ENERGY EFFICIENT INITIATIVES AT VEDANTA LANJIGARH

Driving Efficiency & De Carbonization for Climate change Through its NET ZERO efforts

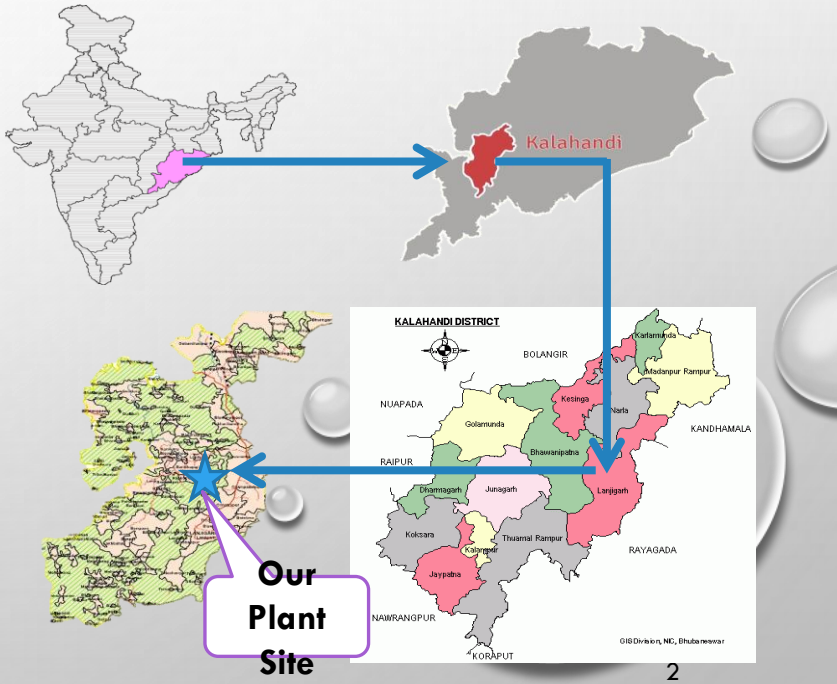
Team Members:-

Sanjaya Kumar Jena – Deputy Head Commissioning & EM

Soumava Das - Deputy Manager, Energy & Carbon- Lead

ABOUT THE ORGANISATION

- Vedanta Limited, Lanjigarh (An ISO 9001, 14001, OSHAS 18001 certified Company) is a 2MTPA Alumina refinery plant which provide Smelter grade Alumina to its smelters in Jharsuguda and Balco
- 2 MMTPA Alumina production with 90 MW CGPP
- Comissioning is in progress : 2 to 5 MMTPA
- 32 Km long railway line
- 65 Km water pipeline
- Dry red mud disposal using press filter
- The 1st Organization to be ISO 50001 certified



Alumina Manufacturing Process

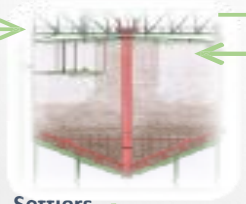
Pre-Desilication

Grinding

Crushing

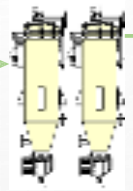
Bauxite Handling

Digestion



Settlers

Washers



Security Filters

Precipitation

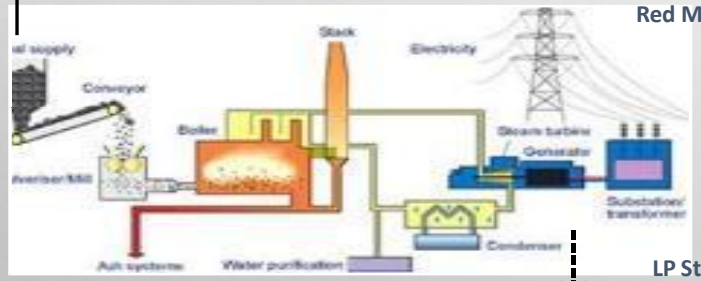
Cyclones

Classification

Red Mud Filter

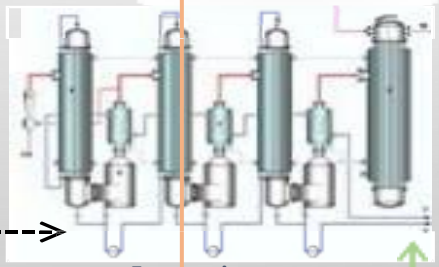
Red Mud pond

HP Steam



Power Plant

LP Steam



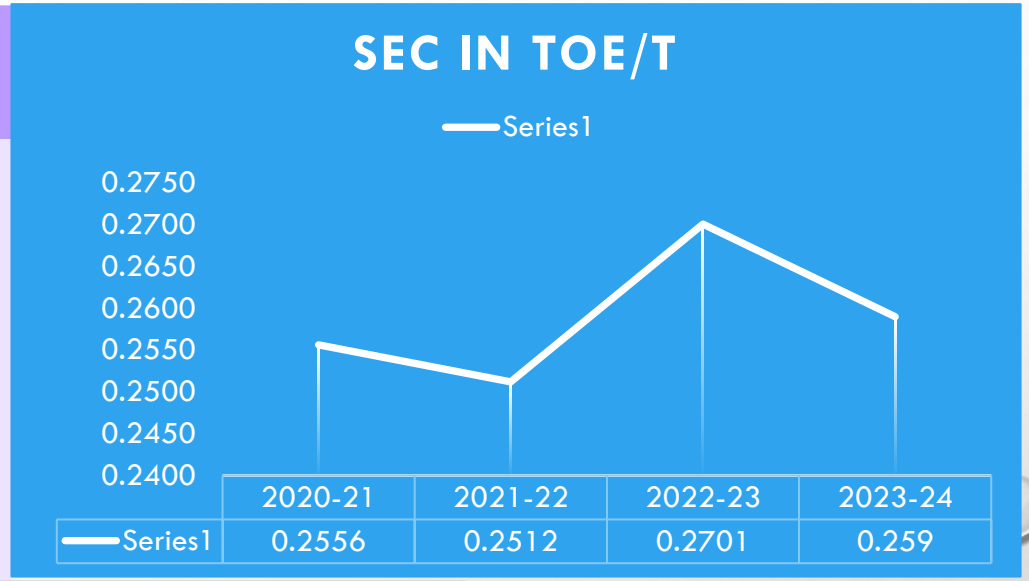
Evaporation

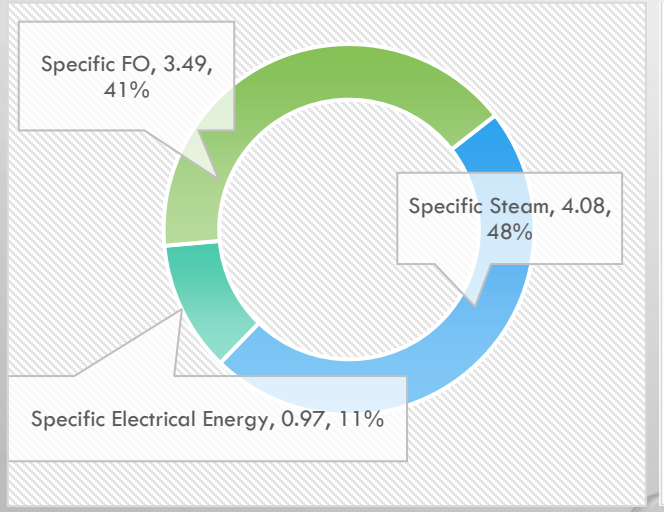
Calcination

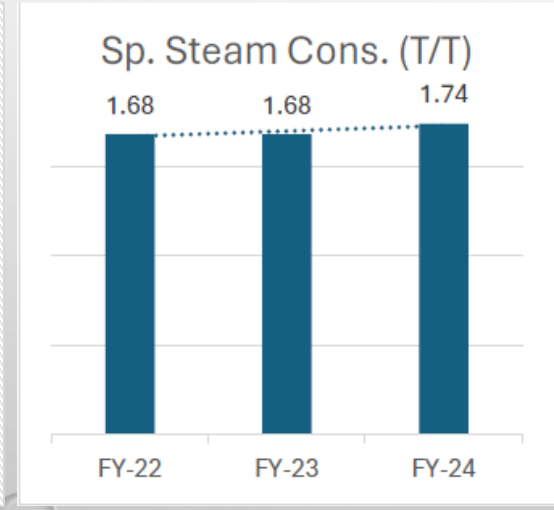
C

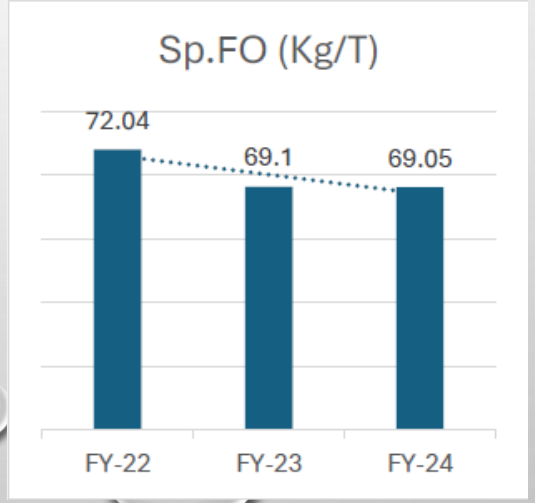
ENERGY MAPPING & ENERGY DISTRIBUTION CHART

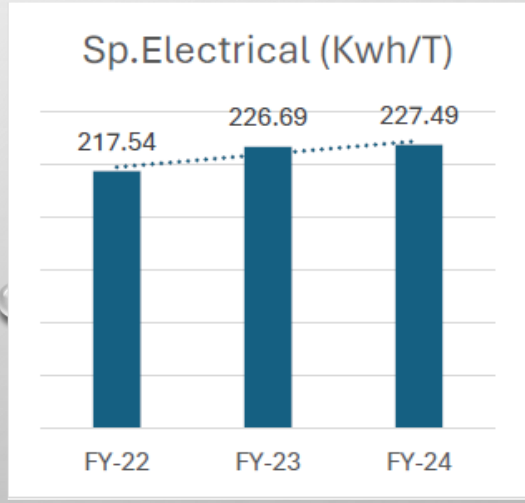
Year	Hydrate Alumina (MMTPA)	Calcined Alumina (MMTPA)	Power (Kwh/T)	FO (Kg/T)	Steam (T/T)	Total Energy (GJ)
FY - 20	18.25	18.11	216.8	70.59	1.73	7.27
FY - 21	18.48	18.41	215.7	71.13	1.72	7.25
FY - 22	19.69	19.68	217.5	70.63	1.68	7.16
FY - 23	18.55	17.92	226.7	72.05	1.68	7.17
FY - 24	18.03	18.13	227.5	69.05	1.74	7.24*











Major Implemented Projects

Project-1 : PDS Area Electrical Energy Reduction

Description of the Project :

- PDS slurry transfer pumps (tank to tank) was operated at 60 -70 % loading with existing production.
- Pumps in Tank 1,2,3 were taken in consideration for valve throttling up to 60%
- Pump 6 In house HT VFD availability with Transformer was installed

Tangible Benefits

- **Electrical Energy Savings: - 768 MWh per annum**
- **GHG savings: - 545 T Co2 per annum**

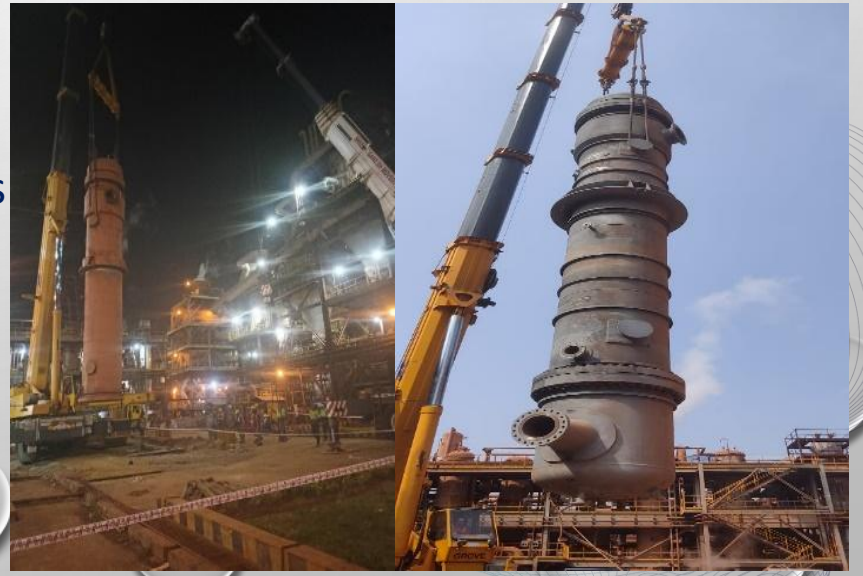
Project-2 : Digestion Heater Heat Transfer Co-efficient Improvement

Description of the Project :

- Digestion heater heat transfer Co-efficient was at 1900 W/m2 after cleaning
- Digestion LSH & FSH with more than 50 tubes dummy were identified in 3 trains
- Heater DP greater than 4 Kg/cm2 were chosen as hinderance for slurry flow

Horizontal Deployment :

- In 3 pair of LSH & 12 Pair FSH heater in 3 Digestion unit



Tangible Benefits

- **Steam Energy Savings: - 80000 T per annum (in 4 heaters)**
- **GHG savings: - 15200 T Co2 per annum**

Major Implemented Projects

Project-3 : Anti frictional Coating in Alkaline Cooling water Pumps

Description of the Project :

- Flow & Head in Cooling water pumps was less than design , resulting in running of 3rd pump
- Antifrictional (bellazona) coating to reduce the frictional losses in the pump
- Loss reduction to increase flow

Tangible Benefits

- **Electrical Energy Savings: - 469 Mwh per annum**
- **GHG savings: - 355 T Co2 per annum**

Project-4 : Installation of HT Capacitor banks in Four Major Substations in Refinery

Description of the Project :

- SS 2, SS 3, SS 4 & SS-6 power factor was hovering around 0.84
- SS-2, SS-4 had old capacitors banks with lower capacity with Extra MVAR requirements
- SS-6 and SS-3 had no capacitor bank installed at site for the whole MVAR requirements were calculated.

Tangible Benefits

- **Electrical Energy Savings: - 1264 Mwh per annum**
- **GHG savings: - 890 T Co2 per annum**

Major Implemented Projects

Project-5 : Ball Mill 1& 2 Throughput improvement

Description of the Project :

- Ball Mill 1 & 2 Throughput was at 210 TPH against the design of 300 TPH
- Product pump flow was not sufficient to increase ball mill feed
- Spent liquor flow not sufficient
- Liner replacement & Ball segregation required

Tangible Benefits

- **Electrical Energy Savings: - 2400 MWh per annum (in two mills)**
- **GHG savings: - 1702 T Co2 per annum**

Project-6 : Evaporation 1 & 2 Steam Economy improvement from 3.5 to 3.8 T of moisture/T of steam

Description of the Project :

- Steam Economy was less at 3.5 T/T against the design of 4.1 T/T
- Evaporation rate of 520 tph required against running of 440 tph in Calendria
- Requirement of running 3rd evaporator with increase in running hours
- Replacement of 4600 tubes in two calendria with tubes with more surface

Parameters	Target	06-05-24			MTD		
		TR-1	TR-2	TR-3	TR-1	TR-2	TR-3
Feed Al2O3 (gpl)	93-98	103.29			103.75		
Feed RP	0.65	0.71			0.70		
Feed Density (T/m3)	1.25	1.259	1.241		1.254	1.241	
Discharge flow (m3/hr)		794	810		771	808	
Discharge temp (0C)	85	90.21	90.72		90.49	89.26	
Discharge Na2O (gpl)		207.08	206.19		201.33	197.34	
Discharge Al2O3 (gpl)		147.16	145.44		141.21	137.09	
Discharge RP		0.71	0.71		0.70	0.69	
Discharge Density (T/m3)		1.33	1.33		1.32	1.33	
Test Tank Na2O (gpl)	180	184.76			185.80		
Test Tank Al2O3 (gpl)		129.83			127.01		
Test tank RP	0.632	0.70			0.68		
Evaporation Rate (tph)	270	250	247	0	230	228	204
Steam Economy (T/T)	3.8	3.78	3.76	0.00	3.97	3.86	3.77
Hotwell in caustic (gpl)	<1						
Hotwell out caustic (gpl)	<1			0.00			
Cooling tower caustic (gpl)	<1	0.93			0.75		
Raw caustic dosage (TPH)		0.00			20.77		
Raw caustic dosage Operating Hour		0.00			12.99		

Tangible Benefits

- **Steam Energy Savings: - 40000 T per annum**
- **GHG savings: - 9500 T Co2 per annum**

Major Implemented Projects

Project-7 : Biomass feed of 20 t/day to Co-generation boilers

Description of the Project :

- Fuel substitution in boilers from Coal to Biomass
- Study of NTPC boilers where Biomass feed of 3 % is ongoing
- Modifying the operation conditions in Boilers, Coal mills and also study of Ash contents of Biomass

Implementation:

- Pilot Trial of 300 T in for first time basis
- Developing a steady supply chain of biomass with affordable prices (same as coal)
- 20 T/day firing of biomass from Feb -24

Horizontal Deployment :

- Fuel substitution up to 5 % with Biomass in Existing Boilers

Tangible Benefits

- **GHG savings: - 10000 T Co2 per annum (600 T of coal substitution per month)**

Intangible Benefits

- **Fuel Substitution in boilers with affordable pricing**

PROJECTS & STRIVING FOR CONTINUAL IMPROVEMENT

69000 Tons of CO_2 saved in FY 2024 from ENCON projects

Year	No. of Energy Saving Projects	Investment(in crores)	Electrical Savings (million Kwh)	Thermal Savings (GJ)	Savings (In Crores)
FY 2020-2021	7	1.12	34.2	13.4	11.97
FY 2021-2022	15	7.63	5.5	339759	15.92
FY 2022-2023	32	44.72	20.12	914709	61.5
FY 2023-2024	**29**	**40.88**	**10.54**	**591585**	**48.25**

Vedanta's Commitment to achieve NET ZERO by 2050 or sooner

Sign Of Continuous Improvement in Energy Performance

Renewable Energy Sources

FY	Installation Capacity	Generation (in Million Kwh)	Import (IEX/PXIL) (in Million Kwh)	Percentage share
FY-22	180 KWp	0.084	0.671	0.145
FY-23	180 KWp	0.138	6.667	1.32
FY-24	180 KWp	0.038	0	0.148

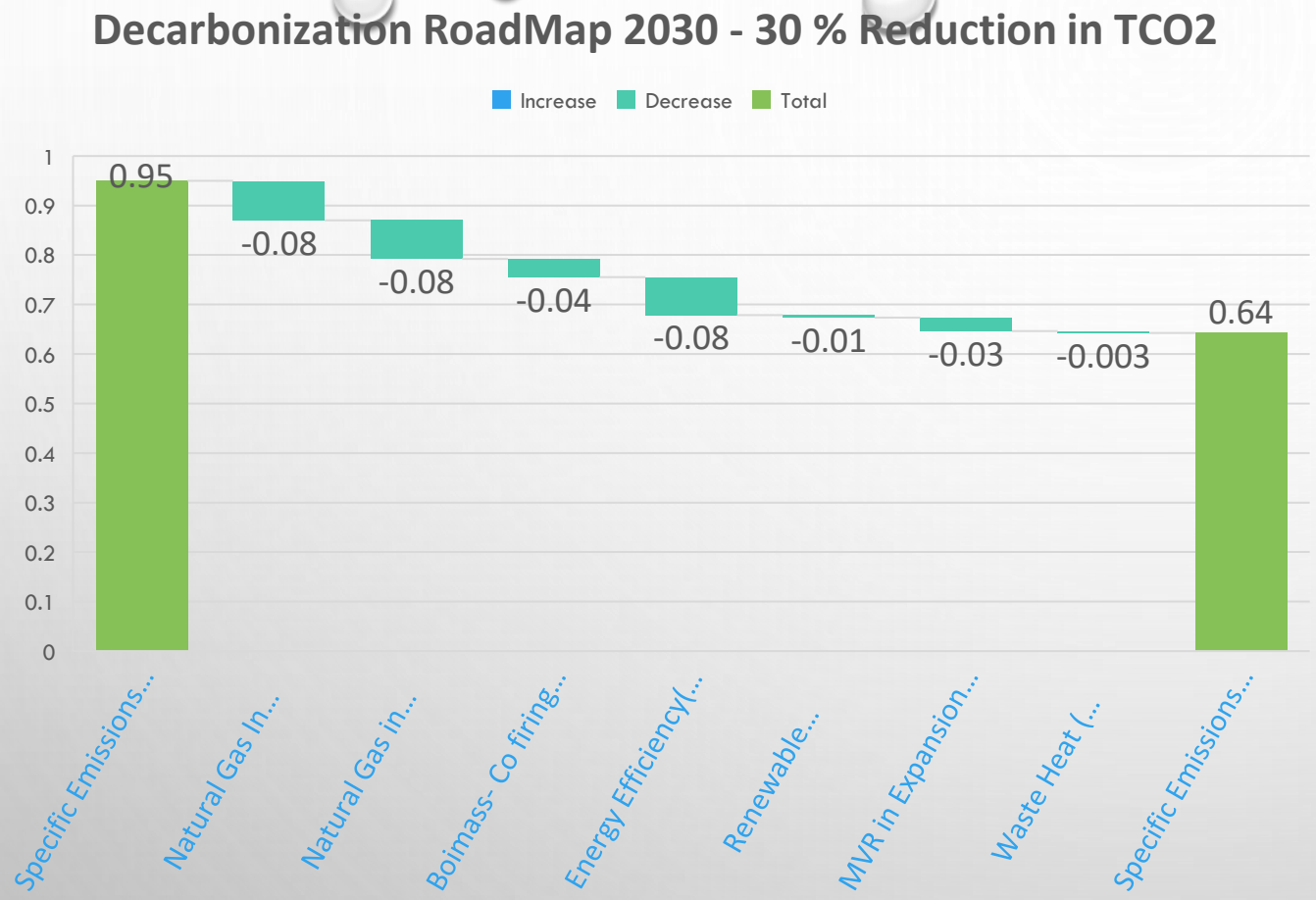
Key Highlights

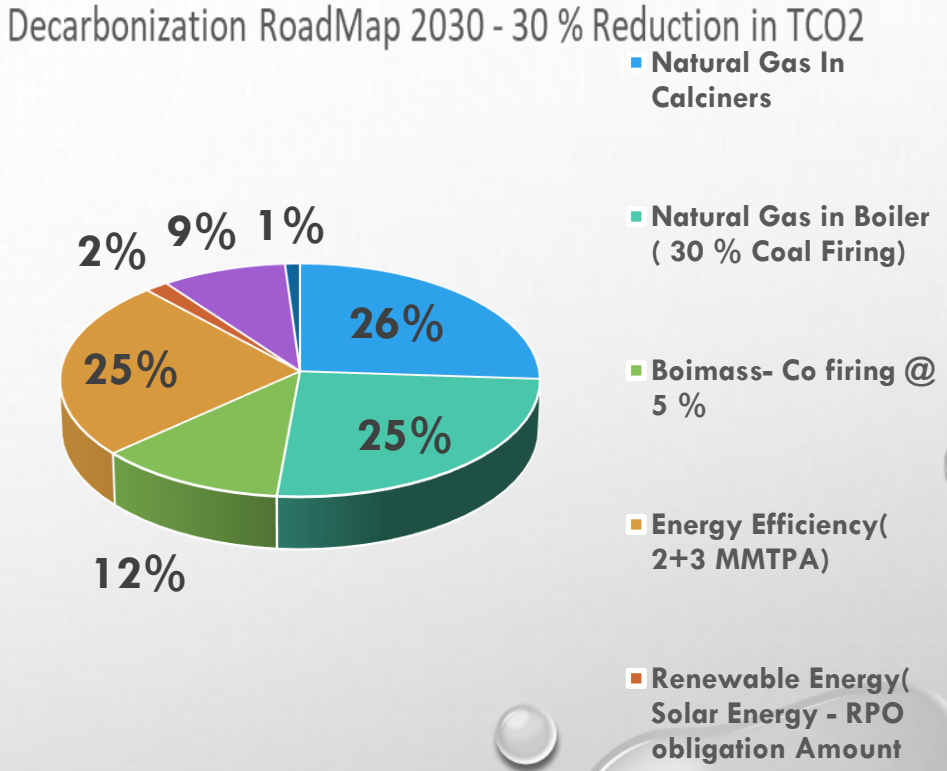
- 6667 MU of Renewable energy imported through IEX and PXIL platforms in FY 23
- Feasibility study of 4.6 MWp carried out by Evolve Solar in Lanjigarh Plant area
- 458 T of Biomass fired in our Co-gen Boilers & 1000 T/Month FY 25 is planned
- First Bio- diesel trial taken in Trucks (Red Mud Discharge Unit) & EV Charging Station Set up in Colony

Key Projects towards path of Decarbonization

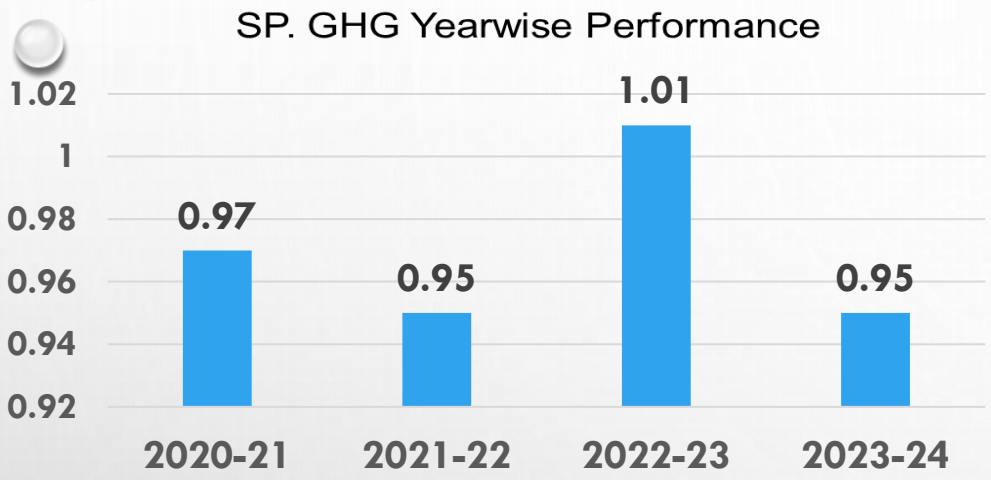
- Usage of Natural Gas in 5 Calciners instead of Furnace Oil
- Setting up of Biomass supply chain for Biomass firing in Boilers @ 1000 T per month.
- Waste Heat Potential Recovery Evaporator (ICT turbine) in Evaporators , Calciner Waste Heat recovery in Cooling tower
- Anti frictional Coating in 16 nos . Water Pumps for 6-8 % Energy Saving
- Compressor Energy Saving initiatives like ZLDS, Demand controller in precipitation area
- Improvement of Heat Transfer Coefficient in Digestion heaters
- Reduction in Specific Coal Consumption and improvement of SHR by 3 Boilers Senior APH tube replacement and Economizer Coil replacement
- Improvement of Liquor Productivity to 88 gpl
- Exploring Solar potential in plant up to 4.6 MWp & PPA with Serentica Energy for 10 MW Hybrid plant

ROADMAP TOWARDS GREEN ALUMINA





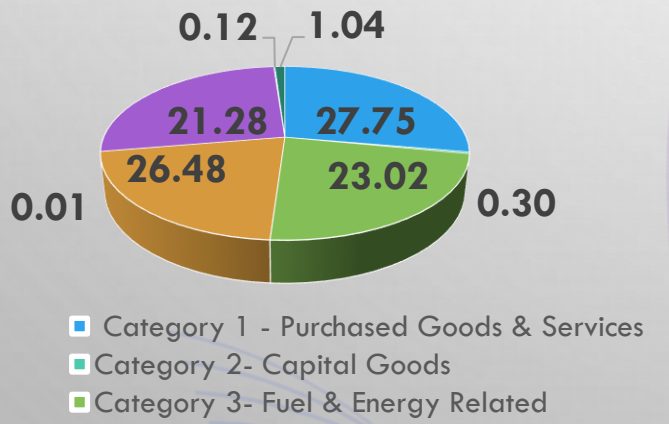
TCO2 Emission Trend & Reduction plan



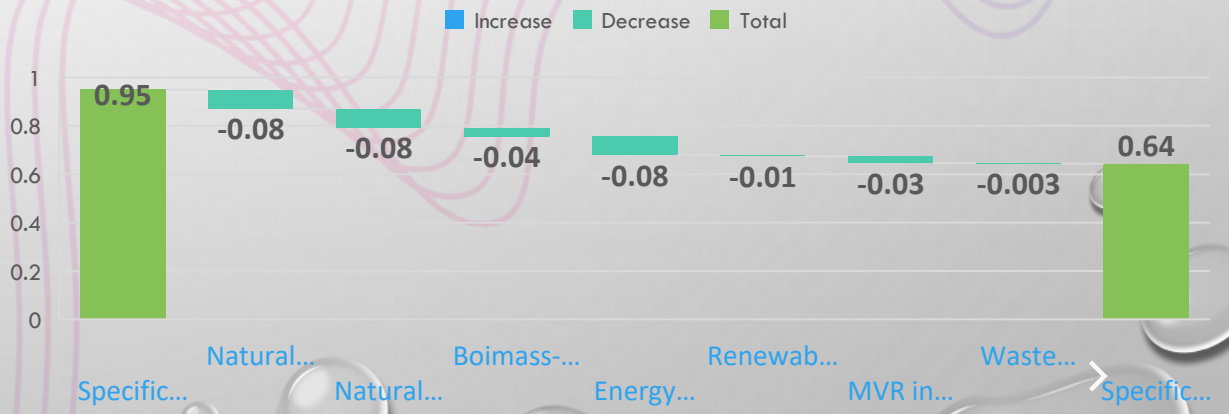
*** TCO2 Emissions Scope 1 & 2**

- Proper Categorization of TC02 Emissions with Monthly Reports & Online Tracking sheets
- Scope emission category definition & calculation on quarterly basis
- Digital Enablon reporting of Scope 1,2 & 3 Emissions
- Reduction plan preparation on category wise

Scope-3 Emission Category wise



Decarbonization RoadMap 2030 - 30 % Reduction in TCO2



PAT , Escerts & Awards

VL-Lanjigarh Received 15044 Escerts in PAT-II cycle compared to 762 certificates received in PAT-I cycle.

→ Organization received first ever National energy conservation award (first prize) for the year 2020 by BEE and MIP.

Till date 6852 nos. of EsCerts were sold generating a revenue of 1.2 Crore INR in FY 23-24

→ For FY 24-25 cycle till date 1050 Escerts sold

Energy Awards & Recognition:

- **CII Energy Circle Best PAT DC & Energy Efficient Unit**
- **CII Hyderabad – Excellent Energy Efficient Unit award**
- **Orissa State Energy Efficiency Award – SDA BEE Cell (2 consecutive years)**
- **Kalinga Award : 5 star category 2024 in Energy Efficiency from IQEMS**

Vehicle Decarbonization Drives at Vedanta Lanjigarh

- 4 out 6 Forklifts converted to EV . 8 EV forklifts conversion targeted till FY 25
- Employee Friendly EV policy
- EV charging infrastructure in township
- Bio-diseal trial in trucks

Energy Efficiency as Brand

Vedanta Aluminium accelerates shift to renewables, deploys biomass for power generation

Sustainable **deployment of biomass briquettes for power generation**. Vedanta Lanjigarh is now utilizing **20 tonnes of biomass briquettes per day** at its world-class alumina refinery in Lanjigarh, Odisha. This will help potentially **decrease the unit's greenhouse gas (GHG) emissions by more than 10,000 tonnes of CO2 equivalent each year**, in addition to reducing its reliance on fossil fuels.

WORLD ENVIRONMENT DAY 2024

"Land restoration, desertification and drought resilience ·"

An awareness session on the theme "Land restoration, desertification and drought resilience", was organized in collaboration with the Environment department, VLL.

Goipeta Village

100 Beneficiaries

Empowering Communities through Solar Lamps:

A Case Study on Vedanta's Clean Energy Project

Recognizing need for reliable energy sources in fostering development of a region, Vedanta embarked on a mission to provide sustainable solutions to under-served communities.

Lanjigarh struggling with erratic electricity supply, pose challenges to the daily activities of people particularly during evening hours. Identifying this critical need, Vedanta implemented the provision of solar lights in community driven model as a sustainable solution. A total of 1665 solar lamps were distributed in 22 villages addressing the energy deficit to households in need identified through a beneficiary survey conducted.

Solar lamps revolutionized daily life for people extending work hours in evenings; enabling women to carry household chores, children to study, etc. In villages like Kankeri, without an electricity infrastructure, solar lamps catalyze economic activities

helping artisans to engage in Dhokra craft, which was previously limited by daylight hours leading to increased production. By harnessing the power of solar energy, Vedanta addresses the immediate energy needs ensuring uninterrupted learning, improved productivity and an enhanced quality of life.

A CSR Initiative
Vedanta Limited Lanjigarh

Vedanta Lanjigarh deploys advanced Energy Management System for enhanced energy efficiency

The alumina refinery is leveraging data to reduce emissions and enable energy efficient processes

Vedanta Lanjigarh recently launched an **advanced Energy Management System across its power plant.** The initiative is a notable digitalization effort that will result in enhanced functional optimization and increased automation of the refinery operations.

It will help monitor the energy performance parameters of 120 critical electrical assets, thereby enhancing energy efficiency levels across the plant.

vedanta | aluminium

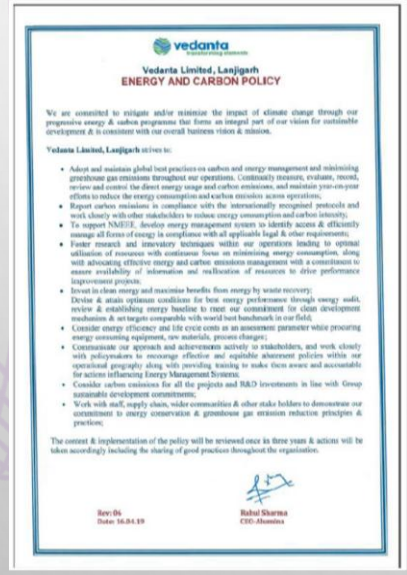
VEDANTA LANJIGARH INTRODUCES THE FIRST-EVER E-SCOOTER STALL TO SUPPORT OUR EV POLICY AND REDUCE CARBON FOOTPRINTS!

The Inauguration

Key handover to Mr. Subhashish Mund(1st buyer)

By setting up the first-ever EV stall, Vedanta Lanjigarh welcomes employees and business partners and aims to make sure they have a hassle-free experience by offering two-wheeled EVs at the doorstep. This aligns with our slogan as we work toward achieving our ESG (environment, social, and governance) objectives. As part of this program, we've teamed up with Ather to provide Vedanta employees with a special discount on their cutting-edge electric scooters. Our dedication to lowering our carbon footprint and promoting environment friendly mobility choices among our employees is demonstrated by the EV policy. The first buyer received the key from our respected CEO, **Mr. Pranab Kumar Bhattacharya**, who inaugurated the ceremony.

EnMS ISO 50001:2018 & E&C Committee



vedanta

Vedanta Limited, Lanjigarh

ENERGY AND CARBON POLICY

We are committed to mitigate and/or minimize the impact of climate change through our progressive energy & carbon programme that forms an integral part of our vision for sustainable development & is consistent with our overall business vision & mission.

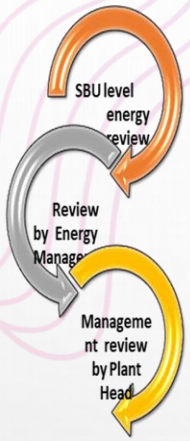
Vedanta Limited, Lanjigarh strives to:

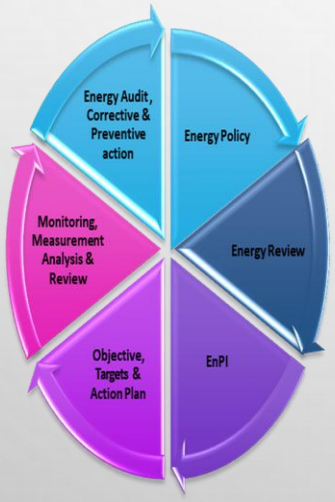
- Adopt and maintain global best practices on carbon and energy management and minimizing greenhouse gas emissions throughout our operations. Continually measure, evaluate, record, review and control the direct energy usage and carbon emissions, and maintain year-on-year efforts to reduce the energy consumption and carbon emission across operations;
- Report carbon emissions in compliance with the internationally recognised protocols and work closely with other stakeholders to reduce energy consumption and carbon intensity;
- To support NMEEE, develop energy management system to identify access & efficiently manage all forms of energy in compliance with all applicable legal & other requirements;
- Foster research and innovative techniques within our operations leading to optimal utilisation of resources with continuous focus on minimizing energy consumption, along with advocating effective energy and carbon emissions management with a commitment to ensure availability of information and reallocation of resources to drive performance improvement projects;
- Invest in clean energy and maximise benefits from energy by waste recovery;
  Devise & attain optimum conditions for best energy performance through energy audit, review & establishing energy baseline to meet our commitment for clean development mechanism & set targets comparable with world best benchmark in our field;
- Consider energy efficiency and life cycle costs as an assessment parameter while procuring energy consuming equipment, raw materials, process changes;
- Communicate our approach and achievements actively to stakeholders, and work closely with policymakers to encourage effective and equitable abatement policies within our operational geography along with providing training to make them aware and accountable for actions influencing Energy Management Systems;
- Consider carbon emissions for all the projects and R&D investments in line with Group sustainable development commitments;
- Work with staff, supply chain, wider communities & other stake holders to demonstrate our commitment to energy conservation & greenhouse gas emission reduction principles & practices;

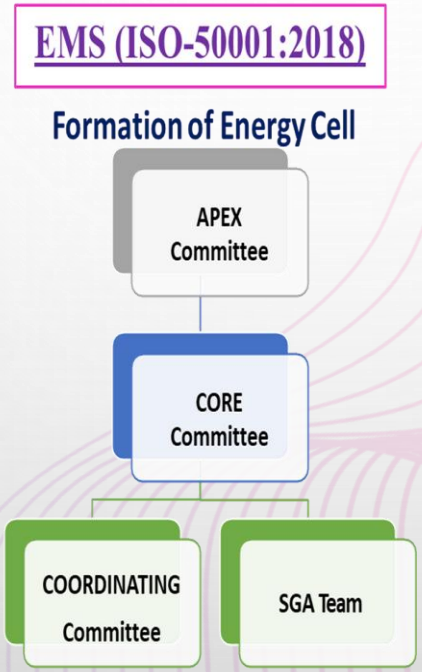
The content & implementation of the policy will be reviewed once in three years & actions will be taken accordingly including the sharing of good practices throughout the organization.

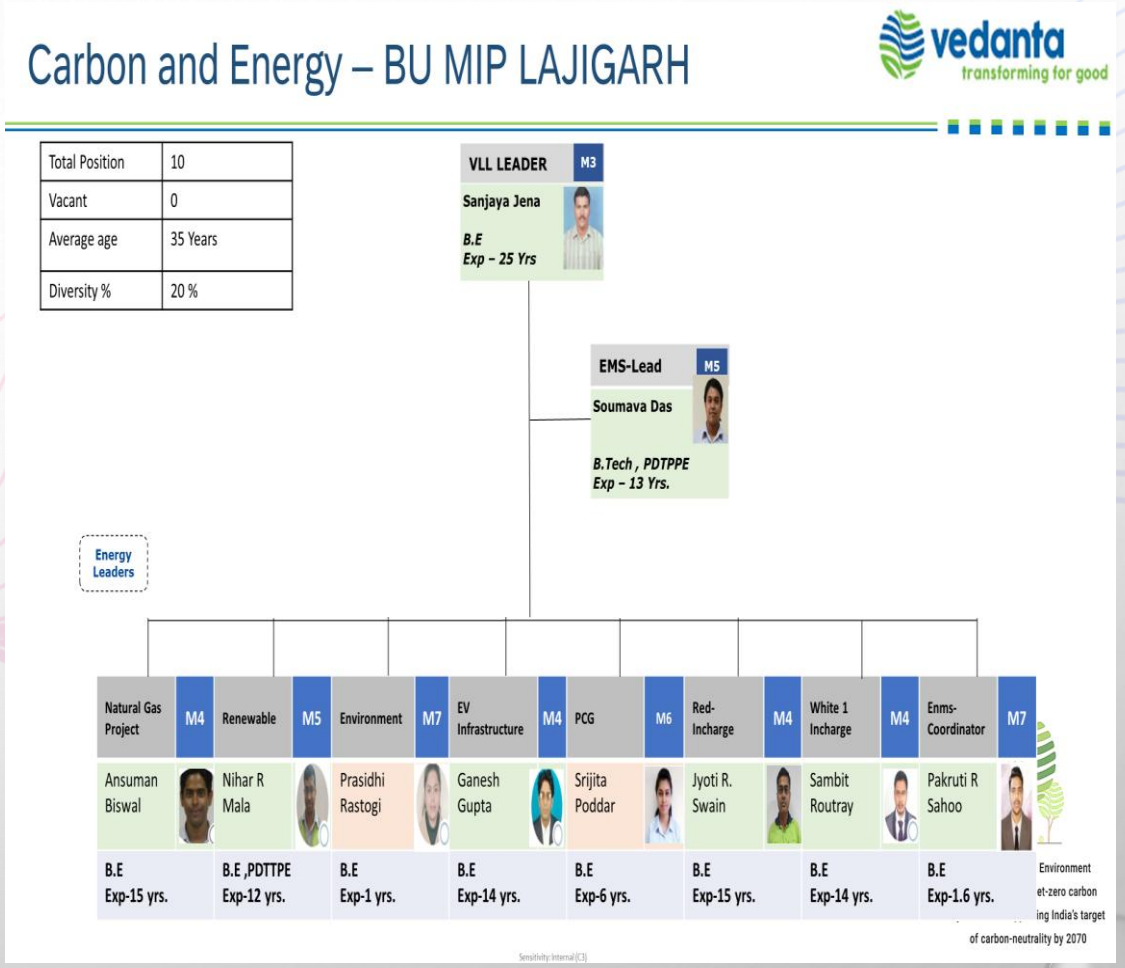
Rev: 06
Date: 16.04.19

Rahul Sharma
CEO-Alumina









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THANK YOU !

Aiming to create a more beautiful, sustainable, clean planet . . .