

# Manufactured Capital



## Striving to Lead the Industry with Excellence

To become a global high-performing contemporary organisation, we have significantly expanded our product portfolio, focusing strongly on downstream and value-added products.

We at Hindalco believe that aluminium and copper are the fundamental building blocks for a sustainable future. We are determined to contribute significantly to India's Net Zero transition journey, aligning with our commitment to environmental stewardship.

Our products play a vital role in various applications and sectors, including electric vehicles, energy-efficient buildings, and modernised electrical grids, which are instrumental in reducing GHG emissions. Our products enrich the lives of our customers by offering enhanced performance, increased convenience, and an overall superior experience. By collaborating closely with our customers and partners, we are committed to supporting India in achieving its ambitious Net Zero goal.

### Focus Areas

Downstream expansions in aluminium and copper	Driving operational excellence
Process digitalisation	ESG integration across the value chain

### Key Highlights

Manufacturing Facilities*	Operational Mines*
<b>19</b>	<b>21</b>
Overseas units of Novelis	Primary aluminium metal production*
<b>33</b>	<b>1.32 Mn MT</b> (Highest-ever)
Alumina production*	Copper Cathode production*
<b>8%<sup>^</sup></b> (Highest-ever production)	<b>11.79%<sup>^</sup></b>

\*India Operations | <sup>^</sup> YoY growth

### Contributions to SDGs



### Interlinkages with material topics and other capitals

#### Material topics

- ▶ Market Presence

#### Capitals connected

- ▶ Financial Capital
- ▶ Natural Capital
- ▶ Intellectual Capital
- ▶ Human Capital
- ▶ Social & Relationship Capital

### Key Risks and Opportunities addressed

R3	Price volatility of aluminium
R4	Increased import of aluminium
R2	Supply chain risks
R9	Changes in the regulatory requirements

### Alignment with Strategic Priorities

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

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## Production Capacity

Alumina	Specialty Alumina	Primary Aluminium	Aluminium VAP
<b>3.6 Mn MT</b>	<b>0.36 Mn MT</b>	<b>1.30 Mn MT</b>	<b>0.40 Mn MT</b>
Copper Cathode	Copper Rods	Novelis Rolling Capacity	
<b>0.42 Mn MT</b>	<b>0.54 Mn MT</b>	<b>4.1 Mn MT</b>	

We are a leading aluminium, copper, and chemicals producer with over 52 manufacturing locations across 10 countries.

Our copper division, which operates one of the largest custom smelters in the world at a single location, meets more than half of India's copper requirements. We are one of the leading manufacturers of specialty alumina, supplying our high-quality products to customers across major geographies.

### Overview of Our Production

We observed a robust domestic demand for aluminium and copper across sectors, with a 14% jump year on year in aluminium consumption and a 22% jump year on year in copper consumption.

This steep demand arose due to the increased use of aluminium and copper in the electrical, automotive, building and construction sectors.

Hindalco's integrated portfolio encompasses the entire value chain, starting with bauxite mining, alumina refining, smelting, and converting primary metal into downstream value-added products.

Our finished products includes alumina, primary aluminium in the form of ingots, billets, and wire rods, as well as an array of value-added products such as flat rolled products, extrusions, and foils. We utilise metallurgical alumina for our captive needs. In contrast, chemical alumina and hydrates find applications across various industries, such as water treatment, cable and plastic fillers, refractories, ceramics, and glass manufacturing.

During FY2022-23, our wholly owned subsidiary Novelis, the world's largest flat-rolled aluminium producer and recycler, sold 3.79 Million MT of FRP in beverage cans, automotive, aerospace and specialties sheets.

We anticipate a 3% year-on-year increase in global demand for FRP aluminium.

To cater to this demand, Novelis is well-equipped with a rolling capacity of 4.1 Million MT and uses more than 2.3 Million MT of recycled material inputs.

Novelis operates in 33 units spread across nine countries, with 15 equipped with recycling capabilities. Novelis recycles post-consumer aluminium, such as used beverage cans and post-industrial aluminium, such as class scrap and is the largest recycler in the world.

Hindalco has the largest custom copper smelter in Asia (ex. China), where we conduct smelting and refining operations and manufacture value-added downstream products. Our product range includes copper cathodes, continuous cast copper rods (CCR) in various sizes and precious metals such as gold and silver. In our manufacturing process, sulphuric acid is a major by-product.

Production details from FY2019-20 to FY2022-23 ('000 MT)					
Segment	Parameter	FY2019-20	FY2020-21	FY2021-22	FY2022-23
Aluminium Upstream	Alumina*	2,768	2,699	3,235	3,525
	Primary	1,319	1,229	1,294	1,322
	Flat-Rolled Products	291	233	301	287
Aluminium Downstream	Extrusions	41	37	50	52
	Foils**	18	19	28	29
	Copper				
Copper	Copper Cathodes	326	262	359	407
	Copper Cast Rods	245	235	259	347
Novelis	Flat-Rolled Products (Shipments)	3,273#	3,613	3,858	3,790

\* Hydrate as alumina | \*\*Part of Flat-Rolled Products production | # Excluding Aleris

## Specialty Alumina (Chemicals) Business

Our chemicals business is committed to delivering the highest quality products and services to our customers.

The business is committed to delivering sustainable products through various initiatives like biomass utilisation, harnessing renewable energy and complete utilisation of bauxite residue leading to a green alumina road map.

We operate as a customer-centric market-serving team by engaging with customers and delivering tailored solutions. These efforts have resulted in remarkable growth in EBITDA over the past two years, and we anticipate a two-fold growth in the next three to four years.

We constantly invest in new technologies and processes to take advantage of emerging markets and ensure we are at this industry's forefront. Our two manufacturing units in Belagavi and Muri have been manufacturing hotspots for the chemicals business for the past



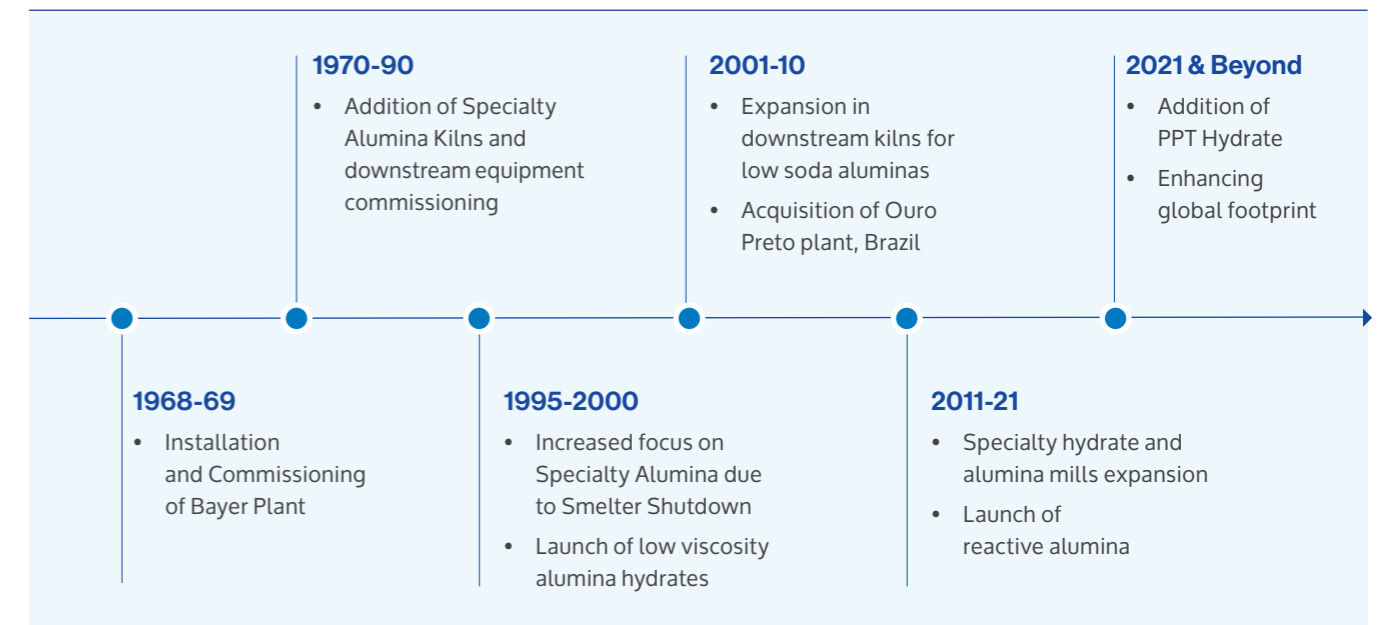
four decades. These facilities have empowered us to serve customers across 42 countries globally.

We are supported by Hindalco Innovation Centre – Alumina, recognised by the Department of Scientific & Industrial Research (DSIR), Government of India, for our research and development activities. Our key market segments include water treatment chemicals, ceramics, refractories, glass, and abrasives, reflecting our expertise and reach in these domains.

Alumina's remarkable mechanical properties, thermal stability, strength, and chemical inertness make it a material of choice primarily in three major applications: refractory, ceramics, and polishing.

Also, alumina's insulating properties make it ideal for electrical insulators, circuit boards, batteries, and other electronic applications. Aluminium hydrate, an effective flame retardant, is used in the wire and cable industry.

### Journey of Our Chemical Business



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Hindalco's chemicals business has diverse manufacturing capabilities. Our alumina refinery and downstream operations in Belagavi, Karnataka, have a capacity of 340 KT for producing specialty chemicals. Similarly, our alumina refinery and downstream operations in Muri, Jharkhand, have a capacity of around 400 KT. Moreover, our carbon manufacturing plant in Belagavi, with a capacity of 45 KT, is a leading producer of high-quality carbon products.

Belagavi and Muri have obtained ISO 50001 certification highlighting our commitment to energy management and sustainable practices. Muri Operations has received the National Award for Manufacturing Competitiveness.

The Hindalco Innovation Centre in Belagavi is a modern research and development facility dedicated to developing new technologies and processes to improve our products and operations.

We are proud to be a part of the global specialty alumina chemicals industry and are committed to continue growing and expanding our business. Our focus on quality, customer service, and innovation will help us achieve our goals.

The domestic market for specialty alumina is experiencing double-digit growth in India, while global markets are seeing a steady 5% to 6% growth in various applications. Given this promising trend, we have set our sights on expanding our current production capacity and aim to double it by FY2026-27.

We are currently converting our Muri operations to produce specialty alumina. The expansion goes beyond mere operational growth; it also involves the integration of modern technologies to enhance processes and product quality. The plant can now produce multiple grades serving water treatment, refractory and ceramics markets within India and East Asia.

Our primary objective is to broaden our product portfolio by focusing on Value-Added and Super Value-Added Products. In our primary market, India, very few manufacturers offer Value-Added Products and Super Value-Added Products, resulting in a heavy reliance on imports. As an integrated player, we have abundant resources that give us a unique advantage to become a key player in these markets. Our goal is to not only substitute domestic imports but also to export products in large volumes, strengthening our global presence.

We are expanding our in-house development capabilities for halogen-free fire retardants and high-end ceramic products. These offerings have gained significant interest across various industries, such as semiconductors and lithium-ion battery separators for electric vehicle batteries. We recognise the growing demand for these items and are committed to meeting the needs of our customers in these sectors.

## CO-DEVELOPMENT OF HIGH-END SERIES OF ALUMINA WITH CUSTOMERS

Alumina needs to be tailored to specific grades for applications on parameters such as specific surface area and particle size. We collaborate with our customers throughout development to fulfil these particular needs. For example, in FY2022-23, we partnered with Hindalco Innovation Centre (alumina) to develop grade SMA4 for refractory applications.

The product underwent a series of application studies and analytical tests to assess its suitability for refractory end-use. We also provided the customer with product samples at various process stages to ensure alignment with their requirements. This close collaboration allowed us to meet their needs, fostering a solid and enduring customer relationship.

As we continue to expand, we focus on ramping up low-carbon aluminium production to at least 30% of its output within three to four years. This move is driven by the increasing demand from global consuming industries, seeking to clean up their supply chains.

We are finalising a contract with a renewable energy provider for a round-the-clock (RTC) power supply sourced from pumped hydro water storage. With a 100-megawatt capacity, this pilot project is expected to start operations in 2024. Its primary objective is to supply reliable and sustainable power to our existing smelter at Aditya through the grid. The outcome of this pilot programme will be decisive in assessing the viability of utilising Round-The-Clock renewable energy in our smelters. It will pave the way for integrating RTC renewable energy to achieve low-carbon aluminium production in India.

In FY2022-23, we entered into a commercial agreement with Greenko Group, one of India's largest renewable energy companies. This agreement entails the provision of RTC carbon-free electricity for our Odisha smelter for 25 years. This initiative shall help us enable a CO<sub>2</sub> reduction of 680,000 MT annually through 100 MW of captive power, which shall be enhanced to 350 MW in the future. The project is slated to be the first such in the world for the aluminium sector. Hindalco could become the first aluminium company in the country to use RTC's carbon-free power for smelting. Furthermore, we are pivoting towards integrating cleaner energy sources into our operations to fulfil the potential demands of implementing the European Union's Carbon Border Adjustment Mechanism (CBAM), which imposes levies on carbon-intensive aluminium imports from other countries.

We are commissioning a precipitated (PPT) hydrate plant with a capacity of 20 KT by FY2023-24. The precipitates and hydrates due to be produced by this plant are fine particles of about 1 to 2 microns in size, and they find applications in various sectors. Notably, these particles are essential for meeting the new safety standards for halogen-free wires in flame retardants. They are also used in producing paints and other industries.

In addition to PPT hydrate, our product portfolio enrichment includes development of white fused alumina and tabular alumina for applications in refractories and abrasives; high precision sub-micron alumina with excellent insulation properties & protection, high purity 3N/4N alumina and high crystalline alumina for advanced applications in industrial ceramics; activated alumina used as an adsorbent/catalyst in petrochemical and refinery industries.

To become the global leader in terms of technical superiority and customer centricity and to enhance our relationships with stakeholders, we are strategically expanding our presence worldwide.

This expansion includes setting up warehouses, processing offices, and sales offices in the US, Europe, and Southeast Asia regions. We recently have set up a sales office in Japan to cater to the far-east Asia markets.

## Growing Our Operational Footprint

Over the next decade, the demand for aluminium in the Indian industry is projected to double from 4.5 Million MT to ~9 Million MT. This growth will likely be supported by strong demand in packaging, automotive and transport, building and construction, and industrial machinery.

Across our upstream locations, we currently have an alumina capacity of 3.6 Million MT, and we have strategically planned brownfield expansions at various sites. One such expansion project is underway at the Utkal refinery. The debottlenecking project, with a capacity of about 350 KTPA, will elevate the refinery's current capacity of 2.2 Mn TPA to approximately 2.6 Mn TPA by the end of FY2023-24. In alignment with our ESG commitments, we have decided to refrain from any expansion based on thermal power at our smelters.



Our primary objective is to broaden our product portfolio by focusing on Value-Added Products.

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As a result of our efforts, we successfully shipped about 200 MT of low-carbon aluminium during FY2022-23.

In the next 10 years, we anticipate global copper consumption to double. To meet the ever-growing demand, we acquired Polycab's CCR unit, Ryker (now Asoj), in FY2021-22, which can produce 225,000 MT copper rods. This acquisition has positioned us among the world's top 3 copper rod players outside of China.

Copper products play an important role in expanding markets such as electric vehicles and renewable power, where their exceptional electrical conductivity is essential.

As a result, we are making new forays into the copper market and expanding our presence in downstream applications. We plan to enter the market for superior copper alloy rods used in railways and inner-grooved copper tubes for air conditioning and refrigeration applications. Additionally, we plan to install a copper and e-waste recycling facility of 50 KTPA.

Eterna, our new-age doors and windows brand, provides customised window solutions that deliver high performance by combining advanced design with unique alloys.

It serves the direct consumer market and allows us to establish closer relationships with our customers while enhancing our brand reputation.

At Novelis, we have a transformational growth planned of about \$4.5 Billion worth of capital expansions for the next five years. Out of these, \$3.3 Billion worth of project expansions across different categories are already underway. These expansions include an integrated rolling and casting facility of 600 KT capacity in Bay Minette, Alabama, expected to be commissioned in FY2026. The facility is expected to be the world's most sophisticated, automated, safest, and greenest aluminium rolling mill.

We also have planned an automotive-focused sheet ingot recycling facility of 240 KT capacity. The facility is expected to be commissioned in FY2025 at Guthrie, Kentucky.

Moreover, we are expanding our facilities in Korea and have planned a 100 KT casting and recycling facility.

The plant shall help us progress towards our ESG goals as it will reduce our carbon footprint by 420,000 MT annually.

We are investing more than \$30 Million to build a new continuous annealing line at our facility in Plettenberg-Ohle, Germany. The investment shall double the plant's aluminium production capacity for coffee capsules. It will cater to the increasing demand for sustainable packaging solutions as these capsules are 80% recycled aluminium. Furthermore, we have partnered with Sortera Alloys, an innovative industrial scrap metal sorting and recycling company, to utilise their advanced sorting technologies, such as AI imagery, data analytics and advanced sensors. The collaboration shall aid in increasing the recycling and reuse amounts of automotive post-production and post-consumer scrap at our Guthrie recycling facility.

## Expanding Our Downstream Capability

Hindalco is the only large and organised player in the downstream sector in India. We delivered a strong performance in the downstream business due to an enriched product mix and improved operational efficiencies. Our downstream strategy includes product enrichment, adding new products/solutions, and debottlenecking assets.

We plan to enrich our product mix by commissioning the Silvassa extrusion facility with a capacity of 34 KT by FY2023-24. Silvassa will service the fast-growing market for extruded aluminium products in western and southern India. Our 170 KT FRP project with casting and cold rolling in Aditya and Hirakud will contribute to enhancing our downstream capacity. Furthermore, our coated aluminium AC fin project in Taloja, Maharashtra and the copper IGT project in Waghodia, Gujarat, under the Government's PLI scheme is on track as per the scheduled timeline.

Across the world, countries, including India, are encouraging people to transition to electric vehicles (EVs) to reduce their dependency on fossil fuels and achieve the global goal of zero carbon emissions.

In pursuit of its Net Zero target by 2070, India has implemented various incentive schemes and measures to drive the adoption of EVs by reducing their costs. As a result, the Indian EV market has grown rapidly over the past few years and is likely to multiply. We are developing new products such as battery enclosures and battery foils to capitalise on this opportunity.

Towards this, we are targeting commissioning our battery enclosure facility (6.5 KT) in FY2023-24 and Battery Foil mill (24 KT) by FY2025-26.



Hindalco is the only large and organised player in the downstream sector in India.

Debottlenecking projects across our plants continue to enhance downstream capacity.

For instance, we have commissioned a new line to augment circle blanking capacity by ~8 KTPA and a new degreasing line of 24 KT capacity in Renukoot. This initiative will help us enhance our product offerings and expand our downstream capacity from ~400 KT to 600 KT by FY2026-27.

Copper's versatility and suitability for diverse applications make it an ideal metal to help us align with our commitment to ESG initiatives and meet our Company's and customers' sustainability goals.

Consequently, we have planned to move further in the downstream segment and incorporate circularity for the copper value chain.

### Major initiatives

- We have installed a superior manufacturing facility with a capacity of 5 KTPA, capable of manufacturing various copper alloy rods, including Copper Magnesium. With high tensile strength and a better environmental footprint, this alloy will have applications in railways.
- We are installing India's first Inner Grooved Copper Tube facility with a planned capacity of 25 KTPA. These thin-walled, small-diameter tubes have applications in air conditioning and refrigeration.
- We are installing the first-of-its-kind copper and e-waste recycling facility with a capacity of 50 KTPA cathode.

These strategic ventures will enable us to enter new markets, reduce our reliance on imported products and positively impact our profitability.



Novelis integrated rolling and casting facility of 600 KT capacity in Bay Minette, Alabama, likely to be commissioned in FY2026, is expected to be the world's safest and greenest aluminium rolling mill.

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## Driving Operational Excellence

We are committed to operational excellence by investing in the right capabilities, capacities and conducting internal and external benchmarking to adopt best practices.

We are also adapting to new-age technologies to streamline costs, process efficiencies and new product developments. Our initiatives, such as World Class Manufacturing (WCM),

as well as Maintenance Strategy and Execution Framework (MSEF), have helped us to improve process excellence. We hold Kaizen competitions across all our operations to increase employee engagement and develop problem-solving skills in our employees.

Our employees submitted a total of 32,334 Kaizen projects. We also implemented a total of 850 continuous improvement (CI) projects, which helped us achieve a saving of ₹51.03 Crore during FY2022-23.

Sustainability initiatives remain a continuous focus of our operations. For instance, we invested in revamping a soaking pit and annealing furnace to reduce the energy consumption to less than 1150 kWh/MT.

We have plans to start an RO plant in Taloja Unit to achieve Zero Liquid Discharge while also increasing our solar capacity in Alupuram by 2 MW. Solar power accounts for ~26.4% of total power consumption at our Alupuram facility.

## REDUCTION IN AUXILIARY POWER CONSUMPTION ACROSS HINDALCO POWER PLANTS

Through a collaborative approach, we continuously conduct process improvements to reduce auxiliary power consumption (APC) in our Captive Power Plants at Aditya, Mahan, Hirakud, and Renusagar.

The initiatives included de-staging of BFP pumps, ID fan loading optimisation, change in the construction material of cooling tower fans and optimising running hours of various equipment.

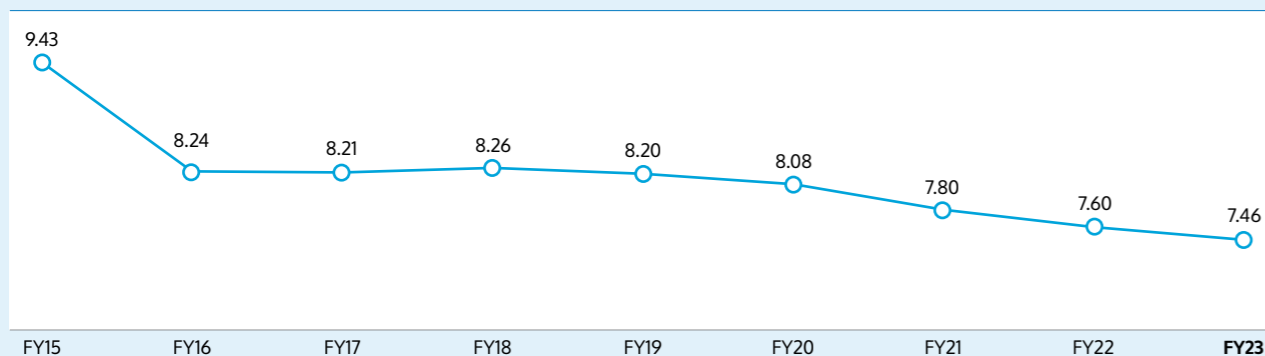
Through the various initiatives taken, there has been a year-on-year



improvement in APC consumption. Along with FGD operation at Aditya and Mahan, we achieved an overall APC consumption reduction of 0.14%

in FY2022-23 compared to FY2021-22. This reduction resulted in approx. annual coal cost saving of ₹10 Crore and 2.3 Million tCO<sub>2</sub> emission.

Overall Hindalco auxiliary power consumption (%)



## AMPERAGE INCREASE IN ALUMINIUM SMELTER

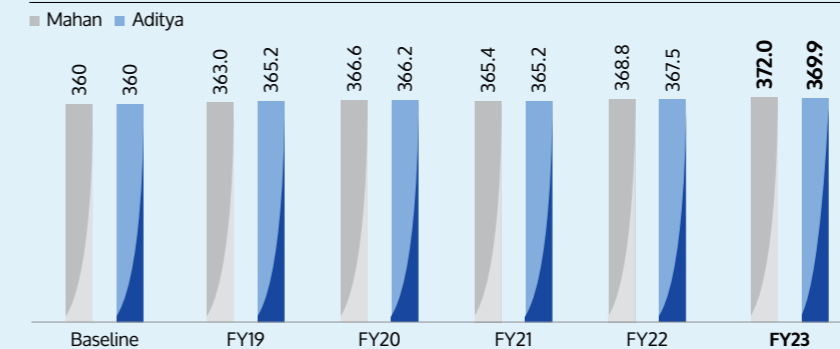
We have consistently worked to increase amperage and enhance metal productivity at our new-age smelters, Mahan and Aditya.

We have achieved an exit current of 374 KA at Mahan and 372 KA at Aditya, respectively, against the designed capability of 360 KA. Mahan Aluminium is the first

Indian smelter to achieve 374 KA in FY2022-23.

Some initiatives taken to increase the amperage comprise using copper insert collector bar, new lining design implementation, digital twin, and various simulations by Aditya Birla Science and Technology Company (ABSTC).

Amperage increase in Mahan & Aditya (Avg Current (KA))



## HIGH PURITY METAL PRODUCTION

We strive to innovate our processes to produce metal of the highest purity among primary producers in the world.

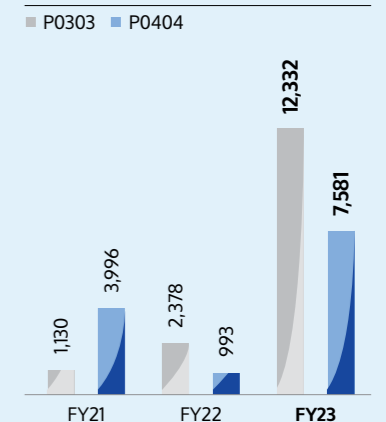


Our Mahan smelter has been producing metal with the lowest ferrous (Fe) content among the AP30 smelters for five years.

Mahan has produced 12 KT P0303 grade and 7.5 KT P0404 grade in FY2022-23, which is by far the purest Aluminium metal in India with about 99.90% and above aluminium content.

This outperformance was made possible by using the finest quality raw materials for anode making, implementing specialised operation and process control in pots, and maintaining close coordination between the pot room and cast house teams.

High Purity Production (in MT)



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## Maintenance Strategy and Execution Framework

We introduced the Maintenance Strategy and Execution Framework (MSEF) in FY2021-22 to assess and improve the maturity of maintenance and reliability practices across our locations. It has proved extremely useful in helping us achieve the highest equipment reliability and availability levels while reducing costs and minimising downtime.

Building on the success of our MSEF framework, we launched the MSEF 2.0 in FY2022-23, representing a significant milestone in our journey towards maintenance excellence. The framework incorporates the latest best practices and technologies in maintenance. It also covers digital asset management, predictive and prescriptive maintenance, connected workforce and IT/OT security. The framework, built on the principles of strategy, execution, and results, has enabled us to improve equipment reliability, availability, and performance significantly.

### Asset Performance Management for Aluminium Upstream

To further strengthen the maintenance and reliability practices across our manufacturing operations, we have

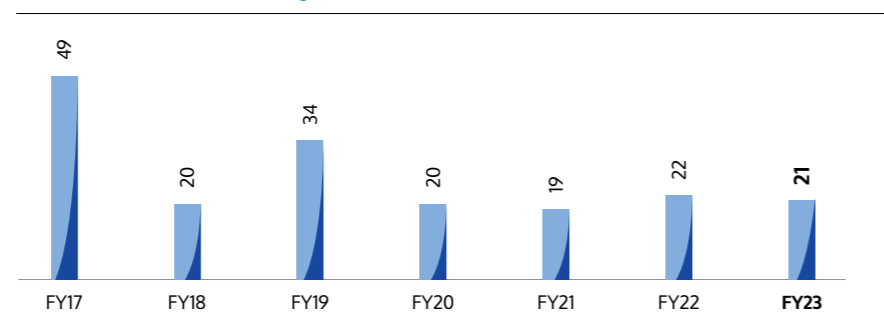
established second and third-level leading indicators to provide a comprehensive understanding of the reliability and performance of the assets. We have leveraged cutting-edge technologies for online and offline Condition Based Maintenance (CBM) and prescriptive maintenance technologies, which help detect anomalies well in advance, utilising real-time equipment and data processing.

We have also developed standards which provide corporate guidelines and industry best practices to standardise our reliability practices regularly. Adhering to these standards, ensures consistency, efficiency, and effective risk management across all asset-intensive operations. This compliance has significantly reduced the risk of unexpected failures, thus improving the overall asset uptime and reliability.

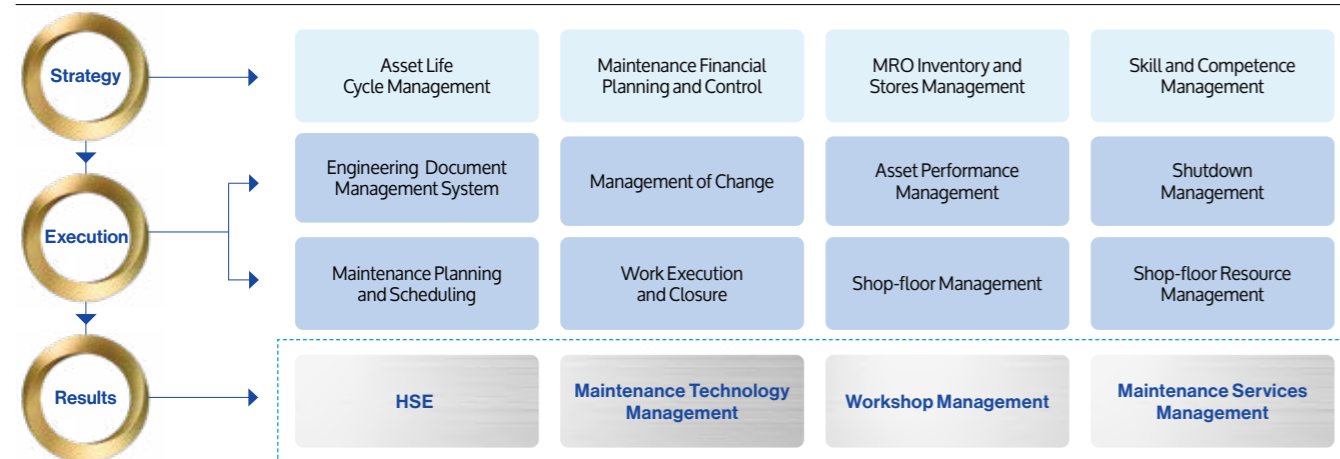
Consequently, our concerted efforts resulted in outpacing our defined targets such as:

- Improved availability of critical circuits of hydrate and calciner by approximately ~0.5 to ~1% at our Refineries.
- Improved mean time between failure (MTBF) for critical ball mills from 636 hours to 700 hours as compared to FY2021-22 in our refineries.
- Improved the overall carbon plant availability by ~1% and maintained the availability of Pot Tending Machine (PTM) and electric overhead travelling (EOT) cranes by close to 95% in all our smelters.
- Reduced the incidents of boiler tube leakages (BTL) by ~57% since FY2017, in line with the established reduction roadmap at our power plants.

Reduction in boiler tube leakages (Numbers)



### Maintenance Strategy and Execution Framework (MSEF)



\* MRO- Maintenance, Repair and Operations

## REDUCTION IN TOTAL HARDNESS OF WATER TREATED IN EFFLUENT TREATMENT PLANT (ETP) AT BIRLA COPPER

Due to elevated calcium, magnesium, and sodium sulphate levels in ETP-treated water, we undertook aqueous simulations and laboratory studies to address the high total hardness in the treated water.

The results of these initiatives were implemented in our plants, resulting in a reduction of 30% in soda ash consumption and a 20% decrease in conductivity at the reverse osmosis (RO) facility.



## Build Quality in Process (BQiP) Framework to improve our Downstream Quality

Our products' quality and timely delivery are essential for nurturing strong customer relationships and maintaining our credibility in the market.

Therefore, in our commitment to enhancing our downstream products' quality, we introduced the BQiP Framework in FY2021-22. The Framework consists of a comprehensive evaluation process based on 24 criteria. These criteria include Material Handling, Packing and Storage Standard, RCA & Horizontal replication of learning (Reliability Calls), and Computerised Maintenance Management System (CMMS), among others.

The result of this evaluation helps us identify the strengths and opportunities for improvement at our downstream operations and helps us quantify the improvement at all locations. For instance, our Renukoot operations showed a year-on-year improvement of 24% across all criteria.

To enhance the quality of our downstream products, we introduced the BQiP Framework in FY2021-22

This change was seen after multiple process improvement projects were implemented, resulting in the efficient utilisation of resources, reduced energy consumption, enhanced product quality, and safety.

## Integrated and Robust Management Systems

We have implemented robust processes and systems across all our locations. Our integrated management systems are certified at our offices and manufacturing units within Hindalco's India operations. The units hold certifications such as ISO 9001 for Quality Management Systems, ISO 14001 for Environment Management Systems and ISO 45001 for Occupational Health and Safety Management Systems. Additionally, six of our units – Aditya Aluminium, Utkal Alumina, Renukoot complex, Mahan Aluminium, Hirakud Power and Smelter and Birla Copper at Dahej – have obtained ISO 50001 certifications for Energy Management.

Furthermore, our extrusions plant in Alupuram, Renukoot downstream and Hindalco-Almex Aerospace Limited (HAAL) plants have received AS 9100 certifications. These certifications enable these facilities to meet the stringent criteria for manufacturing automobile and aerospace-grade products. Our Mouda plant has obtained the license and approval from the Bureau of Indian Standards (BIS) to manufacture marine-class supplies.

Alupuram, Belur and Renukoot downstream plants have obtained NABL ISO/IEC 17025 certification.

Additionally, our Kuppam and Talaja operations have received the IATF 16949 certificate, signifying their commitment to producing high-quality automobile-grade aluminium. Our Alupuram, Hirakud, and Belur plants hold certifications to develop products for the Navy.

Along with Mouda, Hirakud and Talaja have also achieved the Aluminium Stewardship Initiative (ASI) performance standard certification. All our products comply with the Restriction of Hazardous Substance (RoHS) directive requirements. Moreover, we periodically conduct tests through NABL-accredited labs to ensure we stay within the prescribed limit of restricted materials.

At Novelis, all the manufacturing sites are certified with internationally recognised management systems – ISO 9001 or ISO/TS 16949 Quality Management System Standards and ISO 14001 Environment Management Standard. Out of the total locations, 80% are EMAS-certified, and seven sites are internally certified for the Environment Management System. The aerospace plants at Koblenz, Germany and Zhenjiang, China, are certified with accreditations of DIN EN ISO 9001, EN 9100/AS 9100, ISO 14001, NADCAP – Heat Treating, and NADCAP – Non-destructive Testing.

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## Adopting Digitalisation

Over the last five years, we have adopted digital technological innovations in our processes and systems, such as IoT platforms, analytics, rapid cloud adoption, AR, blockchain, and drones. This approach has enabled us to digitalise core operations while better understanding operating imperatives. We also continuously raise awareness and take our employees' input to understand and deploy relevant digital technologies.

To transfer ownership to the plants and build capability within our operational teams, we introduced a comprehensive people capability programme – DISHA (Digital Shiksha). DISHA is designed to upskill our workforce on key digital technologies. It also focuses on using technology to improve aspects of operational performance such as energy reduction, reduction in water consumption, and safety enhancement, among others.

Our aim is to raise awareness and engage our employees in providing inputs and ideas to incorporate digitalisation and enhance operational efficiency.

We are focused on enhancing the skills of our maintenance and reliability teams using digital training programmes like AR/VR, interactive training modules, and simulation-based learning, among others. These programmes have enabled us to provide targeted and personalised training to our employees, ensuring they have the knowledge and skills to operate and maintain our equipment effectively.

We have ventured into digital and predictive/prescriptive analytics for asset performance management. We have made significant progress in leveraging digital technologies to improve the efficiency and effectiveness of equipment at our plants.

One key initiative has been the implementation of predictive and condition-based maintenance. Deployment of sensors and advanced analytics, and technologies like vibration analysis, thermography, ultrasound, and oil analysis, has helped us proactively anticipate equipment failures and perform maintenance activities, thus minimising downtimes and reducing costs.

In FY2022-23, we observed a significant improvement in data infrastructure across all our plants. The focus was to continue to create a big business impact by scaling up adoption and completing ongoing projects across plants.

We implemented IoT platforms for real-time real-time visibility of operational parameters at all our downstream operations. A state-of-the-art extrusion management system is already implemented at all our extrusion manufacturing facilities. At our mines, we have incorporated a coal supply chain automation project that covers the entire supply chain cycle from mines to consumption. Our digital initiatives have improved equipment reliability, increased efficiency, and reduced costs. Moreover, we remain committed to continuously leveraging digital technologies to improve the maintenance and reliability of our processes.

**We incorporate innovations in our processes and systems, such as IoT platforms, analytics, rapid cloud adoption, AR, blockchain, and drones.**



We engage our employees in providing inputs and ideas to incorporate digitalisation and enhance operational efficiency.



Our digital initiatives have improved equipment reliability, increased efficiency, and reduced costs.

### Digital initiatives taken up for specific KPIs at our operations

KPIs addressed through Digitalisation	Initiatives
<b>Increasing productivity &amp; efficiency</b>	<ul style="list-style-type: none"> <li>Industrial IoT platform</li> <li>Robotic process automation</li> <li>Real-time data</li> <li>Video analytics</li> <li>Data warehouse</li> </ul>
<b>Increased yield and quality</b>	<ul style="list-style-type: none"> <li>Digital Twin for Mahan, Aditya, and Hirakud Smelter &amp; CPP, Talaja Downstream</li> <li>In-house development &amp; advance analytics</li> <li>Vision analytics</li> </ul>
<b>Improved asset availability (uptime)</b>	<ul style="list-style-type: none"> <li>AI / ML-based predictive maintenance platforms</li> </ul>
<b>Continuous safety &amp; inspection</b>	<ul style="list-style-type: none"> <li>Real-time monitoring and alerts through AI and drones</li> </ul>
<b>Customer-centricity (logistics)</b>	<ul style="list-style-type: none"> <li>Smart warehouse</li> <li>Track &amp; trace</li> <li>Video analytics</li> <li>e-Bill of lading</li> <li>Logistics Insight Tower (LIT) 2.0</li> </ul>

We plan to continue aligning digital outcomes with business outcomes and imbibing a digital culture across our workforce. We have developed detailed plans for our plants while incorporating digitalisation to improve energy efficiency

through initiatives like smelter digital twin, power plant digital twin and energy management platform. Our plans also focus on quality improvement and customer return reduction in downstream and copper rods.

### PROCESS CONTROL AND PRODUCT QUALITY CONTROL DASHBOARD AT UTKAL REFINERY

At our operational locations, most process parameters were monitored through Excel sheets.

The objective of the dashboard was to shift to real monitoring of parameters.

The dashboard also conducted a trend analysis for all process parameters and an online future prediction of intermediate and product fines for the next 18 days. The dashboard is helping to save 90 to 120 minutes per day.

We aim to drive digitalisation in sustainability and safety through Integrated Safety Systems, increased traceability, moving towards zero paper in our operations, and end-to-end visibility.