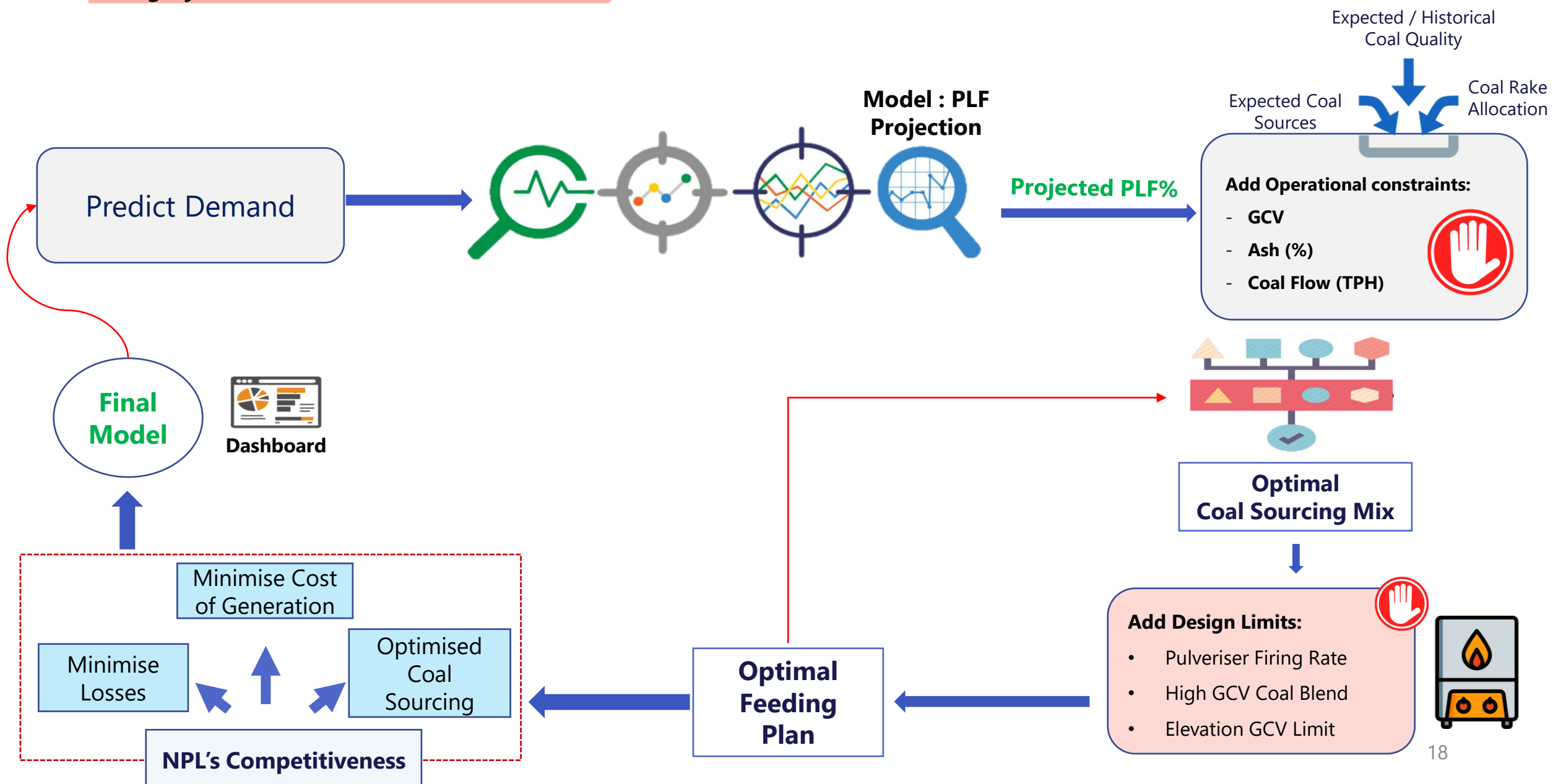
NPL supplies 31.68 million units per day (~24 Lakh households)\*

Power supply to Discom



- Annual Business Turnover ~4000 Cr (Avg.)

- Convert Water to Steam
- Pressurised Steam rotates Turbine in-turn Generator

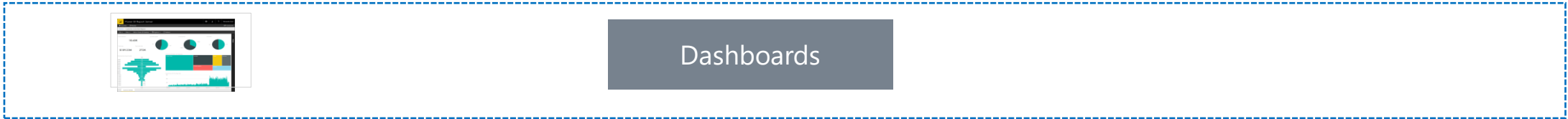




# High Level Architecture & Benefits

## Mindtree NxT Cloud

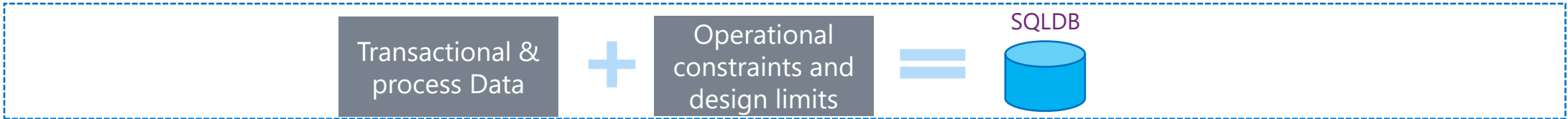
Visualization



Models & Optimization



Data Layer



Source



### Program Outcome:

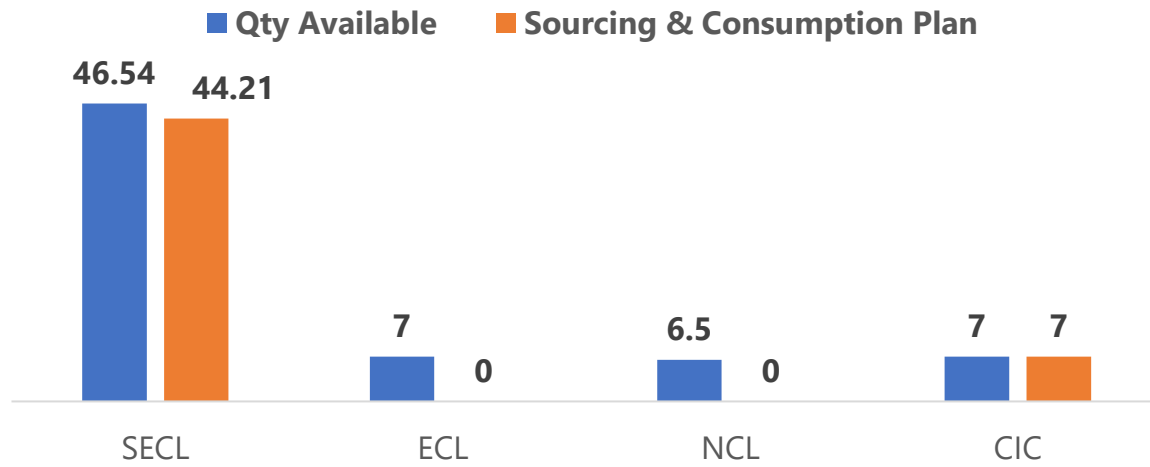


- ✓ Annual Saving of INR 5.0 Cr
- ✓ Reduced planning horizon, better quality and lower losses
- ✓ Visibility of complete value chain and End to End optimization
- ✓ Integration with current IT/OT infrastructure

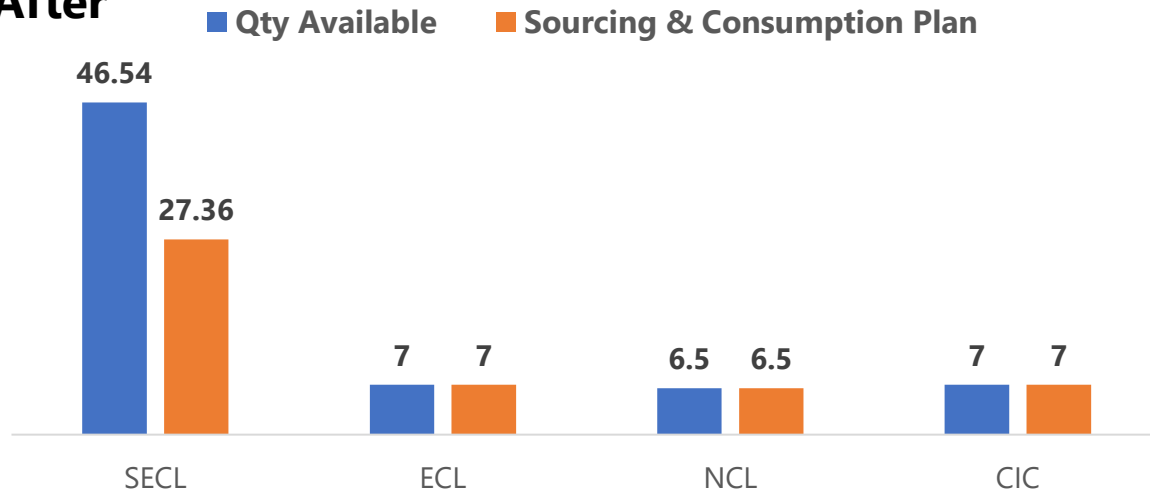


# Illustration

## Before



## After



## An Illustration

Before	KPI	After
3646	• <b>GCV (Kcal/Kg)</b>	3898
39%	• <b>Ash %</b>	35%
420	• <b>Coal Flow (TPH)</b>	392
2.82	• <b>Energy Charge (Rs/Unit)</b>	2.84
<b>113</b>	• <b>Losses (Rs Cr)</b>	<b>108</b>

**Estimated increase in EBITDA : ~5 Cr**





## REQUIREMENT OF MODIFICATION

1

- Lower Hot PA & SA temperature

2

- Increase in hot PA flow demand because of low temperature

3

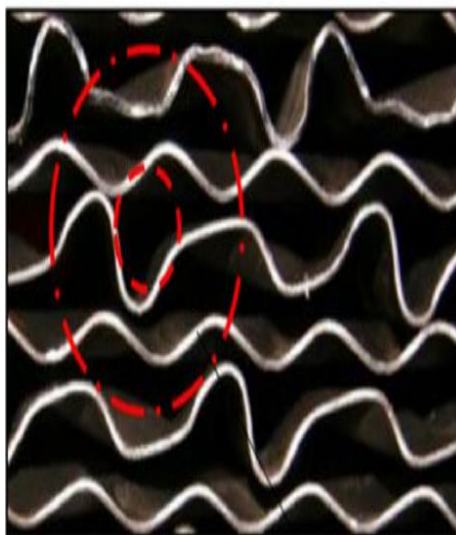
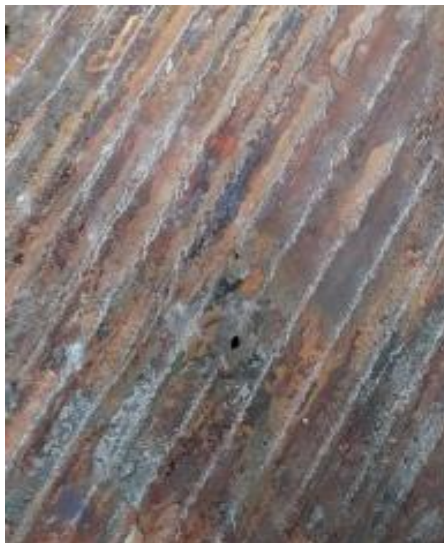
- Higher Flue gas exit temperature- Dry flue gas loss

4

- Higher DP in RAPH resulting increased fan loading

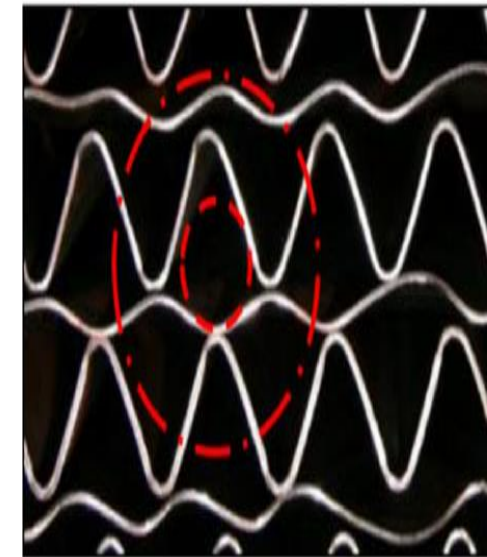


## ADVANTAGES OF HC11 OVER HS8



### Old Basket Design – HS8

- ❑ Combination of notch-undulated with an undulated sheet.
- ❑ Higher DP due to Undulations running in one direction creates cold corner problems and skew flow within each container.



### Modified Basket Design – HC11

- ❑ Transverse herringbone pattern of undulated sheet paired with a corrugated sheet.
- ❑ More cleanability due to narrow channels in the direction of flow. Lower DP
- ❑ Increase in efficiency due to increased heat transfer area

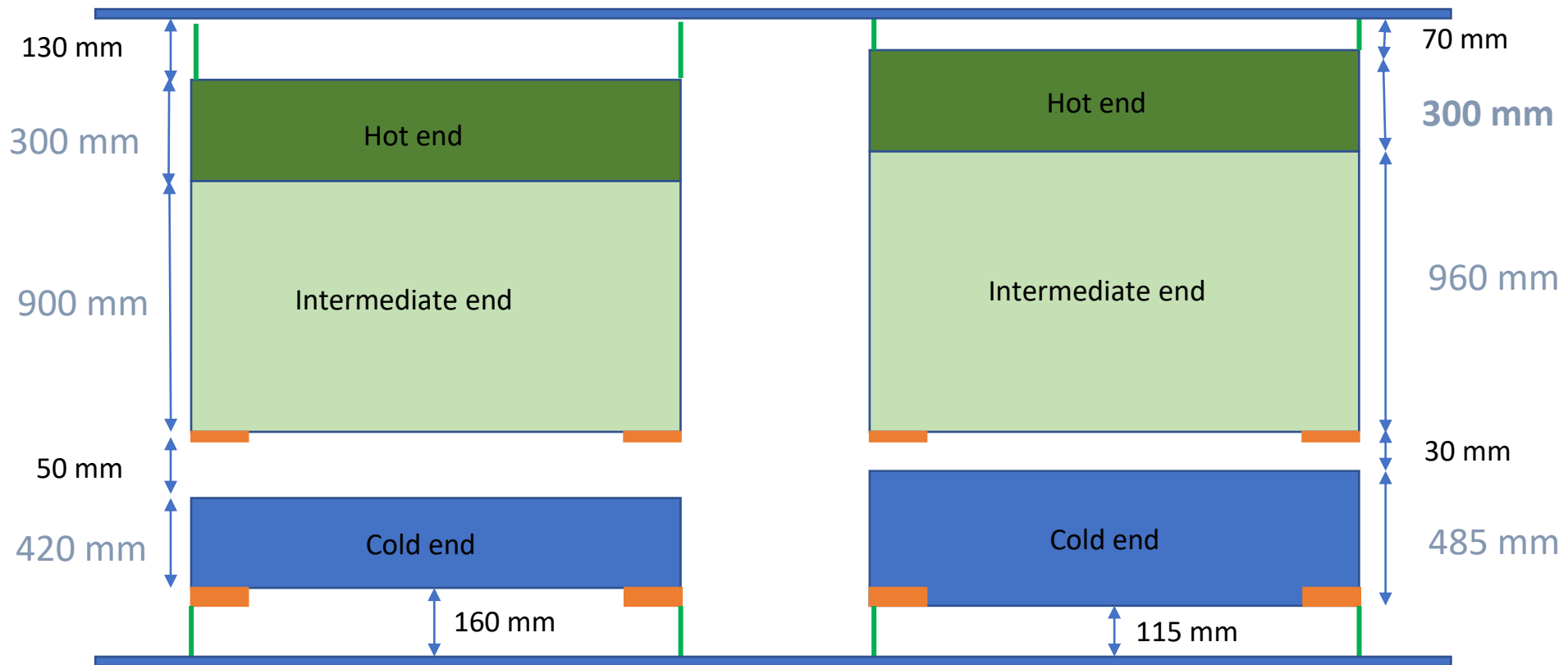


# RAPH Basket Modification

## ARRANGEMENT OF MODIFIED BASKET

Old-1620

Modified-1745



Weight of basket- 458 MT/RAPH  
Heating Surface area- 56344 SqM

Weight of basket- 482 MT/RAPH  
Heating Surface area- 58314 SqM



## RAPH Basket Modification

RAPH Performance	With Old Basket	With Modified Basket	Improvement (Unit Heat Rate)
Dry Flue Gas Loss (Normalized to design)	4.46 %	3.90 %	<b>0.56 %</b> <b>(14.6 kcal/kWh)</b>





## Energy Management Review:

Chaired by Head O&M fortnightly  
Chaired by CEO monthly

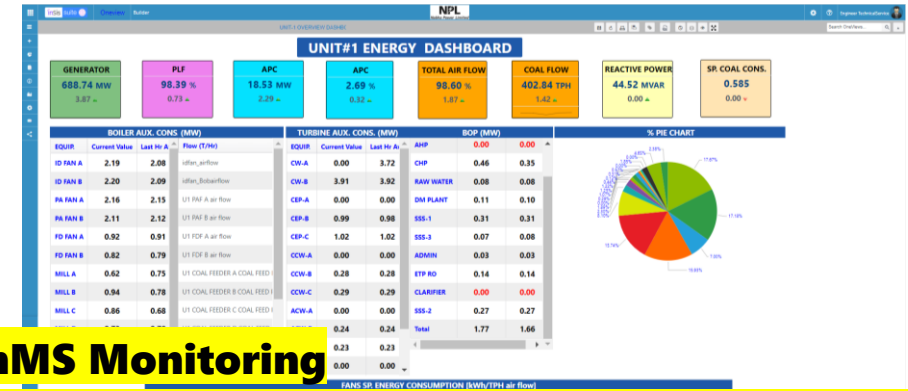
**Budget for Energy Conservation FY23 =  
INR 1.29 Crore**

## Energy Efficiency Awareness Training Program Conducted:

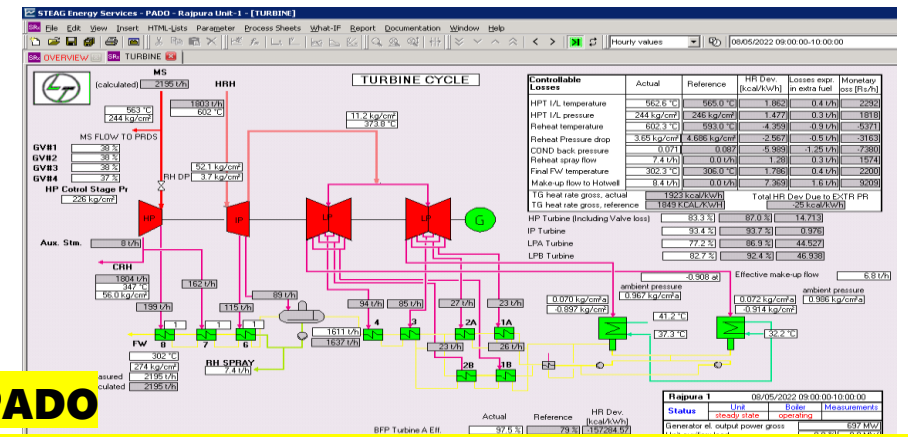
1. ISO 50001 Energy Management System by CII
2. Energy Efficient Design & Energy Audit & Review Process as per ISO 50002 by CII
3. Certified Professional in Energy Efficiency by CII

Organized 2-day virtual O&M conference on "Best Practices in O&M of Coal based TPPs"

## Energy Monitoring (Realtime)



**EnMS Monitoring**  
**For new project development & monitor real time energy consumption of equipment/system!!**



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



- **“Best Operating Thermal Power Generator - Commissioned after 2008” by IPPAI 2022**
- **“Independent Power Producer of the Year- India: by Asian Power Awards 2020**
- **Twin awards from CII**
  - **National Energy Leader** for its progressive performance for second consecutive year in Energy Management (**3<sup>rd</sup> time in a row**)
  - **Excellent Energy Efficiency Unit** award for outstanding achievements in Energy Efficiency (**5<sup>th</sup> time in a row**)
- **Won Golden Peacock Award for CSR** in power generation category- **May 2021**
- **Nabha Power registers its name in the top 10 thermal power plants of the Country for Highest PLF** in the period of **April 2021 – August 2021**





# Thank You

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