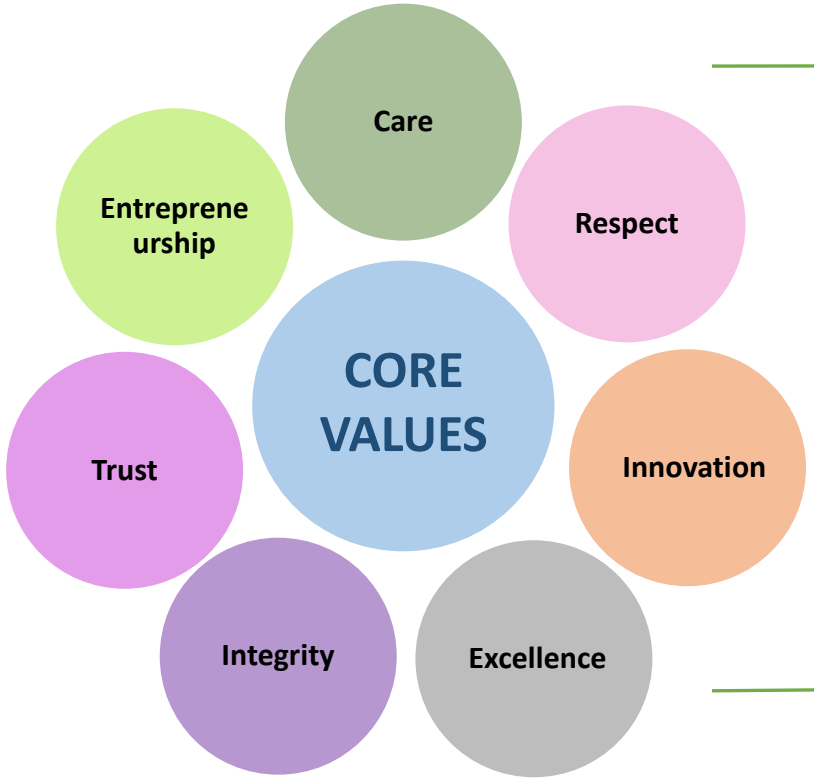


CII Award for Excellence in Energy Management – Metal Sector
Bharat Aluminium Company Limited

Date: 13-Sep'23

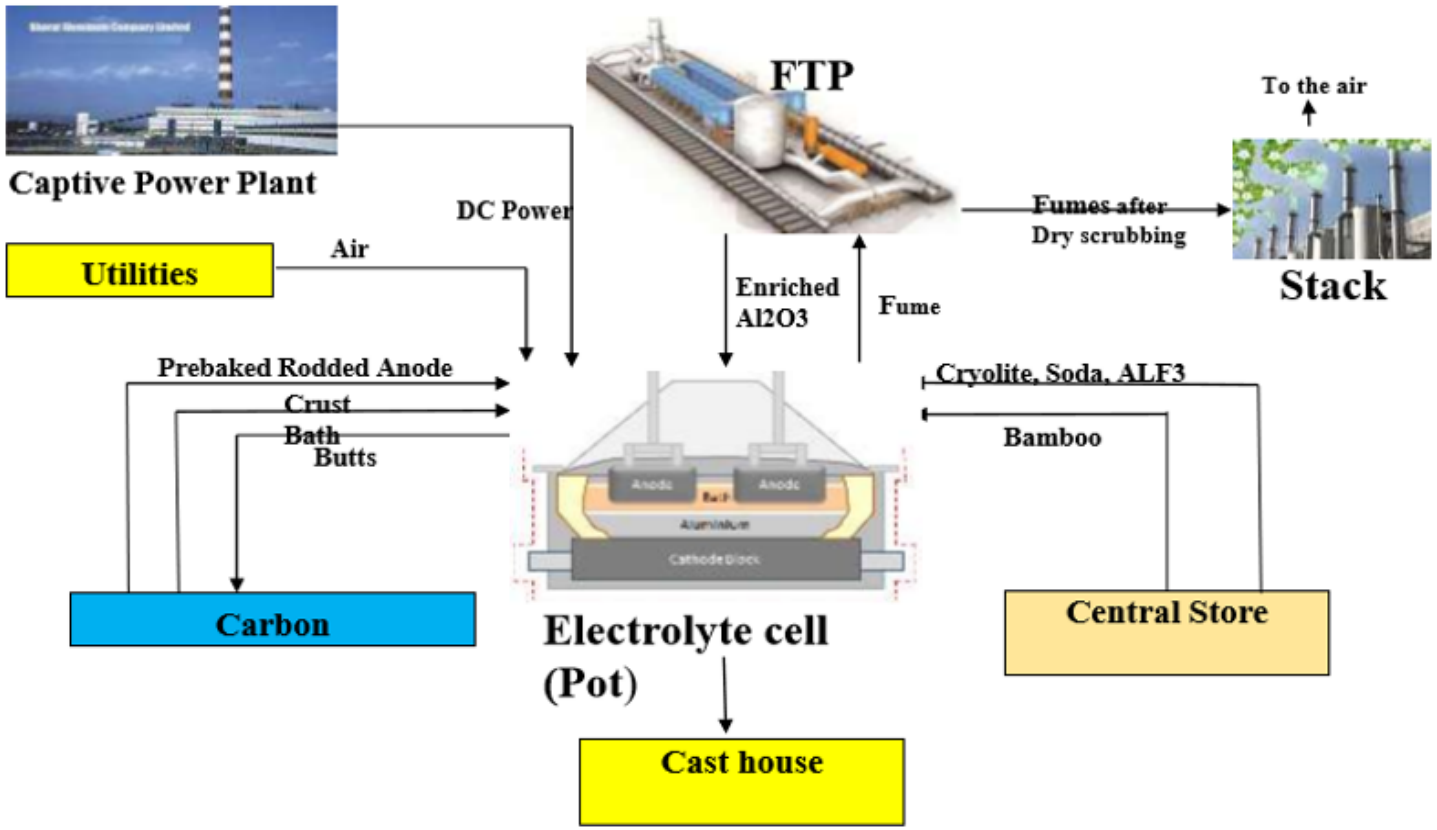
- Abhishek Patel – (Manager)
- P Anish Rao-(Manager)
- Shivendra Agarwal- (Manager)

BALCO-A Snapshot

- **Bharat Aluminium Company** (BALCO) has made significant contributions as the **1st PSU** in India's Aluminium sector Incorporated in 1965, **BALCO** is India's first integrated Aluminium business.
- One of the first disinvestments of the Government of India. It now a part of Vedanta Limited, with 51% stake held by Vedanta Limited and 49% held by Government.
- Balco is based in Chhattisgarh State having Captive Bauxite mines in Mainpat and Kawardha, Captive coal mines in Chotia, 2010 MW power generation capacity and 5.7 LTPA Aluminium Smelting capacity at Korba Complex.
- Balco produces Wire Rods, Ingots, Alloy Rods, Alloy Ingots and Rolled Products. Balco is also selling Power to State Utilities & own sister concerns.
- Balco has been India's first to have - Captive Power Plant, to venture into +300 kA Prebake pots, to produce Alloy Rods for conductors used in power transmission industry, to roll material for Aerospace Industry, online riser replacement, busbar insulation in Pot Room, single beam implementation and holds patent for aluminium cell fuse technology.

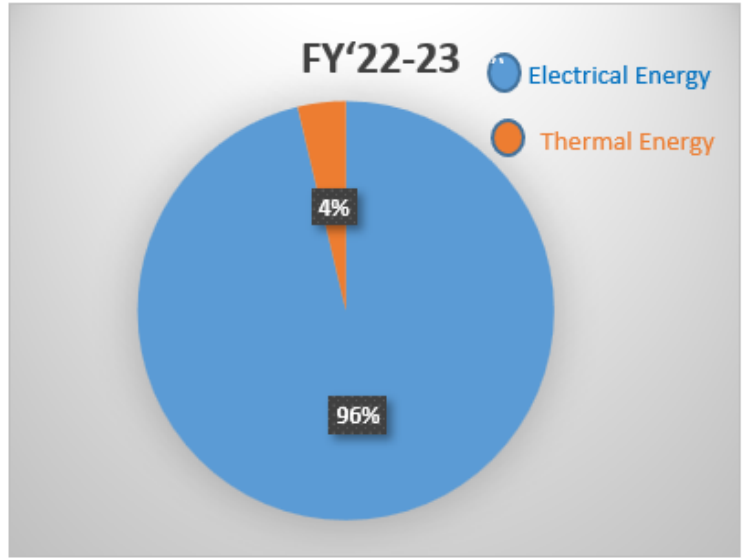
PANDIT NEHRU THEN PRIME MINISTER OF INDIA SIGNING AGREEMENT WITH USSR.FORMALLY STARTING KORBA ALUMINIUM PROJECT.(FORMER NAME BALCO)

Pot line Process Flow



Technology Provider –

Potline1 GAMI (320KA),
Potline2 GAMI (340KA)



Prebaked smelting processes (Hall Heroult) involve electrolytic reduction of the Alumina by Carbon to Hot metal and Carbon dioxide.

$$2\,Al_2O_3\,(dissolved) + 3C(s) \text{ ------> } 4Al(l) + 3CO_2(g)$$

Energy Objectives

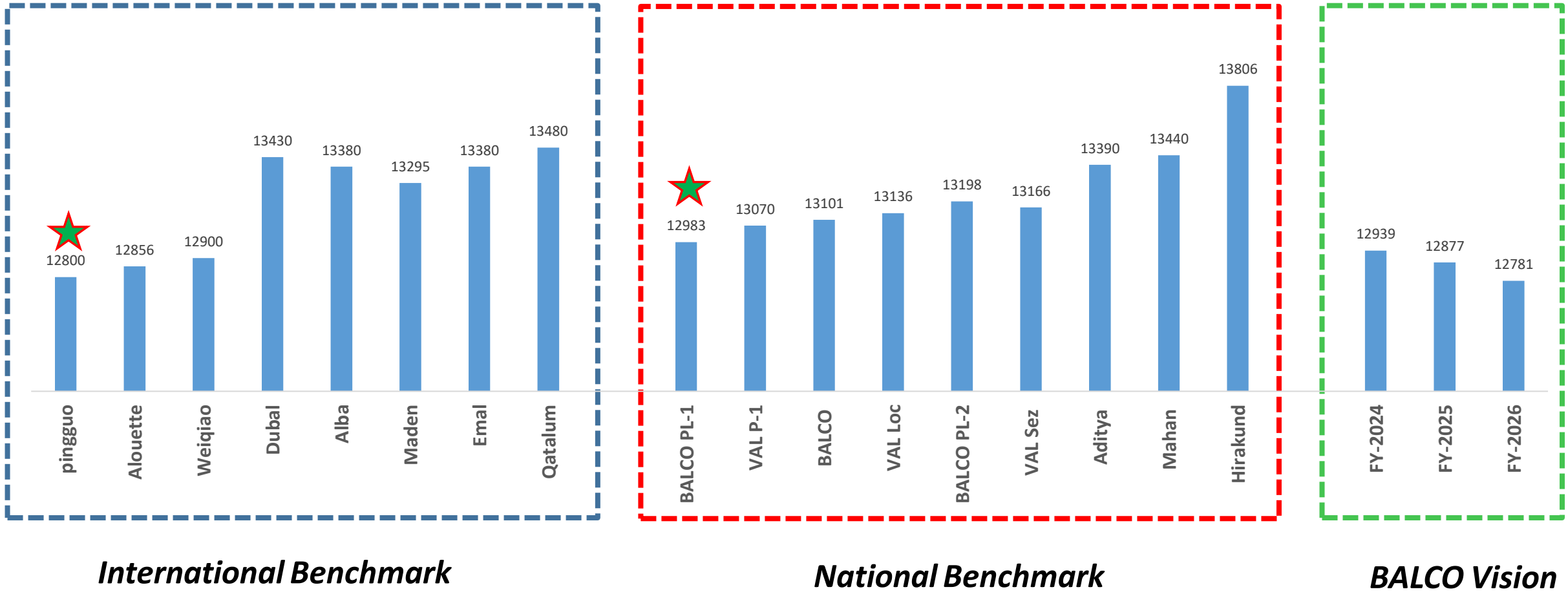
ENERGY OBJECTIVES (FY 24) :

- Reduce Net AC Power consumption for
  Potline-1 (13587 KWH/MT to 13439 KWH/MT) - **148 kWh MT**
  Potline-2 (13817 KWH/MT to 13608 KWH/MT) -**209 kWh/MT**
- Reduce Auxiliary Power Consumption of potline-1 from 427 to 412 KWH/MT- **15 kWh/MT**
- Reduce Auxiliary Power Consumption of Potline-2 from 480 to 460 KWH/MT - **20kWh/MT**

ENERGY OBJECTIVES (Vision FY25)

- Reduce Net Ac Power consumption – **13457 kWh/MT of Al**
- Reduce Auxiliary Power Consumption - **11 kWh/MT**

Pot-line DC Specific-Power kWh/MT & Benchmarking



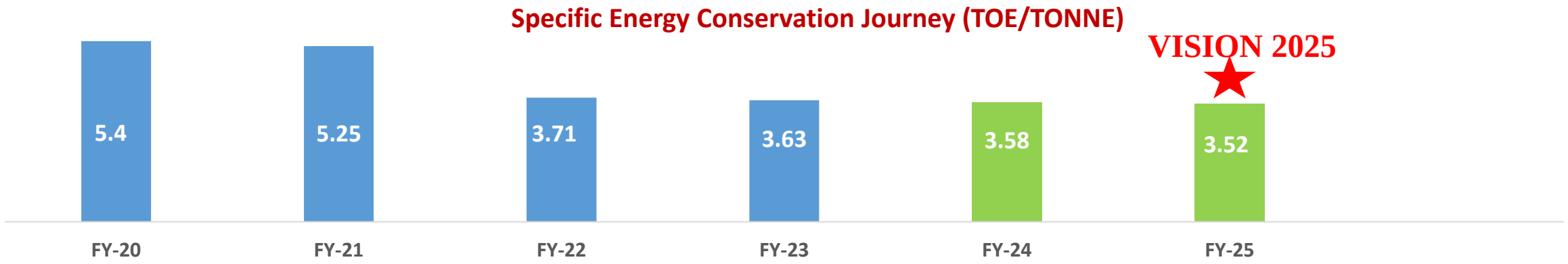
International Benchmark

National Benchmark

BALCO Vision

** Balco is benchmark in Indian & Gulf smelters in DC Specific Power Consumption

Energy Conservation Vision 2023



SN	Major Projects / Action Plan for Vision FY 25	Power Saving	Unit	Target Completion
1	Installation of Copper collector bar in Graphitized Cathode pots	0.02	TOE/TON	Mar-25
2	Replacement of conventional motors with energy efficient motors	0.02	TOE/TON	Mar-25
3	Reduction of Stub Carbon drop , High Slotted Anode	0.002&0.005	TOE/TON	Mar-25
4	Reduction of Auxiliary energy Consumption PL-1 & PL-2	0.008	TOE/TON	Mar-24
5	BALCO thermal modelling for New Relining Design	0.02	TOE/TON	Mar-25
6	Anode coating to reduce dust formation in pot	0.001	TOE/TON	Feb-24
7	Magnetic Compensation loop implementation	0.017	TOE/TON	Mar-25
8	Copper Insert Anode yoke to reduce Anode voltage drop	0.001	TOE/TON	Mar-25
9	Process optimization Carbon & cast Hosue	0.02	TOE/TON	Mar-25

Major Energy Conservation Projects-2021

S.No	Title of Project	Annual Energy Saving Million KWH	Investment Million INR
1	120 (PL 1 : 45 pots & PL 2 :75 pots,) 100% graphitized pots installation & Normalization	79.1	138
2	Reduction in Sp Aux consumptions by 19 kwh/mt (F20 : 479 to BP21 - 459)	3.58	2
3	Auto Cut off EMS whenever furnace tilts up in Cast house 1	0.03	NIL
4	Optimizing furnace temperature set point by operational excellence in cast House 3	0.44	NIL
5	Optimization of annealing furnace cycle time from 9 Hr. to 7 Hr.	0.02	NIL
6	Reduction of compressed air Usage in cast House 3	0.24	NIL
7	Closed loop system in pump house in cast House 3	0.51	35
8	Optimizing furnace temperature set point by operational excellence	0.44	NIL
	TOTAL (ROI- 16 Months)	**84.36**	**175**

Major Energy Conservation Projects-2022

S.No	Title of Project	Annual Energy Saving Million KWH	Investment Million INR
1	120 (PL 1 : 43 pots & PL 2 :77 pots,) 100% graphitized pots installation & Normalization	82.7	1440
2	Reduction in Sp Aux consumptions by 15 kwh/mt (Mar'21 : 454 to BP21 - 440)	1.13	NIL
3	Idle running hours reduction of roller conveyors(10 conveyors)	0.01	NIL
4	Cast House Reduction in compressed air consumption	0.22	NIL
5	GAP Throughput Increment	0.04	NIL
6	Led Replacement	0.66	2
	TOTAL (ROI- 15 Months)	**84.76**	**1442**

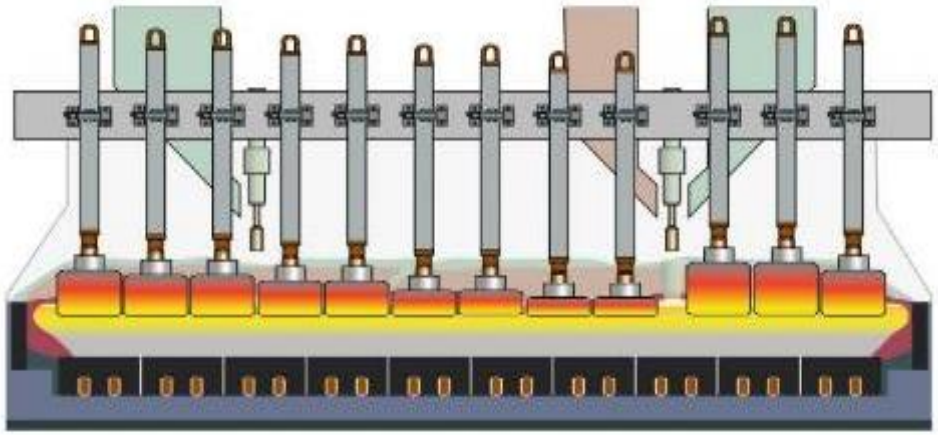
Major Energy Conservation Projects-2023

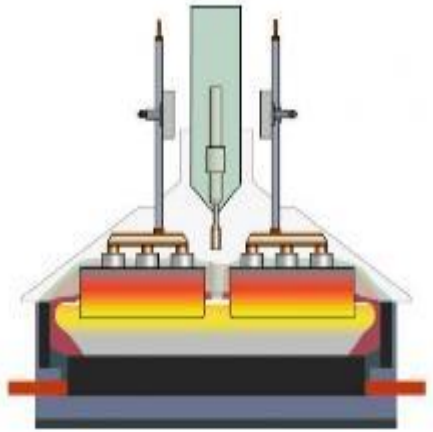
S.No	Title of Project	Annual Energy Saving Million KWH	Investment Million INR
1	110 (PL 1 : 14 pots & PL 2 :37 pots,) 100% graphitized pots installation & Normalization	6.3	510
2	Reduction in Sp Aux consumptions by 15 kwh/mt	4.8	65
3	Gap process Optimization	0.05	NIL
4	Cast House-Reduction in compressed air consumption	0.79	NIL
5	Cast Replacement of hot-well pump with lower rating of pump	0.7	2
6	LED Replacement	0.36	2
	TOTAL (ROI- 18 Months)	**13**	**579**

Major Energy Conservation Projects-2024

S.No	Title of Project	Annual Energy Saving Million KWH	Investment Million INR
1	Anode Stub hole Former - New Design to implement.	11	NIL
2	Process optimization in Potline (High CVD Pots Optimization & Reduction in high voltage pots).	7	NIL
3	Increase in Pot line Current Efficiency from 93.94% to 95.30 %.	33	NIL
4	Improvement in ER from 58.06 (FY 23) to 56.5%.	11	NIL
5	100% graphitization of Pots from the level of 98%.	5	49
6	Anode Slot Height Improvement from 237 to 260 mm & Anode Stub hole Former - New Design	11	6
7	Reduction in Aux power Consumption	11	70
8	Rodding Process Optimization	0.3	NIL
9	New design Cathode development	5	70
10	cast House-Close loop system , Trimming CW Pump impeller & Colling Tower	0.2	1
	TOTAL (ROI- 18 Months)	**94.5**	**196**

Objective	Implementation of Copper collector bar Cathode pots ,Balco with following benefits ✓ Increase in Current efficiency. ✓ Reduction in specific DC energy consumption. ✓ Increase in Pot life.
Approach	✓ 2 Pots Trial pots installed in PL-1 & 3 Pots in PL-2 , which are highly successful. ✓ Lowest voltage and lowest power consumption achieved in those trial pots. ✓ Pots are more stable & less Alf3 consumption.





Uniqueness of the project

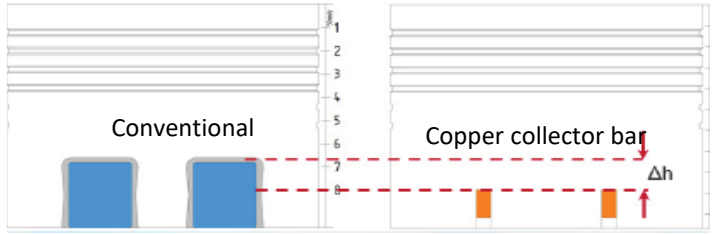
The Aluminum production is an energy intensive process. To be more cost efficient, the process needs to be more energy efficient. Energy efficiency depends mainly on the technology used and relining materials being used. In electrolytic cell, energy consumption can be reduced by reduction of voltage drop & Increasing the pot life.

In electrolysis process, generates horizontal & vertical component of electric current between anode & cathode .High Horizontal component indicates high noise, Voltage swing. High vertical component indicates pot stability means high CE & high life. This vertical component can be increased, and horizontal component can be reduced by inserting the copper plate in Collector bar or used by copper collector bar .Through this, collector bar resistivity will also reduce.

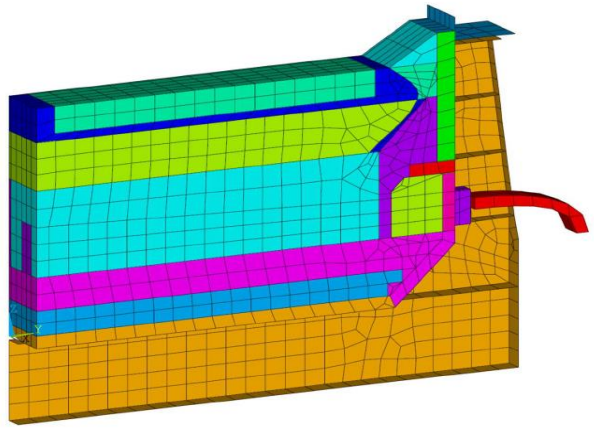
Copper is high thermal conductive material so that heat dissipation will be more in this collector bar and to compensate the heat extra insulation provided by modified relining design .

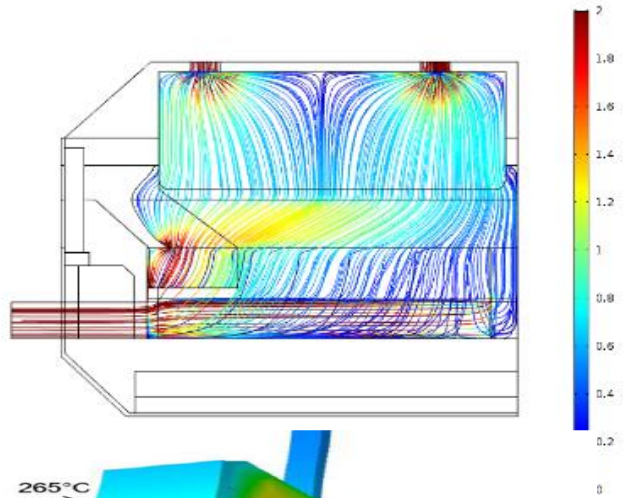
The advantages of using Copper collector bar are:

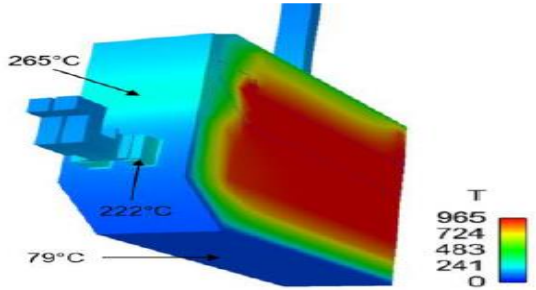
- Lower cathode voltage drops.
- More even cathode current density distribution.
- Increase life expectancy of the cells.
- Copper Insert collector bar helps , improving the cell magneto-hydrodynamic (MHD) state.



$\triangle h:$ *additinal cathode material* $\rightarrow$ *extended life*





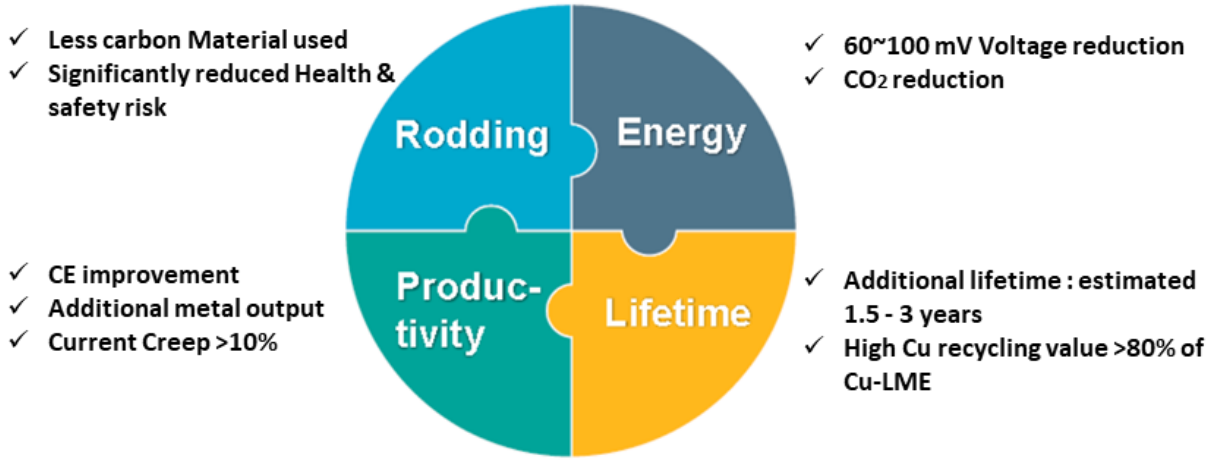


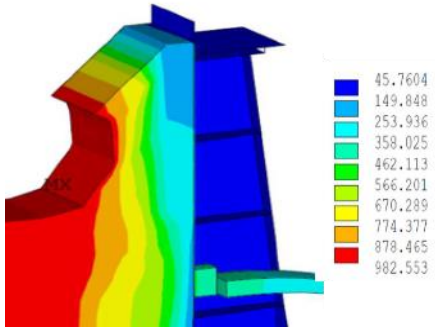
Data Analysis, Countermeasures & validation

Accuracy and repeatability of measurements is important as data is input for calculations.

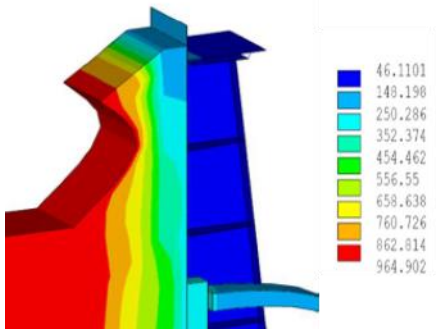
The higher thermal conductivity of Copper insert collector bar cathode compared to normal collector bar cathode blocks required added insulation within the cell lining to maintain the same thermal balance without increasing the energy required to operate the pot.

This operating window is defined by the thermal limits (bath freezing and melting of the ledge) and the stability of the pot. Further constraints about minimum metal output or maximum specific energy consumption can be included to understand the regions where the operation of the pot is possible,

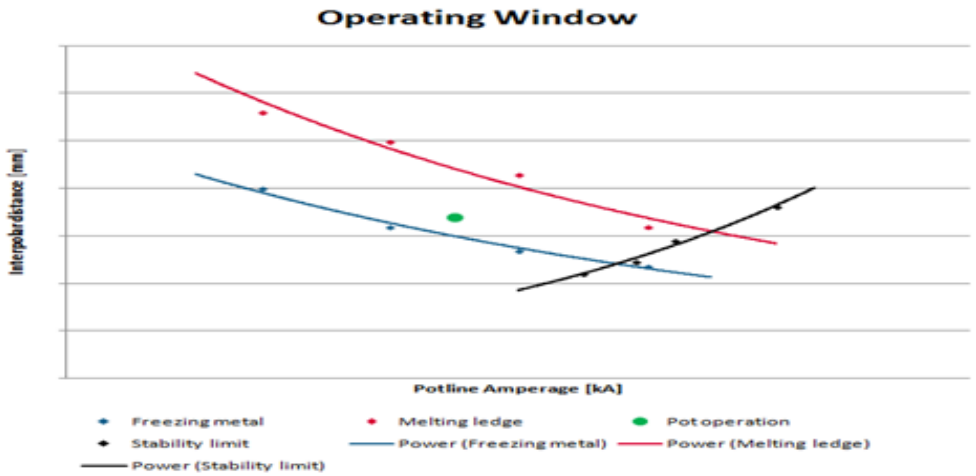




Side Protection ledge profile for graphitized cathode + copper collector bar with new relining design

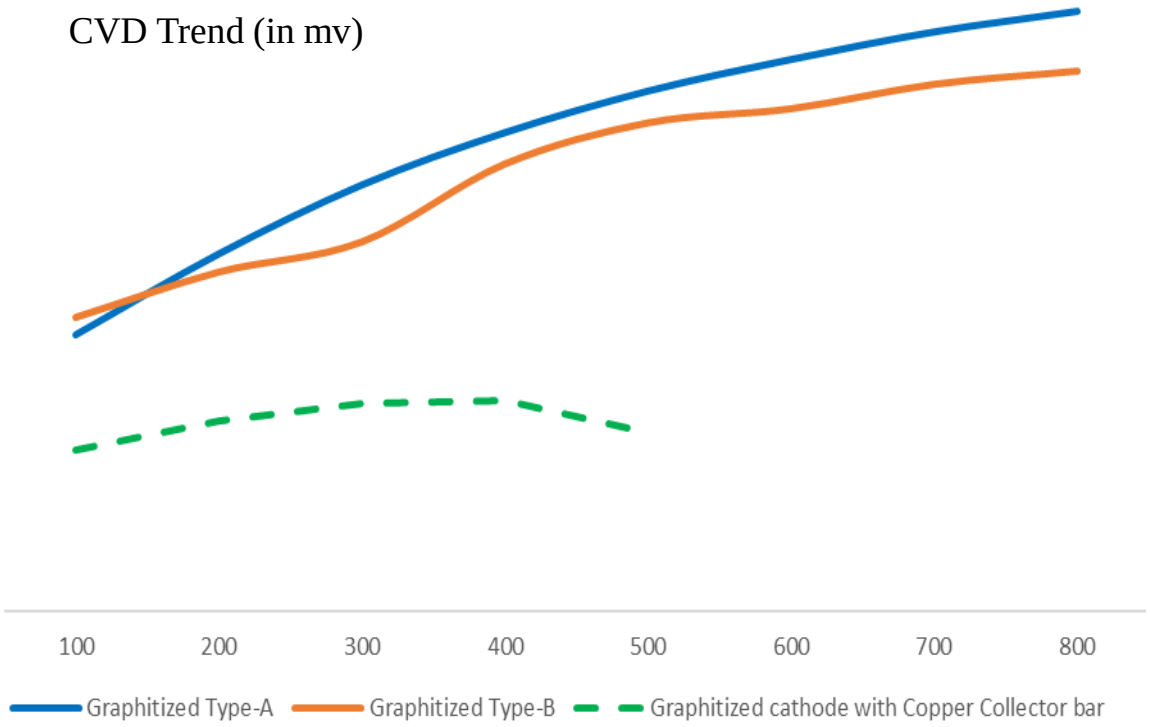


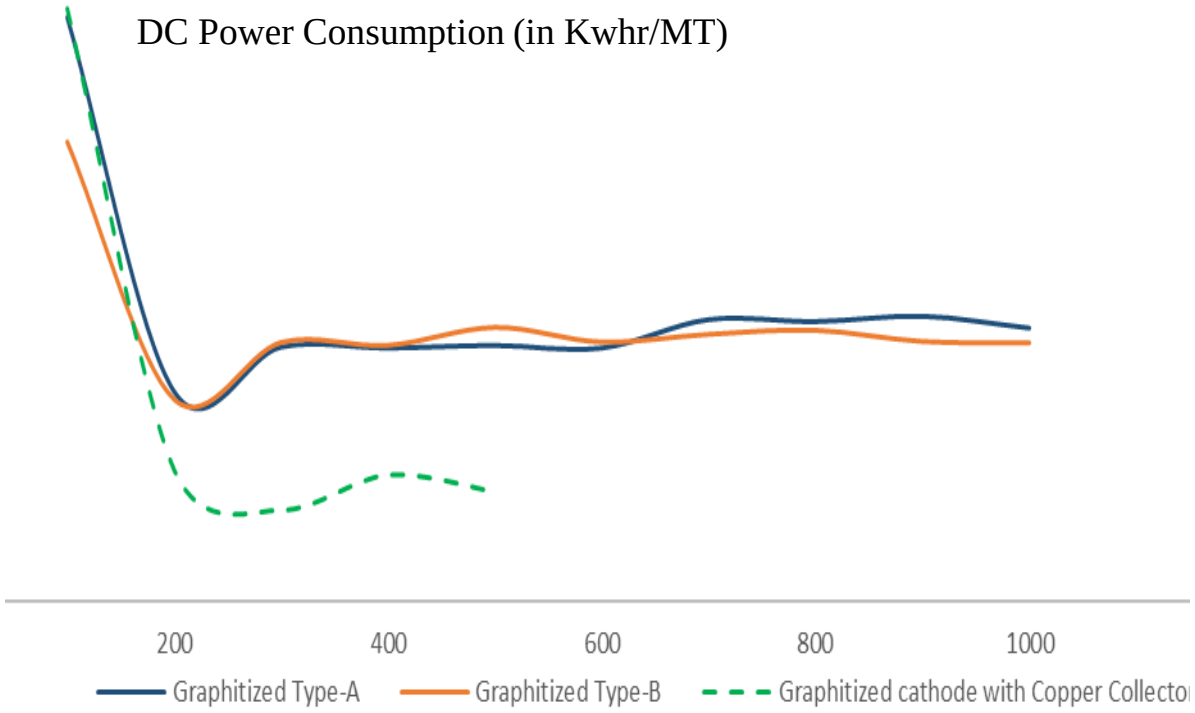
Side Protection ledge profile for graphitized cathode with normal collector bar



Qualitative example of the operating window of a smelter.

Results:- Cathode Voltage Drop and wear rate has been substantially lowered than reference graphitized cells and leading to reduction in Specific Energy Consumption and satisfying project target.





Comparison of measured CVD and DC power between Reference graphitized cathodes and copper insert collector bar with graphitized cathodes.

Benefits to Organization (Tangible) :

1) Potential Energy Saving : 300 kwh/mt

2) Potential Energy Cost Saving : 70 INR Cr./Year

Innovation I Reduction of Anode voltage Drop

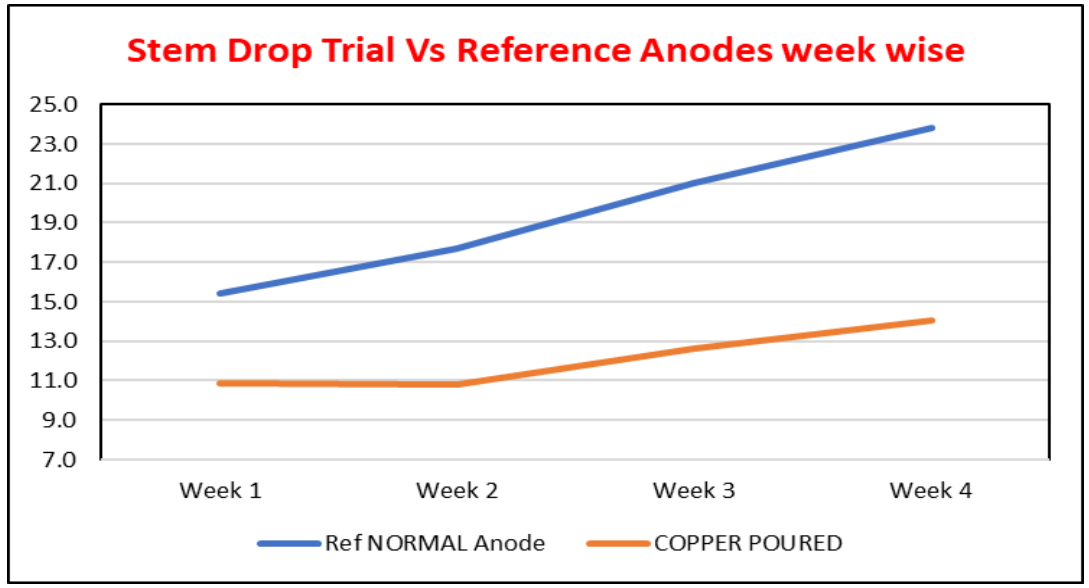
Objective	Aluminium manufacturing is done through Electrolytic process which involves huge power consumption of up 13500-14000KWhr/MT of AL. It is thereby necessary to explore all possibilities to control the consumption and reduce Carbon Footprint. Power consumption of potline is measured thus DC Energy consumption= Gross Voltage(in V)/CE%*Kh of Al prod./hr*KA
Approach	Reduction of Voltage by even 1mV/Cell will give a huge margin to reduce Power consumption by 3.3 Units. Voltage is required in aluminum production to drive the current through the reduction cell. In practical application its seen that voltage required to run the reduction cell is more than the theoretical value. This is mainly to overcome various losses and resistance of mediums involved in the electrolytic cell. One such huge scope is in Anode voltage Drop. Various drops in the total Anode Drops are Clamp drop, Stem to Clad, Clad to Stub, Stub to Carbon, carbon drop. This trial is based on the actions taken to reduce drops at anode stem & joint between carbon and stub.

Benchmarking and scope Identification

Anode drop bifurcation	Voltage Drop - BALCO	Benchmarking	Smelter	Scope of Improvement	Contribution
Anode clamp drop	18	14	VAL,J	-4	6%
Stem to Clad drop	28	8	Hirakund	-20	28%
Clad to Stub	20	10	Hirakund	-10	14%
Stub to Carbon drop	85	55	Alba	-30	42%
Carbon Drop	257	250	Hillside	-7	10%
Total Anode Drop	408			-71	

While benchmarking, Anode Stem-Clad, Anode Stub-carbon drop were found to have a huge scope for improvement

Trial -1: Inference and Trend (Cu-Insert anode stem)

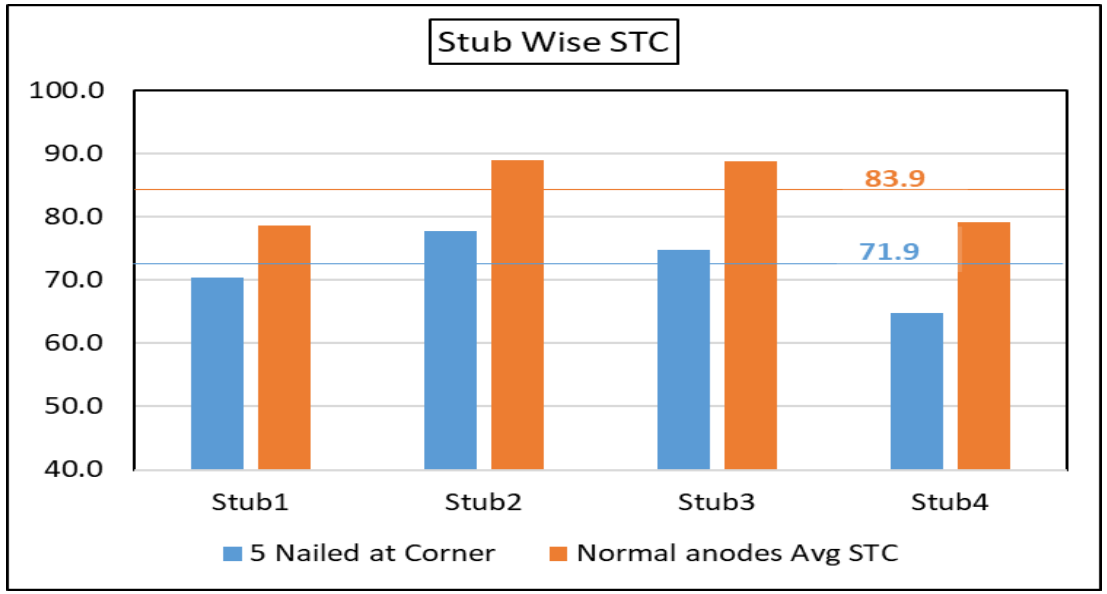


Results:

- **7-8mV reduction of Anode Drop will impact 21-22Unit in Power reduction of Potline (Cost Saving 5.4 INR Cr./year).**
- No major abnormality w.r.t. Anode stem structure or transition joints were seen.
- All trial Butts were found in good shape and compared to their reference.

		Week wise data						
	Anodes	**1-7**	**8-14**	**15-21**	**22-28**	**Average of 28 days**	**Ref-Actual**	
ACD	**Ref NORMAL ANODES**	1.3	1.5	1.5	1.4	1.4		
	COPPER POURED	1.3	1.4	1.5	1.3	1.4	-0.1	
Stem drop	**Ref NORMAL ANODES**	15.5	17.7	21.0	23.8	19.5		
	COPPER POURED	10.9	10.8	12.7	14.0	12.1	-7.4	mV

Trial -2: Inference and Trend (Drop reduction by air resistance reduction between stub and carbon)



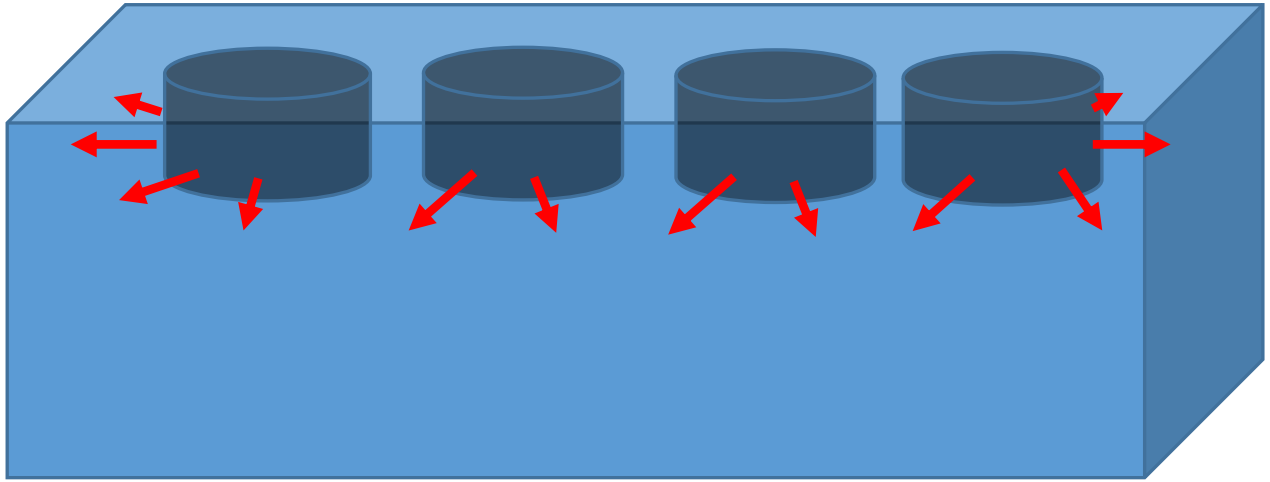
Results :

Nails reduces the voltage drop impact due to Air resistance between stub to Cast iron and Cast Iron to Anode block.

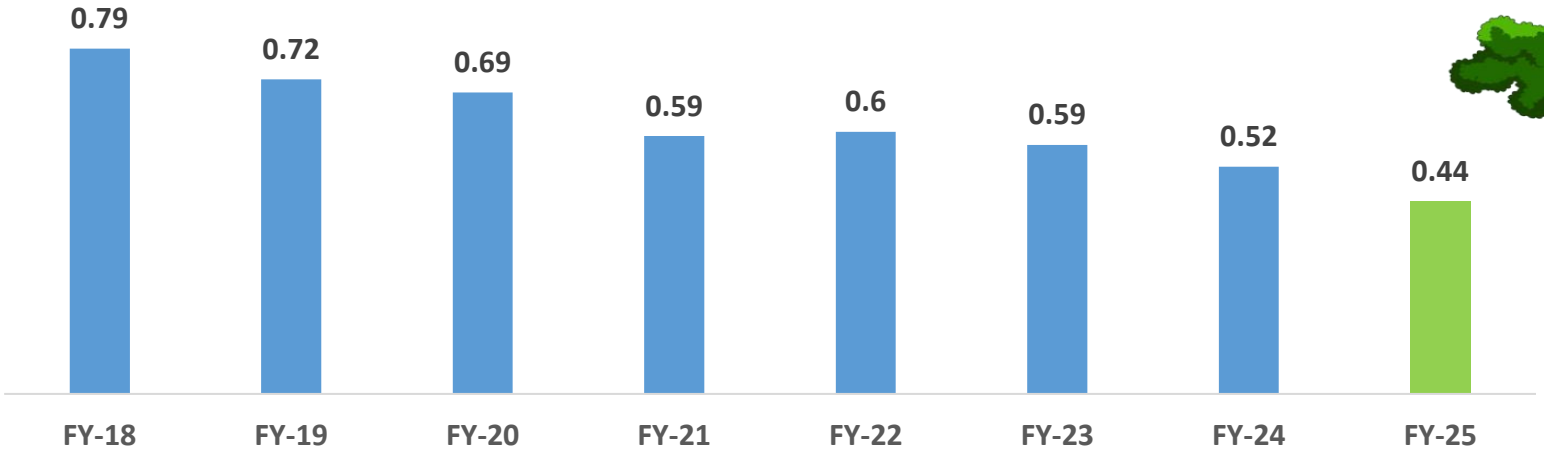
10-12mV reduction of Anode Drop will impact 30-33 Unit in Power reduction of Potline (Cost Saving 7.6 INR Cr/year)

No major abnormality w.r.t. Anode stem structure or transition joints were seen.

All trial Butts were found in good shape and compared to their reference.



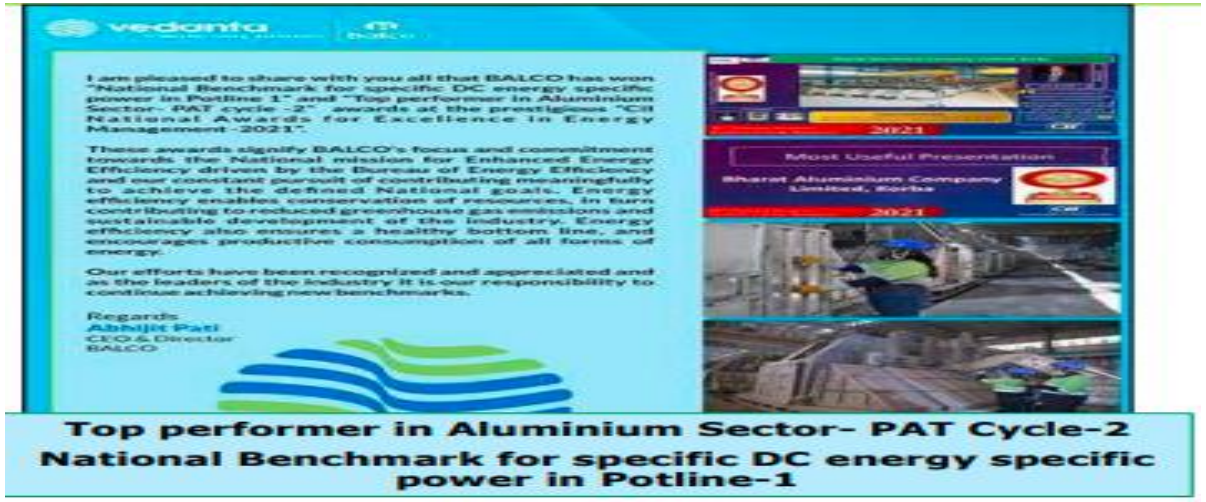
Specific Water Consumption (KL/MT)



Plantation Drive		
Year	Planted	Survived
2015-16	30000	25434
2016-17	30000	25000
2017-18	5000	4500
2018-19	5000	4500
2019-20	15000	12000
2020-21	10000	8000
2021-22	15000	14500
2022-23	123562	113677

Designated Consumer under PAT scheme for Aluminum Sector. PAT cycle -1 target over-achieved by 0.088 TOE (awarded 22203 ESCerts).

Balco has topped in PAT Cycle-2 in Aluminium Sector across India. Highest no of Energy certified - 4.24 Lakhs



Particulars	UOM	PAT Cycle -2
Notified baseline SEC (Period 14-15)	TOE/MT	5.3967
Notified target SEC	TOE/MT	5.0275
SEC Target for Reduction	TOE/MT	0.3692
Energy Certificates achieved	Nos.	424421

Year	Scope-1 Emission KG CO2/Ton	Scope-2 Emission KG CO2/Ton	Total Kg CO2/Ton
FY-15	21	2.3	23.3
FY-16	18.3	0.2	18.5
FY-17	18.87	0.03	18.9
FY-18	17.32	0.27	17.59
FY-19	17.38	0.05	17.43
FY-20	17.79		17.79
FY-21	17.29		17.29
FY-22	16.75	0.26	17.03
FY-23	15.44	0.81	16.26

Year	Scope-3 Emission KG CO2/Ton
FY-21	3
FY-22	3.15
FY-23	3.51

Table 4: Scope 3- Inventory Group (Category Wise)
Total Scope 3 Emissions (tCO2e)
Category 1- Purchased Goods and Services
Category 2- Capital Goods
Category 3- Fuel and Energy Related
Category 4- Upstream Transport
Category 5- Waste in operations
Category 6- Business Travel
Category 7- Employee Commute
Category 9- Downstream Transport

Plan for E-Vehicle

1. OPEX model-having plan to Change Battery Operated vehicle for shorter distance movement., Transportation cost reduction in longer term as right sizing led to 40% Annual CO2 release amount is 3470000 Kg Co2 approximately per year which can replaced by use of E-vehicle
2.E-vehicle Policy for all employees 50% discount on 2-Wheeler & 30% on 4-Wheeler to promote.

NET ZERO PLAN & GHG intensity Reduction

Area	Key Initiative	Business Partner	Saving (TCO2/T)		Timeline	Investment (Mn$)	Cost Benefit (Mn$/Yr)
			FY26	FY30			
Renewable Energy	• Hybrid Phase-I (380 MW) at BAL	Serentica	0.7	0.7	Sep'24	59	13
	• Hybrid Phase-II (155 MW) at BAL	Serentica	0.2	0.3	Jun'25	24	5
Technology	• Pot controller	Alpsys	0.06	0.11	Mar' 27	21	5
	• Graphitization/ Upgraded Relining	COBEX	0.05	0.19	Mar' 30	48	12
Alternate Fuel	• Bio mass Co-firing in Power plant (5 -10 %)	-	0.14	0.57	Sep'26	-	-
	Total		**1.65**	**5.37**		**455**	**102**

Sl No	Particulars	UoM	FY21	FY23	FY24	FY26	FY30	FY40	FY50
1	**Production**	**MnT**	**0.6**	**0.57**	**0.58**	**0.78**	**1.02**	**1.02**	**1.02**
	% Increase from FY21	%		*-6%*	*-3%*	*30%*	**71%**	*71%*	**71%**
2	**Absolute Emission**	**MnT**	**10.3**	**9.2**	**8.9**	**15.6**	**11**	**6.8**	**2**
3	**Intensity**	**TCO2/T**	**17.21**	**16.26**	**15.34**	**15.26**	**11**	**6.7**	**2.2**
	% Reduction from FY21	%		*6%*	*11%*	*11%*	*37%*	*61%*	*87%*
4	**Renewable Energy (RTC)**	**MW**	**0**	**62**	**65**	**500**	**700**	**1000**	**1800**
	Mix	%	0%	7%	7%	30%	45%	63%	95%
5	**Green Aluminium**	**KT**	**0**	**0**	**42**	**100**	**300**	**600**	**1000**

Our decarbonization roadmap

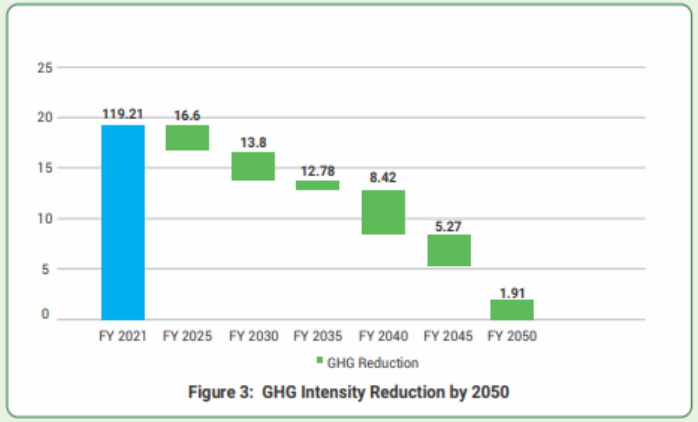


Figure 3: GHG Intensity Reduction by 2050

Table 3: Phase wise action plan for GHG intensity reduction

FY 2025	FY 2030	FY 2035	FY 2040	FY 2050
Increasing potline energy efficiency through pot graphitization, smart pot controllers, ready to use cathodes, voltage reduction and auxiliary power reduction. Power plant efficiency improvement through annual overhauling and capital overhauling, variable frequency drives (VFD) on auxiliary pumps and fans. Shift calciner operations from oil to natural gas at our alumina refinery. Enter into PDA and use of 200 MW and 180 MW renewable power for our aluminium smelters at BALCO and Jharsuguda plants respectively.	Biomass co-firing up to 5% in 135 MW power plants at BALCO and Jharsuguda respectively Total 1500 MW of renewable power purchase for our smelter at JSG & BALCO. Natural gas at our BALCO and Jharsuguda plants at Cast house & back oven plant. MoU & pilot trial of inert anodes and wetted cathode usage at our smelters	Commencement of inert anodes and wetted cathode usage at our smelters Commence Battery backup for storing the RE power at operations. Additional renewable power capacity for our smelter.	Continue shift to inert anodes and Wettable cathodes Explore hydrogen fuel for calciner at alumina refinery	100% of anodes to be inert anodes and cathodes to be weighted cathode 100 % power from RE power at smelters

Renewable Energy

- India's largest consumer of renewable energy at 3 Billion Units in FY22.
- Achieved highest ever RPO obligation in FY 23 : 100%
- In FY 23, we have **purchased 46% of RE power** (i.e 546 MU) when there was coal scarcity in PAN India level.
- India's first company to **bilaterally procure REC**, started in the month of March' 23.
- Balco a unique entity in the country which can simultaneously export and import of power. This has given freedom to Balco to **purchase RE power** as per the requirement without restricting its export of power, this has laid to tremendous scope of sourcing RE power which would result in reduction of carbon footprint, thereby laying a strong foundation for our journey towards Net zero carbon and production of green aluminium.
- 505 MW RE mix tie up for BALCO Smelter operation to be completed by FY-25.

Table 7: Our progress towards climate associated sustainability targets and goals

Net Zero emission by 2050	Summary of progress in 2022	Target 2022	Target 2025	Target 2030
100% Renewable Energy by 2050	3% of total energy procured across all our BUs was renewable energy 3 billion units of renewable energy consumed	2.5% of power requirement of the Sector to be met through renewable energy	7% of power requirement of the Sector to be met through renewable energy Enter into PDA for and use of 400 MW of RE power	30% of power requirement of the Sector to be renewable energy Enter into PDA and use of 1500 MW of RE power

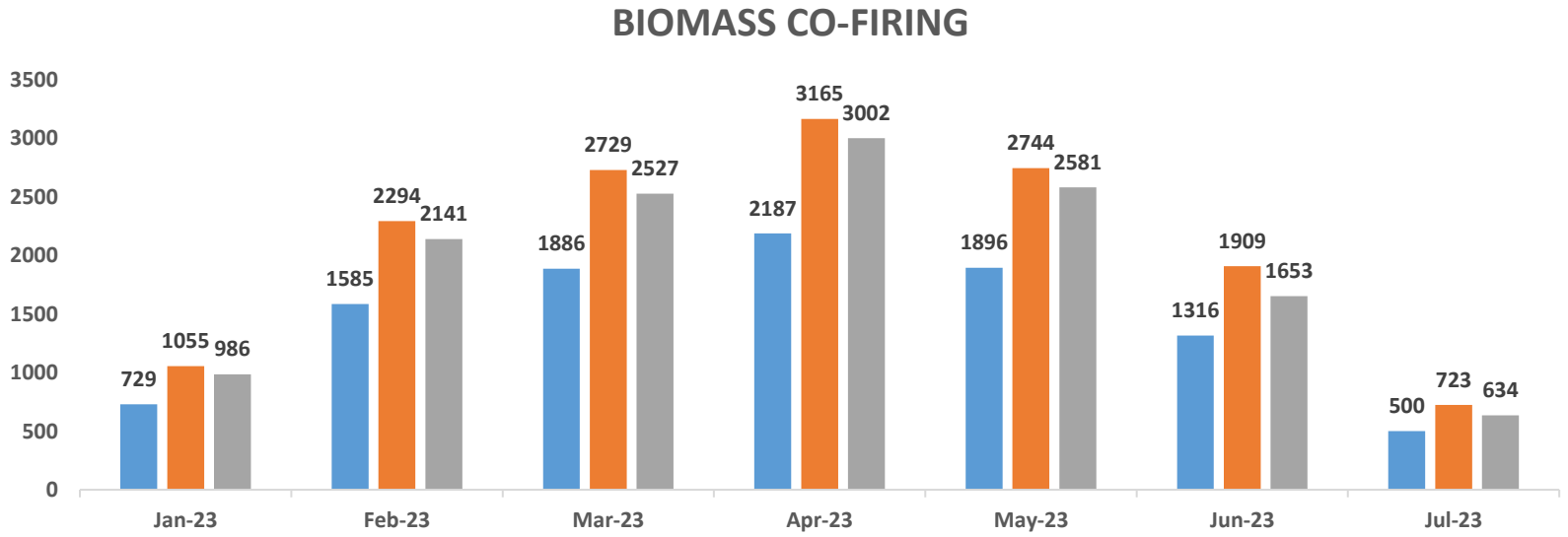
Business	RTC Capacity in MW	Mode	Target date
BALCO	200	Solar	Jun'24
		Wind	Sep'24
BALCO	105	Solar	Jun'25
		Wind	Jun'25
BALCO	200	Solar	Mar'25
Total	505		

RPO Details

Year	Captive Consumption (MU)	% of Obligation		Obligation in Units (MU)	Certificates Bought/RE purchase
		Solar	Non-Solar	Solar & Non-Solar	
Till FY-23	5814	1.00%	6.25%	5069	5113
Till FY-23 (Import)	477	10.5%	10.68%		

Renewable Energy

- Biomass Pilot Trial taken successfully at BALCO check technical feasibility as per MNRE guideline line.
- Biomass Co-firing **4755 MT biomass has been fired in FY-22**
- **Biomass Co-Firing Total 10645 MT biomass has been fired till July-23 (13.5 MU)**



5% Biomass Co-firing at BALCO

ESG Impact: (0.75 tCO_e/T) with 4,50,000 tons of coal replaced

1A Project Milestones

Jan-23
Resumed Biomasss co-firing which was initiated in May-22 in CPP#2 PP.

Apr-23
Achieved 1 % mark in CPP#2, initiated cofiring in CPP#3 units and overall, .3% mark in 1740 MW PP with existing contract.

June -23
Gap Analysis of current biomass cofiring and initiation for study for modification required to achieve higher mark. By 3rd party.

Sep-23
Vendor locking in next season purchase and correction initiation as per recommendation. Resume cofiring as per monsoon condition.

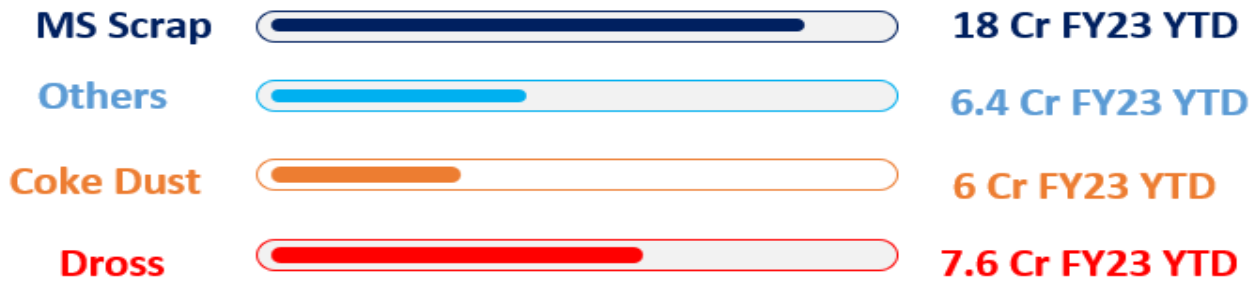
March-24
Achieve the 2-3 %(400-500tons/day) biomass consumption mark with suggested modification as per recommendation.

Sept-24
- Continuous biomass firing with availability by having long term contract establishing the dedicated biomass pallets manufacturing plant nearby plant premises.
- Handling, consumption & sustainable operation(3-4%) range with available biomass Quantity.

Current status
- Biomass Cofiring is under progress since 1st Jan-23 in CPP#2 units.

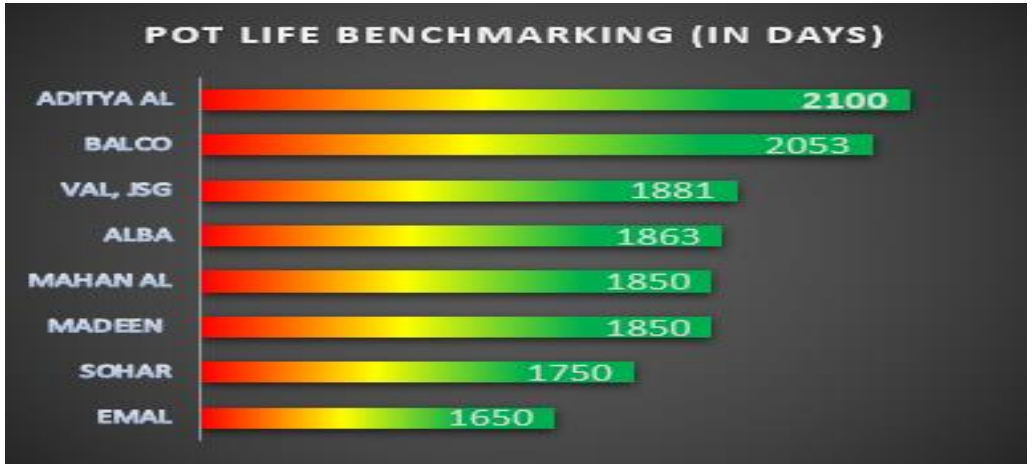
Next steps
- Tie up for the long-term contract for locking the vendors in market by team commercial for the required quantity
- Engagement of Vendors (Micro level startup)/established biomass briquettes/pallets manufacturing plant near to Balco to reduce landed cost and sustainable operation.
- CHP study for modification for feeding & storage considering adverse weather condition and implementation of same in PP

Waste to Wealth



- Droses Utilization- (FY-23 6303 MT) (FY-24 2778 MT)
- Used Oil sellout – 68.63 MT

- 3224 MT/year Co-processing at M/s Green-mech Technology SPL ,SPL Utilization- (FY-23 21721 MT) (FY-24 3640 MT)



Short Term

Medium Term

Long Term

SPL

Annual Generation

4520 MT

- Increase of Pot Life by improving operational efficiency
- Set up of SPL Detoxification plants(Under CPCB Approval)
- Explore for Blast furnace injection as fuel, As Flux for Steel making or as reducing agent for slag cleaning

Al Dross

Annual Generation

6963 MT

- Maximising Al recovery by increasing utilisation of DPM to 95%
- Achieved Melt loss 0.45 %
  Further reduction target- 0.35%
- Install and Operate DPS which can recover metal of approx. 30-35% from hot Dross Processing

Green Supply Chain & Ongoing Plans with Various Vendors

SN	Initiatives	Savings IN Rs
1	Smart logistics for vehicles	60 Lakh/Year
2	EV vehicle in operation	
3	Availability of LCM machine	8 Lakhs
4	Reduction in Ladle Dispatch cost	5 Lakhs

Sl. No.	Name of the Vendor	Description of the Collaboration / energy reduction initiative
1	SGL	For energy efficient cathodes
2	GAMI & AP	Pot controller upgradation
3	SKF	For energy efficient bearing & V-belts
4	EESL	Energy Efficient Motor replacement
5	Atlas Copco	Compressed Air Audit
6	Energy Audit	Mott Macdonald

Implementation of Best Practices

Idea Portal & !DEA@BALCO APP for generation of ideas for All Balco & Contract employees.

- Idea generated FY23 –4403
- Idea accepted FY23 –2201
- Idea implemented FY23– 1668
- Idea under implementation FY23 –566

Green-co certification with CII ,Learning From CII & Others

Confederation of Indian Industry

GreenCo Scoreband - Bharat Aluminium Company Ltd, Korba

PARAMETERS	POINTS AWARDED														
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120	121-130	131-140	141-150
Energy Efficiency													X		

Legends: Points scored by BALCO | X: Maximum points scored by another GreenCo company

Green-co Silver certification

Confederation of Indian Industry

CII - Sohrabji Godrej Green Business Centre

hereby certifies that

Bharat Aluminium Company Limited

Korba

has successfully achieved the standards as required for the following level of certification under the GreenCo - Green Company Rating System which is valid for a period of 3 years

GreenCo Silver

Issue Date: 24-12-2022 Expiry Date: 23-12-2025

Jamshyd N Godrej	Pradeep Bhargava	L S Ganapati	K S Venkatagiri
Chairman	Chairman	Chairman	Executive Director
CII-Godrej GBC	GreenCo Rating System	GreenCo Assessor Panel	CII-Godrej GBC

Learning From CII & Other Energy efficiency Program

- **Benchmarking Data.**
- **Energy management system.**
- **Global Energy efficient technology.**
- **Waste to wealth creation idea.**
- **Cooling tower modification – Efficiency improvement**
- **Closed loop Implementation in Pump Houses.**
- **Compressor House Air line Interconnection HP & LP line**
- **ESCO model for financing.**

Energy Policy & Certifications

#	Description	Certification
1	Quality management system	ISO 9001:2015
2	Environment Management System	ISO 14001:2015
3	Occupational Health & Safety Management System	ISO 45001:2018
4	Energy Management System	ISO 50001:2011
5	Asset Management System	ISO 55001:2014
6	Quality Management System for the automotive industry.	IATF 16949
7	Information Security Management System(ISMS)	ISO/IEC 27000:2013
8	NABL accredited Lab	ISO 17025:2005
9	Social Accountability	SA8000

POLICY NO.: BALCO/POLICY/01 **ISSUE NO. :07** **ISSUE DATE: 03.02.2022**

At BALCO, we are committed to the effective management of health, safety, and the environment as an integral part of our business. The health and safety of our employees and any other person who may be impacted by BALCO's operations are of paramount importance and our aim is zero harm to people and minimal impact to the environment.

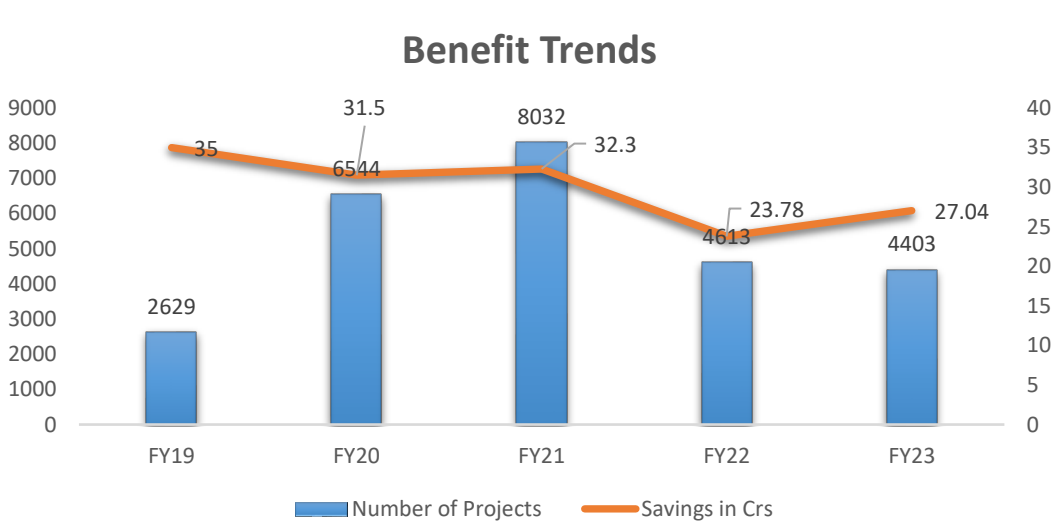
BALCO strives to:

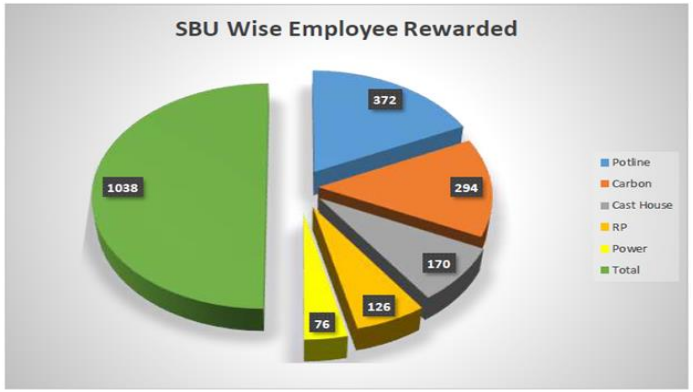
- comply with applicable national, regional, and local Health, Safety, and Environment (HSE) regulations and statutory obligations. In the absence (or lack) of appropriate legislation, industry best practices and standards will be used;
- prevent injury and ill-health to employees and business partners by providing a safe and healthy work environment and minimising the risks associated with occupational hazards;
- implement regular health surveillance and risk-based exposure monitoring of employees;
- avoid, reduce or mitigate impacts to the environment and neighbouring communities and where feasible improve and enhance environmental conditions;
- conserve natural resources by adopting environmentally-friendly and energy-efficient technologies and through process improvements;
- eliminate existence of hazardous substances from the workplace through effective administrative and engineering controls
- commit to taking responsibility when conducting our business by integrating environmental, social and governance (ESG) factors into our operational processes;
- manage waste from our operations and adopt the principles of waste avoidance, reuse, recycling and beneficial utilisation to minimise discharge and disposal to the environment;
- consistently assess our climate-related risk, manage our emissions, take appropriate mitigation and adaptation measures and communicate our climate strategy to our stakeholders;
- ensure that all tailings' storage facilities are designed, constructed, operated and closed in compliance with all applicable laws and regulations and alignment with accepted international practice;
- develop, implement, and maintain HSE&S management systems aligned with our commitments and beliefs and consistent with world-class standards;
- drive continuous HSE&S improvement through setting and reviewing targets using appropriate best available practices and providing all employees with appropriate training;
- promote a positive HSE&S culture through effective communication, participation and consultation with employees and business partners;
- influence our business partners and suppliers to adopt principles and practices in alignment with our policies;
- communicate with all our stakeholders on the progress and performance of HSE&S management.

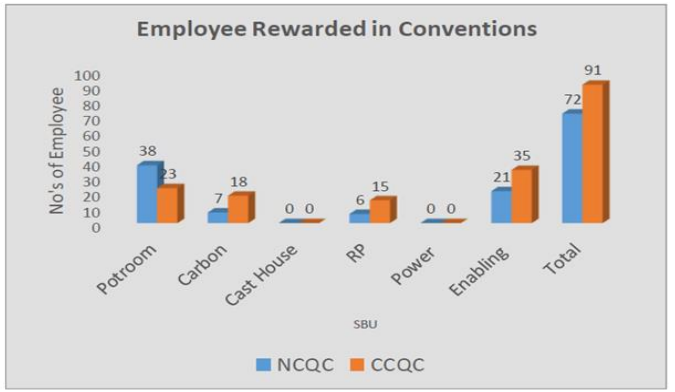
Business leaders will be held accountable for HSE&S performance and line managers are responsible for the full implementation of the related HSE&S standards. We will measure and report performance on a periodic basis to ensure ongoing management of health, safety, environment, sustainability and quality including the sharing of good practices throughout the organization. The content and implementation of this policy will be reviewed periodically.

Creating Awareness Among Stakeholders

Energy savings from Employee & Stakeholder Involvement







Total 1038 no of employees awarded in different categories.

Total 163 no of employees awarded in Chapter and National conventions organized by QCFI .

Details	Unit	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
QCs & Kaizen Projects Implemented	No.	918	1277	2019	2629	6544	8032	4613	4403
Energy Savings	Kwh	4375000	26892304	59584971	25367013	31381627	8,48,70,225	8,42,25,659	13207980
Benefits due to energy savings	Rs. lacs	131	806	1788	887	1098	2907	2378	726

Status of EnMS (ISO 50001) Audit Observation

Year	No. of NC	No. of Observation	Open NC	Open Observation
16-17	3	17	0	0
17-18	0	6	0	0
18-19	0	5	0	0
19-20	0	3	0	0
20-21	0	2	0	0
21-22	0	2	0	0
22-23	0	2	0	0

%Investment for Major Energy conservation projects on Turnover

FY	Project Description	Investment (Rs. Crs)	Turnover (Rs. Crs)	% Investment on Turnover	ROI(Months)
FY-19	Pot controller up gradation PL-1	183	9063	2.0	20
FY-20	100% Graphitized Cathodes	138	10500	1.3	18
FY-21	100% Graphitized Cathodes	101	9688	1.04	18
FY-22	100% Graphitized Cathodes	147	13607	1.08	15
FY-23	100% Graphitized Cathodes	57.9	12680	0.45	18
FY-24	Cathode development, Anode Modification & Aux power	12.6	10000	0.12	20

Review Mechanism

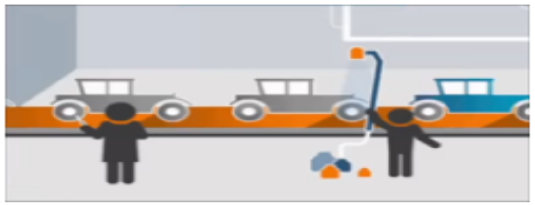
- Corporate Sustainability Review
- Monthly Management Review by CEO
- Monthly Operational Review by Plant Head
- Weekly Energy Cell review by Energy Manager
- SBU Level review – Daily War Room

Measuring & recoding Energy consp	Correlating energy Consp with production	Comparing with Benchmark	Setting targets to control energy consp	Comparing energy consp w.r.t target on regular basis	Reporting Variance against Target	Implementing measures to correct variance
Recording	Analysing	Comparing	Target setting	Monitoring	Reporting	Controlling

BALCO 1.0

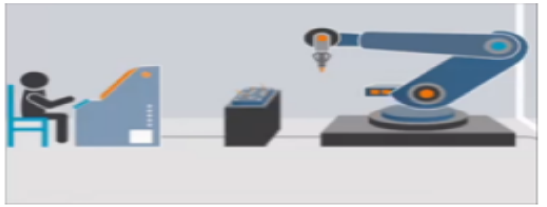
- Smelter **of 1 LTPA** with **Soder berg** technology in 1973
- BALCO was taken over in 2001 by **Vedanta**

BALCO 2.0



- **270 MW** Captive power plant
- **320 KA Smelter** with **GAMI - China**
- Expanding further by the installation of **3.25 LTPA** aluminium and

BALCO 3.0



- **540 MW** Captive power plant
- Expansion of the smelter by installing **5.10 LTPA** by employing 500 KA
- **1200 MW** thermal power plant.

BALCO 4.0

1 MnT Aluminium Club

- ✓ ESG Leader
- ✓ Digital Driven
- ✓ AI Based Operation

Awards

Year	Award	Category
FY-22	National Energy Leaders Awards and at the CII 23rd National Award for Excellence in Energy Management	Metal
FY-22	CEE Environmental Excellence Award 2022 for Fly Ash Utilization/Disposal	BALCO
FY-22	Best Green Business Award and Best Green Excellence award at Global Green Future Summit & Leadership Awards	BALCO
FY-23	BALCO Top Performer DC for PAT Cycle-II under (NMEEEE).	BALCO
FY-22	Excellence in Fly ash Utilization Award by Mission Energy Foundation	BALCO
FY-22	BALCO - The SUSTAINABLE FACTORY of The YEAR 2022	BALCO

National Energy Leaders Awards and at the CII 23rd National Award for Excellence in Energy Management

BALCO Top Performer DC for PAT Cycle-II under (NMEEEE).

Best Green Business Award

CEE Environmental Excellence Award 2022 for Fly Ash Utilization/Disposal

Manufacturing Today - Reinventing the Future 2022 Award

Thank You!

Bharat Aluminium Company Limited
Korba, Chhattisgarh

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