22nd National Award for Excellence in Energy Management - 2021

(Thermal Power Stations)

GMR Warora Energy Limited (GWEL)

(A 2X300 MW Thermal Power Plant)

Team Member Details:

1. Vinod Gaidhar - Associate General Manager
2. Pratiksha K Sharma - Manager
3. Vinod Mullapudi - Associate Manager

Presentation Flow :

1. GWEL - At a Glance
2. Energy Consumption Over-view
3. Reduction in Sp. Energy Consumption
4. Benchmarking of Energy Consumption
5. Summary of Energy Saving projects implemented in FY 19, FY 20 & FY 21
6. Innovative Project implemented in FY 21
7. Utilization of Renewable Energy Sources
8. Environment Management – Ash Utilization
9. Environment Management - Emission
10. Environment Management - Water
11. Best Practices – Non Energy Efficiency
12. Team work, Employee Involvement & Monitoring
13. Implementation of ISO 50001 at GWEL
14. Learnings from CII/Other Award Program
15. Awards & Accolades

1. GWEL - At a Glance

1.1 GMR Group -Values & Beliefs

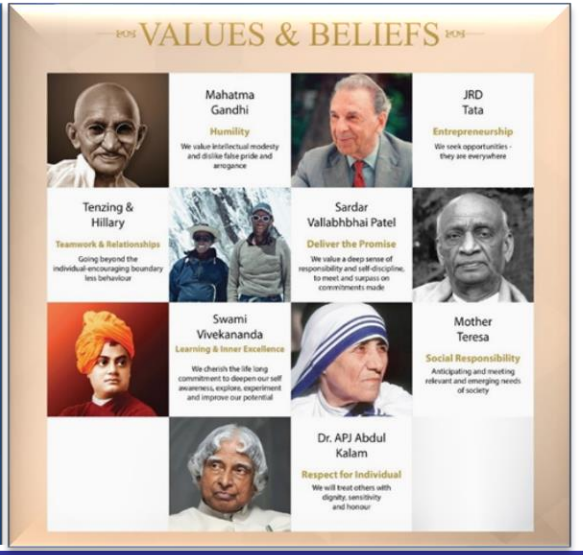
Vision

"GMR Group will be an institution in perpetuity that will build entrepreneurial organization making a difference to society through creation of value."

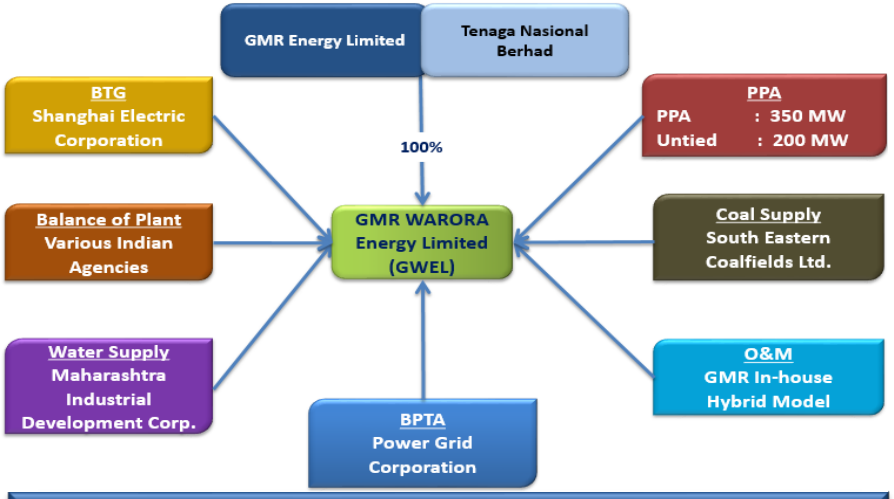
Mission

"GMR Energy wants to be the most profitable and one of the leading Integrated Energy Companies in India and derive value by

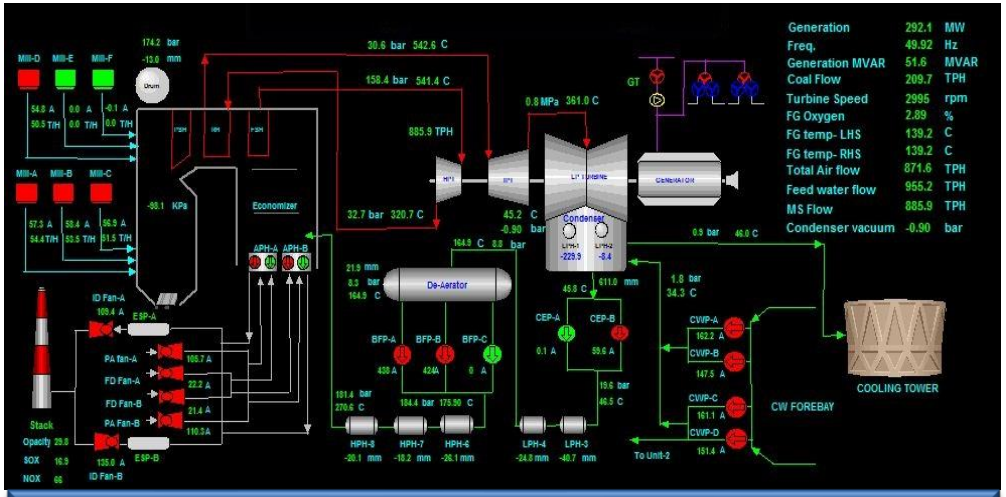
- Diversifying strategically across Energy value chain
- Being a preferred employer
- Being socially responsible"



1.2 Plant Synopsis & Technical Schematic



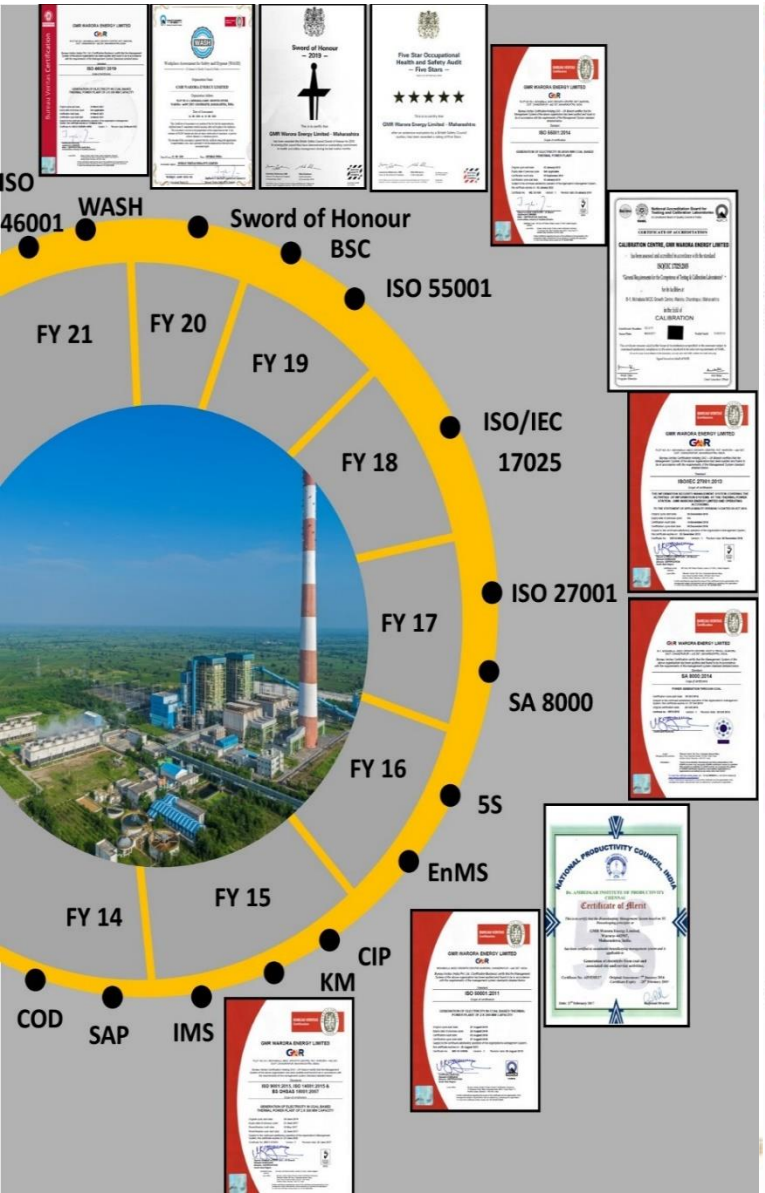
GWEL Plant Synopsis



Technical Schematic

1. GWEL - At a Glance

1.3 Certificates: GWEL Follows "Auditable System Based Approach"



GMR Warora Energy Limited

ENERGY MANAGEMENT POLICY

ISO 50001:2018

GMR Warora Energy Limited (GWEL) is committed to be the most Energy Efficient and Integrated energy utility in the world. Our Vision is to make use of all forms of energy resources most efficiently, minimize the impact of our operations on environment and conserve the scarce natural resources.

In order to achieve, we will

Adopt appropriate energy efficient and clean technologies in process design, procurement, and implementation and continually upgrade operating performance.

* Manage and make efficient use of all forms of energy by adopting industry wide best practices.
* Continual improvements in energy performance against the best in the world and improve competitiveness by training and knowledge sharing.
* Create awareness on efficient use of energy and various conservation methods amongst all stakeholders.
* Establishment of effective framework for setting & reviewing the energy Objective & Targets.
* Carry out regular energy audits to identify areas for improvement.
* Comply with all relevant Legal & other requirements on Energy Management.

This Policy statement is displayed at prominent places, and will be made available to interested external parties.

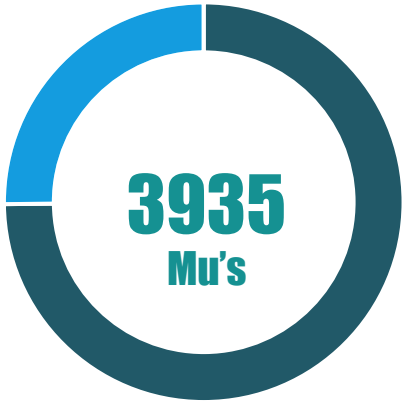
01st Jan 2020
Revision: 02

Dhananjay Deshpande
COO
GMR Warora Energy Limited

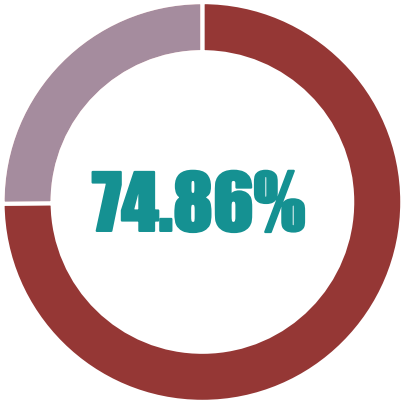
- Setting of Energy Objectives & Targets
- Efficient Management and usage of Energy
- Adoption of Best Practices & Continual Upgradation
- Training & Knowledge sharing to raise awareness
- Internal & External Energy Audits & Improvement Initiatives
- Compliance with all legal requirements

2. Energy Consumption Overview

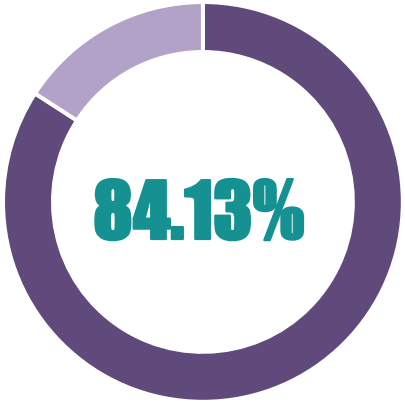
2.1 Plant Performance - FY-2020-21



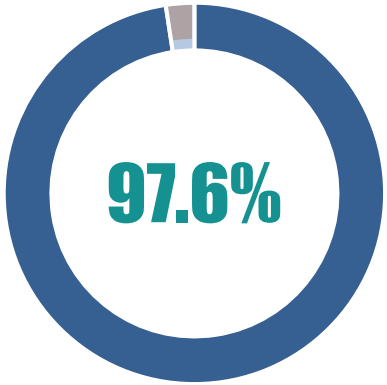
Generation Mu's



PLF %



Machine Availability %



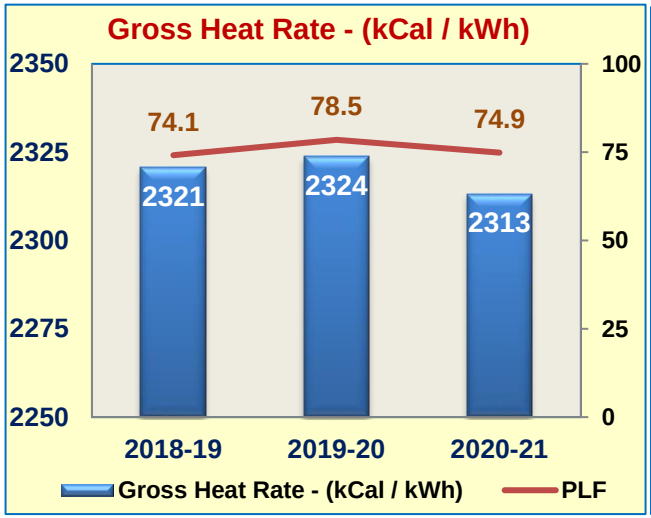
Deemed Availability %

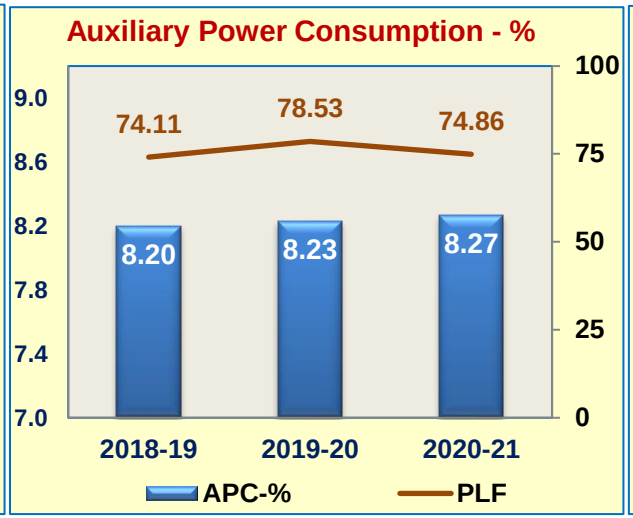
Gross Station - Heat Rate	2313 kcal/kWh
Turbine Heat Rate	1979 kcal/kWh
Boiler Efficiency	87.68%

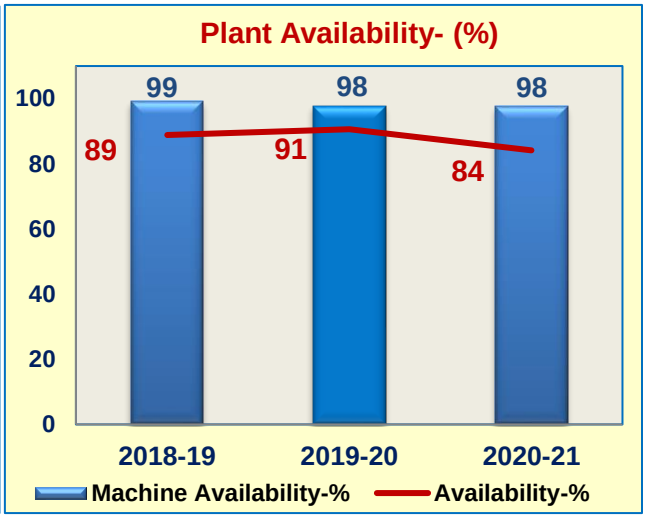
APC -	8.27%
SOC -	0.15 ml/kWh
DM -	0.14%
Raw water-	2.32 m3/MWh

3. Reduction in Specific Energy Consumption

3.1 Year-wise Reduction in Specific Energy Consumption







KPI	Improvement*
Heat Rate	(+) 0.5 %
APC	(-) 0.5 %
Plant Availability	(-) 7.19 %
Plant Load Factor	(-) 4.67 %

Reason for Deviation

Reasons for Deviation

1. During COVID, 1 of the Customer curtailed 100% PPA quantum for 3 Months (37% of Export)
2. Heat Rate & APC effected because of parameter deviation due to frequent schedule revisions
3. Machine aging impact as U2 COH deferred from past 2 years, same planned in Dec-2021
4. Low PLF & Availability on account of Customer curtailment, coal shortage, untied capacity.
5. As received GCV Deterioration

Action Taken

1. U1 COH conducted in Aug-19. Achieved Heat Rate improvement of 47 Kcal/Kwh & APC improvement of 0.5%
2. Several other projects like Flexible load operation, CT Fill replacement for 12 cells, 3 Mill Operation at part load, River water pump modification, Boiler CAVT taken-up for Heat-rate & APC improvement
3. Best Operational & Maintenance Practices helped in maintaining till date Machine Availability greater than 98%

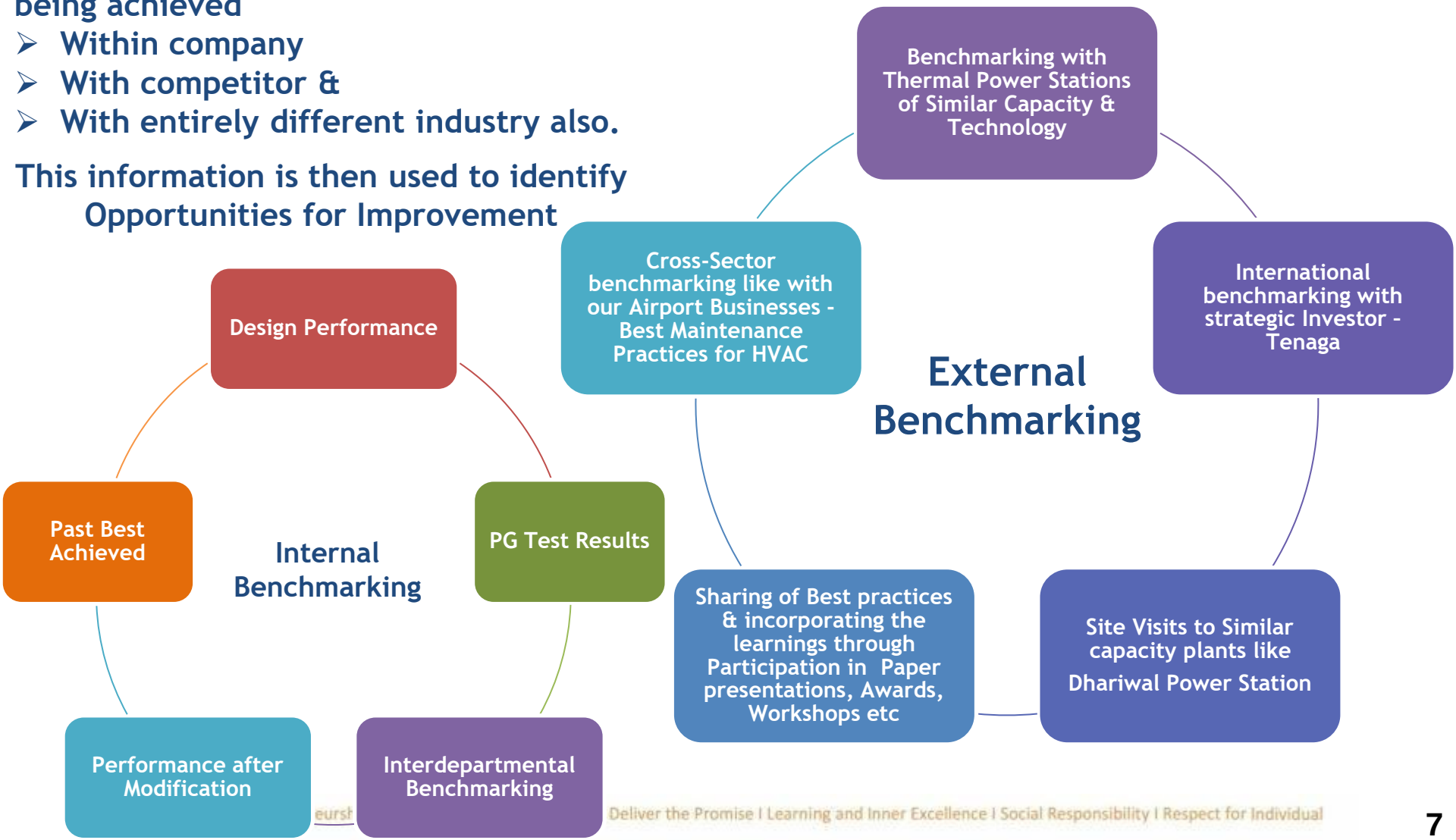
4. Benchmarking of Energy Consumption

4.1 Benchmarking Strategies: Roadmap to achieve National / Global Benchmark : Approach

GWEL uses Benchmarking tool to discover best performance being achieved

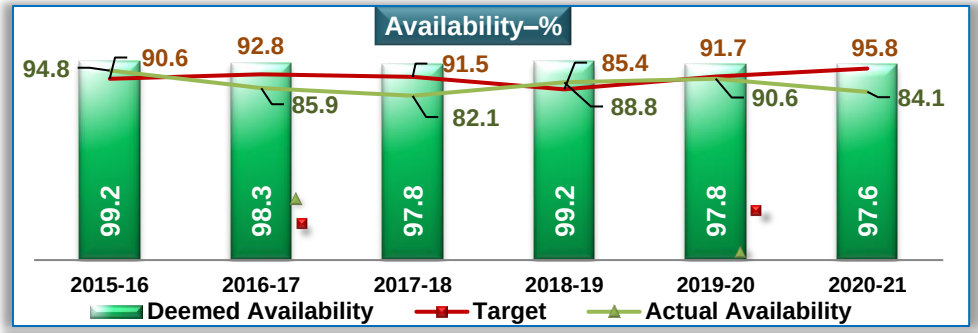
- Within company
- With competitor &
- With entirely different industry also.

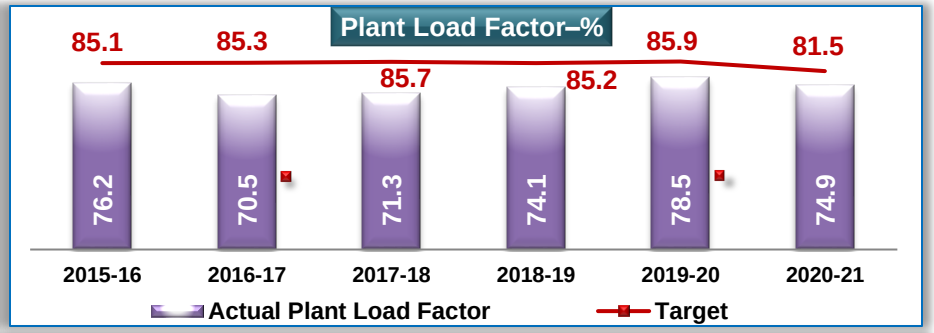
This information is then used to identify Opportunities for Improvement

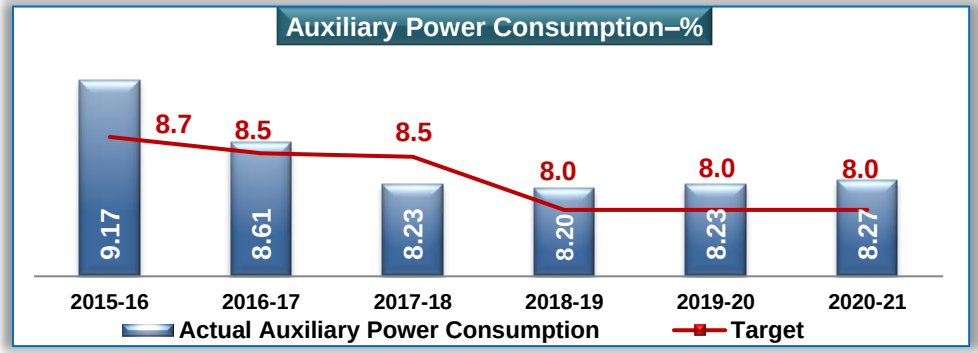


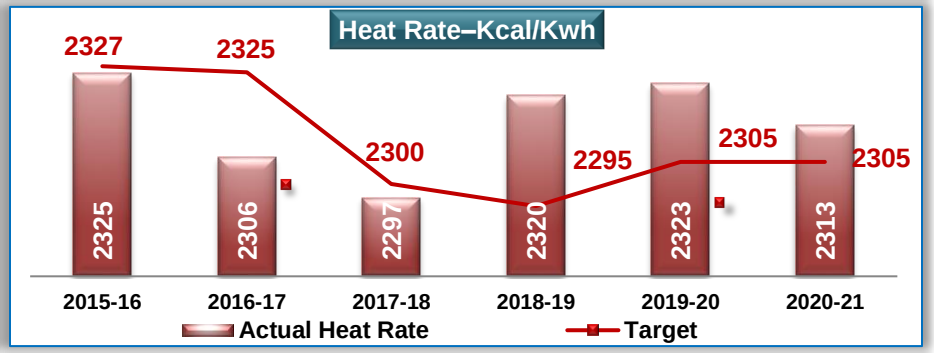
4. Benchmarking of Energy Consumption

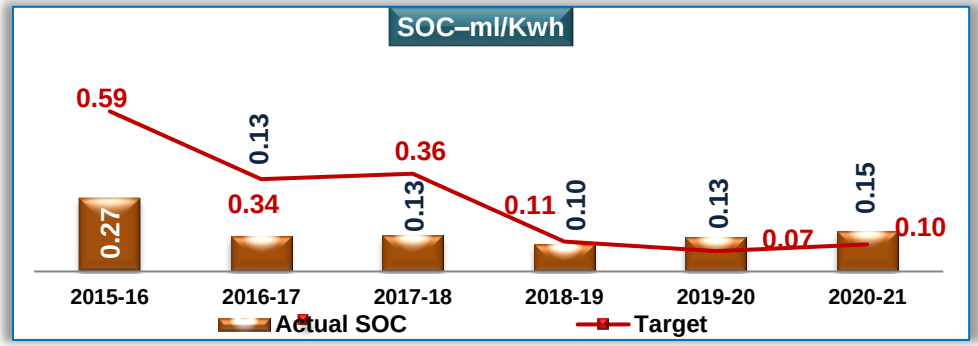
4.2 Internal Benchmarking of Key Performance Indicators (KPI's)

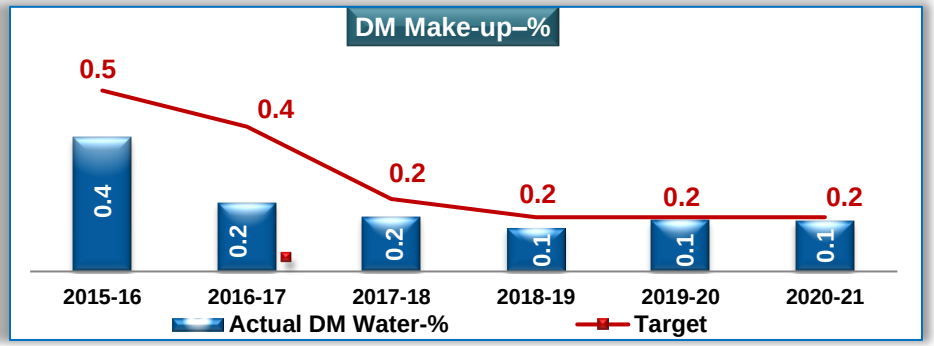








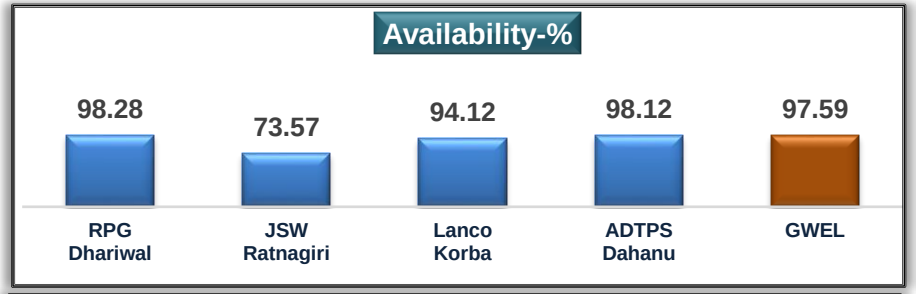


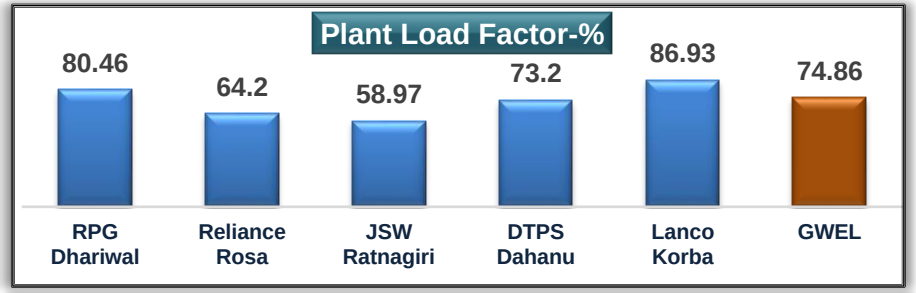


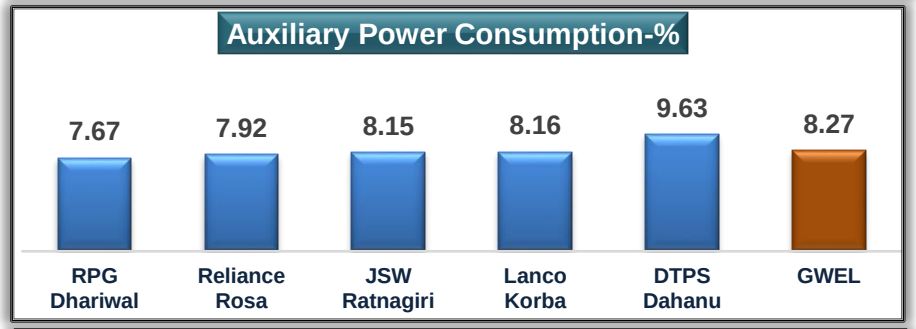
- Low Availability & PLF is on account of COVID, Coal Shortage & Customer Curtailment. However, GWEL has maintained Machine Availability of 98 %
- Increase in APC is on account of Low PLF due to COVID, Coal Shortage & Customer Curtailment. 42% of the Time PLF was less than 80%.
- Increase in SOC is due to more no. of Start-ups due to Coal Shortage & COVID impact

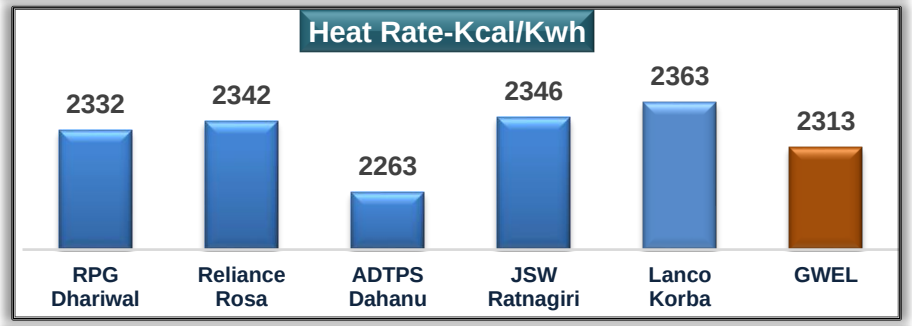
4. Benchmarking of Energy Consumption

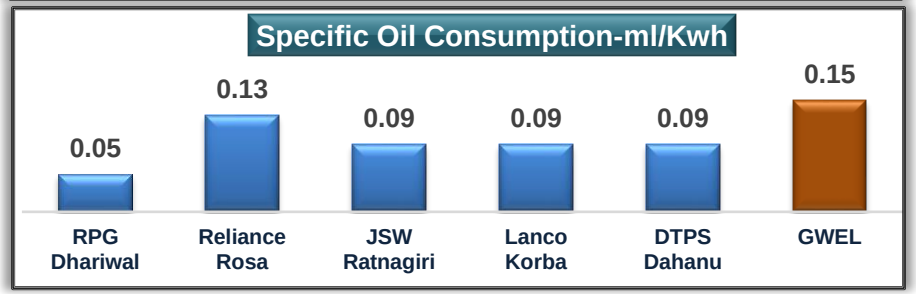
4.3 External Benchmarking with Competitors of Similar Capacity & Technology (FY 2020-21)

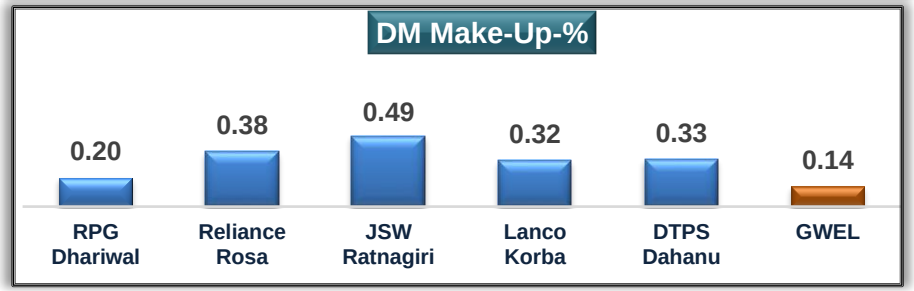












	National Benchmark	Global Benchmark
Aux Power Consumption (%)	7.67 % (RPG Dhariwal)	7.50% (TNB Janamanjung)
Gross Heat Rate (Kcal/kWh)	2263 (ADTPS)	2280

GWEL Best Achieved - Heat Rate of 2274 Kcal/Kwh & APC of 7.24% at 100% PLF

GWEL achieved the Best Heat Rate & DM make-up %

4. Energy Benchmarking – Action Plan

4.4 Future Plans towards Energy Conservation – FY-21-22

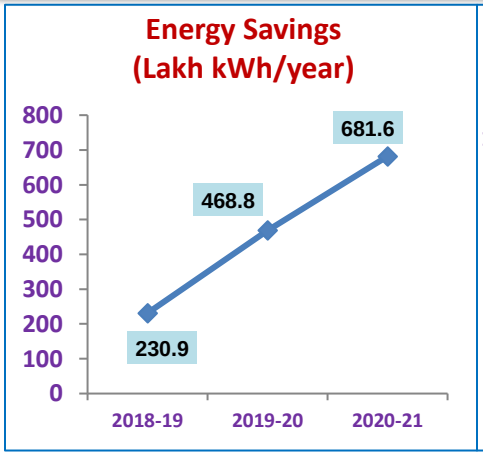
S.No	Project Description	Status	Target Date	Annual Expected Benefit
1	Installation of Sonic Soot Blower in APH	Feasibility Study Under Progress	November-2021	102.00 Million Kcal
2	Installation of Vibro Feeder in Second Stream Conveyor-BCN-2A	PO Placed	October-2021	221.29 Million Kcal
3	Installation of 5 MW Floating Solar Plant at Reservoir	Contract Finalization Under Progress	January-2022	21.60 Million kWh
4	Unit-2 COH Planned in Dec-2021	COH planned in Dec-21	December-2021	1.86 Million kWh 92045 Million Kcal
5	Six Sigma project taken for Reduction in Start-up Oil consumption by 20% by adopting various operational strategies & new technologies	Under Progress	October-2021	454.18 Million Kcal
6	Utilization of fluidized air for hopper instead of hopper heater in ESP	Project Under Study	December-2021	3.24 Million kWh
7	Cooling Tower Performance Improvement Programme (Existing Cooling Tower Drift eliminator & Fill replacement, CW line modification etc)	12 No. of CT Cells Fill Replacement Completed, Further 12 Planned	December-2021	54270 Million Kcal
8	Intelligent flow controller (IFC) installation in Compressed Air System.	Procurement Under Progress	November-2021	0.233 Million kWh
9	CFD Analysis of Flue gas duct-Economizer outlet to APH Inlet	Planned in COH in FY-21-22	December-2021	0.596 Million kWh
10	Application of Anti-erosion Coating in ID fan 2A and 2B Impeller	Planned in COH in FY-21-22	December-2021	0.901 Million kWh
11	Cooling tower fan motor to gearbox metallic shaft to be changed with carbon fiber shaft	Vendor Exploring Under Progress	January-2021	1.051 Million kWh
12	VFD installation for Induced draft Fans	Planned in COH in FY-21-22	December-2021	3.564 Million kWh
Total Expected Benefits :		**Electrical Energy : 33.04 Million kWh**	**Thermal Energy : 147092 Million KCal**	

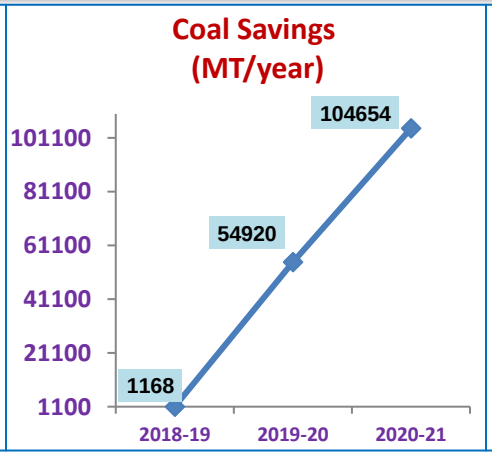
5. Summary of Energy Saving Projects

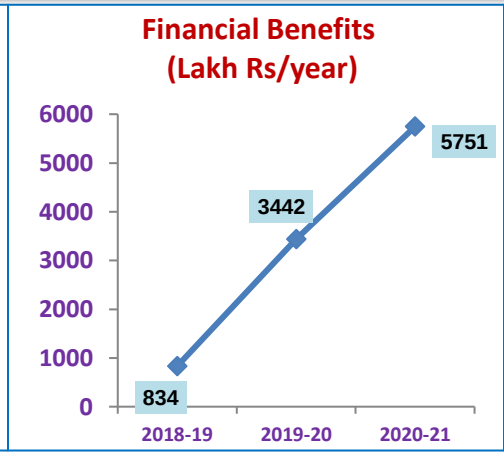
5.1 Summary of Energy Conservation Projects implemented in last 3 FY's

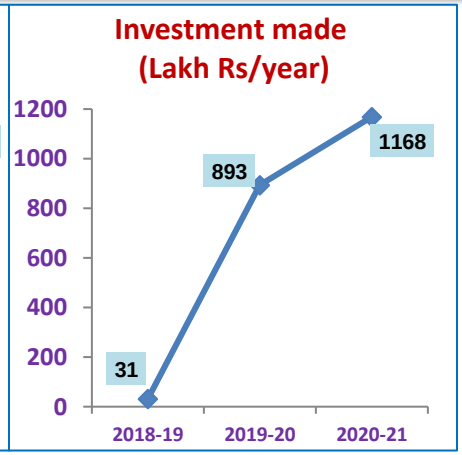
FY	No. of Energy Saving Projects	Investments INR Million	Electrical Savings (Million kWh)	Thermal Savings (Million Kcal)	Savings (INR Million)
FY 2018-19	20	3.09	23.09	5799	83
FY 2019-20	22	86.23	23.78	196878	261
FY 2020-21	21	27.47	21.28	181377	231
Total	63	116.80	68.16	384054	575

Cumulative Benefits Achieved







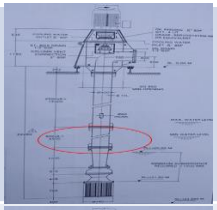
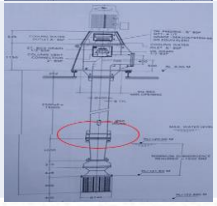


***All savings achieved audited by Management Assurance Group (MAG) Audit.

5. Summary of Energy Saving Projects

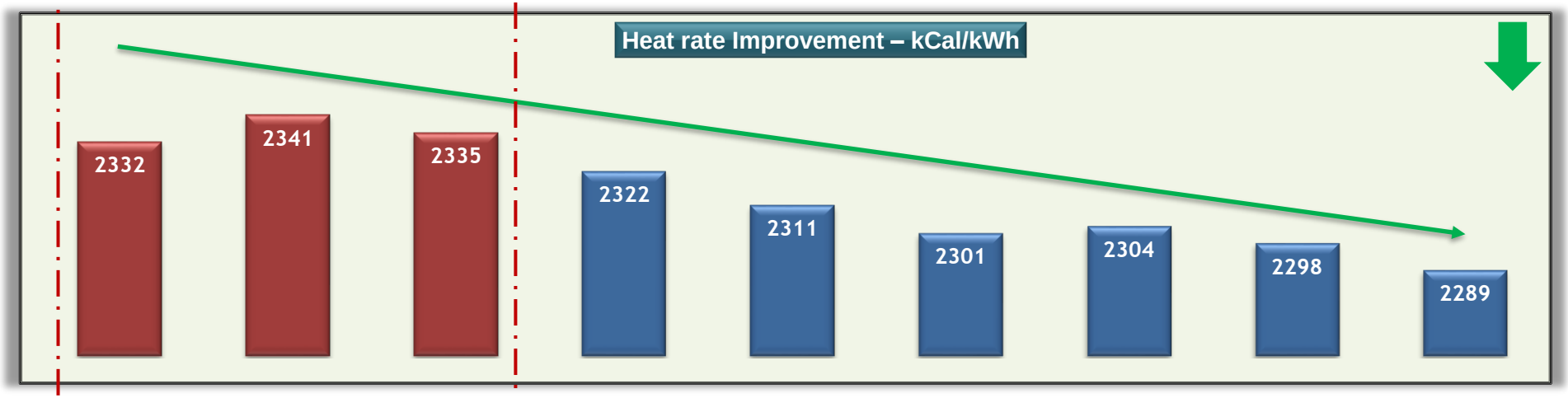
5.2 Major EnCon Projects Implemented in FY 2020-21

S.No	Title of Project	UoM	Annual Energy Saving
1	Auxiliary Power Consumption reduction through removal of short Column Pipe in River Water Pump	kWh	61706
2	Power Consumption Optimization through 3 Mill Operation during low load operation	kWh	264005
3	Installation of Airtron-AC Energy Saver for energy conservation in Air Conditioner	kWh	29134
4	Water Treatment Plant Power Consumption Optimization by improving RO Recovery	kWh	30800
5	Plant Performance Improvement during Flexible load Operation	MT	6158
6	BFP Power Consumption Optimization by Replacement of Existing Valve with Modified RC Valve	kWh	1786220
7	Heat Rate Improvement Through CT Fills Replacement	MT	15292
8	Heat Rate Improvement Through CT Nozzle's Replacement	MT	1019
9	Reduction in Diesel Consumption in CHP by adopting best operational practices	Kl	23
10	Boiler Efficiency improvement by CAVT Test & Attending Duct Leakages	MT	4078
11	Auxiliary Power Consumption reduction by CAVT Test & attending duct leakages	kWh	295691
12	Improvement in Yard GCV losses by 48 Kcal by adopting best operational strategies	MT	23187

	Cooling Tower Fill & Nozzle Replacement		Airtron Energy Saver	River Water Column Pipe Removal	BFP RC Valve Modification
Before					
After					

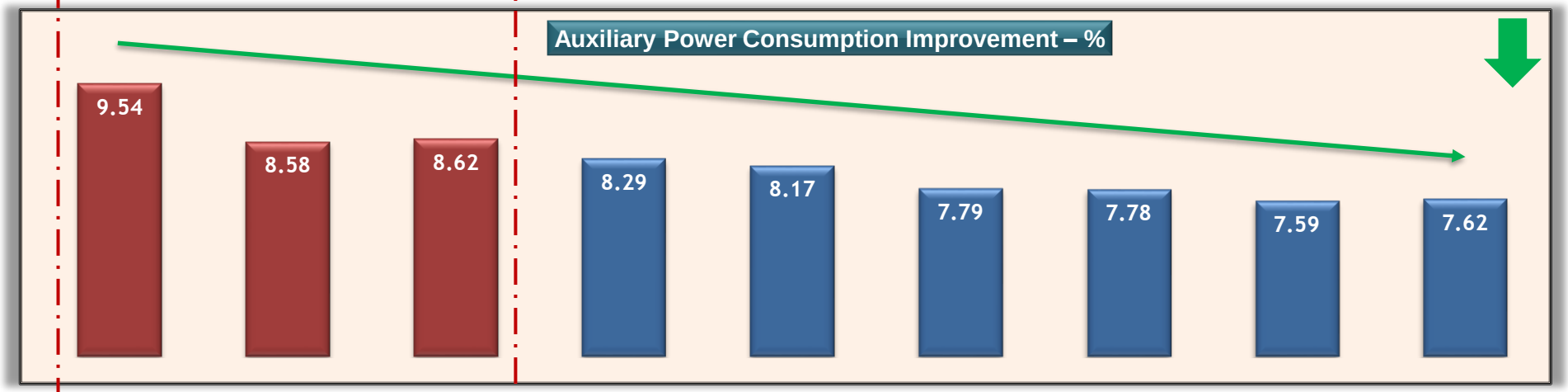
5. Summary of Energy Saving Projects - Benefits

5.3 Heat rate & APC Improvement - Pre & Post Initiatives Taken



1 Customer - 100% Curtailment

1 PPA Expired (37% Export Capacity)- Various Initiatives Taken



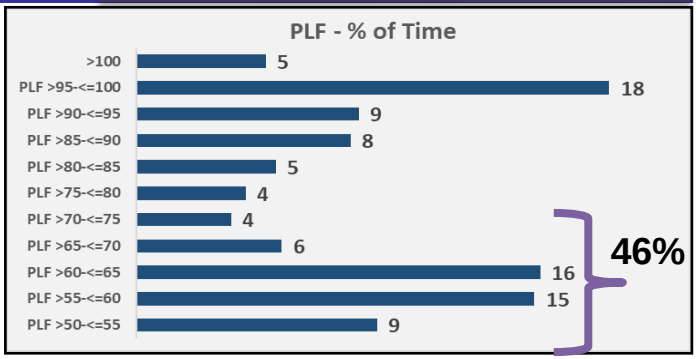
6. Innovative Project implemented in FY 2020-21

6.1 : Plant Performance Optimization during Flexible load Operation

Replicability : YES

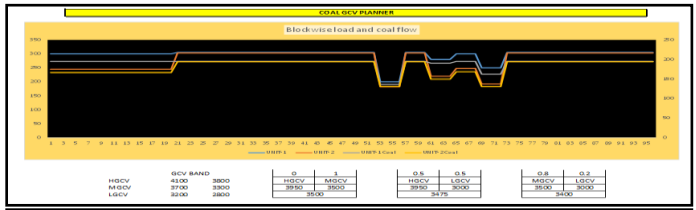
Problem Description:

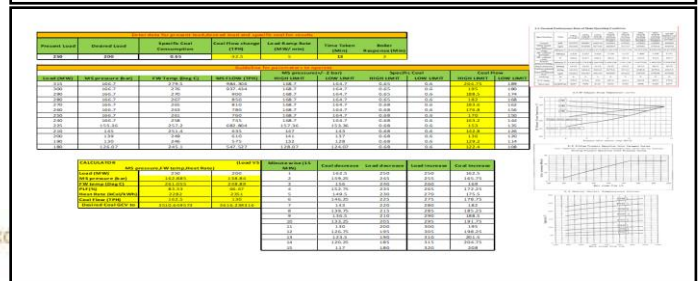
- 200MW PPA (37% of Export Capacity) Expired – Currently selling in IEX.
- Huge Load variation – Significant variation in operating parameters.
- Aggravated due to customer curtailment. In Few blocks units were operated at technical minimum load.
- Impacting APC, Heat rate & equipment performance.



Analysis & Solution finding:

- Adopted **Six Sigma methodology for** station performance improvement during Flexible load operation.
- **ANOVA Testing –** Merit Order Operation to identify best performing unit at various operating condition
- **Regression Analysis -** Study for ascertaining impacting parameters
- **FMEA for Risk Mitigation**
  - Beyond Technical minimum
  - Reliability of various process & equipment
- **Online Load Planner** – Study of Load Response & Ramp rate
- **Opportunity Materialization** - Optimization of nos. of equipment's running
- **I-MR Control Charts -** To identify process deviation



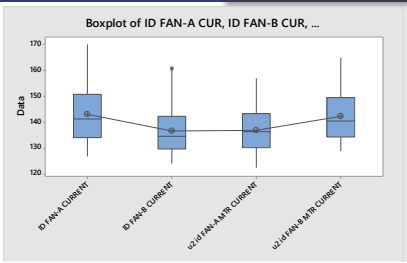


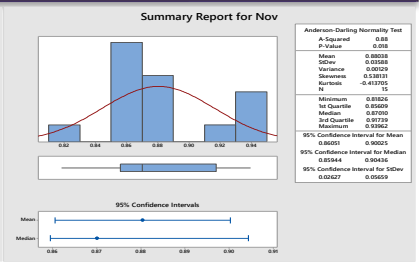
6. Innovative Project implemented in FY 2020-21

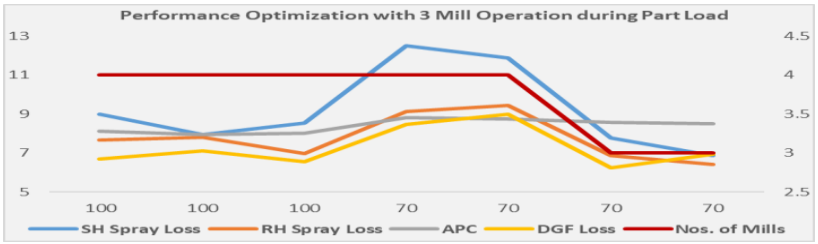
6.1 : Plant Performance Optimization during Flexible load Operation

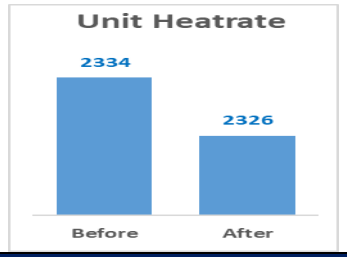
Replicability : YES

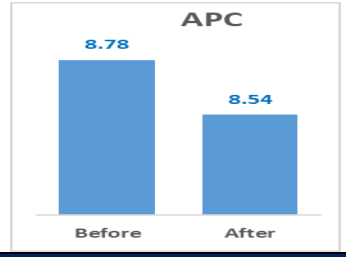
Identification	Action
Load Response Study	1. Comparative Study of Machine response & variation in parameters wrt ramp-rate 2. Online Load change Planner based operation
Merit Order Operation	STEP Factor Analysis for running 1 unit at full load & load variation in other unit
Optimization of nos. of equipment's	Energy Conservation by 3 Mill & 3 CWP Operation during Low Load Operation
Specific Coal Consumption Optimization	1. Coal Blending software 2. Elevation wise bunker Coal Strategy for maintaining optimum SCC during variable operation 3. Online Heat-rate & GCV Planner based operation
Parameters Optimization	1. Online PGIM Performance Monitoring 2. Temperature Optimization through Elevation wise Coal Mill Feed-rate Strategy 3. Coal Mill Combination Strategy during Low & High Load operation 4. Spray & Soot Blowing Optimization through Mill feeding strategy
Operator Capability Enhancement	Hands on Simulator Training to all Operators for seamless operation at low load operations with various operational challenges
Control Loops Optimization	1. All Control loops fine tuning with required logic modification wrt Low load operation 2. Condensate Throttling
Identification of Bottlenecks & mitigation	Reliability improvement of Flame scanner system, Oxygen Measurement System











Mean Difference Analysis			
Month	**MS Temp**	**RH Temp**	**MS Pressure**
Apr-20	1.52	1.41	2.88
May-20	1.55	1.45	2.76
Jun-20	1.44	1.41	2.45
Jul-20	1.25	1.38	2.41
Aug-20	1.13	1.31	2.02
Sep-20	1.01	1.09	1.96
Oct-20	0.97	0.94	1.93
Nov-20	0.93	0.89	1.87
Dec-20	0.84	0.78	1.78
Jan-21	0.79	0.65	1.66
Feb-21	0.64	0.51	1.57
Mar-21	0.45	0.41	1.51

Impact : Coal Saving - 6158 MT
Plant Reliability Index & Performance improvement
Machine Ramp rate improvement

7. Use of Renewable Energy

7.1 : Renewable Energy Projects at GWEL

Renewable Energy Utilization

Wind operated Cooling Fans

(150 nos.) on TG Building, Ware House, CW Pump House, AHP Compressor House by replacing motor operated fans.

Solar Water Heater for Associates

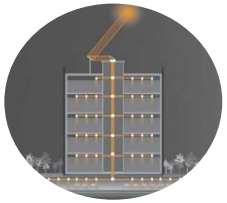
Solar water heater of capacity 1000 LPD installed at Associate employee township.

Solar Water Heater for Township

Solar Water Heater in Permanent Township installed for 150 Families

Translucent sheet cladding

Translucent sheet cladding in CHP belt conveyors, Compressor House, RO-DM to reduce lighting load



Pipe-lighting

Pipe light in Stores & Warehouse.

Roof Top Rainwater Harvesting

Roof Top Rain Water Harvesting from all buildings.

Rainwater Harvesting

Deep Aquifer & reservoir Recharge by Rainwater Harvesting in Plant & Colony

7. Use of Renewable Energy

7.2 : Savings achieved through Onsite Renewable Energy Projects

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
No. of Project Implemented	2	1	1	3	3	3
Total Capacity - MW	1					
Total Power Savings Lakh KWh	87.02					
% Share	0.22					
Cumulative Savings (Rs Lakh)	16.93	25.63	38.76	68.20	242.09	267.38
RPO Obligation	Not Applicable					

7.3 : Renewable Energy Projects under Implementation at GWEL

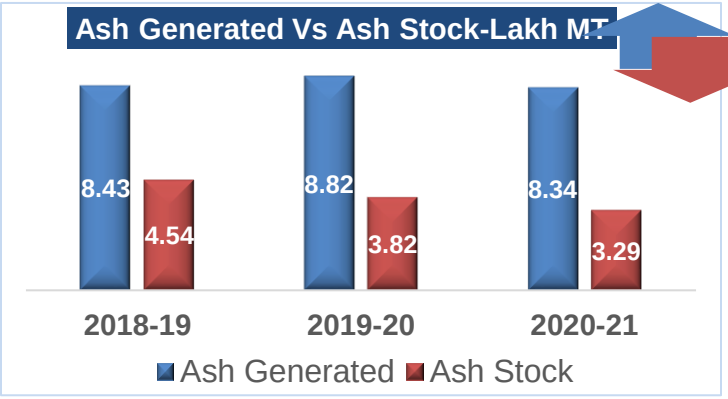
Installation of 5 MW Floating Solar Plant in reservoir at GWEL.

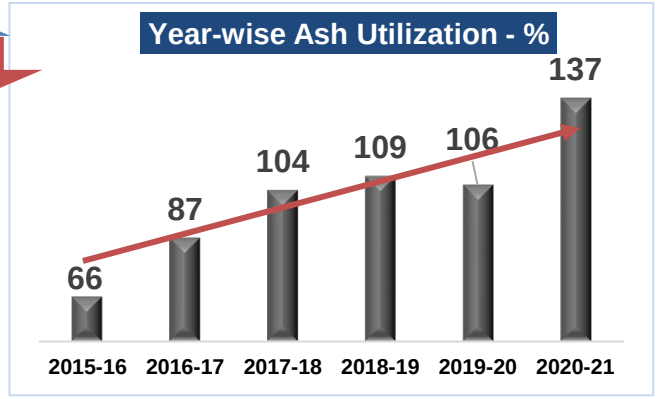
Key Highlights:

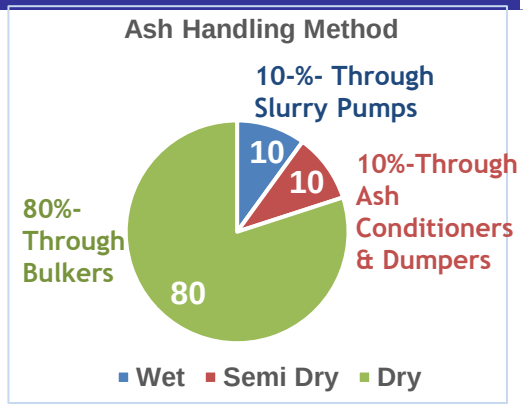
- ✓05 MW Internal Grid connected Floating Solar Installation on Plant reservoir
- ✓Contract under Finalization, project execution planned from Jan-2022
- ✓Payment through POS (Pay out of Savings) Scheme to ESCO.
- ✓Electricity generated to be fed as internal APC throughout the plant.

8. Environment Management-Ash Utilization

8.1 : Utilization of Ash Generated







Distribution of Areas of Ash Utilization					
Sr No.	Particulars	UoM	2018-19	2019-20	2020-21
1	Ash Utilized in manufacturing of cement/ concrete others similar products	%	68%	53%	28%
2	Ash Utilized in Fly Ash Bricks	%	0%	14%	25%
3	Ash Utilized in Mine Filling	%	9%	2%	20%
4	Ash Utilized for Road Pavements	%	4%	26%	24%
5	Ash Utilized in Brick Manufacturing (From Bottom Ash)	%	13%	4%	2%
6	Ash Utilized in Bottom Ash Mine Filling	%	4%	0%	0%
7	Ash Utilized Bottom Ash for Road Pavements	%	2%	0%	0%
8	Expenditure on Ash Utilization (Annual)	INR (Lakhs)	0	828	1181

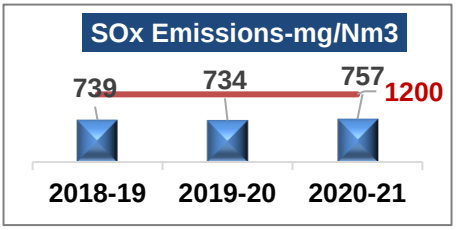
Ash Utilization at GWEL is 100% of the Total Ash Generated

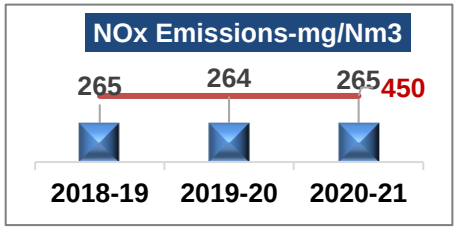
9. Environment Management-Emission

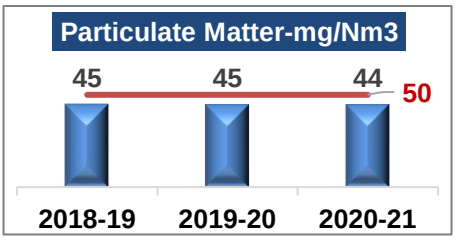
9.1 GHG Inventorisation

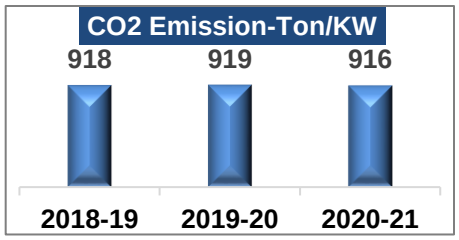
GMR Sustainability Report

- Every year GMR group publishes its sustainability report for public. It is available on the following link: https://www.gmrgroup.in/energy/









Best Practices for Maintaining Emission Level within Norm

Current Control:

- GWEL is having **Low Nox Burner installed** since design stage with Nox value within norms limit
- GWEL is having **100% Ash Utilization**
- **Coal Blending through Automated Software** to minimize emission & maximize efficiency. PM within norms limit
- **Real time Ash monitoring system** installed
- Transportation of ash through jumbo bags by train mode

Future Control:

- **FGD Implementation by 2024**- Contract finalization In progress, Project Execution will start from Jan-2022
- **5 MW Floating Solar Installation**- Contract finalization under progress, Project Execution by- Jan-2022
- AAC (Aerated Autoclave Concrete) block manufacturing unit installation

9.2 PAT Cycle-II Compliance

PAT Cycle-II - Energy Consumption Target & Actual - Registration No.-TPP0149MH

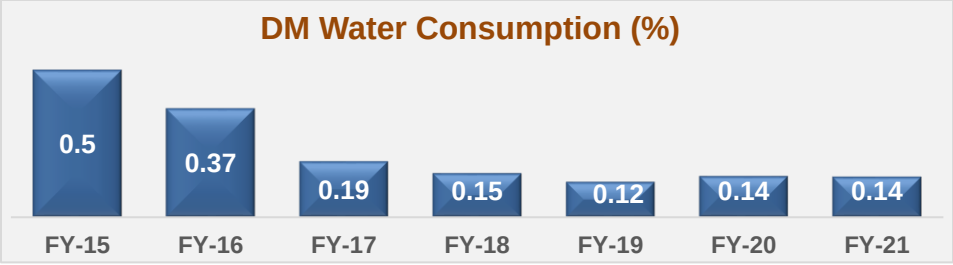
Target Net Heat Rate for Assessment Year 2018-19	Actual Net Heat Rate Achieved for Assessment Year 2018-19	Net Heat Rate Target Overachieved for PAT Cycle-II by
2554.62	2524.24	30.38

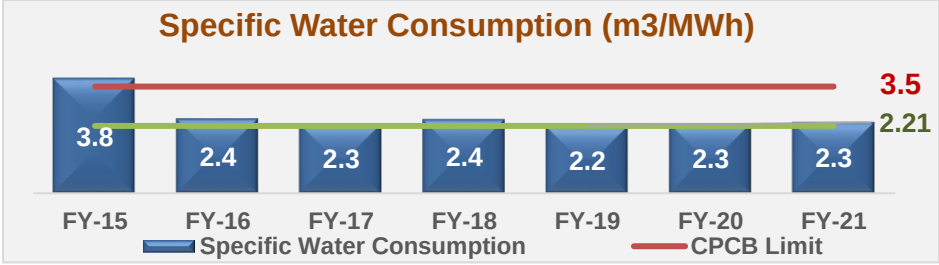
Operating Station NHR achieved with Normalization in FY 2018-19 : 2524.24 kCal/kWh

Number of Escerts to Sell : 9956 **Total Price of Escerts to sell : Rs. 1 Crores**

10. Environment Management - Water

10.1 Specific Water Consumption





Zero Liquid Discharge Scheme

S No	Waste Generation Area	Generation Point	Collection Point	Treatment Process	Application of treated water	Photo
1	Pre-Treatment Plant	PT & ERS clarifier	Sludge Handling System	Sludge pit- Sludge Thickener- Centrifuge Feed tank- Centrifuge- Sludge Transfer point	✓ Water recycled to Reservoir ✓ Solid Sludge separated disposed to Ash dyke	 
		RGSF Back wash	Supernatant tank	Physical Settlement of impurities		
2	RO-DM Plant	RO & UF Reject/ MGF Backwash/ DM Regeneration waste	Effluent Collection (EC) Pit	Acid and Alkali treatment scheme for Neutralization	✓ Ash handling plant ✓ Coal handling plant	 
3	Circulating Water System	Cooling Tower Blowdown	CW Blowdown tank & Dead Storage for Fire Water System	Effluent recovery system (ERS), wherein water is passed through Clarifier- MGF- UF- RO system	✓ Fire Fighting System make up ✓ Stored in ERS Clarified water storage tank for downstream applications	 
4	Domestic Waste	Various domestic waste generation points	Collection sump of STP	Collection sump- Collection chamber- FBR (Fluidized Bed Reactor)- Tube settler- Clarifier storage tank- Filter Press	Green belt development and landscaping	

GWEL is a Zero Liquid Discharge Plant

10. Environment Management - Water

10.2 Best Practices in Water Management

GWEL is committed for Process Excellence & delivering **Our Value** of **Social Responsibility by Conservation of Natural Resource.**

To achieve above, we have adopted **Auditable System Driven Approach by implementing comprehensive "Water Efficiency Management System" (WEMS, ISO 46001:2019)**

- ✓ Water Management Policy & Objectives
- ✓ Identify Business activity indicators
- ✓ Evaluate the Water Use Review Report
- ✓ Significant Water Use Equipment's/Process
- ✓ Baseline Water Efficiency Indicators targets & action plan
- ✓ Benchmarking with Industry Leaders & capturing Best Practices

"GWEL is First Thermal Power Plant in India to get Certified for WEMS, ISO 46001:2019"

Water SCADA

Dedicated **Water SCADA** for Water consumption accounting & balancing.

32 Flowmeters installed plantwide

Key Benefits :

- Area-wise Water consumption & cost accounting
- Specific water consumption Monitoring
- Identification of Water Wastage
- **Automated Reports**
- **Real Time Dashboard & Trend**
- **Alarm** for increase in Water Consumption above base value
- **WaterSaving-317314 m3**

Water Audit

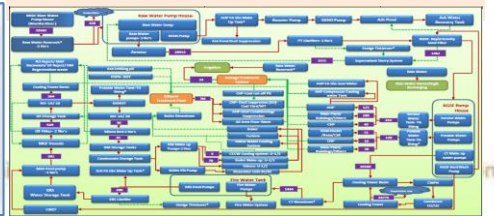
External Water Audit by CII Triveni Water Institute.

- Plant overall water balance
- Opportunities for Water Conservation

8 Nos. of recommendations given & all implemented resulted in significant water saving

Internal Audit:- Through CIPs - Continual Improvement Plan

- Every year CIPs being taken through Cross-functional team for internal assessment of water resources & conservation by internal audits,
- Water Saving of **3.41 Lac m3** has been achieved through CIPs



Rain Water Harvesting

At Plant:

Deep Aquifer Recharge:

- Plant-wide storm water drains connected to Rain water harvesting pond.
- **Annual Rain Water Harvesting of 8.6 Lac m3.**

Rooftop Rain Water Harvesting:

- Rain water harvesting from building roof tops & used as cooling tower makeup .
- **Fresh Water Saving-13141 m3/Annum**

Reservoir Recharge:

- **Fresh Water Saving-54000 m3/Annum**

At Colony:

Water collection from Building Rooftop & drains for Deep Aquifer Recharge

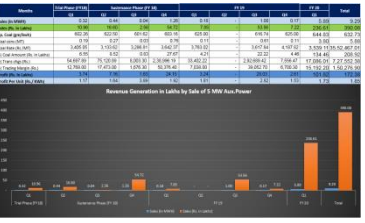
Water-Beyond the Fence

- Awareness on Scientific Watershed Management for improving water condition in draught areas
- **RO Water ATM** installed in **17 Villages** for providing **Safe drinking water in fluoride zone**
- **Check Dams** construction
- Pond deepening at nearby villages
- **2 Nos. KT Weir** restored
- More than **285 acre land** brought under **irrigation**

11. Best Practices - Non Energy Efficiency

11.1 Best Practices – Non-Energy Efficiency

Flexibility	Digitisation- "Digital GWEL"	Biodiversity	Afforestation	Asset Management
Sale of 10 MW of Power saved through APC in Market	**Project SARATHI - Digital Platform for Becoming Paperless**	**Friendly Habitat for Floras & Faunas**	**Green GWEL**	**GWEL is Certified with Asset Management System**
➢ Regulatory Market with Fixed tariff ➢ **Sustenance** by **Agility & Innovation** ➢ **First Plant to Materialize this Opportunity for Revenue Generation** ➢ Revenue Generation – 13.73 Crs	**31 Process Digitized** with **PDCA approach** ➢ Digital Logbook ➢ Near Miss, Incidents ➢ IMS Internal Audits ➢ Waste Management ➢ Vehicle Gate Pass ➢ Agency Gate Pass ➢ Agency Evaluation ➢ HIRA ….. ETC	➢ Increase in no. of various bird species like Indian pond heron, Indian roller, etc ➢ Various varieties of fruit bearing & forest species plants like Danima, Eycaliptus, Golichowli, Conocorophous, Jamun, Amla etc	➢ **41% of the total Plant area is covered under Green Belt against norm of 33%** ➢ Total **205250 No.** of Plants has been planted in plant area. ➢ Plantation has been done in nearby villages under CSR activity.	AMS Helped in ➢ Performance & Cost improvements ➢ Management of risk ➢ Enhanced stakeholder confidence AMS implementation by ➢ Asset System Manual ➢ AMS Procedures ➢ Work Instructions and Manuals ➢ Identification of Significant Assets by Asset Risk register



11. Best Practices - Non Energy Efficiency

11.1 Best Practices – Non-Energy Efficiency

Research

Power Sale Optimization Model

- **Data analysis tool to generate innovative solutions to Cope with dynamic & regulated scenario for correct decision making for profitability improvement**

New Technology

Online Monitoring System for Ash & Density

1. **Online Ash & Moisture Content Analyzer** – Provides instantaneous, continuous, on-belt measurement of Ash and Moisture in coal
2. **Online Ash Density Meter** - for Continuous Online monitoring of water content to optimized on water consumption

Wellness

Nirmal Jeevan Initiative

Employees Wellbeing is of Paramount Importance

Various Wellbeing Initiatives being taken

- Fun Run
- Kausalika
- Tournaments
- Celebrations
- Open Air Movie
- Outbound Trainings
- Yoga & Mindfulness
- Heath Awareness

Maintenance & Reliability

Reliability Centered Maintenance

Best in class Maintenance Methodologies adopted for 100% reliability

- Vibration Analysis
- Lube Oil Analysis - Wear Debris, NAS, TAN
- Infrared Thermography
- Dissolved Gas Analysis
- Motor Current Signature Analysis
- At GWEL we follow Six Sigma based approach for Chronic issues.

Beyond The Fence- CSR

Social Responsibility

- Infrastructure support to Govt. Schools
- Kid Smart Centres
- Transportation Facility for students
- Health Clinics & Camps
- Construction of Individual Sanitary Lavatory
- Vocational Training Centre
- Tailoring centres for women
- Farmers Training
- Community Libraries
- Drain Construction


Education


Health Hygiene & Sanitation


Empowerment & Livelihood


Community Development

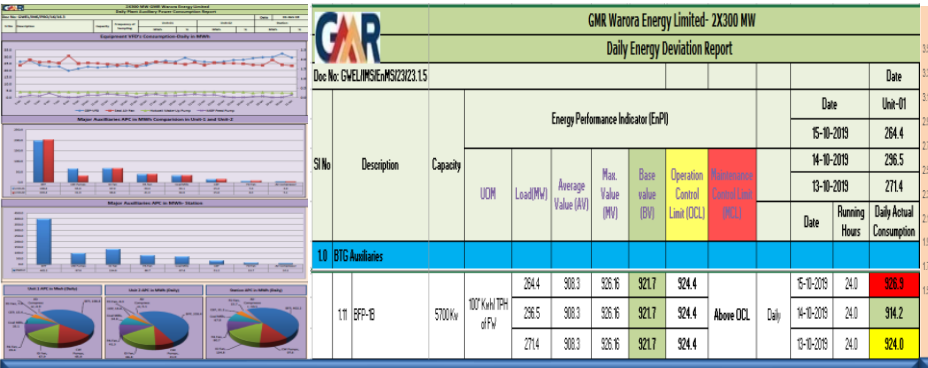
12. Team work, Employee Involvement & Monitoring

12.1 Monitoring of Energy Consumption

Centralized Energy Management System

- ✓ **Real Time Comparison of HT & LT Equipment's Auxiliary Power consumption** in EMS system for **BTG, BOP, AHP & CHP**
- ✓ **Auto Reports Generation for Energy Consumption** on Daily/ Monthly and FY basis
- ✓ **Trending for better Analysis** of Energy Consumption
- ✓ Availability of Plant-wide Equipment's with Rating >75KW
- ✓ Availability of Alarm, Auto SMS & Auto Mail Facility
- ✓ **System Upgraded for**
  - ✓ Integration with DCS for Monitoring of Energy variation wrt interlinked variables

12.2 Daily MIS Reports for Monitoring of Energy Consumption

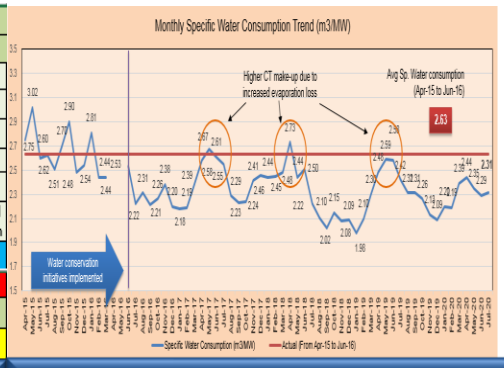

GMR Warora Energy Limited- 2X300 MW

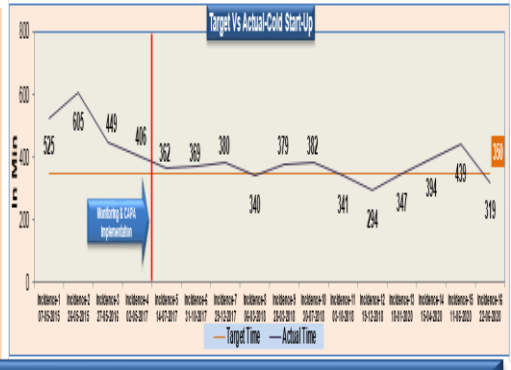
Daily Energy Deviation Report

Doc No: GWEL/IMS/EnMS/23/23.1.5

Sl No	Description	Capacity	UOM	Load(MW)	Average Value (AV)	Max. Value (MV)	Base value (BV)	Operation Control Limit (OCL)	Maintenance Control Limit (MCL)		Date	Running Hours	Daily Actual Consumption
	Energy Performance Indicator (EnPI)									Date			Unit-01
										15-10-2019			264.4
										14-10-2019			296.5
										13-10-2019			271.4
1.0	BTG Auxiliaries												
1.11	BFP-1B	5700Kw	100*KwH TPH of FW	264.4	908.3	926.16	921.7	924.4	Above OCL	Daily	15-10-2019	24.0	926.9
				296.5	908.3	926.16	921.7	924.4			14-10-2019	24.0	914.2
				271.4	908.3	926.16	921.7	924.4			13-10-2019	24.0	924.0

Daily APC & Energy Deviation Report



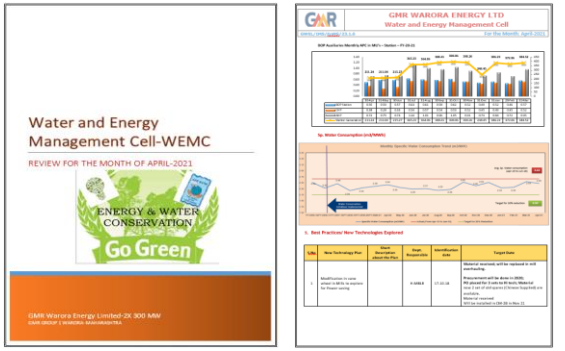


Sustenance Monitoring Reporting

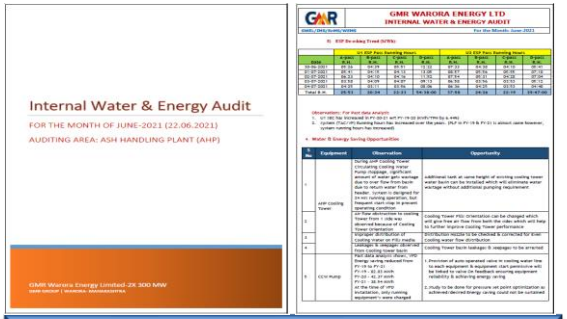
12. Team work, Employee Involvement & Monitoring

12.3 Involvement of Employees in Energy Conservation

- **Formation of Water & Energy Management Cell under ISO-50001 & ISO-46001**
- **Objectives of EMC :**
  - Monitoring of Specific Water & Energy Consumption
  - Water & Energy Audit (Internal & External) & Recommendation implementation status review
  - Discussion on Water & Energy Conservation Projects
  - Identification of New Water & Energy Conservation Initiatives
- **Members of EMC :** Plant Head (Chairperson), O&M Head, Head of WEMC, WEMC members (Energy Managers & Auditors)
- **Total Energy Managers- 21 Energy Auditors- 18**
- **Appointment of Water & Energy Leaders**
  - Appointed throughout the plant & township
  - Monitoring of Water & Energy consumption in their area
  - **Reporting of Energy (Electrical, Thermal, Air, Water wastage)**
  - Identification of Water & Energy saving opportunities.
  - Monthly Localized Water & Energy Audits through Checklist
  - Quarterly Detailed Water & Energy Audit by Team of Energy Auditors & Managers
  - **Total 23 Water & Energy leaders appointed.**



WEMC MOM



Internal Water & Energy Audit under Water & Energy Management Cell

12. Team work, Employee Involvement & Monitoring

12.4 Trainings & Workshops related to Energy Conservation

Internal & External Trainings and Workshops related to Energy Conservation

Sr.No	Program Name & details	Organized By
1	**Six Sigma Training to All Employees for Structured Methodology of Energy Efficiency Optimization**	M/s KPMG
2	**Workshop on Opportunities for Energy Saving in Thermal Power Plant**	M/s NPC
3	**Workshop on Energy Audit Process for effective Energy auditing**	M/s NPC
4	Understanding the best practices of Energy Management System	M/s EU India
5	CII Energy Efficiency Summit	M/s CII
6	National Boiler Work Shop	M/s NPC-Visakhapatnam
7	**O&M conference on best practices by NTPC**	M/s NTPC
8	Overview of PAT Scheme: Achievements & prospects	M/s BEE
9	**Regional Workshop on PAT Scheme**	M/s BEE
10	**Strategies & Best Practices on Energy Efficiency, Conservation & Management for Sustainability" by CII**	M/s CII Nagpur
11	**Workshop on "Advanced Training Program on Energy Efficiency" by CII**	M/s CII Hyderabad
12	**Workshop on "RCM & Streamlining the Maintenance Processes for Better Productivity & Energy Efficiency" by CII**	M/s CII Nagpur
13	**Workshop on Induced Draft Cooling Tower Performance Enhancement**	In-house
14	**In-house Workshop on Plant Performance Monitoring-(Boiler Efficiency, Heat Rate, Cooling Tower, Pump, Fans)**	In-house
15	**Knowledge Sharing Session on "Operational SOP for Auxiliary Power Consumption Reduction at GWEL"**	In-house
16	**Training on Energy Management System (ISO 50001) & Energy Conservation awareness for all stakeholders**	In-house
17	In-house Workshop on Learning from Failures in Thermal Power Plants	In-house
18	In-house Workshop on Learning from COH in Thermal Power Plants	In-house




12. Team work, Employee Involvement & Monitoring

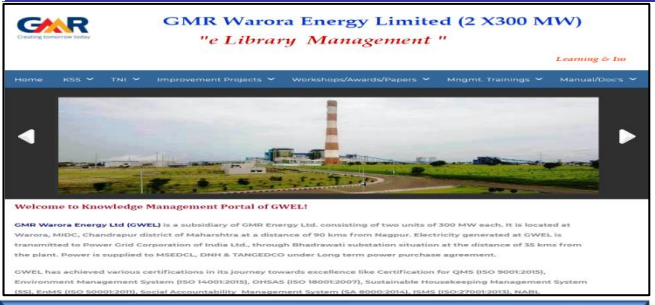
12.5 GWEL – Celebration of Energy Conservation Week

- Display of Energy Conservation Posters
- EC Training for GWEL Employees and Associate employees
- EC Programme for Children of nearby village schools
- Competitions based on EC for Employees, Associates, family members etc
- EC programme for family members
- Felicitation of Winners

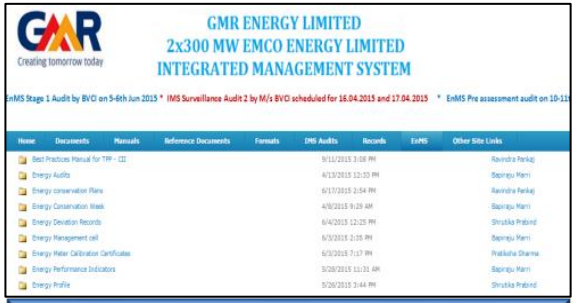
12.6 GWEL –Training & Awareness to Associates



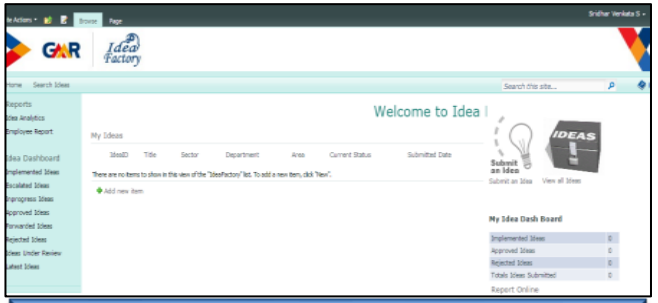

12.7 GWEL - Web based Portals for Creating Awareness



Knowledge Management Portal in Intranet



EnMS (ISO 50001) Web Portal in GMR intranet



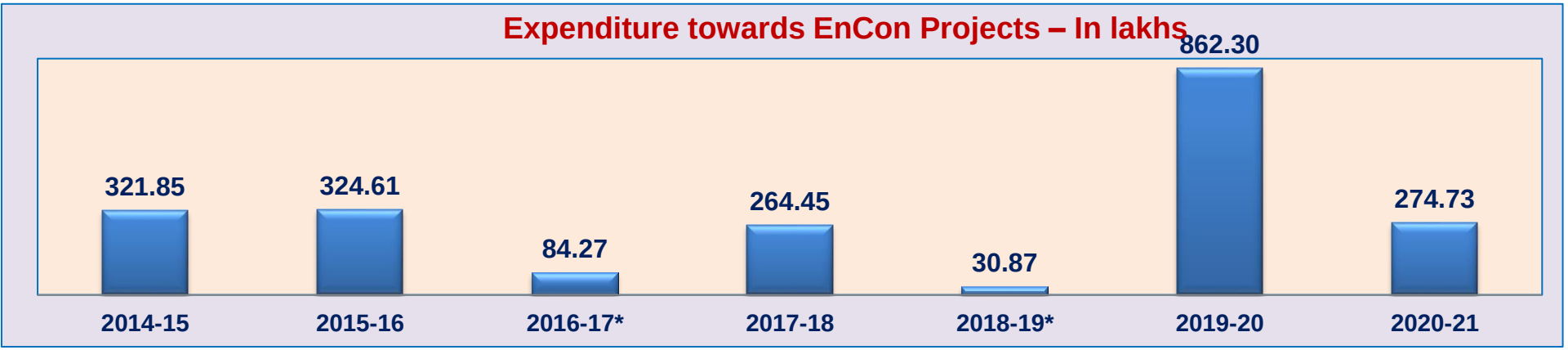
EnMS (ISO 50001) web page in GMR intranet

12. Team work, Employee Involvement & Monitoring

12.8 Projects implemented through Kaizen (Workers and Supervisor level)

At Supervisor Level	At Workmen Level
❑ Energy Conservation through Installation of Wind Driven Exhaust fan in RO-DM building Roof Top	❑ Installation of Sensor lights in Washrooms
❑ Stopping of Ferric Chloride dosing pump by providing Ferric Chloride Tank By-pass discharge line for gravity dosing	❑ Auto Operation of Lamps in CW pump house by Day-Night Sensor
❑ CSU Screw Conveyor Bypass Modification Work for stopping Motor	❑ Utilization of EC Pit water for floor cleaning instead of fresh water
❑ Replacement of Conventional exhaust fans with energy efficient exhaust fans at washrooms.	❑ Reduction in Auxiliary Power Consumption in Compressor House by identifying and attending air leakages.

12.9 Expenditure towards EnCon Projects



% Investment on Turnover in FY 2020-21 : 0.20%

- **- Implementation of few projects of FY 2016-17 was already started in FY 2015-16. Budget of these projects is considered in FY 2015-16.**
- **- Implementation of LED projects of FY 2018-19 was already started in FY 2017-18. Budget of this projects is considered in FY 2017-18**

12.10 Major Area of Concern in Energy Efficiency & Reliability

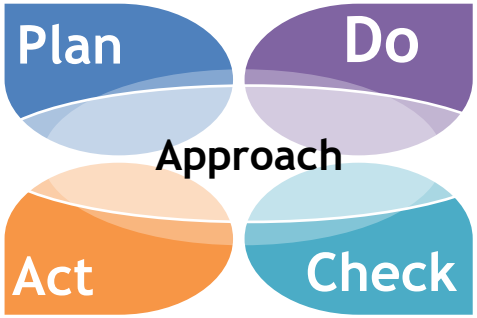
PPA Expiry	One out of 3 PPA which is **contributing to 37% of Station export capacity** got expired in June-20 which is significantly affect plant performance in absence of new market opportunity & dynamic scenario of exchange market
Coal Issue	Plant PLF is getting affected due to **Coal Quality & Quantity Constraint** & same is affecting station Performance
Machine Aging	Impact of **Machine aging** on Plant Performance
Increase in APC due to FGD	**FGD** installation will result in **increase in plant Auxiliary Power Consumption**
Fund Availability	**Fund availability** major constraint for Technological Upgradation
Increase in Renewable Energy Portfolio	Increase in worldwide **Renewable Energy portfolio** is necessity for tackling Climate change issues but same **may affect Plant PLF which will effect performance**

13. Implementation of ISO 50001 at GWEL

13.1 Implementation of ISO 50001- Upgraded to ISO 50001:2018

- ✓ Energy Objectives & Targets
- ✓ Separate budget for Energy Conservation
- ✓ Participation in Various Forums & Awards
- ✓ Training & Knowledge Sharing

- ✓ Adoption of New Technologies
- ✓ Renewable Energy Projects
- ✓ EC Plans Implementation
- ✓ Green Supply Chain Management



- ✓ Best O&M Practices
- ✓ Energy Conservation projects for Stakeholders & CSR
- ✓ Sustenance Monitoring

- ✓ Evaluation of Energy Performance
- ✓ Internal & External Energy Audits
- ✓ Evaluation of Vendors / Suppliers
- ✓ Benchmarking of Performances

Electrical Energy(KWh)	Thermal Energy- Coal	Thermal Energy- LDO	Thermal Energy- HSD
As per Motor Capacity-APC	Coal Consumption-Heatrate	LDO Consumption-SOC	Equipments consuming HSD
✓ Installing Energy Meters and Monitoring online through EMS ✓ Accuracy Class of Energy meters : 0.5 ✓ Calibration Schedule in form of SAP notification.	✓ As Fired Coal Weighment through Coal Feeders. ✓ Coal feeder Integrator recorded in DCS. ✓ Accuracy Class : +/- 0.2% ✓ Calibration Schedule in form of SAP notification.	✓ LDO tank oil level & the difference of the tank level with respect the calibration charts is monitored. ✓ LDO tank oil level Transmitters are calibrated on regular basis	✓ HSD tank oil level & the difference of the tank level with respect to calibration chart is monitored. ✓ HSD tank oil levels are Monitored on regular basis

Total 180 Energy Conservation SIP's implemented in last 7 FY's.

13. Implementation of ISO 50001 at GWEL

13.2 GWEL - Management of Energy Conservation Program- SIP Digitalization-Complete Cycle in SAP

1. Identification

- Identification through Internal/ External Audits, RCA for Energy deviations. Approval of Plant Head

2. Implementation

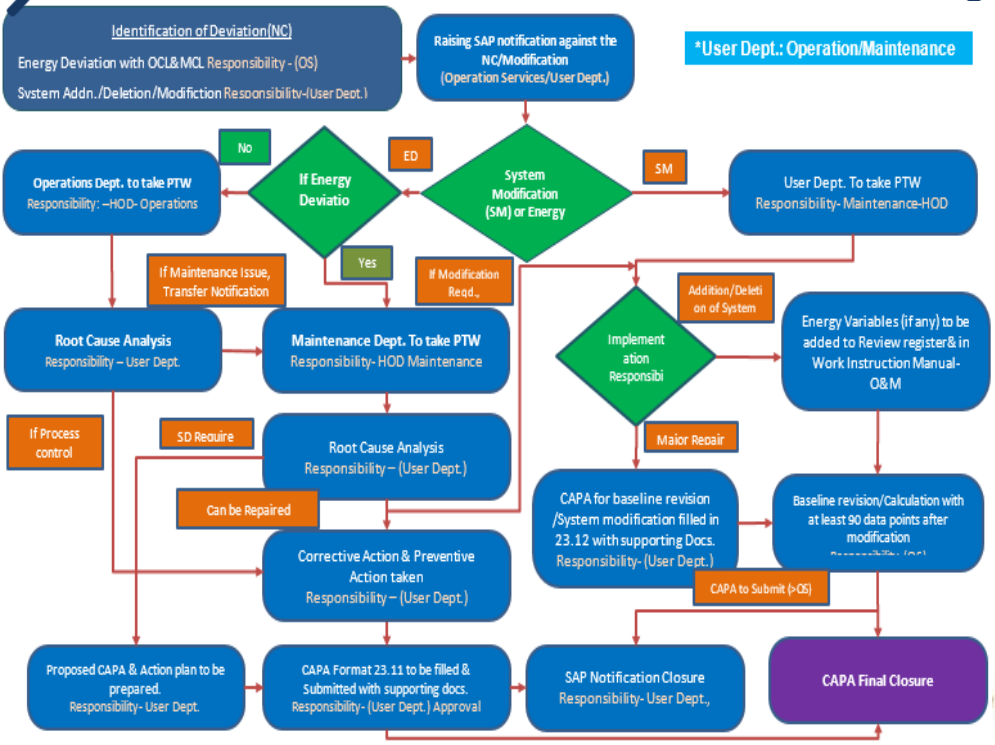
- EC Plan Implementation Plan is Approved by Steering committee headed by Plant Head

3. Completion

- Post Completion of EC Plan, Completion along with Benefits will be certified by Steering committee

4. Effectiveness & Sustenance

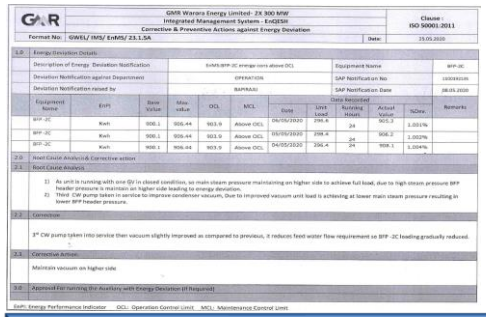
- Actual savings achieved to be furnished against expected after 1 month of project completion.

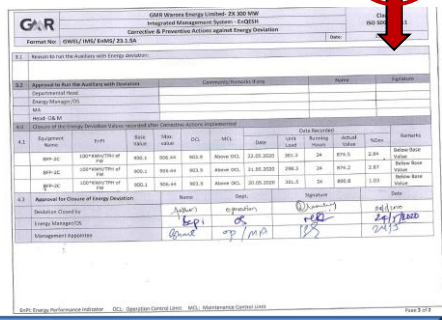


GMR Warora Energy Limited- 2X300 MW
Daily Energy Deviation Report

Doc No: GWEL/IMS/EnMS/23/23.1.5

Sl No	Description	Capacity	Energy Performance Indicator (EnPI) UOM	Load (MW)	Average Value (AV)	Max. Value (MV)	Base value (BV)	Operation Control Limit (OCL)	Maintenance Control Limit (MCL)	Duration	Date	Running Hours	Unit-02 Daily Actual Consumption
											09-05-2020		300.8
											08-05-2020		297.6
											07-05-2020		298.3
1.0	BTG Auxiliaries												
1.15	BFP-2C	5700 Kw	100* Kwh/ TPH of FW	300.8	881.0	906.4	900.1	903.9	Above OCL	Daily	09-05-2020	24.00	908.17
				297.6	881.0	906.4	900.1	903.9			08-05-2020	24.00	903.19
				298.3	881.0	906.4	900.1	903.9			07-05-2020	24.00	899.05





Monitoring through Daily Energy Deviation Report & Deviation Closure by CAPA Closure Mechanism

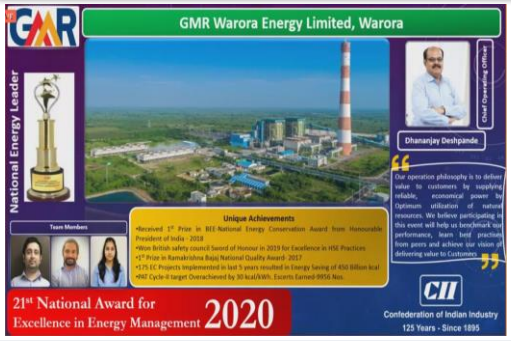
14. Learning from CII/Other Award Program

- To learn about the best practices adopted from best performing companies.
- CII event gives opportunity for Inter & Intra Sector Benchmarking for improvement
- Facilitate adoption of similar projects at our unit, leading to enormous saving viz.
  - Intelligent Flow Controller - Textile Sector
  - Airtron AC Energy Saver - Airport Sector
  - Mill Dynamic Classifier - Cement Sector
- An Opportunity to interact & network with individuals and companies of repute for further strengthening Energy Efficiency System
- CII Best Practices Manual brings Potential Projects with high replicability of Energy Saving
- Information about Latest market trends & innovative products for Energy Efficiency .
- To identify strengths and opportunities to excel, based on a comprehensive and rigorous assessment by experts.

15. Awards & Accolades

BEE-National Energy Conservation Award 2020-Consecutive 2 Times

BEE-National Energy Conservation Award 2017

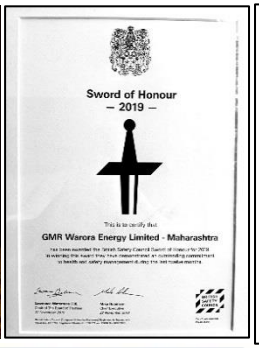


CII National Energy Leader Award for Excellence in Energy Management-2020

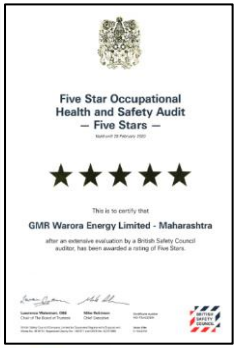
CII Innovative Environmental Project 2021

IMC Ramakrishna Bajaj National Quality Award 2017

Global Performance Excellence Award 2018-World Class



Sword of Honor 2019



BSC 5 Star 2019

There is a Name for those Who Conserve Energy….

… SMART

Thank You…

Team Member Details:

1. Mr. Vinod Gaidhar - Associate General Manager - 8390903510 -Vinod.Gaydhar@gmrgroup.in
2. Ms. Pratiksha K Sharma - Manager - 8380098446 -Pratiksha.Sharma@gmrgroup.in
3. Mr. Vinod Mullapudi - Associate Manager - 8390903571 -VinodKumar.Mullapudi@gmrgroup.in