Decarbonisation Initiatives at Aditya Aluminium (Hindalco)

Vision

To deliver superior value to our internal & external customers and other stake holders

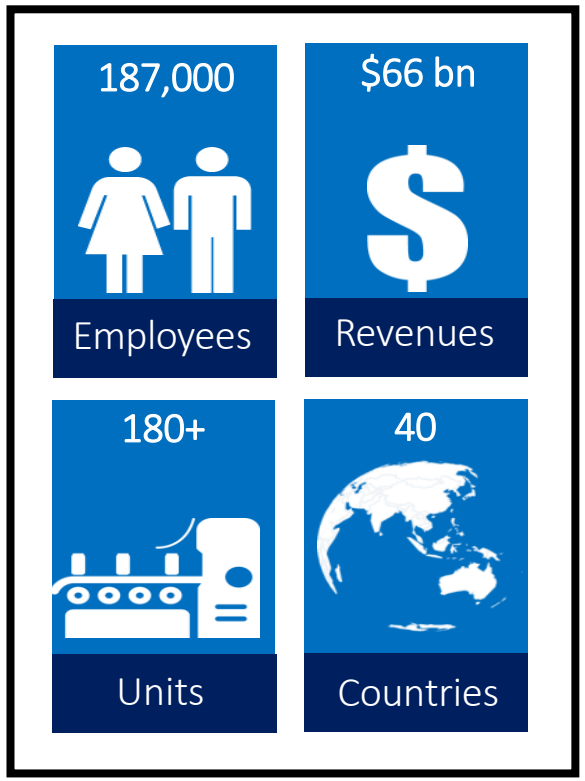
Mission

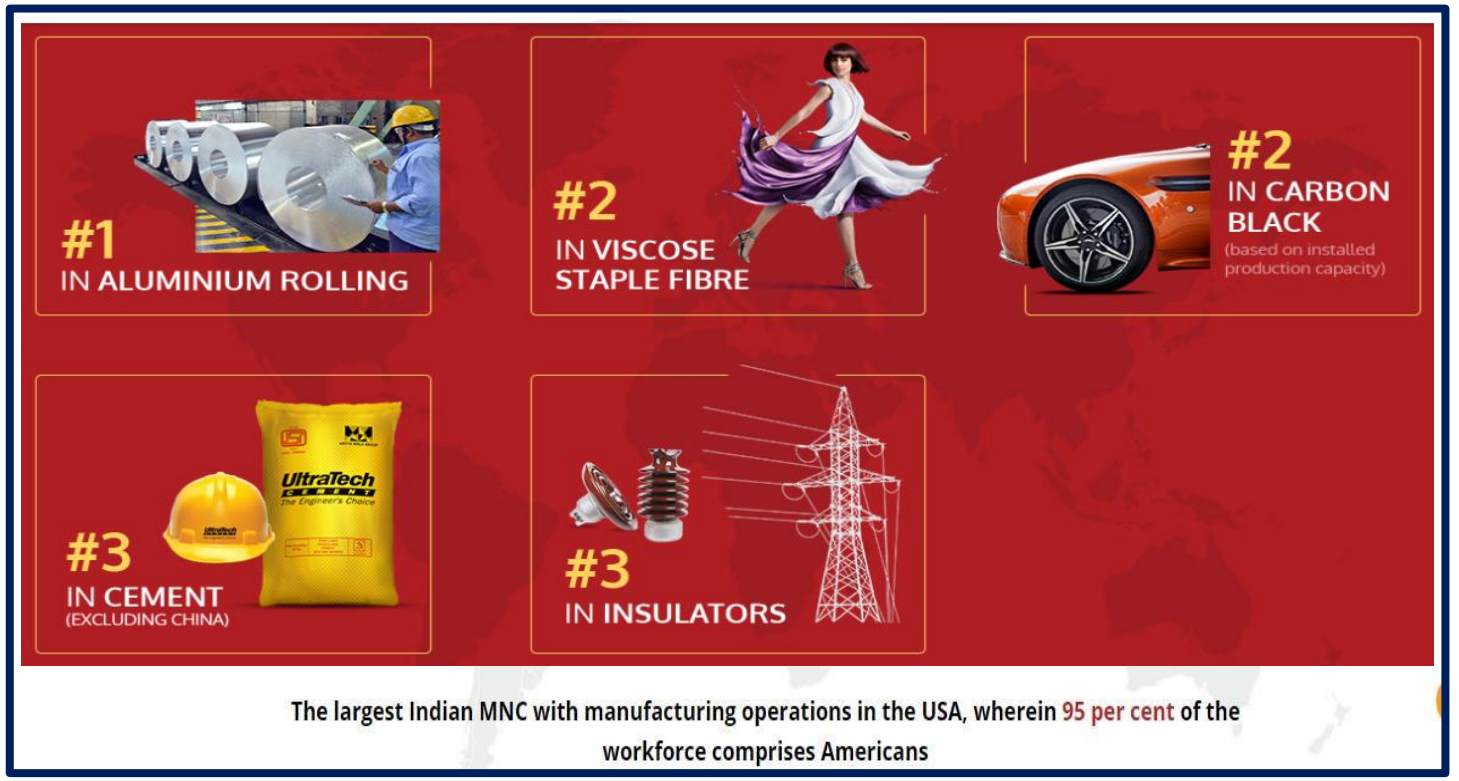
To be a premium primary aluminium producer with clear focus on Profit, People & Planet

Purpose

We manufacture the materials that make the world greener, stronger & smarter

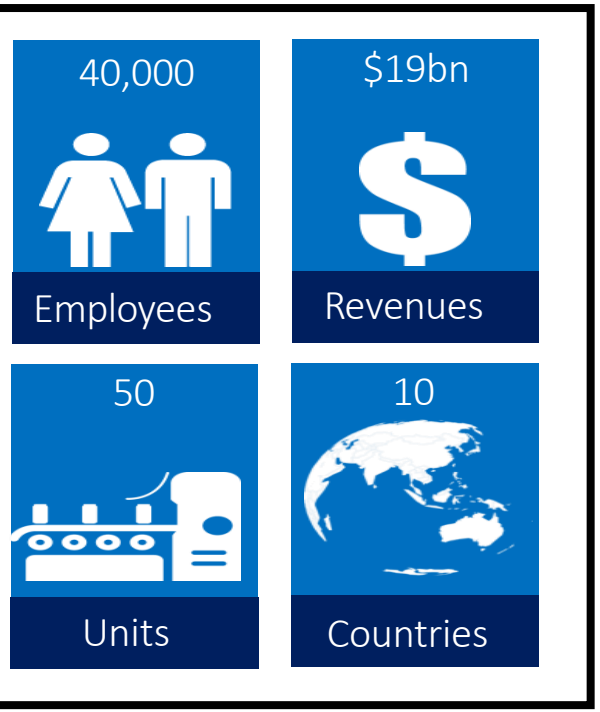
Aditya Birla Group





- Global Conglomerate
- Diversified Business
- Metals (Aluminium & Copper), Cement, Telecom, Viscose Fibre, Fashion apparels, Insulator, Carbon black, Fertilisers & Chemicals, Paints, Jewellery, Renewable Power, Real Estate

Hindalco



India:

Alumina : 2.9 Mn MT

Aluminium : 1.3 Mn

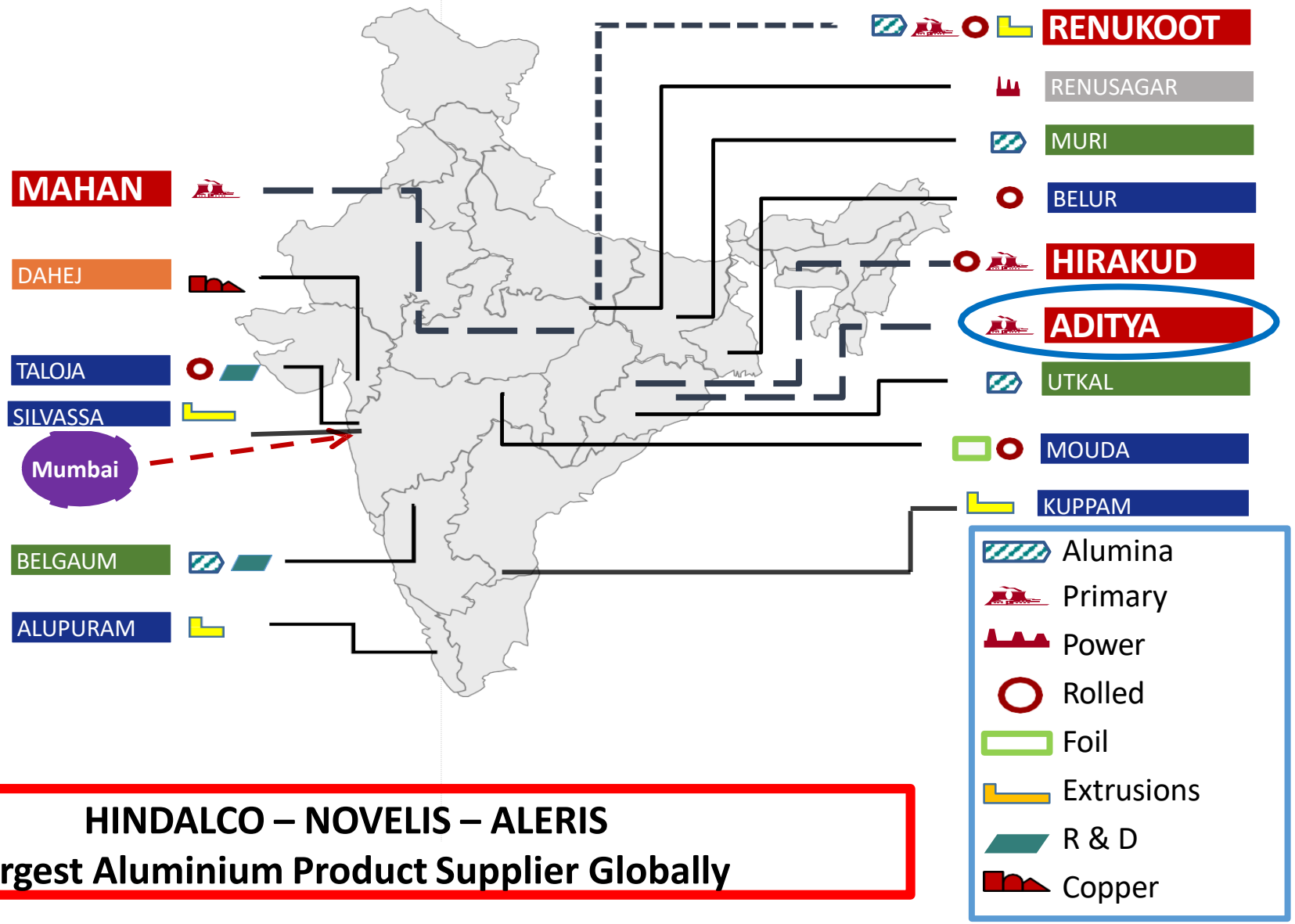
MT Rolled: 360 KT

Extrusions: 65 kt

Global:

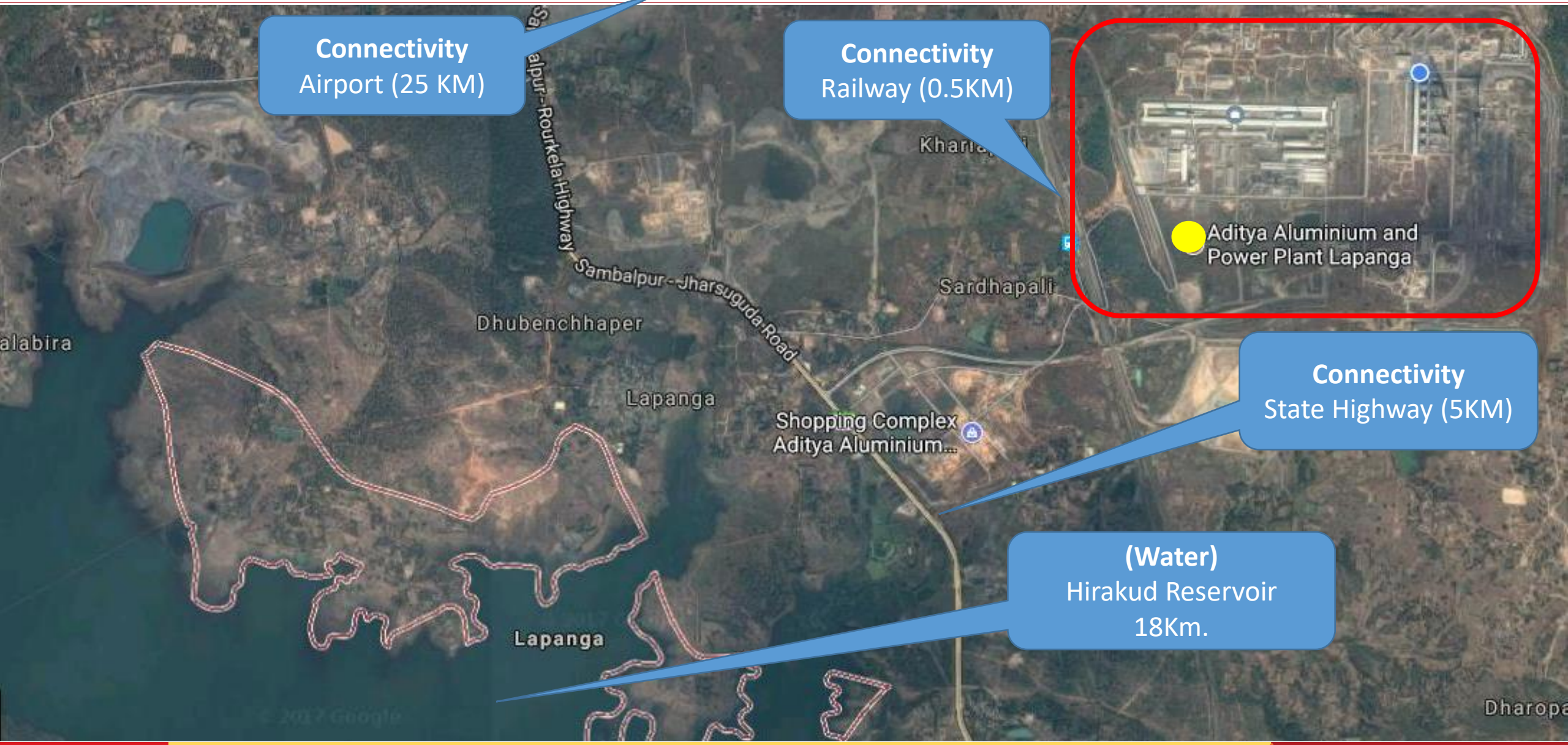
Novelis : 3.1 Mn MT

Aleris : 1.3 Mn MT



HINDALCO – NOVELIS – ALERIS
Largest Aluminium Product Supplier Globally

Aditya Aluminium - Location



Aditya Aluminium

- Smelter: 3,60,000 T/Year
- Technology: Rio Tinto Alcan (AP36S)
- 1st Metal Production: Jan-2014
- 360th Pot Start-up: Mar-2016

- CPP for Sustainable Power : 6 X 150 MW
- Technology: BHEL
- 1st CPP Unit: Dec-2013
- 6th CPP Unit: Dec-2016

ESG Target

Carbon Neutral - 2050

Decarbonization Pathways

Electricity Decarbonization

– RE Power

Solar

Wind

Hydro

Direct Emissions

Process Efficiency, Innovation Supply Chain

CCUs

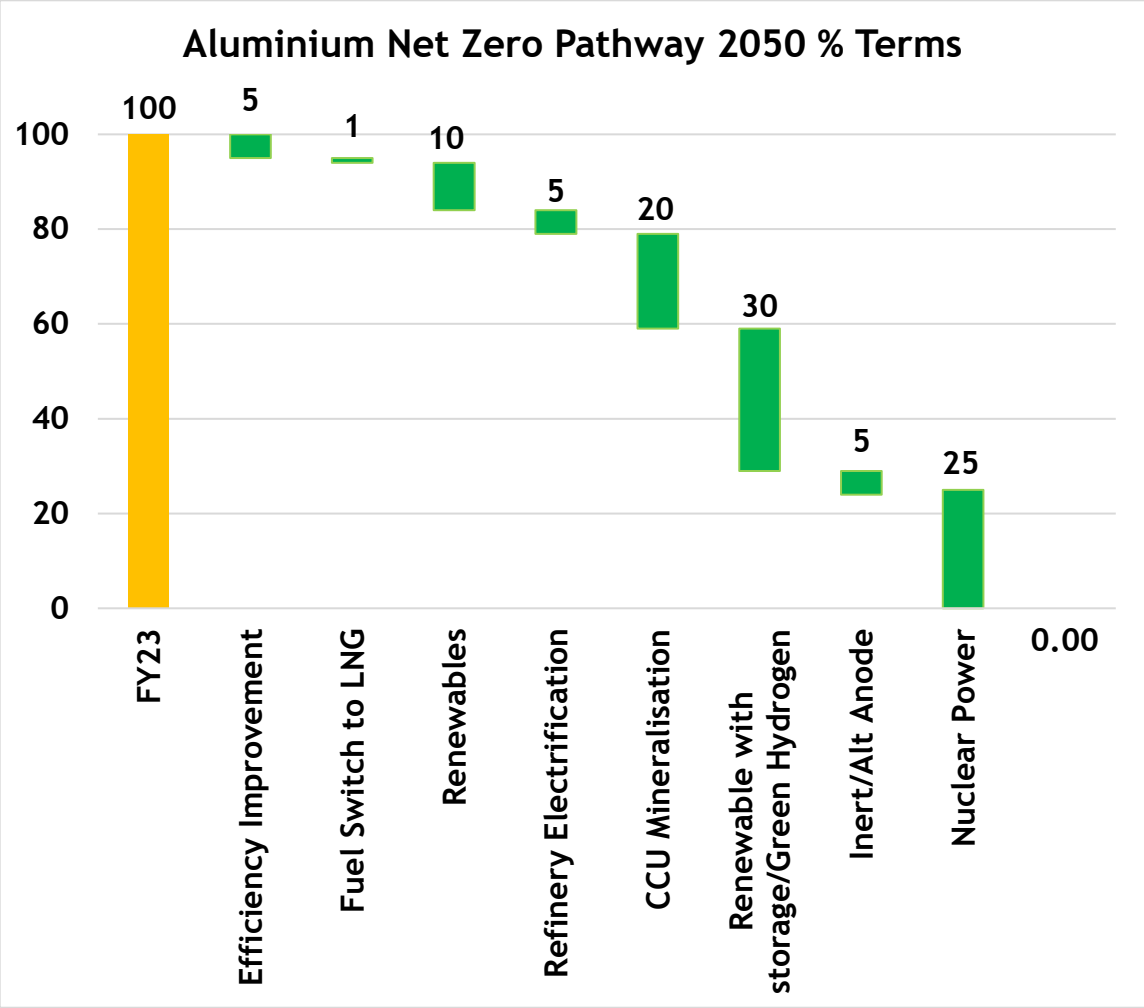
Recycling

Reduce

Reuse

Recycle

Decarbonization Pathways



Efficiency Improvement	At Smelter & Refinery
Fuel Switch to LNG	Based on availibility & feasibility
Renewables	With affordable storage cost
Refinery Electrification	Success of Biomass/Electric Boiler
CCU Mineralisation	Subject to low-cost capture cost & utilization option
Renewable with storage/Green Hydrogen	With affordable Cost
Inert/Alt Anode	As & when becomes commerciall avalable
Nuclear Power	As & when becomes available

Electricity Decarbonization

PUMPED HYDRO PROJECT

One of the world's first pumped hydro projects in the aluminium sector.
Round-the-clock (RTC) carbon-free power to make our smelters greener.

Commercial agreements with Greenko and major renewable energy (RE) developer

Project will supply RTC carbon-free electricity over 25 years

Expected CO_2 reduction of 680,000 MT annually

100 MW pumped hydro energy storage plus associated RE

Slated to come online in 2024 at the Aditya smelter

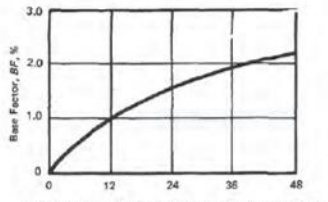
Plans to enhance capacity to 350 MW in the future

Direct Emission Reduction

Turbine Heat Rate Decay

THR DECAY DESIGN ACCORDING TO PTC CODE

GUIDANCE FOR EVALUATION OF MEASUREMENT UNCERTAINTY IN PERFORMANCE TESTS OF STEAM TURBINES



GENERAL NOTES:
(a) Estimated percent deterioration in heat rate after N months of operation =

$$\frac{BF}{\log MW}\sqrt{\frac{\text{initial pressure, psig}}{2400}} \quad (f)$$

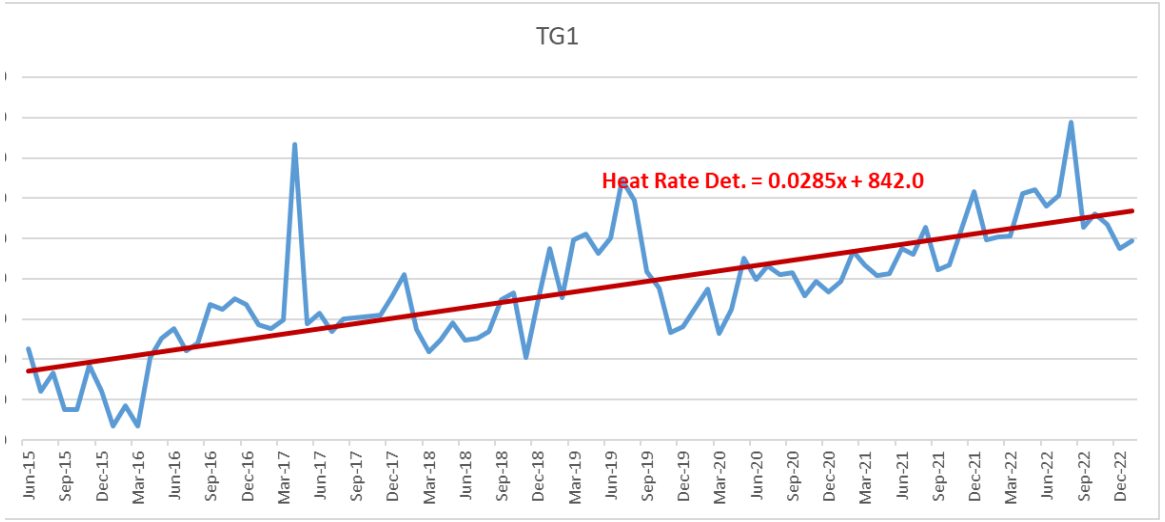
where
MW = megawatt rating of turbine
f = 1.0 for fossil units
= 0.7 for nuclear units

$$Decay\ factor\ \% = \frac{BF}{\log MW}\sqrt{\frac{initial\ Pressure\ ,psig}{2400}}$$

Considering Aditya f =1; BF = 1.0 for 1 year i.e. 12 months. Initial pressure = 133 kg/cm2 = 1891psig

$$Decay\ factor\ \% = \frac{1}{\log 150}\sqrt{\frac{1891}{2400}} = 0.4468\ \%\ per\ year$$

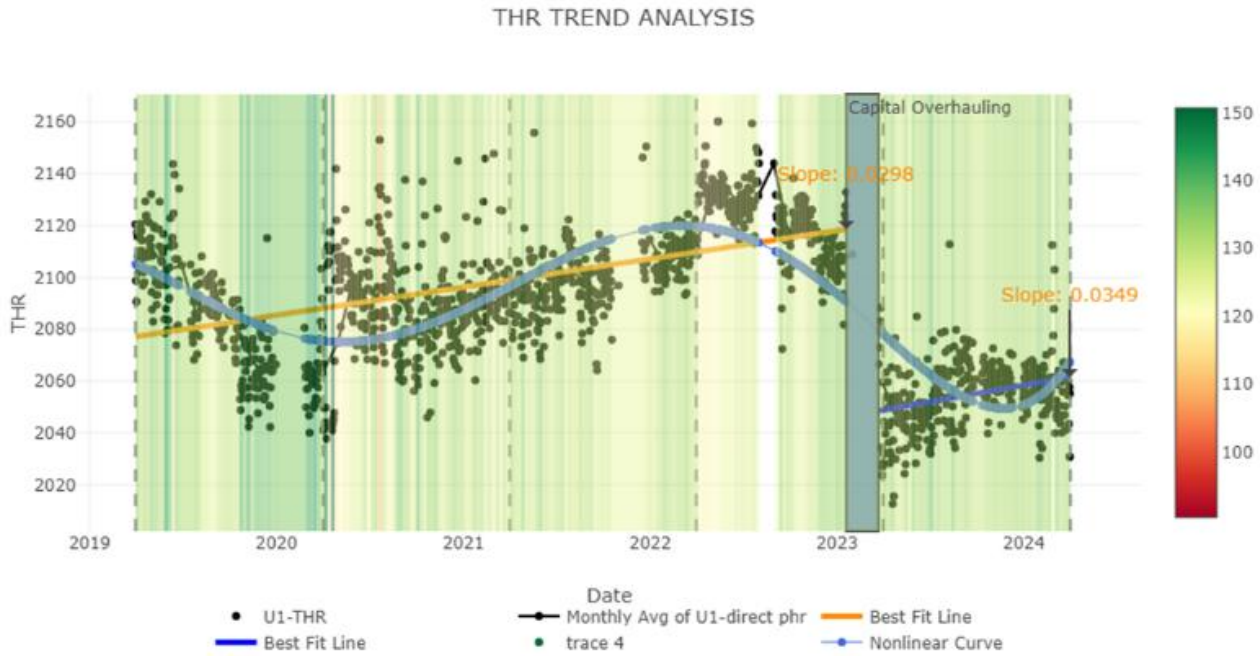
$$THR\ Decay = \frac{0.4468x\ 2047\ (Avg\ THR)}{100} = 9.15\ kCal/kWhr$$

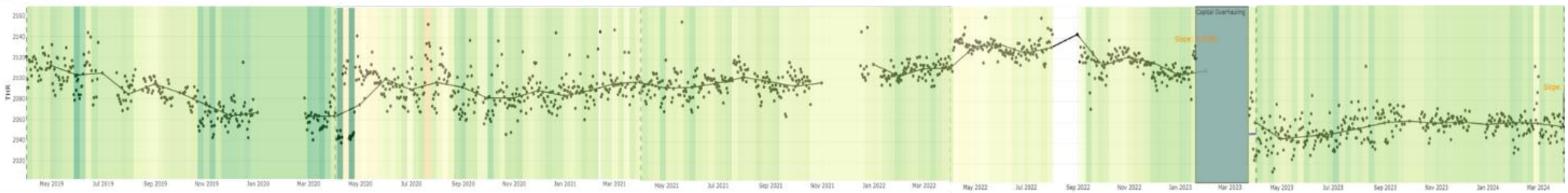


- Comparison of THR decay with the decay prediction given by ASME PTC – 6 and DIN 1943.

Problem Statement: After commissioning of the plant and monitoring of the Turbine Efficiency and Plant Heat Rate (PHR) it was observed that there is the gradual deterioration of Turbine Efficiency (Turbine Heat Rate). This resulted in Higher Coal Consumption rate thereby increasing the Unit Power Cost. Which in turn increase the Cost of Metal (power being the major cost component).

Utilization of Data Analytics Tools:





Steam Flow Path Audit

It is a computational method using software eSTPE Encotech USA to evaluate component wise losses by various measurements undertaken inside the steam Turbine. The data is fed into the software to predict and indicate the losses and corrective measures to recover a part of these losses by various maintenance activities.

Recommendations

- Replace Tip spill strips in Turbine casing in next coming opportunity.
- Fin on rotor shaft to be replaced in next overhaul.
- End packings are to be replaced during overhauling.
- Slight deposition was observed on the rotating and stationary blades which shows surface reference is approx. 0.5 mils, which is removed during the Alumina blasting to reduce the surface roughness.

Results/Saving

S. No.	Unit	Year Of Capital AOH	Savings in THR	Savings in tC02e	%tCO2e Reduction
1	Unit-3	2020	67	24904	0.40%
2	Unit-4	2021	69	25647	0.41%
3	Unit-2	2022	35	13010	0.21%
4	Unit-1	2023	74	27506	0.44%
5	Unit-5	2024	23	8549	0.14%

Direct Emission Reduction

ABF-1 HFO to Natural Gas Conversion

Conversion of existing HFO based Firing system to Natural gas-based firing system in Anode Baking Furnace

(First Aluminium Smelter in India)

- **Reduction in greenhouse gas emissions from baking anodes by about 30%**
- **Elimination of SOx emission from HFO burning.**
- **Environment friendly & Cleaner Fuel.**

Direct Emission Reduction

ABF-1 HFO to Natural Gas Conversion

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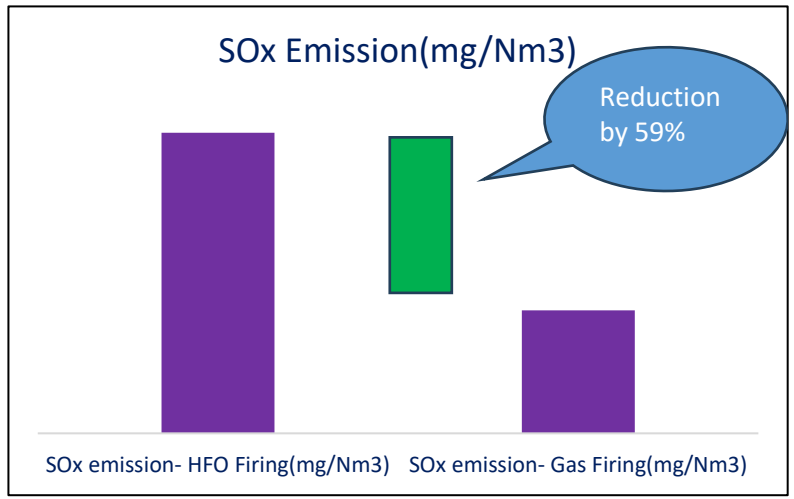
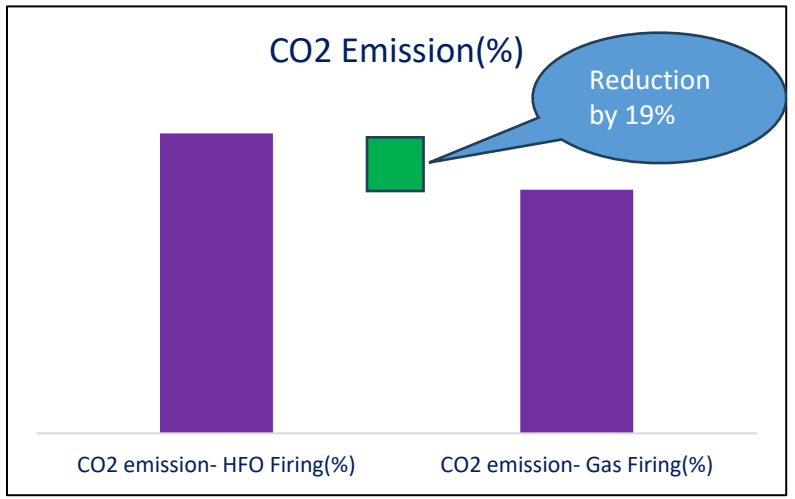
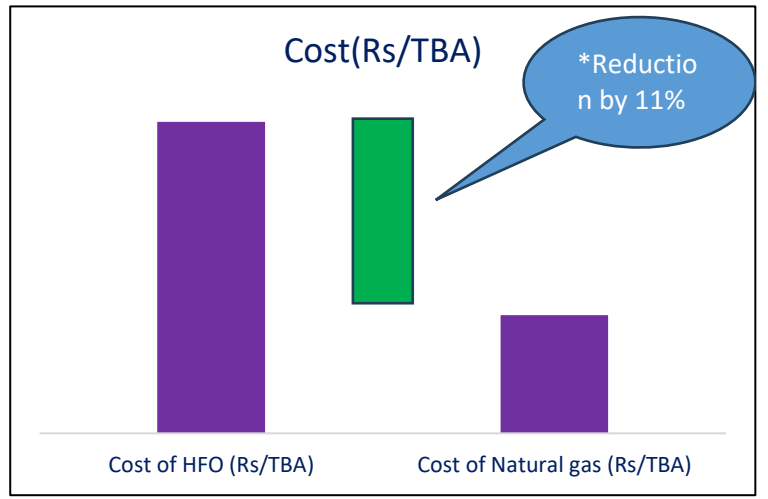
(Benefits)







*Cost benefit depends upon the price of HFO and LNG for the time-period considered.

Direct Emission Reduction

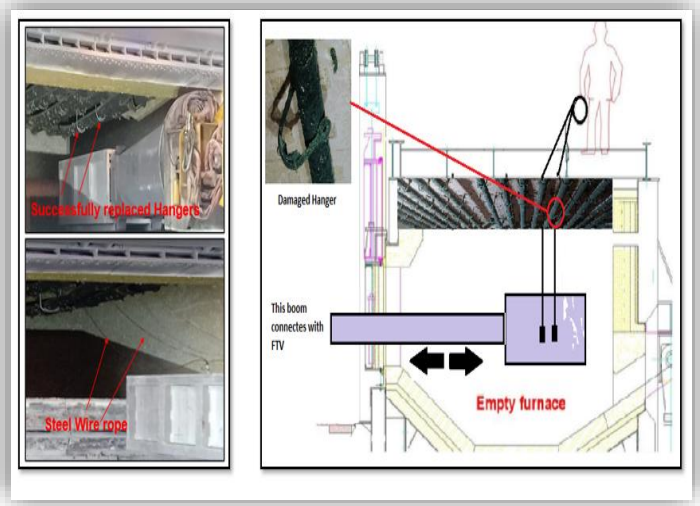
Furnace Reliability – Reducing shutdowns

Developed innovative solutions to replace damaged hangers, heaters and APM tubes in Electrically heated furnaces to reduce shutdowns required, thereby saving substantial energy in re-starting furnaces

Online Hanger Replacement – Results in saving early failure of Heater/Tubes

Online heater and Tube replacement resulting in saving of cold shutdown requirement saving approx. 23 MWh /shutdown

Approx. CO_2 reduction of 230 MT annually by reducing 10 shutdowns in 6 furnaces



Direct Emission Reduction – Digital Initiatives

ADITYA BIRLA
HINDALCO

2018
Digital Foundation
Unit-team Formation and DA's identification

2020
- Digitization
- AR/VR
- Energy Analytics
- Simulators
- Online-CBM
- E-Permit
- HTU Trainings

2022
- Digital Benchmarking-Mckinsey
- OAC/APEX
- Prediction Models
- Core Analytics
- Smart Dashboards

2024
- In-house pool of Data Scientists
- Digital Twin
- AGV
- Chatbots
- Osi-Pi Data Management Sys.

2026
POTF
"Plant of the Future"

Value creation of Big Data stored in Historians/Servers

Creation of Digital Thread

- Data Access
- Data Storage
- IT-OT Integration
- IIOT-Sensors
- Plant Assets/Equipments

CALENDAR 2022

In-House Pool of 2 Data Scientist | 40+ Trained on OAC/APEX | 60+ Trained on ATOMS | 290+ coverage DISHA

YEAR 2024

INHOUSE COMPETENCY DEVELOPMENT

DATA ACQUISITION → DATA MODELLING → ANALYTICS, ML-MODELS & OPTIMIZATION

MySQL, ORACLE APEX, python, jupyter, PYOMO, ATOMS, Azure Machine Learning, TensorFlow

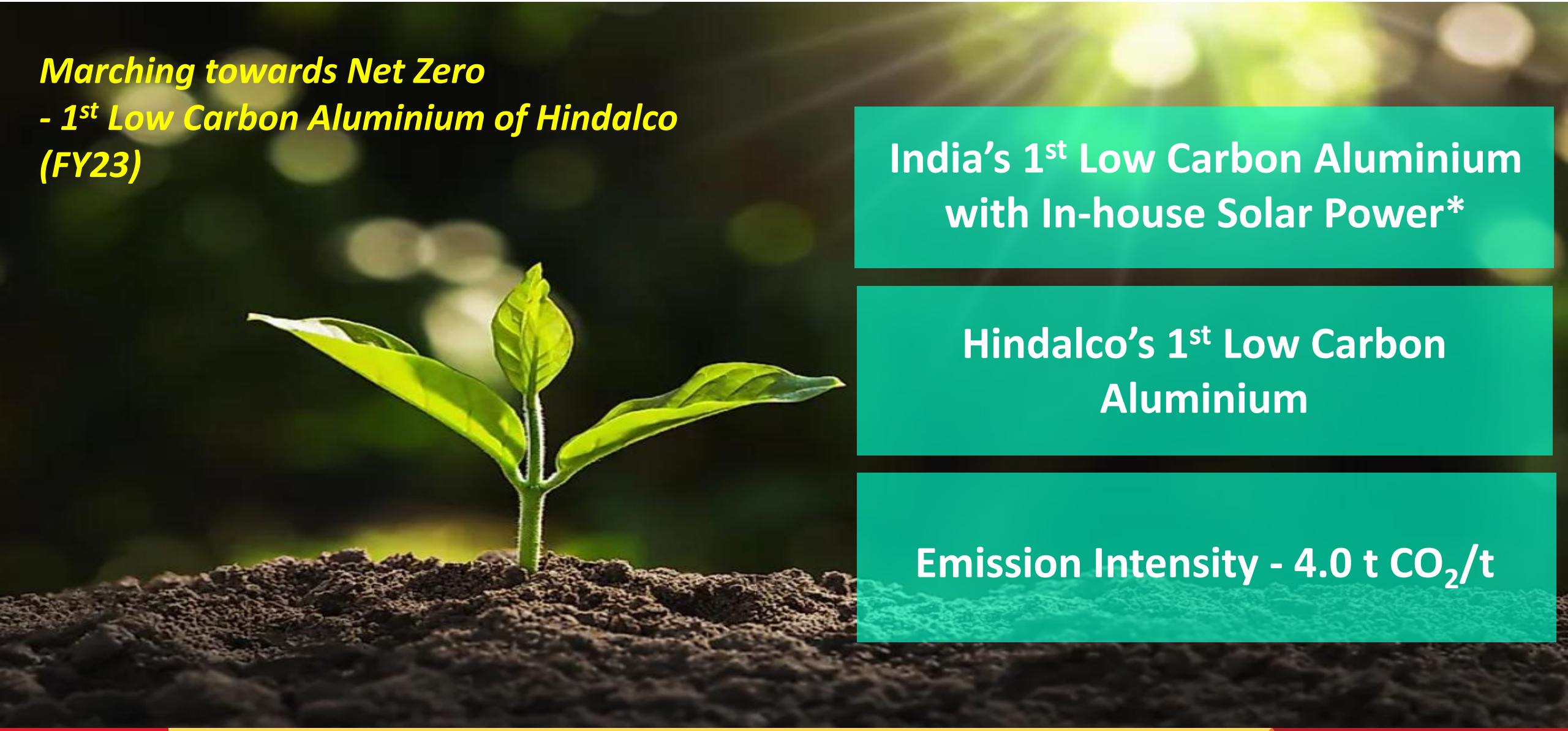
VISUALIZATION LAYER

ORACLE ANALYTICS CLOUD, Streamlit, Power BI

Value Delivery

- ✓ Auxiliary Power Consumption Reduction by 0.07 %
- ✓ Anode Quality (LC>33) population increase by 20%
- ✓ HFO savings of 4 KL/Month
- ✓ Smelter Energy Saving 1.48 MWH/MT
- ✓ 12+ man-hours daily of MIS reports automated

Low Carbon Aluminium



Marching towards Net Zero
- 1st Low Carbon Aluminium of Hindalco (FY23)

India's 1st Low Carbon Aluminium with In-house Solar Power*

Hindalco's 1st Low Carbon Aluminium

Emission Intensity - 4.0 t CO_2/t

Greener → Stronger → Smarter

The Journey Continues….