Thermal Power Plant-Maihar Cement works (Ultratech cement-Aditya Birla Group)

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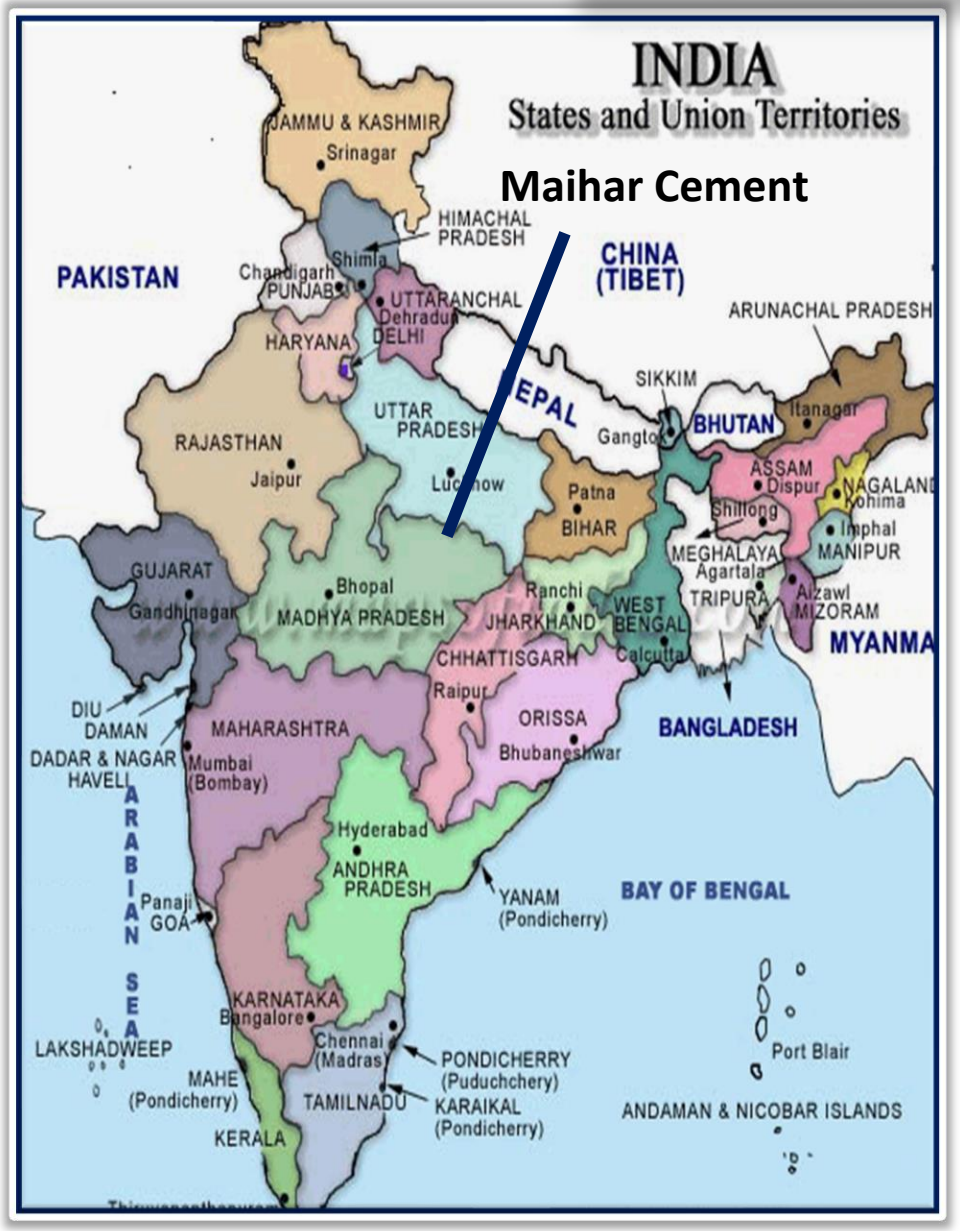
Welcome to CII

23nd National Award for Excellence in Energy Management 2022

About the Organisation



UltraTech Cement-Maihar Cement Works

- 2X15.7 MW Captive Power Plant with AFBC Boiler technology.
- Year of Commissioning- TPP-01 1996 and TPP-02 2006
- 3 MTPA capacity Cement plant & adapted integrated management system .
- ISO 50001,45001and 9001 certified & have framed energy management policy.
- Dedicated Energy conservation team.

About the Organisation

Boiler-2 Nos
Make-CVPL
Technology-2 Nos AFBC
Steam Flow-70 TP
Boiler outlet Pressure-60 kgf/cm2

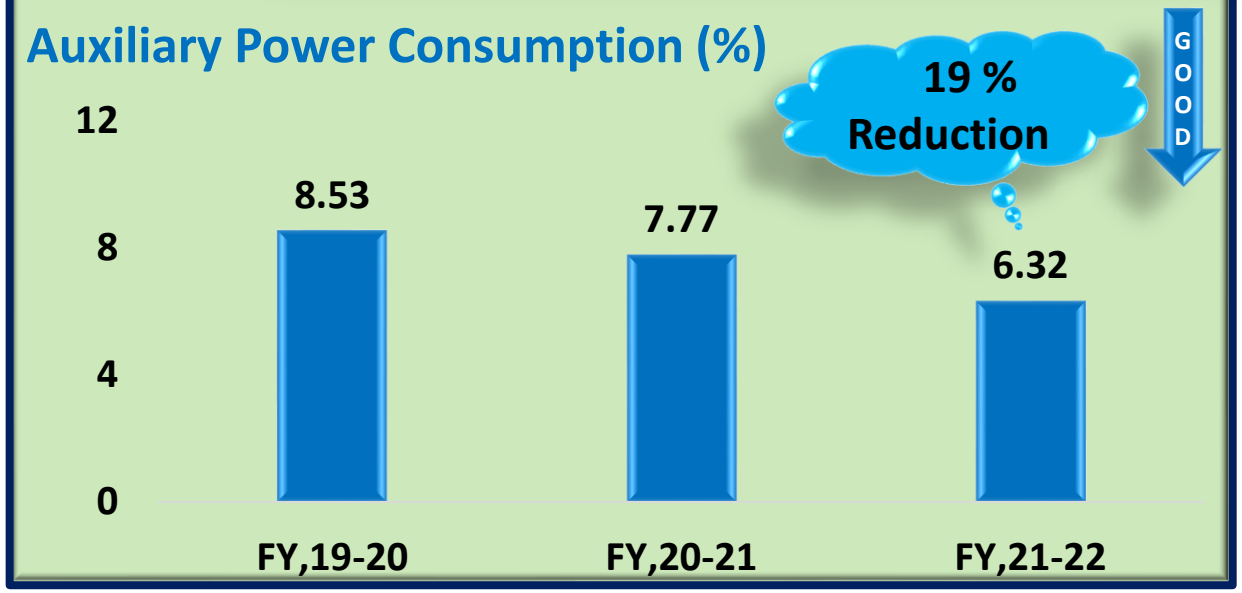
Turbine-2 Nos
Make- 1)BHEL 2)SHIN NIPPON
Technology-Condensate
Steam Flow-70 TPH
TG Inlet Temperature-505

Energy Consumption Overview

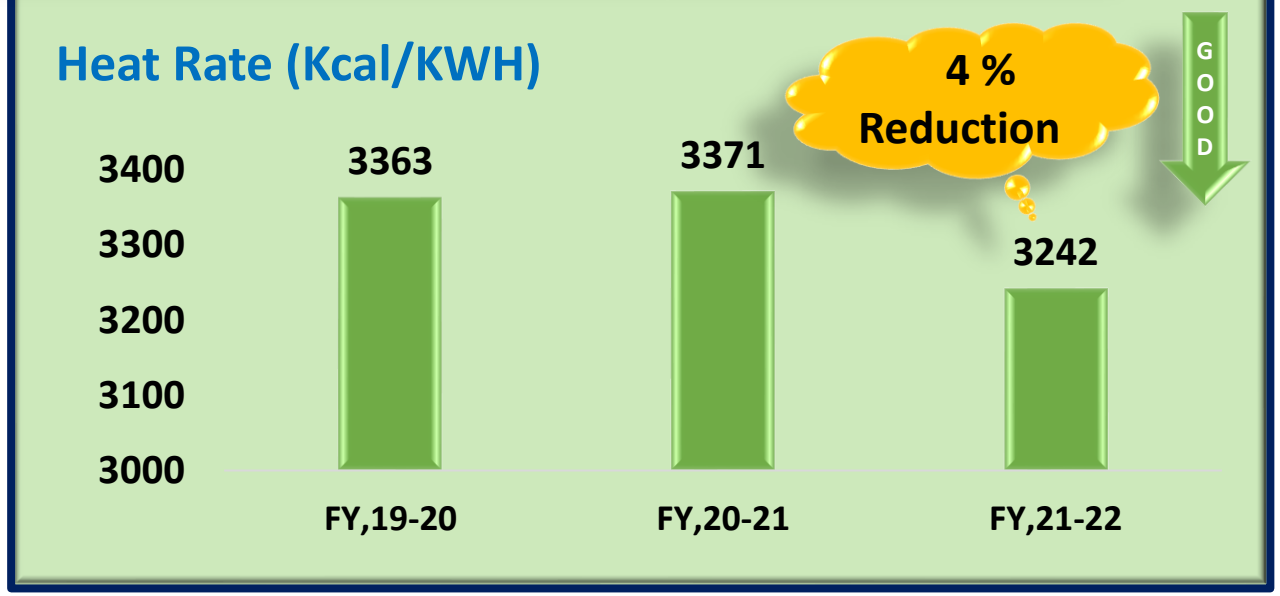
TPP Performance FY,21-22					
Sr No	Performance Parameter	UOM	TPP-1	TPP-2	Total
1	Generation	Lacs Kwh	1001.22	1157.71	2158.93
2	PLF	%	93.20	93.84	93.54
3	Auxiliary Power Cons		6.24	6.38	6.32
4	Plant Availability	%	96.31	98.32	97.18
5	Plant Heat Rate	Kcal/Kwh	3237	3248	3242
6	Boiler Efficiency	%	84.1	83.8	83.9
7	DM Water Consumption	Litre/Kwh	0.10	0.085	0.09
8	Raw Water Consumption	Litre/Kwh	0.57	0.48	0.52

Key Performance Indicators

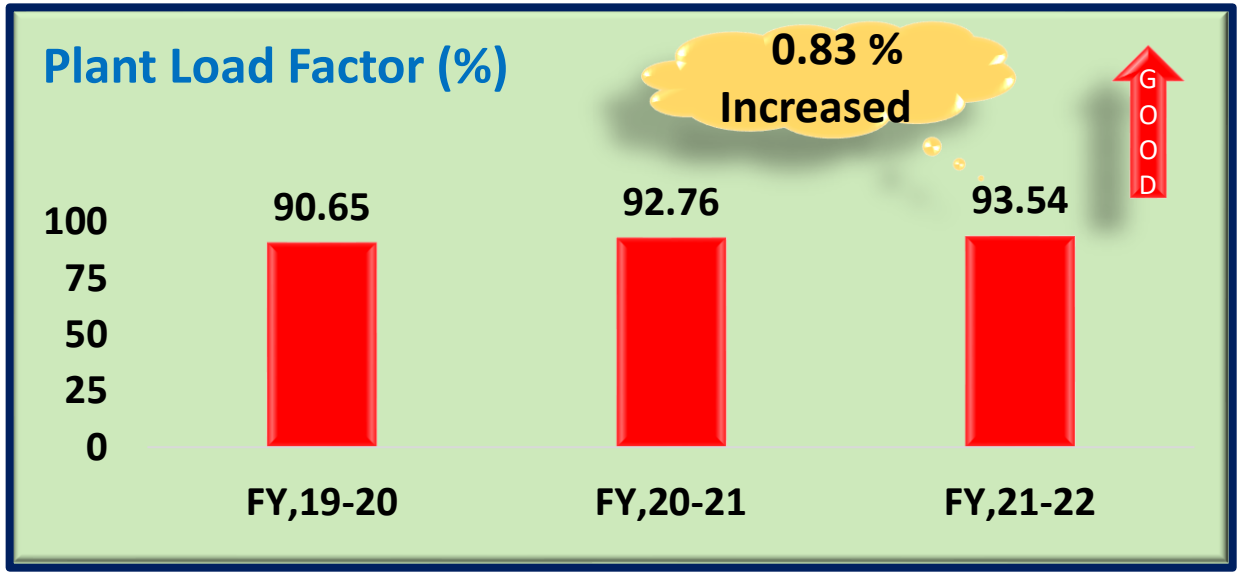
Auxiliary Power Consumption (%)



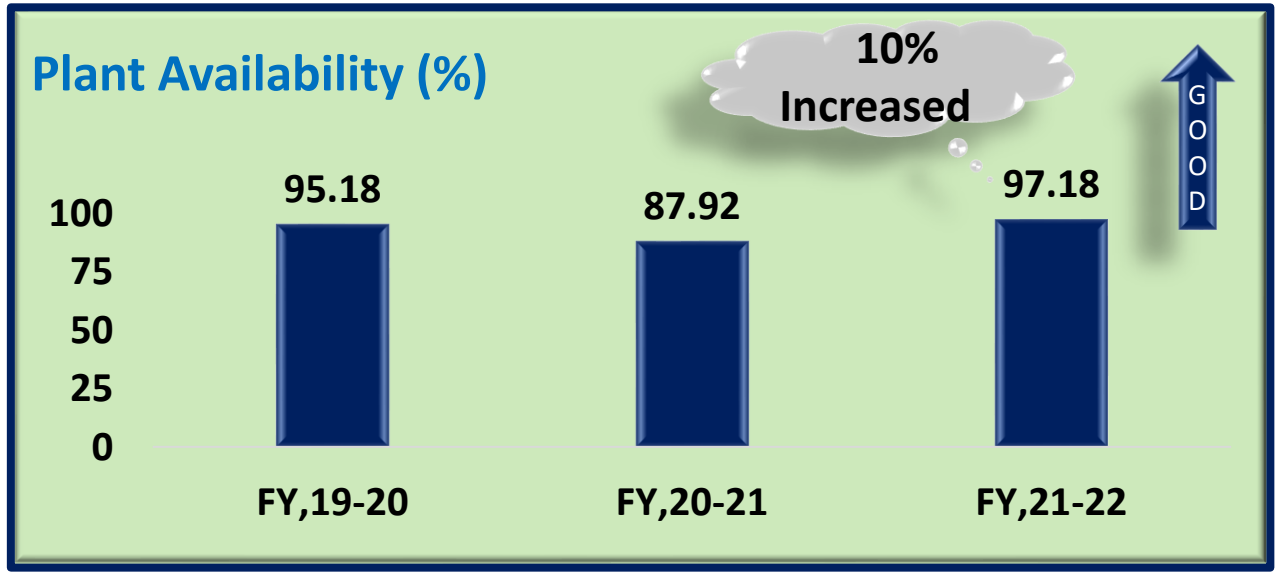
Heat Rate (Kcal/KWH)



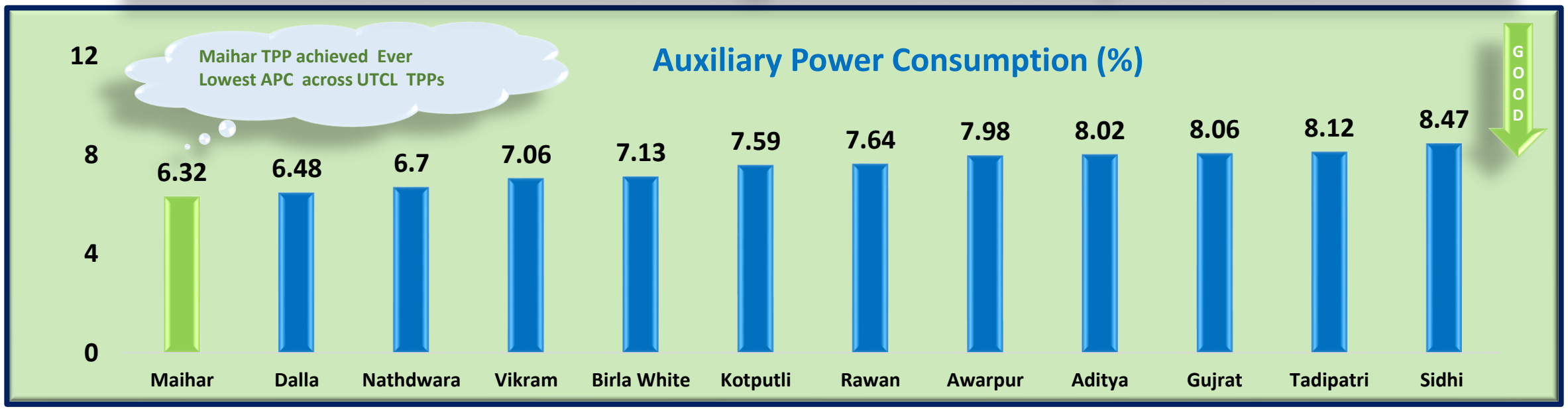
Plant Load Factor (%)

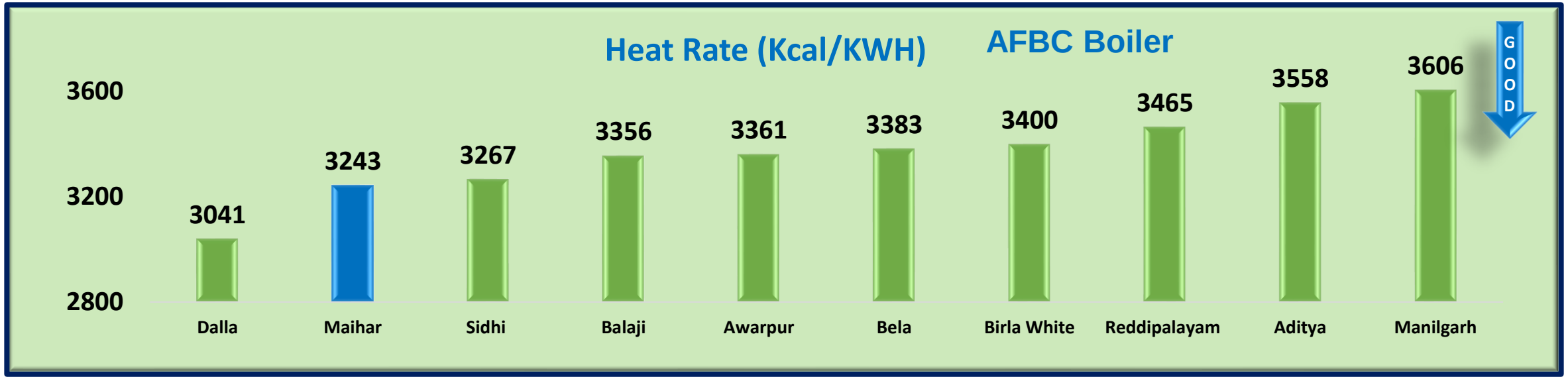


Plant Availability (%)

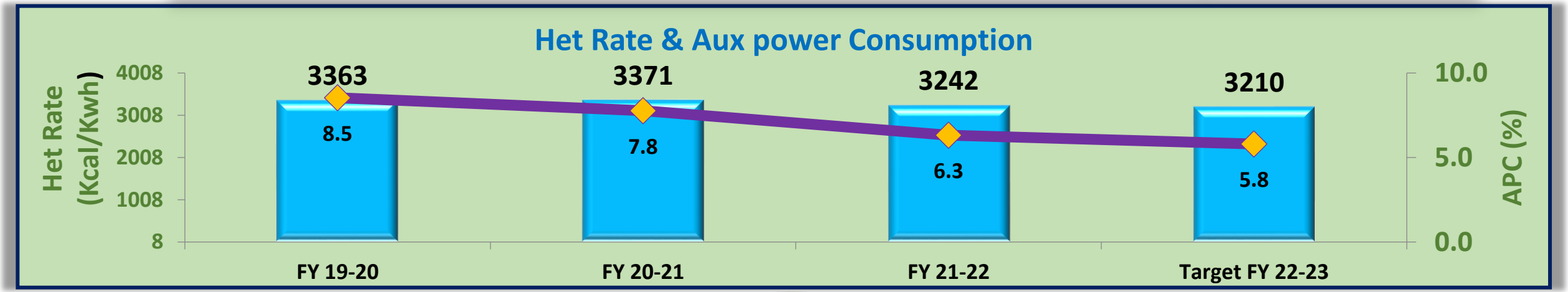


Benchmarking with Group Units





Heat Rate & APC Roadmap



FY,20

- Put PA fan in auto logic as per wind box air pressure
- Replacement of BFP ARC valve
- Arresting of air ingress & leakages in boiler.(false air) in Both Unit

FY,21

- Increase TG inlet steam temperature from 510°C to 515°C
- BFP-3 ARC replacement work
- Reduction in PNV system Power consumption by installation new fan and motor

FY,22

- Installation of WHRS
- Overhauling of TG-01
- Maintenance of cooling tower
- Installation of Energy efficient compressor
- Installation of Energy efficient ACP Pump
- Process optimization
- Installation of new exact space software

FY,23

Encon project in FY,23

- Installation of 10 MW capacity WHRS
- Installation of HAG for increase 2.0 MW load from WHRS
- Increase TPP capacity from 15.7 MW to 16.5 MW by TG and Generator overhauling

Energy Savings Projects Planned (2022-23)

SN	Energy Saving Projects	Saving Achieved			Investment (Rs. Million)	Pay back Year
		Electrical Energy (Million KWH)	Thermal Energy (Million Kcal/Year)	(Rs. Million)		
1	Replacement of New energy efficient FD fan with existing FD Fan	0.22	0	1.1	2.0	2.43
2	Replacement of New energy efficient Boiler Feed Pump with existing Boiler Feed Pump	0.25	0	1.4	5.0	2.1
3	Replacement of New energy efficient ACC Fan Blade with existing ACC Fan Blade	0.17	1338	3.5	4.8	2.0
4	Fanless Cooling Tower	0.6	0	0.2	5.0	2.0
5	VAM System for replacement of existing AC system	0.29	0	1.8	2.0	3.08

Energy Savings Projects Implemented

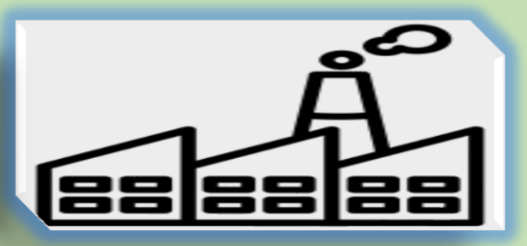
Year	No of Energy Saving Project	Investment (INR Million)	Electrical Energy (Million Kwh)	Thermal Energy (Million Kcal/Year)	Saving (INR Million)
FY 2019-20	7	0.8	1.12	5526	15.4
FY 2020-21	10	7.54	1.54	4432	12.07
FY 2021-22	27	1121	5.8	39373	76.18

Waste Heat Recovery Innovative Projects-1

Problem Statements

1. Preheater and cooler exhaust air account for more than 35.5% of that heat loss.

Waste heat



2. High raw water consumption, to cool the kiln exhaust flue gas before it is emitted into the atmosphere.

Waste Water

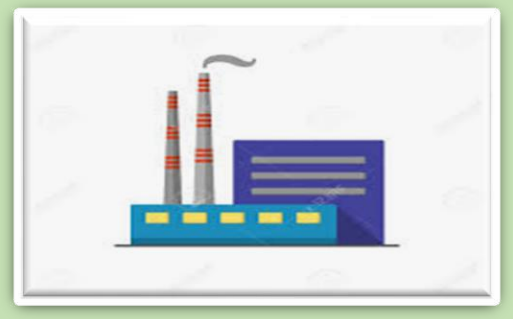
3. **High TPP power cost due to high fuel prices** (High Transportation cost- Location Constraint)

Fixed cost

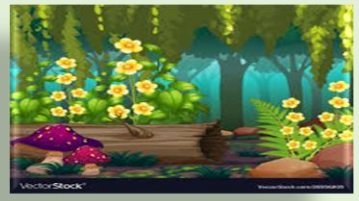
4. **Dependency on GRID-** High fixed cost.

GRID power

Waste Heat Recovery Innovative Projects-1

	Installed Two sets of PH boilers locates at Pre heater exhaust gas down comers and receives waste heat gases of 3, 12,500 MN3/Hr with 320 Deg. C.
	Installed One set of AQC boiler locates at clinker cooler mid tap out let and receives cooler vent gases of 1,45,833 MN3/Hr with 500 Deg.
	The Superheated Steam generated in the PH & AQC Boiler is used in the Steam Turbine Generator where in Power is generated 10 MW
	Saving by WHRS Generation-**Rs 4.74 Crore** Targeted Saving in FY,23-**35 Crore**

Innovative Projects-2



Theme-Interconnection Service air compressor for Both TPPs.

Problem

- ❖ High Power consumption of Service air compressor.
- ❖ Air flow for conveying the ash was higher than design.
- ❖ Conveying system was running on probe mode resulting higher running hours of compressor.

Solution

- ❖ Calculate actual air flow requirement for conveying ash system.
- ❖ Operate all conveying system through draft level sensor.
- ❖ Interconnect both TPPs service air line to operate both TPPs conveying system from single compressor.

Benefit

- ❖ Saving in Power Consumption-**33 Lacs Kwh/Annum**
- ❖ Saving in Cost-**Rs 17 Lacs/Annum**

Innovative Projects-3

Theme-Continuous Operation of Water Cooled Condenser.

Problem

- Turbine Vacuum was maintained-0.78 Kgf/cm2 .
- Higher steam consumption due to low vacuum.
- TPP was operate on less 1.5 MW from design capacity due to low vacuum.

Solution

- Open inspection done of Water cooled condenser there was higher coating inside the condenser tube cleaned by hydro jet system for better heat transfer.
- Low performance of cooling tower during operation of water cooled condenser so done overall maintenance of Cooling tower.

Benefit

- Saving in Power Consumption-**1.2 Lacs Kwh/Annum**
- Reduction in Plant Heat Rate by-**22 Kcal/Kwh**
- Saving in Cost-**Rs 60 Lacs/Annum**

Saving From Energy Projects Implemented

Total Investment in Encon Project

Rs 121 Crore

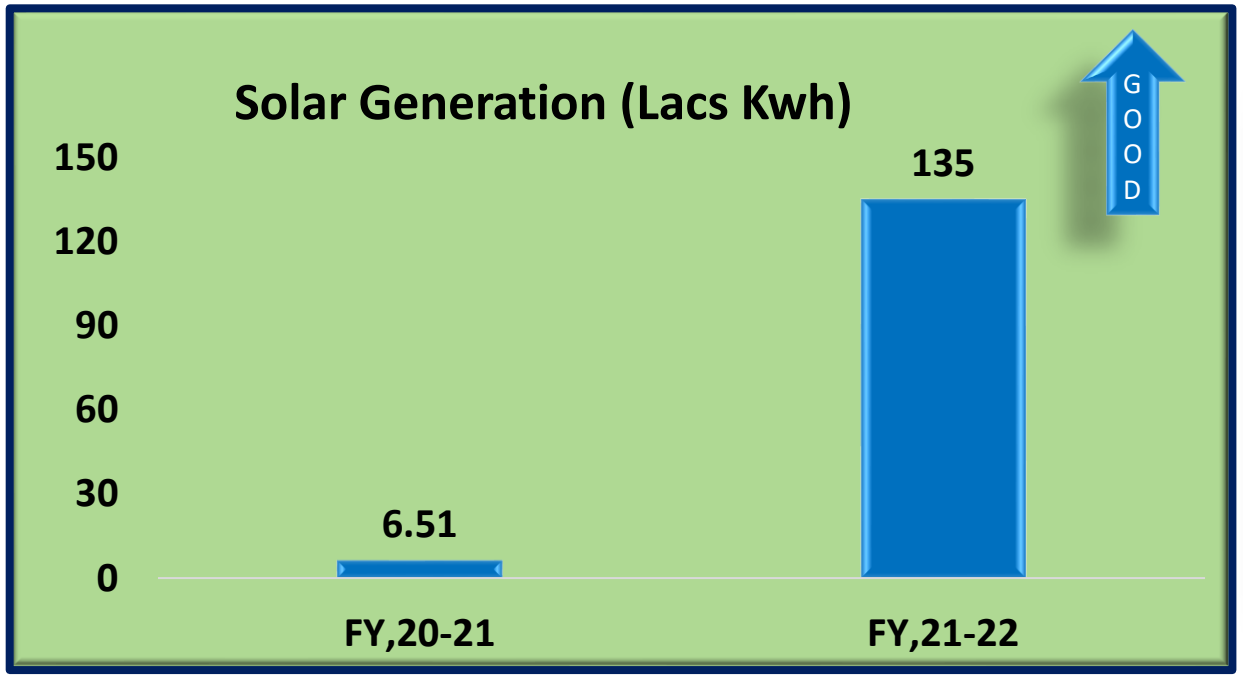
Total Saving in Encon Project

In FY,22-Rs 7.6 Crore

Targeted Saving in FY23- Rs 28 Crore

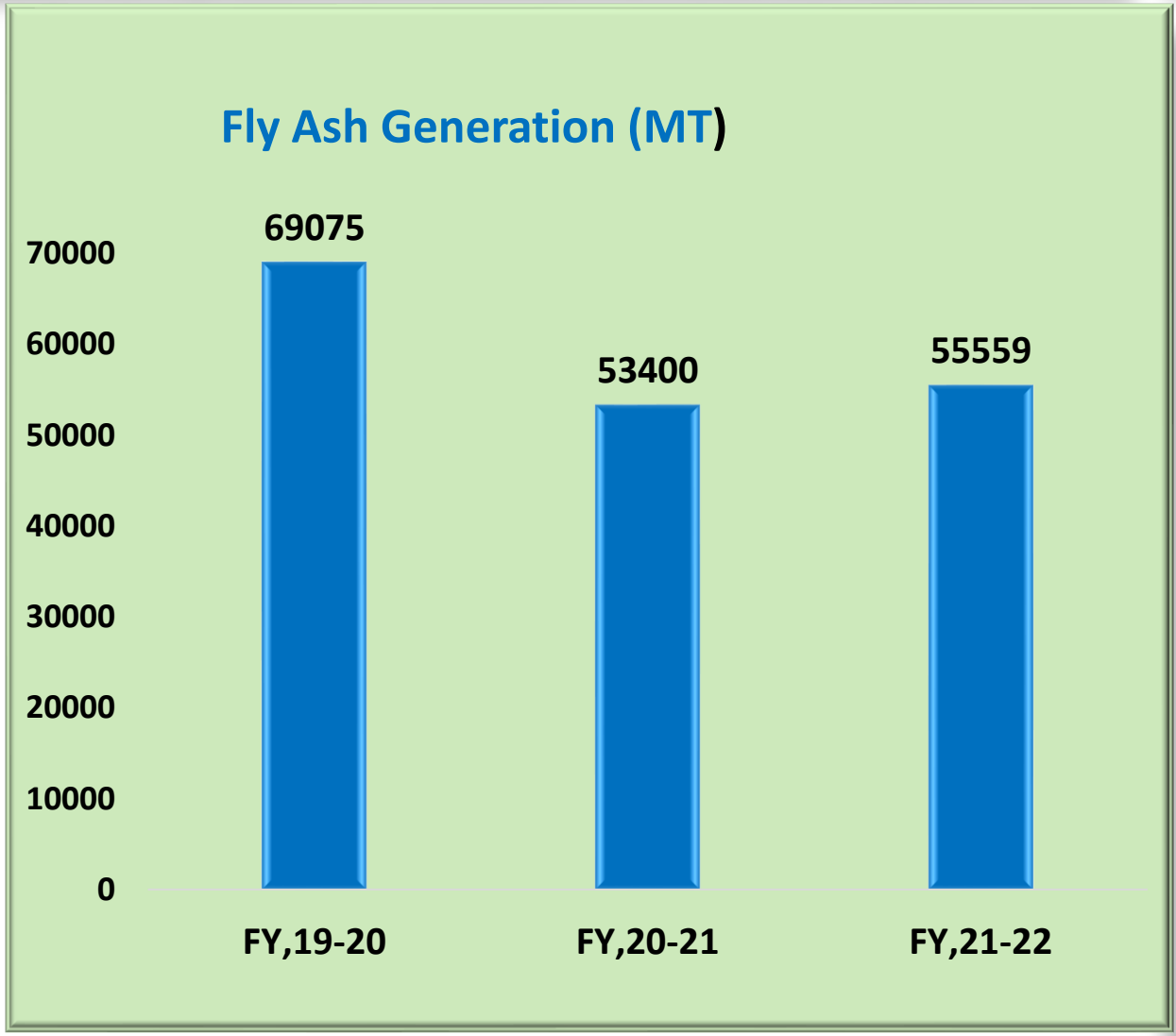
Utilization of renewable energy sources

Year	Technology (Electrical)	Type of Energy	Onsite/Offsite	Installed Capacity (MW)	Generation (Million kWh)	% of overall electrical energy
FY 2020-21	Solar-PV	Solar	Onsite	8.75 MW AC	0.651	0.24
FY 2021-22	Solar-PV	Solar	Onsite	8.75 MW AC	13.5	4.84

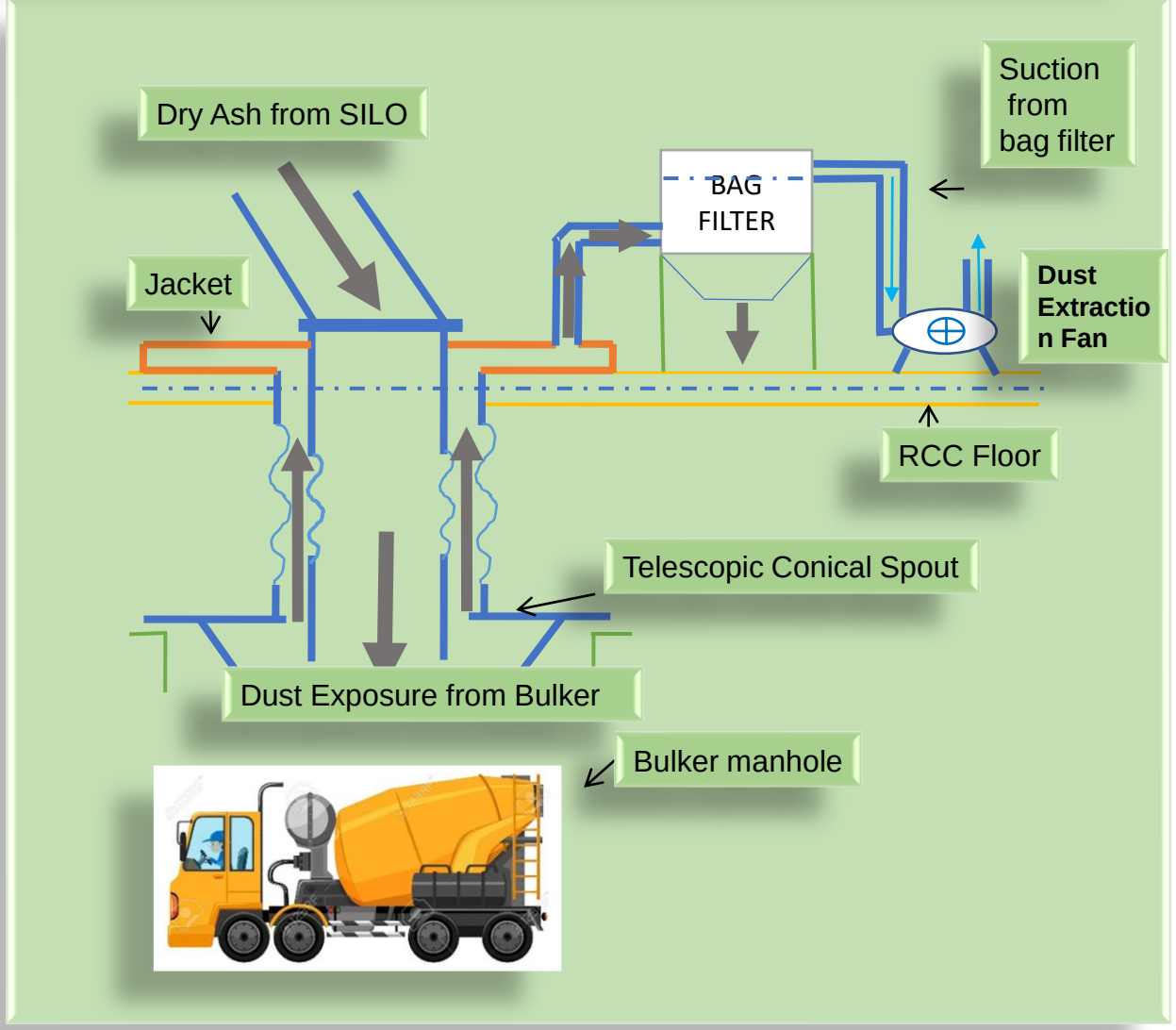


Fly Ash generation & Utilisation

100 % fly ash utilization in cement plant

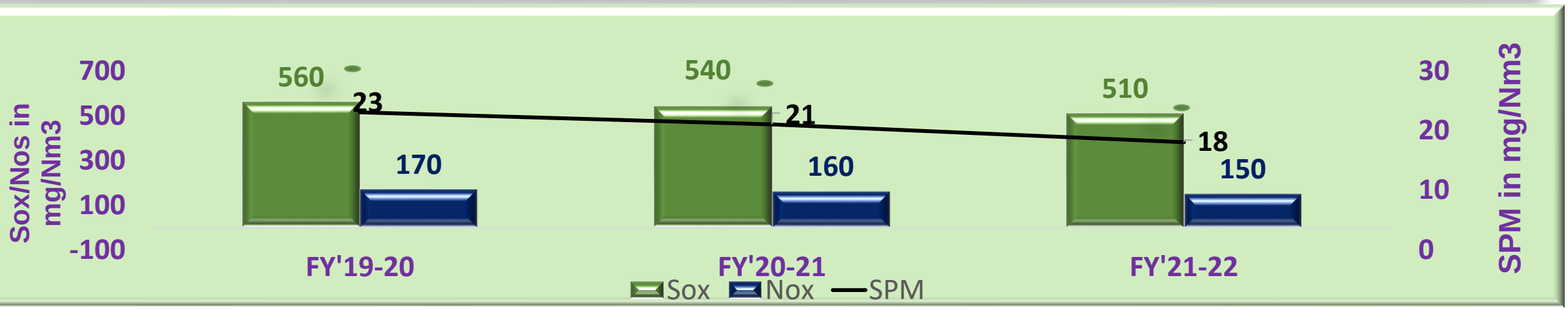


Ash unloading through Telescopies spout.



Environment Management- Emission

- Reduction in Coal consumption from energy saving, solar and WHRS generation in FY,22- **20433 MT**
- Reduction CO2 Emission in FY,22- **19260 MT**
- Reduction CO2 Emission in FY,22- **5 % (From FY,21)**
- Targeted Reduction CO2 Emission in FY,23-**56166 MT**
- Targeted Reduction CO2 Emission in FY,23-**18 % (From FY,22)**



Environment Management-Water

1. Dump system refurbishment done Saving in Raw water-**10230 KL/Year**
2. Reuse the boiler blow down water as cooling tower make up by storage in dedicated tank, Saving in Raw water-**1230 KL/Year.**
3. DMF backwash, backwash water was being collected in dedicated tank and again re use it , Saving in Raw water-**748 KL/Year.**
4. Earlier we are using raw water for bed ash quenching. Now construct a dedicated pit and collect Cooling tower blowdown water in it and this water used for bed ash quenching Saving in Raw water-**9352 KL/Year**.
5. **Total Raw water saving by taken various saving initives in FY,22-69086 KL**

Environment Management-Water

Parameters	UOM	2019-20	2020-21	2021-22
DM Water Consumption	%	9.40	9.35	8.82
Raw Water consumption	M3/Mwh	0.55	0.54	0.52

Fly Ash generation & Utilisation

Parameters	UOM	2019-20	2020-21	2021-22
Ash Generated	Tons	69095	53400	55549
Ash Utilization	%	100	100	100
Ash Utilized in manufacturing of cement/concrete –other similar products	%	100	100	100
Ash Utilized in Fly Ash Bricks	%	0	0	0
Ash Utilized in Mine filling	%	0	0	0
Ash Utilized for Roads pavements	%	0	0	0
Expenditure on Ash Utilization (annual)	INR (Lakhs)	0	0	0

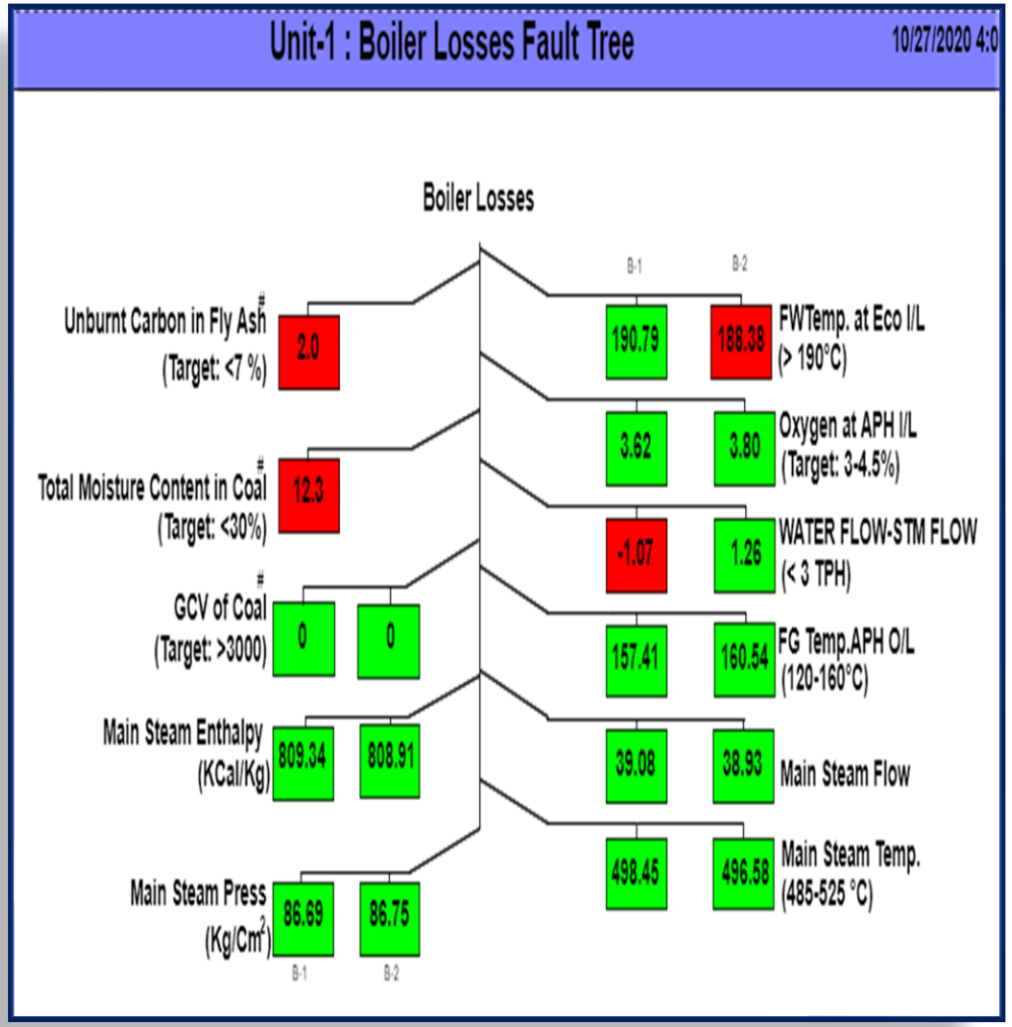
Best Practices – Daily Monitoring

Continuous monitoring of losses due to various performance parameters

Daily online monitoring of auxiliary power by using Exact space

Description	Gain/Loss	Impact B1&2	Impact B3	B-1 Actual/Target	B-1 Impact	B-2 Actual/Target	B-2 Impact	B-3 Actual/Target	B-3 Impact
20°C Increase in Comb Air Temp	Efficiency Increase by 1%	35	80	221.10 / 210.00	19.36	221.81 / 210.00	0.03	190.08 / 200.00	40.06
6°C Increase in ECO Inlet Temp	Efficiency Increase by 1%	35	80	190.82 / 194.00	18.40	188.41 / 194.00	32.47	185.23 / 204.00	246.96
21°C Decrease FG APH OL Temp	Efficiency Increase by 1%	35	80	157.41 / 150.00	12.30	157.41 / 150.00	17.61	143.20 / 150.00	25.92

Description	Gain/Loss	Impact TG1 & TG2	TG-1 Actual/Target	TG-1 Impact	TG-2 Actual/Target	TG-2 Impact
0.01 Vacuum in Turbine	13.29 kacl/kwh	20	-0.00 / -0.89	1772.57	-0.90 / -0.89	24.41
5°C Decrease in Main Steam Temp	13.29 kacl/kwh Loss in Heat Rate	28	412.73 / 494.00	477.52	499.65 / 494.00	9.24
Total Impact		2538.99				



Best Practices – Daily Monitoring

Continuous monitoring of losses due to various performance parameters

TPP -2 PERFORMANCE PARAMETER

PARAMETER	TAG NO.	DESIGNED	MEASURED VALUE
BOILER			
FEED WATER ECO INLET TEMP	NTT-101	203	185.8 Deg C
FEED WATER FLOW	CALC-NFT-101	70.7	45.1 TPH
STEAM TEMP	NTT-203	505(+/-5)	498.0 Deg C
STEAM PRESSURE	NPT-202	63	59.7 KG/CM2
STEAM FLOW	CALC-NFT-201	70	47.4 TPH
O2 IN FLUE GAS	NEOX		7.4 %
AIR HEATER			
FLUE GAS INLET TEMP	NTT-404	240-250	202.8 Deg C
FLUE GAS OUTLET TEMP	NTT-405	140	117.7 Deg C
AIR OUTLET TEMP	NTT-307	160	146.5 Deg C
ECONOMISER			
FLUE GAS INLET TEMP	NTT-403	390-400	400.8 Deg C
FLUE GAS OUTLET TEMP	NTT-404	240-250	202.8 Deg C
FEED WATER INLET TEMP	NTT-101	203	185.8 Deg C
FEED WATER OUTLET TEMP	NTT-102	250	258.4 Deg C
DEAERATOR			
STEAM INLET PRESSURE	NPT-5132	3.8	3.1 KG/CM2
STEAM INLET TEMPERATURE	NTE-5132	286.9	224.7 Deg C
DERTR WATER OUTLET TEMP	NTE-5152-SPARE	148.9	139.4 Deg C

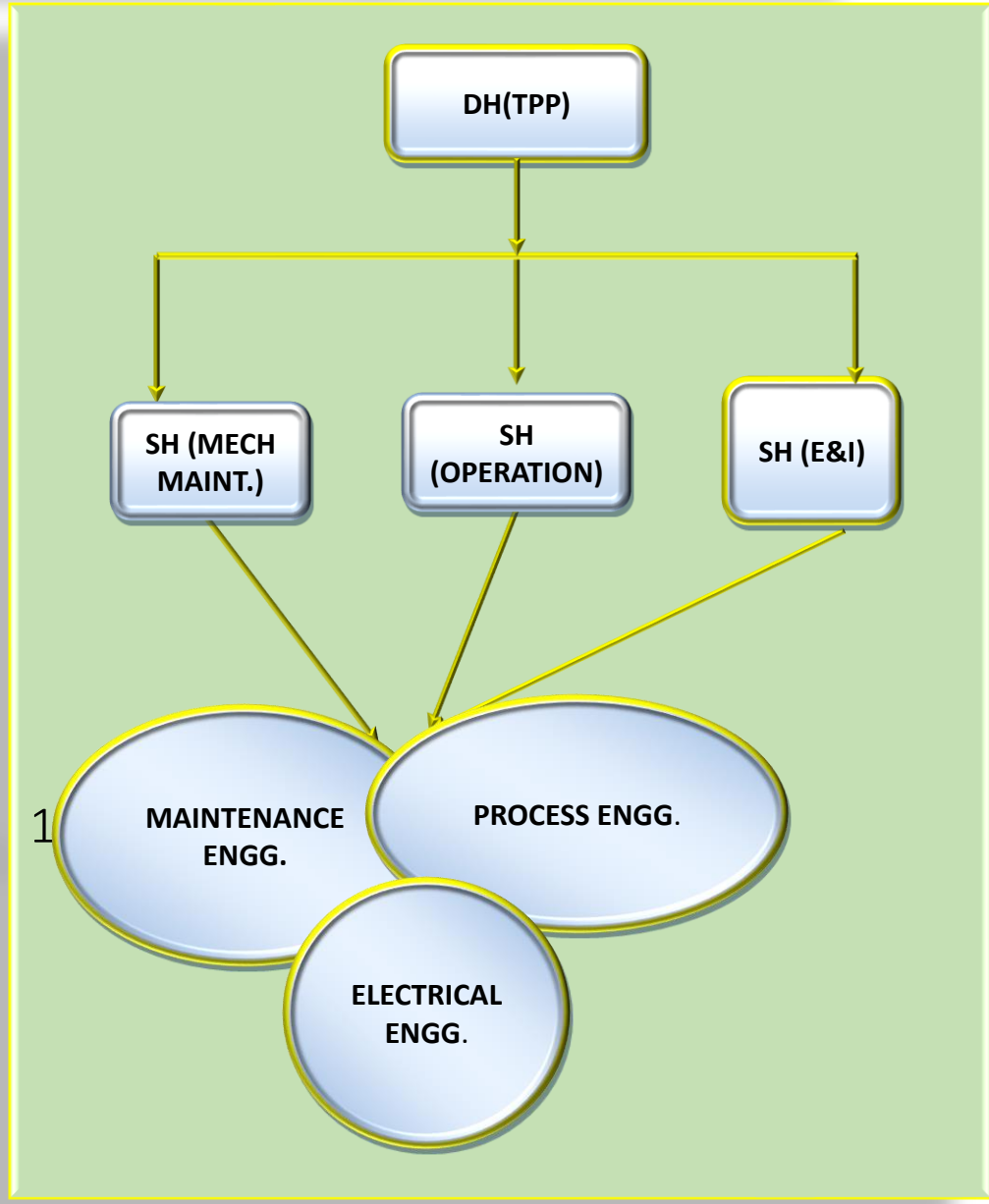
PARAMETER	TAG NO.	DESIGNED	MEASURED VALUE
TURBINE			
STEAM TEMP	NTE-5101	490	485.5 Deg C
STEAM PRESSURE	NPT-5101	59	59.2 KG/CM2
EXHAUST PRESSURE	NPT-5192A	-623	-0.780 Kg/cm2
EXHAUST TEMPERATURE	NTE-5192	57.4	58.9 Deg C
WHEEL CHAMBER PRESSURE	NPT-5111		26.2 KG/CM2
HP HEATER			
STEAM INLET PRESSURE	NPT-5122	16.809	11.7 KG/CM2
STEAM INLET TEMPERATURE	NTE-5122	337.1	344.5 Deg C
FEED WATER INLET TEMP	NRTD-411	150.8	140.7 Deg C
FEED WATER OUTLET TEMP	NTT-101	203	185.8 Deg C
DRAIN WATER TEMP		158.2	
LP HEATER			
STEAM INLET PRESSURE	NPT-5142	0.6833	0.0 KG/CM2
STEAM INLET TEMPERATURE	NTE-5142	110	121.0 Deg C
COND. WATER INLET TEMP		57.6	
COND. WATER OUTLET TEMP		107.3	
DRAIN WATER TEMP		112.7	
MAIN STEAM LINE PRESS. DIFF	AIC467		0.5 KG/CM2
MAIN STEAM LINE TEMP. DIFF	AIC453		2.5 Deg C

Date	Generation (Kwh)	Total Aux. Power(Kwh)	AUX %	PLF%	BFP-1 Power	BFP-2 Power	Total BFP Power	FD FAN	ACC	PA FAN-2	PA FAN	CONV. COMPRESSOR-6	CONV. COMPRESSOR-1	CONV. COMPR SSOR-2
15-May-22	352000	21965	6.24%	93%	5340	0	5340	4740	2080	1756	1756	0	0	1237
16-May-22	362000	22170	6.12%	96%	5530	0	5530	5670	2100	1718	1718	0	0	1208
17-May-22	364000	22270	6.12%	97%	5160	0	5160	4940	2100	1737	1737	0	0	1233
18-May-22	362000	22515	6.22%	96%	5550	0	5550	5340	2220	1750	1750	0	0	1253
19-May-22	360000	22485	6.25%	96%	5540	0	5540	5320	2220	1692	1692	0	0	1232
20-May-22	366000	22645	6.19%	97%	5500	0	5500	5220	2320	1748	1748	0	0	1258
21-May-22	344000	21895	6.36%	91%	5350	0	5350	5200	2020	1762	1762	0	0	1237
22-May-22	316000	21885	6.93%	84%	5450	0	5450	5110	1920	1785	1785	0	0	1247
23-May-22	272000	19705	7.24%	72%	5000	0	5000	4900	1020	1846	1846	0	0	1076
24-May-22	292000	19985	6.84%	77%	5120	0	5120	4940	820	1777	1777	0	0	0
25-May-22	328000	21055	6.42%	87%	5230	0	5230	5240	720	1742	1742	0	0	0
26-May-22	268000	17065	6.37%	71%	4800	0	4800	4500	220	1771	1771	0	0	0
27-May-22	220000	18955	8.62%	58%	4920	0	4920	4740	510	1821	1821	0	0	0
28-May-22	246000	19145	7.78%	65%	4860	0	4860	4680	780	1836	1836	0	0	0
29-May-22	296000	19815	6.69%	79%	4950	0	4950	4840	880	1819	1819	0	0	0

Datewise | Data Entry | Day wise report

TPP Daily review meeting

- Well Established energy management cell headed by DH-TPP.
- Daily monitoring of Heat rate and Aux. power deviation report.
- Analysis of equipment performance for deviation.
- Identification of energy conservation scope.
- Theme base suggestions/Kaizens scheme under “Energy Saving ”.
- Feasibility study of suggestions & submit proposal for sanction.
- Preparation of detail action plan.
- Benefits analysis after project implementation.



Criteria For Energy Savings Projects Implementation

- *Opportunity identification*
- *Energy mapping*
- *Bench marking*
- *Lost cost matrix*

- *Suggestion*
- *Idea generation*
- *Idea screening*
- *Feasibility study*

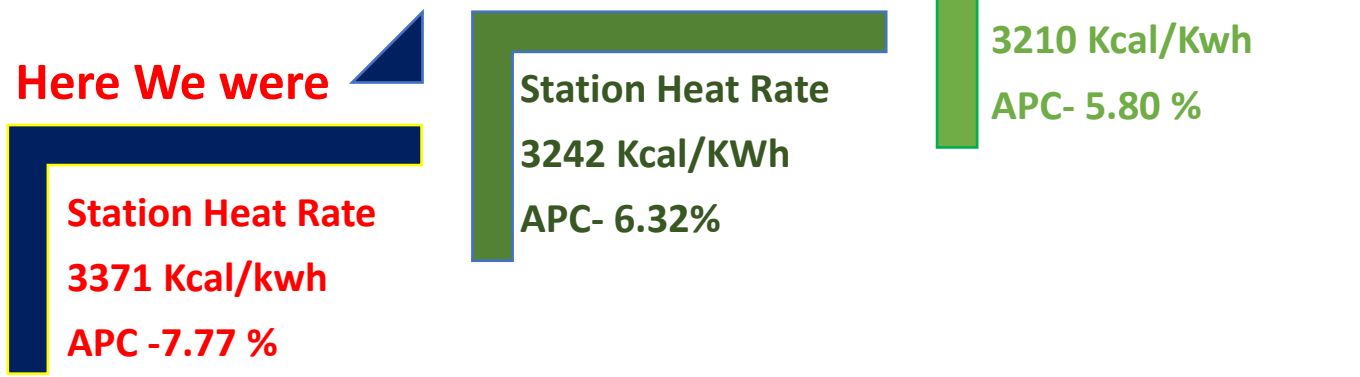
- Team formation and allocation of project team

- *Project Execution & review of progress*

- *Result Achieved*
- *Reward & Recognition*

Way Forward

1. Installation Energy Efficient FD fan with existing FD Fan.
2. Installation of Energy Efficient BFP with Existing BFP
3. Installation of Energy Efficient ACC fan blade with Existing ACC fan blade.
4. HP and LP Heater Cleaning work for better heat transfer.
5. Replacement of Existing AC with VAM system
6. Replacement of Existing ACC Tube bundle with single row tube bundle for reduction in PHR
7. Fanless Cooling tower for water cooled condenser for improve vacuum for reduction in PHR



Learnings from CII energy awards

1)**Installation of online cleaning system in condenser:**

We have installed online ball cleaning system in condenser-2. We took trial with different ball sizes.

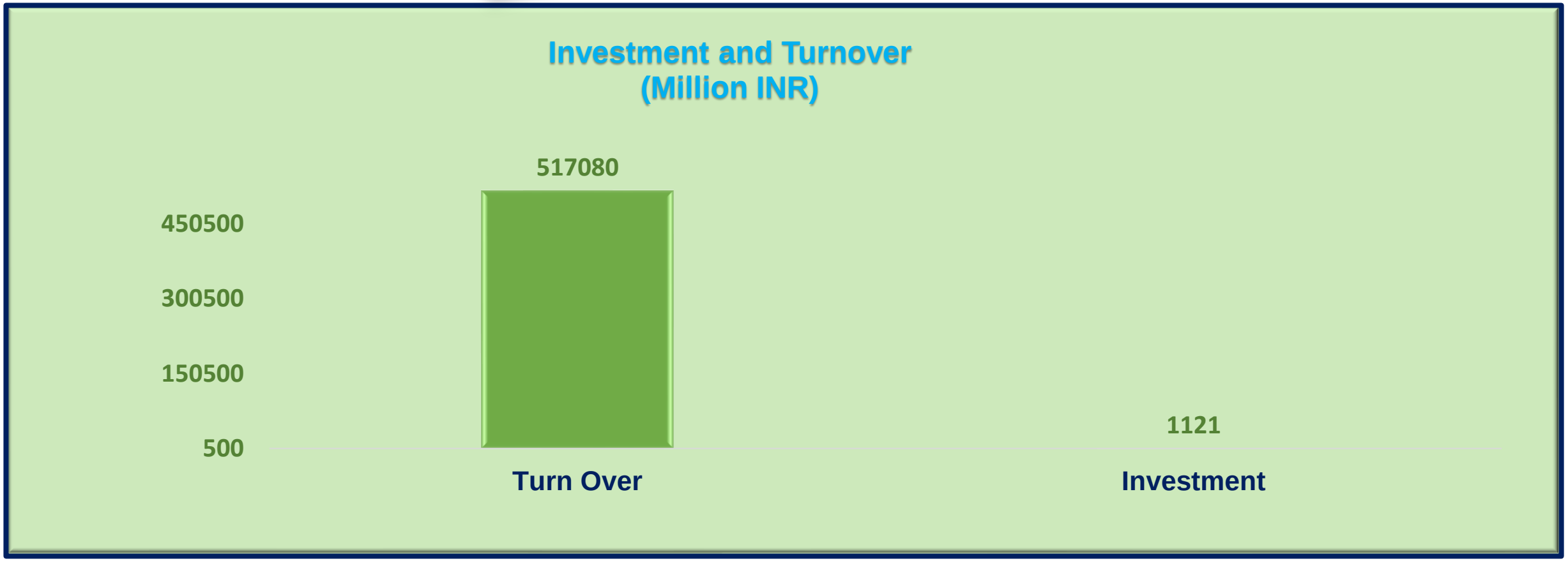
2) ACC Tube bundle in house cleaning in every two months.

3) Daily monitoring of process parameter with graphical method to improve KPI.

4) Daily monitoring of process parameter with graphical method to improve KPI.

Investment in Encon Project

Investment-0.216 %



Project implementation through Kaizen

Kaizen/suggestion submitted by Engineer and workman

Evolution and feasible study by Team

Approved by Committee and Implement

Total Kaizen/suggestion submitted by team-622 Nos

Kaizen Suggestions implemented-281 Nos

The less you burn, the more you earn…..

Narendra Vishnawat
Deputy Manager
Maihar Cement works
UltraTech Cement