Team Hindalco

Welcomes You All

Hindalco Industries Limited, Renukoot
Team Introduction

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Aspect of Energy Saving

- Climate Change Concerns.
- Statutory requirement like PAT, RPO etc.

Methodology

- By Enhancing Energy Efficiency.
- By Energy Conservation
To Reduce Pot Voltage at Renukut Smelter to Enhance Energy Efficiency
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Hindalco Renukoot – Profile & Process introduction

Background of the Project

Concept of the Project

Root cause Analysis and Approach adopted

Project Savings & Economics

Challenges faced in implementation

Measurement and Verification
Hindalco, the flagship company of the Aditya Birla Group and industry leader in aluminium and copper has consolidated turnover of US$17 billion & having footprint in 13 countries outside India. It is fully integrated plant.
Hindalco Renukoot: Fully Integrated Operations

- Bauxite
- Alumina
- Captive Power
- Aluminium
- Electrolysis Process
- Finish Product

Through
Typical Cost of Aluminium Production

- Alumina: 35%
- Smelter Power: 40%
- Net carbon: 15%
- AlF3: 1%
- Depreciation: 1%
- Store, potlining, misc.: 4%
- Wages: 5%
Renukut Smelter

• Renukut smelter has 11 pot lines and 2138 Electrolytic cells (pots). Annual Aluminum Production is 409 KT.
According to Faraday’s Law:
Production = 8.052* Amperage*Current Efficiency
Project background

• Power Consumption

\[ \text{kWh} / \text{kg} = \frac{V}{CE} \times 298 \]

This project was taken to reduce pot voltage by 80 mv.
Problem Diagnosis
Approach

Project Methodology:
Statistical analysis of process parameter

- Stability Test (Run Chart)
- Process Capability
- Gage R & R Study
- Micro mapping & Process Mapping
- Regression Analysis

Cause and effect analysis
Macro Map

Pot Lining
- New pot shell
- Refractory lining

Pot baking
- Pot taken in circuit

Pot Loading
- Pot taken in operation

Alumina Feeding
- Installation of point feeders and Micro Processor control

Sampling
- Bath ratio, temperature
- Bath Level measurement

Correction
- Bath ratio balance by adding AlF3 or Soda ash
- Bath maintenance

Anode changing
- Spent anode removal
- Dust skimming
- New anode set
- Anode covering

Crust breaking
- Crust breaking
- Bath melting

Bath maintenance
- Solid bath addition

DC Power from Rectifier
- Anodes from carbon plant

Primary alumina from Alumina plant
- Secondary alumina through DSS

Metal Tapping
- Metal tap out in cruze
Team did round of brainstorming sessions to identify all potential causes using fishbone diagram. Total 18 X’s identified which further reduced to 10 using C&I matrix.
Critical parameters

- ACD
- Cathode Voltage drop
- Pot age
- Noise
- Alumina concentration
- Metal level
- Anode effect
- Bath Chemistry
- Clamp drop
- Diamond drop
Correlation & regression analysis carried out to find out most critical parameters
Regression Analysis

• Series of DOE were carried out to find out the way to reach at optimum pot voltage without affecting other critical parameters.
• A Solution Selection Matrix prepared to prioritize the solution and different DOE (Design of Experiments) conducted. Finally an action plan made to reduce pot voltage.

Pot age, ACD, Noise, CVD, Bath Chemistry
Problem Remedy
Problem Remedy

Voltage Reduction Plan

Noise
1. Noise limit for voltage reduction – Avg. noise value 0.002V/pot
2. Voltage will be reduced @ 0.01V/pot only

Age
1. Minimum voltage of 4.27 V with life 90 to <3000 days.
2. High life (>3000 days) voltage 4.36 V (min)
3. New pot maintained upto 4.320 V/pot by 90 days of life.
CVD
1. Voltage of pots with high CVD is 4.35 (min)

Bath Chemistry
1. Bath Ratio target increased from 1.130 to 1.160 due to higher CaF2 content in bath
2. Maximum 0.06 V reduction in one week

ACD
1. No voltage reduction if pot is under high noise, low bath level, metal left in the pot, and less current anodes
Control Plan
Control plan for Improvement

Monitoring parameters

- Metal Left
- High bath temperature Pots.
- High Bath Ratio Pots.
- Low Bath Level Pots.
- Anode Effect frequency.
- High search time (higher Alumina content in bath) pots.
- Avg. Noise of the lines and No. of noisy pots.
- No. of pot failure

Monitoring of all these parameters and strategy change in between whenever deviations found.
Replication

• Formation of Standard Operating Practices.

• Extended trial in all pot lines before implementation

• Implemented in all pot lines

• An exhaustive monitoring system developed

• Any deviations were planned to be rectified within 8 hrs
Results
Strict follow up of action plan led to reduction in pot voltage
Tangible Results

• Improvement in CTQ

Pot voltage

Volts/pot

July'15  Aug'15  Sep'15  Oct'15  Nov'15  Dec'15  Jan'2016  Feb'16  Mar'16

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Tangible Results

• Improvement in Power consumption

Power, kWh/T

July'15    Aug'15    Sep'15    Oct'15    Nov'15    Dec'15    Jan'16    Feb'16    Mar'16

- Improvement in Power consumption

Power consumption has shown a steady decline from July 2015 to March 2016.
Tangible Results

Power consumption reduced by

284 kWh/ T
Intangible Results

• Enhance in process consistency also improved metal purity
• Lowest Iron content and Silicon content in aluminium.
• Increased Internal customer satisfaction
Thank You