vedanta
transforming for good

Confederation of Indian Industry
125 Years - Since 1895

24th National Award for Excellence in Energy Management – 2023

Asia's 1st ISO-50001 certified Smelter

VEDANTA LIMITED – JHARSUGUDA

TEAM MEMBERS

1. VIMAL O S C BABU
2. PRAFULLA CHANDRAKAR
3. ABHISHEK KUMAR VERMA

OUR CORE PURPOSE & VALUES

CORE PURPOSE

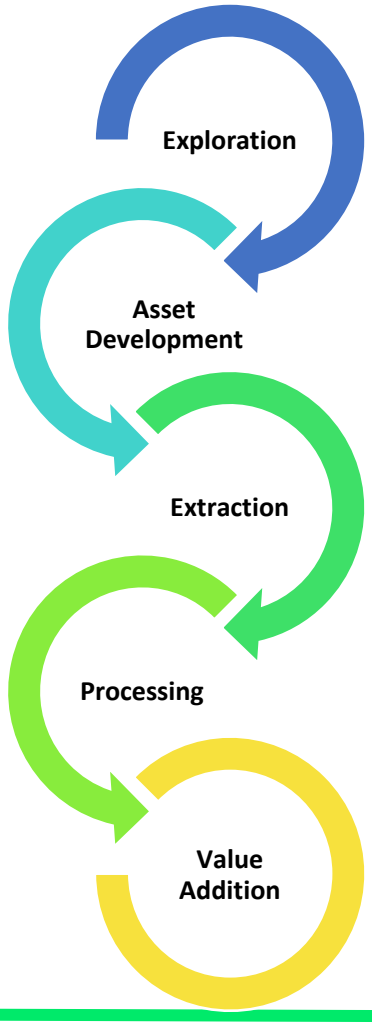
Vedanta is a globally diversified natural resources company with low cost operations. We empower our people to drive excellence and innovation to create value for our stakeholders. We demonstrate world class standards of governance, safety, sustainability and social responsibility.

OUR VALUES

Safety *Excellence* *Trust* *Care* *Entrepreneurship* *Innovation* *Integrity* *Respect*

Vedanta - What we do!

Value Chain



Our operations

Zinc-Lead-Silver
India, Ireland, Namibia & South Africa

Oil & Gas
India & South Africa

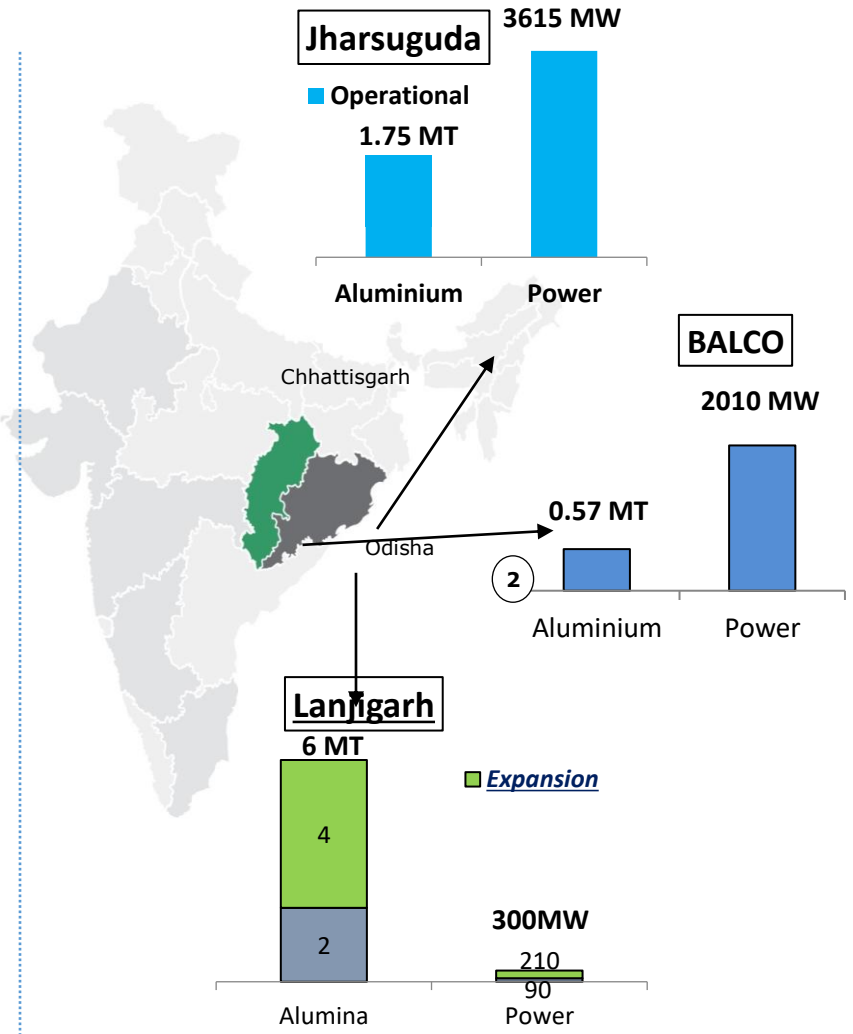
Iron Ore
Goa, Karnataka & Libera

Copper
India, Australia and Zambia

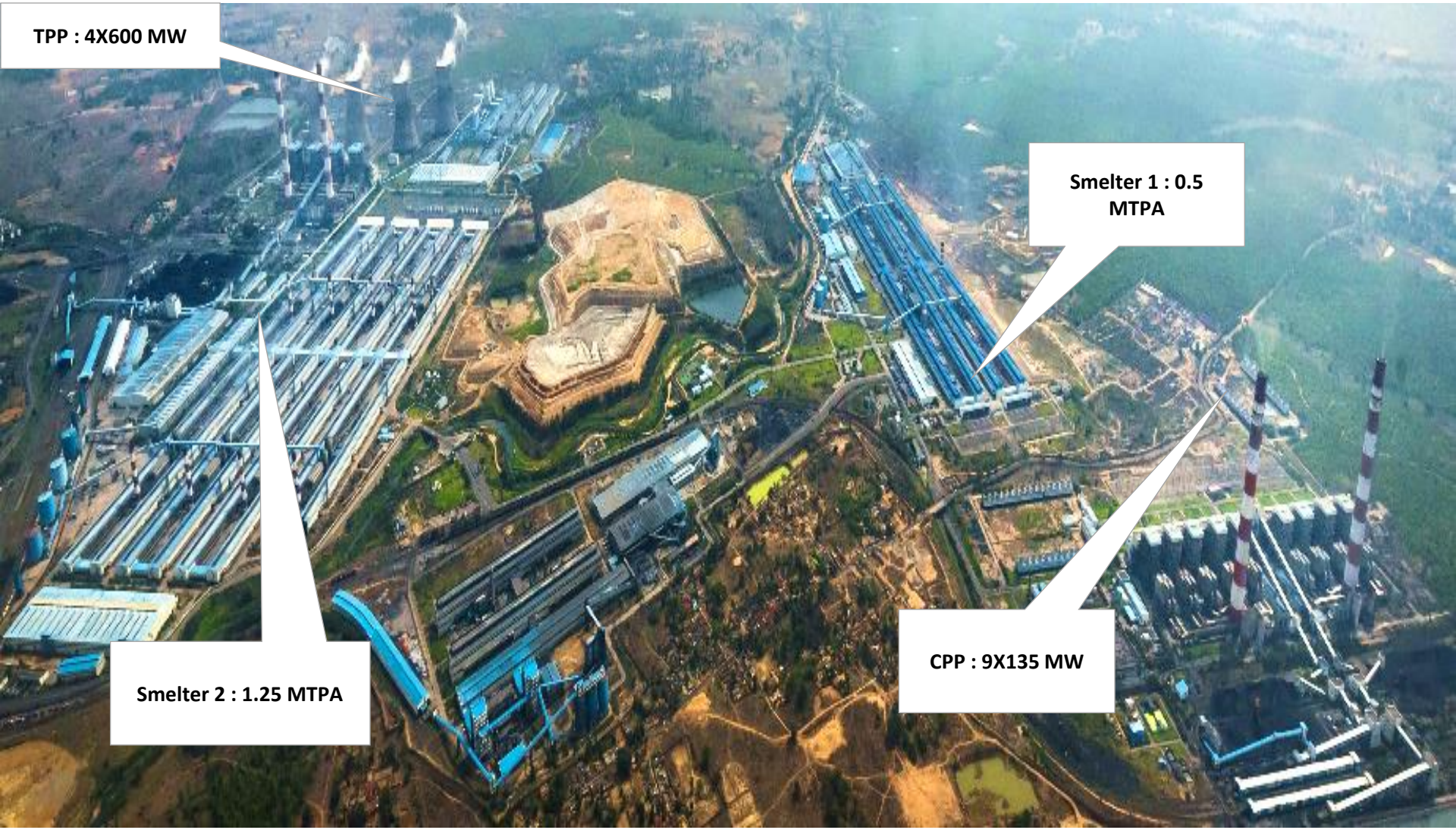
Aluminium
Jharsuguda, Korba (Balco), Lanjigarh

Power
Talwandi, Jharsuguda, Korba, Tamil Nadu

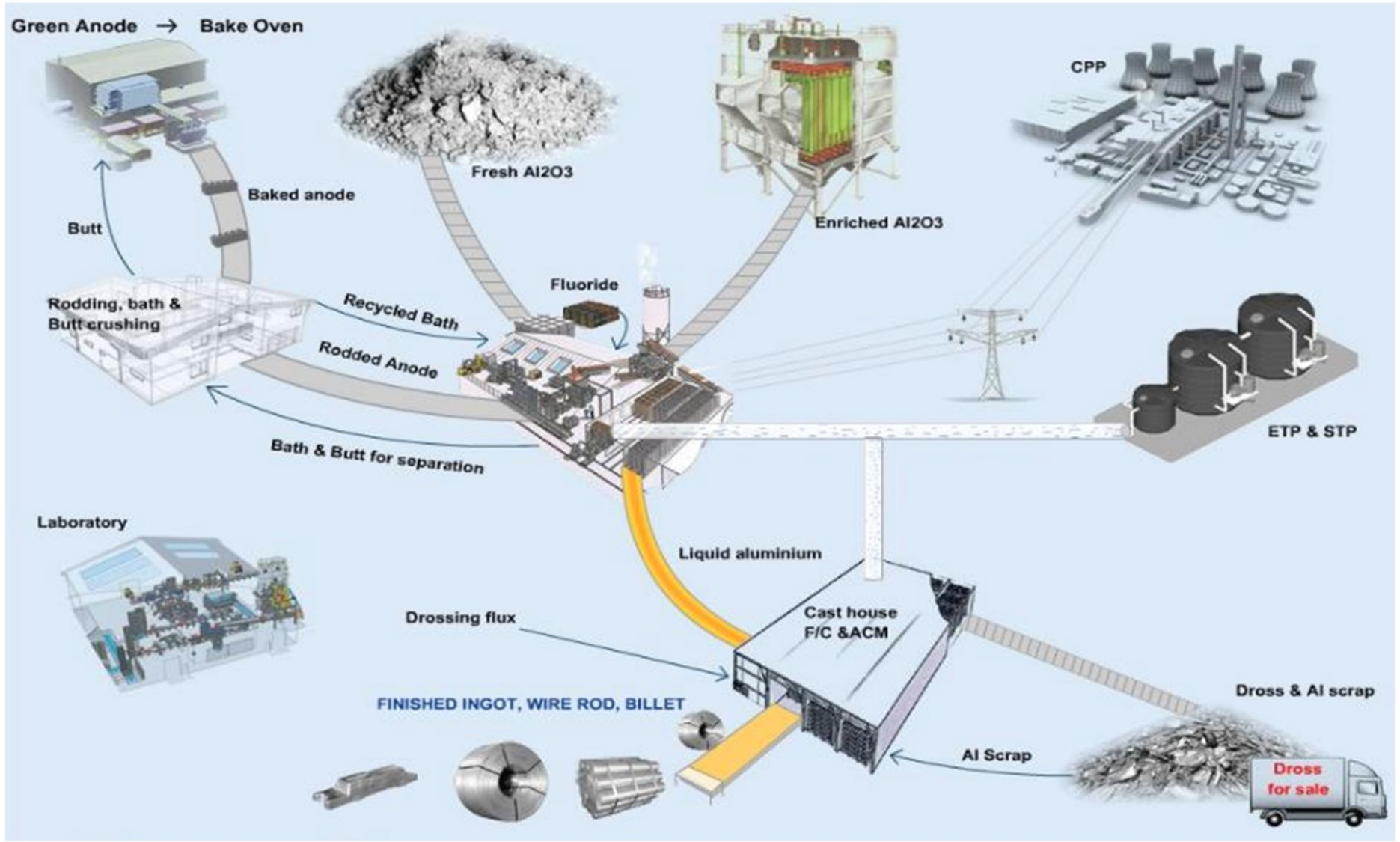
Aluminium business at a Glance



VEDANTA LIMITED, JHARSUGUDA

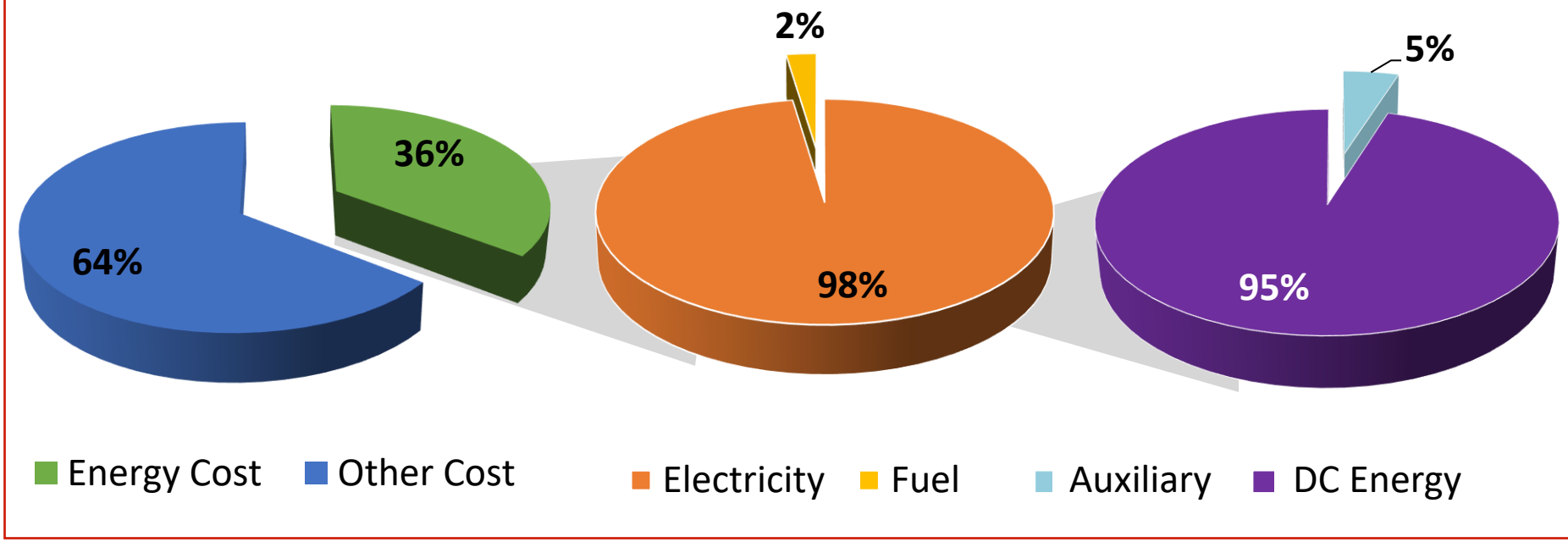


MAKING OF ALUMINIUM



Ingots, wire rod, Billet, Slab, T- Ingot.

ALUMINIUM - ENERGY & COST



DC Energy consumption = $\frac{2.98 * \text{Volts/pot}}{\text{Current Efficiency}}$

Focus is on DC energy reduction

ENERGY POLICY & OBJECTIVES

vedanta
transforming for good

VEDANTA LIMITED, JHARSUGUDA
Energy Policy

The Aluminium Smelter Plant-I & Plant-2(SEZ) of Vedanta Limited-Jharsuguda, a leading player in its sector, strives to build world class capabilities in every facet of its business operations and affirms its commitment to:

- Continual improvement in energy performance by providing necessary resources and information required to achieve energy management objectives and targets.
- Ensure compliance of all necessary and applicable legal and other requirements related to organization's use, consumption and efficiency.
- Incorporate energy efficient designs, equipment and process in all the future projects.
- Purchase of energy-efficient products on merit basis as per life cycle costing.
- Create awareness towards energy conservation in the organization.

Date: 31.03.2022

Sunil Gupta
CEO, VL-Jharsuguda

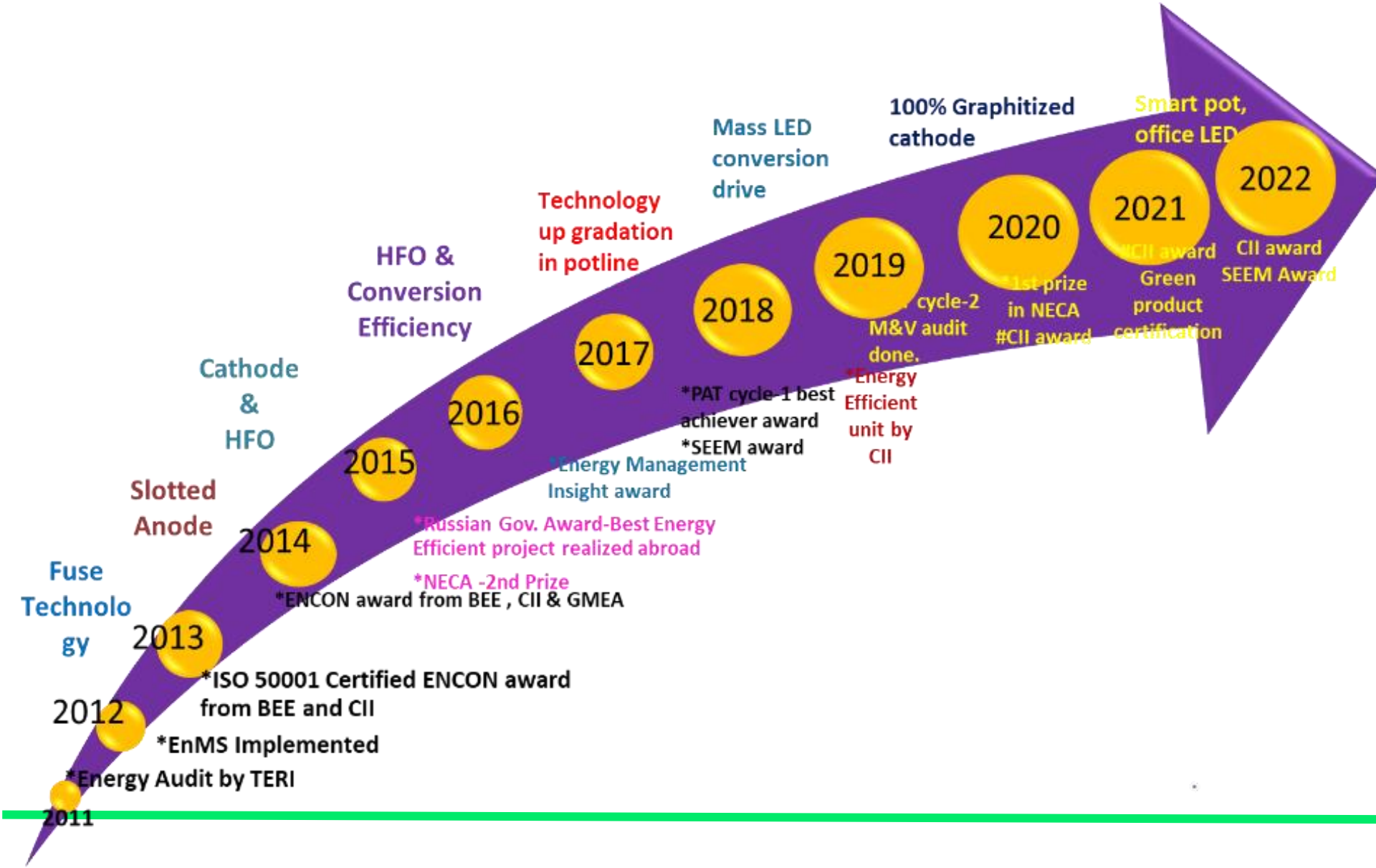
ENMS OBJECTIVES

- Reduce DC Energy Consumption
- Reduce Auxiliary Energy Consumption
- Reduce HFO Consumption
- Reduce Diesel consumption

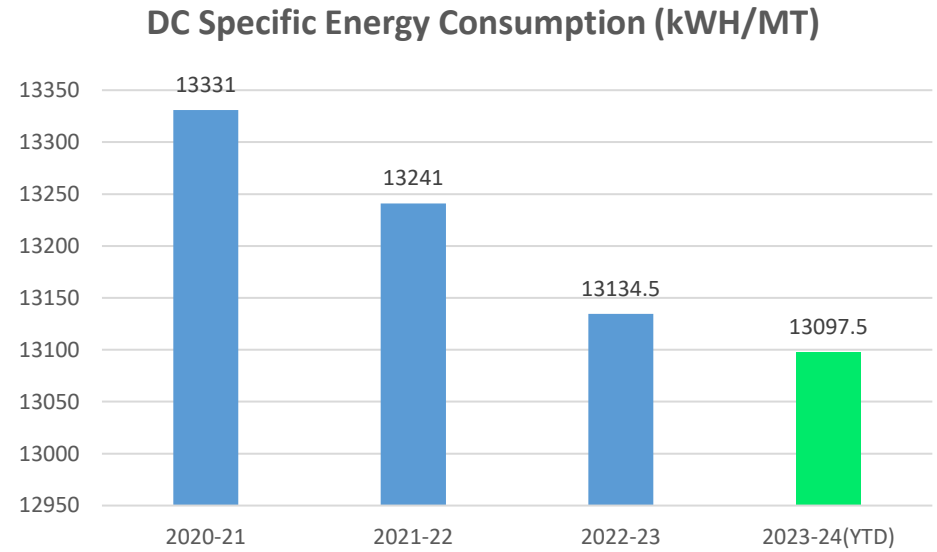
vedanta
transforming for good

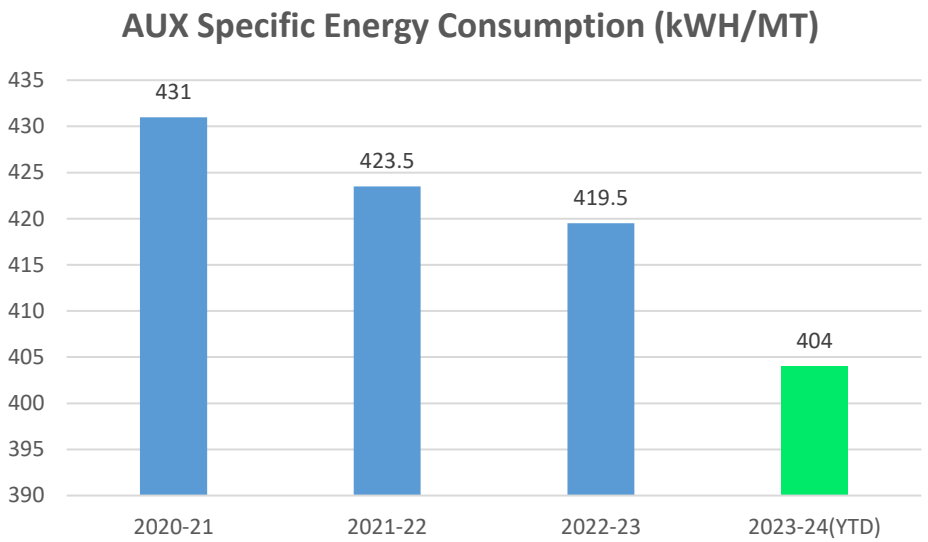
ENCON EFFORTS – A NOTCH UP

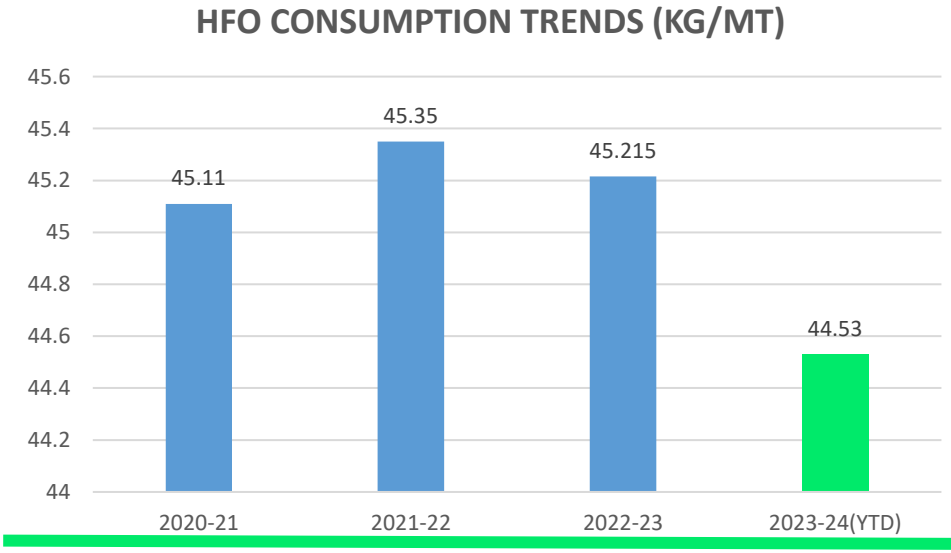
Confederation of Indian Industry
125 Years - Since 1895

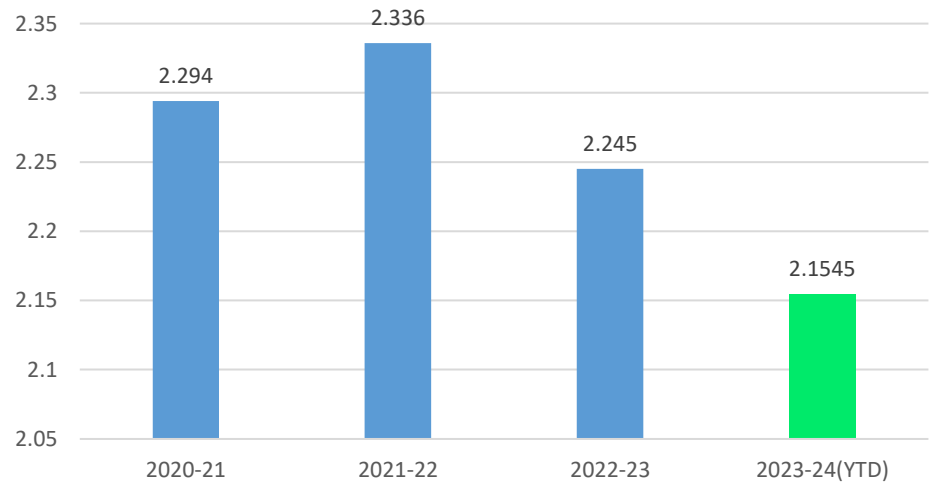


SPECIFIC ENERGY CONSUMPTION TRENDS- METAL

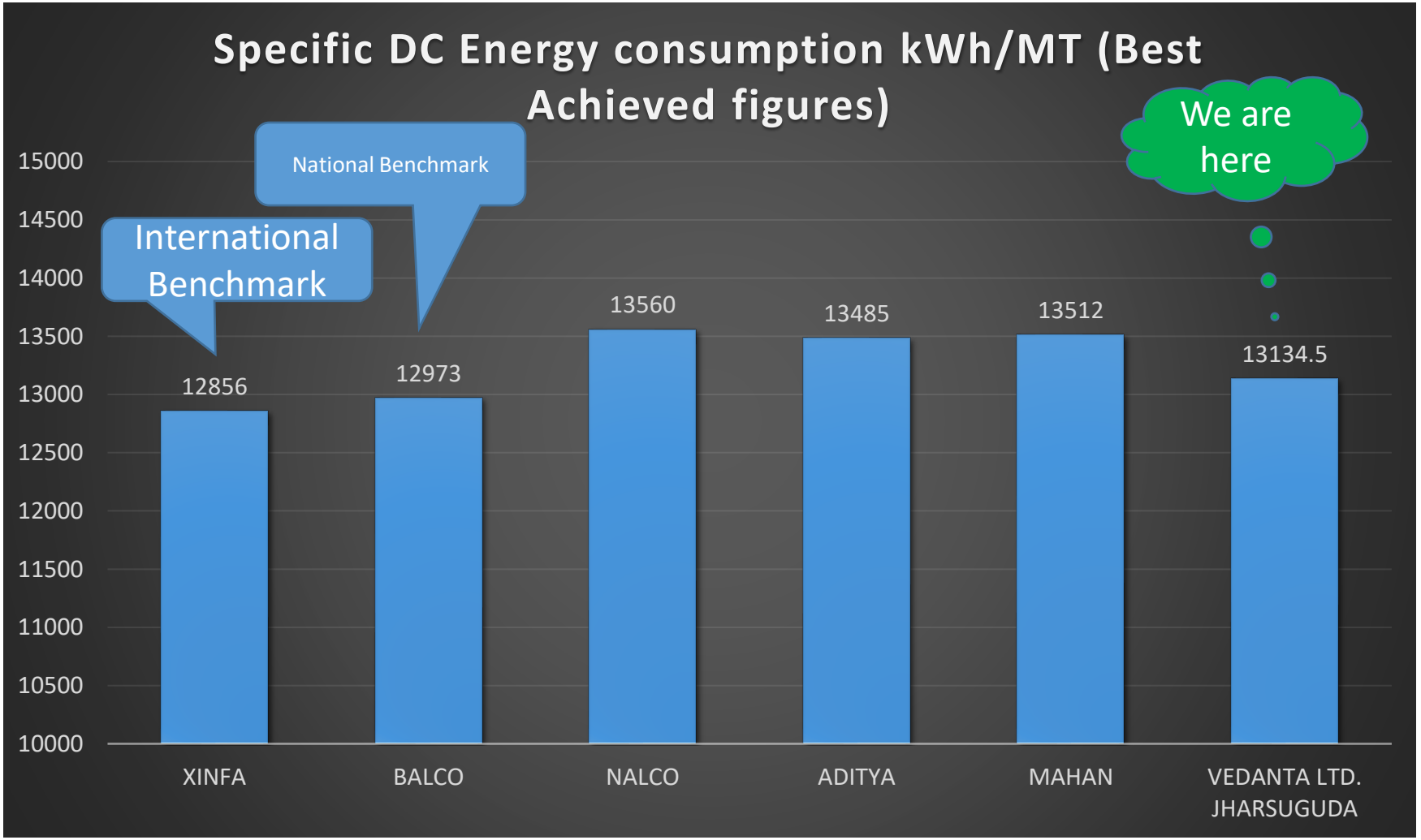








PERFORMANCE BENCHMARKING



One measurement is worth a thousand expert opinions

ENCON PROJECTS FY 2021-22

Sl. No.	Project description	Annual energy saving in Million kwh	Cost saving in Million	Investment in Million	Payback (years)
1	LED lights installed in place conventional lights	1.02	38.74	3.46785	0.90
2	Cooler Rotor Motor - Energy Efficient Motor Installation	0.15	5.67	3	5.29
3	Energy Efficient Motor Installation – Screw Conveyor	0.05	1.84	0.25	1.36
4	Ball Mill Running Hour Optimization	0.80	30.16	4	1.33
5	Process Optimization of A group	0.80	30.16	0	0.00
6	RPH CT Fan VFD Installation 2 nos	0.14	5.30	0.5	0.94
7	Old pump replacement with Energy efficient pump at RPH-01	0.13	5.06	1.5	2.97
8	100% Graphitized Cathode Implementation	7.93	299.86	854	28.48
9	Improvement of Conversion Efficiency of Rectifier systems from 98.58% to 98.62%	3.13	11.85	1	0.08

Total energy savings for FY 2021-22 =14.15 Million kWh

ENCON PROJECTS FY 2022-23

Sl. No.	Project description	Annual energy saving in Million kwh	Cost saving in Million	Investment in Million	Payback (Years)
1	Energy Efficient Pump Installation of CWP-5	0.087	0.380	0.35	0.92
2	Mill roller replacement for 6 unit	4.7	16.25	24	1.47
3	Elimination of potential business risk in plant-1 by separation of air discharge header for cast house and carbon area.	1.977	73.490	0.13	0.13
4	100% Graphitized Cathode Implementation	18.357	113.077	82.8	0.73
5	U#1 APH seal & sector plate replacement	4.08	12.24	9	0.73
6	Ball Mill power optimization	0.898	2.793	4	1.43
7	Installation of led light in shop floor.	0.055	0.207	0.2	0.97
8	FTP-3 By pass duct replacement to stop draft loss	0.998	4.69	0.6	0.12
9	BFP cartridge replacement of 2 units	1.15	3.93	8	2.03
10	2nos. of 350KW VFD installation in Casthouse-2 Pump house	0.49	1.225	2	1.63

Total energy savings for FY 2022-23 =32.792 Million kWh

MAJOR ENCON PROJECTS FY-24 (Ongoing/Upcoming)

Sl.No.	Description of energy efficiency improvement	Category	Units	Status of implementation
1	Reduce the compressed air pressure operating range by 0.4 kg/cm^2	Electrical	KWH	Planned In FY 24
2	Install VFD and optimize cooling tower fan operation (air compressor house)	Electrical	KWH	Planned In FY 24
3	Solar & LED Lighting Installation	Electrical	KWH	Planned In FY 24
4	Maintain the bath temperature at 960±2^{o}C	Electrical	KWH	Planned In FY 24
5	Reduce the clamp below 15 mV	Electrical	KWH	Planned In FY 24
6	Reduce high dead pot voltage from 0.23V to 0.2V	Electrical	KWH	Planned In FY 24
7	Reduce the cathode drop below 300 mV	Electrical	KWH	Planned In FY 24
8	Reduce the compressed air consumption for red shell pots, high collector bar temp for cooling purpose (trials to be conducted)	Electrical	KWH	Planned In FY 24
9	100% Graphitized Cathode Implementation	Electrical	KWH	In-progress
10	U#3 Eco replacement from finned to bare Burner modification & SOFA Installation	Thermal	MT	Planned In FY 24
11	U#3 APH seal and FF bags replacement	Electrical	KWH	Planned In FY 24

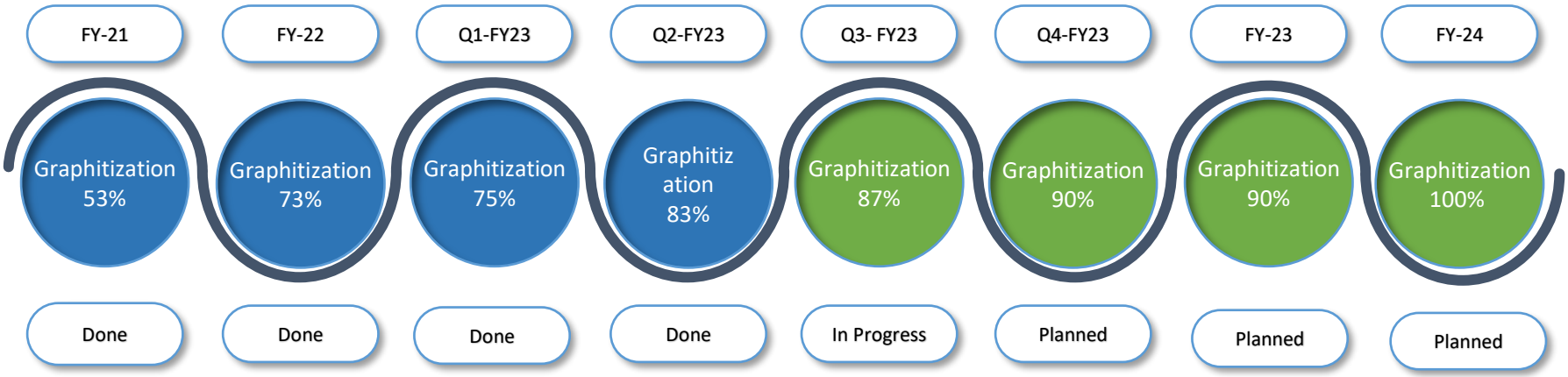
100 % Graphitization Journey-13000 KWH/MT

In smelting, pot Carbon is used as Anode and Cathode block for necessary electrolysis.

Existing cathodes are of 50% graphite content which consumes more power due to less conductivity same is replaced with 100% graphitized cathodes which is having better conductivity and hence high energy conservation.

Benefits of implementation:

- Resistivity reduced from **26 ohm-cm to 12 ohm-cm**.
- Operating Voltage decreased from **4.206 V to 4.110 V**
- CVD (Cathode voltage drop) decreased from **385mV to 265mV**.

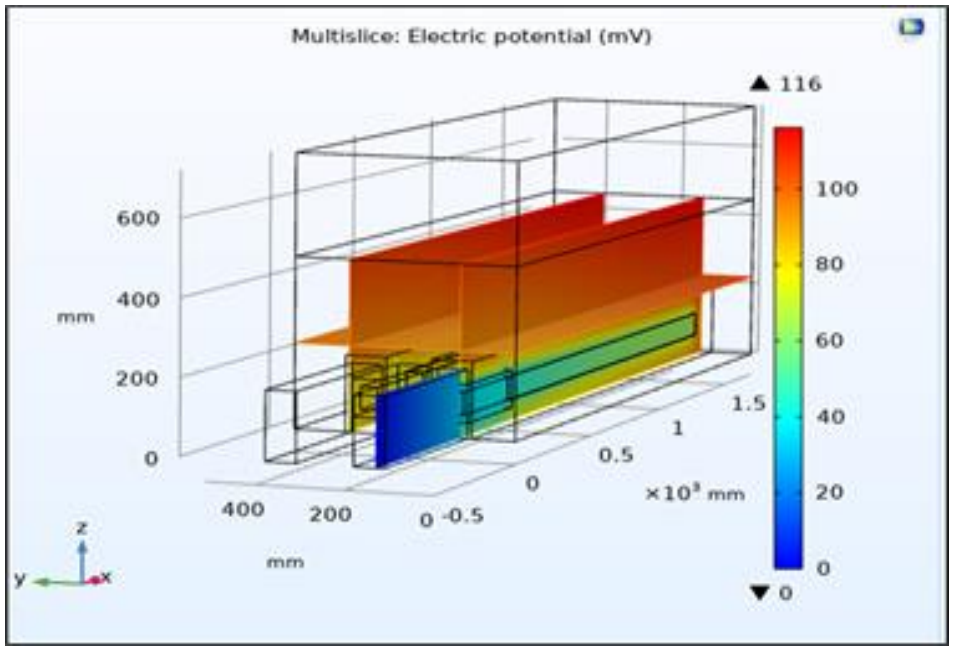


RUC Lining Design.

Brief about the energy efficiency /low carbon technology adopted:

- · To reduce the specific power consumption in potline.
- · RUC lining design which has ready to use cathodes with copper collector bars has been developed with the help of modeling & simulation in collaboration with Tokai COBEX team
- RUC cathode and Vedanta Lining Design that has a potential saving of 150 – 200kWh/MT in one pot is in initial phase. Currently 10 pots have been installed RUC cathodes and Vedanta Lining Design has been implemented in 44 pots in Smelter Plant.

RUC LINING DESIGN MODEL



RUC LINING PROJECT TEAM

"Airline Header separation for Cast house and Carbon area-P1 & Cast House and Potline- P2 "

The previously existing network of compressed air headers supplied air to all user ends (Potline, Carbon and Cast house) from a common header. There was no provision to economically distribute air flow to the user ends without receiving complaints regarding low pressure.

We were not able to provide required pressure to cast house and GAP which lead to production downtime for both areas. As a result, an extra compressor had to be started to maintain the required pressure. An increase in power consumption of approximately 1 MW/day was observed.

For 8 to 7 HP compressor operation, we separated the air discharge header for Cast house and Carbon area and in the meantime fulfilling the pressure needs of all user area.

BEFORE

AFTER

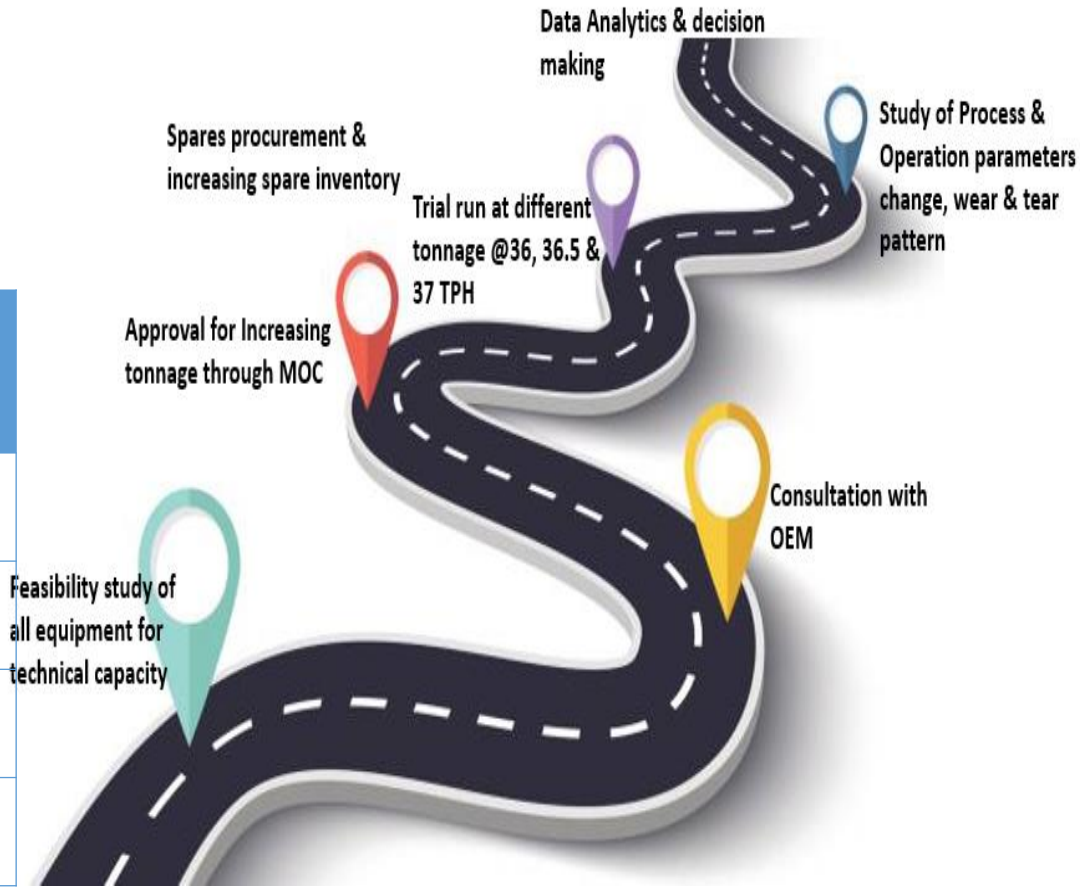
ENERGY SAVING/ANNUM- 11,389.75 MWH

Increase in Green Anode plant Throughput- 35 TPH to 37 TPH

One major step taken in carbon is an “Increase In Green Anode Plant throughput from 35 tph to 37tph” resulting in 4500 nos. more anode production over capacity without affecting anode quality parameters.

Anode quality parameter comparison

Anode quality	@35.0 TPH	@37.0 TPH
Apparent Density (g/cm3)	1.584	1.584
Air Permeability(nPm)	0.47	0.51
Electrical Resistivity(µΩm)	59.0	58.9
Flexural Strength(Mpa)	11.54	11.48

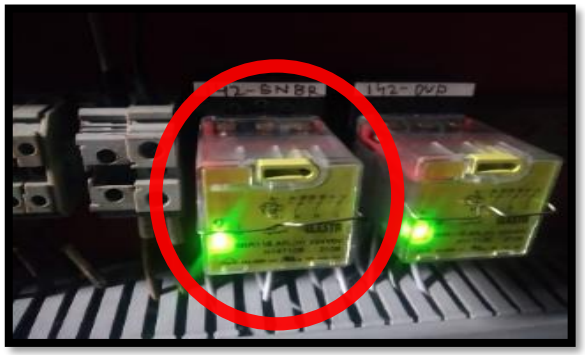


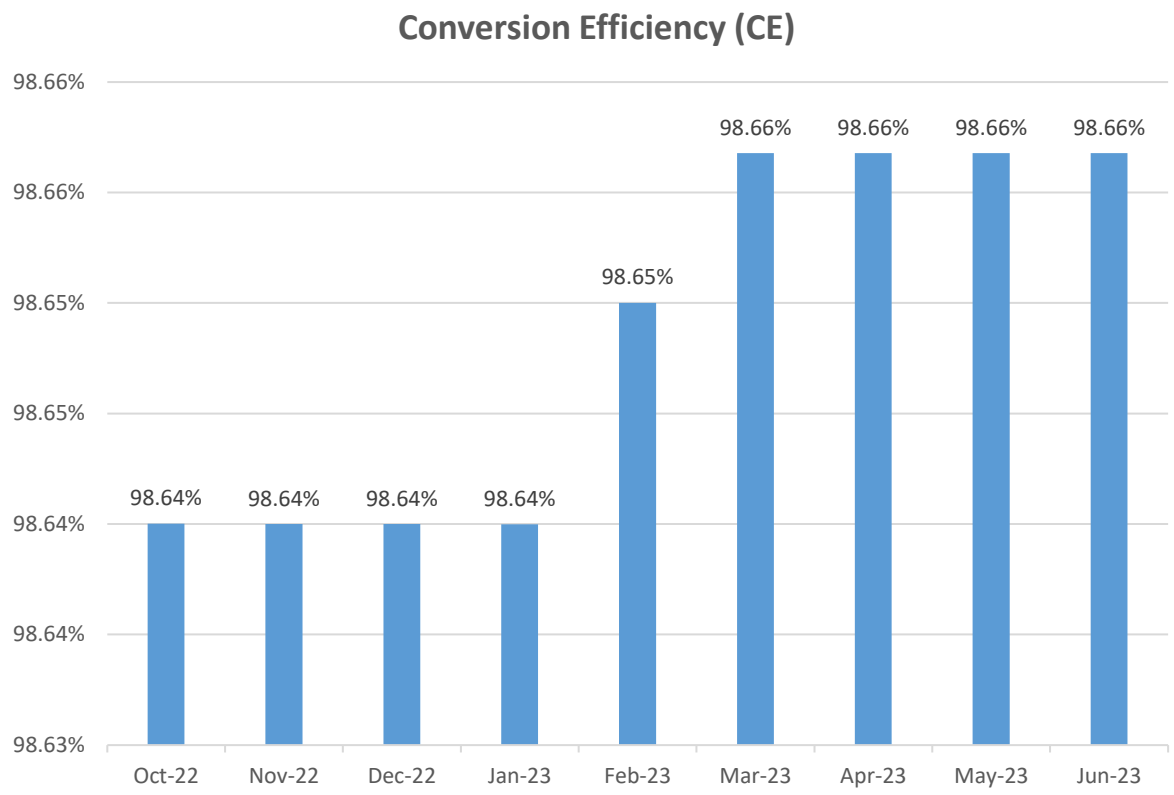
“Software upgradation in MTVs“

Like the newly designed MTV 15 with a new controller and programming which is giving a very low fuel consumption compared to the old MTVs, a target has been set to implement the same in 2 MTVs.

Energy Saving - 8790 lit

CONVERSION EFFICIENCY IMPROVEMENT FROM 98.64% to 98.66%”



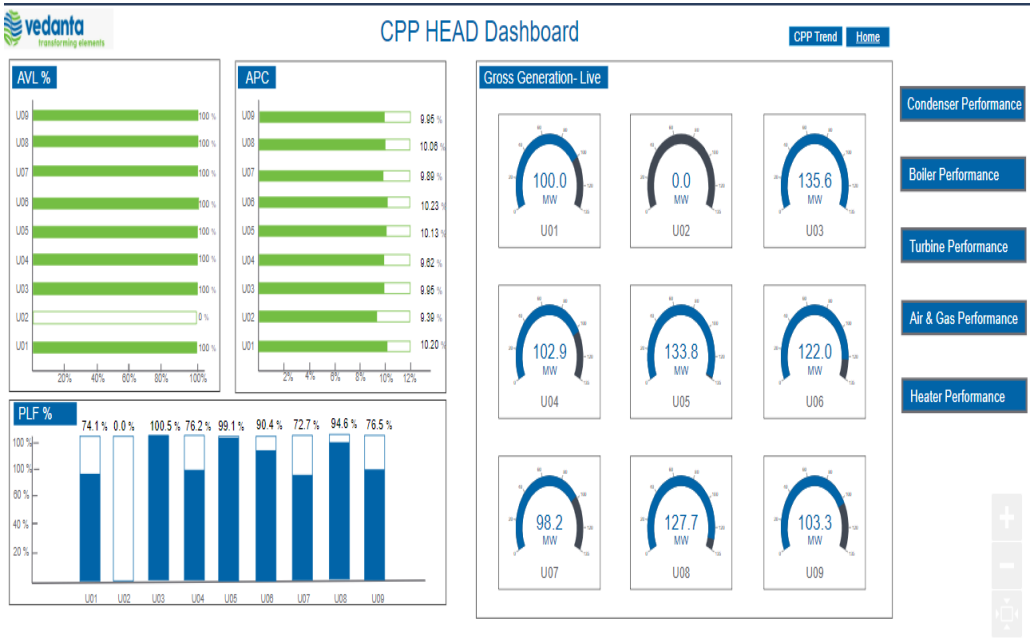


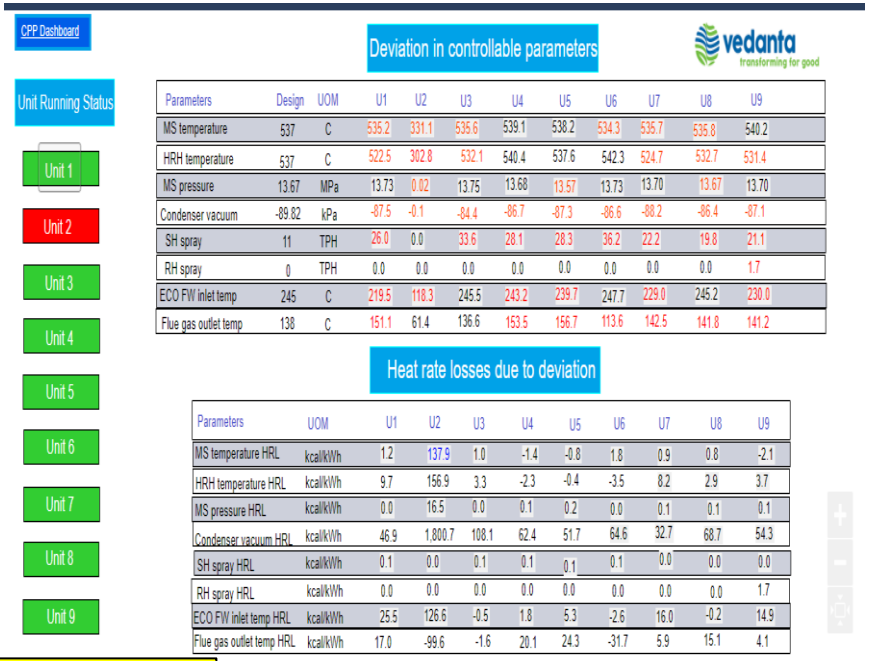
❖ Energy Conservation in 2022-23: 1456.51 MWh/Annum

Operational excellence through digital initiative

Abstract :-

- implemented energy monitoring system though OSI- PI System is a suite of software applications that allows for **collecting , historicizing, finding, analyzing, delivering and visualizing data**.
- The PI System unlocks operational insights and new possibilities. The PI System enables digital transformation through trusted, high-quality operations data. Collect, enhance, and deliver data in real time in any location. Empower engineers and operators. Accelerate the work of **analytics & energy monitoring on real time basis**





Deviation in controllable parameters

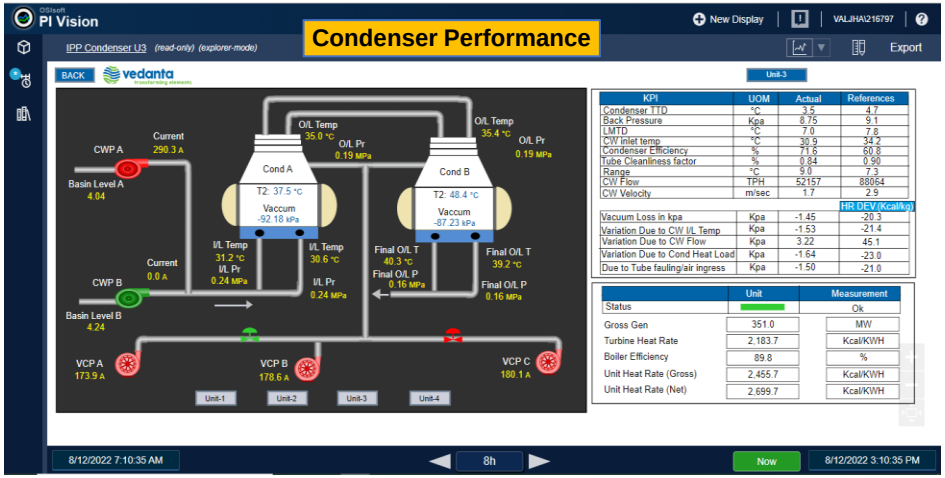
Parameters	Design	UOM	U1	U2	U3	U4	U5	U6	U7	U8	U9
MS temperature	537	C	535.2	331.1	535.6	539.1	538.2	534.3	535.7	535.6	540.2
HRH temperature	537	C	522.5	302.8	532.1	540.4	537.6	542.3	524.7	532.7	531.4
MS pressure	13.67	MPa	13.73	0.02	13.75	13.68	13.57	13.73	13.70	13.67	13.70
Condenser vacuum	-89.82	kPa	-87.5	-0.1	-84.4	-86.7	-87.3	-86.6	-88.2	-86.4	-87.1
SH spray	11	TPH	26.0	0.0	33.6	28.1	28.3	36.2	22.2	19.8	21.1
RH spray	0	TPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
ECO FW inlet temp	245	C	219.5	118.3	245.5	243.2	239.7	247.7	229.0	245.2	230.0
Flue gas outlet temp	138	C	151.1	61.4	136.6	153.5	156.7	113.6	142.5	141.8	141.2

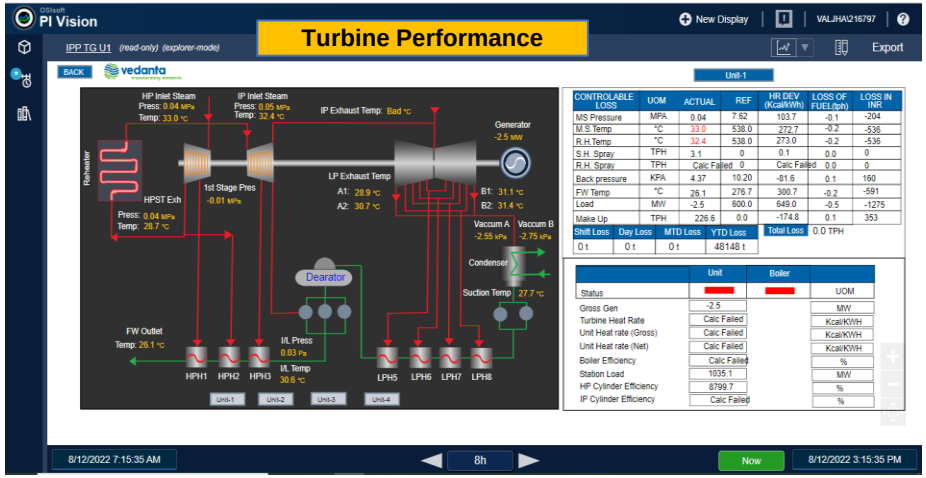
Heat rate losses due to deviation

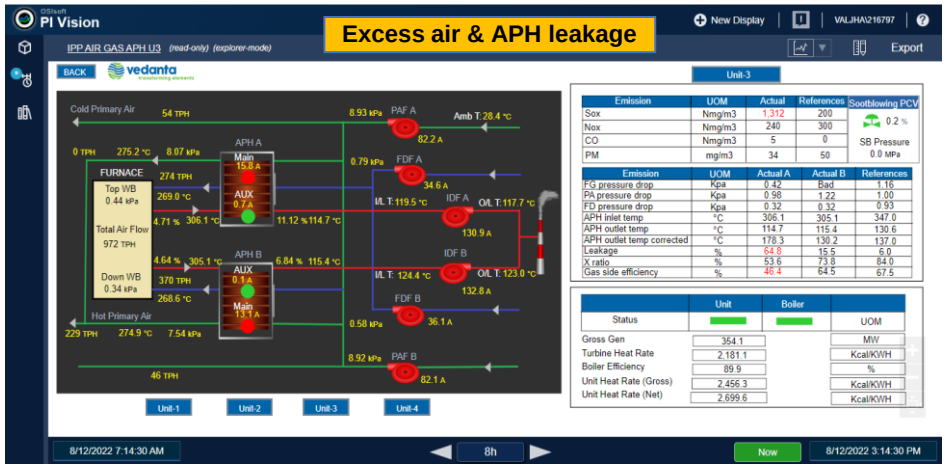
Parameters	UOM	U1	U2	U3	U4	U5	U6	U7	U8	U9
MS temperature HRL	kcal/kWh	1.2	137.9	1.0	-1.4	-0.8	1.8	0.9	0.8	-2.1
HRH temperature HRL	kcal/kWh	9.7	156.9	3.3	-2.3	-0.4	-3.5	8.2	2.9	3.7
MS pressure HRL	kcal/kWh	0.0	16.5	0.0	0.1	0.2	0.0	0.1	0.1	0.1
Condenser vacuum HRL	kcal/kWh	46.9	1,800.7	108.1	62.4	51.7	64.6	32.7	68.7	54.3
SH spray HRL	kcal/kWh	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0
RH spray HRL	kcal/kWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
ECO FW inlet temp HRL	kcal/kWh	25.5	126.6	-0.5	1.8	5.3	-2.6	16.0	-0.2	14.9
Flue gas outlet temp HRL	kcal/kWh	17.0	-99.6	-1.6	20.1	24.3	-31.7	5.9	15.1	4.1

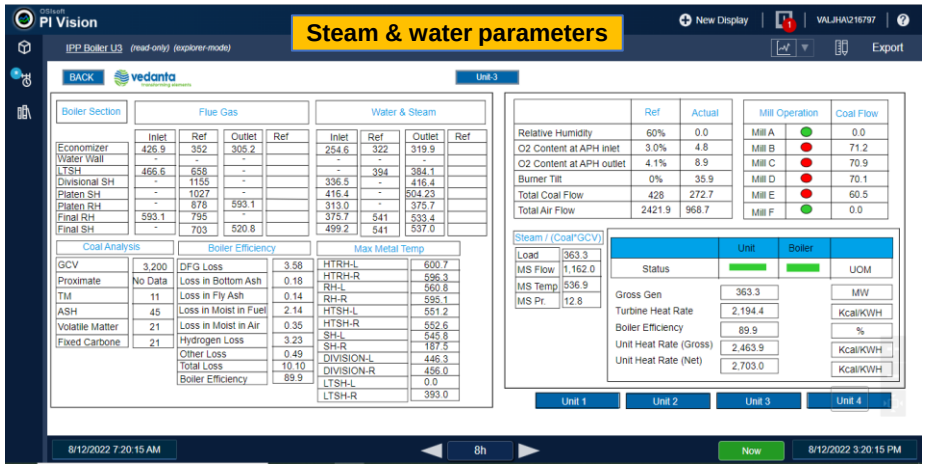
Thermal saving = 22 kcal/kwh
Total saving = 59 lakhs INR/Annum

Online Monitoring through Osi Pi – SMS & mail alert system implemented









Cylinder efficiency improvement by HIP carrier refinning

Challange:-

Low HP cylinder efficiency was concern,72% against 81%

Solution:-

Low HIP carrier refining by during COH improves cylinder efficiency from 72 to 78%.

Thermal Savings of **20 Kcal/Kwh**
Total saving-1.2 crore/Annum

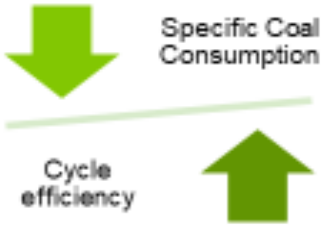
Vacuum Pump Suction Header Separation

Vacuum pump suction line modification has been carried out in all units. so now one vacuum pump is dedicated to each condenser and solenoid operated valve is fixed in between the vacuum pumps for feasibility in operations if any vacuum pumps trips/preventive maintenance is scheduled.

SAVINGS 20.16 Cr

Performance Analysis - Unit #1 Vacuum pump HP & LP suction separation

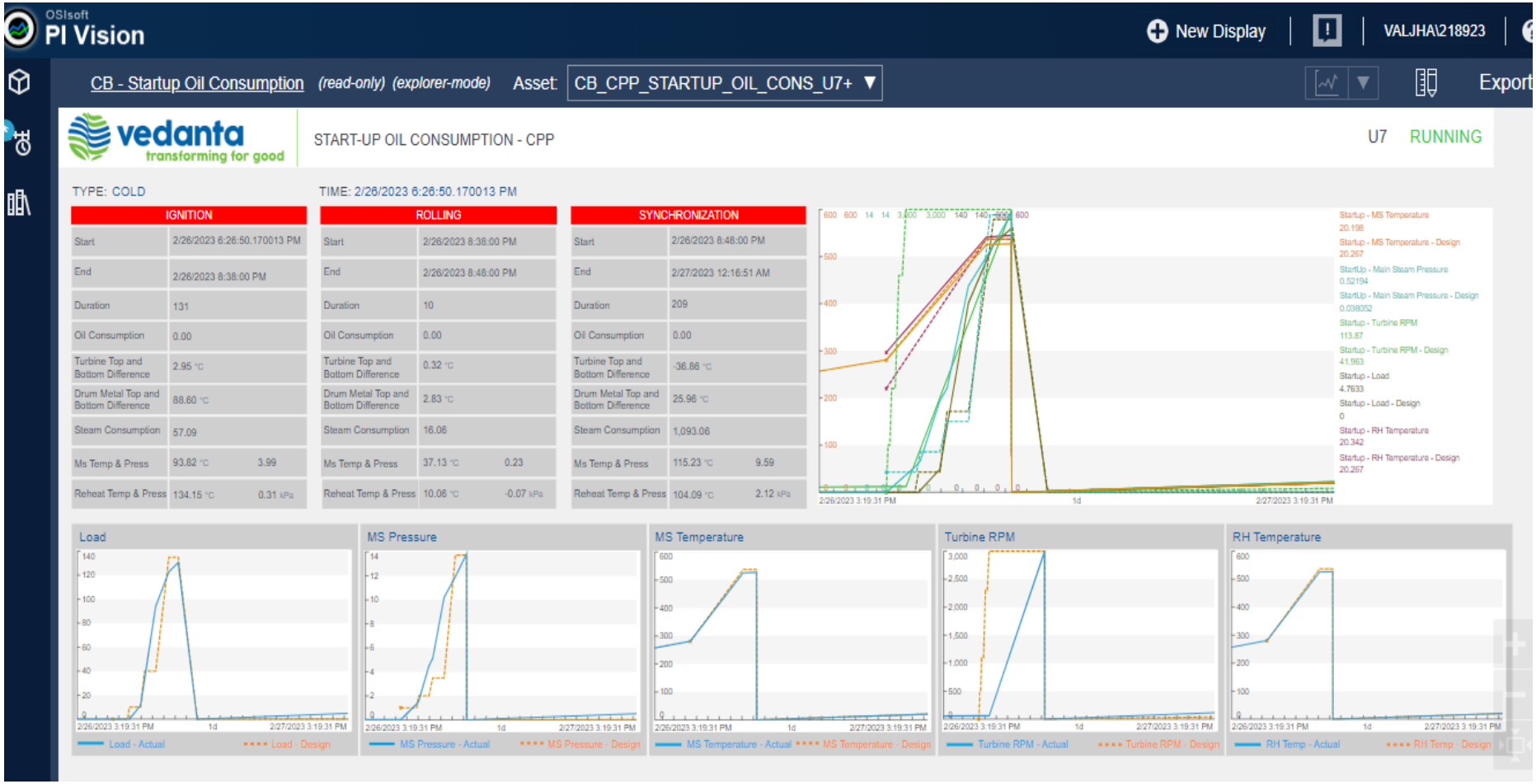
Date	Conditions	Vacuum pump charged with		Load (MW)		Vacuum (in kPa)				Station SCC Gain (gms/kwh)
		LP side	HP side	Before	After	LP side	HP side	Average	Gain	
27-07-2022	Condition 1st	A+B+C (Normal condition)		500	500	-84.3	-83.8	-84.1		4.0
	Condition 2nd	A+B	C			-89	-84.2	-86.6	2.55	
	Condition 3rd	A	B+C			-88.6	-84.5	-86.6	2.50	



Benefits :

- **~ 4200 tons coal saving per month for 1800 MW**
- **Vacuum pumps operation flexibility sustained**
- **Horizontal deployment for other units**

Digital initiative Real time start up curve



- implemented Real time start up curve though OSI- PI System is a suite of software applications that allows for **collecting , historicizing, finding, analyzing, delivering and visualizing data while unit start up.**

Renewable Power – Biomass Co-Firing/ Solar Projects

Biomass Co-Firing-

" Biomass co-firing is a promising technology to reduce the use of fossil fuels for energy generation and mitigate greenhouse gas emissions."

As a part of the renewable energy initiative and to achieve net carbon zero, Vedanta Jharsuguda in line with the Ministry of Power guidelines started biomass co-firing in CPP 1215 MW units. The power generated from co-firing of biomass shall be treated as Renewable energy & eligible for meeting Non-solar RPO. We have consumed 569 tons of biomass pellets till now and saved the equivalent amount of coal.

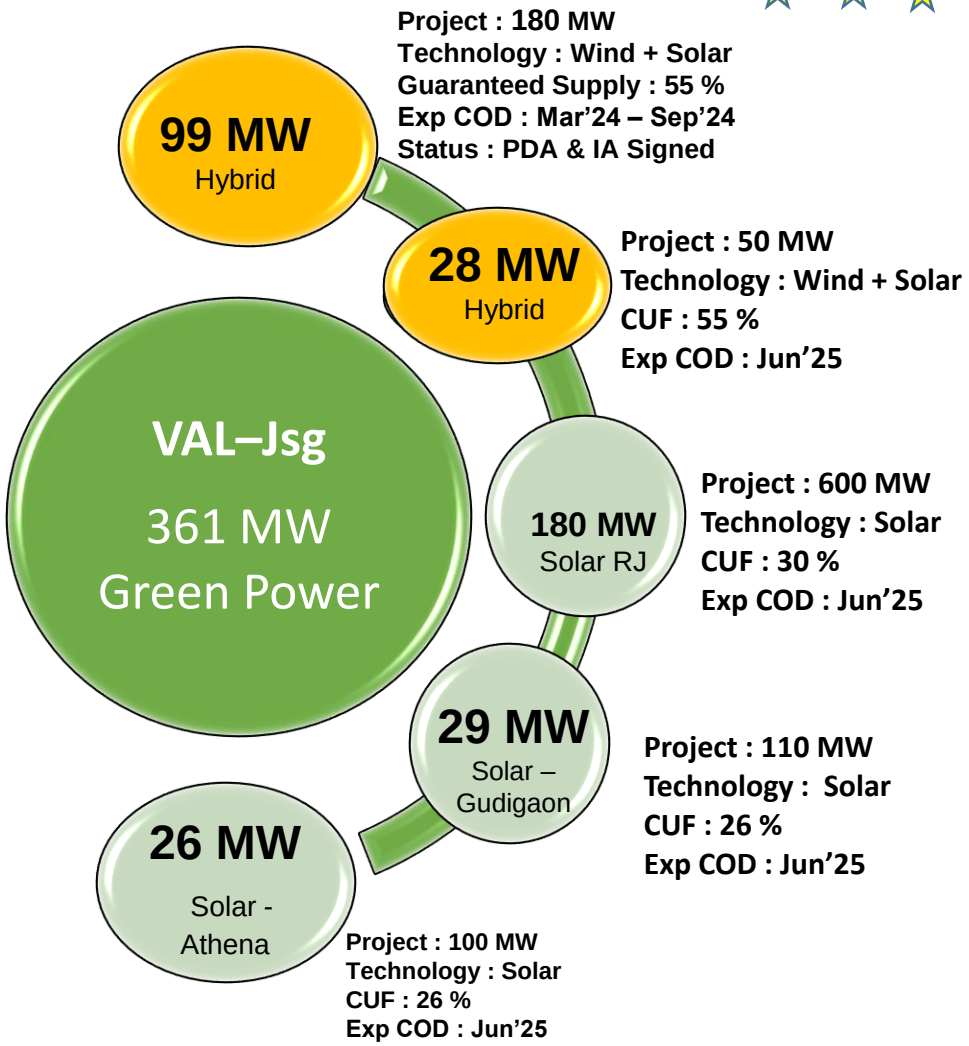
Solar Projects-

- 10 MW floating solar panel feasibility assessment under planned.
- 150 MW power production to begin in Fy-2024/25 at Gudigaon, Jharsuguda.

Year	*Quantity (Tons)*	*Generation (MU)*
FY 23	65	0.078
FY 24	308	0.421
		0.5

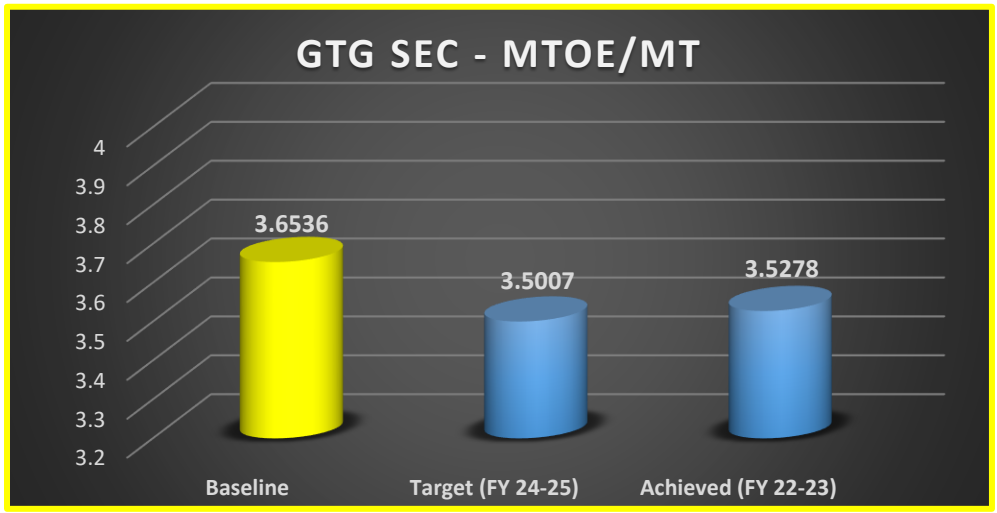
Green Power Project, Net Zero by 2050

	UOM	Vedanta - Jharsuguda
Complex Power Requirement	MW	2877
30% Green Power Target (FY-30)	MW	863
RE lined up	MW	361
Balance RE Power Potential	MW	502



PAT

Plant-1 + CPP 1215MW -ALM0008OR



Mandatory Energy Audit(MEA)

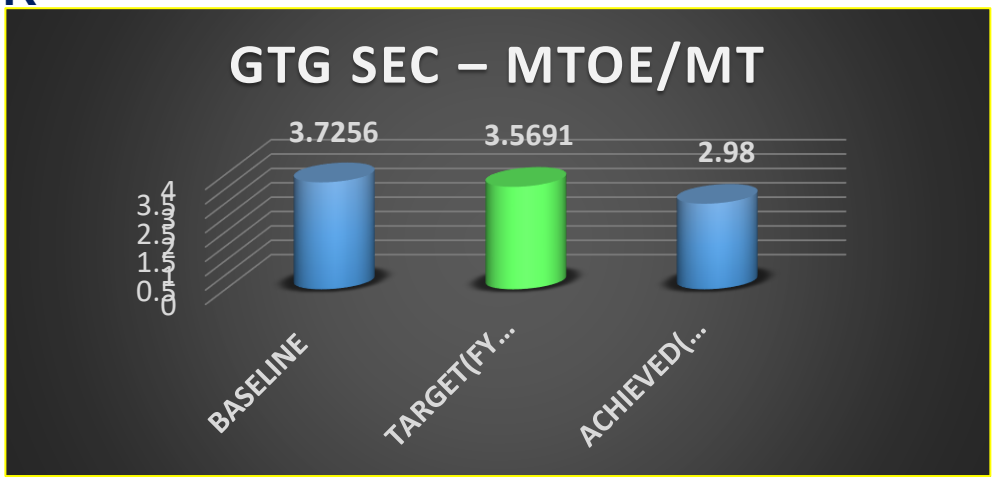
- Plant-1 + CPP 1215MW, already 2nos of Energy Audits were completed.
- 3rd Energy Audit completed in FY22.

Got Best Performer Award in 'PAT CYCLE#1'

Plant-2 + CPP 1800MW -ALM0014OR

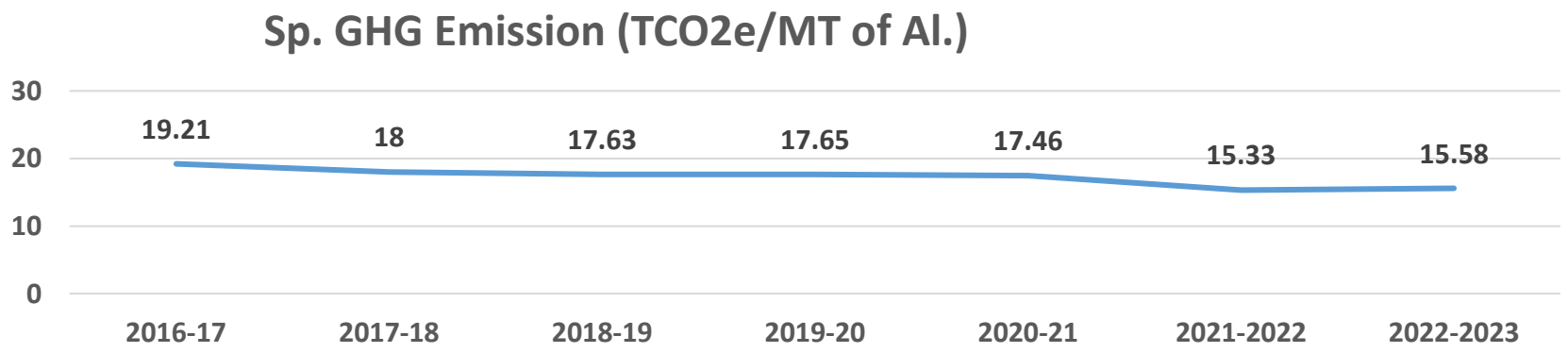
Mandatory Energy Audit(MEA)

- In FY21 1st Energy audit was conducted.
- In July'22 PAT M&V Audit done.



CARBON FOOTPRINT ACTIVITIES

Year	Scope 1 emissions CO_2e (MT)	Scope 2 emissions CO_2e (MT)	Scope 3 emissions CO_2e (MT)	CO_2e MT
2016- 17	1,50,98,803	45,942	3,99,815	1,55,44,560
2017- 18	2,09,01,063	76,404	7,38,042	2,17,15,509
2018-19	2,18,01,821	26,24,891	7,70,588	2,51,97,300
2019-20	2,28,93,187	8,02,665	3,77,712	2,40,73,564
2020-21	2,39,26,260	5,10,837	40,90,989	2,85,28,086
2021-22	2,38,95,267	19,56,916	50,05,928	3,08,58,111
2022-23	2,14,26,617	59,54,167	56,09,258	3,29,90,042



Major Initiatives -2022-23

Battery Operated Forklift	Electric Tanker Pilot Project	Lithium-ion Electric Bikes
Initiative Description: Deployed 23 Lithium-battery powered electric forklifts at Smelter Plants. Substantially longer life than conventional lead-acid batteries. Reduction in diesel consumption by over 2.5 lakh litres annually thereby ensuring GHG reduction of approx. 690 TCO2/yr.	**Initiative Description:** To decarbonize its vehicle fleet, Electric tanker vehicle for transportation of alumina flagged off. It will reduce diesel consumption by 18000 Litres annually/vehicle thereby reducing carbon emissions by ~50 TCO2e per annum.	**Initiative Description: Initiative Description:** Transformation of petrol-fueled bikes to Electric Bikes. These 4 e-bikes are completely emission-less and will be used by security team for patrolling in plant and township. It will reduce petrol consumption by 2800 Litres annually thereby reducing carbon emissions by ~4 TCO2e per annum.
		

Environment– Initiative Details

Fixed Mist Canon in TPP Coal Yard	Mobile Mist Cannon	Wheel Wash System at Main Gate
Initiative Description: Installation of Fixed type mist canon at Coal Handling Plant of 2400 MW TPP resulting in significant improvement in air quality of CHP as well as surrounding areas.	**Initiative Description:** Deployment of mobile mist cannons (6000 Liters/vehicle) on the plant roads to reduce fugitive emission from vehicles during transportation.	**Initiative Description:** Installation of wheel wash system at Main gate to reduce fugitive emission from vehicles during transportation of ash and coal vehicles

Environment– Initiative Details

Rainwater Harvesting

Initiative Description: Six Roof Top Rain Water Harvesting Structures have been installed & commissioned in plant premises and township area.

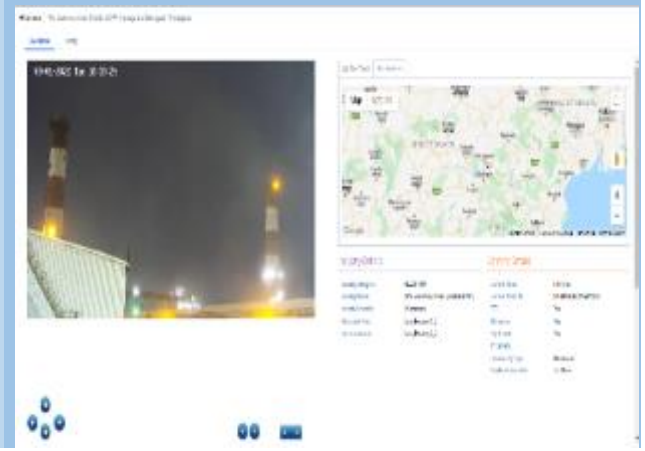
Green belt development

Initiative Description: Plantation of 3,60,000 saplings across the plant boundary and inside plant premises to ensure 33% greenbelt.

Year	No. of saplings planted till date
Till 2016-17	484500
2017-18	33004
2018-19	26370
2019-20	20101
2020-21	6537
2021-22	392245
2022-2023	113699
Total	**1076456**

HDIP camera

Initiative Description: HDIP cameras installed across plant premises for all CEMS Stacks to ensure emission regulation.



Environment– Initiative Details

500 m3 ETP at TPP

Initiative Description: Effluent Treatment Plant (ETP) of 500 m3/hr with RO facility installed for treatment of wastewater and regeneration water from DM Plant.

Runaya Dross Processing Facility

Initiative Description: 33% metal (Al) recovery from Aluminium Dross (HW Waste) through Runaya Dross Processing facility.

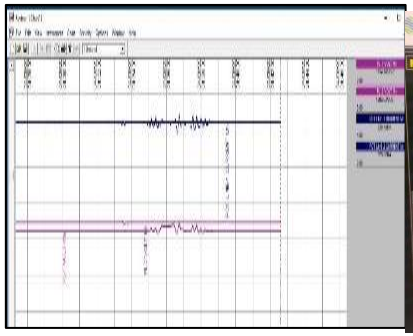
Fly ash dispatch through Rail

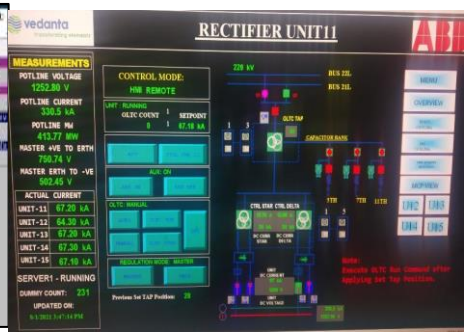
Initiative Description: Dispatch of fly ash by rail initiated at Jharsuguda

UTILISATION OF WASTE

Sl No.	Initiatives Taken
1.	Installation of Mechanical Waste converter done for manure production from food waste.
2.	Dross Refining unit Installation.
3.	Recycling of broken Cathodes in Carbon Plant .
4.	Recycling of used steel stub pins in casting.
5.	Reuse of Refractory (SPL) Waste.
6.	Reuse of used steel collector bars.
7.	Reuse of effluent water for gardening.
8.	Rejected Anode butt utilization.
9.	Incineration of used Bag Filters in Baking Furnaces.
10	Regulated consumption of Contaminated Alumina.

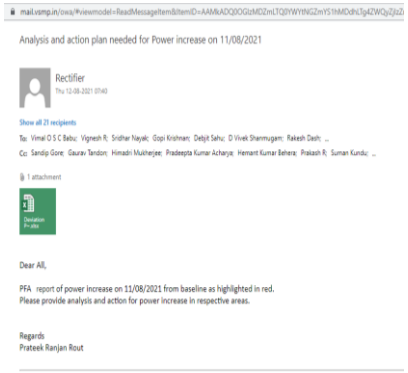
ENERGY MONITORING & REPORTS





- SEC Report to Plant Head
- Section Wise Report to Energy Managers
- Daily reports to HODs

Analysis and action plan for Power increase									
Day Report	Smelter (MW)	Pot AC (MW)	Pot AUX (MW)	Compressor (MW)	GAP(MW)	BO(MW)	ROD(MW)	CAST(MW)	
Baseline	880.89	837.54	18.00	9.60	5.38	1.51	1.84	4.81	
8/1/2021	6.33	5.76	-0.07	2.31	1.26	0.08	-0.01	-2.61	
8/2/2021	4.81	4.62	-0.24	1.93	0.88	0.02	0.24	-2.50	
8/3/2021	5.31	5.00	-0.12	1.32	1.04	0.10	-0.06	-1.95	
8/4/2021	7.27	5.24	-0.18	1.14	1.25	0.03	-0.09	-0.36	
8/5/2021	7.96	5.84	-0.23	1.12	1.09	0.02	-0.01	-0.01	
8/6/2021	9.74	6.34	-0.26	2.00	1.22	0.10	-0.06	0.05	
8/7/2021	8.67	4.86	-0.24	2.00	1.21	0.14	0.08	0.05	
8/8/2021	9.94	5.75	-0.11	1.96	0.80	0.10	-0.27	0.01	
8/9/2021	9.23	6.00	-0.26	1.45	1.14	0.15	0.14	0.01	
8/10/2021	8.52	6.20	-0.28	1.36	-0.60	0.02	0.34	0.76	
8/10/2021	8.09	6.38	-0.16	1.69	-1.42	0.05	-0.27	1.11	



Parameters & Monitoring Frequency	
High Energy Consumers	Daily
Fuel Consumption	Daily
Compressed Air Consumption	Daily
Water Consumption	Daily
Energy deviation report	Daily

ENCON WEEK 2022 MAJOR EVENT GLIMPSES

Events Conducted:-

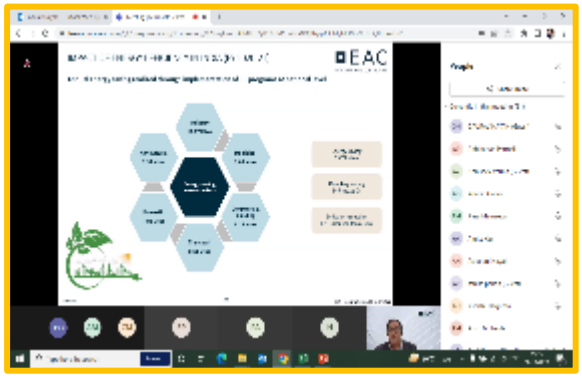
1.Eergy awareness campaign in plant by different departments

2.Online quiz competition for Vedanta employee

3. Awareness training for school children

4.e-paper presentation for school

5. best energy conservation idea competition for contract partner,



ENERGY CONSERVATION WEEK CELEBRATION-2022

PEOPLE INVOLVEMENT

- E – Test launched to check training effectiveness.
- 100% E-test compliance done.
- SGA Activities along with TQM for Encon improvement.
- Energy Dash Boards maintained.
- Mandatory energy Audit done by DNV
- Online webinar organized through energy efficiency product manufacturer

Energy awareness in Tool Box Talk.

Energy awareness Training

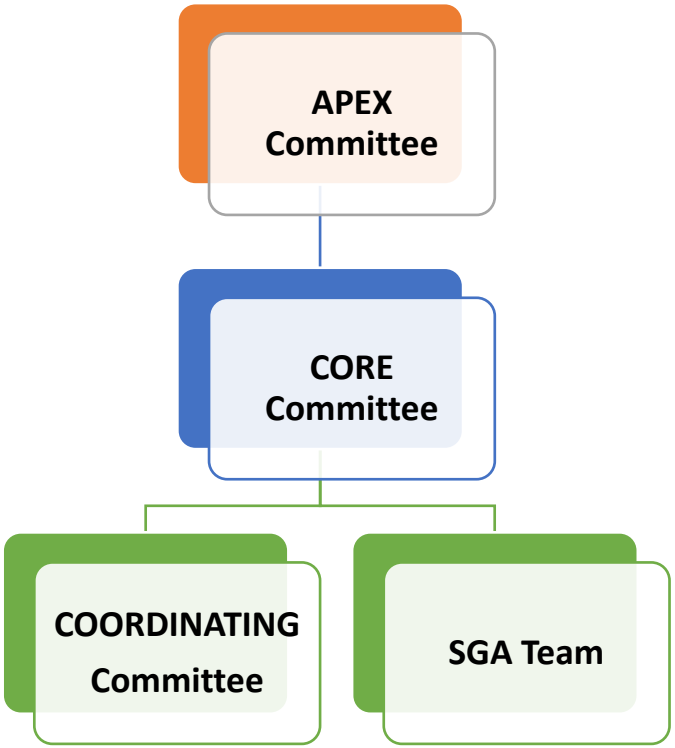
EnMS Re-certification audit

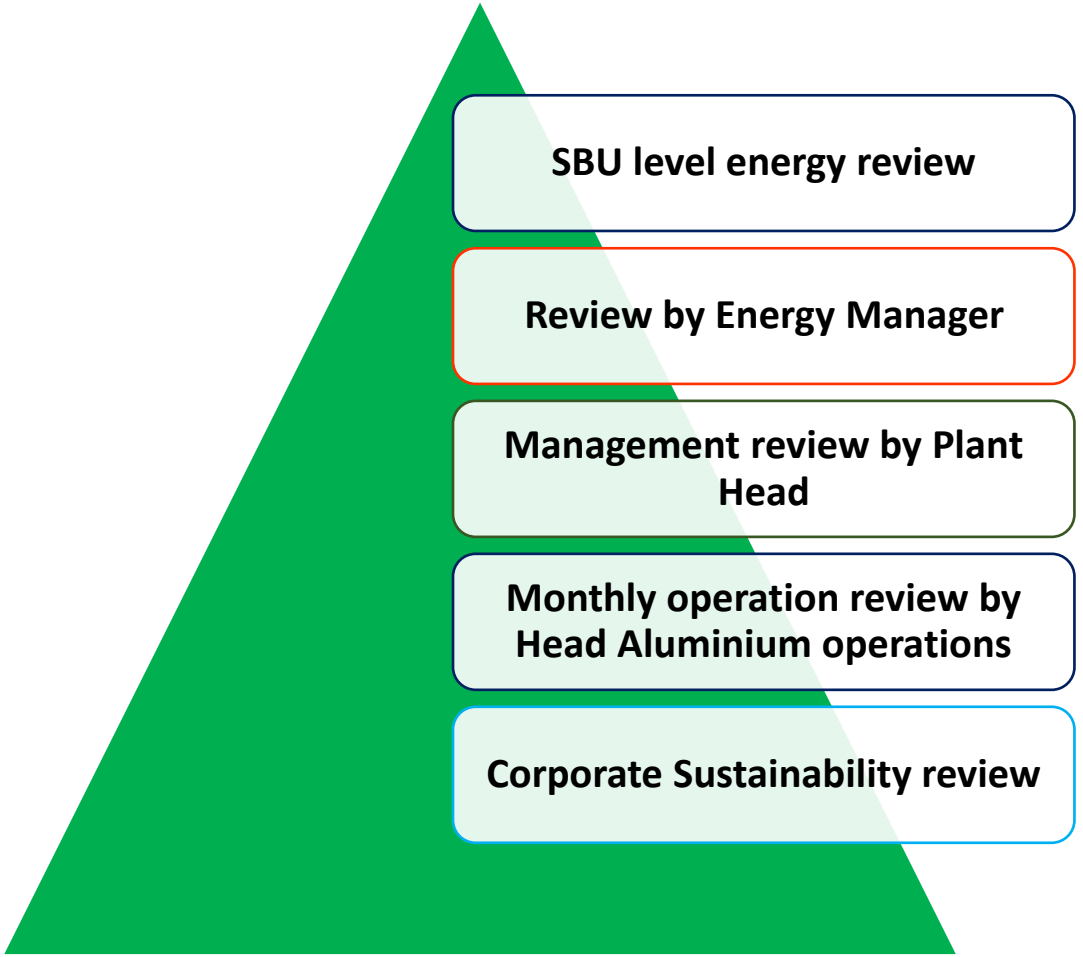
War room meetings

"We value every small contribution"

REVIEW STRUCTURE

Formation of Energy Cell





"Bottom to Top Approach"

vedanta
transforming for good

ROAD MAP TOWARDS BENCHMARK

CII
Confederation of Indian Industry
125 Years - Since 1895

- Adoption of New technology of Cell Modelling
- Up-gradation of Pot Control & Feeding System
- EFO (Emulsified fluid oil) implementation in furnace for HFO reduction
- Use of RUC copper inserted collector bar for pot cathode..
- Hencon Vehicle Operating system upgradation.c
- Addition of New CT Cells
- Green power(RE)

AWARDS & RECOGNITIONS

Confederation of Indian Industry

23rd National Award for Excellence in Energy Management 2022

This is to certify that

Vedanta Limited, Smelter Plant 1, Jharsuguda

has been recognized as

"Energy Efficient Unit"

This acknowledgement is based on the evaluation by the panel of judges at the "National Award for Excellence in Energy Management" held during 23 - 25 August 2022

K S Venkatagiri

Ravichandran Purushothaman

- ✓ **Recognized as "Energy Efficient Unit" at 23rd National Award for "Excellence in Energy Management" organized by CII.**
- ✓ **Gold award for best energy management from SEEM 2023.**

THANK YOU