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transforming for good

Confederation of Indian Industry
125 Years - Since 1895

22st National Award for Excellence in Energy Management – 2021

Asia's 1st ISO-50001 certified Smelter

VEDANTA LIMITED –SMELTER PLANT1

Team Members:

- **Vimal Kumar**
- **Rahul Bharadwaj**

PURPOSE & VALUES

Core Purpose

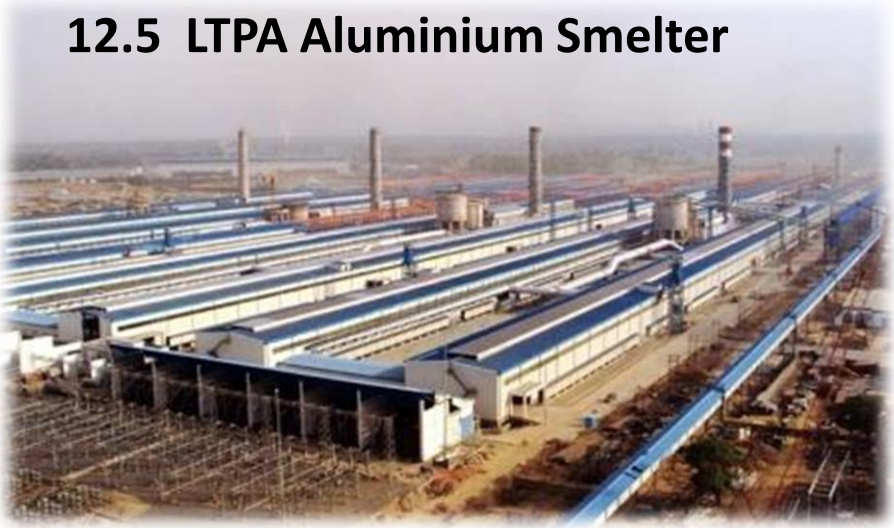
"Vedanta is a globally diversified natural resources company with low cost operations. We empower our people to drive excellence and innovation to create value for our stakeholders. We demonstrate world-class standards of governance, safety, sustainability & social responsibility"

VEDANTA LIMITED, JHARSUGUDA

5 LTPA Aluminium Smelter

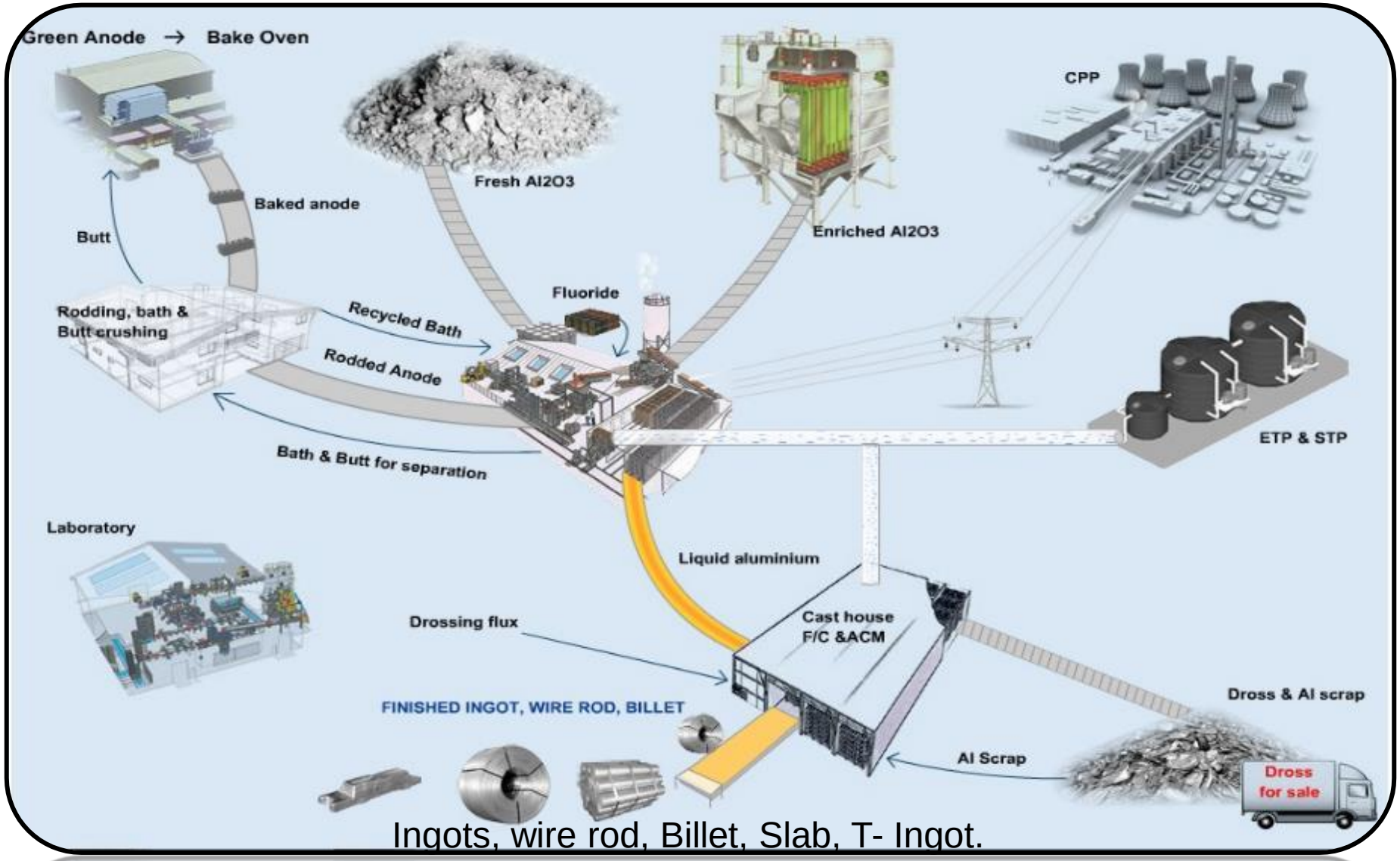
1215 MW CPP

12.5 LTPA Aluminium Smelter



1800MW CPP+600MW TPP

MAKING OF ALUMINIUM



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

PRODUCT MIX

Ingot Casting Machine

Technology
- BEFASA, Spain

Plant Capacity
- 450 KTPA

Product Destination
Apar Industries Ltd.
Jindal Aluminium Limited.
STX, Daechang, Dreample (Korea)
Southern Aluminum (China), etc

Slab Casting Machine

Technology
- WAGSTAFF, USA

Plant Capacity
- 100 KTPA

Product Destination
Novelis(Korea)
Garmco(Middle East)
Hindalco, etc

Wire Rod Mill

Technology
- SOUTHWIRE, USA
- Properzi, Italy.

Plant Capacity
- 120 KTPA

Product Destination
Polycab Wires Pvt. Ltd.
Havell's India Ltd
Nepal Wires (Nepal)
Etsec (Kenya), etc

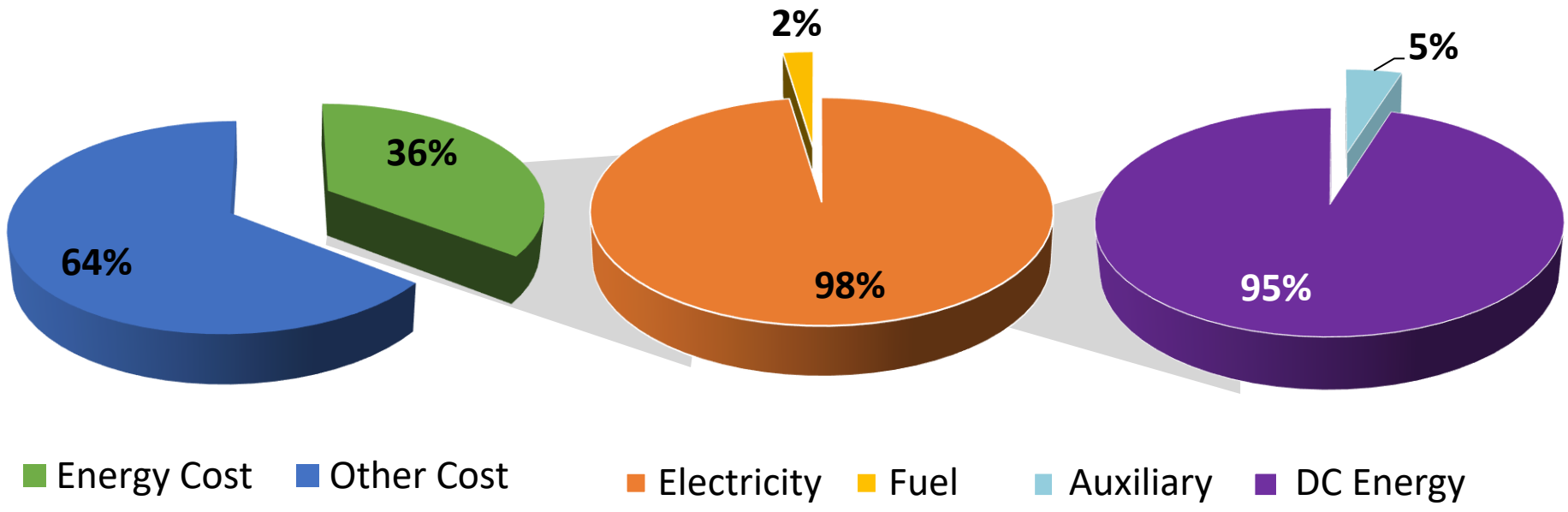
Billet Casting Machine

Technology
- WAGSTAFF, USA

Plant Capacity
- 120 KTPA

Product Destination
Century Extrusions Limited
Alom Extrusions Limited (Turkey)
Hyundai Aluminum (Vietnam)
Wespeco (South Africa), etc

ALUMINIUM - ENERGY & COST



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

Focus is on DC energy reduction

ENCON PROJECTS FY 2019-20

Sl. No.	Project description	Annual energy saving in Million kwh	Cost saving in Million	Investment in Million	Payback (years)
1	100% graphatized cathode installation	47.30	1660.248	410.00	1.92
2	Replacement of Conventional (Cylindrical) Filter bag to star type Filter Bag.	0.68	23.803	63.50	1.93
3	LED installation in Plant Area- consolidated	0.40	14.050	2.48	0.00
4	Bakeoven furnace transformer Cooling Ramp VFD installation	0.307	7.083	1.51	2.83
5	Reduction in Alloy Ingot furnace preparation time	0.141	6.269	0.00	0.08
6	Hydraulic power pack oil circuit modification	3.066	2.894	0.03	0.00
7	Energy efficient motor installation in GAP circular motor fan	0.077	1.953	0.35	0.00
8	Cooling tower automation	0.122	1.691	0.00	0.92
9	Cold well pump pressure optimization	0.020	0.650	0.00	0.00
10	Rodding crusher load reduction by reducing mesh size	0.088	0.603	0.02	0.50
11	LCP Room foreceiling repair for AC load optimization	0.002	0.215	0.07	0.00
12	HFO consumption reduction	17241GJ	15.26	0.00	2.00
13	Provision of an external AC compressor unit for Aluminium transport vehicle seal changing job	5061GJ	0.667	0.00	1.17

Total energy savings for FY 2019-20 = 49 Million kWh

Total Fuel savings for FY 2019-20 = 22302 GJ

ENCON PROJECTS FY 2020-21

Sl. No.	Project description	Annual energy saving in Million kwh	Cost saving in Million	Investment in Million	Payback (years)
1	100% graphitized cathode implimentation from 75 % to 85.3% of pots	45.98	122.77	392.04	3.19
2	Energy efficient Lighting/Motors	0.09	0.23	0.39	1.69
3	compressor intercooler replacement for two compressor	0.04	0.10	0.25	2.63
4	Dryer Auto Drain Valve installation	0.32	0.85	0.20	0.23
5	Separate Header provision for CastHouse	0.44	1.17	1.00	0.86
6	Compressor Cooling Tower fills replacement	0.10	0.25	1.40	5.50
7	Replacement light fitting with LED lights	0.22	0.58	0.21	0.36
8	Replacement light fitting with LED lights	0.07	0.18	0.38	2.08
9	Energy Efficient Motor Installation	0.02	0.05	0.08	1.48
10	LED Lighting in GAP Shop floor	0.51	1.35	1.20	0.89
11	New heater installation in Gap2 S20 1B	0.62	1.65	0.89	0.54
12	Energy efficient AC installation	0.03	0.08	0.17	2.12
13	Modification to reduce HFO consumption	9112 GJ	6.94	0.40	0.06

Total energy savings for FY 2020-21 = 60.8 Million kWh

Total Fuel savings for FY 2020-21 = 9112 GJ

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

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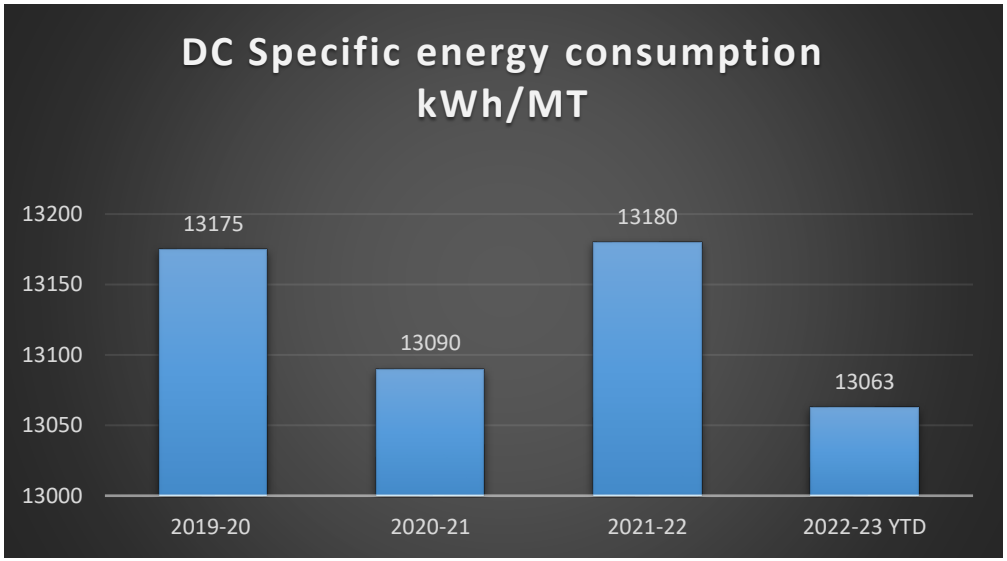
Major Encon Projects

SPECIFIC ENERGY CONSUMPTION TRENDS

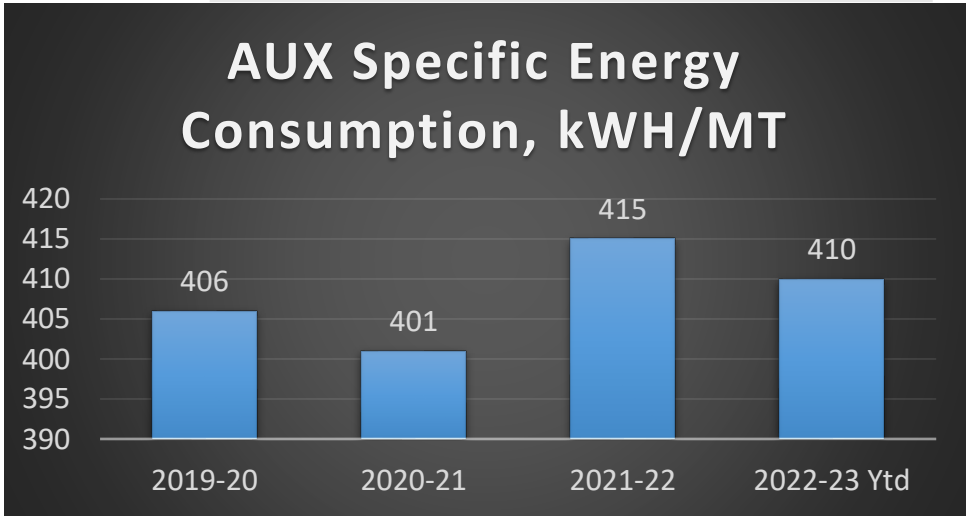


Specific DC consumption highlights

- Non Graphitized pots to Graphitized pots conversion is increased from 76% (Mar'22) to 79% (June'22)
- Graphitized Pots Current efficiency improved from 94.74% (Mar'22) to 95.07%(June'22)
- Graphitized Pots Pot Average Voltage reduce from 4.112 (Mar'22) to 4.105(June'22)
- Relining time decreased from 12 days to 8 days.

Specific AUX consumption highlights

- Star filter bag installation in FTP
- Mass LED conversion in Plant area
- FTP airslide fan optimization



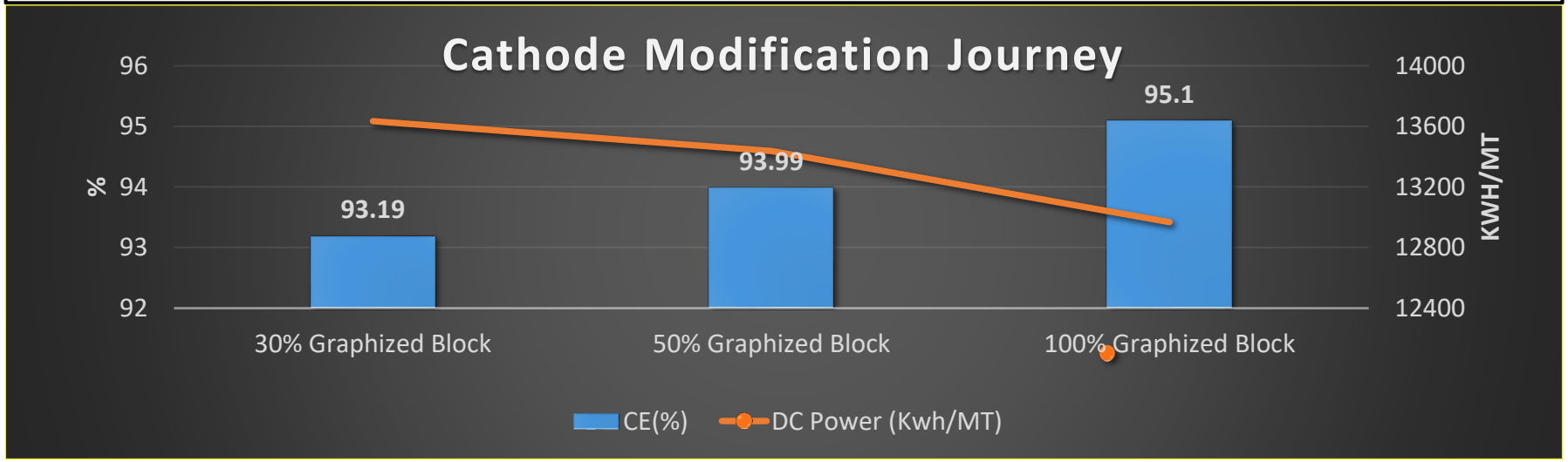
GRAPHATISED CATHODE IMPLEMENTATION

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 hence high energy conservation.

Benefits of implementation:

- Resistivity reduced from 26 ohm-cm to 12 ohm-cm.
- Operating Voltage decrease from 4.206 V to 4.100 V
- CVD (Cathode voltage drop) decreased from 385mV to 247mV
- Which resulting a huge energy saving by the reduction of Specific DC energy consumption from 13500Kwh/Mt to 12950Kwh/Mt.



Energy Conservation: **57.7 MWh/ Annum**

Major Project

Old pump replacement with Energy efficient pump at RPH-01

Old pump replacement with Energy efficient pump at RPH-01.Before old pump having 140.52 kW with current 230amp after replace new pump having 125.24kW with current 205 amp .After replaced energy consumption is less .Details is given below

❖ Energy saving achieved in 2021-22: 133MWh/annum

Anode Coating to Reduce Air Oxidation

- **Problem areas necessitated the plant to introduce innovation**: To reduce the Net Carbon Consumption in potlines by coating the anodes, thereby reducing the Carbon footprint of the Aluminium smelting process
- **Brief about the energy efficiency /low carbon technology adopted:** Carbon anodes in Aluminium smelters are subject to air burn (oxidation in the air) which increases CO2 emissions. Reducing the consumption of anode Carbon in Aluminium reduction cells has technical, environmental, and economic benefits. The Silicate based Anode coating technique is useful in reducing the Top Oxidation and has a major impact on Net Carbon Consumption (NCC)

- **Impacts & Benefits realized:**
  - Gain in Butt weigh
  - Reduction in Net carbon consumption by 3kg/MT of Al
  - Reduction in top oxidation.
  - Reduction of carbon footprints

Innovation project

Software upgradation in MTV 5

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.

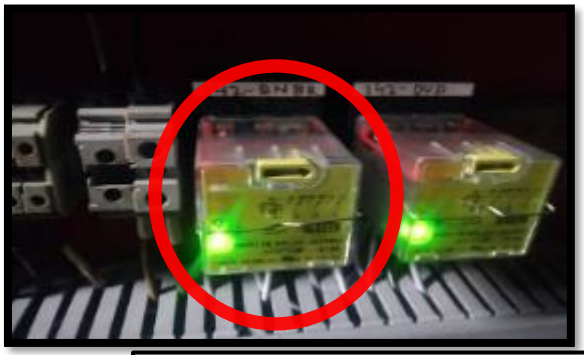
Before Software upgradation				
Month	lit/hr	Lit/hr Avg	Savings (Lit/hr)	Savings (INR/month)
Jun-20	20.22	20.39	NA	NA
Jul-20	20.61			
Aug-20	20.43			
Sep-20	20.31			

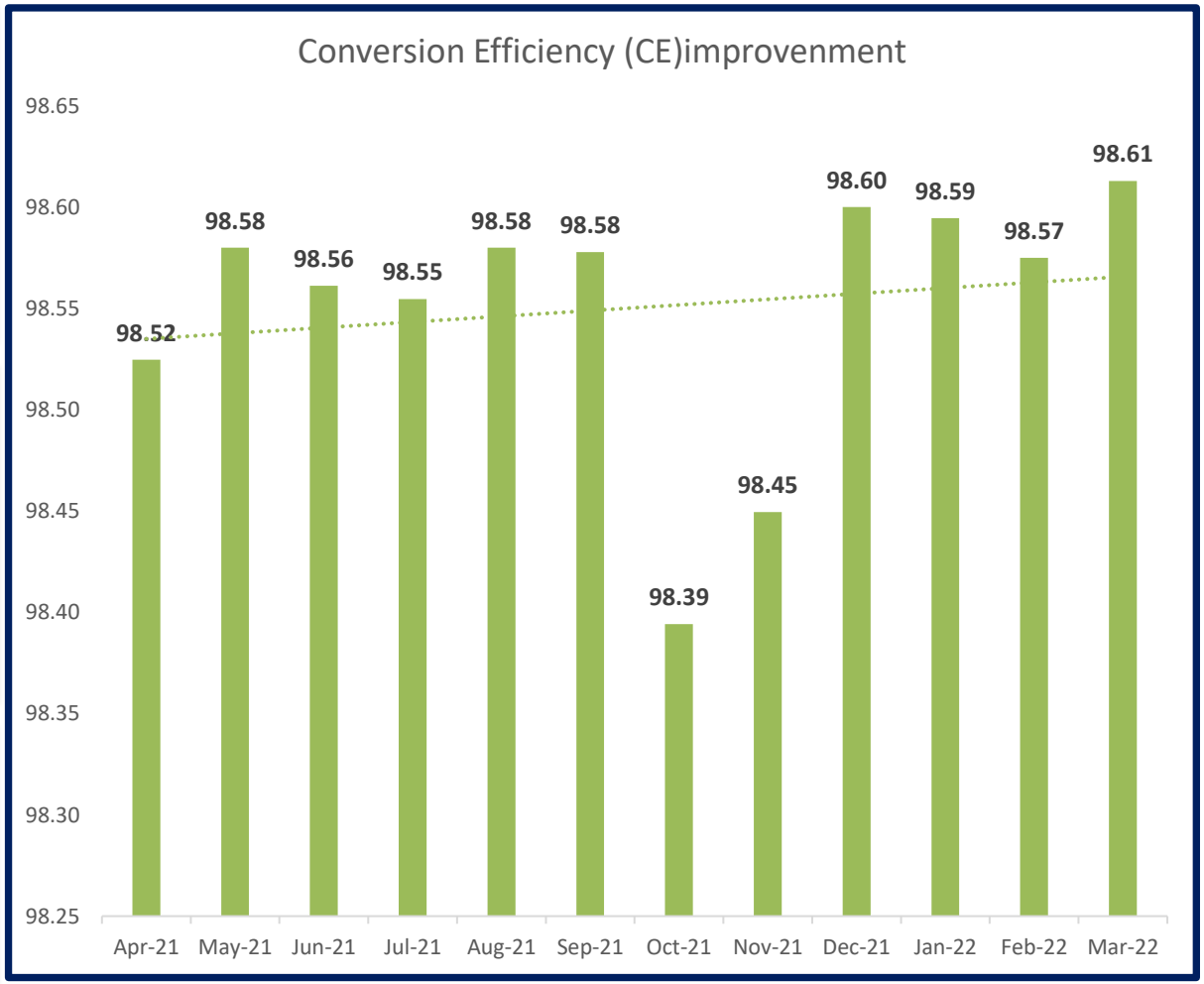
After Software upgradation			
Month	lit/hr	Savings (Lit/hr)	Savings (INR/month)
Jun-21	14.96	5.4	219915
Jul-21	14.96	5.4	219915
Aug-21	16.07	4.3	174960
Sep-21	15.73	4.7	188730
Oct-21	15.84	4.6	184275
Nov-21	15.69	4.7	190350
Dec-21	14.98	5.4	219105
Jan-22	15.04	5.4	216675

Total investment, Rs: 6500000	Year of implementation: 2021-2022
Total savings- Rs. 1613925	

Innovation project

AC TO DC CONVERSION EFFICIENCY IMPROVEMENT FROM 98.58% to 98.62%





❖ Energy Conservation in 2021-22: 3137.38 MWh/annum

Innovation project

ENERGY SAVING THROUGH LED LIGHT & LIGHTING AUTOMATION

Lighting is the area where lot of scope is there for energy consumption reduction. Many initiatives has been taken at all the areas of Smelter-1 like LED conversion, automation of lighting circuit to eliminate idle running of lights, Day time lighting control at shop floor lighting etc.

Potline-2

Ungrouping area of Bake oven

Rectifier ,Plant 1

Occupancy sensor

- Energy Conservation in 2021-22: 1024MWh/annum

Energy Efficient Motor Installation– P1 GAP

In GAP, Motor installed quantity is high. All installed motors are less efficiency motors which is having 70% to 75%. Taken initiative to replace 20no's to 25no's of Motor in a year. This is continual improvement of every year to replace low energy efficient to energy efficient motor.

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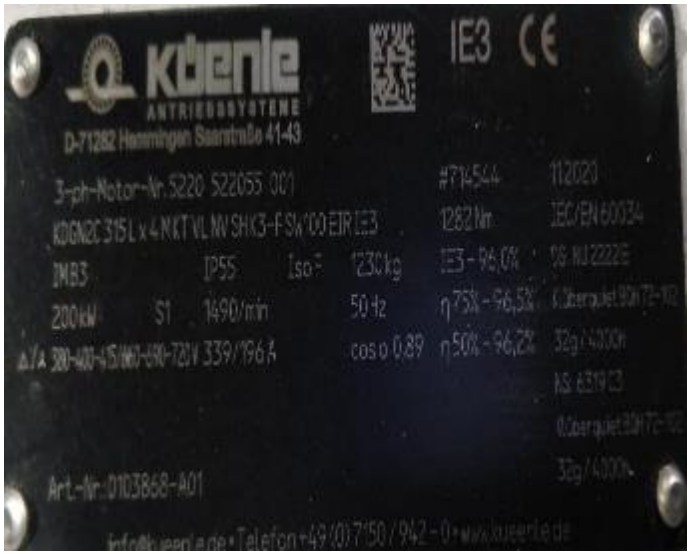
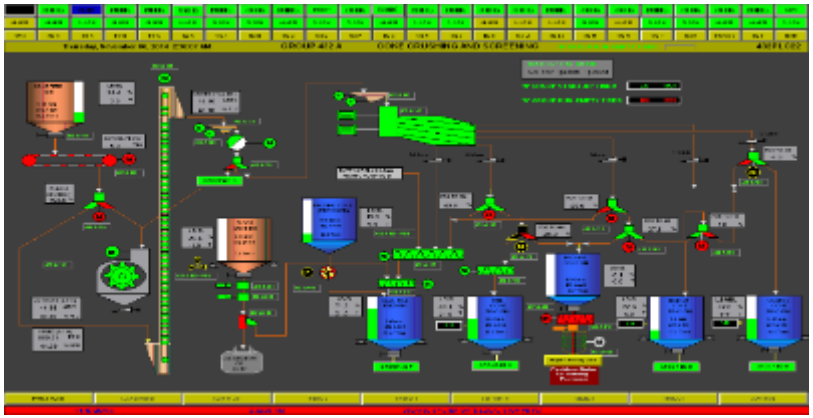
Month	Motor Rated KW	Motor Running KW	Old Efficiency	New efficiency	Savings
Apr-21	200	138	0.78	0.93	18491.32
Jul-21	4	2.9	0.8	0.93	656.71
Aug-21	5.5	3.9	0.8	0.93	883.17
Aug-21	7.5	5.7	0.8	0.93	645.39
Savings kwh per month					**20676.59**

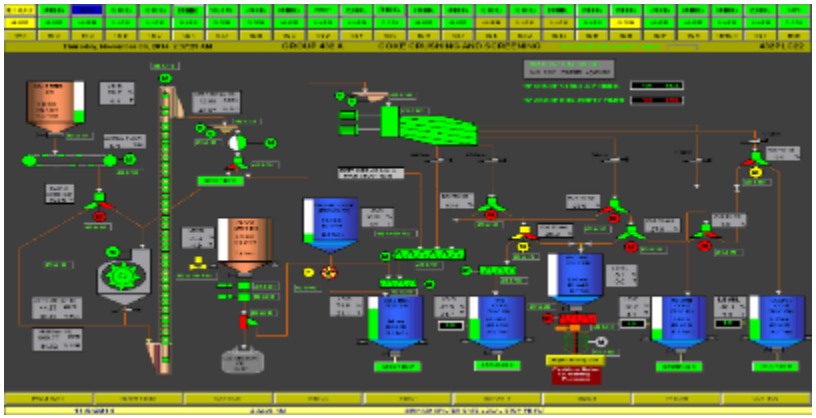


Process optimization of B group GAP

- **Background:** In Coke Crushing & Screening (431A) group Belt weigh feeder stops when its feed bin level got empty. Group runs idle till operator starts A103 after checking feed bin level developed. Idle running is wastage of power and lower performance of equipment's.
- **Modification:** Modification of logic to start Belt weigh feeder automatically as soon as the feed bin is filled.to avoid low tonnage of equipment's (Belt conveyor, crusher, Vibrating screen & 2 screw conveyors) and unnecessary idle running of screw conveyor motors



BEFORE



AFTER

❖ Energy Conservation in 2021-22: 536 MWh/annum

VFD INSTALLATION IN CT FAN OF RPH

In RPH-1 & 2, there are 3 CT fans one with VFD and the other two are of DOL stater. At normal operation one DOL CT fan and one VFD CT fan run simultaneously. Now one more VFD installation done and now at normal operation two VFD CT fans run simultaneously at 36.5Hz. This resulted in energy saving of 8kW in each RPH.

Energy Saving- 140MWH/Annum

STEP TOWARDS NET ZERO EMISSION

As a step towards net zero emission ,it is planned to use battery operated forklift in place of diesel operated . Recently demo trial has been taken,generating saving of 30L/day and one switchyard battery operated car inhousely developed inplace of diesel operated one.

Investment –INR 45lakhs/anum

Battery operated swd. car

Battery operated forklift

Saving- 1000 ltr/month per forklift

PROJECTS IN PIPELINE

Smart pot … A step towards digitisation

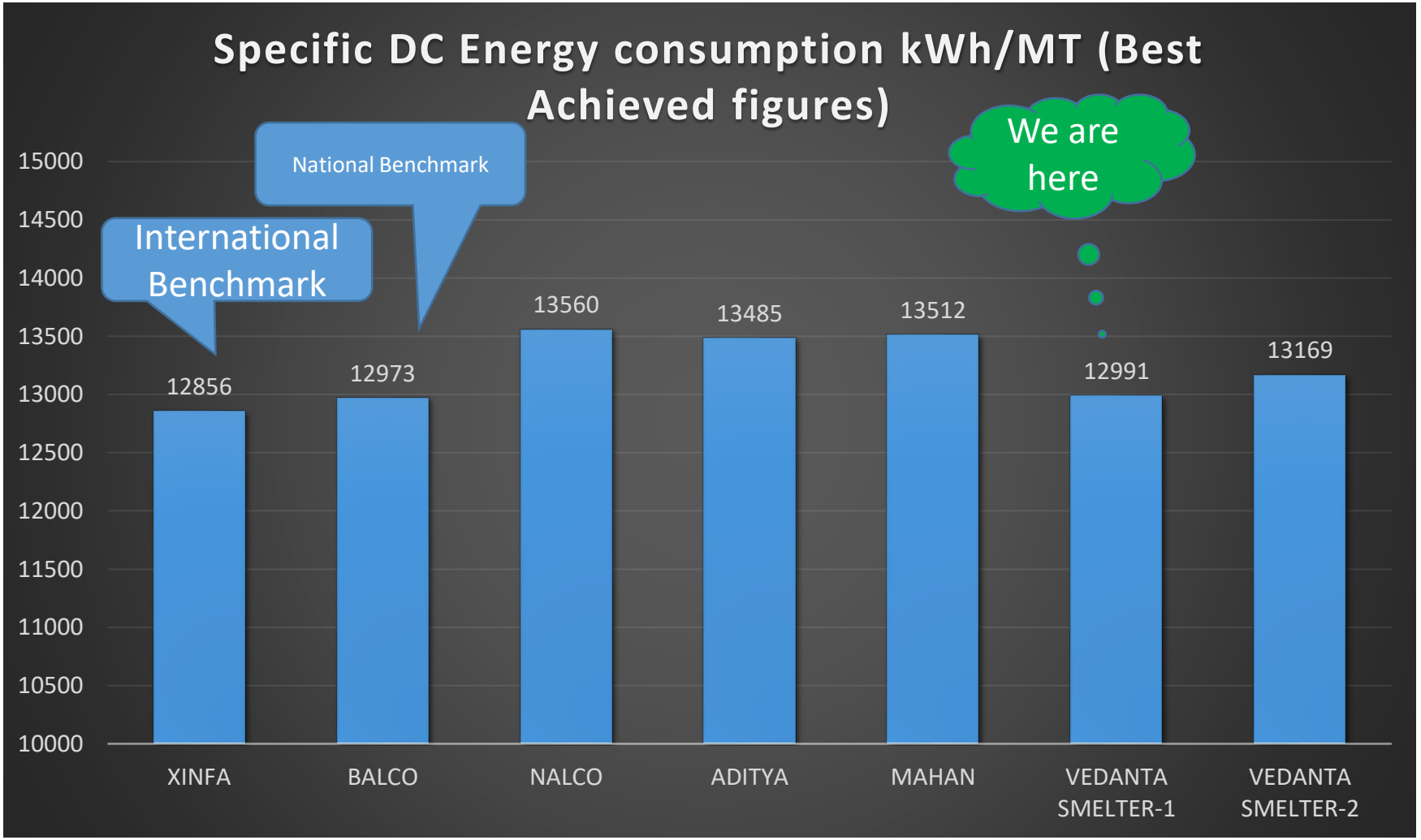
SMART POT

It is a technology for Improving Potline Performance and efficiency through Digital twin solutions applying Digital Predictive and prescriptive analysis and Advance data science solutions in Pot Process control

Expected benefits-

- Reduce **Specific Energy Consumption (SEC)** by 1%
- Reduce **Raw Material (AlF3) Consumption** by 1 kg/MT
- Reduction in Pot leakages

PERFORMANCE BENCHMARKING



One measurement is worth a thousand expert opinions

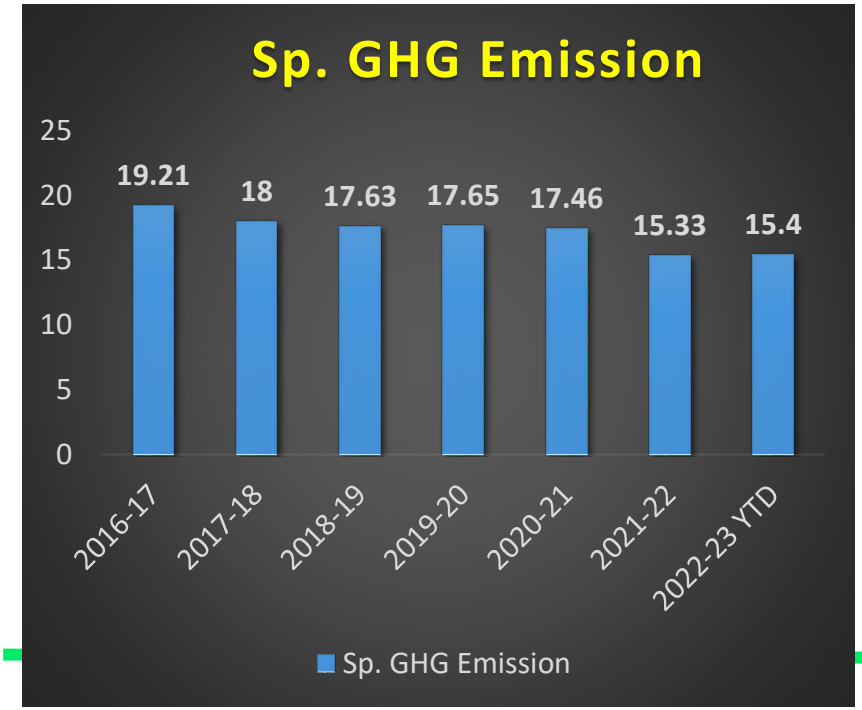
UTILISATION OF WASTE

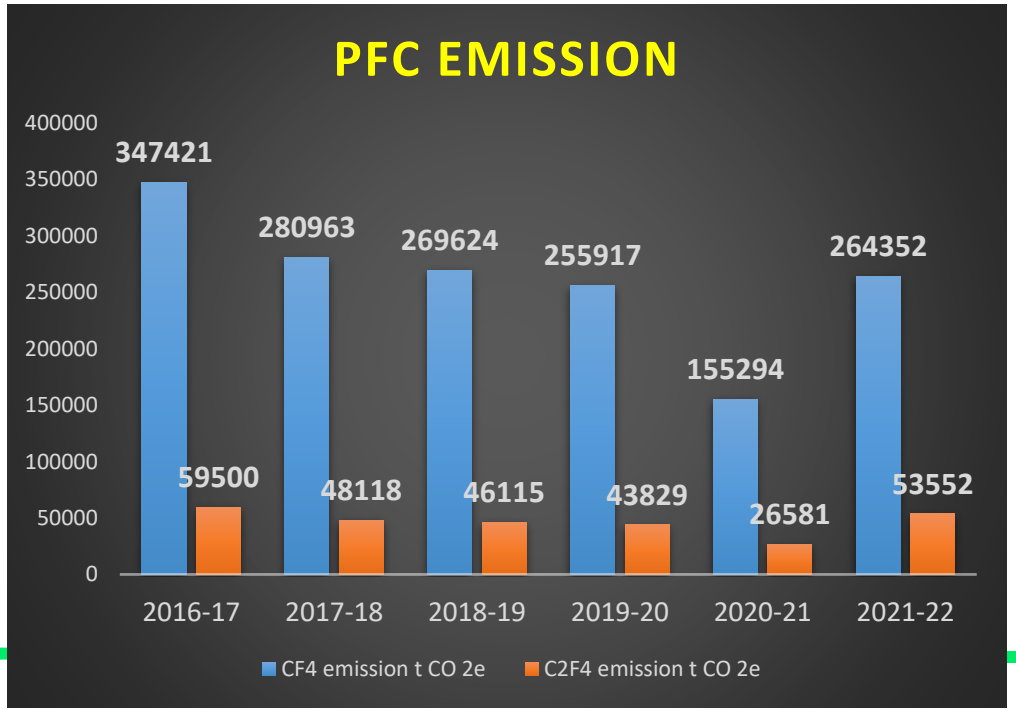
Sl No.	Initiatives Taken
1.	Installation of Mechanical Waste converter done for manure production from food waste.
2.	Dross Refining unit Installation.
3.	Recycling of broken Cathodes in Carbon Plant .
4.	Recycling of used steel stub pins in casting.
5.	Reuse of Refractory (SPL) Waste.
6.	Reuse of used 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.

"Whatever Half Full or Half Empty, Resources are limited"

CARBON FOOT PRINT 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
2018-19	2,18,01,821	26,24,891	7,70,588	2,51,973,00
2019-20	2,28,93,187	8,02,665	3,77,712	2,40,70,583
2020-21	2,39,26,260	5,10,837	-	24437097
2021-22	23895350	1956916	5005928	30858194





Major Initiatives -2021-22

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.

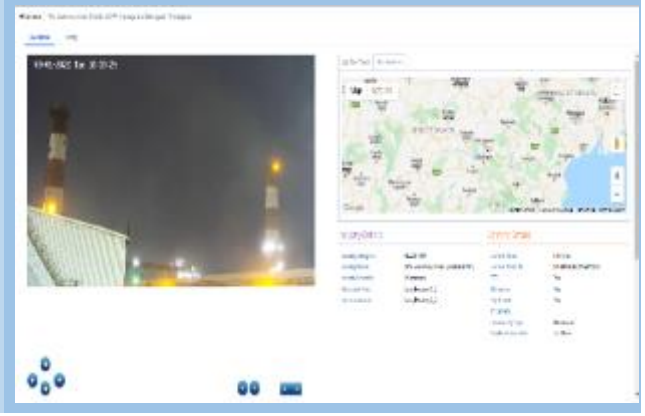
Green belt development

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
Upto 2014-15	364883
2015-16	57038
2016-17	62579
2017-18	33004
2018-19	26370
2019-20	20101
2020-21	6537
2021-22	392245
Total	**962757**

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

INITIATIVES FOR A GREENER TOMORROW

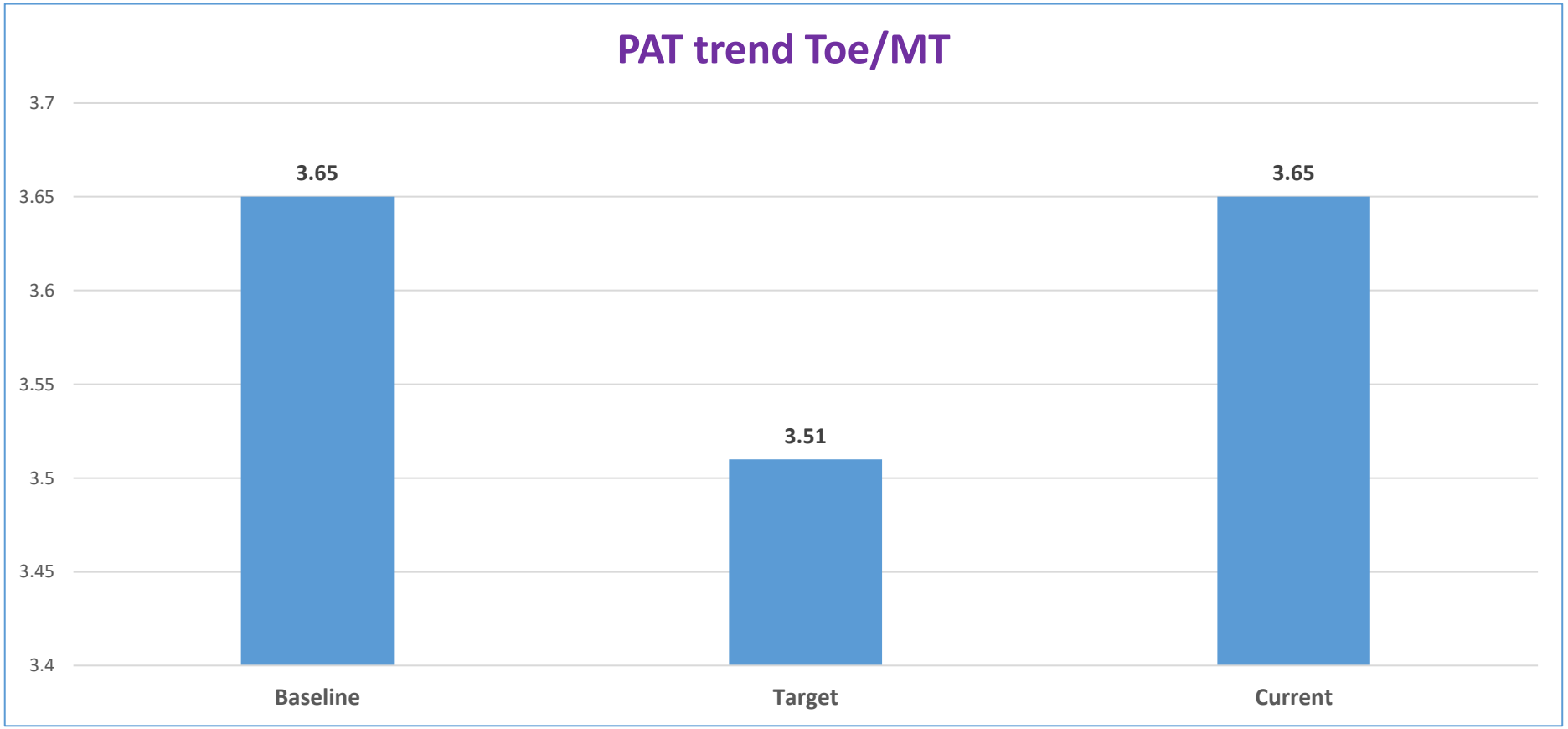
- "Each one Plant one" taken on world Environment Day in which all employees & contractors have planted one tree across the location
- Environment Incident Management System
- Waste Management Systems under Sustainability Framework
- Rehabilitation of Ash filled area by plantation
- Green Jharsuguda Project – in PPP mode 100750 saplings at Behrapat, Lohrabudh & Banjari village

PLANTATION DRIVE IN PLANT (IN FREE AREA)

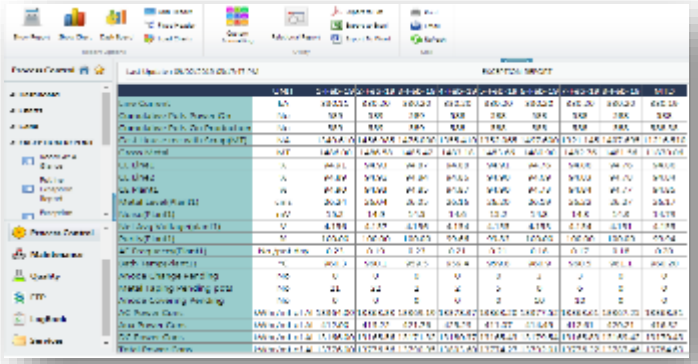
100750 SAPLINGS DISTRIBUTION

AWARENESS IN SCHOOLS

PAT CYCLE-7 PERFORMANCE



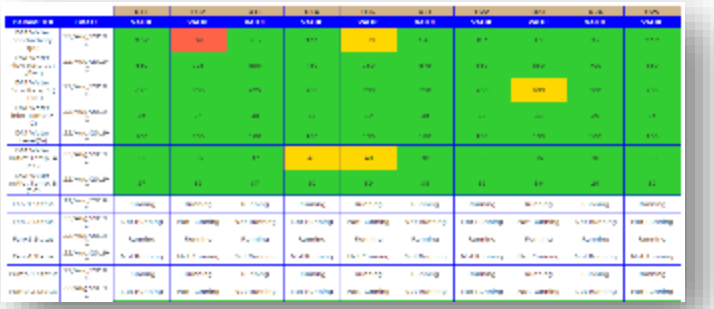
OUR STEPS TOWARDS DIGITILIZATION



MES Online Flash report

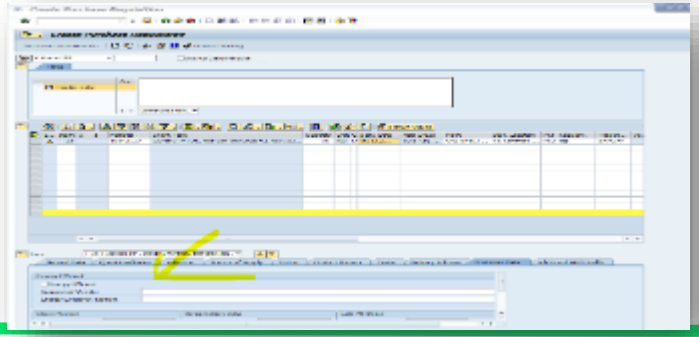
Online solar power generation trend

Online Monitoring of parameter in MES



Online Logbook Mobile app

E-DMS (Document control & Approval)



Energy Efficient Procurement Verification

ENERGY MONITORING & QUANTIFICATION

Major Energy Consumers

- Integrated Energy Meters are installed in the Sub Stations
- Related Process parameter are displayed on the screen
- Data is captured from these resources at regular intervals

Integrated Energy Meters

Other Energy Consumers

- Energy consumption is measured by Power Analyzers before & after the Project for quantification of savings
- Flow measurements are taken for quantification of savings before & after the project
- Fuel consumptions are validated by third party auditors every month
- Meters used for all measurements are calibrated as per ISO Standards

Power measurement

BAR CODING for energy shift data

Other Improvement Projects From Smelter-1 for FY-21-22			
Sl No	**Project Category**	**No. of Projects Completed (In Numbers)**	**Cost Saving (Lakhs/ Annum)**
1	**Six Sigma**	15	997.13
2	**Quality Circle**	24	NA
3	**Lean Quality Circle**	47	NA
4	**Kaizen**	592	NA
Total		**678**	**997.13**

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 CII.
- Online webinar organized through energy efficiency product manufacture

EnMS Re-certification audit

War room meetings

Energy awareness in Tool Box Talk.

Energy awareness Training

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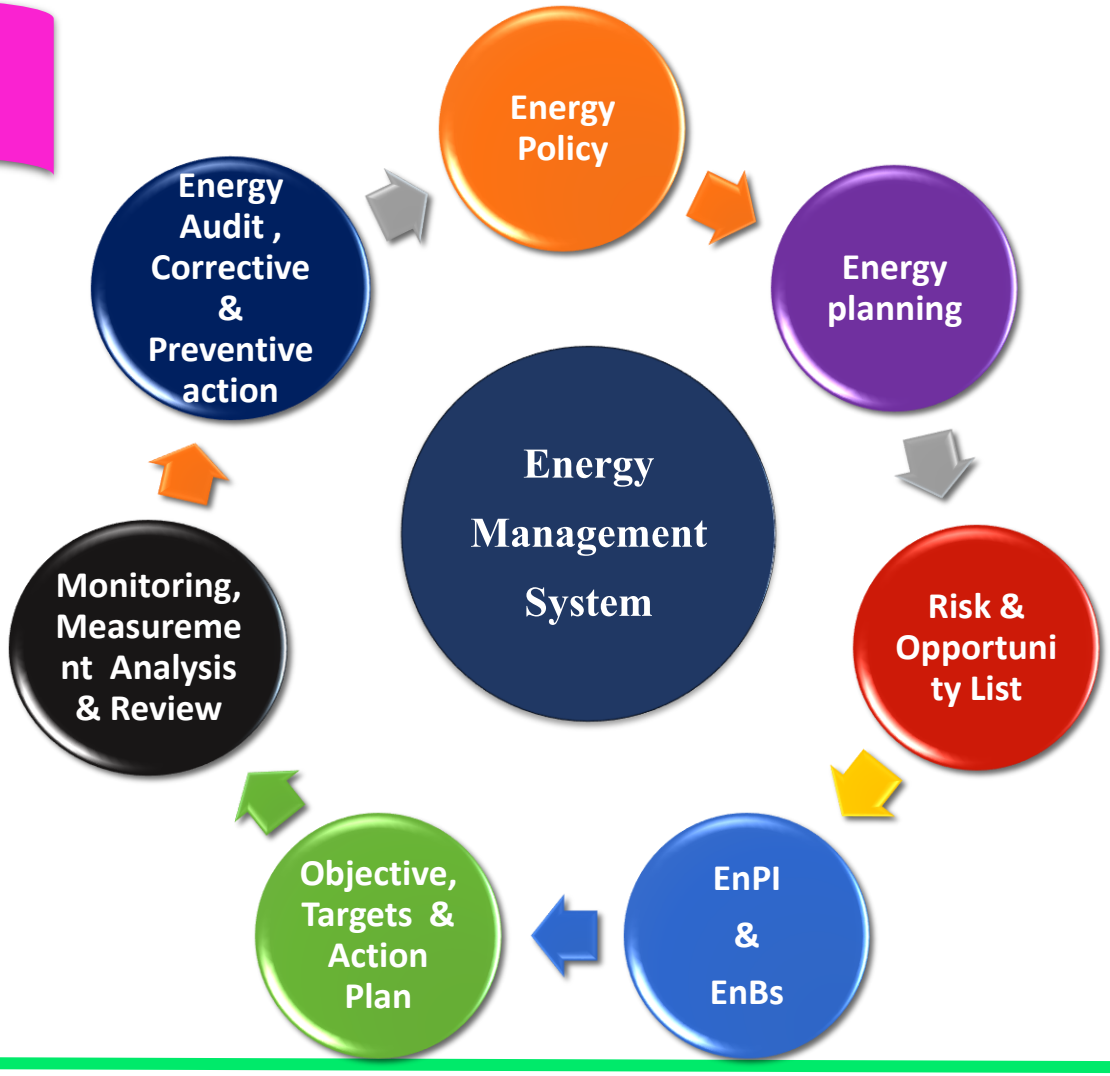
ENCON WEEK 2021 MAJOR EVENT GLIMPSES

ENERGY CONSERVATION WEEK CELEBRATION-2021

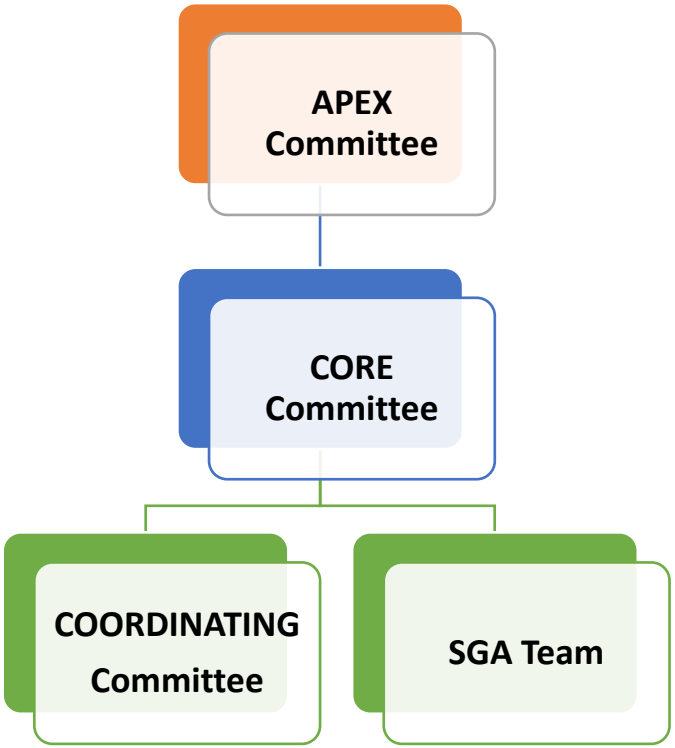
ENERGY MANAGEMENT SYSTEM (ISO-50001)

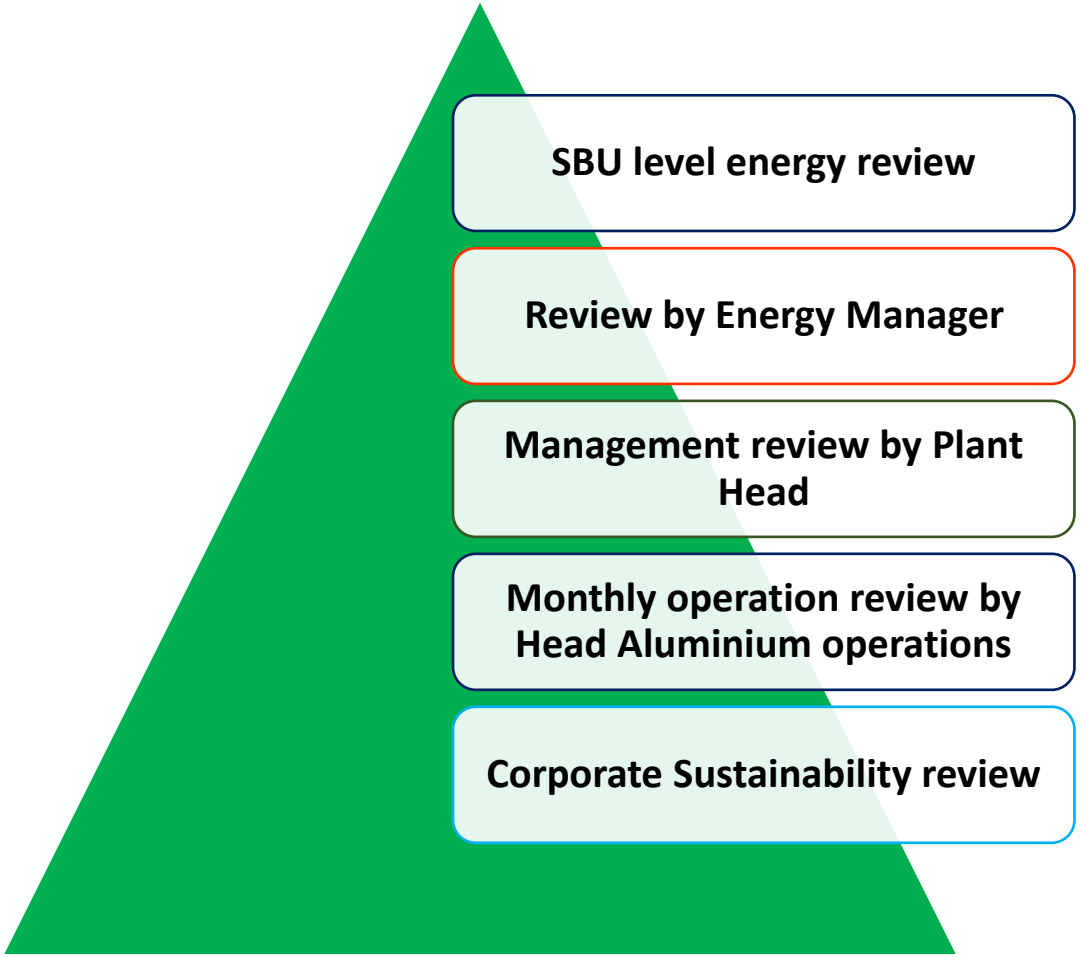
1st Smelter in Asia
ISO-50001 certified



REVIEW STRUCTURE

Formation of Energy Cell





"Bottom to Top Approach"

ENERGY POLICY & OBJECTIVES

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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.

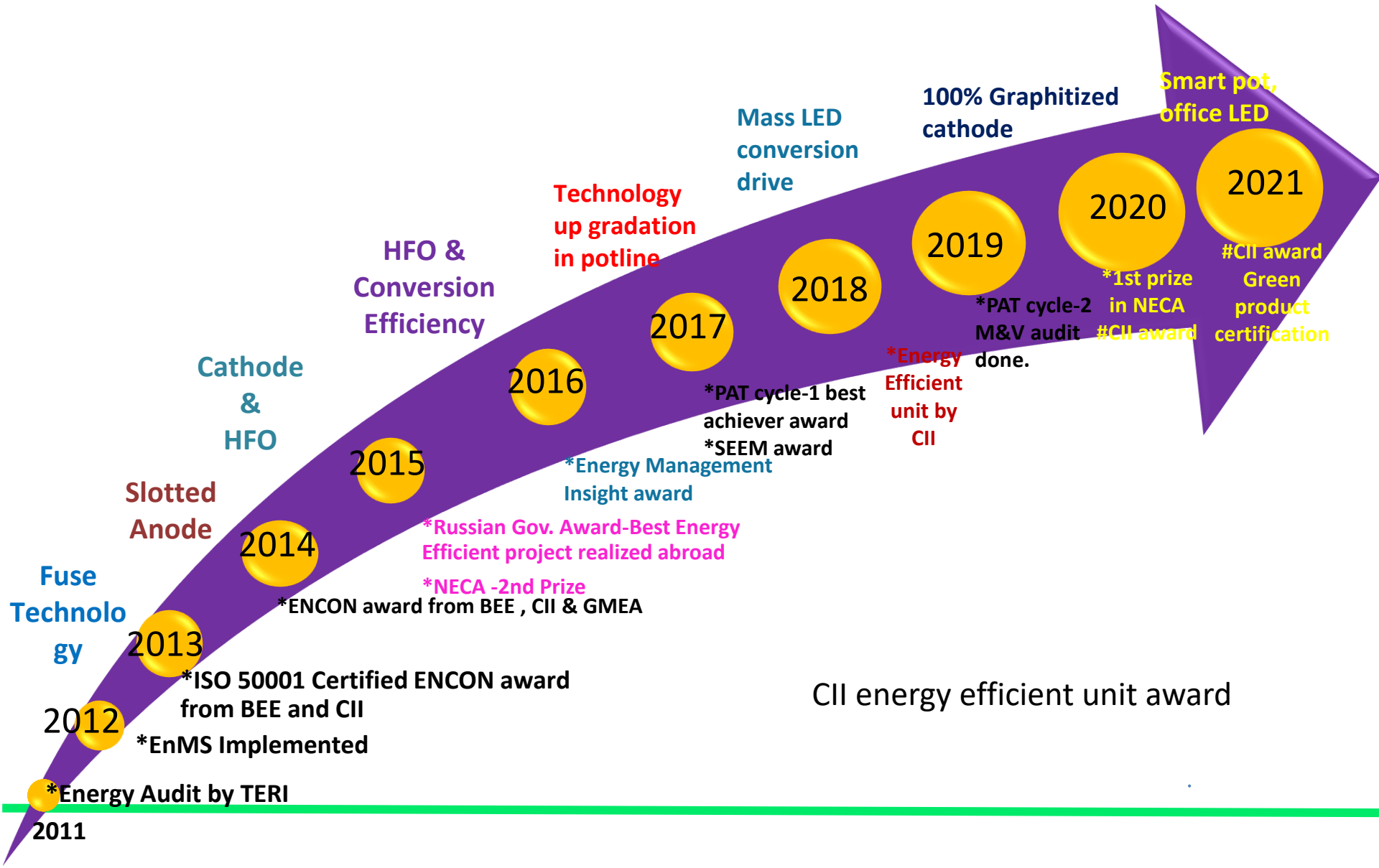
Date: 31.03.2022

Sunil Gupta
CEO, VL-Jharsuguda

ENMS OBJECTIVES

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

ENCON EFFORTS – A NOTCH UP



CII energy efficient unit award

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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.

ENCON WEEK 2021 MAJOR EVENT GLIMPSES

ENERGY CONSERVATION WEEK CELEBRATION-2021

AWARDS & RECOGNITIONS

- ✓ *1st prize in NECA from Ministry of power (BEE)*
- ✓ *2nd Best achiever for PAT cycle-2,P1.*
- ✓ *CII energy efficient unit award for P1 & 2*
- ✓ *SEEM golden award for energy management.*

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THANK YOU