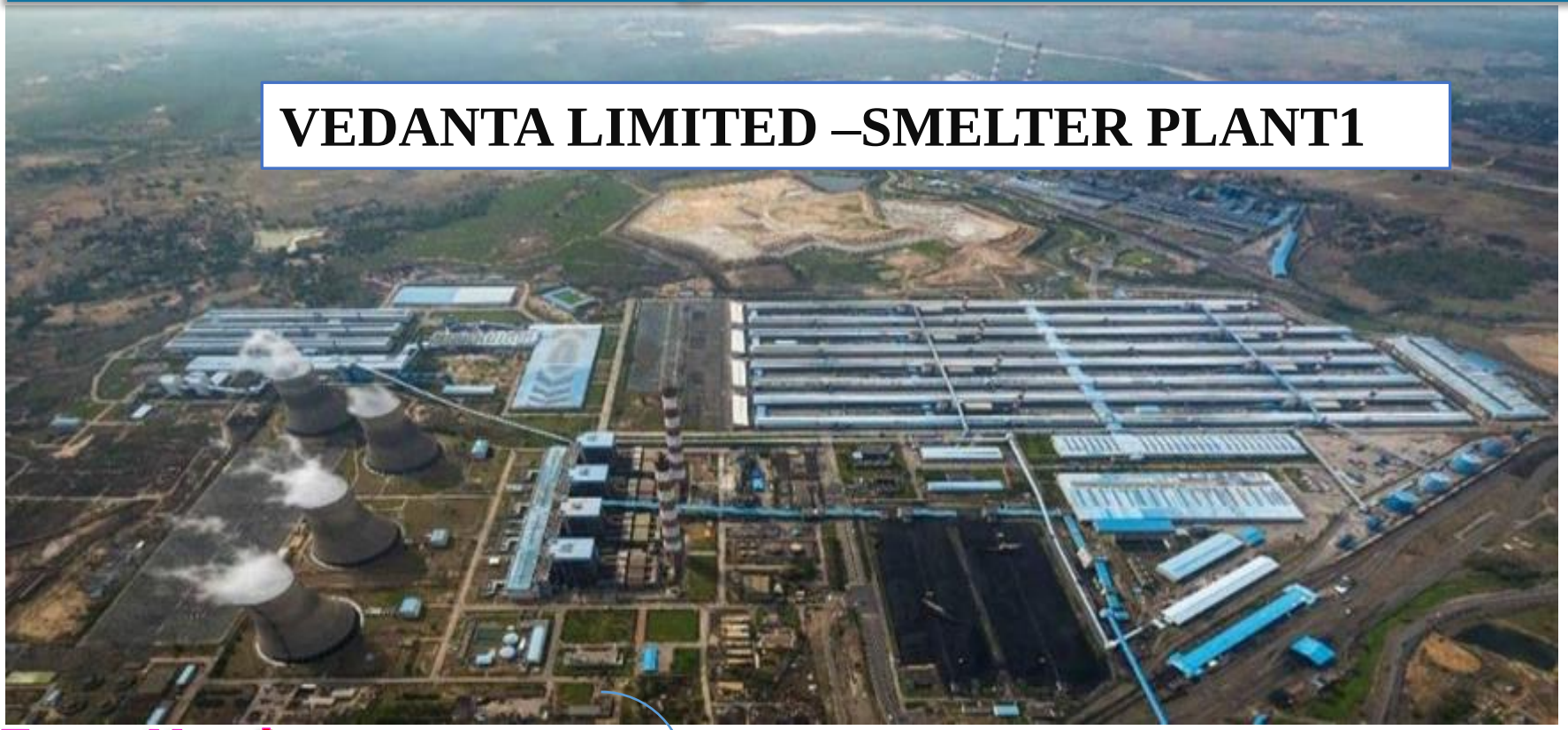
Confederation of Indian Industry
125 Years - Since 1895

vedanta
transforming elements

# 22st National Award for Excellence in Energy Management – 2021



## VEDANTA LIMITED –SMELTER PLANT1

**Team Members:**

- ANKITA KARMAKAR
- GANESH KUMAR MISHRA
- SATHES KUMAR MANOKARAN

**Asia's 1st ISO-50001 certified Smelter**

# 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"***

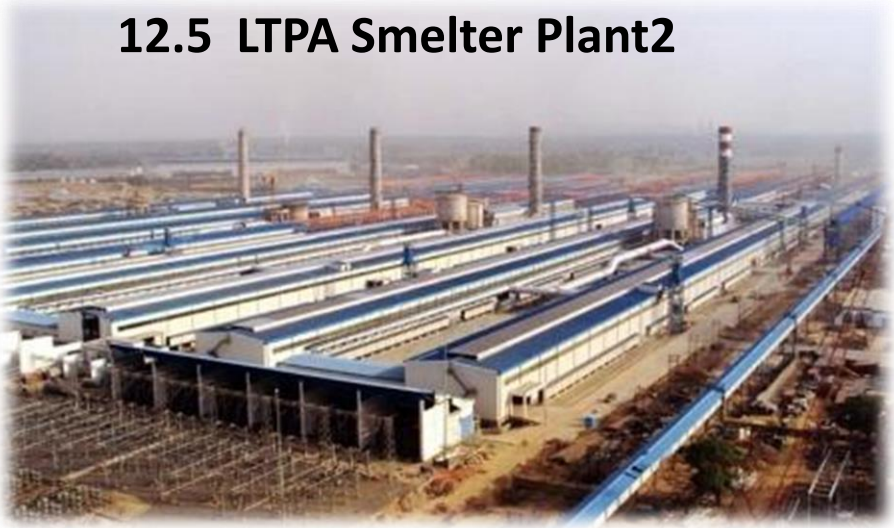
# VEDANTA LIMITED, JHARSUGUDA



## 5 LTPA Smelter Plant1

## 1215 MW CPP

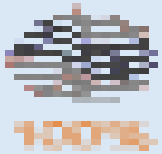
## 12.5 LTPA Smelter Plant2



## 2400 MW IPP

# HOW ALUMINIUM IS MADE?





# 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

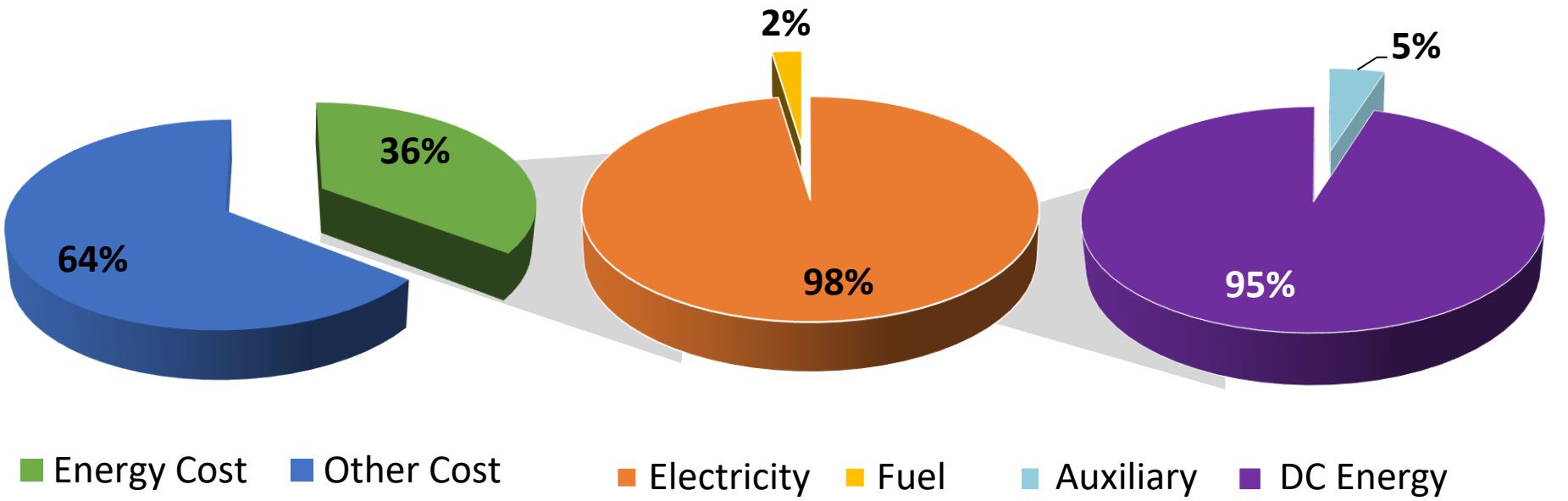
## Billet Casting Machine

### Technology
- WAGSTAFF, USA

### Plant Capacity
- 120 KTPA

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

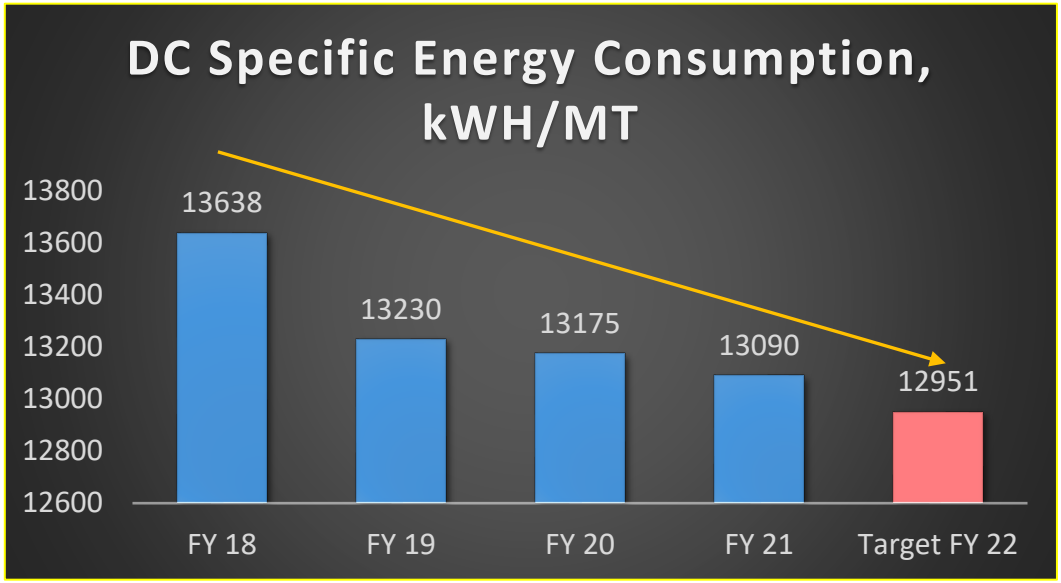
# ALUMINIUM - ENERGY & COST




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

**Focus is on DC energy reduction**

# SPECIFIC ENERGY CONSUMPTION TRENDS

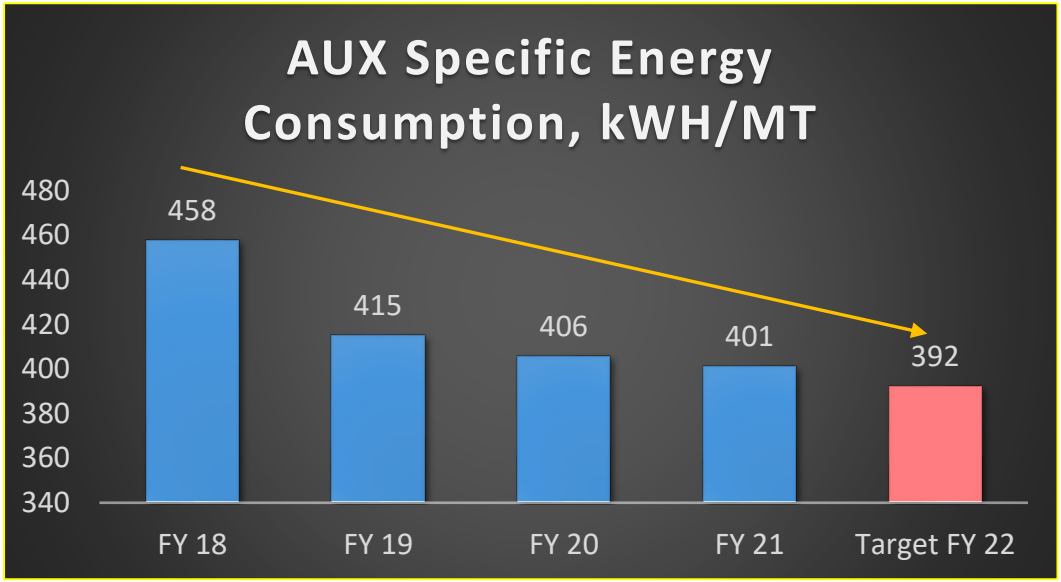



## Specific DC consumption highlights

- 100% pots are converted into 100% graphitized cathode.
- Pot Unscheduled cut out reduced drastically from 61 to zero since last 3 years.
- CRR improved from 89% to 92%.
- 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



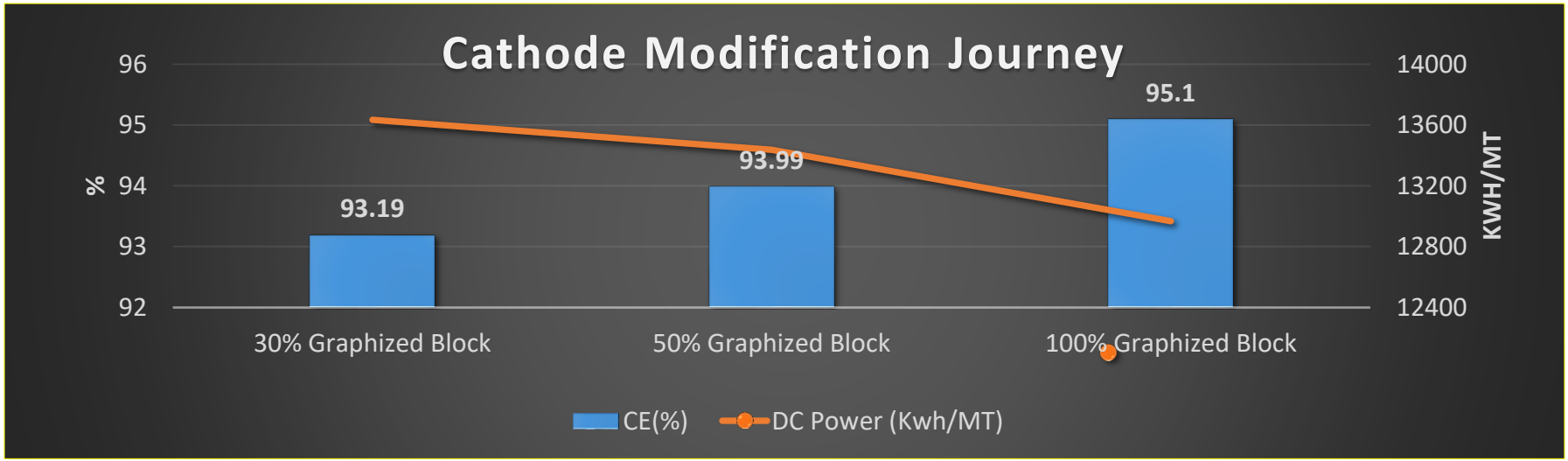
# GRAPHATISED CATHODE IMPLEMENTATION

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.

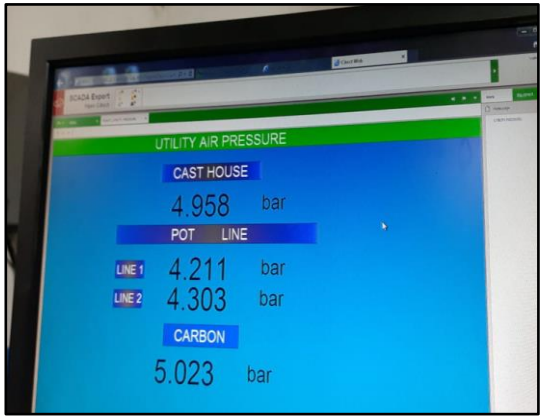



Energy Conservation: **47.3 MkWh/ Annum**

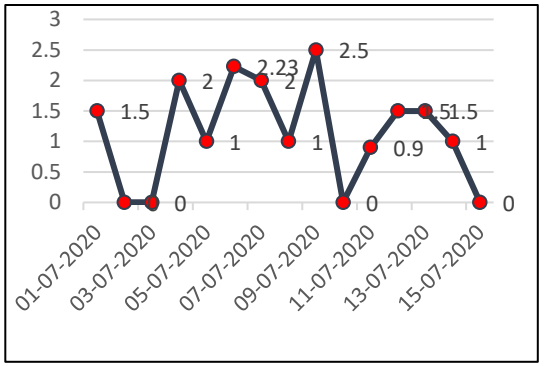
# 1. INDIVIDUAL AIR PIPELINE FOR CAST HOUSE



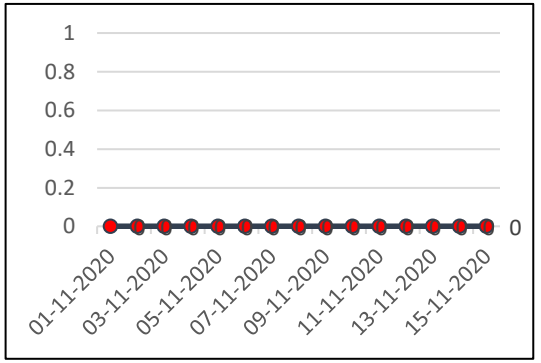
Earlier cast house instrument airline and pot line process airline had common header. As pot room process air usage is variable in nature, Cast House had to face pressure drop at their end during peak load condition. Due to this many issues were coming in cast house like Pneumatic gadgets failure due to pressure drop, Strapping machine failure, Rod mill machine failure, Pressure drop affecting metal quality and resulting metal rejection, high downtime etc. . We had to start extra compressor for around 5 hrs/day which costed us increase in power consumption hence the COP. With the segregation of Pneumatic air line of cast house and pot line , we are able to maintain constant pressure now and additional running of compressors stopped.




**Extra HP running hours Before**




**Extra HP running hours After**




❖ Energy saving in 2020-21: 2263 MWh/annum

## 2. DRYER CONDENSATE INSTALLATION

Initially two ½" pipes are provided for release of moisture content from compressed air due to Dryer operation, so along with moisture content compressed air is also escaping through the ½" pipes, now with newly designed condensate only moisture content will be released out and compressed air will flow back into system



❖ Energy saving achieved in 2020-2021: 110 MWh/annum

# 3. HFO CONSUMPTION REDUCTION IN BAKING FURNACE



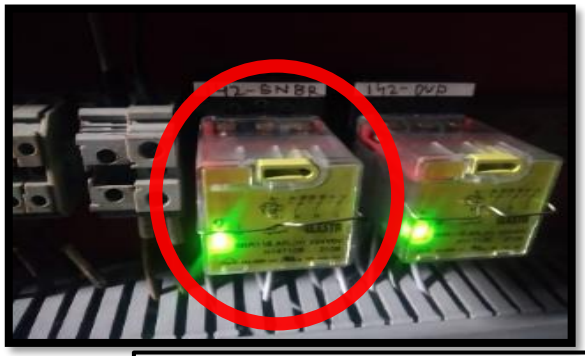
HFO (Heavy furnace oil ) is used for baking anodes in bake oven furnaces. Various improvements have been done to conserve oil. Few of them are:

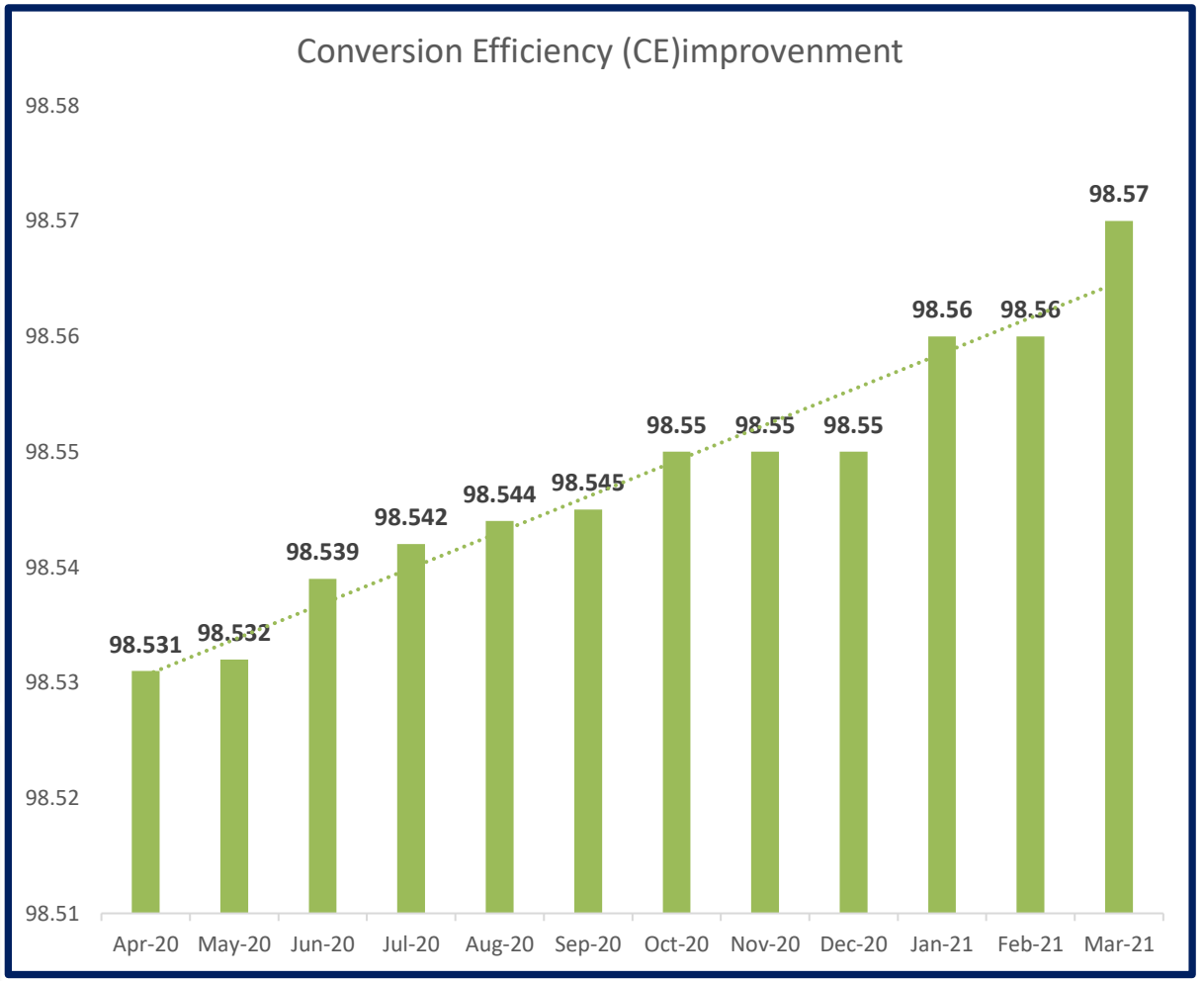
- Automatic soaking calculator
- Mastic sealing of slip joints of crossover sections.
- Cap for Protection tube
- Regular U plate gap sealing
- Timely replacement of damaged Top Crown
- Ph1 and Ph3 covering by coke
- Top crown resealing in preheating sections



- Fuel saving achieved in 2020-21: 28699.2 GJ/annum

# 4. AC TO DC CONVERSION EFFICIENCY IMPROVEMENT FROM 98.53% to 98.57%






- Energy Conservation in 2020-21: 427.2 MWh/annum

# 5. LIGHTING ENERGY CONSUMPTION REDUCTION

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.

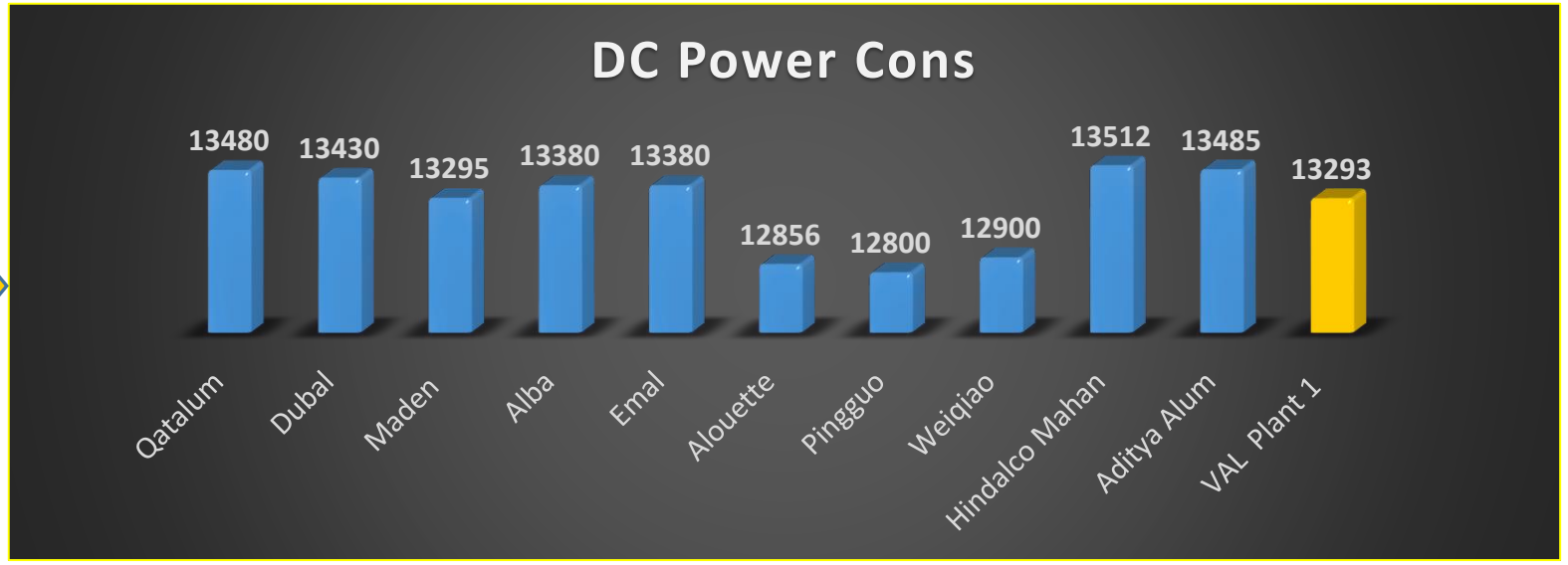
Potline-2

Ungrouping area of Bake oven

- Energy Conservation in 2020-21: 414.8 MWh/annum

# PERFORMANCE BENCHMARKING

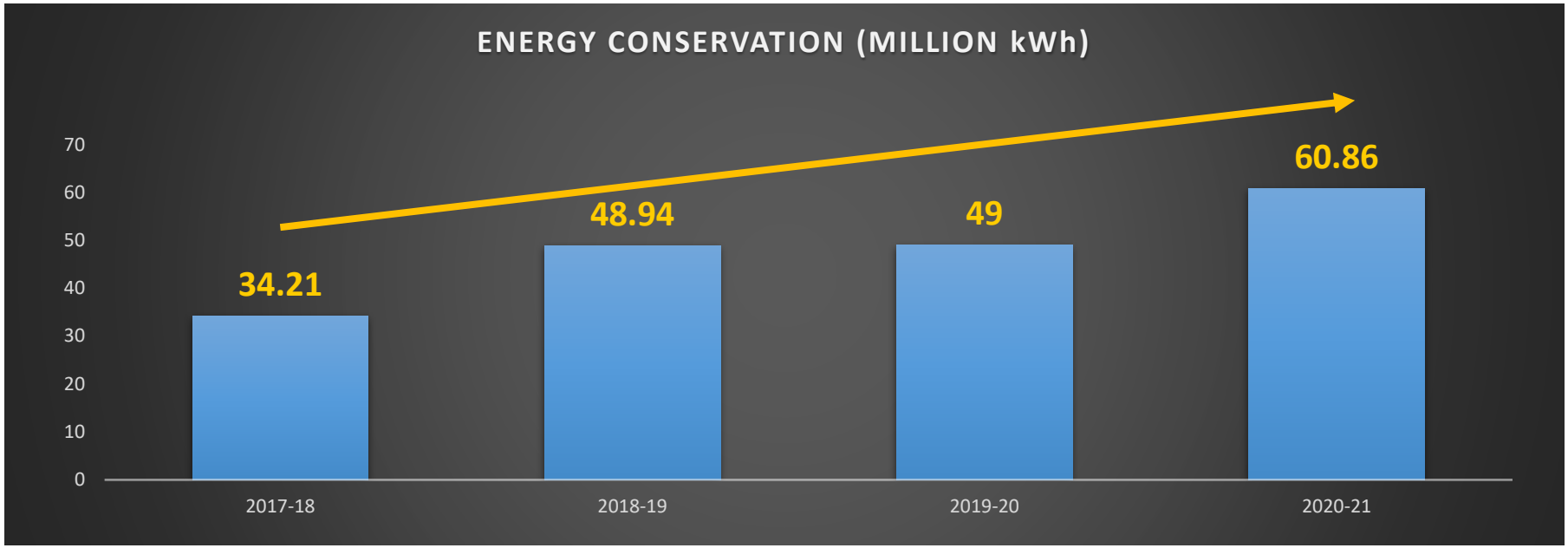
Global Bench-marking




Indian Bench-marking

| IN INDIA - SMELTER BENCHMARKING | | | | | |
|---|---|---|---|---|---|
| | VL-J | BALCO | NALCO | Aditya | Mahan |
| Technology | GP-3XX | GP-3XX | AP-18 | AP-36 | AP-36 |
| Current | P-1: 329.9<br>P-2: 338.6 | P-1: 328.4<br>P-2: 341.8 | 182 | 367 | 367 |
| CE | 94.23 | 94.8 | 93.8 | 94.2 | 94.1 |
| DC Power Cons | 13248 | 13061 | 13560 | 13485 | 13512 |
| Total AC Power Cons | 13885 | 13668 | 14170 | 14165 | 14239 |

# ENCON PROJECTS- LAST THREE YEARS




| Year of Implementation | No of projects | Electricity (Million kWh) | Fuel Saving (GJ) | Investment Rs. (Million) |
|---|---|---|---|---|
| 2017-18 | 36 | 34.21 | 0 | 575 |
| 2018-19 | 35 | 48.94 | 0 | 320 |
| 2019-20 | 37 | 49.00 | 22302 | 410 |
| 2020-21 | 24 | 60.86 | 9112 | 398.6 |

# ENCON PROJECTS FY 2018-19

| Sl.No. | Project description | Annual energy saving in Million kwh | Cost saving in Million | Investment in Million | Payback (years) |
|---|---|---|---|---|---|
| 1 | Energy efficient cathode implementation(100% graphatized) | 42.536 | 161.64 | 310.50 | 1.92 |
| 2 | LED installation projects in Plant area | 1.666 | 6.33 | 5.40 | 1.93 |
| 3 | Improvement in Conversion efficiency by 0.02% | 0.749 | 2.85 | 0.00 | 0.00 |
| 4 | Compressor dryer modification for energy efficiency | 0.307 | 1.17 | 3.60 | 2.83 |
| 5 | Bake oven Hydraulic power pack ungrouping &ideal running elimination | 0.141 | 0.53 | 0.03 | 0.08 |
| 6 | HP power optimization (Operational improvements) | 3.066 | 11.65 | 0.00 | 0.00 |
| 7 | light automation with equipment selection(Light segregation) | 0.077 | 0.29 | 0.00 | 0.00 |
| 8 | VFD installation in cooling ramp in Furnace-2 | 0.122 | 0.46 | 0.30 | 0.92 |
| 9 | Butt press Hydraulic idle run time optimisation. | 0.020 | 0.08 | 0.00 | 0.00 |
| 10 | ICM 3 recirculation pump installation | 0.088 | 0.34 | 0.17 | 0.50 |
| 11 | Motion sensor for lighting optimization in switchyard MCC | 0.002 | 0.01 | 0.00 | 0.00 |
| 12 | Rectifier Conference room partition for AC load optimization | 0.003 | 0.01 | 0.02 | 2.00 |
| 13 | Energy efficient motor installation | 0.014 | 0.05 | 0.05 | 1.17 |
| 14 | GAP Conveyor belt load ideal running elimination | 0.014 | 0.05 | 0.00 | 0.00 |
| 15 | Fire system Jockey pump running optimization | 0.131 | 0.50 | 0.00 | NA |
| 16 | VFD installation and speed reduction of WCS cooling fan | 0.007 | 0.03 | 0.04 | 1.17 |

**Total energy savings for FY 2018-19 = 48.9 Million kWh**

# 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

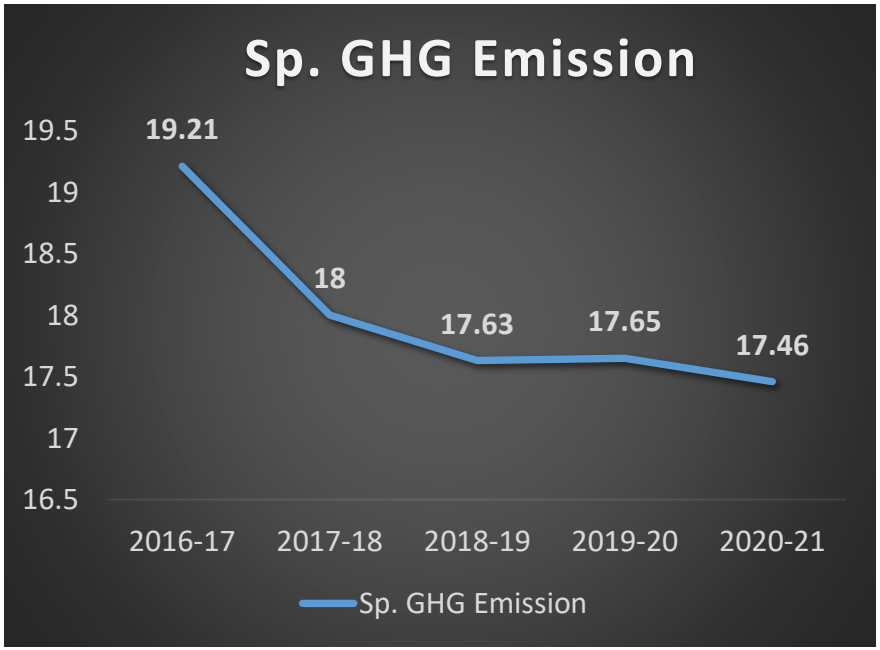
| Sl. No. | Project description | Annual energy saving in Million kwh | Cost saving in Million | Investment in Million | Payback (years) |
|---|---|---|---|---|---|
| 1 | 100% graphitized cathode implimentation from 75 % to 85.3% of pots | 45.98 | 122.77 | 392.04 | 3.19 |
| 2 | Energy efficient Lighting/Motors | 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 |

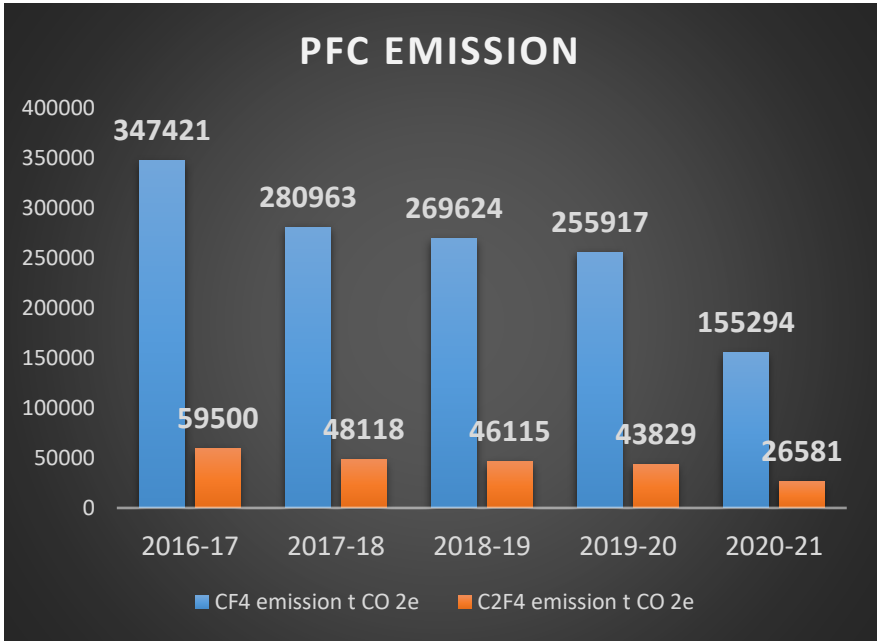
**Total energy savings for FY 2020-21 = 60.8 Million kWh**

**Total Fuel savings for FY 2020-21 = 9112 GJ**

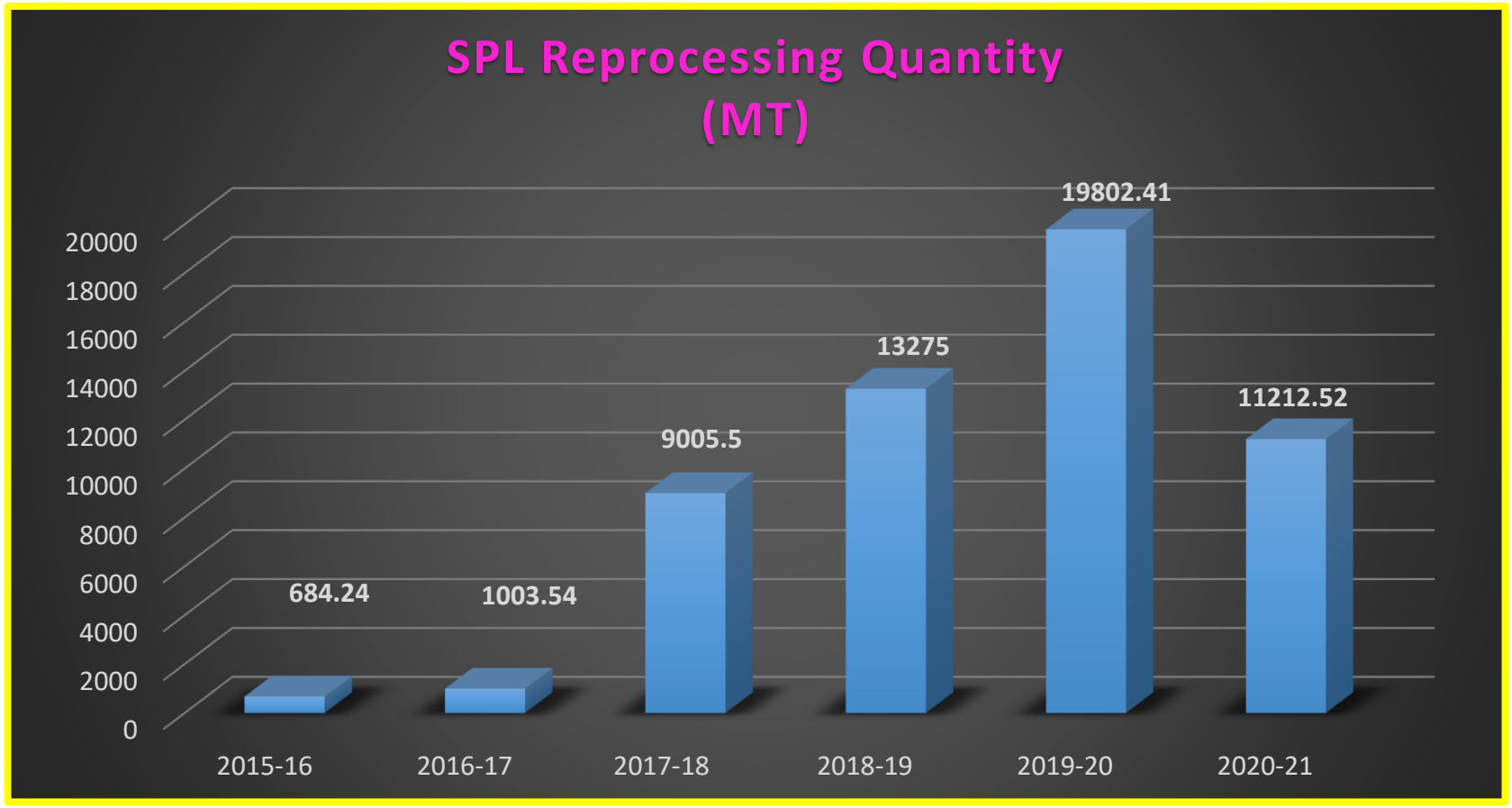
# CARBON FOOT PRINT ACTIVITIES

| 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 |
| 2017- 18 | 2,09,01,063 | 76,404 | 7,38,042 | 2,17,15,510 |
| 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 | 3,39,940 | 24,437,097 |



# CARBON FOOT PRINT ACTIVITIES



# MAJOR ENVIRONMENTAL PRACTICES

**Air Pollution Management-**

1.De-dusting units along with bag filters

2.Installation of CAAQMS for continuous air quality monitoring (2 nos.)

3.Pot cell tap door modification and pot hood ceiling

**Water Pollution Management-**

1.Online waste water monitoring system (added in EnMS SCADA)

2.Storm water guard pond

3.UF & RO for Flouride reduction

**Hazardous Waste Management-**

1.Secured Landfill

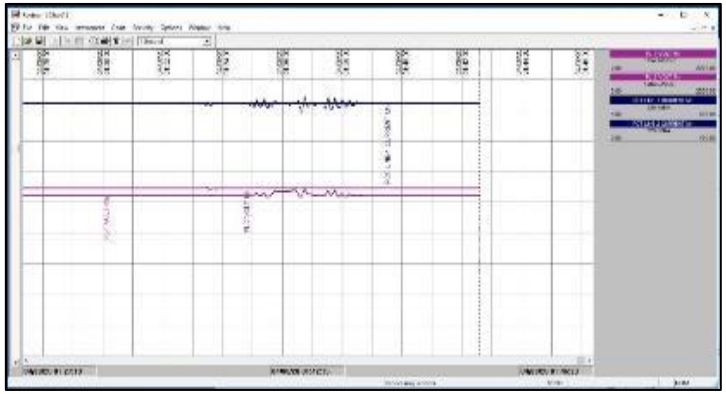
2.Use Of Incinerator (Fluorinated Waste)

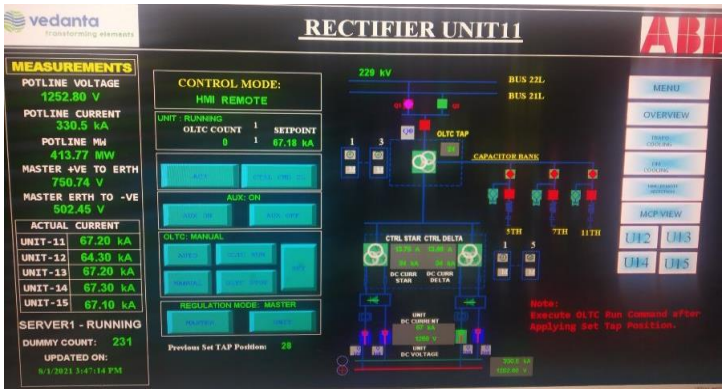
**Hazardous Waste Management-**

1.Segregation biodegradable &

2.High Concentration Slurry Disposal (HCSD) -1st In Odisha

# ENERGY MONITORING & REPORTS



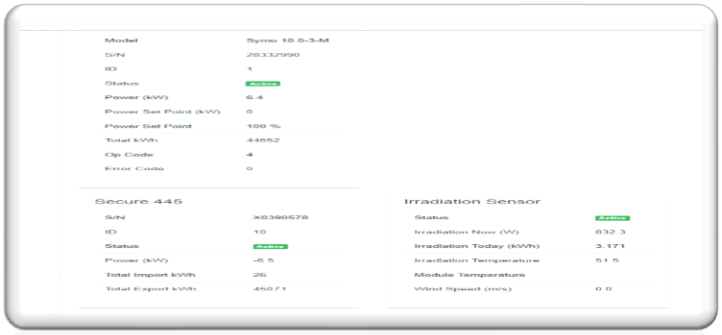

- SEC Report to Plant Head
- Section Wise Report to Energy Managers
- Daily reports to HODs

| Parameters & Monitoring Frequency | |
|---|---|
| High Energy Consumers | Daily |
| Fuel Consumption | Daily |
| Compressed Air Consumption | Daily |
| Water Consumption | Daily |

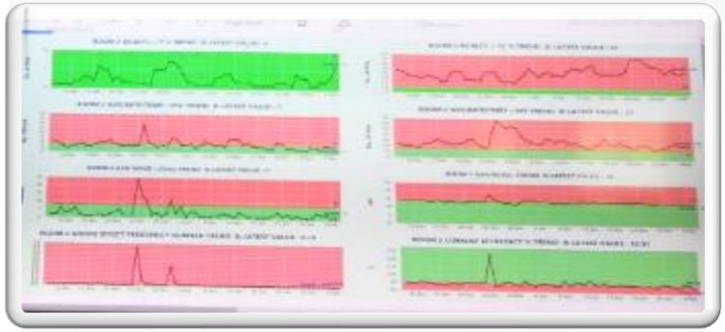
# OUR STEPS TOWARDS DIGITILIZATION

MES Online report

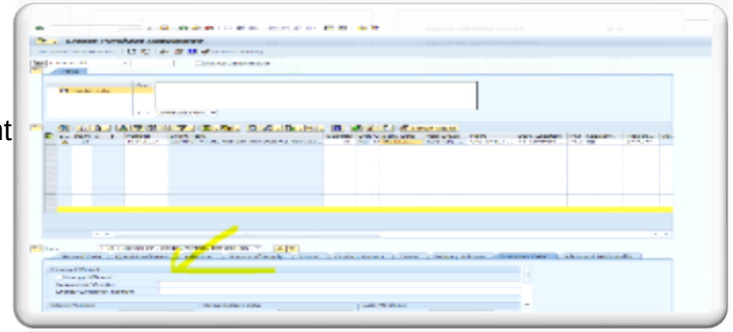

Online solar power generation trend



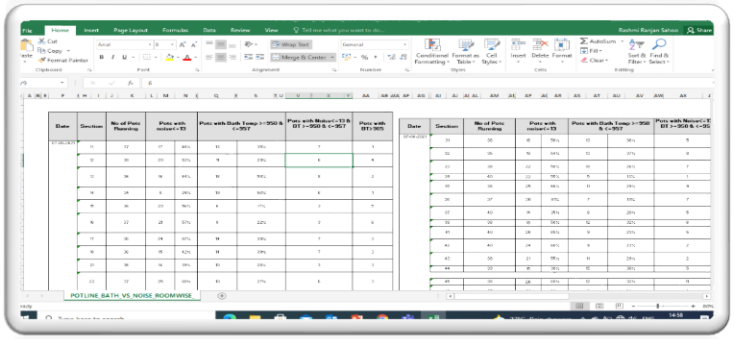
Online Monitoring of parameter in MES



Energy Efficient Procurement Verification



Online report circulation of parameters impacting DC



Online Logbook Mobile app

**Online Reports Auto generated from IT dept. to all incharges and floor level incharge**

**For DC** - Key parameters effecting power consumption, Noise vs. Bath temp report,

**For Metal production** - No of running pots, Coke % in pot, Daily measurements reports of drops ect.

# ENERGY MONITORING & QUANTIFICATION

## Major Energy Consumers

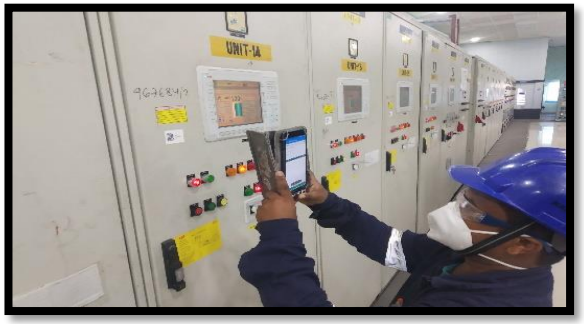
- Integrated Energy Meters are installed in the Sub Stations
- Related Process parameter are displayed on the screen
- Data is captured from these resources at regular intervals


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

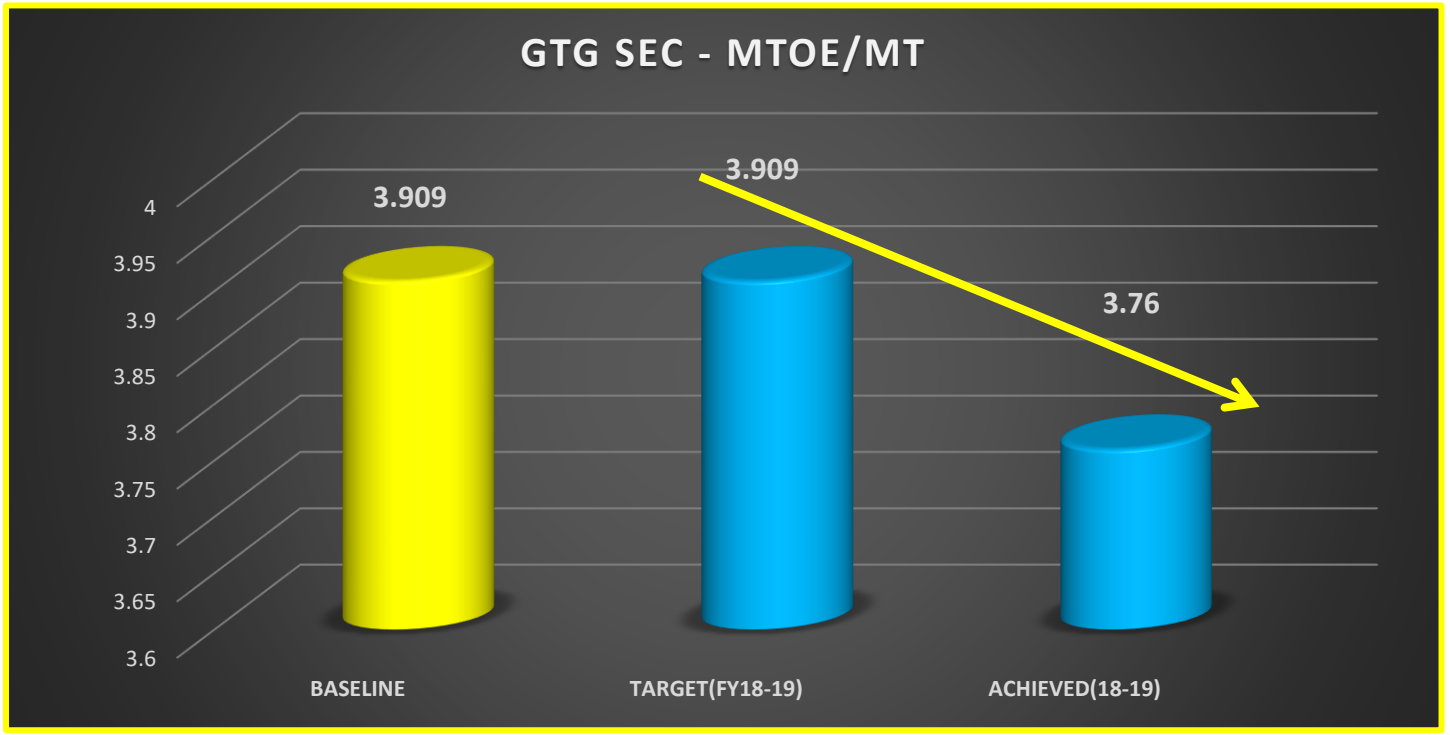



BAR CODING for energy shift data

# ENERGY CONSERVATION WITH TQM

| Other Improvement Projects From Smelter-1 for FY-20-21 | | | |
|---|---|---|---|
| **Sl No** | **Project Category** | **No. of Projects Completed ( In Numbers)** | **Cost Saving (Lakhs/ Annum)** |
| 1 | **Six Sigma** | 14 | 274.62 |
| 2 | **Quality Circle** | 24 | 1.9 |
| 3 | **Lean Quality Circle** | 41 | 6.9 |
| 4 | **Kaizen** | 486 | 2.9 |
| **Total** | | **565** | **286.32** |


# PAT CYCLE-2 PERFORMANCE



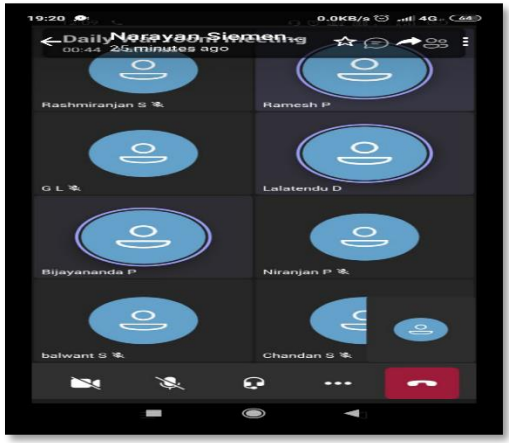

**Got Best Performer Award in 'PAT CYCLE#2'**

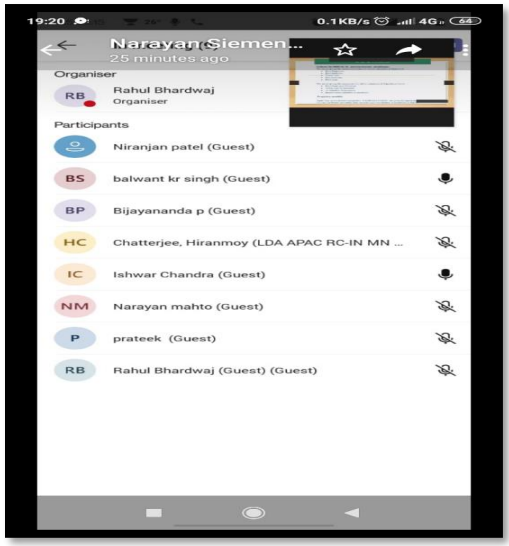
# PEOPLE INVOLVEMENT

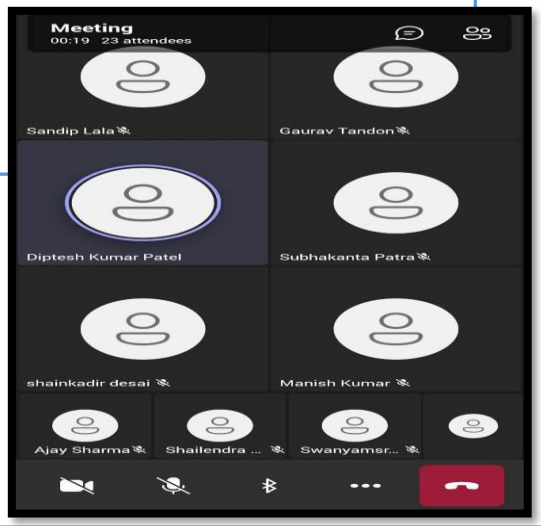


- ISO 50001:2011 is successfully upgraded to ISO50001:2018 .
- SGA Activities along with TQM for Encon improvement.
- AWARENESS PROGRAM ON ENERGY CONSERVATION AT SCHOOLS

- Monthly MR review is being done with all departments.
- Rectifier daily internal WAR ROOM meeting theme on Wednesday "Energy Review" .In same line other departments have this review in their daily WAR ROOM meetings.
- E – Test launched to check.
- training effectiveness.






"We value every small contribution"

# ENERGY CONSERVATION WEEK - 2020

Events Conducted:-

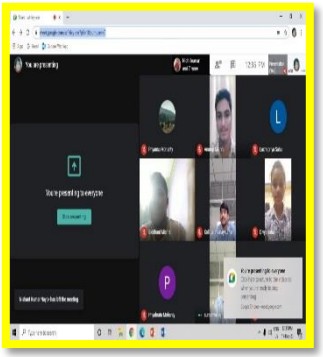
1.Eergy awareness campaign in plant by different departments

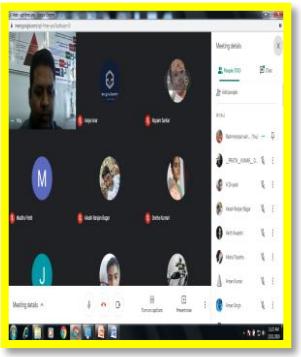
2.Online quiz competition for Vedanta employee

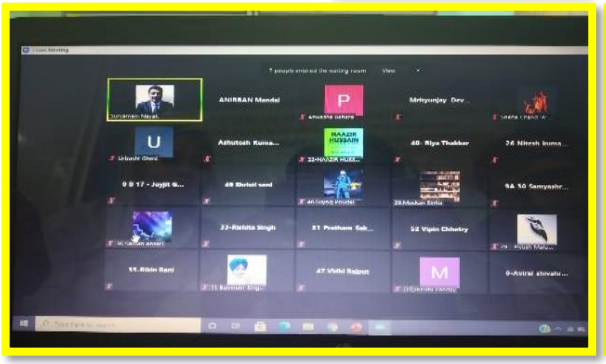
3. Awareness training for school children

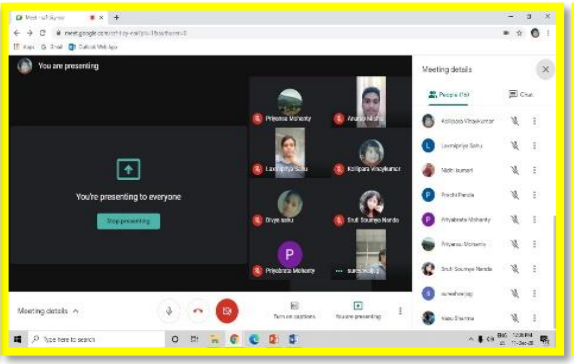
4.e-paper presentation for school

5. best energy conservation idea competition for contract partner,





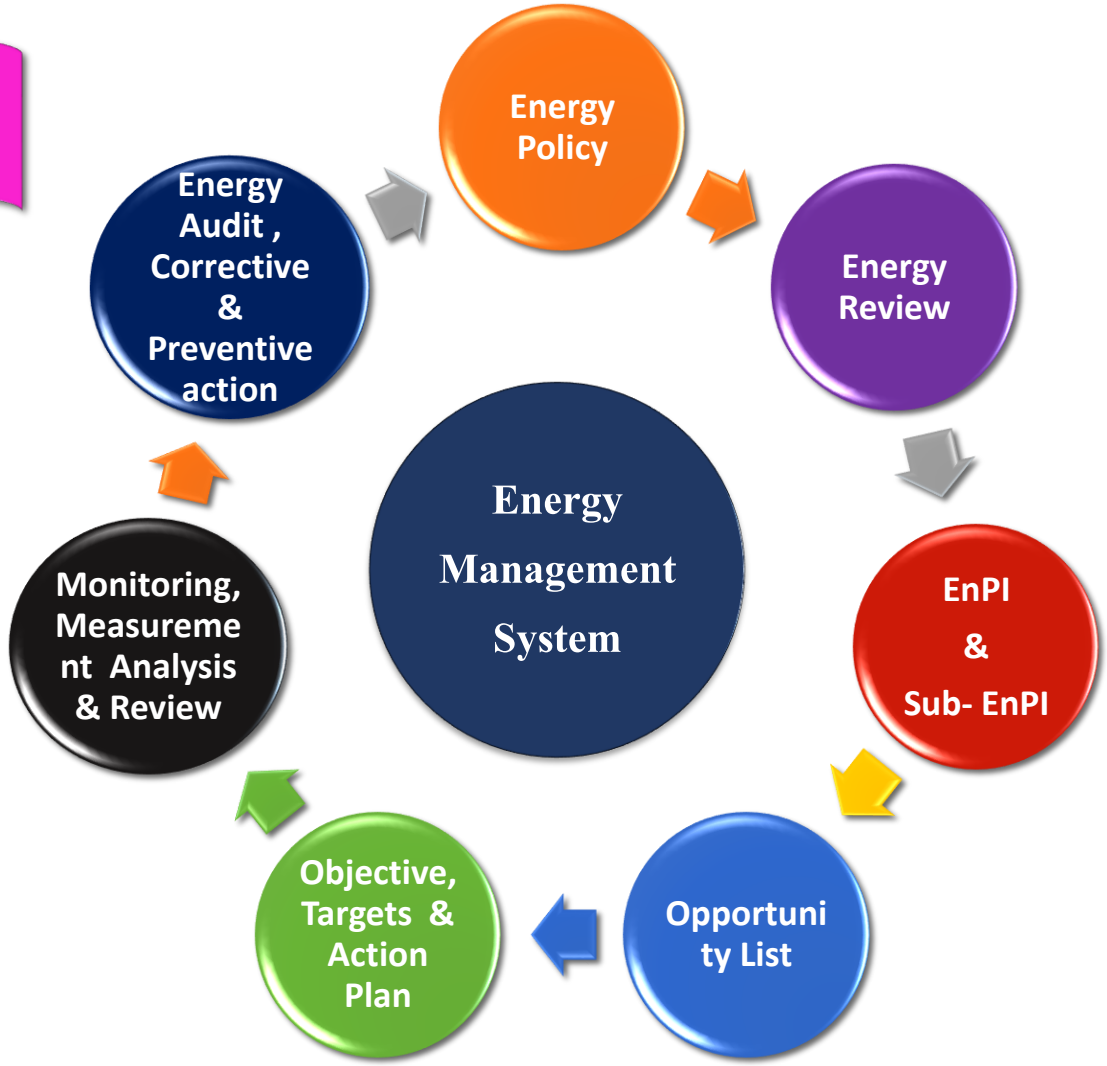




# ENERGY MANAGEMENT SYSTEM (ISO-50001)

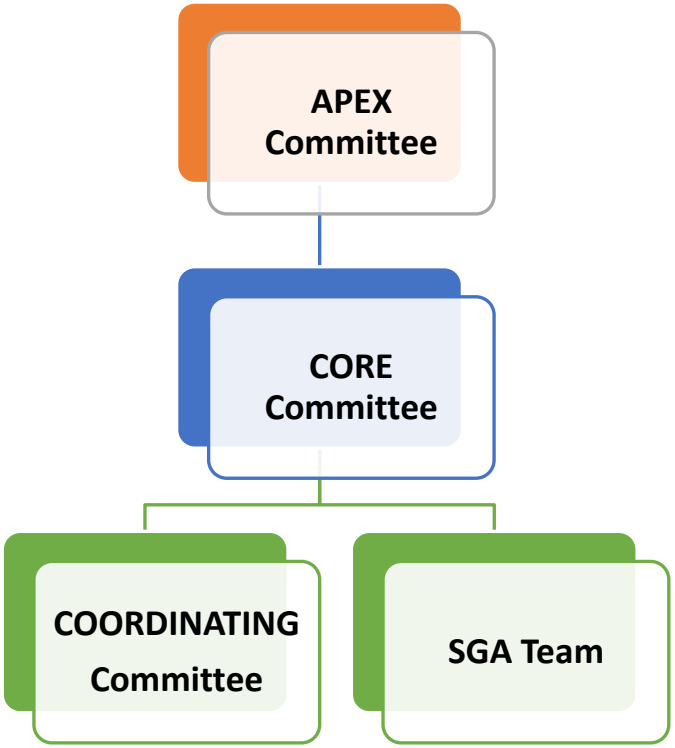


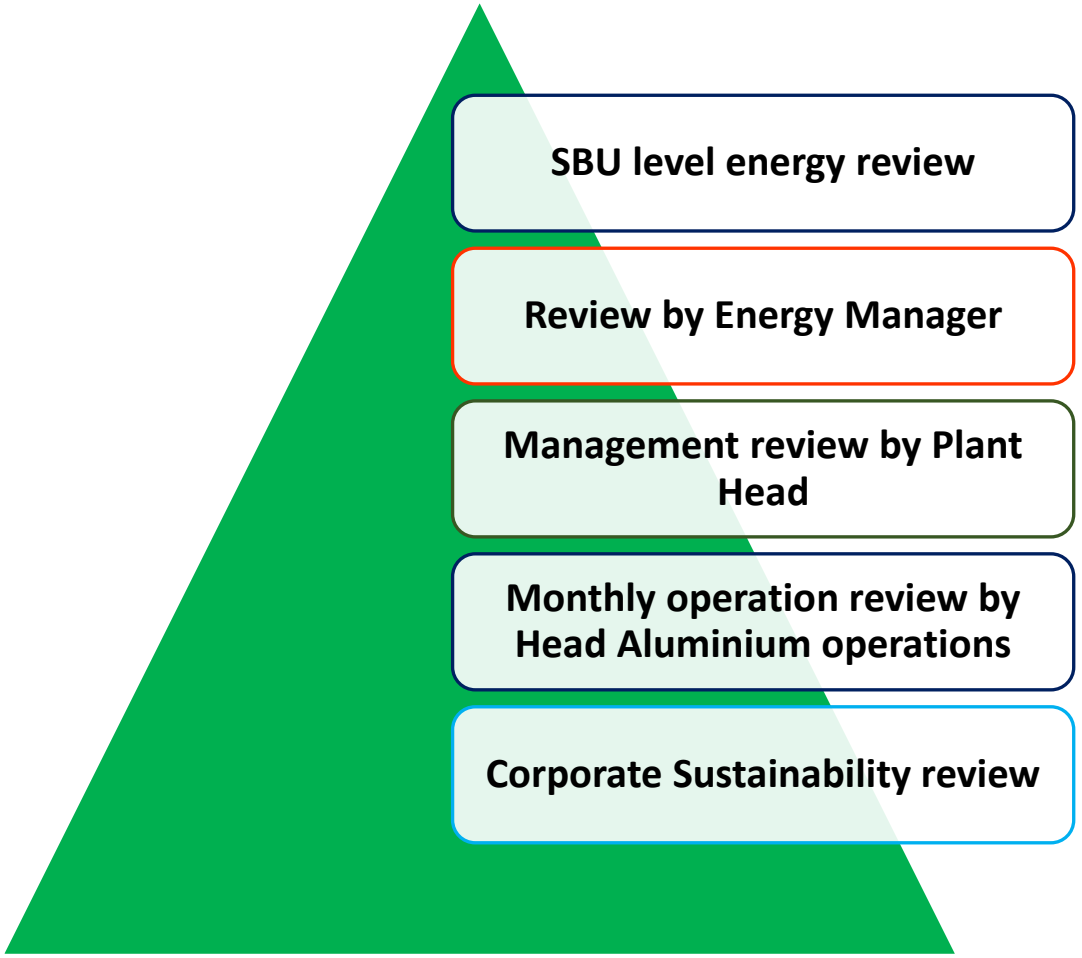
**1st Smelter in Asia**
**ISO-50001 certified**



# REVIEW STRUCTURE

## Formation of Energy Cell



# ENERGY POLICY & OBJECTIVES

Date: 1st August'2020

## Energy Policy

The Aluminium Smelter Plant-1 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 resourced 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.

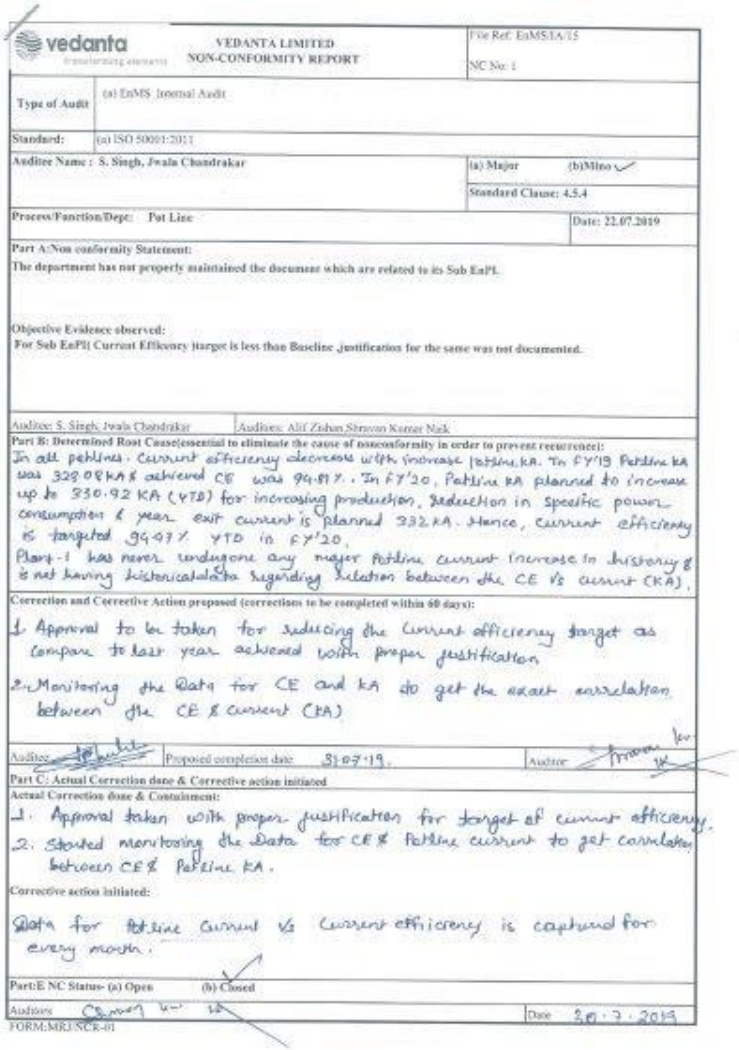
CN Singh
CEO-Vedanta Limited, Jharsuguda

**ENMS OBJECTIVES**

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

# IMPLEMENTATION OF CORRECTIVE / PREVENTIVE ACTIONS





vedanta transforming elements

VEDANTA LIMITED
NON-CONFORMITY REPORT

File Ref: EnMS/IA/15
NC No: 1

Type of Audit: (a) EnMS Internal Audit

Standard: (a) ISO 50001:2011

Auditee Name : S. Singh, Jwala Chandrakar

(a) Major (b)Minor ✓

Standard Clause: 4.5.4

Process/Function/Dept: Pot Line

Date: 22.07.2019

Part A:Non conformity Statement:
The department has not properly maintained the documents which are related to its Sub EnPI.

Objective Evidence observed:
For Sub EnPI( Current Efficiency )target is less than Baseline ,justification for the same was not documented.

Auditor: S. Singh, Jwala Chandrakar | Auditee: Alif Zishan Shrawan Kumar Naik

Part B: Determined Root Cause(essential to eliminate the cause of nonconformity in order to prevent recurrence):
In all potlines. Current efficiency decrease with increase potline KA. In FY'19 Potline KA was 328.08 KA & achieved CE was 94.81%. In FY'20, Potline KA planned to increase up to 330.92 KA (YTD) for increasing production, Reduction in specific power consumption & year exit current is planned 332 KA. Hence, current efficiency is targeted 94.47% YTD in FY'20.
Plant-1 has never undergone any major Potline current increase in history & is not having historical data regarding relation between the CE Vs current (KA).

Correction and Corrective Action proposed (corrections to be completed within 60 days):
1. Approval to be taken for reducing the current efficiency target as compare to last year achieved with proper justification.
2. Monitoring the data for CE and KA to get the exact correlation between the CE & current (KA)

Auditor | Proposed completion date: 31.07.19. | Auditor

Part C: Actual Correction done & Corrective action initiated

Actual Correction done & Containment:
1. Approval taken with proper justification for target of current efficiency.
2. Started monitoring the data for CE & Potline current to get correlation between CE & Potline KA.

Corrective action initiated:
Data for Potline Current Vs Current efficiency is captured for every month.

Part:E NC Status- (a) Open (b) Closed ✓

Auditors | Date: 30.7.2019

FORM:MRJ:SCR-01

**EnMS Internal Audit:**

**Internal audit was started in smelter#1 in the year of 2012, In July 2020 We organized 17th Internal Audit, Our Certified internal auditors conducts audit in cross function units. The Auditee team has to close the NC and Observation with proper documents.**

- **Non-Conformity Statement :**

**In significant activity Criteria ranges is not properly mentioned in the corresponding SOP.**

- **Corrective Actions Done :**

**All the operating ranges properly mentioned in the SOP/SMP's.**

# ENCON EFFORTS – A NOTCH UP

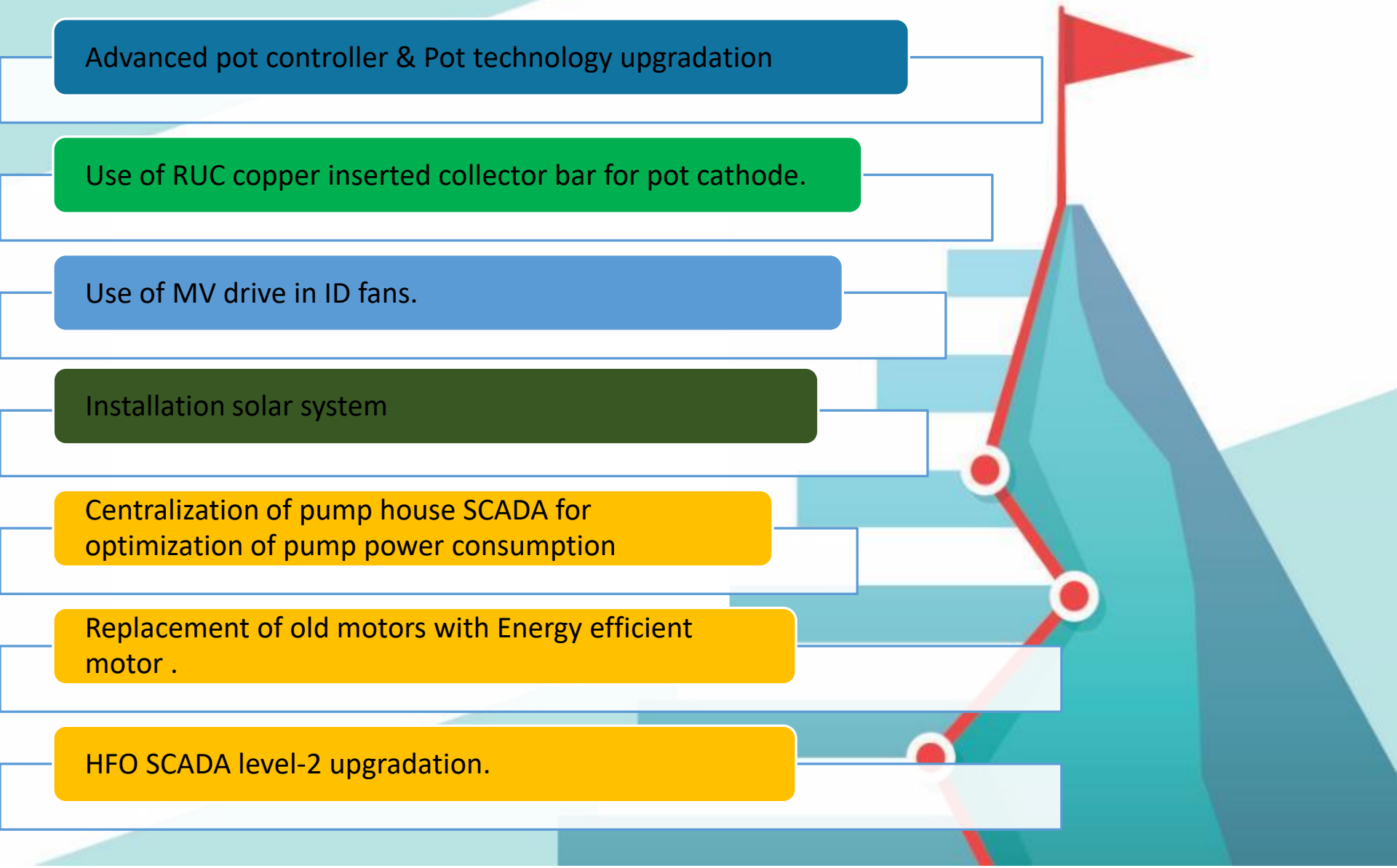
| YEAR | ENERGY PERFORMANCE 8 AWARDS | PROJECTS IMPLIMENTED |
|---|---|---|
| 2010 | Energy Audit by CII | Training, EnMS team formation |
| 2011 | Energy Audited by TERI | Clamp<br>Drop |
| 2012 | EnMS implementation | EnMS implemented, Fuse Technology |
| 2013 | ISO 50001 Certified ENCON award from BEE and CII | Slotted Anode |
| 2014 | ENCON award by BEE, CII, GMEA | Cathode & HFO |
| 2015 | Russian Gov. Award-Best Energy Efficient project realized abroad<br>NECA -2nd Prize | HFO & Conversion Efficiency |
| 2016 | Energy Management Insight award | Technology up gradation in potline |
| 2017 | PAT cycle-1 best achiever award *SEEM award | Mass LED conversion drive |
| 2018 | Energy Efficient unit by CII | 100% Graphitized cathode |
| 2019 | Excellent Energy Efficient unit by CII | PAT cycle-2 M&V audit done<br>Excellent Energy Efficient unit by CII |
| 2020 | Energy Efficient unit by CII,<br>NECA Award 2020,SEEM GOLD AWARD | Energy Efficient unit by CII<br>NECA Award<br>SEEM award |

# ENCON PROJECTS (ONGOING/UPCOMING)

| S No. | Title of Project | Year | Estimated Annual Savings, MWh | Status |
|---|---|---|---|---|
| 1 | Bolt drop correction started, Around 6 pots completed, gain -1mv/pot rest all will be completed. | 2021-22 | 14.9 | Planned |
| 2 | flood light 70W converted to LED 40 w replaced with 400nos, gain of 12 kw achieved till now , remaining 400 nos will be done by oct-21 | 2021-22 | 60.60 | In progress |
| 3 | Ball mill liner replaced in both the mills 50%, energy saving-23.04Mwh in last two month | 2021-22 | 7.6 | In progress |
| 4 | Belt conveyor idle running time reduced, further optimization in process. 4.8Mwh/mon | 2021-22 | 4.8 | In progress |
| 5 | Energy Efficient Ac is being replaced with Old AC | 2021-22 | 1.44 | In progress |
| 6 | Overhauling In MTV-5 has been Completed in May Month,Now will start On MTV-1 | 2021-22 | 0.67 | In progress |
| 7 | Compressed air Air Leakage reduction and Use of Nozel | 2021-22 | 1.8 | Planned |
| 8 | ETP efficiency improvement | 2021-22 | 0.70 | Planned |
| 9 | Reduction of Chipping Material during Casting | 2021-22 | 0.65 | In progress |
| 10 | Pneumatic Overhauling in 2nos MTV | 2021-22 | 2.71(M kCal) | In Progress |

# ROAD MAP TOWARDS BENCHMARK

- Advanced pot controller & Pot technology upgradation
- Use of RUC copper inserted collector bar for pot cathode.
- Use of MV drive in ID fans.
- Installation solar system
- Centralization of pump house SCADA for optimization of pump power consumption
- Replacement of old motors with Energy efficient motor .
- HFO SCADA level-2 upgradation.



# AWARDS & RECOGNITIONS




- ✓ Recognized as “Energy Efficient Unit” at 21st National Award for “Excellence in Energy Management” organized by CII.
- ✓ Gold award for best energy management from SEEM 2020.
- ✓ NECA (National Energy Conservation Award) 2020





It takes
One will
To transform
A million life
At Vedanta Jharsuguda
We harness our Collective will
To make Energy Conservation
A Way of Life
Thank You