एनटीपीसी
NTPC

Vindhyachal Super thermal power station

8MW Hydro Plant

25th National Award for Excellence in Energy Management, 2024

Team Members:

- Kiran Kumar Bantu, AGM (OPN)
- Arvind Kumar Mishra, DGM (EEMG)

Vindhyachal: Largest Power Plant of India

Thermal	Capacity Thermal = 4760 MW (210 MW X 6 + 500 MW X 7) Tangentially fired pulverised fuel Boilers
Solar PV	15 MW (Mono Silicone crystallite Cells)
Small Hydro	2 x 4 MW= 8 MW (Kaplan-S turbines)
Grand Total Capacity	**4760+15+8= 4783 MW**
Land	6000 Acres
Water Source	Discharge canal from NTPC Singrauli
Coal Source	Nigahi, Dudhichua Coal Mines of NCL

Milestones towards Green Energy

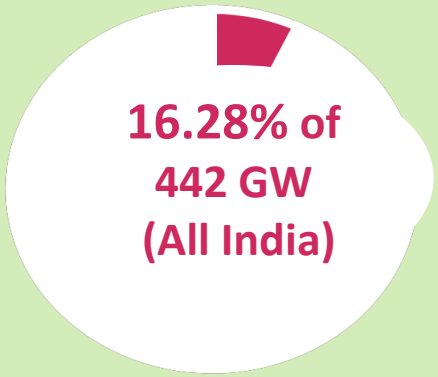
- Solar plant Commissioned on 31.12.2014.
- Hydro plant Commissioned on 05.03.2018.
- First Wet FGD of India Commissioned on 05.03.2017
- CCUS Project : First Carbon captured on 15.08.2022.
- 567KW Roof top Solar in Plant and Township.
- Low NOx burners commissioning completed in 2022.

Upcoming Project

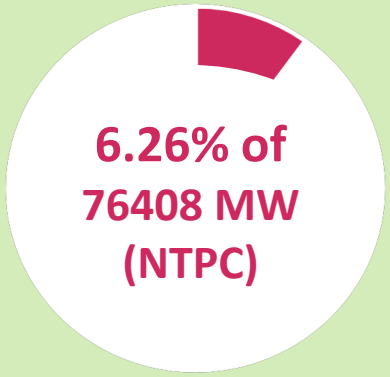
- 20 MW Solar project
- 1 MW Roof top Project.
- FGD in all thermal units.
- 100% Ash utilisation.
- Carbon to Methanol (CCTM)
- 210MW turbine R&M.

- First Thermal unit (U#1, 210 MW) was commissioned on 10.10.1987
- Last Thermal unit (U#13, 500 MW) was commissioned on 06.08.2015

VSTPS- The Most Productive Business Unit of NTPC

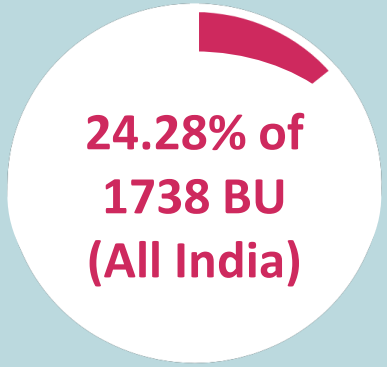


NTPC



VSTPS

Installed Capacity



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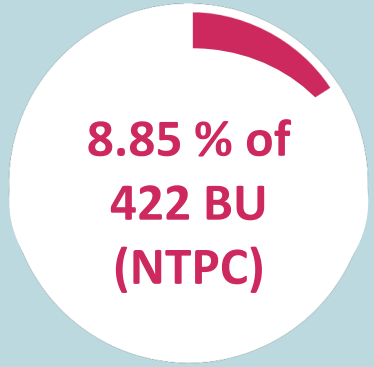


VSTPS

Power Generation

As on 31st March 2024

VSTPS: Visualising Success Through the Progress of its Stakeholders

NTPC Vision

"To be the world's Leading Power Company, energizing India's Growth"

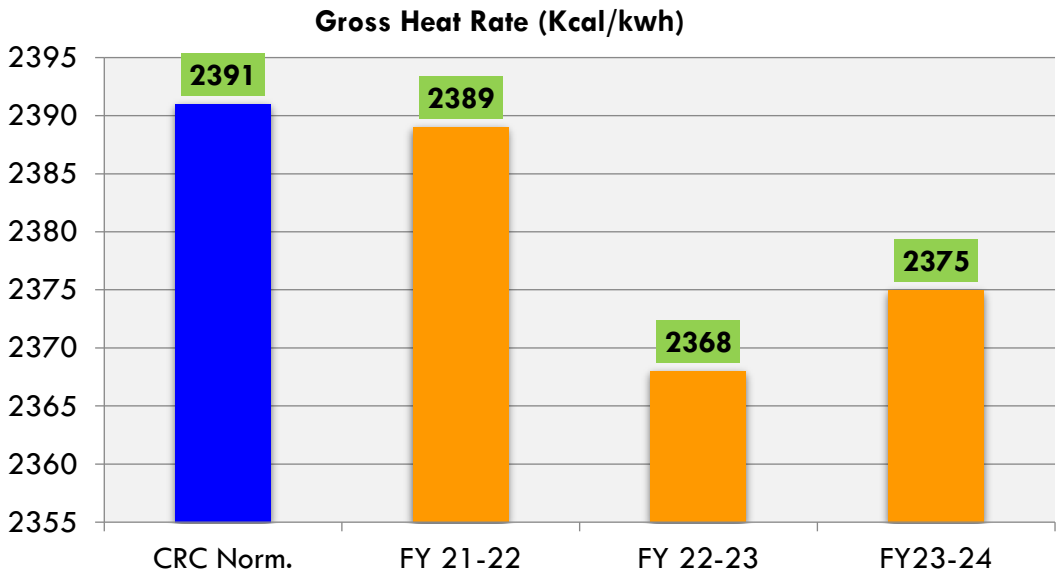
VSTPS Vision

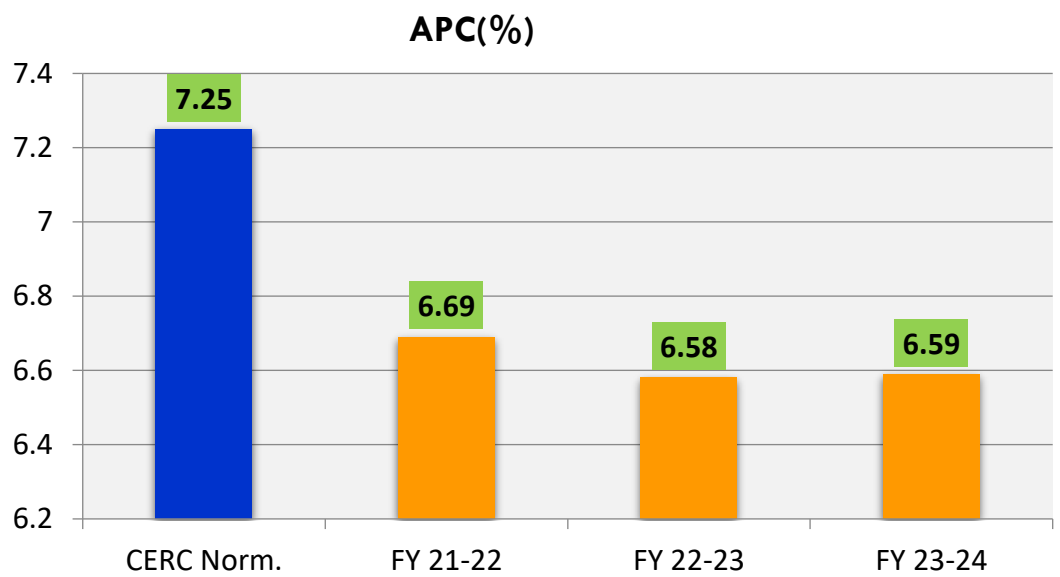
"To be India's Leading Power Station exceeding Stakeholders' expectations."

Vindhyachal Performance : Past three years

Sr. No.	Parameter	Unit	Norms/ Target	FY 21-22	FY 22-23	FY 23-24	Remark FY 2023-24
1	**Annual Generation**	MU	Different targets for each year	35,730.08	37,337.13	37,387.05	Highest generating station
2	**PLF**	%		85.69	89.54	89.42	3rd rank in NTPC
3	**Availability**	%		90.26	92.85	93.60	FO+EPL 1.3% (best in NTPC for last 2 FYs)
4	**Gross Heat Rate**	Kcal/kwh	2391 (Norm)	2,389	2,368	2375	
5	**Auxiliary Power**	%	7.25 (Norm)	6.69	6.58	6.59	
6	**Boiler Efficiencies**	%	87.6/84.6	86.7/85.5	87.3/85.4	87.0/85.3	210MW/500MW
7	**Turbine Heat Rates**	%	2021/1932	2110/1975	2090/1965	2095/1966	210MW/500MW
8	**Specific DM Water consumption**	%	0.50	0.53	0.55	0.56	
9	**Specific Raw Water Consumption**	L/kwh	3.5 (Norm)	2.86	3.00	3.05	
10	**Specific Oil Consumption**	ml/kwh	0.50 (Norm)	0.24	0.18	0.14	Best among NTPC stations for last 2 FYs.

Specific energy consumption past 3 years :

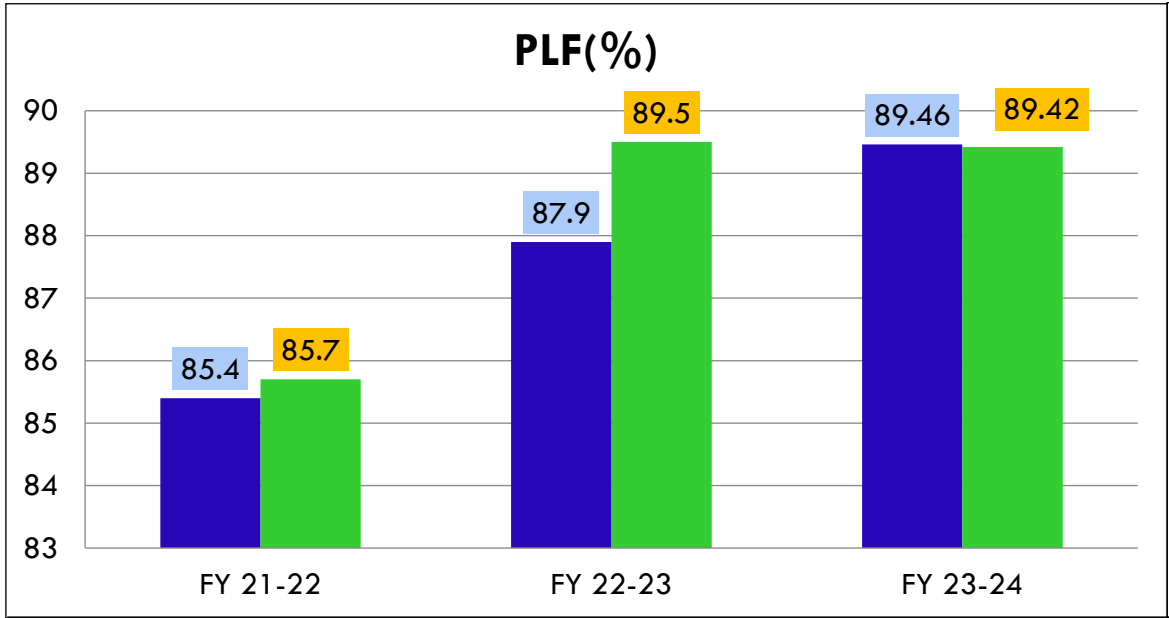


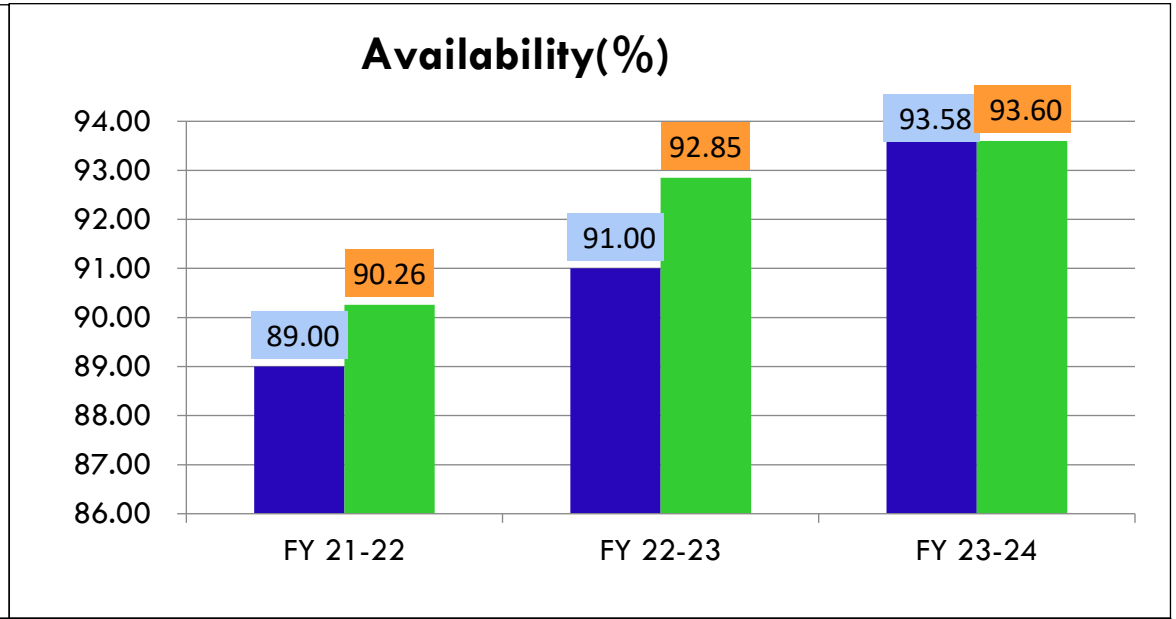


- FY 23-24 High Grid demand in peak hours. Apr-June OH of units OH delayed resulted in increased GHR w.r.t FY 22-23.
- Stage-1 210MW units are 35 years old and stage-2 500MW units are 25 years old.
- AGC/SCUS implementation to meet grid stability resulted in increased Partial load operation.
- Future plan- R&M of stage 1 turbine.

- APC in FY 23-24 has increased slightly as compared to FY 22-23 due to additional APC in FGD operation, addition of new ESP pass stage1, DAES sys, ZLD implementation.
- Delayed OH due to meet high grid demand, increased Draft power, partial load operation due to RRAS/TRAS.
- APC of Vindhyachal all stages are always within CERC norms.

PLF and Availability past 3 years :





- Vindhyachal stations always remains in top 10 position in All India PLF ranking.
- 23-24 Vindhyachal was at 8th Rank on all India Generators ranking and 3rd rank in NTPC ranking.
- If we consider AGC (Automatic generation control) impact on PLF then Vindhyachal Deemed PLF is 93.30% (Loss of approx. 1% PLF due to AGC.)
- Vindhyachal was among few stations of India with AGC system operational.

- Vindhyachal availability is comparable to best stations in India.(improvement 1.02%)
- Forced outage and partial loss due to station problem was 1.3 % only in FY 23-24. This was best among all NTPC stations in FY 23-24.
- As consequence, Specific oil consumption (0.14%) was also best among all NTPC stations in FY 23-24.
- Stations takes 6 planned shutdown(Out of 13 Units) for overhaul every year, Highest for any station.

Benchmarks :

- Benchmarks are set via discussions in Workshop, knowledge sharing, Learnings, Internal MOU etc.
- NTPC BE Model is followed and benchmarking is shown in annual report for each parameter.
- Benchmarking is done with pit head stations having unit configuration in 200MW and 500MW combination, like NTPC Korba and Ramagundam stations.
- All performance parameters have separate benchmarking station, comparison is done with best.
- Various maintenance departments has done benchmarking with respect to international best standards and practices.
- CERC Norms and PAT Target are very basic benchmark targets for station.
- Continuous improvement and providing result beyond customer expectation is our moto so strict benchmarks are set.

Road map to achieve benchmark target :

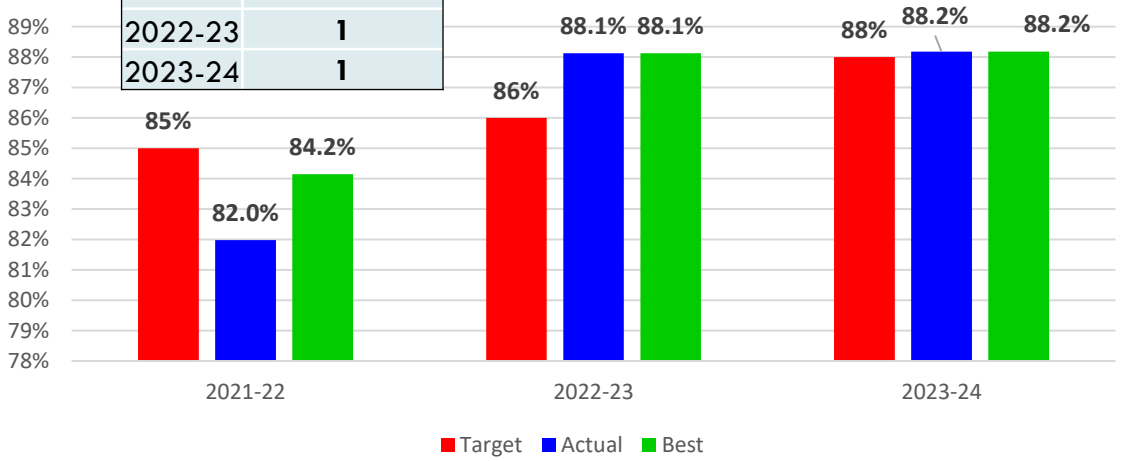
- After target setting lead and lag indicators are identified.
- SWOT Analysis is done.
- Responsible leaders are selected to achieve set target.
- Periodic reviews are done to check progress.
- Vendor development for old Russian technologies.
- 100 % Safety and Zero Accident action plan.
- Employee Engagement is key to success.

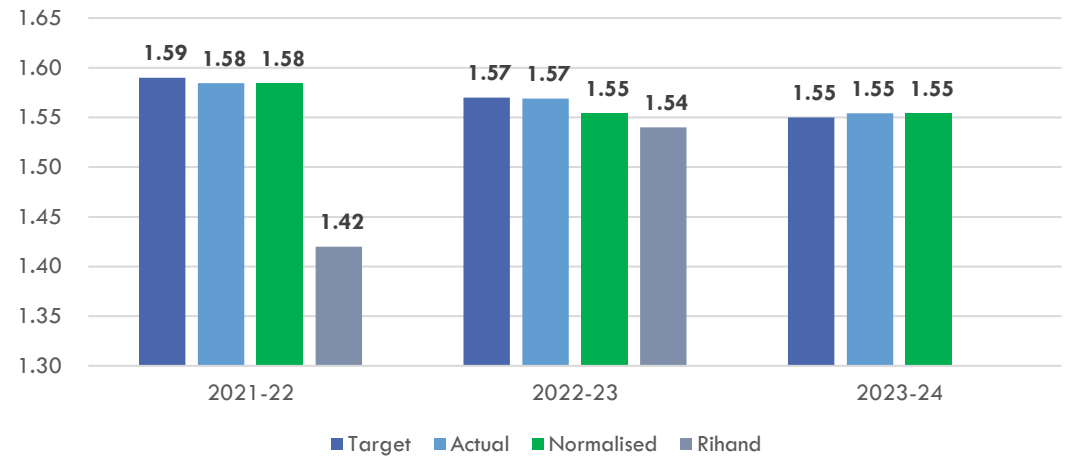
Upcoming Project

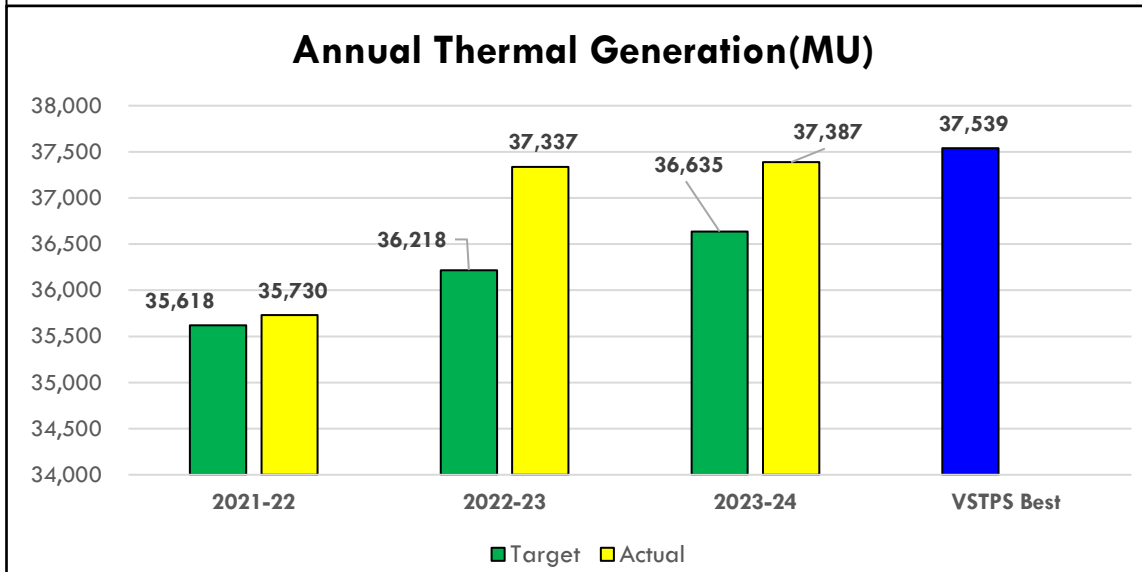
- 20 MW Solar project
- 1 MW Roof top Project.
- FGD in all thermal units.
- Carbon to Methanol (CCTM)
- 210MW turbine R&M

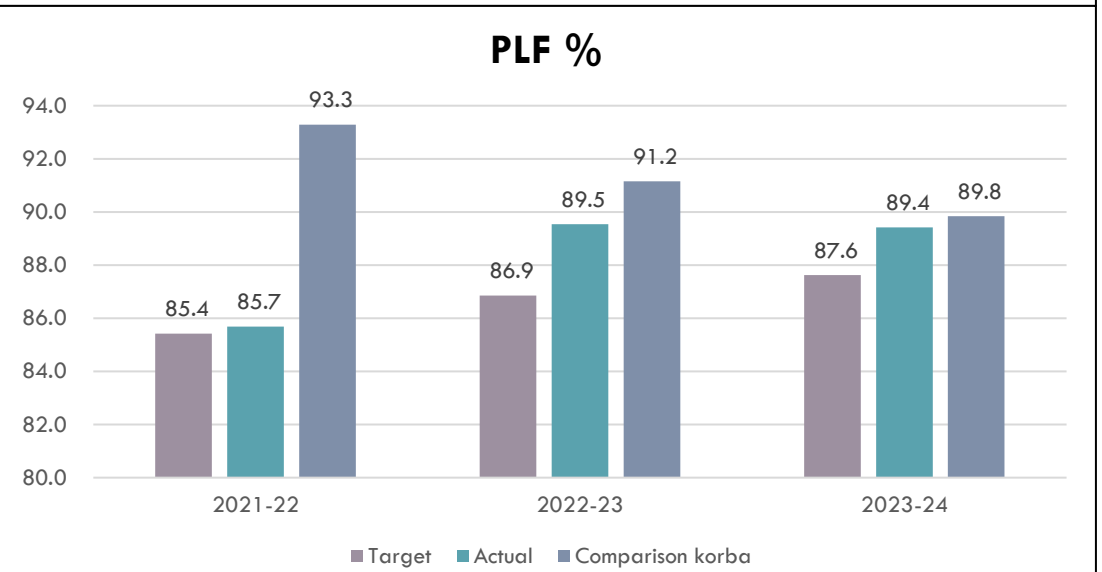
Benchmarks :

	PEM position
2021-22	2
2022-23	1
2023-24	1



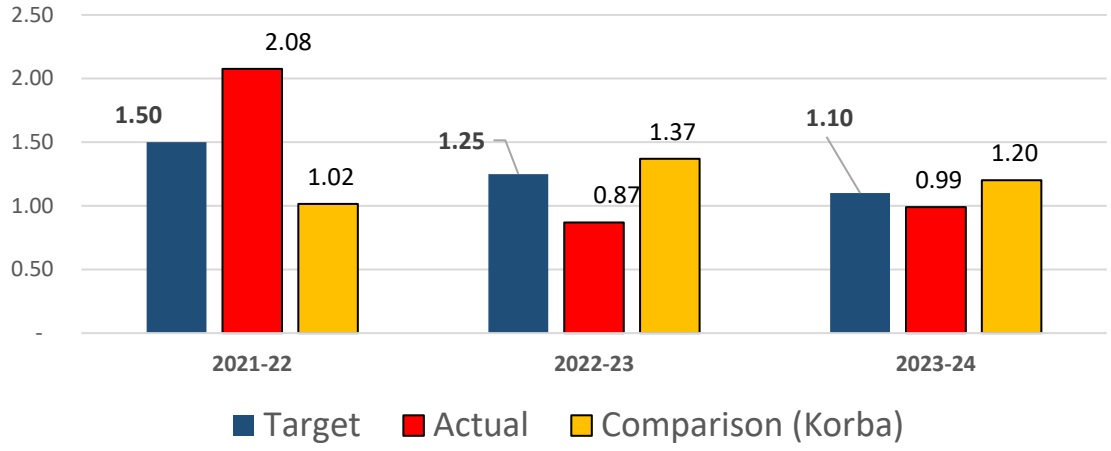




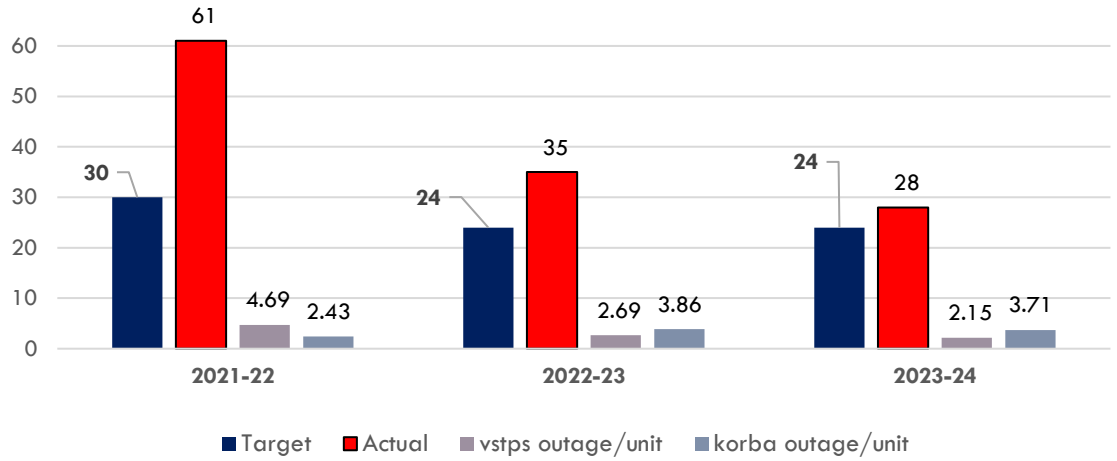


Benchmarks :

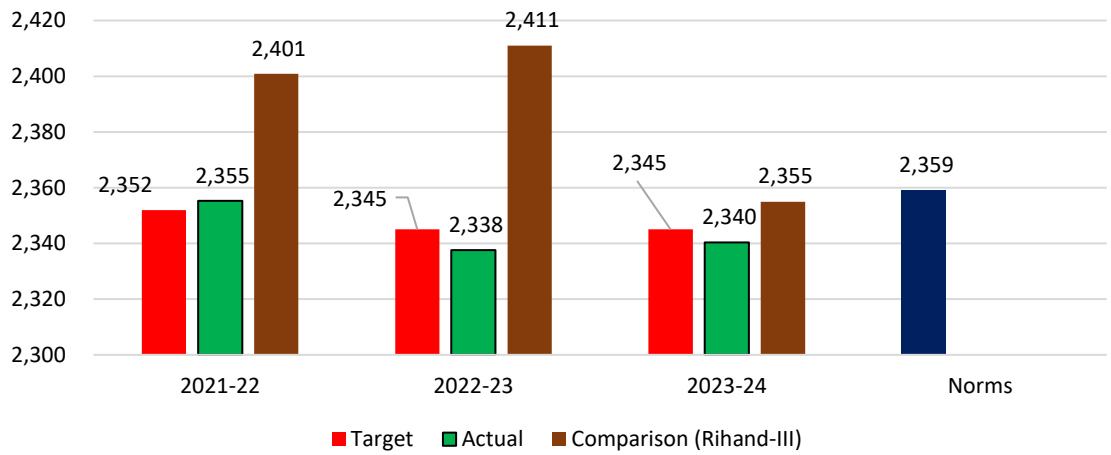
Forced Outage External (%)



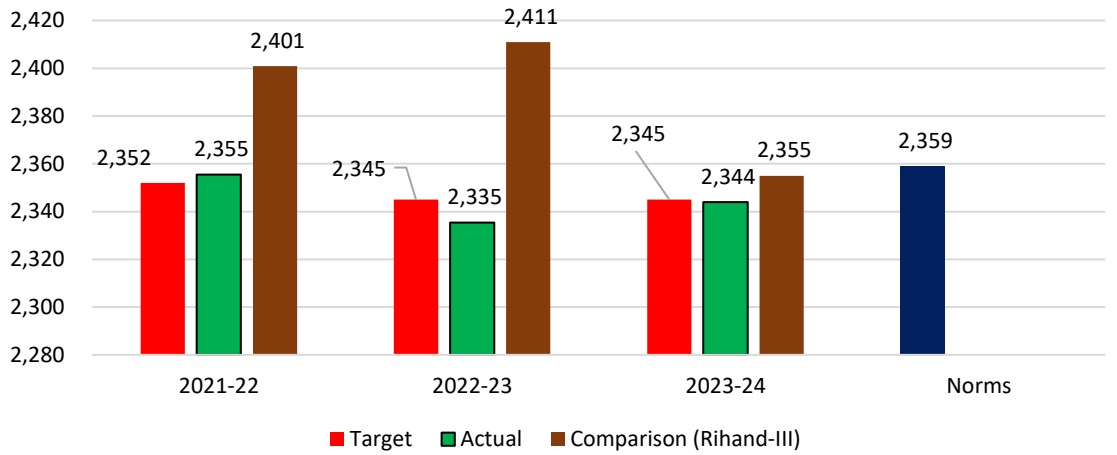
No. of forced outages



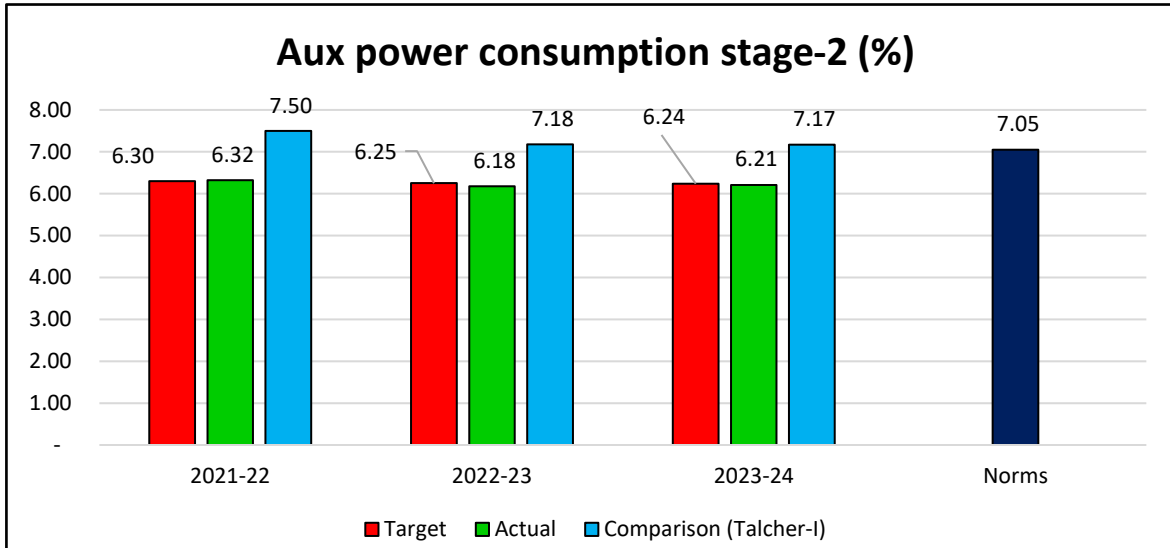
Heat rate stage-4 (Kcal/Kwh)

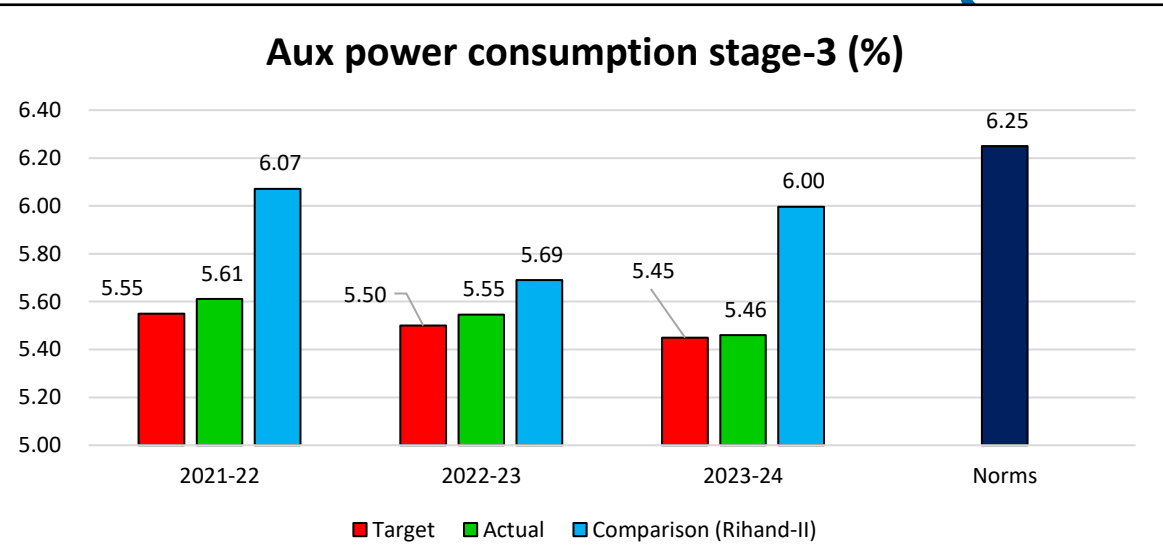


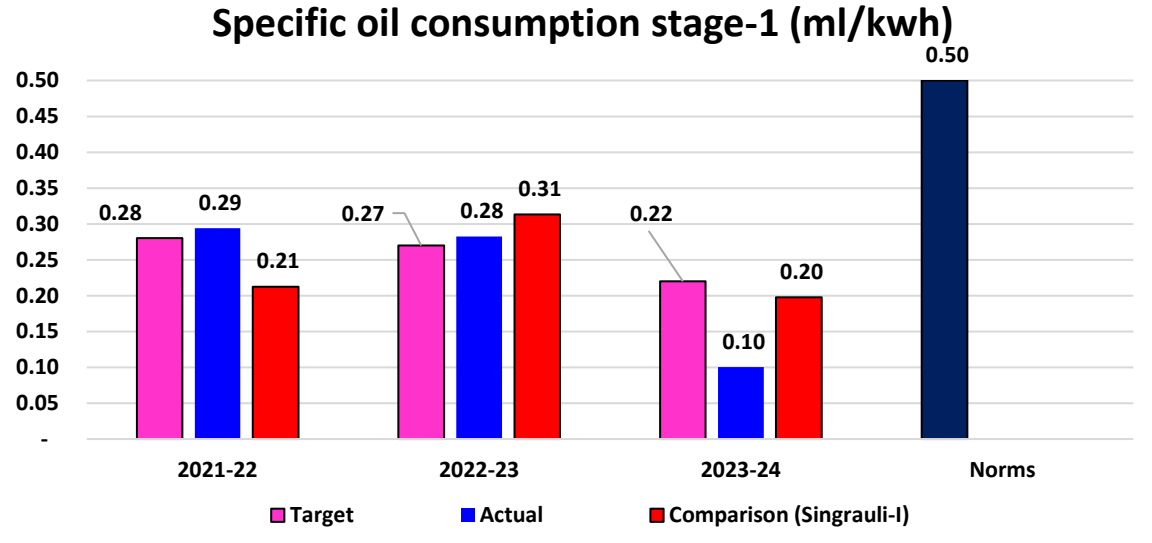
Heat rate stage-5 (Kcal/Kwh)

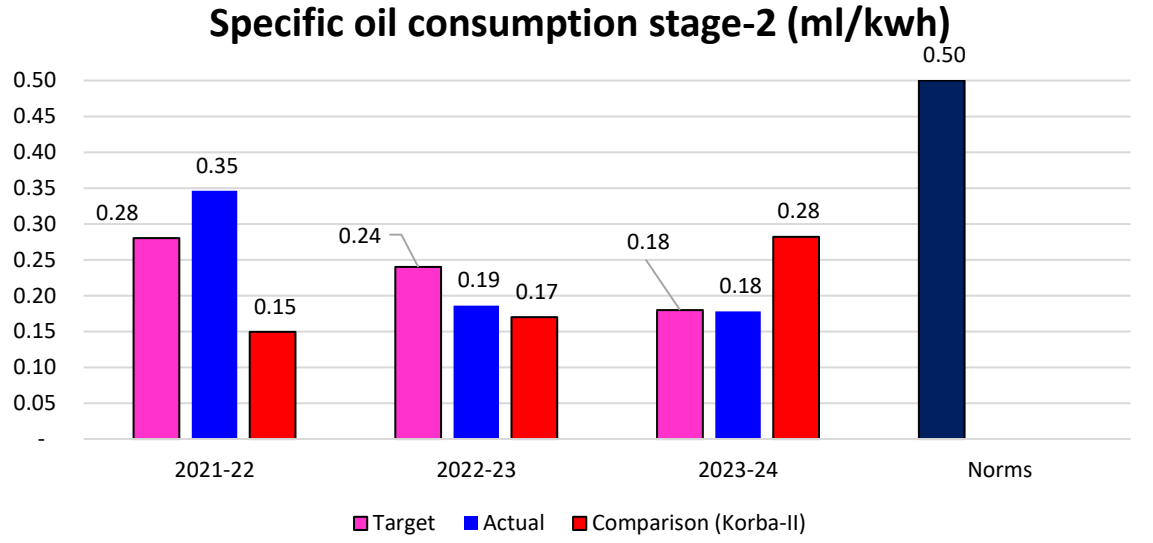


Benchmarks :

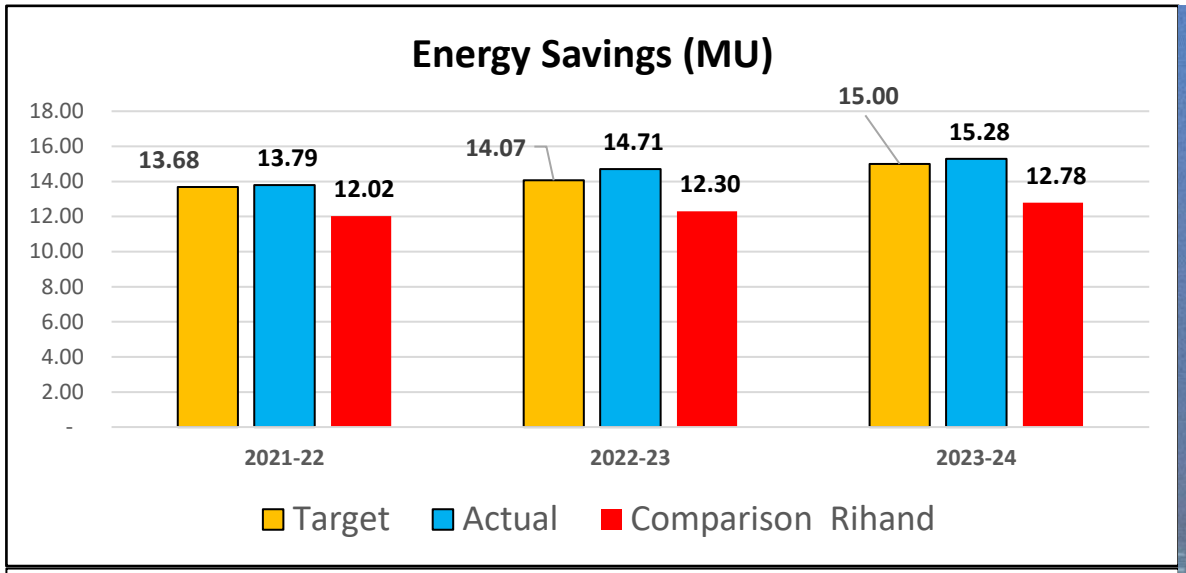

Aux power consumption stage-2 (%)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
-
6.30
6.32
7.50
6.25
6.18
7.18
6.24
6.21
7.17
7.05
2021-22
2022-23
2023-24
Norms
Target
Actual
Comparison (Talcher-I)

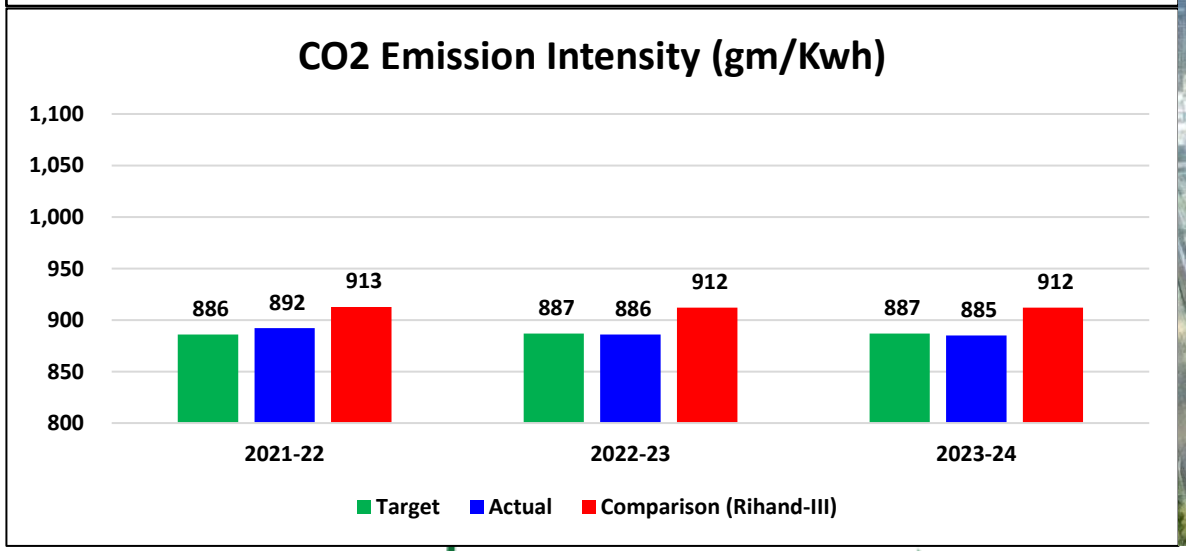

Aux power consumption stage-3 (%)
6.40
6.20
6.00
5.80
5.60
5.40
5.20
5.00
5.55
5.61
6.07
5.50
5.55
5.69
5.45
5.46
6.00
6.25
2021-22
2022-23
2023-24
Norms
Target
Actual
Comparison (Rihand-II)


Specific oil consumption stage-1 (ml/kwh)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-
0.28
0.29
0.21
0.27
0.28
0.31
0.22
0.10
0.20
0.50
2021-22
2022-23
2023-24
Norms
Target
Actual
Comparison (Singrauli-I)


Specific oil consumption stage-2 (ml/kwh)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-
0.28
0.35
0.15
0.24
0.19
0.17
0.18
0.18
0.28
0.50
2021-22
2022-23
2023-24
Norms
Target
Actual
Comparison (Korba-II)

Save Energy, Save Earth





future Targets :

The Rolling business plan serves as the integrating link between long-term corporate plan, Annual plans (Internal MOU and annual budgets) and Performance Evaluation Matrix (PEM).

Key Parameters	Unit	2024-25	2025-26	2026-27	2027-28
Gross Generation	MU	37110	37320	37520	37520
APC	%	6.54	6.52	6.50	6.50
FO+ PL	%	1.3	1.2	1.1	1.0
Availability	%	92.2	92.3	92.5	93.0
DC	%	93.2	93.6	94.2	94.5
Heat Rate	Kcal/KWH	2371	2367	2364	2360
Specific Oil	ml/ KWH	0.200	0.195	0.180	0.170
Specific water	ml/kwh	2.91	2.87	2.85	2.80
Ash utilization	%	80	100	100	100

Major Encon project planned in FY 2024-25

Sr. No	Project	Electrical Saving (Million kWh)	Thermal Saving (Million Kcal)	Investment (Rs Million)
1	Unit-1 Condenser tube replacement		73584	159.00
2	Stage-1 LPH-4 Assembly replacement in remaining 3 units		29163	28.16
3	Complete replacement of 30 years old boiler insulation in unit-4		14715	87.80
4	VFD Installation in stage-3 feeders	0.88	73584	4.83
5	Replacement of existing metallic shaft of Cooling Towers with Carbon Fibre shaft.20 Numbers	1.75		8.20
6	Replacement of Ash Slurry Pumps, Drain Sump Pumps along with drives and accessories of Stage-I	2.19		24.90
7	Polymer Coating on stage-1 CW pumps & Other Pumps - 6 numbers	2.10		1.84
8	Replacement of HT old motors with IE3 grade motors	2.19		24.50
9	Cartridge replacement/Refurbishment in stage-1 MDBFP's. 2 numbers	1.10		5.00
10	Replacement of LT old motors with IE3 grade motors	1.31		7.50
11	Renewable Rooftop Solar addition	0.27		5.60
	Total planned	**11.79**	**1,17,462**	**357.32**

Energy Saving projects 2023-24

Sr. No	No of Energy saving Projects	Investment (INR Million)	Electrical Saving (Million kWh)	Thermal saving (Million kcal)	Saving (INR Million)
1	**Annual Electrical energy saving in FY 23-24 under various heads**	**198.32**	**15.60**	**61,793**	**59.34**
2	Stage-1 LPH-4 Assembly replacement in 3 units	7.50		29,163	**18.13**
	Complete replacement of 30 years old boiler insulation in unit-2,3			29,430	**18.29**
3	Application of Ceramic Pad in place of LRB mattress in different areas of PA Fan, APH Guide Bearing area and Burner Block Stage-I	10.00	0.88	3,200	**3.35**
4	Replacement of existing metallic shaft of Cooling Towers with Carbon Fibre shaft.20 Numbers	24.50	1.75		**2.72**
5	Replacement of Ash Slurry Pumps, Drain Sump Pumps along with drives and accessories of Stage-I	1.87	2.63		**4.07**
6	Polymer Coating on stage-1 CW pumps & Other Pumps - 4 numbers	24.90	1.40		**2.17**
7	Stage-1 Old Instrument air compressors in (reciprocating compressors)replacement with new IACs (screw compressors). 3 numbers	8.20	2.00		**3.10**
8	Cartridge replacement/Refurbishment in stage-1 MDBFP's. 2 numbers	4.83	1.10		**1.70**
9	Replacement of old motors with IE3 grade motors	87.80	3.50		**5.43**
10	Renewable (Solar) addition	28.16	0.25		**0.39**

Energy Saving projects 2022-23

Sr. No	No of Energy saving Projects	Investment (INR Million)	Electrical Saving (Million kWh)	Thermal saving (Million kcal)	Saving (INR Million)
1	**Annual Electrical energy saving in FY 22-23 under various heads**	**75.00**	**14.70**	**228133**	**22.56**
2	Replacement of old HT motors with energy efficient motors in stage-1 units.	2.00	1.64	-	2.62
3	Ash handling drives efficiency improvement based on audit.	5.00	0.29	-	9.15
4	VFD installation in stage-1 RC feeders, feeder motors replaced , R&M of feeders.	10.40	0.24	-	0.76
5	Old PACs were replaced with new PACs : earlier 4 reciprocating compressors were operating 160 KW each along with stage-4 interconnection. Now only 2 new screw compressors remain in service 275 KW each.	30.42	0.89	-	1.42
6	Draft power reduction due to air sealing in Unit-13 APH and Penthouse, Ceramic PADs in burner are and manholes for complete sealing.	2.50	0.95	-	1.52
7	Replacement of existing metallic shaft of Cooling Towers with Carbon Fiber shaft.	5.00	0.21	-	0.33
8	Replacement of old LT motors with energy efficient motors in stage-1 units	11.11	2.04	-	3.21
9	Unit-9 & 10 Cooling Tower Performance improvement	77.40	1.55	2,28,133	141.96
10	Replacement of BFP Cartridge- 3C & 1A	8.50	3.33	-	5.23
11	CW impeller and internals energy efficient coating	1.00	0.08	-	1.19

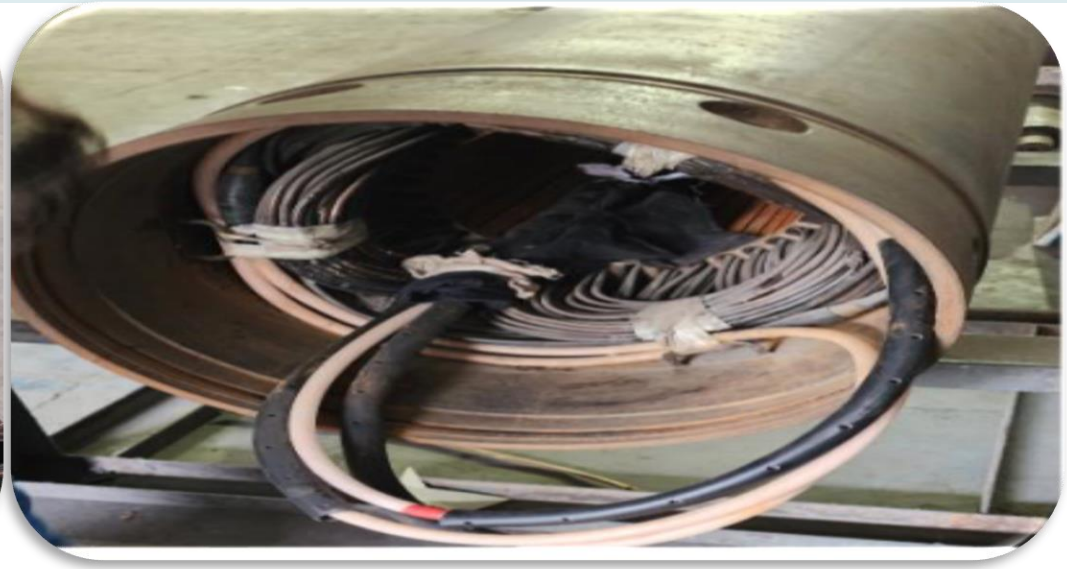
Energy Saving projects 2021-22

Sr. No	Energy saving Projects	Investments (INR Million)	Electrical Saving (Million kWh)	Thermal saving (Million kcal)	Saving (INR Million)
1	**Annual Electrical energy saving in FY 21-22 under various heads.**	**69.5**	**13.79**	**21714**	**22.48**
2	Draft power reduction due to air sealing in various 6 numbers Units.	8.00	2.25	14,000	13.28
3	VFD installation in stage-2 RC feeders and feeder motors replaced , R&M of feeders.	6.10	0.34	-	0.55
4	old motor of stage- 1, 2 replaced with new high efficiency IE3 motor.	8.70	1.70	-	2.77
5	Cartridge replaced due to poor performance of BFP-3 numbers.	8.20	0.21	-	3.32
6	Stage-IV Common CT: Old blade replaced with Aero foil type blade.	30.00	0.17	7,714	5.13
7	Old Fans replaced with Energy Efficient Fans (EESL) in Township.	2.50	0.06	-	0.10

Innovative project - Onsite revival of BCW stator

- **Onsite revival of Hayward Tyler make BCW stator**
- Root cause analysis of scraped BCW stator capsule done with history and trend which was recommended for rewinding by OEM
- Using the Findings and further detailed analysis after partial dismantling of Stator cause of low IR identified.
- Scraped BCW motor stator capsule has been revived after special jointing of new terminal mouldings
- Finally same stator tested with water submersed condition for 48hrs as per OEM standard practice and found healthy as good as new stator.

- Cost saving approximately 1.5 Cr.



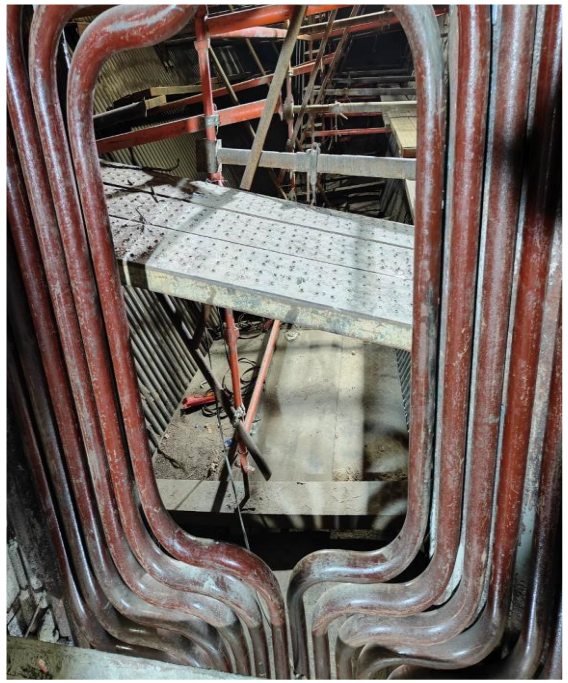
Healthy Stator capsule

Innovative project :Manhole with doors , Stage-1

Manhole with doors on Both side at 8.5 Mt of Boiler , Stage-1

Improved Safety and Reduction in Overhauling timing by 2 days

Before Cutting of Waterwall Tubes for manhole Bends Fit up & Welding



Manhole after Bends Fit Up & Welding

Door Before Application of Plastic refractory

Door after application of Plastic Refractory from Inside Furnace

Door from Outside Furnace

Innovative project -OIL RECOVERY FROM HFO SLUDGE

TANK-3 WASTE OIL PARAMETERS-				
QTY	VISCOSITY	GCV	STATUS	
1677KL	2500	6100	TANK ABANDONED	OIL UNUSABLE

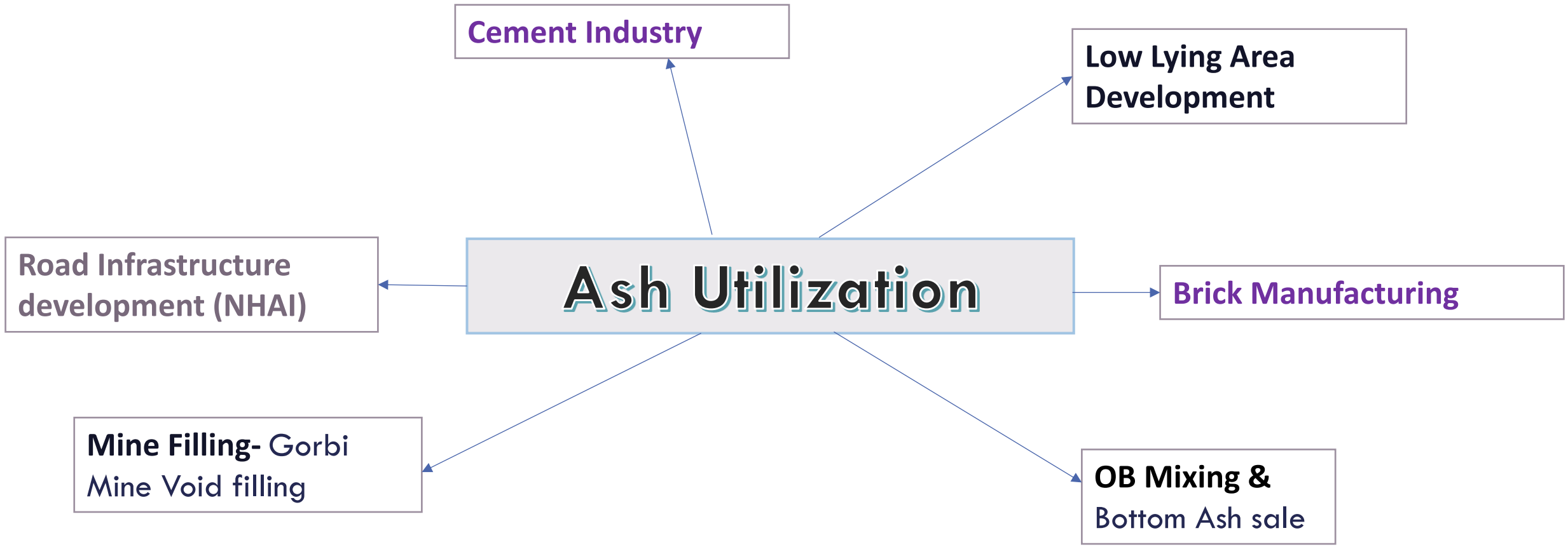
TANK-3 RECOVERED OIL PARAMETERS-				
QTY	VISCOSITY	GCV	STATUS	
1600KL	200	10200	TANK USABLE NOW	OIL ALREADY BEING USED

BENEFITS-		
MONETARY GAIN	800 LACS , ASSET REVOVERY	
OPERATIONAL	INSTEAD OF PRESENT 03 HFO TANKS, 04 TANKS CAN BE USED	
ENVIRONMENT	STORAGE OF WASTE OIL WAS THREAT TO ENVIRONMENT. CLEANING AND REUSE AVOIDED ENVIRONMENT HAZARD.	

Utilisation of Renewable Energy sources

Year	Technology	Type of Energy	Onsite/Offsite	Installed Capacity(MW)	Generation (Million kWh)	% of energy used in consumption
2021-22	Mono silicone crystallite Cell.	Solar Power (Commercial)	On-Site	15	20.065	5.02
2022-23				15	20.870	5.01
2023-24				15	20.536	5.30
Year	**Technology**	**Type of Energy**	**Onsite/Offsite**	**Installed Capacity(MW)**	**Generation (Million kWh)**	**% of energy used in consumption**
2021-22	Mono silicone crystallite Cell.	Solar Power (Roof top Solar)	On-Site	0.569	0.53	100
2022-23				0.569	0.58	100
2023-24				0.569	0.55	100
Year	**Technology**	**Type of Energy**	**Onsite/Offsite**	**Installed Capacity(MW)**	**Generation (Million kWh)**	**% of energy used in consumption**
2021-22	Kaplan-S turbine. Small hydro plant on canal.	Hydro Power	On-Site	8.00	22.89	4.85
2022-23				8.00	32.40	4.60
2023-24				8.00	38.32	4.42

Ash Utilisation Roadmap



NTPC Vindhyachal has developed a comprehensive 100 % ash utilisation plan by 2027 as per GoI guideline

5-year AU Plan & Current Status to achieve 80% in 2024-25

NTPC vindhyachal - 5-year AU Plan					
Description	**2022-23**	**2023-24**	**2024-25**	**2025-26**	**2026-27**
Ash Generation (LMT)	76.63	66.83	**68**(23.5)	70	70
LLAD	10.08	10.63	**17**(0.28)	15	10
Road	10.33	9.86	**15**(5.46)	15	10
Brick	3.13	2.81	**1.0** (0.20)	6	8
Gorbi / Mine	4.62	13.82	**21**(3.30)	40	50
OB mixing*	0	0.25	**0.5**(0.00)	15	20
Cement	0.41	0.23	**0.5**(0.00)	10	15
Bottom Ash Sale	0	0	**0**(0.00)	8	10
Ash Utilization Target (LMT)#	28.59	37.57	**55**(9.23)	109	123
Ash utilization Target (%)	**40%**	**80%**	**80%**(40.0%)	**156%**	**176%**
Ash utilization Achieved (%)	**37.31%**	**56.22%**	**40.0%**		

Note :-

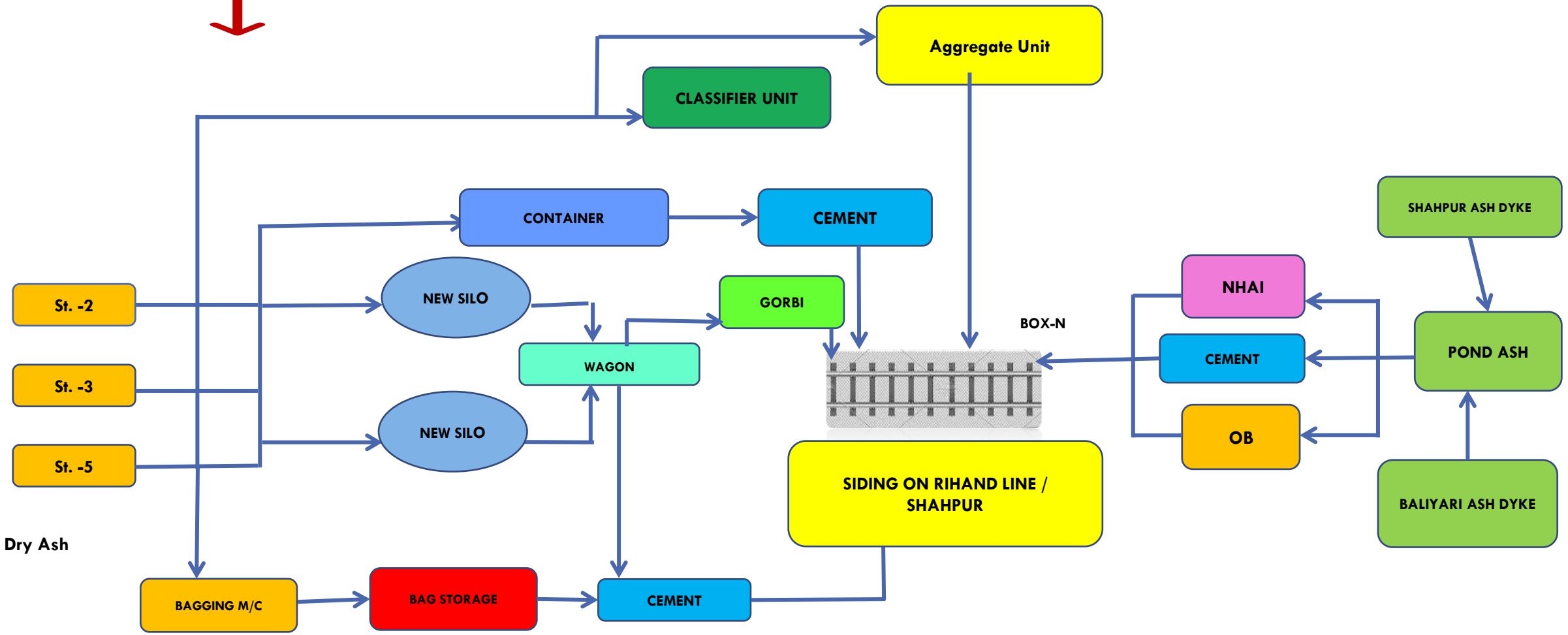
* OB mixing is under trial by M/s NCL under guidance of M/s CIMFER, Target achievements subjected to successful trials.

Actual ash Utilization achieved for the FY 2022-23 & 2023-24 are mentioned in brackets.

Ash generation is reduced in FY 2023-24 due to superior coal quality received by VSTPS, it is likely to remain the same for the upcoming FY.

Environment Management - Ash Utilization

Infra development for 100% Ash Utilisation



Environment Management - Emission

Particulars	Unit	2021-22	2022-23	2023-24
Total CO2 Emissions Per KW of Generation	Ton/Kw	6.706	6.958	6.900
Current SOx Emissions at Full Load	mg/Nm^3	935	925	631 (125 in FGD units)
Current NOx Emissions at Full Load	mg/Nm^3	450	300	300
Particulate Matter	mg/Nm^3	44.55	44.54	43.9

Action Plan

1. FGD installation in progress in all 13 units. Functional in 2 units. Dec'26 target.
2. Low NOx burner installed in all 500 MW units.
3. SOFA dampers installed in all 500 MW units.
4. ESP additional pass addition completed in stage-1* and stage-2 units.
5. Station ZLD compliance and Rainwater harvesting system has been commissioned

Major Improvement initiatives :

2023-24

- Conocorpus tree plantation in ash dyke areas
- Cotton bag distribution to discourage polythene bag use
- Mass tree plantation on ash fill areas
- Follow-up Flora-Fauna study in GORBI.
- Deployment of truck-mounted fog cannon in Ash dyke area.
- Ash Dyke stability study.
- Bio-diversity mapping study
- Vetiver grass plantation for slope protection in ash fill areas
- Miyawaki plantation
- DAES installation in Stg 1.
- Township Rainwater harvesting
- Stg 1 Track Hopper DE system installation
- DFDS installation in Stg 1,2,3 CHP
- Integrated Water Dashboard.

2024-25

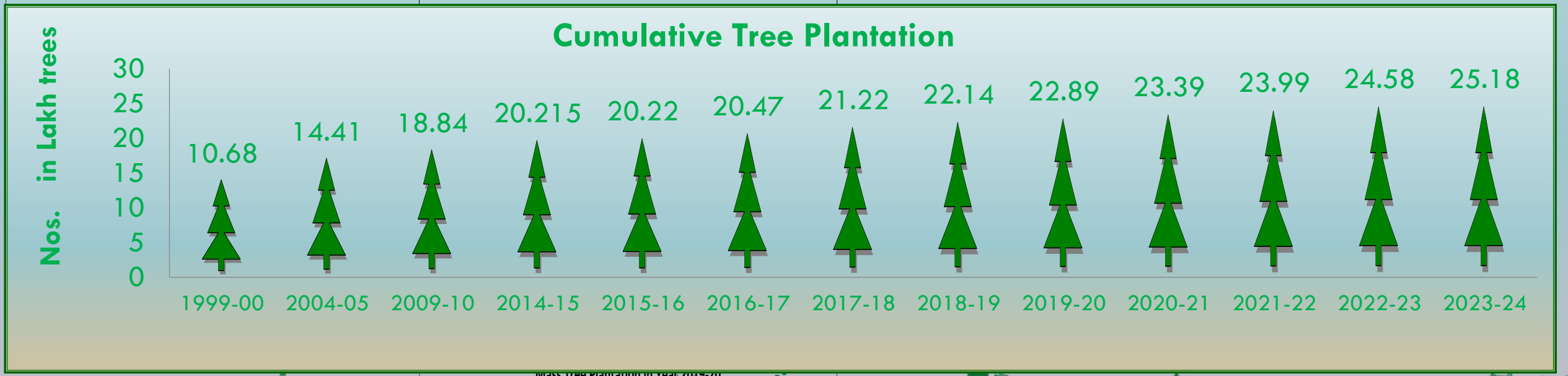
- Switch to low-sulfur LDO
- Physical structure erection around SILO area to contain fugitive emission
- Unit 7,8,9,10,11, FGD commissioning
- Stage-1 all units Flue gas NOx to be reduced below CPCB limits
- *Completion of ESP R&M in Unit 4
- FGD Commissioning U12 completed.

2025-26

- Water Treatment plant for GORBI overflow
- Unit 1,2,3,4,5,6 FGD commissioning.
- 100% utilization of CCUS methanol.

Efforts at Green Cover Enhancement

- MoU with MP Rajya Van Vikas Nigam for 05 lakhs tree plantation in MP.
- More than 60,000 tree plantation in 2023-24.
- 1 Lakh trees plantation done in FY 24-25.



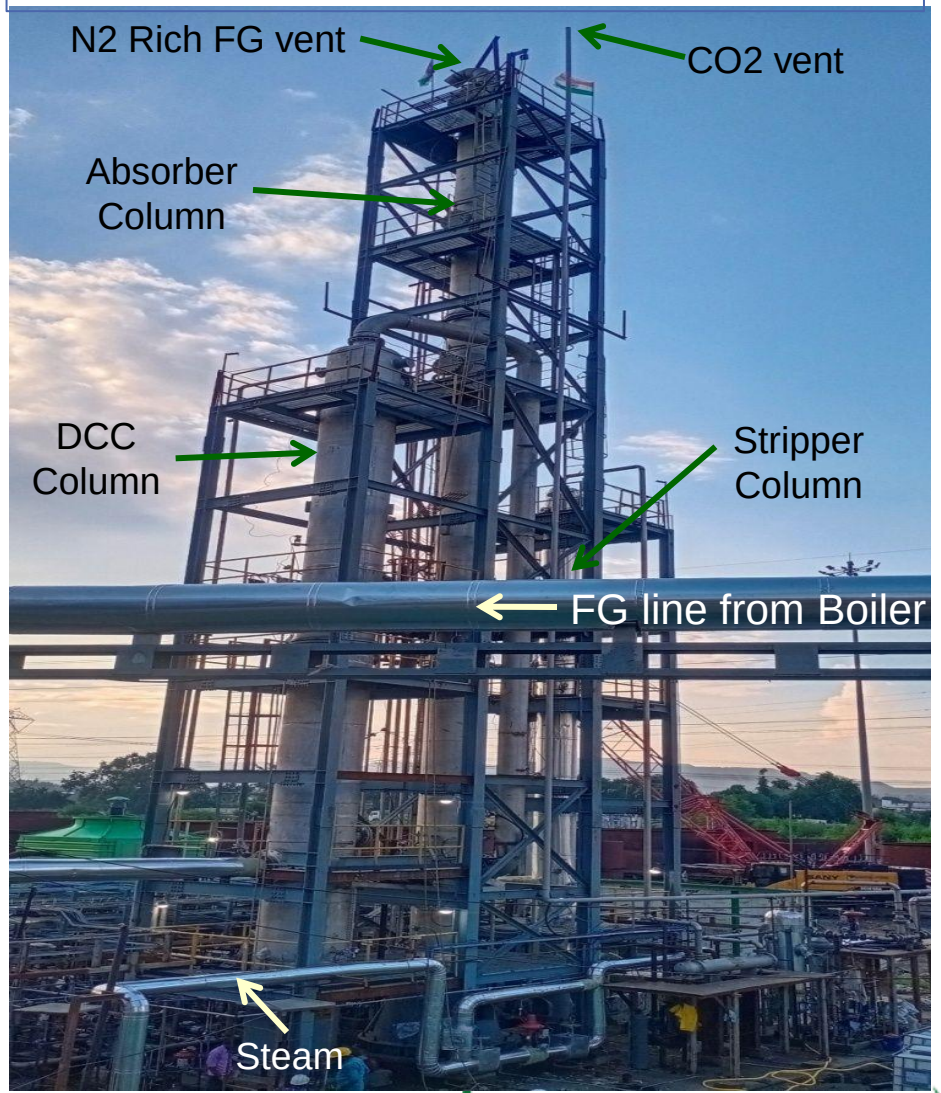
Mass Tree Plantation in Year 2019-20

Environment Compliance :

SPM	SO_X & NO_X	CO2 to Methanol	ZLD	Monitoring
ESP R&M in Unit # 1,2,3,5,6,7&8 completed. R&M completion of Unit#4 by Oct'24	In U-12,13 FGD is operational for other stages FGD project in full swing. De NOx SOFA for all units completed in unit 9 to 13. Combustion tuning in U#1 to 8	10 TPD CO2 TO Methanol Pilot project of NTPC . Flue gas captured from U#13 .	ZLD System commissioned in all stages. AWRS functional in all dykes. Toe drain R/C available in Biliary dyke. 100 % recycling from ETPs and STP.	Online continuous monitoring system available for Flue Gas Emission, Effluent water and Ambient Air Quality.

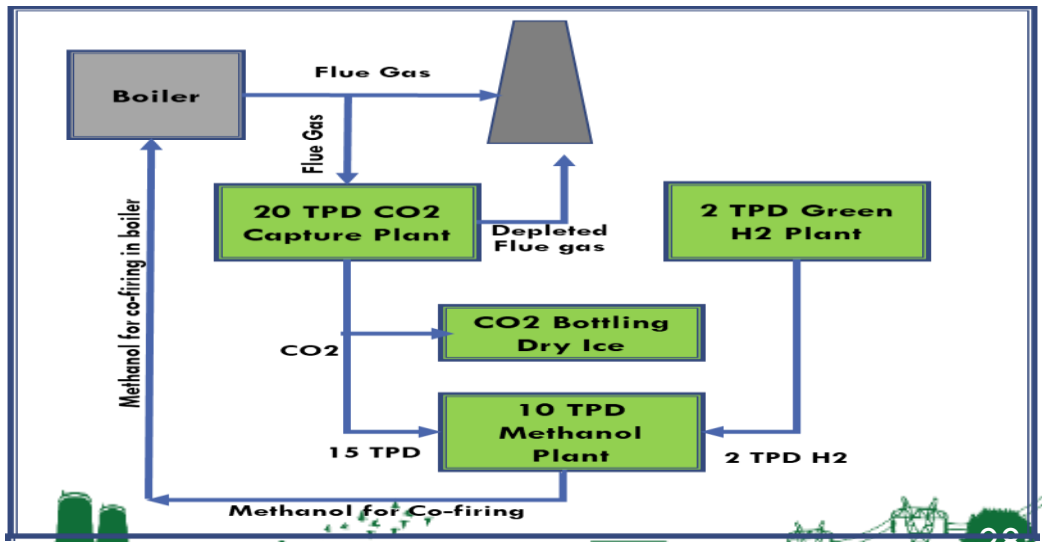
CCUS: 10 TPD CO2 to Methanol (CTM)

20 TPD CO2 Capture Plant



20 TPD CO2 Capture Plant	2 TPD PEM H2 Electrolyser	10 TPD Methanol synthesis
Commissioned	Commissioned	Commissioning By Oct'24

- ✓ Reduction in CO2 emission by 6570 TPA.
- ✓ India's first Pilot project of its kind.



Environment Management - Water

DM water Consumption of Plant			
Unit	2021-22	2022-23	2023-24
%	0.53	0.55	0.56

Raw water Consumption of Plant			
Unit	2021-22	2022-23	2023-24
m3/MWH	2.86	3.00	3.05
m3/MW	22,373	24,566	25,095

Vindhyachal plant has been declared as Zero Liquid Discharge station.

Best Practices in Water Management :

- COC maintained on higher side up to 7 to reduce blow down water.
- Reducing plant overflow to zero via ZLD scheme.
- 100% Ash water recirculation pump house utilization. Tow drain pump house in all ash dykes.
- Rainwater harvesting is done inside plant and township. Three huge reservoir of total 2,40,000 Cubic meter capacity were prepared and connected to plant ZLD schemes via pipelines for rainwater harvesting system.
- Construction of new STP with 6MLD capacity completed for use in horticulture, gardening of public buildings.
- Proper metering at each consumption location helped us to identify wastage and reduction in water consumption.

Best Practices at Vindhyachal :

Flexibilization :

- Pilot project has been started for stable operation at 40% of MCR capacity as per CEA guidelines.
- At present our units can operate at 55 % load without oil support.
- All units have 1% ramping capability and trials are in progress for 2% ramping capability.

Technology Advancement:

- Vindhyachal is lead station of NTPC to experiment and absorb any new technology. 1st Wet FGD system was installed at Vindhyachal unit-13.
- Most recent project is Green technology project CTM (Carbon to methanol) with an investment of approx. Rs 122 Cr. Carbon capture to methanol conversion is unique project of India, first for any power plant.
  - 20 Ton per day CO2 capture plant has been commissioned.
  - 2 Ton per day green hydrogen generation plant has been commissioned.
  - Using captured CO2 and Hydrogen generated, 10 ton per day Methanol will be generated.
  - Methanol conversion plant will be commissioned under progress.
  - Methanol will be substitute of Coal and LDO for firing in boilers. This will help in reducing green house emission.

Best Practices at Vindhyachal :

Maintenance and reliability:

- Every year Station completes Major Overhauling of 7 units (Out of 13) and 5 to 7 days mini-Overhaul of 2 to 3 units depend on condition assessment to increase reliability and Improve heat rate.
- Station has achieved best historical Forced outage, Boiler tube failures, Partial loss.
- Vindhyachal was best station in NTPC with minimum forced outage and equipment partial loss.
- Heat rate achieved in FY 22-23 was best in history of Vindhyachal even though stage-1 units (6 numbers) are 35 years old and stage-2 units (2 unit) are 25 years old.
- Quality of Overhaul is daily monitored not only by station management but also by corporate offices.
- All overhauling's are completed within stipulated time frame.
- 100% SAP monitored reliability centered maintenance practices are used.

Digitization:

- Station is completely paperless. PRADIP (Pro - Active and Digital Initiatives to become Paperless) has been implemented
- All communication, reporting, Note sheets, Payments, Data recording, Contracts are handled in digital mode only.

Asset Management:

- Station has set target-based inventory management.
- Status of assets are closely monitored by management.
- Stores department has started using RFID and Bar code ID for each material available.
- GPS Monitoring of dozers heavy vehicles etc.

Best Practices at Vindhyachal :

Biodiversity:

- Bio-diversity mapping study was done. It is being done on regular interval as per requirement.
- Vindhyachal is biodiversity rich Rihand reservoir area and efforts are taken by station for preserving it.

Afforestation:

- 80,000 plantations through MP forest department annually. More than 60,000 tree plantation in 2023-24
- Miyawaki plantation, Conocorpus tree plantation in ash dyke areas are some of practices started recently.
- 25 Lakh tree plantation has been done by station till date.
- Green coverage in and around Vindhyachal station is significantly higher.

New Initiatives:

- **Automation: Mill scheduler** in house developed to minimize human intervention and improve automation. Various in-house tools for data analysis and performance monitoring.
- **Infrastructure : Railway siding and tracks** are being created for 100% Ash, Gypsum transportation goal.
- **Drones** : are used for Coal yard survey, Ash dyke and pipelines survey . Robotic inspection of ash dyke wells using under water drone etc.
- **Renovation and Modernisation : To remove** Obsolescence particularly in stage-1 and 2 units. Stage-1 Turbine R&M planned will met all CERC requirement and improve heat rate.
- **Unified control rooms: To optimise** manpower and knowledge sharing

Teamwork, Employee Involvement & Monitoring :

Daily monitoring system : Online live monitoring of all parameters. Results are monitored in daily planning meeting.

- Pi system for online data and efficiency parameters monitoring.
- APC guidance software. Condenser performance monitoring .

Review meeting chaired by:

- Daily meeting by head of O&M.
- Monthly Regional ED review.
- Weekly HOP Review.
- Quarterly review by Director operations.

Separate budget for Energy Conservation : EC budget Allottment each year approx Rs 3 to 5 Cr.

Energy efficiency / awareness training program: EC week is celebrated every year not only within station but also with local communities. Industry and Retired experts take various awareness and learning program each month.

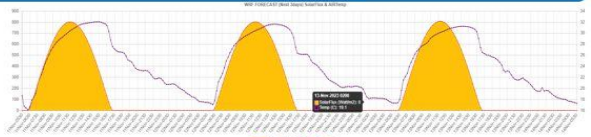
Projects implemented through Kaizens (Workers and Supervisor level) : Business excellence is theme of our all activities and projects. More than 30 innovative projects were implemented by workers in past two years Station has achieved various Quality circle awards for some of these projects.

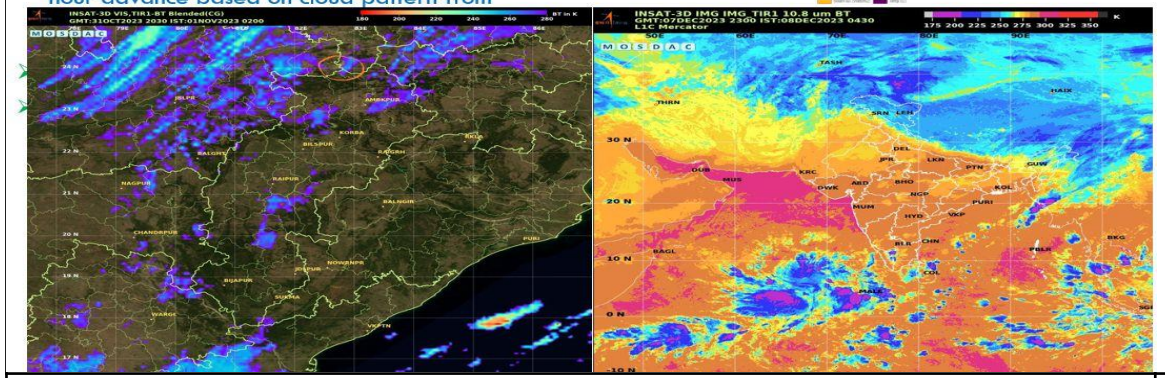
Major Areas of concern in terms of energy efficiency and reliability : Obsolescence and spares for stage-1 Russian units. Indian Vendors are being developed for that using station efforts.

Monitoring system – way to improvement :

Energy analytics tools for Solar Generation prediction:

- Use of ISRO-MOSDAC data for Solar DC declaration.
- Accurate prediction of Solar generation in one hour advance based on cloud pattern from





APC Guidance Software

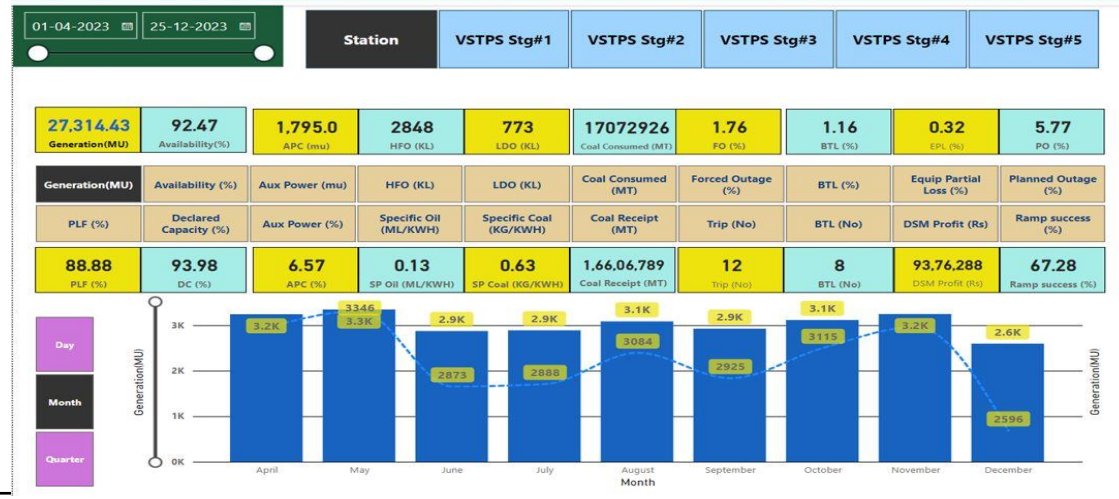
EEMG — **OPERATOR GUIDENCE PARAMETER FOR APC OPTIMIZATION**

200 MW	LOAD (MW)	Mill Power Actual (KW)	Predicted (KW)	Draft Power Actual (KW)	Predicted (KW)	BFP Power Actual (KW)	Predicted (KW)	APC (%)	Saving In Rs
Unit-1	211.7	1397.3	1257.1	5837.3	5760.3	6200.8	6307.3	9.3	-159
Unit-2	223.3	1455.5	1159.6	5871.9	6161.6	5649.8	5356.2	8.5	-432
Unit-3	186.2	1185.2	1104.8	5107.3	5661.1	5128.3	5400.4	9.6	1073
Unit-4	218.9	1378.0	1318.4	5922.7	5851.2	5667.4	5469.8	8.5	-473
Unit-5	208.0	1072.9	1169.4	5778.3	5961.0	5379.2	5302.6	8.5	292
Unit-6	217.3	1305.5	1107.6	6078.2	6295.3	6028.2	5446.4	9.5	-810

Online Condenser Monitoring Sheet

		Load	Cond Press (mmhg)	CW inlet	CW outlet	CW rise	Saturated temp correspon ding to pr	TTD	Expected Back Pressure	Expected Back Pressure	BP due to CW flow & CW inlet Temp	kcal loss due to temp	kcal loss to CW flow	kcal loss due to Choking/a ir ingress	Total condenser loss due to
Stage 1	Design	210	67	30.0	38.4	8.4	43.2	5.9							
	unit 1	208	64.20	29.4	40.6	11.21	42.8	2.24	64.2	67.1	77.5	-4	-8.5	8.3	-1.97
	unit 2	211	48.65	29.1	40.4	11.27	37.6	-2.82	48.7	66.4	77.0	-5	12.5	-33.5	-25.84
	unit 3	220	54.03	29.1	39.9	10.80	39.5	-0.38	54.0	66.3	75.0	-5	8.1	-19.4	-15.86
	unit 4	208	48.80	29.3	39.6	10.29	37.6	-1.97	48.8	67.0	73.9	-4	8.5	-31.3	-26.69
	unit 5	197	53.31	29.3	38.7	9.42	39.3	0.56	53.3	67.0	70.6	-5	4.5	-21.7	-21.64
	unit 6	213	63.42	29.2	40.7	11.41	42.6	1.91	63.4	66.8	77.9	-4	-3.8	4.9	-3.08
Stage 2	Design	500	76	32.0	42.2	10.2	46.0	3.9							
	unit 7	508.6	62.45	30.5	40.5	10.01	42.3	1.74	62.4	70.6	69.9	-9.8	-1.3	-12.8	-23.9
	unit 8	494.8	85.42	30.8	43.7	12.94	48.4	4.67	85.4	71.5	82.2	-8.5	20.3	6.2	18.0
Stage 3	Design	500	77	33.0	43.2	10.2	46.4	3.1							
	Unit 9	502	83.73	30.9	42.9	11.95	48.0	5.13	83.7	69.1	75.6	-14.1	12.7	16.0	14.6
	Unit 10	504	79.02	30.9	42.1	11.18	46.8	4.73	79.0	69.1	72.7	-13.9	7.2	12.7	6.0
Stage 4	Design	500	77	33.0	43.2	10.2	46.4	3.1							
	Unit11	466	61.45	30.0	41.0	10.97	42.0	0.97	61.5	66.0	68.7	-21.8	5.7	-15.3	-31.4
	Unit12	450	65.83	30.3	40.1	9.86	43.3	3.15	65.8	66.8	65.7	-20.7	-3.3	0.5	-23.5
Satge 5	Design	500	77	32.5	43.2	10.7	46.4	3.1							
	Unit13	501	67.41	32.2	42.7	10.51	43.7	1.07	67.4	75.6	74.8	-2.3	-1.4	-14.2	-17.9

Advance dashboards for Plant performance monitoring



EMS System and other requirements

Existing energy monitoring system / IOT system:

- 100 % remote monitoring of all parameters is available.
- Vindhyachal has received CII award for APC guidance software.

Implementation of ISO certifications like ISO 50001/55001 certification etc :

- Vindhyachal is ISO 50,001 Certified station, certification valid till 28.03.2025.
- VSTPS received IMS Certificate for ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018, valid upto 5th July 2025.
- 5S certification received valid till 2025.

RLA of Boiler and turbine :

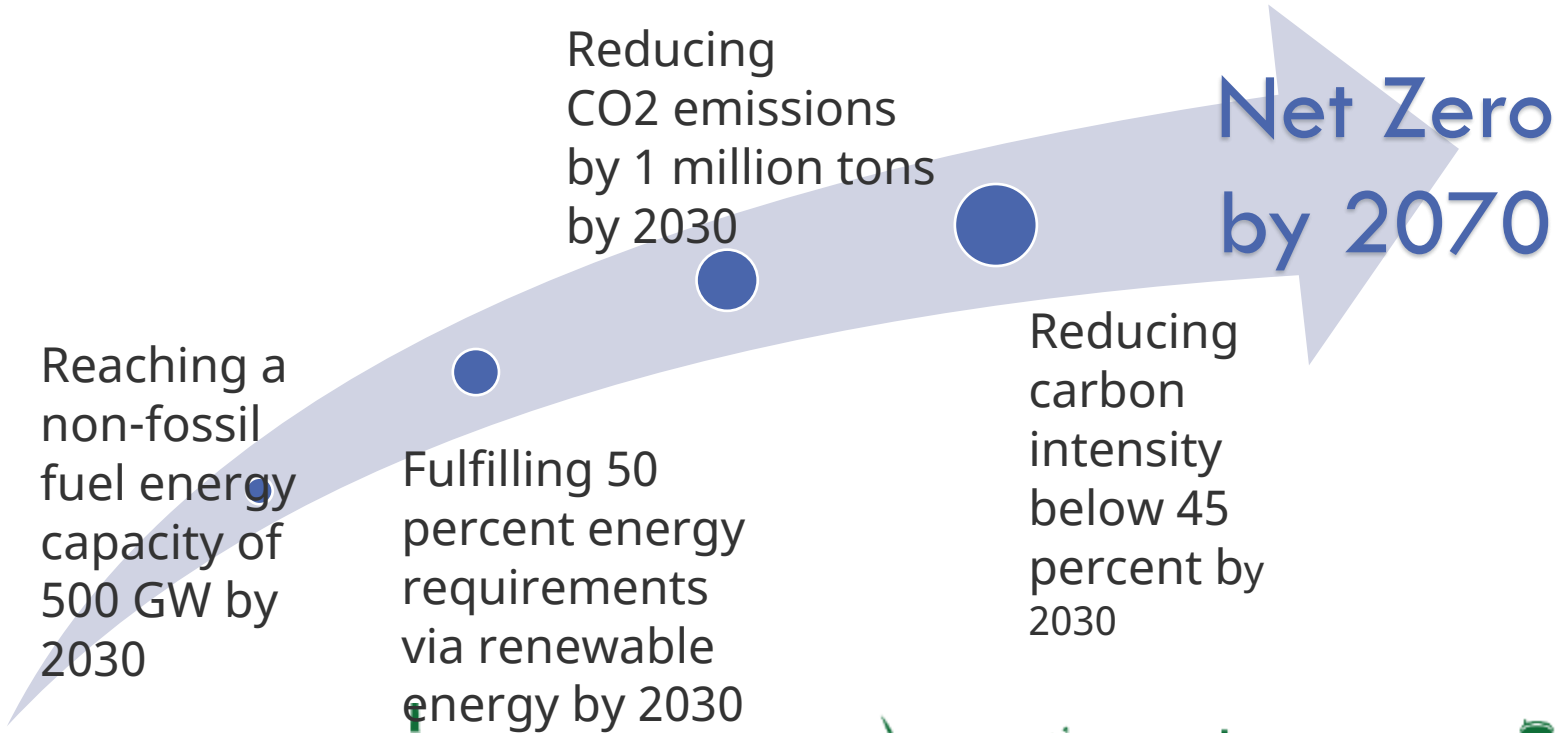
- RLA has been completed in all 6 units of stage-1(Boiler and turbine both).

Net Zero commitment : CCUS Project

Reducing carbon emission to 50% by 2050

Net-zero carbon emissions target by 2070

Net-zero Vindhyachal Township by 25-26 in Water, Energy, Waste.



Learning from CII Energy Award or other award Program

- Vindhyachal has participation in various award programs of CII. Like National award for excellence in energy management, water award, CII National Excellence Practice Competition - Customer engagement and satisfaction practices award etc.
- CII Awards always focus on deep understanding of system and encourage participants to have 360 deg look at their systems.

Major Achievements : Awards in FY 2023-24

1. "Champion and Overall excellence Award" for Business Excellence.
2. "O&M Productivity Swarn Shakti Award"
3. "Overall, Champion runner up Swarn Shakti award"
4. "Heat Rate runner up Trophy award" at IPS Conference.
5. "CII National Award for Excellence in Energy Management 2023" for excellent energy efficient unit at CII Energy summit 23-24.
6. CEE Energy efficient power plant of year award 2023.
7. International British safety council Award in the Distinction category for the year of 2023 on 12.03.2024.
8. "Greentech HR Award 2023" under Employee Engagement Category.
9 "Kalinga Environmental Excellence 5 Star" Award.
10. PRSI Awards in area of best communication compaign in external public and best R&D effort for promoting science and technology.
11. "Exceed environment award " in gold category .
12. Greentech CSR award for excellent work in Education field.
13. Team from Vindhyachal won "Asian Management Games 2023" jointly conducted by Macau Management Association and AIMA.

Thank You !!

Artefacts made of Gypsum – A Vindhyachal Exclusive

Presented by NTPC Vindhyachal-

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