ADITYA BIRLA
HINDALCO

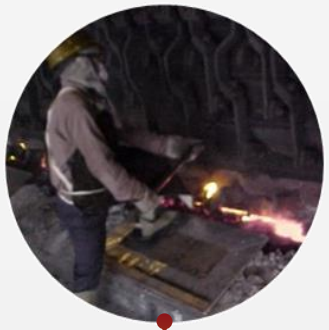
Hindalco Industries Ltd, Hirakud

Prabhat Kumar Dip – Dy. Manager (Energy & CBM)
Md. Imroz Ahmad– Sr. Manager (Technical Cell)
Manish Jaiswal– Dy. Manager (E&I)

1. INTRODUCTION TO HINDALCO, HIRAKUD

- The Hirakud aluminium smelter, located in Sambalpur district, is the oldest operating smelter in India
- Production capacity increased to 216 KTPA via brownfield expansion of GAMI technology based 235 kA potline, in 2013
- Consistent efforts to uphold sustainability and consistent value creation for all stakeholders

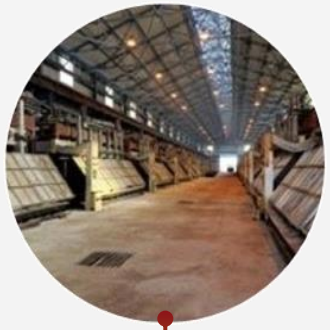
Journey of our smelter



10 kTPA
55 kA

1959-05

Operations based on old Soderberg Pot (HSS) technology



165 kTPA
85 kA

2006-12

Upgraded operations to prebake technology

216 kTPA
235 kA

2013-19

Completed brownfield expansion by addition of 80 pots

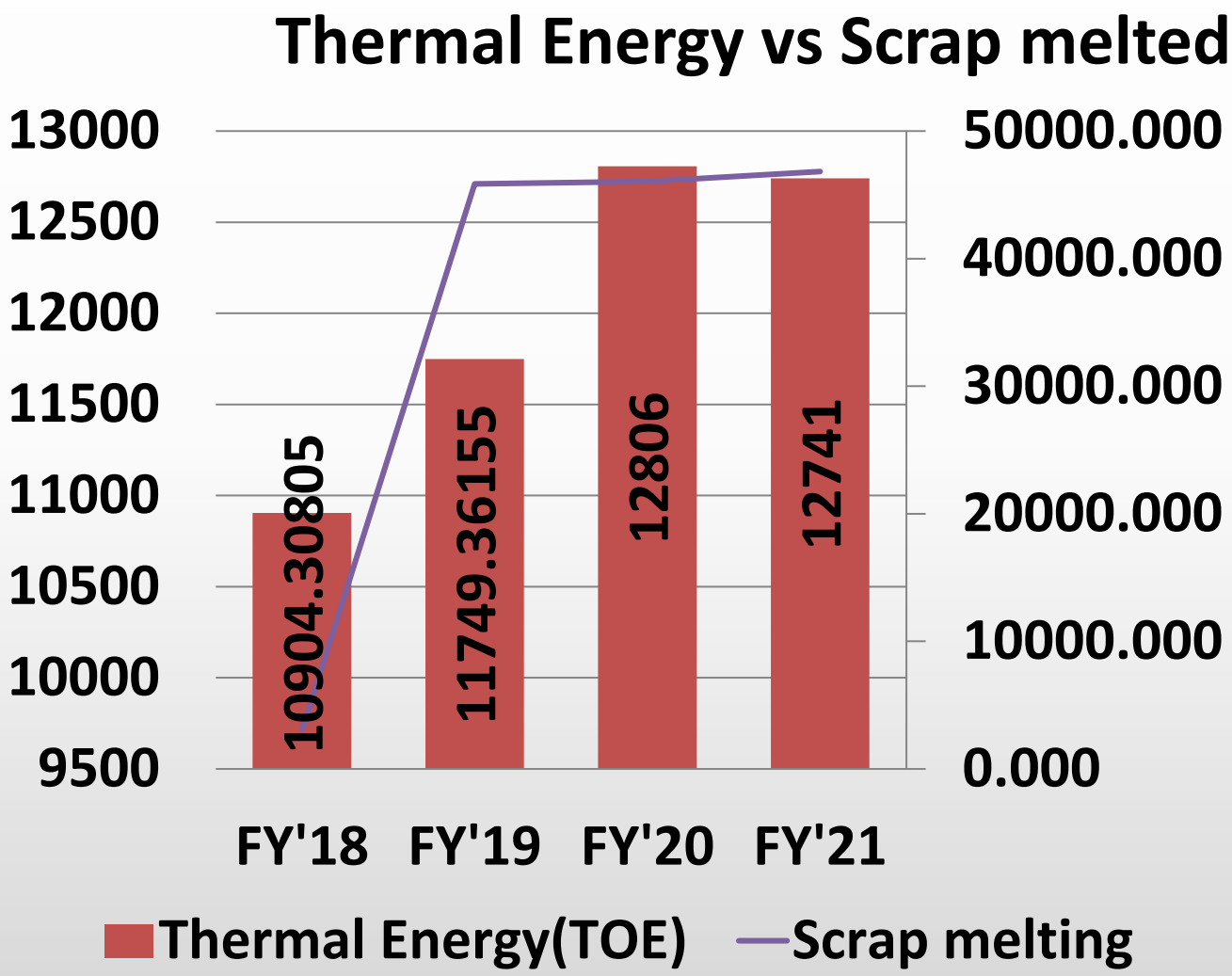
Rated smelting capacity

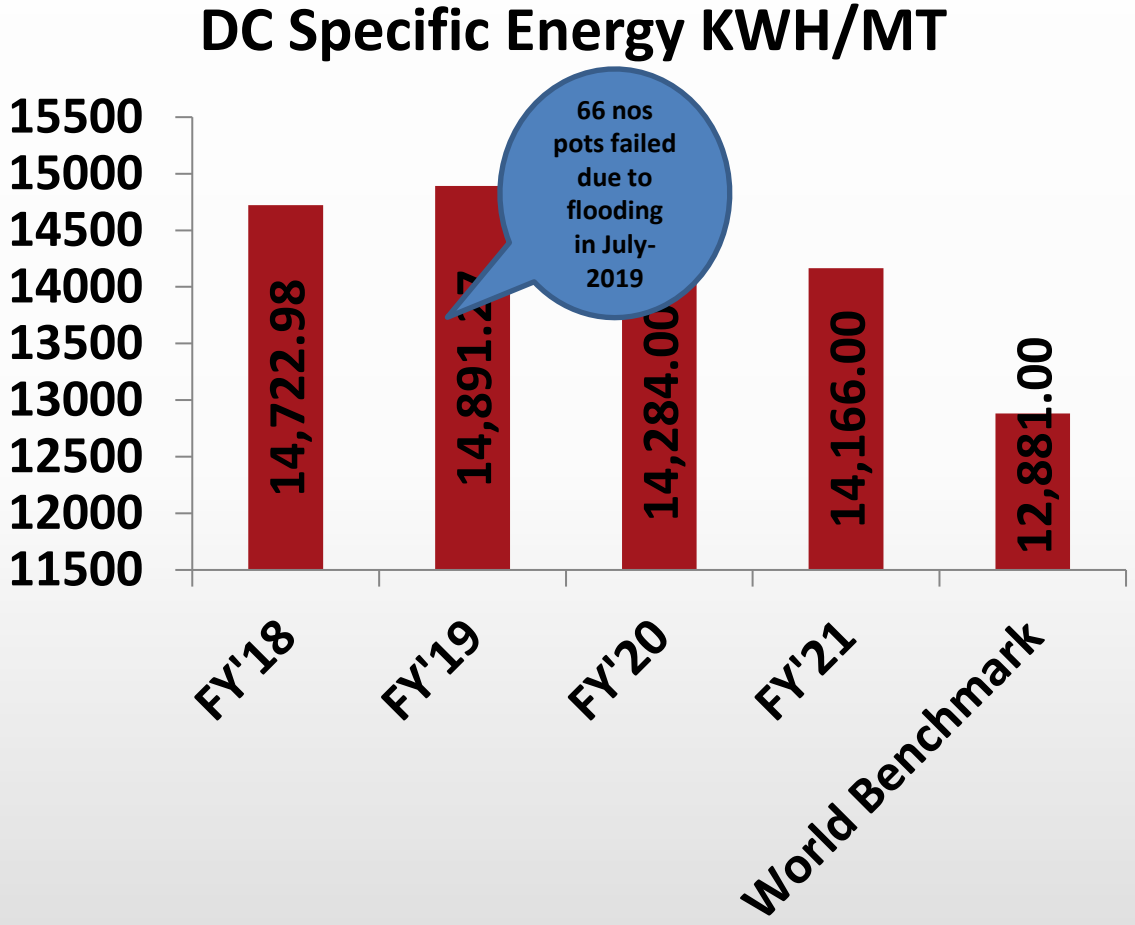
Operating Amperage

2. IMPACT OF COVID-19

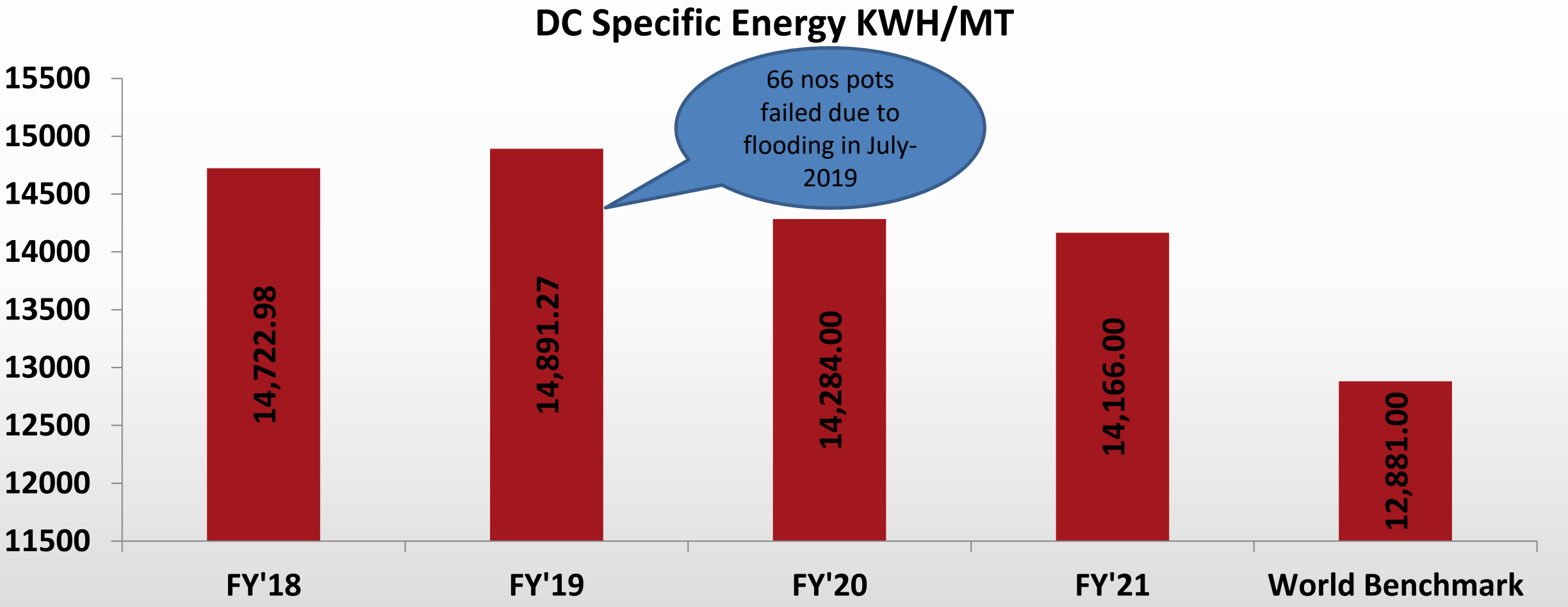
- Covid-19 started in mid March-2020
- 66 number pots were shunted in a planned way.
- P&B was revised.
- Shortage of manpower due to shutdown and travel restrictions.
- There was a cut in CAPEX budget and many energy conservation and improvement projects were halted.
- Digitization had a very crucial role and online meetings gained momentum.
- Many shifts began to go vacant and management employees also came in shifts

3a. Sp. Energy Consumption in last 3 years



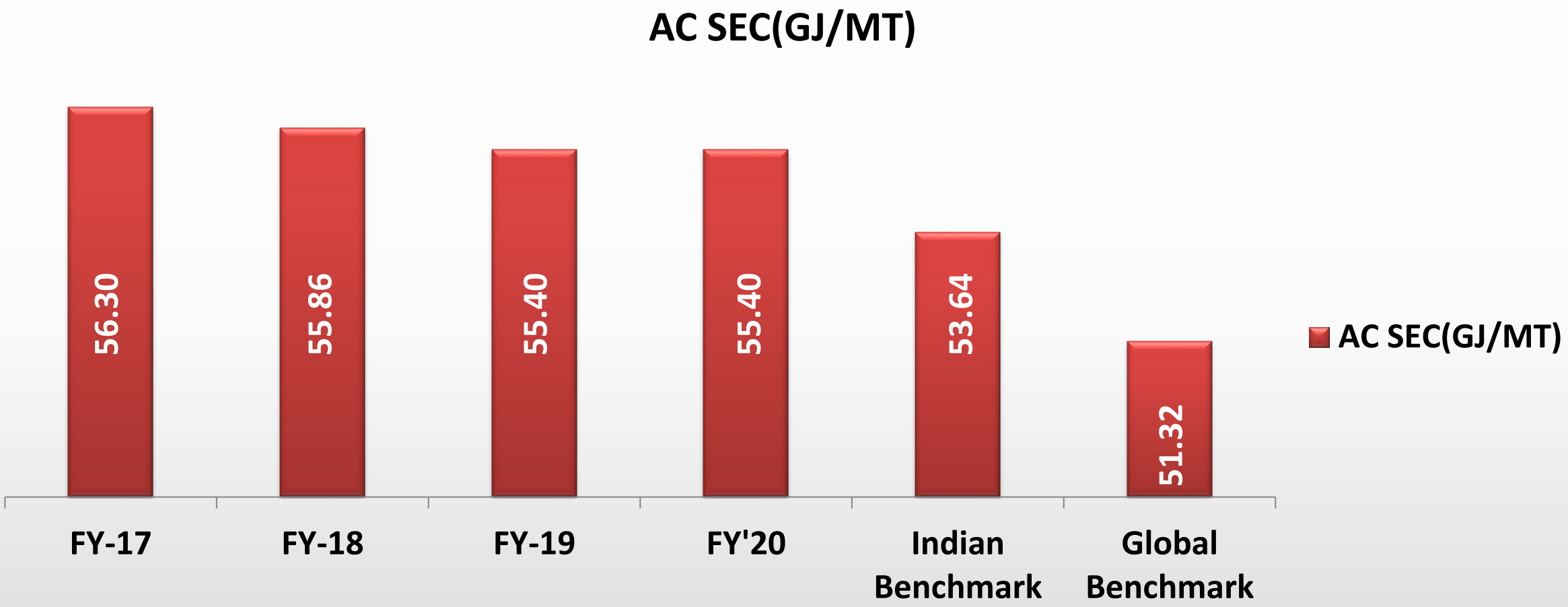


3b. Sp. Energy Consumption in last 3 years



World Benchmark: Source International Aluminium Institute

4a. National & Global benchmark



Source : www.world-aluminium.com

4b. Energy Saving projects planned in FY'22

Sl. No	Title of the project	Annual Electrical Savings kWH	Annual Electrical Cost Savings in Million	Total Annual Savings in Million	Investment made in Millions	Payback in months
		KWH		INR	INR	
2021-22						
1	Procurement, installation and commissioning of Compressor Air Flowmeters for Smelter and integration of Compressor controllers for measuring online efficiency	1231090.85	4.7397	4.739699773	16.1	40.76
2	Use of 100% graphitized cathode to reduce DC energy in 235kA potline (6 pots)	3888	0.014969	0.0149688	0.0786	63.01
3	235KA CI sealing	268056	1.032016	1.0320156	0.054	0.63
4	85KA CI sealing	1787040	6.880104	6.880104	0.36	0.63
5	235KA Copper inserted collector bar	2593836	9.986269	9.9862686	43.2	51.91
6	85KA Copper inserted collector bar (120)	6254640	24.08036	24.080364	84	41.86
7	Next Gen HI pot Technology in 85kA(72 pots)	3752784	14.44822	14.4482184	77.4	64.28
8	PLC based controller in 43 pots in 85kA potline	2382720	9.173472	9.173472	7	9.16
9	Point Feeder modification in 50 pots of 85kA potlines	11789500	45.38958	45.389575	3	0.79
10	Power factor at different load centres manily compressor, cooling towers, FTP, HDPS to be meaured and corrective action to be taken	963600	3.70986	3.70986	3	9.70

5a. Energy Saving projects implemented in FY '19

Sl. No	Title of the project	Annual Electrical Savings kWH	Annual Electrical Cost Savings in Million	Total Annual Savings in Million	Investment made in Millions	Payback in months
		KWH		INR	INR	
2018-19						
1	85kA pots 100% cu inserted collector bar	3440052	16.34	12.73	23.8	22.4
2	85kA pots 100 % CI Rodding through Aditya CSS	819060.00	5.80	3.03	1.65	6.53
3	85kA pots 160mm dia anode project	7580949.91	28.05	28.05	54.60	23.36
4	235kA pots 100% cu inserted collector bar	2161530.00	4.54	8.00	14.90	22.36
5	235kA pots 160mm dia anode project	3053187.68	11.30	11.30	7.98	8.48
6	235kA pots 100 % CI Rodding through Aditya CSS	402084.00	5.35	1.49	10.40	83.89
7	External Current Magenetic compensation	9945946.00	36.80	36.80	36.00	11.74
8	Installation of VFD for Blower Application in Cast House	114756.00	0.42	0.42	0.20	5.65
9	Interconnection of dust collector in HDPS line to be done	50000.00	0.19	0.19	0.01	0.65
10	Installation of Harmonic Filter at RS#4 to reduce TG loss & Copper Loss	2847000.00	10.53	10.53	28.70	32.69
11	Individuals boosters to be installed in beam raising machines	885000.00	3.27	3.27	0.25	0.92

5b. Energy Saving projects implemented in FY 20

Sl. No	Title of the project	Annual Electrical Savings kWH	Annual Electrical Cost Savings in Million	Total Annual Savings in Million	Investment made in Millions	Payback in months
		KWH		INR	INR	
2019-20						
1	Replacement of 5 no IR make reciprocating comp with lubricated screw compressors	1375000.00	5.50	5.50	20.00	43.64
2	Replacement of high lighting load with almost 12 hrs of running with LED	876000.00	3.24	3.24	1.00	3.70
3	Voltage regulation to be done for all lighting loads	54000.00	0.20	0.20	0.32	18.92
4	Stopage of one compressor in 235 KA after blower installation	2628000.00	10.51	10.51	20.00	22.83
5	85KA Copper inserted collector bar	4221882.00	15.62	15.62	46.20	35.49
6	85KACathode collector bar sealing with cast iron	1265820.00	4.68	4.68	0.55	1.41
7	235KA Copper inserted collector bar	3746652.00	13.86	13.86	36.00	31.16
8	235KA Cathode collector bar sealing with cast iron	416976.00	1.54	1.54	0.08	0.65
9	Using shorter anode in 85kA potlines	7135135.14	30.68	26.40	16.50	6.45
10	Next Gen HI pot Technology in 85kA	2084880.00	8.96	19.90	48.00	64.25

5c. Energy Saving projects implemented in FY '21

Sl. No	9Title of the project	Annual Electrical Savings kWH	Annual Electrical Cost Savings in Million	Total Annual Savings in Million	Investment made in Millions	Payback in months
		KWH		INR	INR	
2020-21						
1	85KA Copper inserted collector bar	4134541.552	15.91798	15.91798497	64.4	48.55
2	100% cu inserted collector bar in 235kA	1049906.705	4.042141	4.042140812	0.525	1.56
3	100 % CI Rodding through Aditya CSS for 235 kA potline	74460	0.286671	0.286671	0.015	0.63
4	100 % CI Rodding through Aditya CSS for 85 kA potline	1116900	4.300065	4.300065	0.225	0.63
5	Next Gen HI pot Technology in 85kA	2084880	8.026788	8.026788	24	35.88
6	PLC based controller in 43 pots in 85kA potline	811117.6	3.122803	3.12280276	7	26.90
7	Point Feeder modification in 50 pots of 85kA potlines	1178950	4.538958	4.5389575	0.3	0.79
8	FTP#2 ID Fan#1 modified impellar to be installed to increase the efficiency from 69 to 80% and 1 no new ID Fan of 315 KW to be installed thereby stopping 1 no 1050KW ID Fan#2	2628000	10.1178	10.1178	8.5	10.08

Summary of Energy Saving Projects(FY16-FY19)

Year	No.of Proposal	Investments	Savings	Payback months
2016-17	4	1800000	20409074.3	1.05
2017-18	5	20900000	64721332.8	3.88
2018-19	5	137100000	57013585.2	28.85
2019-20	12	133017490	166730000	15.01
2020-21	8	104965000	50353210	10.08

6. Innovative Project Pot logic controller modification in 85kA

Challenges encountered in old EPC	
1	High Anode Effect Frequency
2	Abnormal pot behavior
3	Alumina dissolution problem
4	Less pot life

The upgraded control logic helped in	
1	Increasing operational excellence
2	Improving process efficiency
3	Lowering Anode Effect Frequency
4	Reducing specific energy consumption

Project : Process optimization through implementation of PLC based pot controller at 85kA pot lines

Project Summary

Background

- Hirakud smelter has taken significant strides in pot design to improve productivity & process efficiency. The present pot control logic at Hirakud smelter provided by GAMI has limited flexibility and should be better customized according to Hirakud pot design and operation.

Business case

- Develop new pot control strategy on PLC based pot controller for Hirakud 85 kA smelter, which is having ease of accessing logic and ease of doing maintenance compare to GAMI-embedded controller
- Reduce the anode effect frequency (AEF) and improve pot stability.

Technical approach

- Detailed analysis of existing control system and conduct necessary pot level experiments
- Develop new control system: Control strategy + EPC Hardware + Fiber Optic based network+ Improved visualization & reporting.
- Trial and fine-tuning of the new system and subsequent roll-out.

Timeline

- Large scale trials
- **1st phase** of 43 pot completed & running successfully.
- **2nd phase** of 35 pot to be completed by Oct'21.
- **3rd phase** of 50 pot by May'22.
- Total 85 kA pot line to be replicated by next 3years.

Potential impact

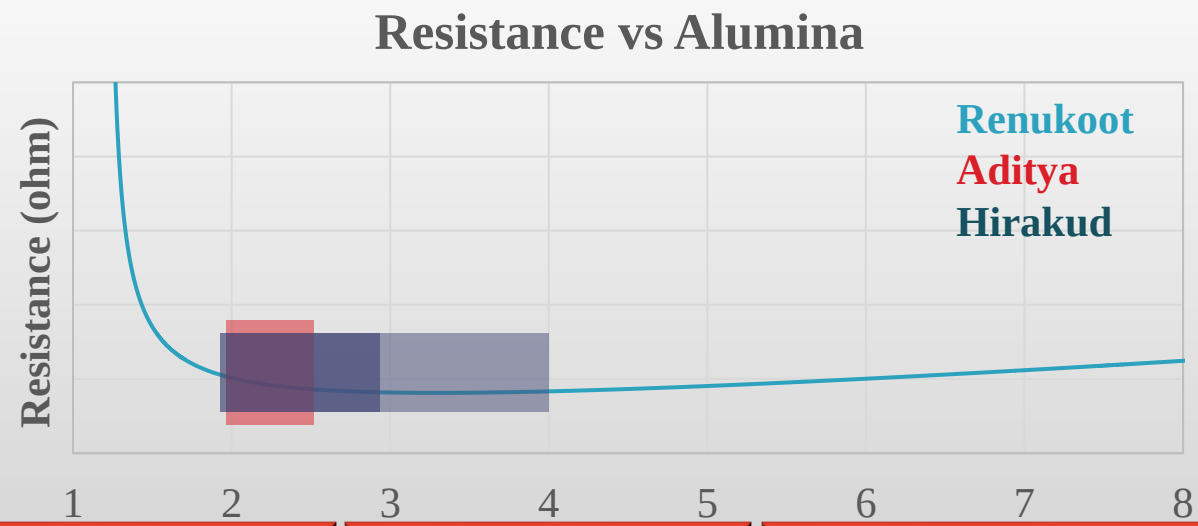
- Saving of 27.8 L/ annum for 43 pots considering AEF reduction by 0.3/pot/day (potential of 3.5 Cr for entire plant).
- OPC enabled controllers that can easily be incorporated with digital twin enablers.

Key learning

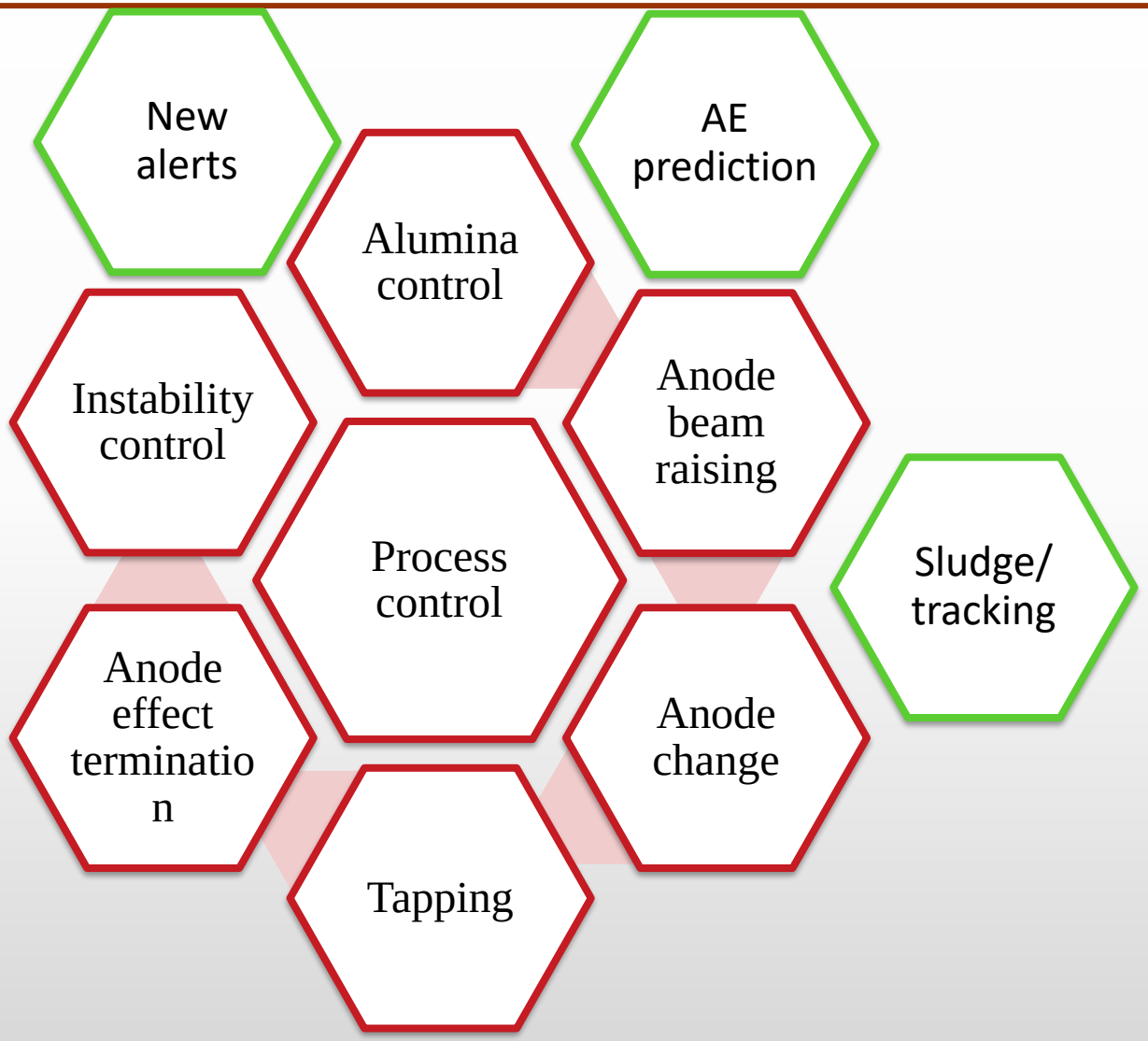
- Taking the learnings from GAMI and AP technology for development of indigenous control system.
- Up skilling for logic & graphics modification as per process need.

Project - Overview

Comparative study → Scope for improvement → Development of **New Logic** → Hardware study & integration → Installation of PLC with fiber optic network → Trial → Creating SOPs → AEP, sludge, tracking logic → Fine-tuning of strategy → Phase-wise roll out



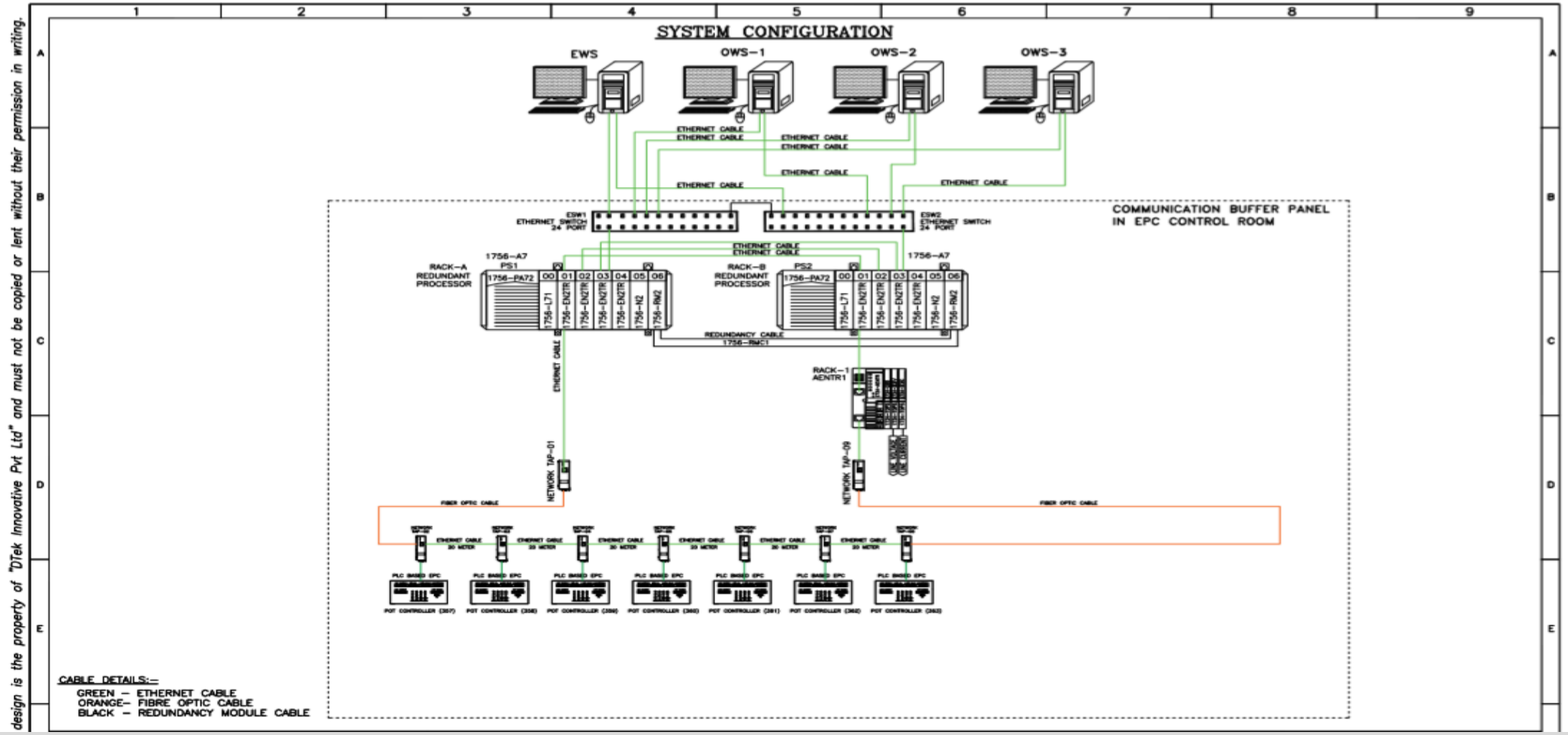
Control logic development and Hardware integration



PLC controller installed at pot

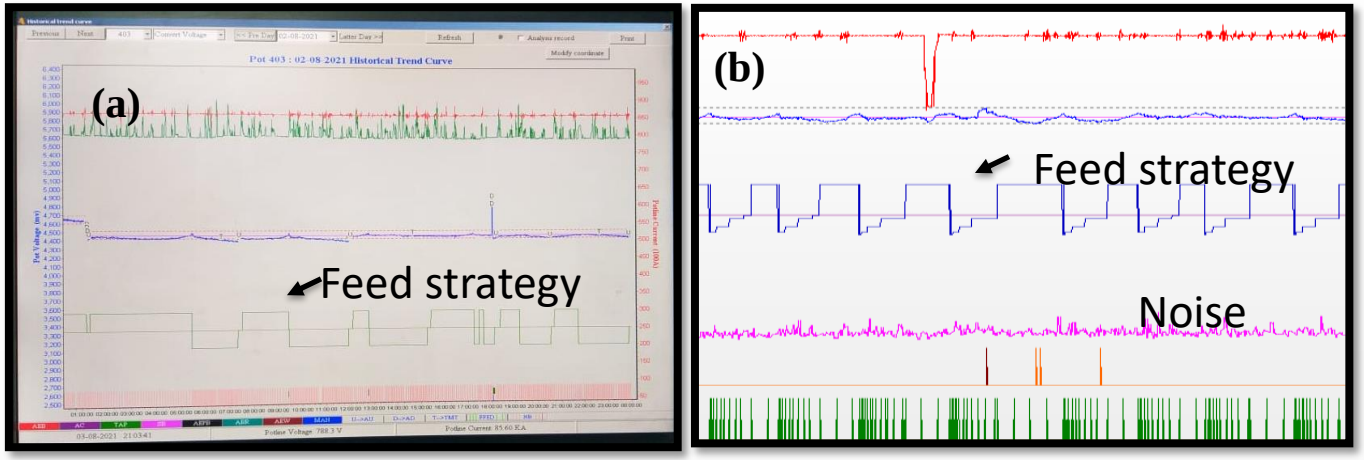
Indigenous system

Network Architecture

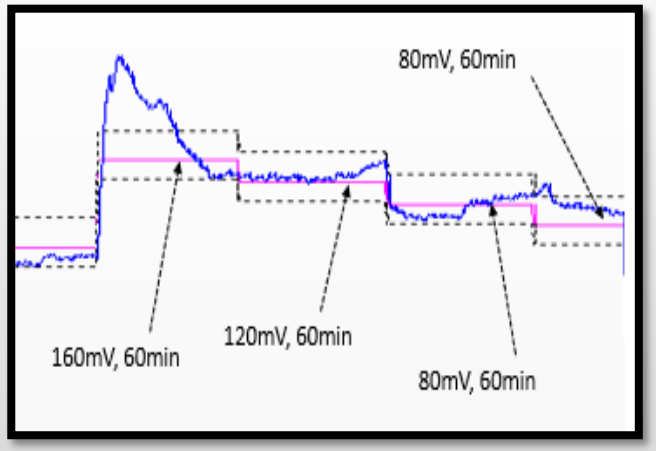


Comparison between GAMI & New PLC logic

Old (GAMI)	New (PLC based)
Variable UF as well as OF	OF duration constant
Overfeeding strategy- linear decrease (90% to 75% of NB interval)	Parabolic increase (75% to 90% of NB interval)
Remains inactive auto AE termination logic	New AE termination logic introduced
Decisions based on difference on Voltage	Slope and curvature of resistance to be used for decision making
AC Voltage buzz decreased in 1 step	AC voltage buzz reduction stepwise
Process tracking absent	Post AC and Tapping, tracking started & auto tracking in every 48 hr
AEF ~ 0.35 /pot/day	AEF ~ 0.15 /pot/day



Feed strategy : (a) old and (b) new control logic



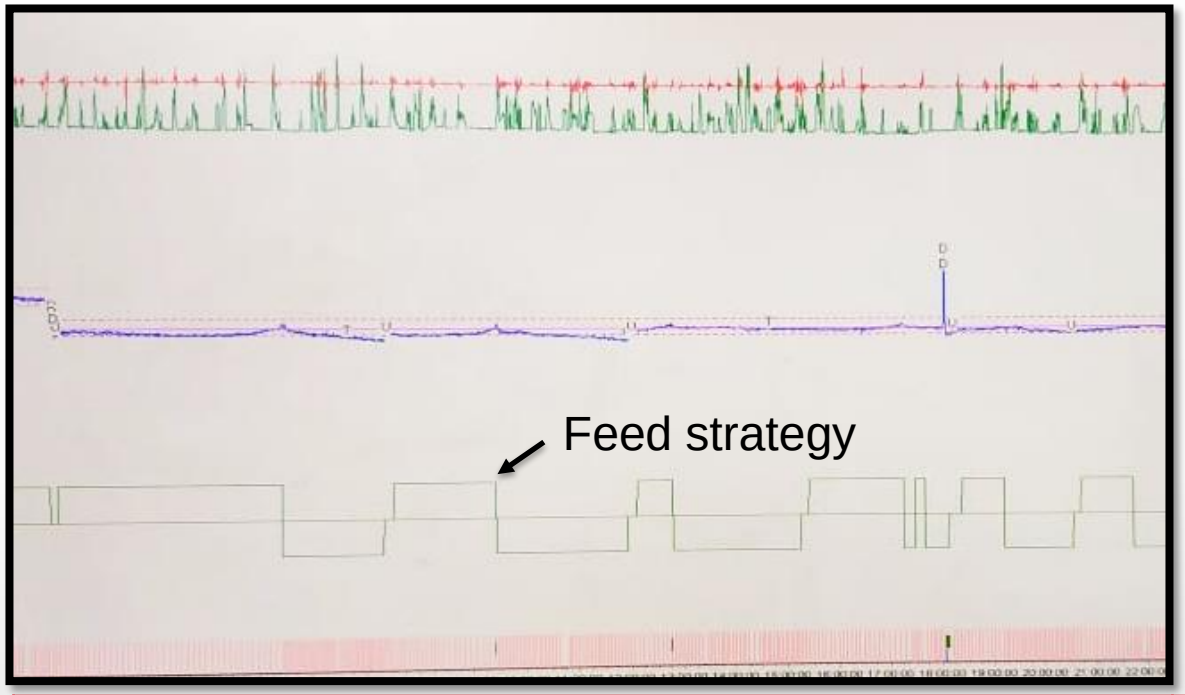
Stepwise voltage cut

Tracking

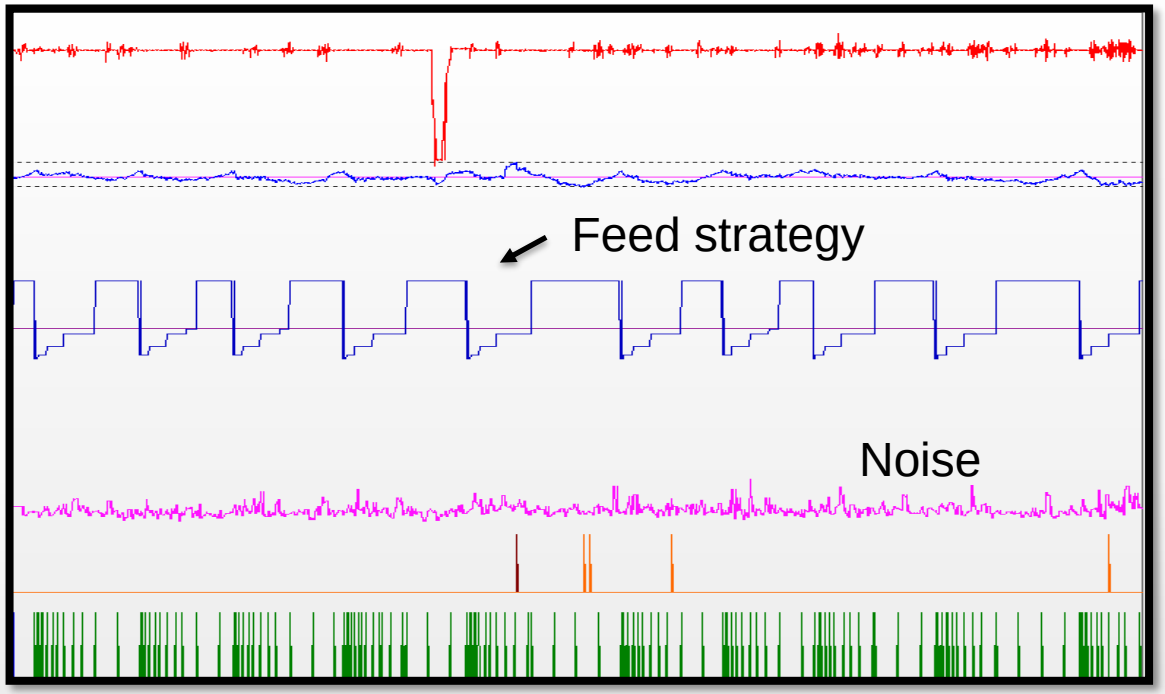
Project - Major Changes

Feed strategies:

A: Old logic trend



B: New logic trend



• Over feeding as well as underfeeding durations are dynamic - Alumina cannot be monitored correctly	• Over feeding duration is constant and underfeeding duration is still dynamic
• Overfeeding strategy- linear decrease (90% to 75% of NB interval)	• Overfeeding interval increases parabolically from 25% to 85% of NB interval (more alumina at end of underfeed)

Advanced Features

Features

- **Alumina concentration** operating within 1.9-3 % compared to GAMI's 2.5 to 4%
- **Tracking feature/ button** provided for faster sludge dissolution
- **New alerts** – Hole choke prediction, anode slip prediction, dump test alarms,
- **Auto-adaptive logic & Ultra Fast-feed**- Automated feed strategy changes with line current, bath height and noise.
- **Statistical report generation** like bar chart, line chart etc
- **Fast AE detection** 12 sec compared to GAMI's 40 sec

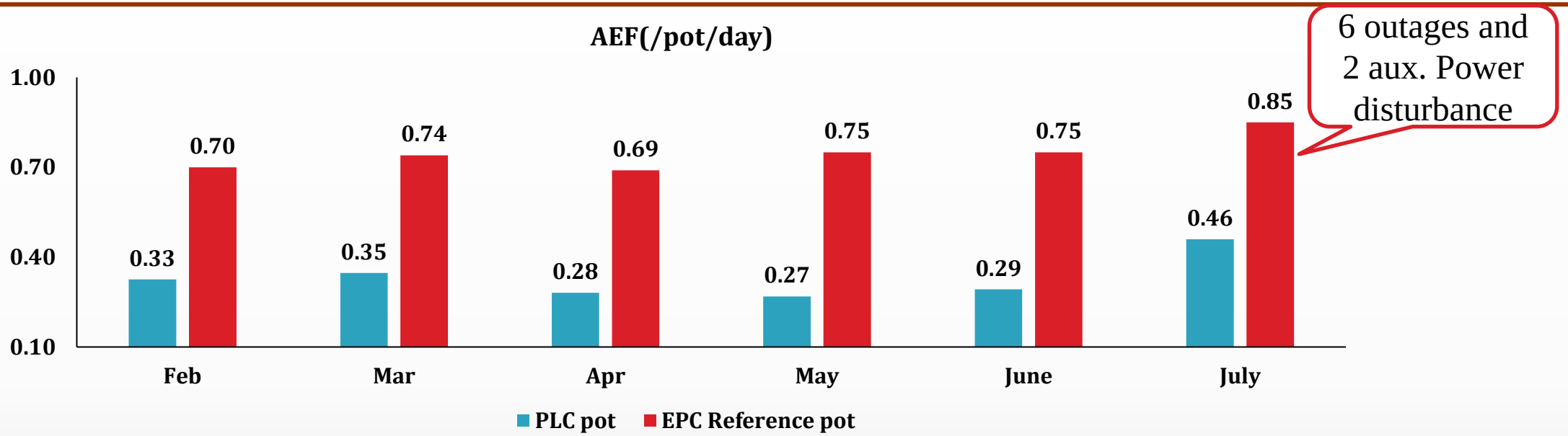
Hardware & software

•It offers high speed data communication over **fiber optics** network with **redundant** controller which will ensure 100% network & data availability.

•Enhanced report, graphics & fault diagnostics tool for better operational & maintenance control.

•Improved reliability against Obsolescence of HART & GAMI EPC Hardwares & operating system.

Benefits & Impact on business



- Saving of 27.8 L/ annum for 43 pots considering AEF reduction by 0.3 per pot per day.
- Corresponding to an energy saving of 661 MWh/ annum or 41 kWh/T.
- Saving potential of 3.5 Cr/ annum if implemented in all pots.
- CO2 equivalent saving of 50.5 kt (kilotonne)/ annum.
- Additionally, reliability improvement and current efficiency, which is currently being monitored.

- Investment for 1st phase (43 pots) – 1.5 Cr

Challenges & Learnings

Challenges & Learnings

- Commissioning of PLC based controllers with new network & hardware architecture.
- Online switching of control system from GAMI to PLC based.
- Sludge forming tendency due to more feeding during overfeed --> feed cycle changed.
- High fluctuation of process parameters --> Data automatic synchronization through one drive for corrective actions.
- Changing the operator mindset with training and familiarization with new control system.
- High anode effects during noise and after anode change.
- Addressing delay in display loading after controller is restarted and also delay in trend loading on supervisory computer.

SUSTAINABLE WAY FORWARD

- Indigenous developed technology --> Patenting
- Further phase wise roll out of new control system.
- Reduced feeder size (1 kg) large scale trial.
- Fine-tuning of anode effect termination logic to reduce AE duration.
- Trials of new control system in 235 kA pots along with AlF3 feeding logic
- Technical knowledge of the team has increased; motivated to carry out other sustainable energy reduction projects
- Increased collaboration across all Hindalco plants & ABSTC

7. Utilisation of renewable energy sources

Established in the year1958 and with continuous capacity enhancement in limited space, therefore no major actions could be taken on Renewable Energy Sources except partially installed solar light. However we purchase REC's as a part of RPO obligations.74220 RPO were complied.

Utilisation of waste material as fuel

Project1

Uses of waste wood for bath recovery in calciner

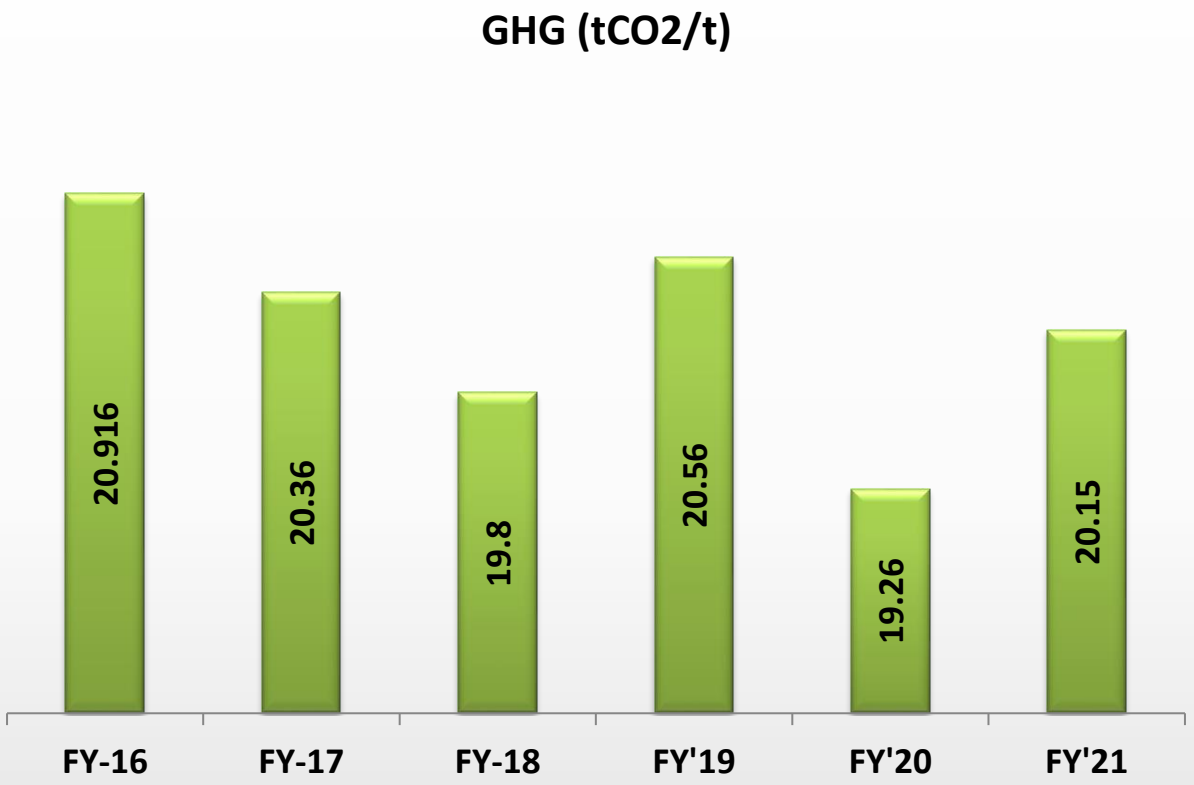
Project2

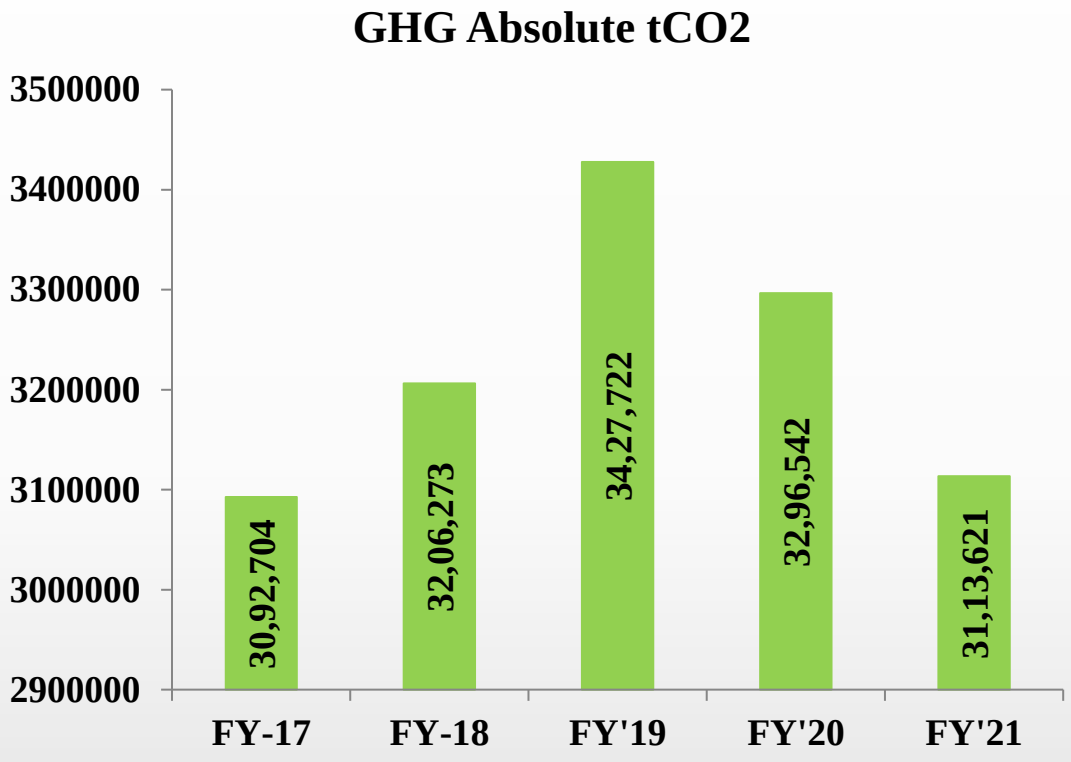
Uses of used carbon anode butt for metal recovery from Dross(First time in India).

Project3

2 nos polycracker machine to crack polythene into oil(used for boiler firing alongwith LDO ,cooking gas(used in cafeteria) and carbon(used in CPP).

9. GHG





Target is to reduce by 35% taking 2005 as base. The figures of Hindalco is disclosed in the yearly sustainability report

1. considered Scope-1 and Scope-2, addition of Scope-3 is in process

8. Green Supply Chain

- Alumina used in the process is transported by rakes.
- Anodes used in the process is purchased from Aditya which was earlier imported from China.
- No loading/unloading vehicle is entered in the plant premises without valid pollution certificate.
- Capacity of Hotmetal truck is upgraded

10.Team work, Employee Involvement & Monitoring

1.We monitor SEC in terms of ACE,DC, Conversion Loss,FTP & Auxillary on daily basis.

2.Review meeting chaired by Mr.Debasish Mallik(Smelter Head) monthly.

3 Separate budget for Energy Conservation via Galaxy projects

4. Energy efficiency / awareness training program at Business, Cluster as well as Plant Level organised by Corporate Energy cell and Plant Energy cell.

5. Projects are being implemented through Kaizens (Workers and Supervisor level).

- Timer control of Plant Lighting
- Occupancy Sensor for offices.

11. Implementation of ISO 50001/Green Co/IGBC rating

Lloyd's Register

Current issue date: 19 July 2021
Expiry date: 9 July 2022
Certificate identity number: 10377703

Original approval(s):
ISO 50001 - 19 July 2021

Certificate of Approval

This is to certify that the Management System of:

Hindalco Industries Limited

Hirakud SmelterDist.: Sambalpur, Dist.: Sambalpur, Hirakud, 768016, India

has been approved by Lloyd's Register to the following standards:

ISO 50001:2018

Approval number(s): ISO 50001 – 00031749

The scope of this approval is applicable to:

Manufacture and dispatch of aluminium rolling ingots, SOW Ingots, 22K Ingots and Cast Coils and Generation & Supply of coal based thermal power of capacity 467.5 MW.

This certificate is a continuation of a previous approval from another certification body as follows:

Previous original ISO 50001 approval on 09-JUL-2019, SGS certificate number IN19/90030

Luis Cunha

Area Operations Manager - SAMEA

Issued by: Lloyd's Register Quality Assurance Limited

UKAS

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We are certified with ISO50001:2018.

Outcomes of Surveillance Audit.

1. Internal Audits to be strengthened.
2. Procedure for adding or taking out energy equipments to be made.

% Investment on turnover FY'21 – 0.6 %

Daily Energy Monitoring

ABSOLUTE ENERGY (KWH)								Potline Average Dc Voltage in Volts	Potline Average DC Current in kA	Metal Production in KG
AC Energy	AC For Electrolysis	DC Energy	Conversion loss	FTP Energy	Total Auxiliary	Cast House	Total aux excluding cast house			

SPECIFIC ENERGY (KWH/MT)						
AC Energy	AC For Electrolysis	DC Energy	Conversion loss	FTP Energy	Total Auxiliary	Total Auxiliary excluding CH

Cast House Daily MIS Format								
Date	Production(T)	FRP scrap(T)	Process scrap(T)	Hot metal(T)	FO Consumption(KL)	Solid Ratio (%)	Sp fuel consumption(L/T)	Remarks

We monitor the absolute as well as the specific energy consumption daily & monthly for all the potlines as well as total plant.

12. Learnings from CII & other award ceremonies

- ✓ Best practices of other units.
- ✓ Latest technological upgrades of all plants.
- ✓ Our energy performance comparision with same businesses.
- ✓ Innovative design and technology
- ✓ Impact of energy on climate.
- ✓ Different waste to fuel technologies.
- ✓ Challenges and action plan for future

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HINDALCO

THANK YOU