Brief Introduction on Company/Unit

860MW - SBU2– 2 X 300MW
SBU1- 2 X 130MW

TEAM MEMBERS

Mr. Hanumanth Rao (AGM), Mr. INVSS Kumar (Mgr), Mr. Hemant Chouhan (Dy Mgr)

Brief introduction on Company/Unit

Introduction

JSW Energy is one of the most efficient power generation companies in India. With a capacity of 5.39 GW spread across several locations, with generation facilities at Vijayanagar, Ratnagiri, Barmer and Sholtu

Vijayanagar Plant:

Located in Vijayanagar, Karnataka, this plant consists of two separate business units, along with steel captive power with a combined capacity of 1690 MW. 2x130 MW project is one of the first kind registered under Clean Development Mechanism (CDM) mechanism for reduction of GHG emissions and received 4.95 Million CERs.

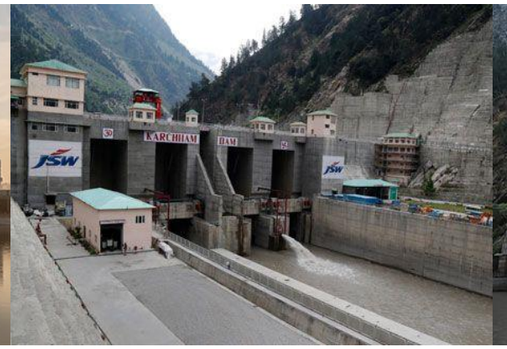
Running on imported coal and a blend of coal from other different sources that help boost cost effectiveness. This unit is retrofitted with in-house burners to operate with steel plant by-product gases.

225 MW Solar Power plant has been commissioned in April 2022 for Captive use in JSW Steel Plant

Vijayanagar

Ratnagiri

Barmer



Karcham

Basapa

GROWTH PATH...

JOURNEY TOWARDS EXCELLENCE

JSW ENERGY, VIJAYANAGAR

Jindal Tractebel Power Company Ltd

Year 1994

SBU1 2x130MW COD

Year 2000

Jindal Thermal Power Company limited

Year 2002

CPP1 - 100 MW COD

Year 2005

CPP2- 130 MW COD

Year 2005

JSW Energy Ltd.

Year 2006

SBU2 2x300MW COD

Year 2009

CPP3 & CPP4 2X300MW COD

Year 2012

400 kV BPS

Year 2017

225 MW Solar Power Plant

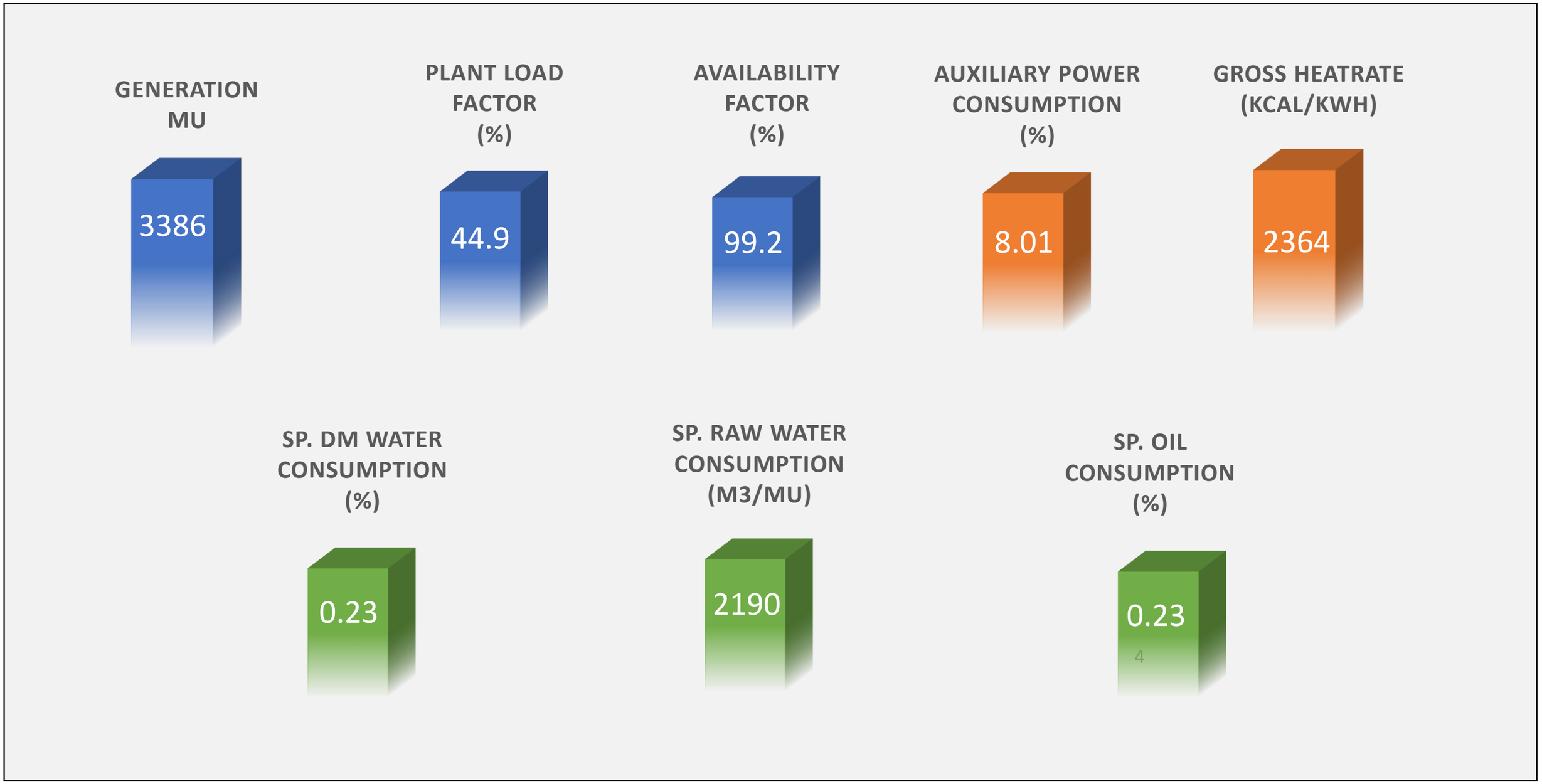
Year 2020/22

1690MW Thermal + 225 MW Solar

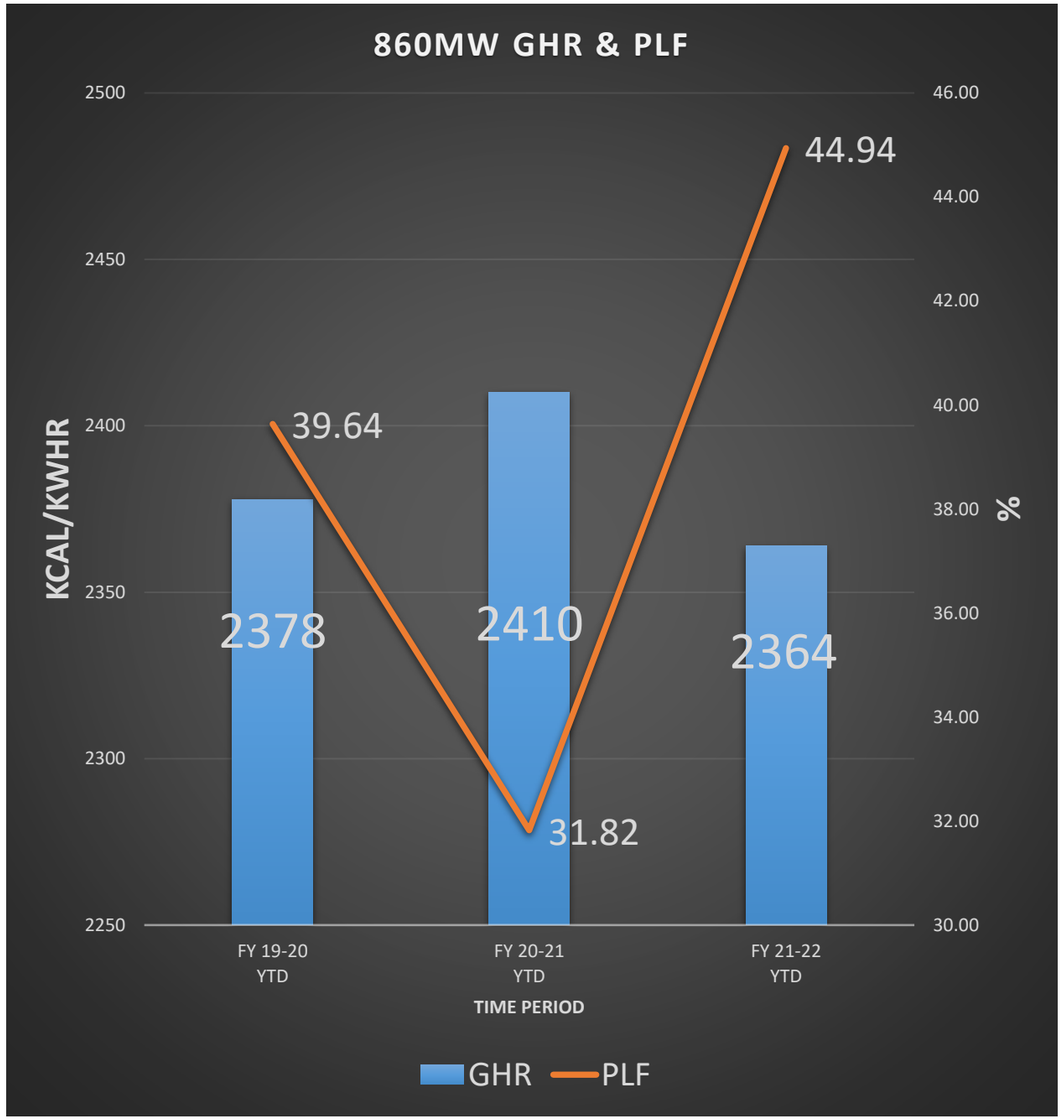
260 MW

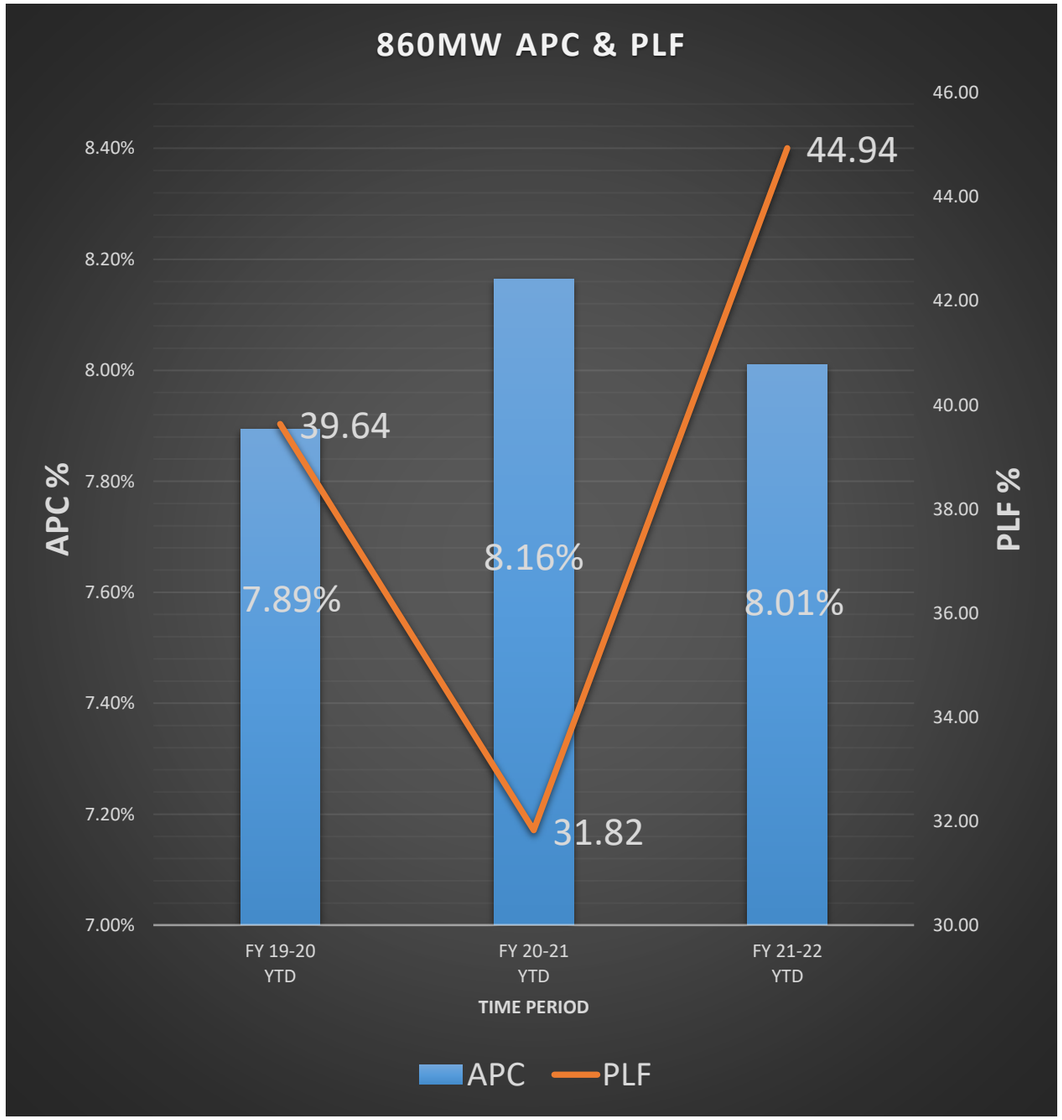
Better Everyday

Energy Consumption Overview FY 21-22



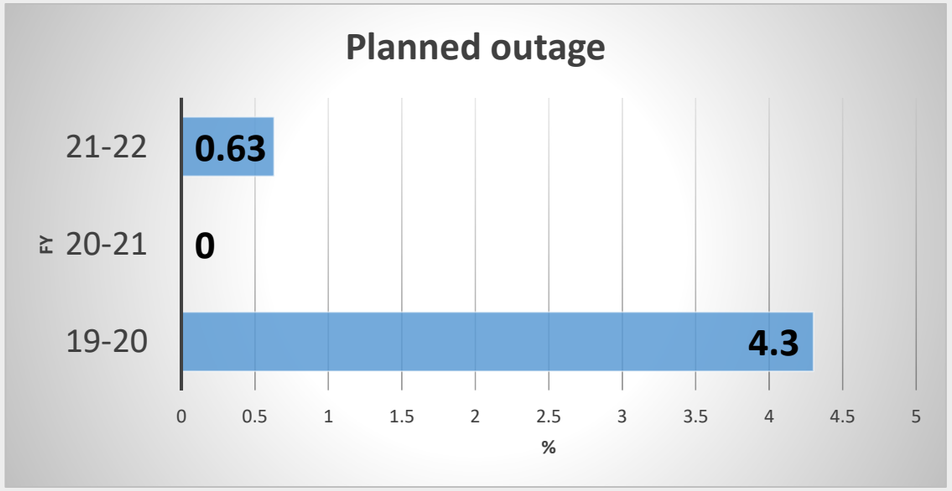
Sp. Energy Consumption in last 3 years (FY 2019-22)

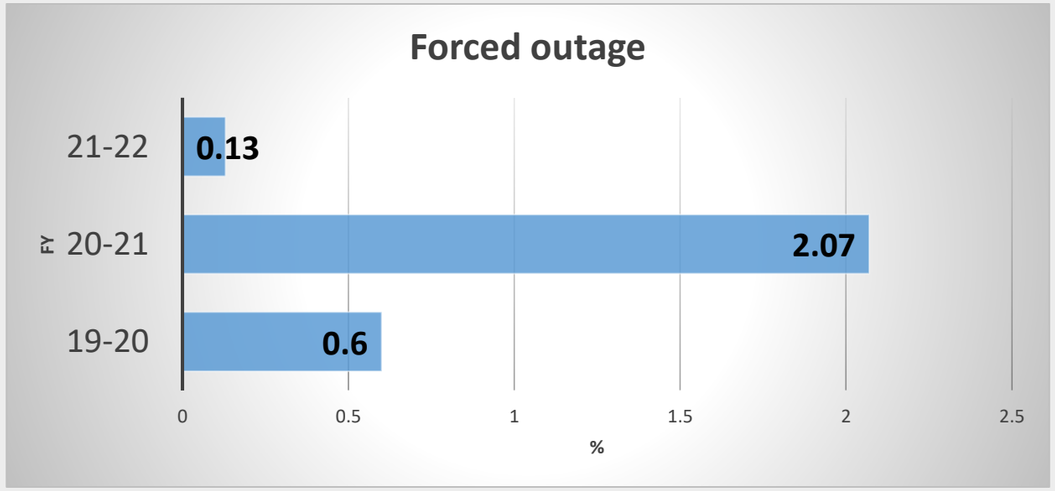




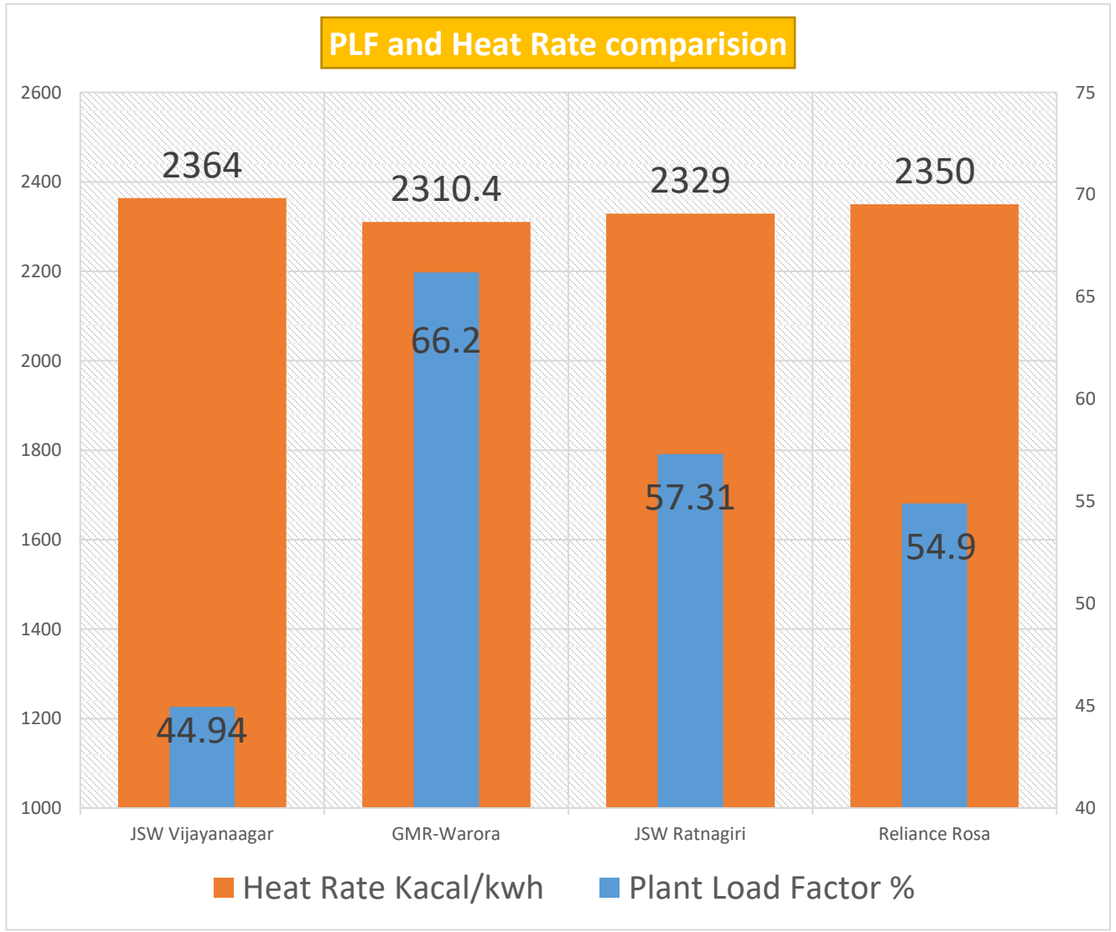
PLF has increased, GHR and APC have reduced

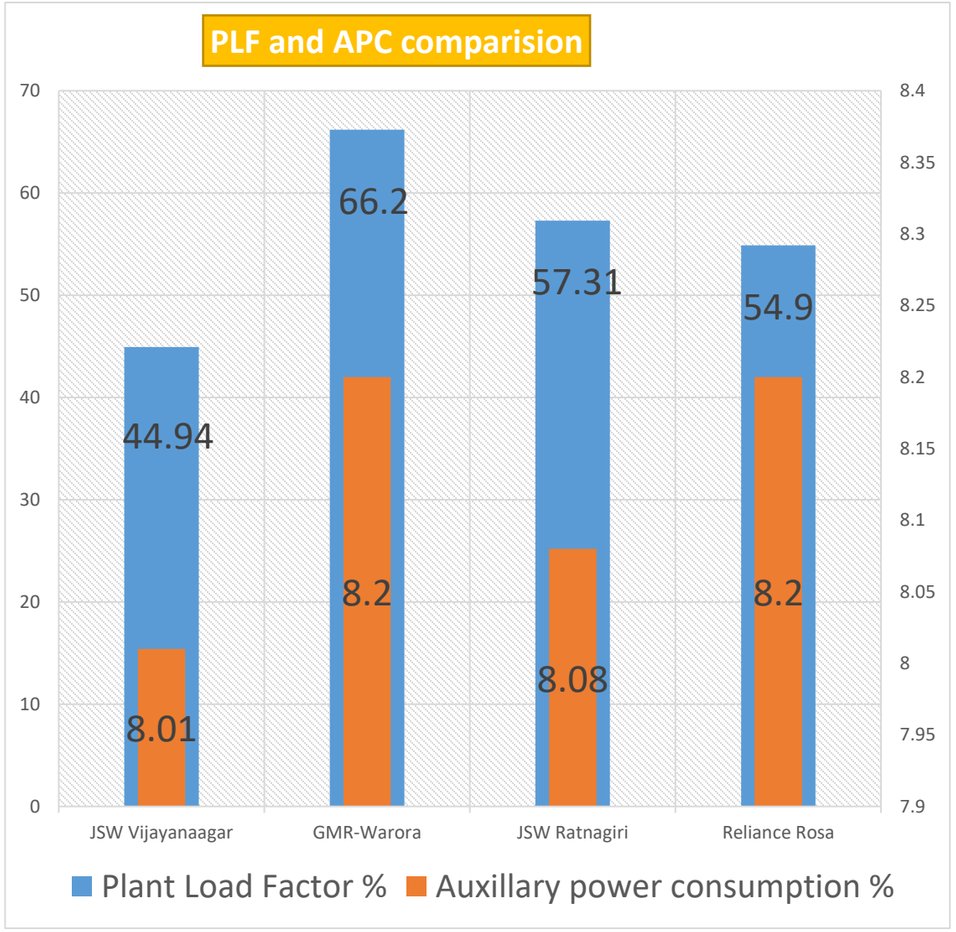
Availability Trend for last 3 years (FY 2019-22)





Internal benchmarking/external benchmarking

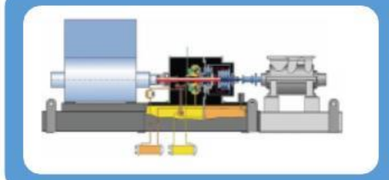
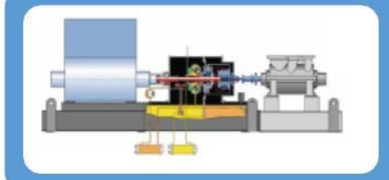




Heat Rate is competitive with plants running at much higher PLF

APC is lower in spite of very low PLF

Encon PROJECTS PLANNED IN FY 22-23

	BFP-1A & 1C De-staging to save energy consumption, similar to already done	Investment –Rs.63 Million Benefit – 5.7 MU electricity savings per annum
	Installation of VFD drive in ID Fans of one of the 300 MW units to reduce power consumption	Investment –Rs.38 Million Benefit – 4.9 MU electricity savings per annum
	Installation of VFD drive in PA Fans of one of the 300 MW units to reduce power consumption	Investment –Rs.34 Million Benefit – 1.2 MU electricity savings per annum
	Enhancing the cooling tower effectiveness by replacing the cross flute fills with hybrid trickle grid fills	Investment –Rs.170 Million Benefit – CT Effectiveness improvement, 13907439 Million Kcal thermal savings
	Replacement of APH baskets in SBU-2 Unit-1 for APC improvement	Investment –Rs.45 Million Benefit – 3.5 MU electricity savings per annum

ENERGY SAVING PROJECTS IMPLEMENTED

JSW Energy
Better Everyday

Financial Year	No. of Energy savings project	Investment Rs. Million	Electrical savings (Million KWHr)	Thermal savings (Million Kcal/MTOE)	Savings (INR Million)
2021-2022	6	28.300	3.3460	0.000344	30.11
2020-2021	5	14.265	3.0495	0.000536	15.88
2019-2020	9	47.29	4.93294	0.001445	40.92
Total	18	61.55	11.328	0.002569	86.91

SUMMARY OF ENERGY SAVING PROJECTS IMPLEMENTED FOR LAST 3 FINANCIAL YEARS

JSW Energy
Better Everyday

Financial Year	PROJECT	Investment Rs. Million	Electrical savings (Million KWHr)	Thermal savings (Million Kcal/MTOE)	Savings (INR Million)
2021-22	Instrument Air Compressor Power Consumption Optimization by attending system leaks	0	0.543	0	4.887
2021-22	PAF 1A IGV throttling losses rectification by replacing hydro coupling scoop	0.3	0.442	0	3.978
2021-22	SBU1 Compressor -A Power Consumption Optimization by changing from base mode to suction throttling mode	0	0.314	0	2.826
2021-22	SBU2 BFP 1A RC Passing identification & rectification	0	1.593	0	14.337
2021-22	SBU2 U1 CEP Bypass MOV open to reduce throttling losses across deaerator level CV	0	0.205	0	1.845
2021-22	Turning gear & JOP Stopped in reserve unit	0	0.249	0	2.241
2021-22	SBU2 U1 8 CT cell fills replaced with trickle grid	28	1.396	0.0003442	8.364
2020-2021	CEP VFD Deaerator level logic implementation to reduce throttling losses of Deaerator control valve	0	0.5326	0	1.7416
2020-2021	SBU2 U1 4 CT cell fills replaced with trickle grid	14	0.6983	0.0001721	4.182

SUMMARY OF ENERGY SAVING PROJECTS IMPLEMENTED FOR LAST 3 FINANCIAL YEARS

JSW Energy
Better Everyday

Financial Year	PROJECT	Investment Rs. Million	Electrical savings (Million KWHr)	Thermal savings (Million Kcal/MTOE)	Savings (INR Million)
2020-2021	SBU2 U1 Reduction in Net Unit Heatrate by improving the vacuum at 140MW by Keeping 2 CWP in service	0	1.3500	0.000286	7.565
2020-2021	SBU2 U1 Clear water pump sump Level Auto control by varying VFD speed	0	0.1253	0	0.40974
2020-2021	SBU2 U1 Condenser cleaning 8-March-2021	0.265	0.3433	0.00007823	1.986
2019-2020	Energy conservation by seal air header pressure optimization w.r.to coal flow	0	0.12813	0	0.45
2019-2020	Energy conservation by stopping of Standby Mill Lube Oil Pumps in SBU2 units	0	0.02145	0	0.07
2019-2020	SBU-2 Unit-1 improvement in cooling tower effectiveness by 7% by replacing the existing cross flute PVC CT fills with anti-clogging trickle grid fills in 06 Nos of CT cells	19.79	0	0.0013388	18.08
2019-2020	SBU-2 reserve unit Cold startup oil consumption optimization	0	0	0.0001058	5.59

SUMMARY OF ENERGY SAVING PROJECTS IMPLEMENTED FOR LAST 3 FINANCIAL YEARS

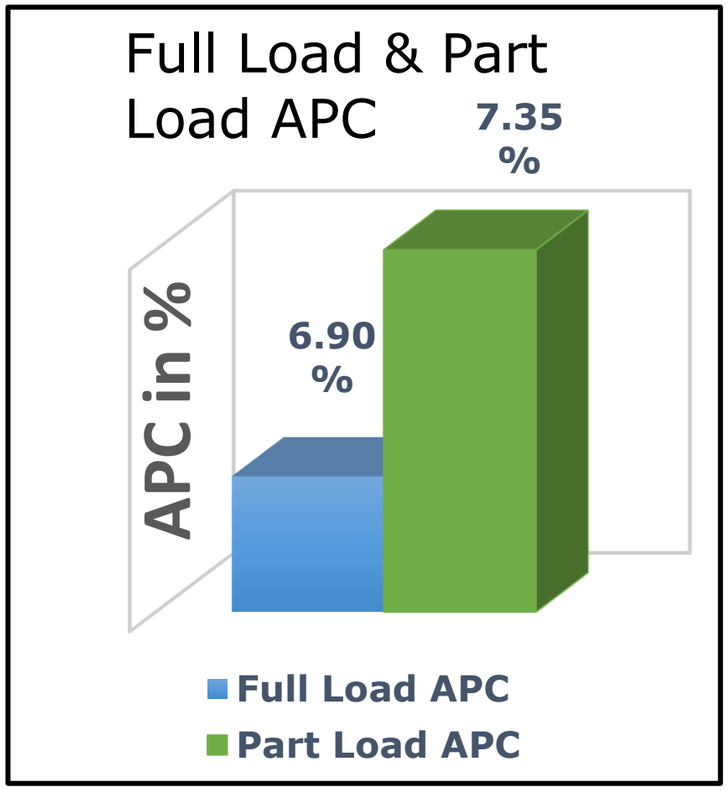
JSW Energy
Better Everyday

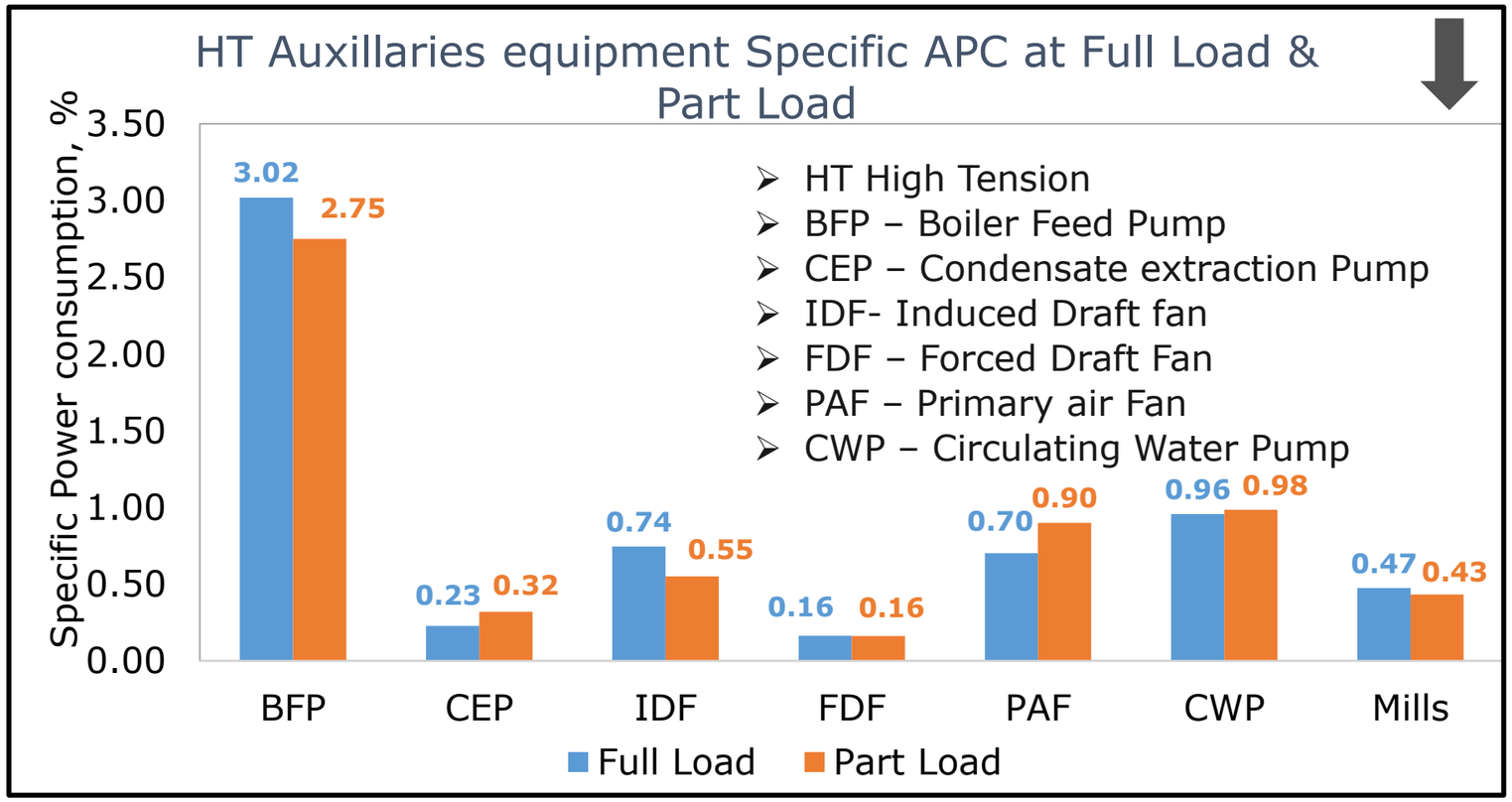
Financial Year	PROJECT	Investment Rs. Million	Electrical savings (Million KWHr)	Thermal savings (Million Kcal/MTOE)	Savings (INR Million)
2019-2020	Replacement of APH baskets and reducing the DP across APH there by reducing power consumption of ID and PA fans	27.5	0.876	0	3.06 *
2019-2020	SBU-1- Reduction of power consumption of 135kWh by switching OFF ESP hopper heater, shaft insulator heaters and rapping motors during reserve shutdown of unit	0	1.13765	0	3.98
2019-2020	SBU-1- Reduction of power consumption of 30Kwh in Instrument air compressor by running in suction throttle mode over Base mode.	0	0.2635	0	0.92
2019-2020	Reduction of Auxiliary power nearly 172 KWh by optimisation of equipment running during the minimum export schedule, optimisation of total air flow with respect to % of Oxygen at APH inlet thereby reduction of power consumption in ID,FD and PA fans	0	1.0662	0	3.73
2019-2020	Reduction of Start-up Auxiliary power from 85MWh to 45MWh for every cold start-up by optimising the equipment's in service	0	1.44	0	5.04

* Payback time is high due to unit not running because of non availability of schedule

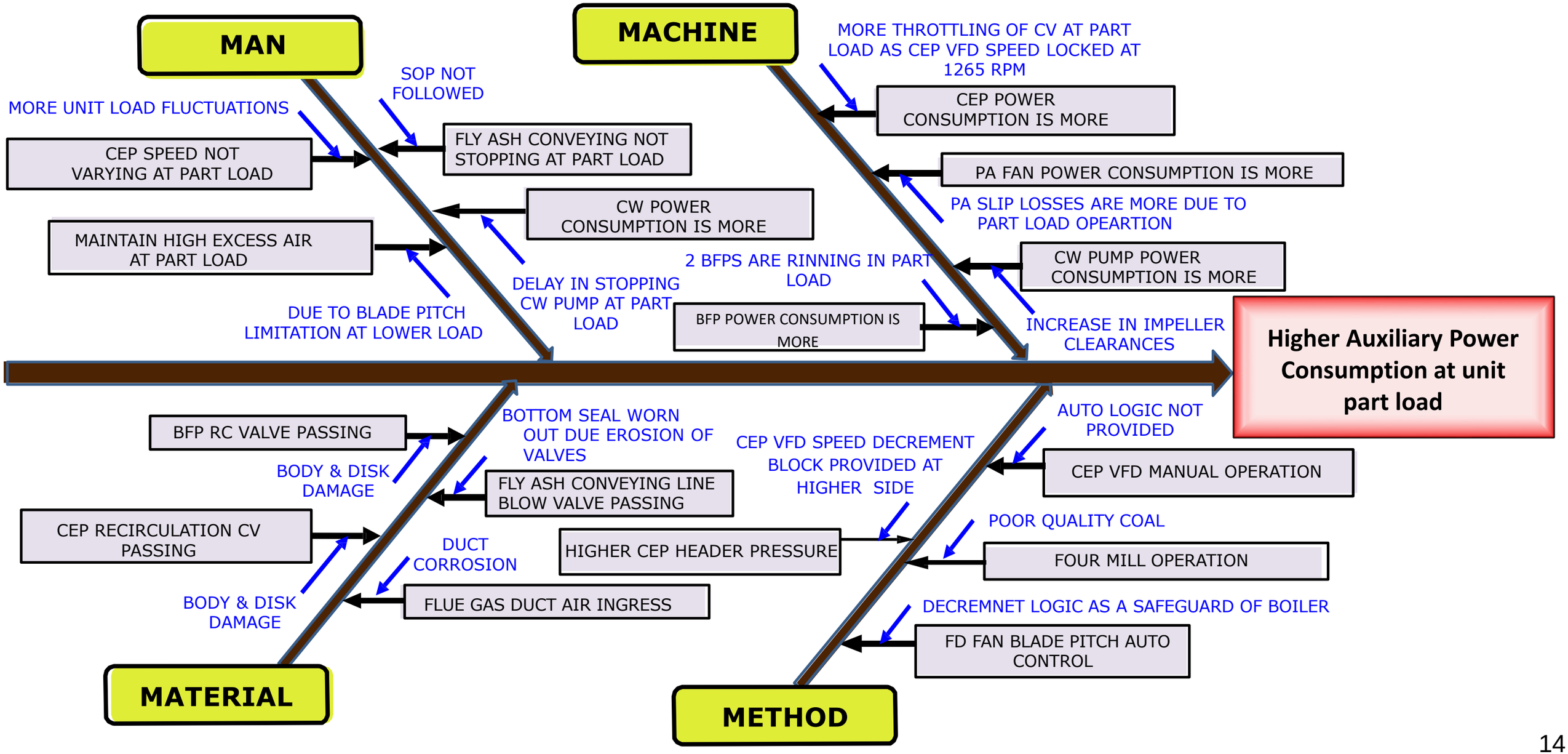
INNOVATIVE PROJECT 1 – REDUCTION OF APC AT PART LOAD

- One out of 4X300 MW unit is mostly running at part load (75 to 90 MW) due to less export schedule, as well as addition of Renewable energy.
- Problem identification- During part load unit operation , APC was high 7.35%
- Solution- Micro solutions were worked upon by involving small kaizen groups.





Cause & Effect Diagram



INNOVATIVE PROJECT 1 – REDUCTION OF APC AT PART LOAD

- Measures implemented-
- Ash handling compressors stopped at part load – power savings 17 kwh
- Only 2 Mills out of six mills kept in service- power savings 450 kwh
- Only 1 set of ID an FD Fans kept running- power savings 48 kwh
- Only 1 BFP kept in service, and its one impeller stage out of six stages trimming done - power savings 284 kwh
- CEP speed reduction from 1270 rpm to 600 rpm by VFD, and Deaerator level control valve and its bypass mov full opened to reduce losses- 30 kwh
- FD fan blade pitch setting done at part load – power savings 24 kwh
- ESP fields made OFF depending upon SPM – power savings 12 kwh
- Six CT fans out of twelve stopped - power savings 90 kwh

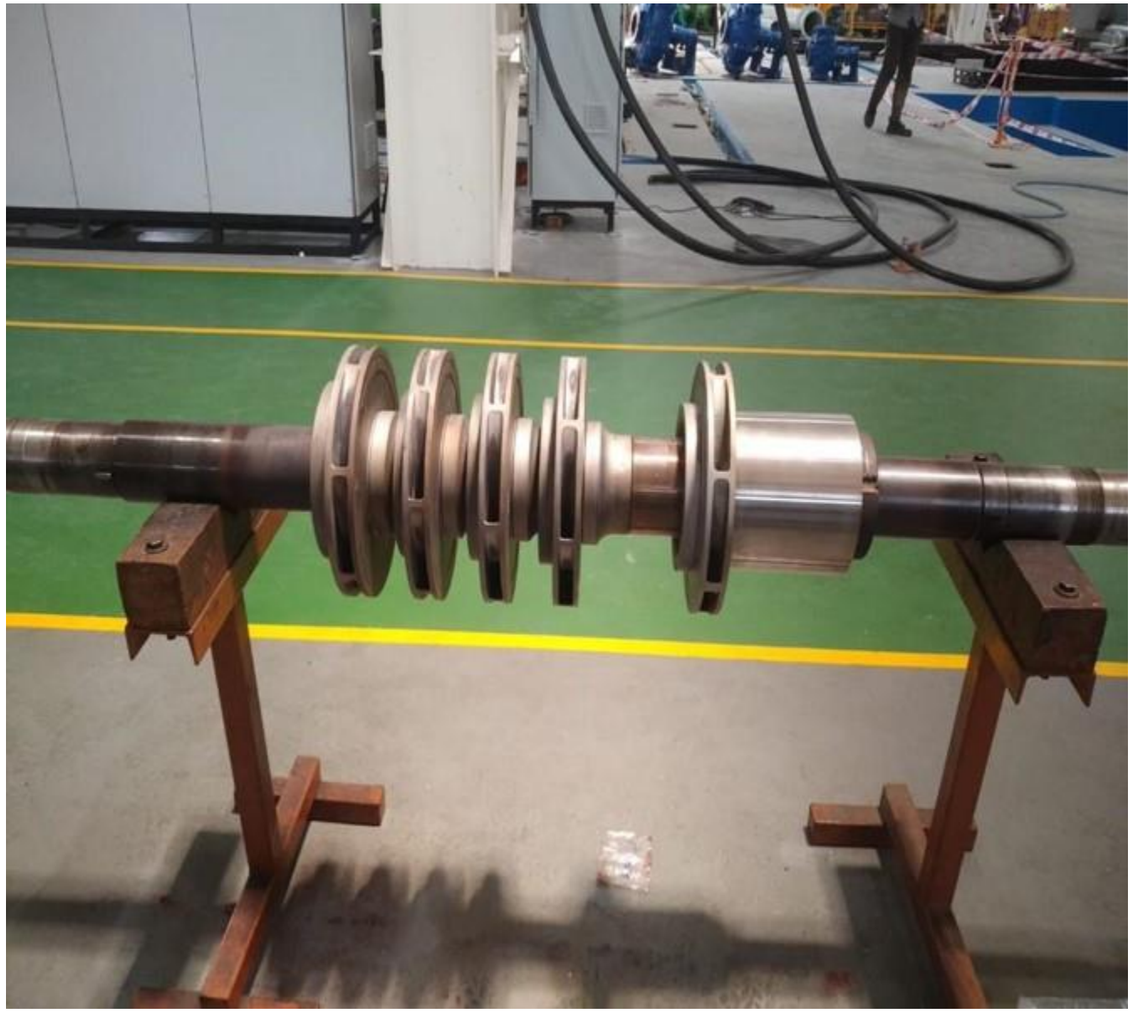
Power consumption reduction by 955 kwh at part load condition

INNOVATIVE PROJECT 2 – BFP POWER REDUCTION

- BFP- Boiler Feed Pump-1B (300 MW Unit)
- BFP’s are used in Thermal Power plant to pump water from Deaerator to Boiler Drum
- Problem identification- BFP specific power consumption was high at unit partial load
- Root cause- BFP Recirculation control valve opening at unit part load due to less Feed water requirement
- Solution- BFP de-staging
- Savings- 320 kwh , 1.3 Million units of Electricity

INNOVATIVE PROJECT 2 – BFP POWER REDUCTION

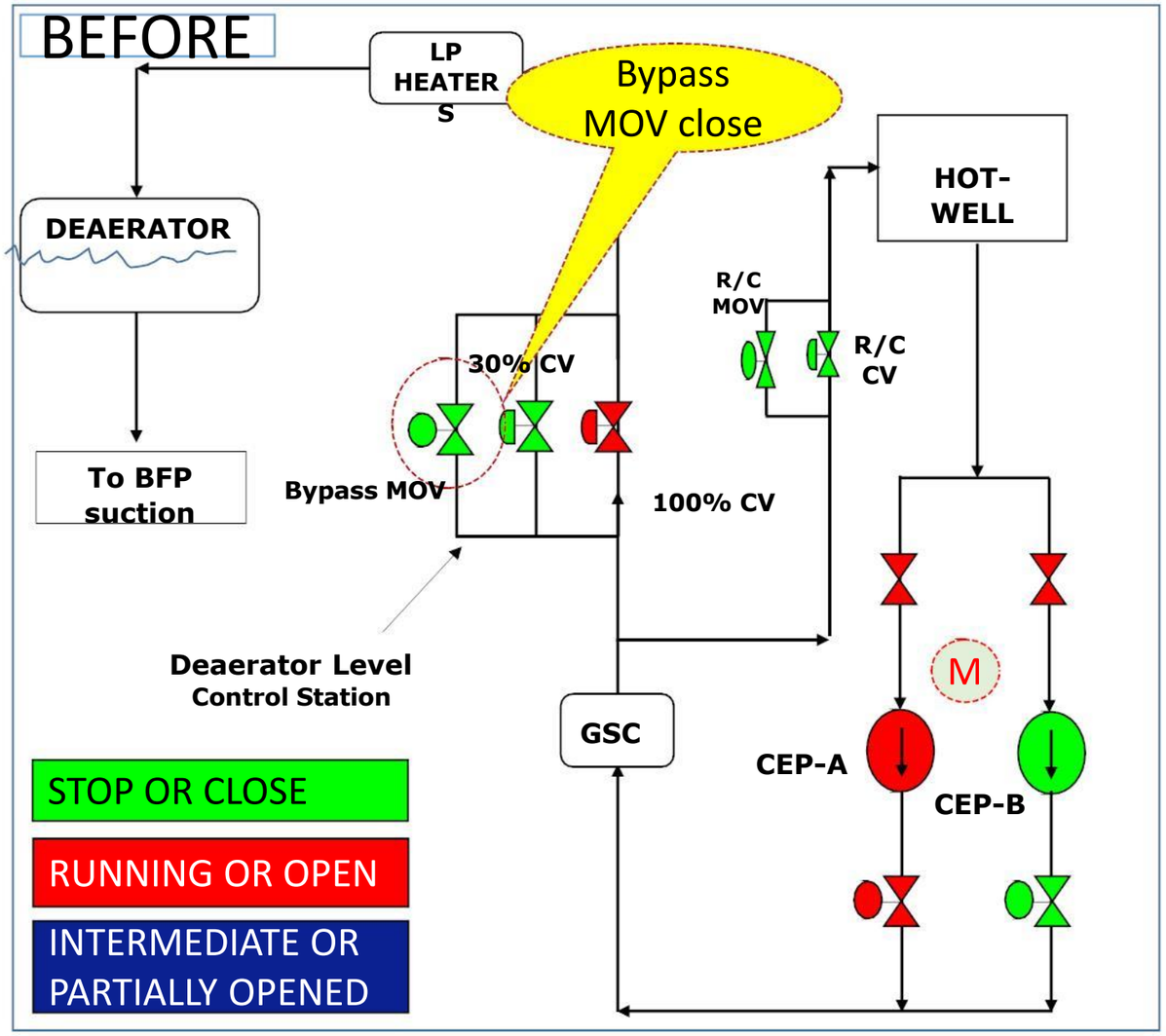
- BFP is originally designed for 6 stages to feed the water to the Boiler Drum.
- 3 BFPs of 50 % capacity each are installed.
- Normally, two will be in service & one will be standby.
- Specific APC at part load with Single BFP is high.
- One stage out of six stages in BFP was removed, resulting in low flow and power requirement

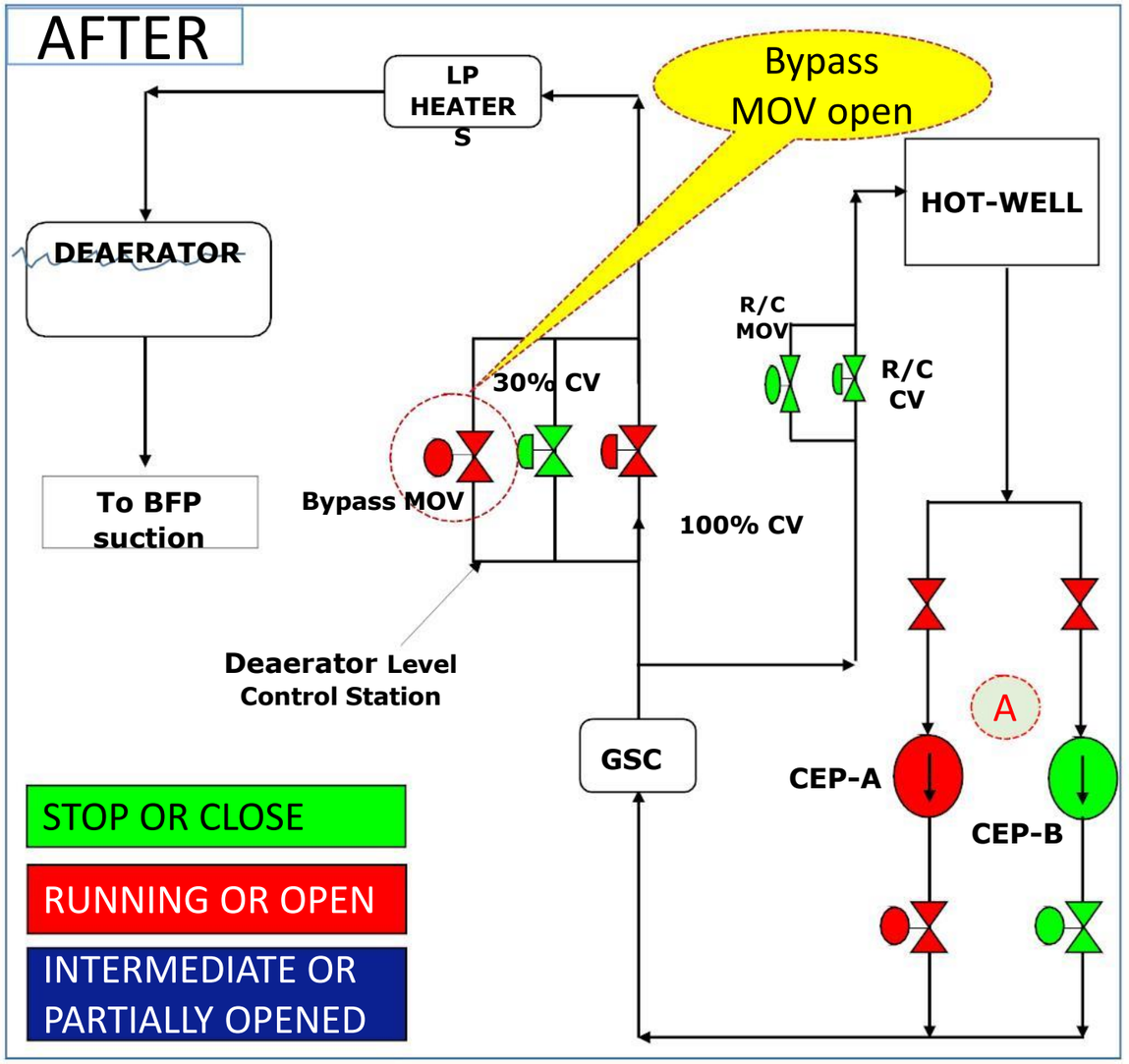


INNOVATIVE PROJECT 3 – CEP POWER REDUCTION

- CEP's are used in Thermal Power plant to pump water from condenser to Deaerator
- Problem identification- During part load unit operation
  - Throttling losses due to differential pressure across level control station
  - CEP running at high speed
- Solution 1-
  - Deaerator level control valve is kept full open to avoid throttling losses, CEP speed reduced from 1270 rpm to 700 rpm
  - Still there was potential savings available in CEP.
- Solution 2-
  - Bypass MOV also kept full open to further CEP VFD speed reduced from 700 rpm to 600 rpm
- Savings- 0.205 Million units of Electricity

Comparative study





Before- Deaerator level control station bypass MOV closed condition
After- Deaerator level control station bypass MOV opened to reduce losses

RENEWABLE ENERGY SOURCES

Transitioning towards a Green Future

- At JSW Energy, supported by an existing portfolio of efficient thermal and hydro assets, we intend to capitalize on a new golden-era of renewable power generation, and play an influential role towards a carbon-free future.
- We look ahead to become a 10 GW company over the medium term with incremental capacity predominantly coming from renewable sources.

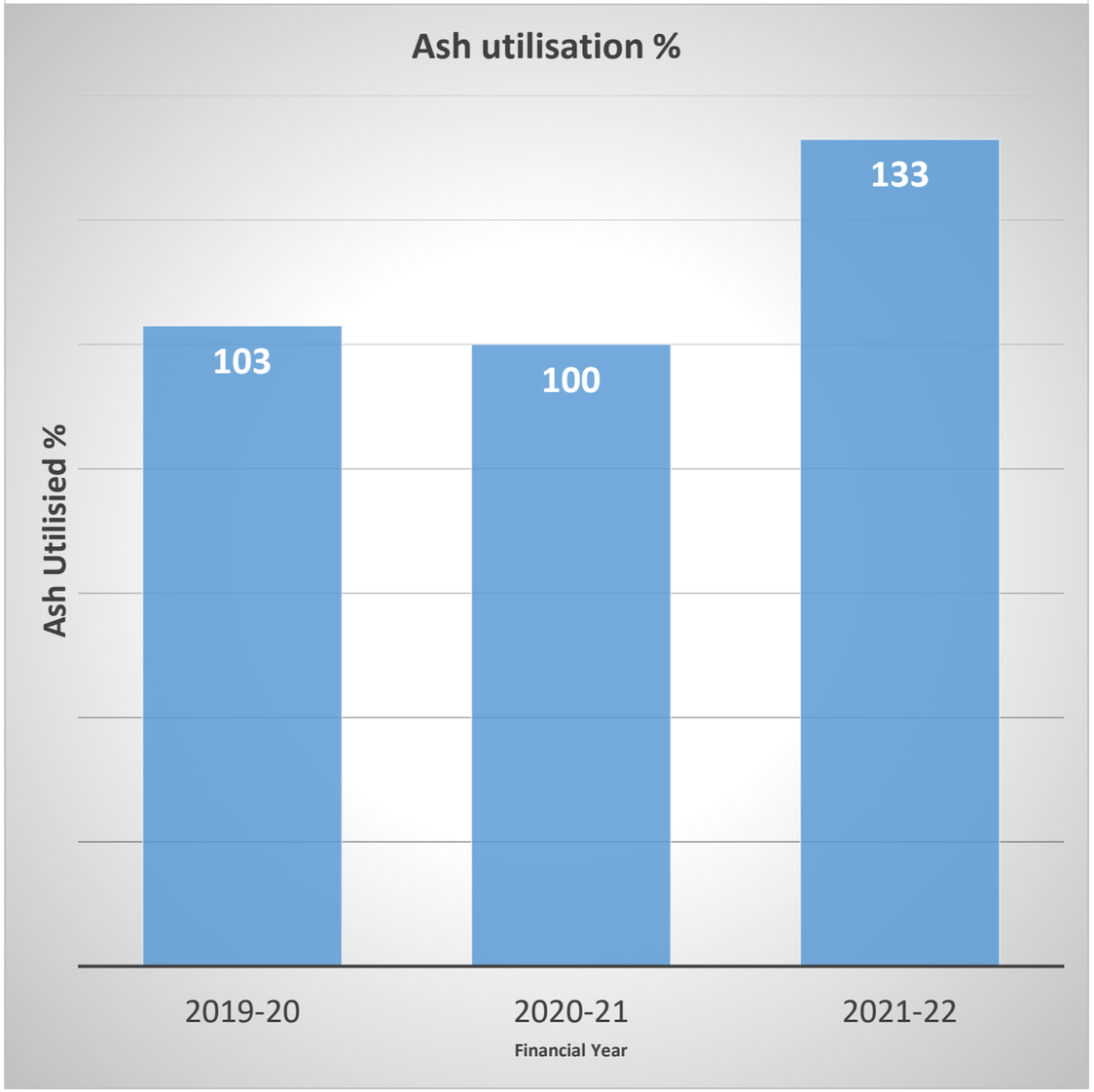
Utilisation of Renewable Energy sources

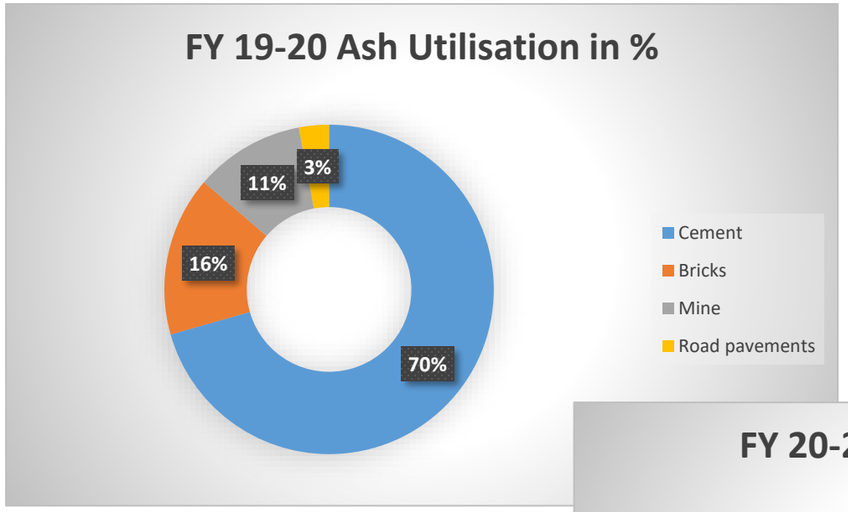
225 MW Solar plant commissioned on 6th April 2022

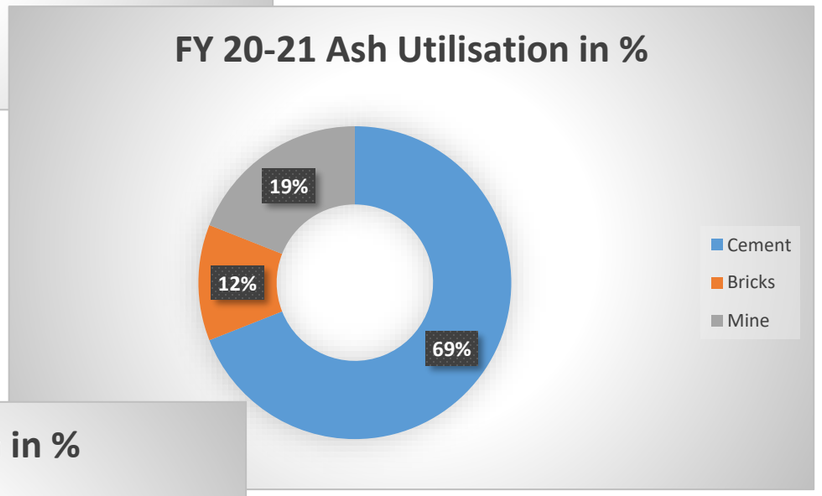
Environment Management- Ash Utilization

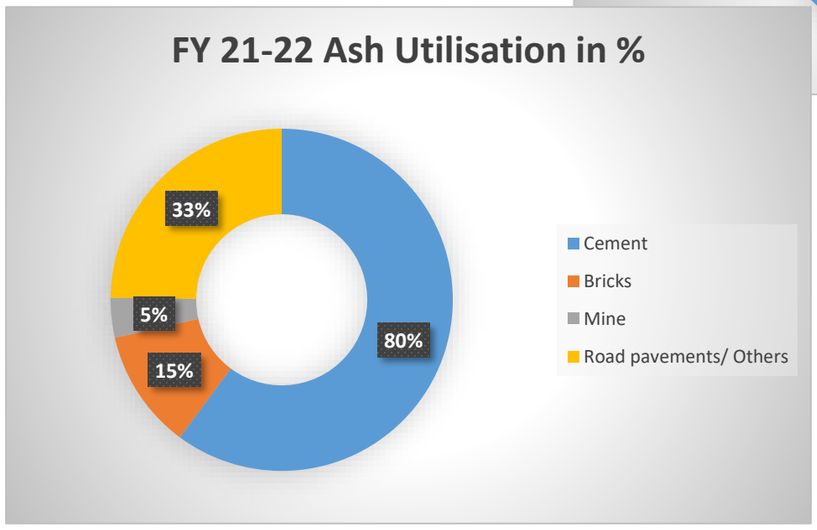
Particulars	UOM	2019-20	2020-21	2021-22
Ash Stock in Plant (yard + pond)	Tons	119660	119660	35160.2
Ash Generated	Tons	145776	113599	254517
Ash Utilization	%	103	100	133
Ash Utilized in manufacturing of cement/concrete – other similar products	%	72	69	80
Ash Utilized in Fly Ash Bricks	%	16	12	15
Ash Utilized in Mine filling	%	11	19	5
Ash Utilized for Roads pavements	%	3		33
Ash Utilization in Other Areas – Please mention below				
Low lying area from Pond	Tons			84500

ENVIRONMENT MANAGEMENT - ASH







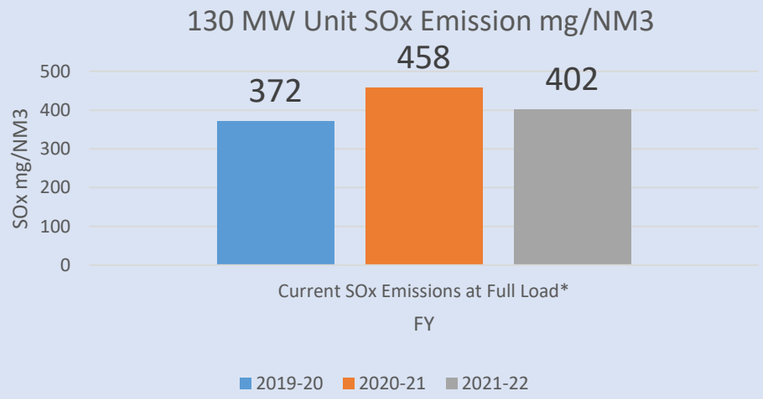


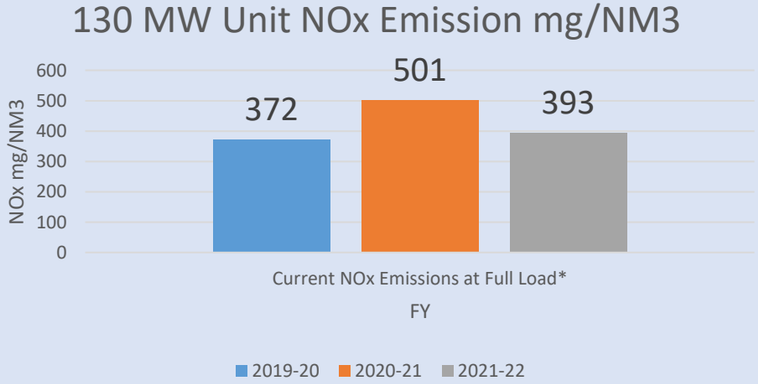
Environment Management- Ash Utilization

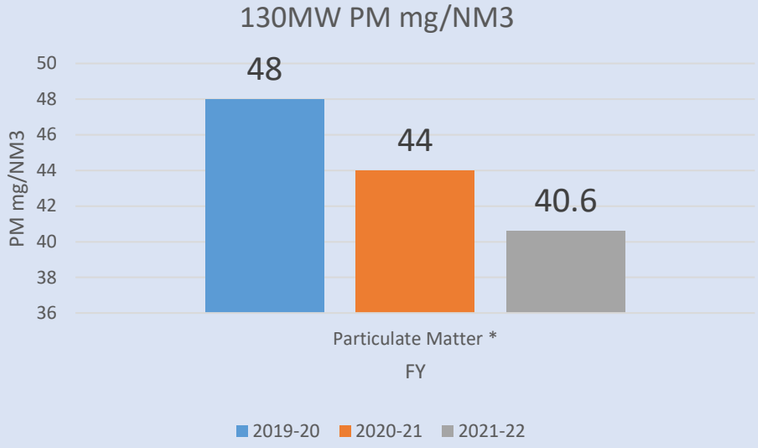
Ash Handling done through various methods		
Ash Handled (Wet Method)	%	15.3
Ash Handled (Dry Method)	%	84.7
Ash Handled (semi wet)	%	NIL

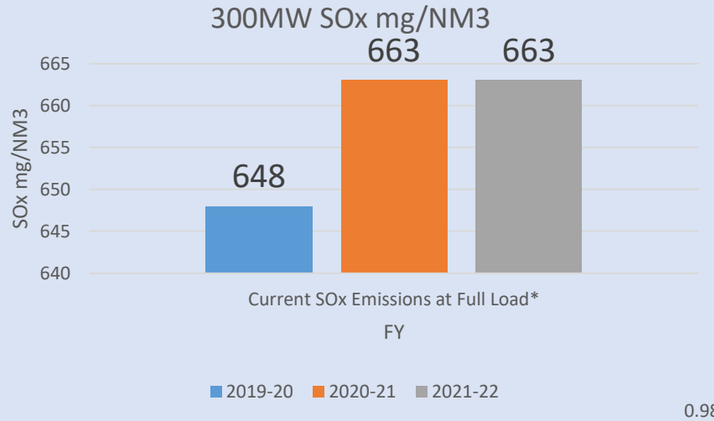
JSWEL Vijayanagar has achieved 100% Utilization of Ash for the consecutive last three financial years.

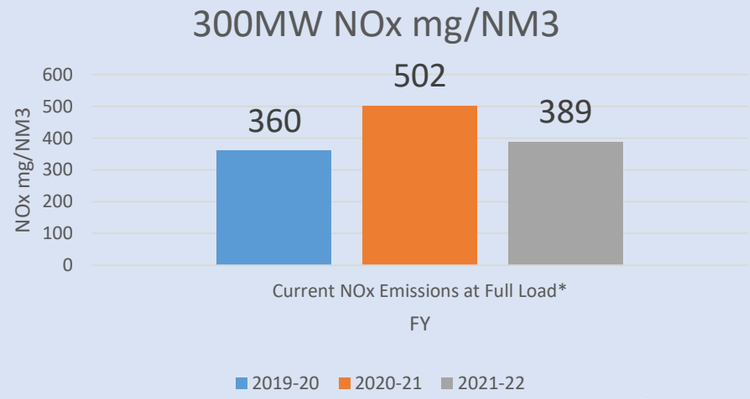
ENVIRONMENT MANAGEMENT - EMISSIONS

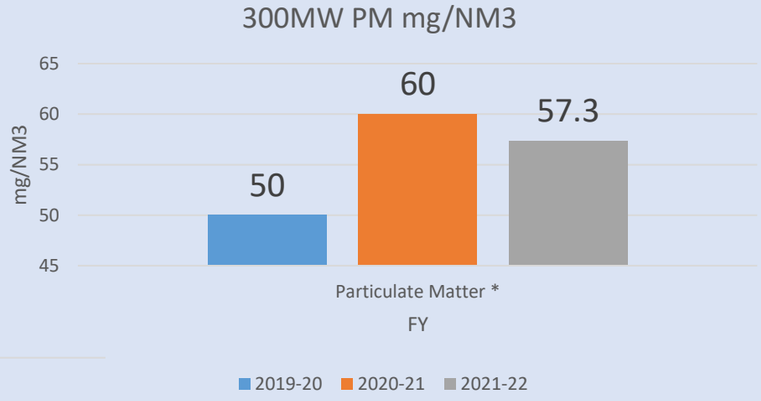


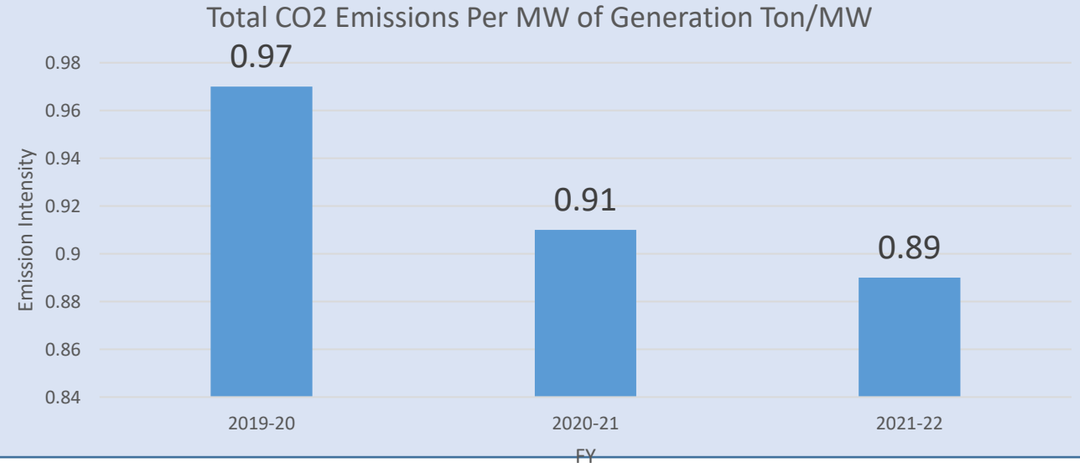












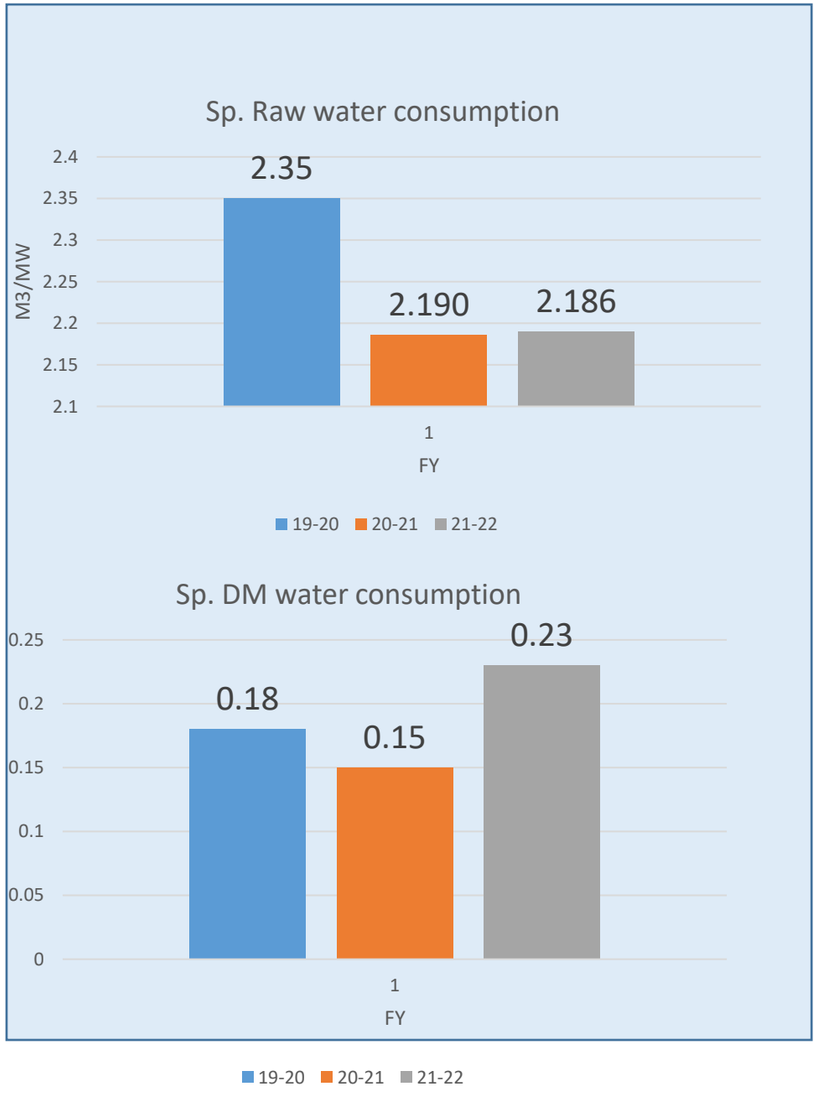
ENVIRONMENT MANAGEMENT - WATER

Better Everyday

Whether Plant is Zero Liquid Discharge - YES

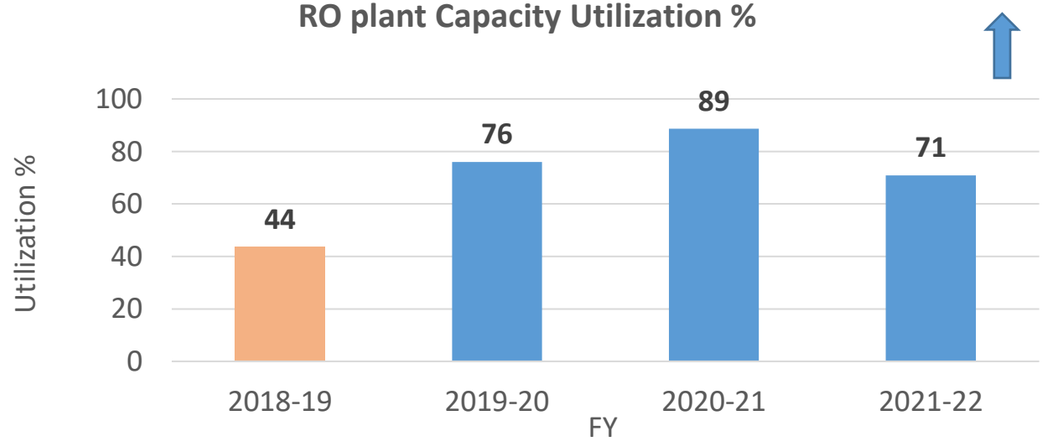
MEASURES TAKEN ON WATER CONSERVATION

- Utilization of Waste water
  - ✓ Drain lines from SWAS, VAM are routed to CW fore bay
  - ✓ Reuse of RO Reject & Ash water for Boiler refractory cooling in Ore Beneficiation Plant
  - ✓ Routing all roof drains into Rain harvesting pit & to CW fore bay
- Optimization of Cycle Make up
  - ✓ Condition based blow down
  - ✓ Stringent monitoring & control of DM water quality
- Recycle of CW Blowdown water after treatment
  - ✓ Improving the RO Plant capacity utilization by changing existing membranes by Anti foulant type & by introducing oxidizing biocide and high soluble liquid-based chemical in pre-treatment stage



- RO Plant capacity utilization has increased from 44% to 71%
- Additional blowdown of 4.6 lac cum of water has been recycled per year
- Reduction in Cooling tower blowdown by 20%

FY	Specific Raw water Cons m³/MW	Blowdown water m³/day
2019-20	2.350	4559
2020-21	2.192	4920
2021-22	**2.186**	**3700**



Note: The low capacity Utilization in FY 2021-22 is due to the reduction in Cooling Tower blowdown water

- Introduction of chlorine dioxide
- Dosing of chemical was optimized. (Soda Ash, Dolomite & Lime)
- Conventional NaOCL replaced with Highly stable Solid Chlorine TCCA (90% purity)

Teamwork, Employee Involvement & Monitoring

- Daily monitoring system is done through DM (Daily Management) board in all department with SIC & dept. Employees. Daily O&M Meeting. HOD Meeting, Quality Assurance Review Meeting (QAR)
- Review meeting chaired by Head of the Plant
- Separate budget for Energy Conservation in CAPEX Energy conservation budget is included
- Energy efficiency / awareness training program - Energy Efficiency Training programs conducted by CII, BEE, QSHEEN (ISO)
- Projects implemented through Kaizens (Workers and Supervisor level)
- Major Areas of concern in terms of energy efficiency and reliability

TEAMWORK, EMPLOYEE INVOLVEMENT & MONITORING

Monitoring Architecture

SMS App

ABB / METSO

PI DCS

SCADA

PI SCADA

Energy Exported to Grid

PI ENMS

ABT System

PI ABT

Planned in Next FY 19-20

1. SAP DGR – Gone Live
2. EBIDTA – UAT
3. Schedule-6 & Cash flow – UAT
4. Dashboard – 25 KPI - WIP

Mobile App

PI Server

PI Web parts 2013

SAP ECC

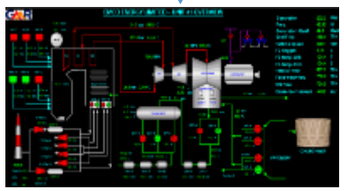
1. Safety Documents
2. Trip Analysis
3. Overhaul
4. Emergency Exit
5. MOPR Report
6. Incident Report
7. Telephone Directory

LAN & Internet

Intranet Portal

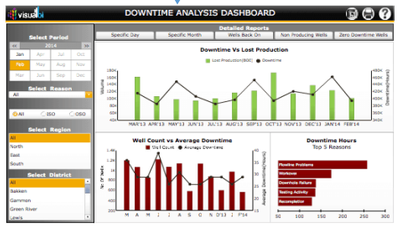
PI RDBMS

SAP BI/BO



Process books

Dash Board



BEST PRACTICES

Better Everyday

Giving Safety paramount importance, Safety Modules are created for training wrt work at height.

Electric vehicles are procured for local conveyance. Electric vehicle charging facility is constructed inside the plant premises

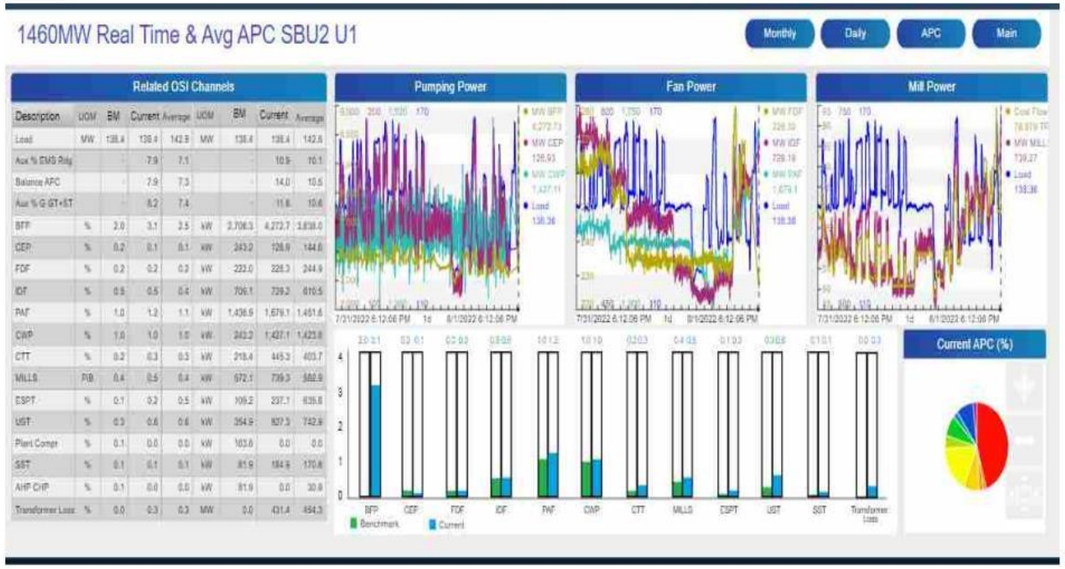
JSW Energy a Certified Great place to work, is also a Single Use Plastic (SUP) free Workplace

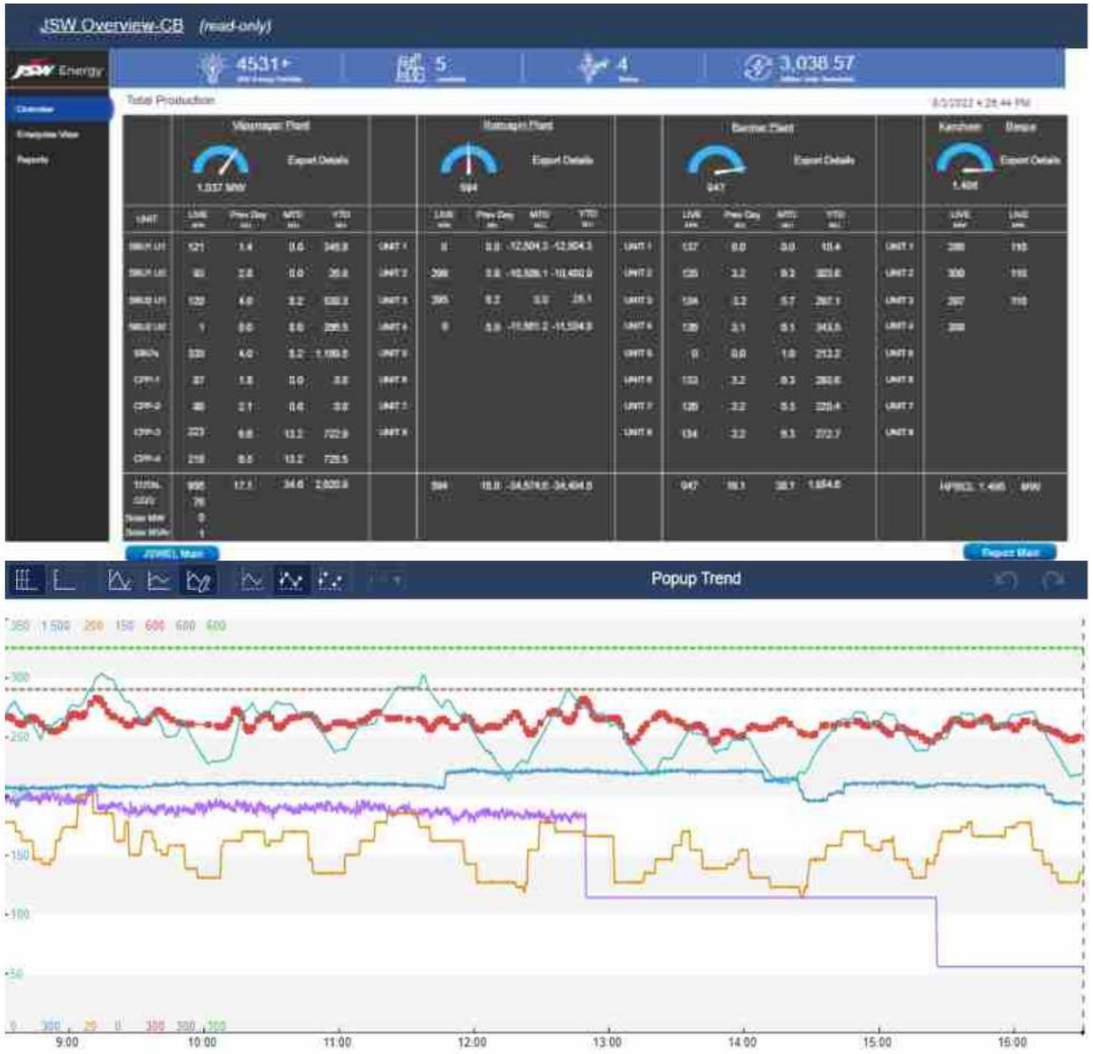
BEST PRACTICES

DIGITISATION

Better Everyday

DIGITAL DASHBOARDS FOR MONITORING AND ANALYSIS





ISO CERTIFICATION

Bureau Veritas Certification

JSW ENERGY LIMITED

JSW Energy

POST BOX NO. 09, TORANAGALLU, BALLARI DISTRICT – 583 123, KARNATAKA, INDIA.

Bureau Veritas Certification Holding SAS – UK Branch certifies that the Management System of the above organization has been audited and found to be in accordance with the requirements of the Management System standards detailed below.

Standards

ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 & ISO 50001:2018

Scope of certification

GENERATION OF 2X130MW & 2X300MW ELECTRICITY FROM THERMAL POWER PLANT

Original cycle start date for ISO 9001 & ISO 14001:	**08 December 2007**
Original cycle start date for ISO 45001:	**29 January 2021**
Original cycle start date for ISO 50001:	**09 May 2014**
Expiry date of previous cycle ISO 9001 & ISO 14001:	**07 December 2019**
Expiry date of previous cycle ISO 45001:	**Not Applicable**
Expiry date of previous cycle ISO 50001:	**08 May 2020**
Recertification Audit date for ISO 9001, ISO 14001 & ISO 50001:	**26 October 2019**
Certification Audit date for ISO 45001:	**06 November 2020**
Recertification cycle start date for ISO 9001, ISO 14001 & ISO 50001:	**21 November 2019**
Certification cycle start date for ISO 45001:	**29 January 2021**

Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on:

For ISO 9001, ISO 14001 & ISO 45001: **07 December 2022**

For ISO 50001: **29 November 2022**

Certificate No. **IND19.8996U** Version : **2** Revision date: **08 February 2021**

Signed on behalf of BVCH SAS – UK Branch
Jagdheesh N. MANIAN
Head – CERTIFICATION, South Asia
Commodities, Industry & Facilities Division

Local office: Bureau Veritas (India) Private Limited (Certification Business), 72 Business Park, Sitaram Industrial Area, MIDC Cross Road "C", Andheri (East), Mumbai – 400 093, India

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization. To check this certificate validity please call +91 22 6274 2999.

JSW
Better Everyday

LONG TERM VISION ON ENERGY EFFICIENCY

- Flexibilization of unit operation by adopting new technology
  - ✓ Redesigning Technical Minimum load operation to 25 % of MCR for 300 MW units
  - ✓ 70MW Operation of 300MW plants, when the Solar & Wind Power starts Generating Power. Wrt bundling Thermal, Solar & Wind Power.
- Cost optimization through hybrid power generation
  - ✓ Bundling of existing thermal power with solar and Wind power
  - ✓ 1400MW Wind Mill Project – By FY 2023
  - ✓ Exploring the possibility of PSP – Pumped storage plant
  - ✓ Hydrogen Plant- JSW Energy started its work on Hydrogen Energy, with acquisition of land

learning from CII Energy Award 2020 or any other award program

Better Everyday

- Awareness related to Energy conservation, Water conservation, digitization measures taken by other Similar Power plants.
- Increases knowledge about new advancement and growing technologies in the field of Energy Efficiency.
- Energy savings opportunities in Electrical Systems.
- Archives of Previous years industries presentation is an excellent source of information.

FY 21-22 AWARDS

SL NO	AWARDS RECIEVED
1	Awarded Energy Efficient Unit for energy conservation at the National Award for Excellence in Energy Management 2021 by Confederation of Indian Industry.
2	Received “SEEM National Energy Management Award 2020 under Gold category “ in recognition to efforts towards achieving sustainable energy performance by Society of Energy Engineers and Managers.
3	Bagged Golden Peacock National Quality Award for the year 2021 under Power sector (Generation) by Institute of Directors.
4	Conferred with Extra Mile Energy Conservation Awards – 2021 under top most Diamond category for outstanding achievement in the area of Energy conservation by Green Maple Foundation.
5	Awarded Best Water Efficient Plant less than 500 MW category by Mission Energy, New Delhi.
6	Received Diamond Award in GMF Ace Awards-2022 under the Corona Fighter Award Category organized by Green Maple Foundation.
7	Awarded Innovation in Data Intelligence Award for Innovation in Data Intelligence by International Data Center

AWARDS

CII National Energy Management Award

Extra Mile Award by Green Maple Foundation

Golden Peacock National Quality Award by IOD

Diamond under Corona Fighter Category by GMF

Innovation in Data Intelligence by IDC

Excellent Energy Efficient Unit by CEE

TQM Awards at CCQC, NCQC and ICQCC

Unnatha Suraksha Purashkar by NSC Karnataka

THANK YOU

hanumanth.rao@jsw.in - 9449849800
kumar.ivaturi@jsw.in – 9449879370
hemant.chouhan@jsw.in- 9449879368