

Intellectual Capital



Enriching Lives by Enhancing the Product Mix and Improving Customer Experience

As the global industrial market demand constantly evolves, our commitment to enriching lives drives us to stay ahead. Innovation is not just our biggest tool; it is the foundation of our journey to unveil new products, combinations, and designs to cater to an array of opportunities.

Our innovation capabilities are one part of the equation, with external associations and industry learnings completing the loop. We invest in partnerships, specialised innovation centres, and state-of-the-art facilities to bolster our innovation capabilities. These investments empower us to create new products and processes and achieve breakthroughs that positively impact the lives of our stakeholders. By embracing innovation as our guiding principle, we are confident in our ability to enrich lives through exceptional solutions and experiences.

Focus Areas

Strengthening R&D for downstream products	New technological solutions
Product quality and performance	Digitalisation

Key Highlights

Patents Filed	Patents Granted
529	427
New products developed	R&D spend
62	₹796 cr.
Launched	

Aluminium Freight-Trailer Rakes

Contributions to SDGs



Interlinkages with material topics and other capitals

Material topics

- ▶ Market Presence

Capitals connected

- ▶ Manufactured Capital
- ▶ Financial Capital
- ▶ Natural Capital

Key Risks and Opportunities addressed

R8	Product development strategy risks
R10	Cybersecurity and data protection risks

Alignment with Strategic Priorities

SP-2	Value Enhancing Growth
SP-3	Strong ESG Commitment
SP-4	Portfolio Enrichment

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At Hindalco, we gauge ourselves by our innovations that can redefine and bring new vigour to our business. This relentless pursuit of ours is substantiated through new patents, well-equipped innovation labs and our increased spending on Research and Development (R&D).

We have been consistently increasing our R&D spending over the years. Our total R&D spending, which includes our Capex and Opex, stood at ₹796 Crore in the reporting year. Out of this, ₹763 Crore (\$8.54 million) was spent in Novelis and ₹33 Crore in India Operations. Out of ₹33 Crore, we spent ₹6 Crore dedicatedly towards environmental benefits.

Our R&D efforts were recognised through various accolades. We received the Best Executor Award for Innovative Sustainable Solutions at ABG InnoSol Conference in March 2023.

We even received an appreciation certificate from SME for Chemical Safety, acknowledging our efforts in providing technical training.



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Innovate to Improve: Optimising Our Processes

Our process innovation initiatives play a crucial role in enhancing time and resource efficiency, resulting in cost benefits. Our R&D centres are constantly working to improve the value provided to customers by enhancing product performance and quality.

To ensure the quality delivery of products, we conduct Life Cycle Assessments (LCA) at downstream (FRP & Extrusion) and refinery plants to identify the potential impacts of products and services during their entire lifespan. The results of the LCA are used to implement measures to reduce the identified impacts of our products. In FY 2022-23, we commenced the process of refreshing the LCA for both our aluminium and copper manufacturing products. This is expected to be completed in FY 2023-24.

At Novelis, we completed a cradle-to-gate and gate-to-gate LCA for product-side and public-side lamination for can end sheet. The assessment did not identify any major environmental risks arising from the products.

Additionally, we have research and technology centres in Shanghai, China, and Sierre, Switzerland which are focused on automotive research. Our research and technology centre in Göttingen, Germany specialises in the development of new products and processes for our can and specialties customers.

Additionally, our innovation centres in Koblenz, Germany and Zhenjiang, China, are dedicated to aerospace research, catering specifically to the aerospace product portfolio. We also have a dedicated automotive customer solution centre in Novi, Michigan to strengthen the partnerships we have with our customers.

Our R&D facilities are dedicated to developing new technologies and products, that will help us stay ahead of the competition. In the reporting period, our R&D team filed 529 patents and had 427 patents granted.

At Novelis, we are focusing on expanding our product portfolio through innovation and new technologies with our eight dedicated R&D facilities spread across North America, Europe, and Asia.

Our global research and technology centre in Kennesaw, Georgia, offers state-of-the-art R&D capabilities. This helps our plan to meet the global long-term demand for aluminium in the automotive, beverage, and aluminium specialties markets.

We also have a global casting engineering and technology centre in Spokane, Washington, specialising in molten metal processing.

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Bolstering Our R&D: Hindalco Innovation Centres

Our Hindalco Innovation Centres, equipped with state-of-the-art infrastructure and facilities serve as the foundation for our R&D activities.

We have four innovation centres located at Belagavi, Talaja and Dahej - which have dedicated research focus areas.

Our innovation centres at Belagavi and Talaja are recognised by the Department of Scientific and Industrial Research (DSIR). The DSIR, a promotional wing under the Ministry of Science and Technology, Government of India, nurtures in-house technology and development at global standards. In addition to the dedicated innovation centres, all our plants are equipped with in-house R&D Centres and dedicated Technical Cells.

R&D Focus Areas of Hindalco Innovation Centres

Belagavi	Talaja	Dahej
HIC Alumina <ul style="list-style-type: none"> Bauxite Specialty Alumina and Hydrate Bayer's Process 	HIC Tribology <ul style="list-style-type: none"> Oil and Lube Aluminium Coating Technology HIC Semi-Fab <ul style="list-style-type: none"> Metallurgical Applications related to aluminium 	HIC Copper <ul style="list-style-type: none"> Copper Smelting Copper Refining By-product applications Copper Related Services

TELLURIUM RECOVERY FROM ANODE SLIDES

In the electrolytic refining step in the copper manufacturing process, anode slime is generated as a by-product.

The composition contains significant amounts of copper, lead, tellurium, selenium, precious metals gold, silver, and platinum along with other impurities. Prior to the recovery of precious metals and selenium, the removal of copper is necessary.

During the copper removal stage in slime leachate, about 50-60% of tellurium in anode slime gets co-dissolved. The remaining tellurium remains in a solid residue, resulting in the loss of this valuable element. At HIC Copper, we developed a process to recover this tellurium from slime leachate in the form of Copper Telluride (Cu₂Te) powder. The laboratory scale development of the project is complete, and pilot implementation is in the pipeline.

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LIBERATOR CAKE TREATMENT TECHNOLOGY

During copper refining operations, liberator cake is produced as a by-product. Liberator cake contains about 70 to 90% copper and 6 to 10% arsenic along with other impurities. This is usually consumed as feed input for smelters. However, due to a mismatch between the generation and consumption of liberator cake, there is a gradual build-up in the inventory.

Reprocessing/recycling of liberator cake in smelters and exports is also a challenge due to the high-level impurities present in it. This problem led us to develop a process that would treat liberator cake and reduce the piled-up inventory. After evaluating multiple approaches, a mineral beneficiation method was selected to separate the arsenic lean (less than 2%) material.

This solution converted non-saleable liberator cake to saleable copper products, thus adding value.

Further, we modified our process and reduced the arsenic content to less than 2% in the liberator cake. The penalty reduction of 70-80% will have a direct impact on the cost incurred in treating the liberator cake and make it a marketable product.

Innovate to Inspire: Developing New Products

We introduce new products to meet the growing demands of our customers and the market. Our product innovation focuses on exploring untapped opportunities in various sectors. In addition to increasing our existing market share, we are also venturing into new product verticals. For example, our new product developments like HLV206: a hydrate equivalent, AC Fin Stock Coatings, Battery Enclosures and Foils, Inner Grooved Copper tubes, and Superior Copper Alloy Rods enable us to capture new markets.

In the reporting year, we successfully developed 62 new products at our Innovation Centres.

We are dedicated to contributing to India's Net Zero Goals by leveraging innovative technologies. The adoption of electric vehicles plays an important role in mitigating fuel emissions. And we are utilising our capabilities to contribute to this transition. For instance, we have developed BB590 alloy-grade sheets that exhibit high wire bond strength and corrosion resistance, specifically for busbar applications in electric vehicles.

New Products at Our Innovation Centres

Innovation Centre	Products and applications developed and accepted by customers	New products and applications developed in lab
HIC Belagavi	9	11
HIC Tribology	3	12
HIC Semi-fab	6	4
HIC Dahej	3	2

Additionally, we have developed a hybrid manufacturing process combining additive technology with aluminium extrusions to create lightweight EV motor housings.

Battery enclosures and battery foils made of aluminium have proven to be superior choices for electric vehicle batteries. The lightweight nature of aluminium has contributed to an increasing trend in its use in automobiles and transport vehicles. Using aluminium not only improves fuel efficiency but also reduces the total cost of ownership.

As a result, we have developed and launched products such as aluminium freight rakes, aluminium trailers, aluminium boats for water metro, and aluminium container boxes to replace traditional container boxes.

We systematically evaluate market demands and closely monitor megatrends to proactively develop products ahead of time allowing us a first-mover advantage. The development of Spherical Alumina and Hydratable Alumina is a testament to this commitment. We aim to focus on new areas of research, such as copper anode and cathode quality, copper refinery bleed generation optimisation, purification, and recycling, as well as ETP load reduction and advanced applications for achieving zero-waste-to-landfill.

Additionally, we have developed a hybrid manufacturing process combining additive technology with aluminium extrusions to create lightweight EV motor housings.

In our chemicals business, we have recognised the versatility of alumina, leading us to introduce "NPD-30", which focuses on developing 30 projects for new product development. Currently, we have 26 projects in the new product development funnel, with 16 of them already in advanced stages.

Currently, our main focus is on integrating Super Value-Added Products (SVAPs) that are expected to have a high future demand and are currently very limited in terms of market players globally.

As an integrated player, we believe we have an edge over our competitors in the production of SVAPs.

An example of such a product is high-purity alumina which is experiencing rising demand in electric vehicles, LEDs, semiconductors, and other electronic applications due to its inert qualities and good thermal and electrical insulation properties.

At Novelis, we have developed various products having overall applications in our can portfolio, such as BPA – NI coating for can end sheets and public-side and product-side lamination for can end sheets.

Our specialties segment developed a water-based clear coat for specialty painted products and a wrinkle-free coating for painted products. The specialties segment also developed a high-recycle content aluminium sheet for coffee capsules.

In the automotive segment, we have developed a second-generation design for the aluminium EV battery pack enclosure.

Further, we are also exploring carbon capture and conversion technologies for plant operations and buildings, as well as water-based clear coats and extensions for painted products.



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Other Product Development Efforts

Turbine Oil and Compressor Oil

- Development of indigenous turbine oil (Mineral and Synthetic-based) of VG 32 and 46 for captive power plants.
- Improved resistance to foaming tendency and better oxidation stability.
- Use of In-house developed ISO VG 32 and 46 (Synthetic and Mineral) Oil for Compressors. Approval from an expert institute under progress.

Fume Free Billet cutting lubricant

- Development of fume-free cutting oil.
- Reduced health impacts caused by fumes and smoke.
- Reduced lubricant consumption and cost.
- Pilot trial completed at Alupuram Plant.

Development of Hot rolling lubricant for Roughing Mill and Finishing Mill of Hirakud FRP

- In-house lubricant has been successfully developed, and Laboratory Evaluation completed.
- Plant trial is planned in FY 2023-24.

Development of In-house AC Fin Stock Coating

- Epoxy/Polyester Primer base coat and PVA Hydrophilic topcoat for AC fin stock.
- Corrosion resistant, quick-dry organic coating for AC fin stock.
- Provides a 30% cost reduction compared to commercially available products.

Development of Hydrate Equivalent to Martinal ON921

- Developed and commercialised as grade name, HLV206.
- Approved by customers in lab scale evaluation and bulk trials are in progress to establish plant scale production.
- Shall facilitate our entry into the composite market of automotive, PU foam and other related applications.

Development of Hydrate for Electrical FRP Composite Application

- Developed and commercialised a product equivalent to Portaflame SG100LV flame retardants called MHB30.
- Applications in Electrical FRP composites.
- Successful bulk trials conducted in India and Spain; the product has now been commercialised.

In our quest of innovating to inspire, we are always developing new products to meet the growing demands of our customers and the market. Our product innovation focuses on exploring untapped opportunities in various sectors. In addition to increasing our existing market share, we are also venturing into new product verticals.

We are venturing into new product verticals; Inner Grooved Copper tubes, Superior Copper Alloy Rods, etc.



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INDIA'S FIRST ALL-ALUMINIUM FREIGHT RAIL RAKES

Rail transport is an important mode of conveyance in India and caters to a large share of the Indian population. Supporting the country's ambitious plan to modernise freight transportation and enable large carbon savings for the Indian railways, we developed India's first all-aluminium freight rail rakes.

Our aluminium rakes are 180 MT lighter than existing steel rakes and can carry 5 to 10 % more payload. They consume less energy, are corrosion resistant and are 100% recyclable with relatively negligible wear and tear to rolling stock and rails. The new wagons are based on RDSO-approved designs and made from indigenously made

high-strength aluminium alloy plates and extrusions.

The wagons are specifically designed to carry coal to reduce carbon footprint significantly. For every 100 kg weight reduction in the wagon, the lifetime CO saving is 8 to 10 MT. This translates to a saving of more than 14,500 MT of CO for a single rake. With the railways planning to deploy more than one lakh wagons in the coming years, we expect that there will be a 15 to 20% shift to aluminium wagons. A potential annual CO reduction of over 25 lakh MT can be expected, thus making a notable contribution to the country's sustainability goals.



CARGO SOLUTIONS FOR COMMERCIAL VEHICLES

Over the past two years, Hindalco has invested in the creation of an ecosystem of technology partners, vendors and fabricators to introduce lightweight, sustainable applications for last-mile connectivity in the transport sector. We developed the lightest cargo containers with a 30% weight reduction per trip for last-mile mobility operators such as e-commerce companies.

This enhances the battery range by approximately 15% for the users of EVs. The container boxes are made of high-strength aluminium alloys. They are designed with inputs from our partner OEMs using the latest aluminium joining technology to reduce the total cost of ownership (TCO) and thus benefit the end-users. We built 600 containers mounted on various EVs and about 10,000 cargo boxes for last-mile delivery vehicles.



PROPELLING INDIA'S FIRST WATER METRO AT KOCHI

Kochi Water Metro Project is the first-ever integrated water transport system of this size and scale in Asia. It is expected to connect 10 islands along a 76 km route using 38 jetties and 78 Electric Hybrid Catamarans. Our aluminium was chosen as the primary material for the construction of the Electric Hybrid Catamarans.

The boats, with a capacity of 100 passengers each, are powered by lithium titanate oxide batteries, and made of aluminium catamaran hulls and FRP superstructure. Marine-grade flats and angles supplied by our Alupuram Extrusions plant

were used to build the aluminium hulls. The metal's unique combination of lightweight, high strength-to-weight ratio and superior corrosion resistance made it an ideal choice for this project. The boats have been designed uniquely to ensure negligible wave activity.

The project established us as a leading player in the water transportation industry, with enormous potential for growth in India and globally. Kochi Water Metro also won the prestigious Gussies Award (France) for the Best Commercial Passenger Electric Boat in the World.



ALUMINIUM TRAILERS FOR COMMERCIAL VEHICLES: NUVOCO

Light-weight commercial vehicles not only reduce the logistics cost through higher payload and lower total cost of ownership (TCO) but also result in lower greenhouse gas emissions. Following a structured NPI approach, we used high-strength marine-grade aluminium alloys to build trailers for Nuvoco's commercial vehicles.

The trailers, built in accordance with ARAI-approved design, are durable and have better load-bearing capacity yet weigh lighter than an equivalent steel truck. These features help to boost overall mileage by reducing fuel consumption and lead to savings of 28 MT of CO2 emissions over a truck's lifetime.

BATTERY ENCLOSURE FOR PERSONAL MOBILITY EVs

There is an increased consumption of aluminium products in the personal mobility EV space. Catering to this, we have developed solutions such as Battery, Housing, Handlebars, Motor casing and Bus bars for OEMs of 2-wheelers. This was carried out by collaborating with OEMs throughout the cycle, from product development to commercialisation. We aim to emerge as leaders of aluminium-based sustainable product ranges in the sector and aspire to help India become a global design and manufacturing hub for aluminium products and components in the personal mobility space.

At Novelis, our Second-Generation Aluminium Sheet Intensive Battery



Enclosure Solution was developed in collaboration with our industry partners and automotive engineers.

It is designed in a way to maximise weight reduction, reduce costs, and deliver a higher pack energy density.

The product is 50% lighter and shows an improved 30% energy density and 20% better mass reduction compared to commercial battery enclosures.

DEVELOPMENT OF SPHERICAL ALUMINA FOR ADVANCED REFRACTORY/POLYMER APPLICATIONS

Spherical alumina, which has applications in thermal conductive polymers, has the potential to cater to the growing market in refractories. It is normally used in high-end castable applications to get better rheological properties. It is also seeing an increasing demand from domestic refractory manufacturers who manufacture high-end castables. Considering this, we have also developed spherical alumina for polymer application. Our lab trials were conducted successfully, and evaluation of the material is in progress at the customers end.

LAMINATED ALUMINIUM SURFACES FOR BEVERAGE CAN END

Coloured aluminium beverage can-ends, especially black, are popular for new and innovative beverage products and energy drinks. However, producing lacquered black ends poses challenges in terms of colour stability and the can-making process.

Novelis has developed a new aluminium sheet, which comes with a black lamination film. The film is free of Bisphenol A (BPA) and per- and poly-fluoroalkyl substances (PFAS) and meets all food and beverage industry requirements.

The lamination film can be easily applied to the rolled aluminium sheets by a combination of pressure and heat. The lamination of aluminium coils for can-ends also

reduces CO₂ emissions by 33%, compared to the conventional liquid coating, as the process requires less heat and chemicals.

The lamination film can also be removed in the recycling process by thermal pre-treatment and the waste heat can also be utilised.

The innovative application improves beverage container appearance, increase production process efficiencies, and lowers CO emissions for European beverage brands and can makers, thus, advancing our leadership in the growing market.

DEVELOPMENT OF HYDRATABLE ALUMINA EQUIVALENT FOR NO CEMENT CASTABLE APPLICATION

The use of alumina refractory is increasingly becoming critical to enhance the efficiency and quality of products. Products like AA-101 and Alpha bond 300 are generally used in the export market but have very less usage in the domestic market. This has opened multiple opportunities to develop the right product for this application, which led to the development of hydratable alumina (HA). HA is a calcium-free and high-refractoriness binder used in high-performance no cement refractory castable formulations. The product was developed successfully, and commercialisation is in progress.

HIGH-PERFORMANCE BATTERY FOILS

Spherical alumina, which has Battery grade aluminium foil, is used as a cathode current collector in Li-ion cells. At Hindalco, we have developed these battery-grade foils having superior mechanical properties to deliver high performance during manufacturing of Li-ion cells. Our foils are the requirements of various customers in electric vehicles and energy storage in India and abroad.

We have collaborated with the premier institute to develop in-house technology for differentiated foils and comprehensive testing of aluminium current collector foils. Further, we are working on coating technologies to develop high-performance battery foils to deliver better adhesion, corrosion resistance and reduced charge transfer resistance.

Innovate to Evolve: Our Partnerships

We actively seek collaborative partnerships to create scalable solutions. Our long-term associations with Aditya Birla Corporate R&D Centre at ABSTC, thought leaders, academic and research institutions and technology providers have supported us in developing new solutions and optimising our operational performance.

Further, we are constantly on the lookout to identify opportunities to participate in. Being active contributors and participants also enables us to increase our reach and scale and bring us impactful learning experiences.

Our collaboration with ABSTC is focused on developing sustainable technology solutions for core processes in Hindalco units. The major focus is on the reduction in specific energy consumption in the aluminium smelting process.

Over the last few years, the aluminium smelting team at ABSTC has worked on the 'Roadmap for Energy Reduction in Hindalco Smelters', and developed several innovative solutions like CuCB, Energy Saving Lining, Magnetic Compensation, Improved Anode Assembly, 400 kA pot design, New Pot Controller and Digital Twin, which are generating significant value to Hindalco. At the end of FY 2021-22, the ABSTC team developed three new roadmaps namely, (i) Low Energy High Productivity 400kA, (ii) Carbon Anode Technology, and (iii) Transformative Technology covering Process Control and Digital aspects and all aluminium smelting activities have been aligned to these three roadmaps.

In FY 2022-23, the ABSTC team worked closely with our team in Hirakud, Mahan, Aditya and Renukoot smelters, focusing on all the chartered research projects and

technical support requirements. Some of the key highlights of the initiative were:

- Hindalco's management approved the proposal to install a booster section in Mahan potline to test the 400 kA solution,
- Trials of a new design (without booster) were initiated successfully at Mahan smelter,
- New collector bar and energy-efficient lining design trial initiated in Aditya,
- New copper insert collector bar, designed and trialled in 72 kA pot at Renukoot Smelter,
- Digital Twin with AWS cloud platform was implemented in Aditya smelter,
- New pot controller trial initiated in one pot of Hirakud 235kA smelter,
- Carbon anode process benchmarking and optimisation performed to improve the electrical resistivity and baking level of anode,
- CFD model of anode baking furnace (ABF) developed and validated for Renukoot and Mahan. This would be used for ABF design retrofitting analysis related to 400 kA.



Over the past few years, the aluminium smelting team at Aditya Birla Science and Technology Company has developed several innovative solutions to reduce energy consumption in Hindalco's smelters

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We actively seek collaborative partnerships to create scalable solutions. We have partnered with IIT Bombay to conduct research on the neutralisation of our bauxite residue (bulk waste) and the identification of new applications. We have also collaborated with ICT- Mumbai to develop specialty coatings and lubricants.

Furthermore, we have partnered with CSIR-IMMT (Institute of Minerals and Materials Technology) Bhubaneswar to reduce arsenic in copper liberator cake

by optimising the electrowinning process in a refinery. We also engaged with IIT-Gandhinagar to develop a suitable process for recovering gold from primary dore slag generated in our Precious Metal Recovery (PMR) plant. We also collaborated with renowned cement companies to use smelter ferro-sand and ETP gypsum in the cement industry. Our partnership with National Environmental Engineering Research Institute pertained to a project on the reclamation of a gypsum dump yard.

We are also working on alternate cell chemistries and have partnered with leaders in the oil & gas and energy sector for aluminium air battery technology. Further, we are developing novel aluminium alloys and solutions for the recycling of spent electrolytes for batteries. In addition, we are collaborating with various organisations in alternate cell chemistry for the development of raw materials.

ENHANCING ENERGY EFFICIENCY AT ADITYA THROUGH COPPER INSERTED COLLECTOR BAR

A new design of copper-inserted collector bar (CuCB) along with cell lining was developed along with the ABSTC team and tested in one pot. The objective of this trial was to validate the ideas of copper insert, PSW design, and usage of the high insulation material for high amperage operation. Learnings from the trial will help us to finalise the lining for the booster trial. Additionally, it is expected that the

pot will operate at a reduced specific energy of approximately 70 kWh/MT of aluminium. The increased mass of copper will reduce the cathode voltage drop (CVD) along with an improved current distribution in the cathode. Sidewall insulation lining modification leads to a change in the bath cavity; thus, pot start-up parameters were tuned accordingly. The pot is under trial and is running smoothly.

IMPROVEMENT IN ENERGY EFFICIENCY AND PRODUCTIVITY AT HIRAKUD

Improved Cell design for existing pots: A new design for a steel shell of 235 kA was finalised to reduce steel shell temperature and avoid pot failures due to side wall leakage. The modified design resulted in a more uniform distribution of heat loss. The modified steel shell was found to reduce the temperature by 15°C. This reduced temperature indicates sufficient ledge thickness and no appearance of a red spot. The new busbar configuration is also being developed to operate the pot at above 235 kA and reduce the specific

energy consumption further. This modified busbar design is planned to be tested in FY 2023-24.

Horizontal deployment HiPoT-85kA bus bar design in line three: A 3-riser bus bar design was developed with better magnetic compensation, for line-4. Currently, the plant is in the process of horizontal deployment of this design in line-3. A feasibility study was performed through E-mag analysis and results confirmed that it will be safe to replicate this design in line-3.

LOW ENERGY 400kA HiPOT DESIGN AT MAHAN

The new 400kA cell design developed jointly by ABSTC and Mahan team was selected for plant trials. The trial at operating amperage will have challenges with respect to thermal balance, which would be taken care of by an additional voltage to maintain the required internal heat generation.

The trial will be followed by a premature shutdown and pot autopsy to assess the condition of the cathode lining. The position of the reaction front in the lining will be helpful to predict the pot life.

Based on the results of the pot autopsy, corrective actions will be taken, if required before implementation. The trial was initiated successfully in one pot using the existing anode at Mahan smelter.



Net Zero Lab Valais, a collaboration to advance carbon neutral solutions of Aluminium manufacturing



NET ZERO LAB VALAIS: A COLLABORATION FOR A CARBON NEUTRAL FUTURE

Novelis signed a long-term collaboration agreement to start a joint research and development (R&D) laboratory, Net Zero Lab Valais. The lab will aid in advancing carbon-neutral solutions for aluminium manufacturing. The agreement was signed with HES-SO Valais-Wallis in collaboration with EPFL of Energypolis Campus, a Swiss innovation and research hub, as well as energy distributor OIKEN.

The lab will be located at Novelis' plant in Sierre, Switzerland. Due to the availability of renewable energy and strong research institutions, the Sierre site, the broader Valais region and Switzerland are an ideal fit for the planned initiatives. The lab will focus on research in identifying and implementing innovative solutions to neutralise the carbon footprint of Novelis manufacturing operations and neighbouring communities. The aim is to reach carbon neutrality for Scope 1 and 2 emissions at the plant by 2030.

The Net Zero Lab Valais is another lever for increasing energy efficiency, reducing waste, and supporting our communities. We will develop innovative solutions that we can later implement on a broader scale at our different production sites across the globe while we continue to work on increasing the recycled content in our products to deliver the lowest total carbon footprint for aluminium sheets.

AL - SMELTER DIGITAL TWIN FOR HINDALCO

A digital twin of the smelter was developed with the ABSTC team for predicting the current efficiency of individual pots. The prediction model was tested and deployed at Mahan to improve process performance and reduce carbon footprint. Multiple deployment architectures have been explored for sharing of CE% model with different plant units. A cloud-based approach on the AWS environment was used for deployment

at Aditya. The model is executed daily, and results can be visualised in a customised web-based GUI. The pot failure prediction model after being customised for Aditya smelter was validated by comparing the predicted remaining life to the actual remaining life obtained after the pot autopsy. The deployment of the pot failure prediction model and ROM for thermal health prediction has been planned and would be deployed in FY 2023-24.

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Innovate to Excel: Our Digital Journey

With Industry 4.0 redefining the global manufacturing outlook, we have embarked on a journey to transform Hindalco into a digitally-enabled Company. Along with bringing in a myriad of opportunities for streamlining business and innovative data usage, it comes with inherent threats and risks. We recognise that cybersecurity poses an increased risk to our business and stakeholders. We are continually refining our internal policies, systems, certifications, and awareness and ensure no internal or external security events impact our business continuity. We have developed and continue to improve upon a comprehensive information security and cyber resiliency system.

In an ever-changing world, we are pioneering the use of blockchain in supply chain and sustainability, artificial intelligence (AI) initiatives in logistics and transportation, digital twins for key operations like power plants and smelters to optimise and reduce energy consumption as well as full traceability of the coal supply chain.

The current year saw significant improvement in the data infrastructure across all plants and the cyber security integration across IT and Operational Technology. The focus will continue to be on creating big business impacts by scaling up adoption and completing ongoing projects across plants. We are also creating a Hindalco Data Lake and democratising data in operational, sales and marketing.

We have transitioned from our old Enterprise Resource Planning (ERP) system to Ekaayan, which is one of the largest transformation programmes undertaken by a company in the Asian region.



We have embarked on a journey to transform Hindalco into a digitally-enabled Company.

This will accelerate the adoption of analytics to improve performance and sustainability goals.

Our digital strategy is well aligned and in synergy with our long-term goal of creating a more sustainable business model for the future. Our key focus areas include analytical assessments on emissions, energy, water and waste management and carbon capture opportunities. We are also strengthening our digital systems in logistics and transportation, process optimisation, workplace safety, employee upskilling, and eliminating the use of paper.

Along with this, we have invested in platforms that help collate data and facilitate real-time monitoring to identify trends and early indicators of failures, if any, across our operations. Our key IT initiatives include an industrial IoT platform, real-time data monitoring and analytics, video analytics, data warehouse, digital twin, visual analytics and AI/ML-based predictive maintenance platforms.

Hindalco Information Technology Policy guides our practices around cybersecurity and the protection of our information assets. The policy is available on our website and is accessible to all stakeholders, and is updated periodically to synchronise with the evolving IT landscape.

Our IT governance and strategy are monitored by the Risk Management Committee and headed by Chief Digital Information Officer (CDIO). We have also appointed a Chief Information Security Officer (CISO) who reports to the CDIO and is wholly responsible for overseeing the cybersecurity activities across the Company.

We have formed an Information Security Management Committee, which consists of the working committee members, including executives from all IT centres, such as corporate IT and location IT, and is chaired by the CISO. The working committee further reports to the steering committee, which includes senior executive members such as the MD, CFO, and CDIO.



We conduct regular training for our employees on IT and cybersecurity ensuring employees are aware of threats and better prepared to handle them

We conduct regular training for our employees on IT and cybersecurity ensuring employee awareness and better preparedness. Information Security is also an integral part of the new hire orientation programme. We observe Information Security Week every year to raise awareness about information security and integrate it into our culture. Further, to strengthen security awareness among employees, a comprehensive information security awareness programme was launched that keeps users engaged and updated throughout the year.

We ensure our systems and processes are resilient to face any potential threats. Our complete IT infrastructure is certified with ISO 27001 Information Security Management System. We aim to carry out vulnerability assessment and penetration testing for all our infrastructure semi-annually by external auditors to identify potential threats and contain them effectively. We have improved our threat landscape visibility and now have a deeper insight into telemetry. Network segmentation has been improved to contain the damage of any future adverse scenario. For faster detection and quick response, we have

implemented architectural changes and adopted new technology solutions, i.e. End-point Detection and Response (EDR).

We have an Incident Reporting Form on our intranet portal on which any breaches of information security actual or suspected can be reported. The incident will be investigated by the security team and further action will be taken based on the severity.

Information security also forms a part of employee performance evaluation, and employees are liable to face disciplinary action for any non-compliance. Owing to our concerted efforts, we did not have any cases of data breach and information security failure in the reporting year, and no complaints were received from any stakeholder regarding data breaches, including customer privacy in the past two financial years.

Our digital strategy is well-aligned and in synergy with our long-term goal of creating a more sustainable business model for the future.

CYBER SURAKSHA ABHIYAN

Cyber Suraksha Abhiyan was implemented to increase employee awareness of information security.

The programme offers knowledge using several different modes, including threat simulation exercises, e-learning, online sessions, posters, infographics, wallpapers, screensavers, news, case studies, reference docs, events and celebrations, etc.

Users are engaged throughout the year, and their assessment is done regularly. It also offers a dedicated infosec helpline, where users can raise any query related to cyber security and get their doubts cleared.

This has played a pivotal role in transforming the weakest link of the security chain, i.e. employees to the first line of defence by raising their infosec awareness.