Journey of Hindalco Renukoot - An Integrated Aluminium Producer in India

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Abstract

Hindalco, Renukoot, is one of the largest integrated primary producers of aluminium in Asia, with a pan-Indian presence encompassing the entire gamut of operations, from bauxite mining and alumina refining to aluminium smelting and downstream processes such as rolling, wire rod production, and extrusions. Our journey began in 1958 in Renukoot, Uttar Pradesh, as the first integrated aluminium plant in independent India. The plant received bauxite from the Lohardaga mines and hydropower from G. B. Pant Sagar Dam project to produce 40 kt/a of alumina and 20 kt/a of aluminium, initially with entirely manual operations. Over the years, through successive organic expansions, the Renukoot Aluminium Complex has reached a production capacity of 410 kt/a of aluminium. To operate this integrated plant, approximately 830 MW of power is sourced from our Renusagar Captive Power Plant, located about 45 kilometres from Renukoot.

Alumina Refinery: It was commissioned in 1962 through technical collaboration with Kaiser Aluminum, USA, with an initial production capacity of 40 kt/a of alumina. This capacity has since increased to 720 kt/a. To enhance energy efficiency and production capacity, the plant has been expanded in phases, implementing new technologies over time. It employs the Bayer process, and its major raw materials include bauxite, steam, caustic soda, and furnace oil.

Aluminium Smelter: The aluminium smelter was also established in partnership with Kaiser Aluminum in 1962. Currently, it operates 11 potlines with a total of 2138 pots. Aluminium smelting is an energy-intensive process, with energy accounting for approximately 35 % of the total production cost. The company's efforts towards energy conservation have been consistently recognized by the relevant authorities. Over the past years, the company has implemented more than 500 energy-saving projects (both small and large) to improve energy efficiency, resulting in a reduction of specific energy consumption from 16 500 to 13 800 kWh/t Al. With the addition of a gas treatment centre, alumina feeders, pot controllers, dynamic feeding control, in-house lining design, and partial automation in the potroom, the smelter has managed to sustain its operations and remain competitive in the current market.

Fabrication Plant (Value Added Products): The Fabrication Plant began operations in 1965 with Bliss cold and hot mills and expanded in 1993 with the addition of a Davy cold mill. Starting with two US-made presses (Baldwin Lima Hamilton and Farrel) in 1965, the extrusion plant has expanded to eight presses from SMS Germany in 2021. The Fabrication Plant at Renukoot comprises four main product streams: ingots (50 %), wire rods (20 %), flat-rolled products (20 %), and extrusions (10 %). The transformation in value-added products has shown a significant shift from conventional direct chill casting to the latest state-of-the-art Wagstaff air slip casting, incorporating modern facilities such as inline degassing and over-the-top (OTT) coiling.

As the mother plant of Hindalco's Metal Business, the Renukoot complex has consistently facilitated and motivated our other upstream and downstream operations across Hindalco. This journey has been made possible through a continuous focus on the adoption of new technologies

and ongoing improvements in automation, resulting in performance and efficiencies that are comparable to newer generation plants.

As a responsible manufacturing unit, we place a special focus on sustainability, with targets of 100 % utilization of bauxite residue, net-zero liquid discharge as well as landfill and emissions by 2050. Various technological initiatives, such as the generation and storage of renewable energy, 100 % utilization of bauxite residue, and fly ash, and decarbonization, are in different stages of implementation. Simultaneously, to maintain competitiveness, several initiatives have been undertaken for specific energy reduction, loss minimization, and efficiency improvement.

To continue the proud legacy of excellence and future readiness, the Cultural & Business Transformation journey - "Parivartan RKT 2.0" - is underway. This marks a pivotal shift in the 60-year-old aluminium manufacturing unit, transitioning from a traditional functional structure to a dynamic, process-based organizational model. This realignment cultivates a culture of ownership, innovation, and resilience, positioning the organization to tackle evolving challenges while sustaining legacy strengths in a competitive landscape.

Keywords: Manufacturing, Sustainability, Cultural transformation.

1. Introduction

Hindalco Industries started its journey early in 1958. Mr. G D Birla had a vision to contribute best to Indian industries, and he successfully established India's first integrated aluminium industry at Renukoot, Sonebhadra district, in the state of Uttar Pradesh. In 1967, this aluminium plant was fused up with a thermal power plant which is situated at Renusagar. The integrated plant offers significant advantages by encompassing the entire value chain from alumina refinery to the production of finished aluminium products within a single complex. This approach leads to substantial cost efficiencies through reduced transportation expenses of raw materials and intermediate products such as alumina, primary aluminium etc. Furthermore, it allows for better control over the entire production process, ensuring consistent quality and enabling quicker identification and resolution of issues.

During these 67 years of operation, Hindalco has evolved into one of Asia's largest primary aluminium producers. In India, Hindalco's operations are spread across key locations including Renukoot, Hirakud, Mahan, Aditya, and Utkal, among others. Hindalco's smelters and refineries are supported by captive power plants, ensuring energy security and cost efficiency, which are critical in the energy-intensive aluminium industry. From bauxite mining to alumina refining, aluminium smelting, and subsequent rolling and extrusions, Hindalco operates an end-to-end production process that allows it to serve diverse sectors. Hindalco is also a major player in the copper sector, with its facility in Dahej, Gujarat being among the largest single-location copper smelters in the world. Its copper business, based in India, includes smelting, refining, and the production of continuous cast copper rods and precious metals. A significant transformation came in 2007 when Hindalco acquired Novelis Inc., a global leader in aluminium rolled products and the world's largest recycler of aluminium. The acquisition strategically transformed Hindalco into a global leader in aluminium rolling, significantly boosting its international footprint, especially across North America, South America, Europe, and Asia. Hindalco's customer-centric approach and diversified product portfolio make it a key supplier to industries such as automotive, construction, packaging, electrical, and consumer durables. Through Novelis, the company has also become a major supplier to the global beverage can and automotive sectors, both of which are increasingly prioritizing sustainability and lightweighting.

The company places a strong emphasis on innovation, sustainability, and operational excellence. Hindalco has embraced sustainable practices across its operations, including significant

Figure 12. Transformation in overall plant look and feel.

6. Summary

Hindalco's Renukoot complex, established in 1962 as India's first integrated aluminium plant, is one of Asia's largest primary aluminium producers, managing operations from bauxite mining to refined aluminium and various downstream products. Starting with an initial capacity of 40 kt/a alumina and 20 kt/a aluminium, it has expanded to 410 kt/a aluminium production, powered by its Renusagar Captive Power Plant. The Alumina Refinery, commissioned in 1962, has increased its capacity to 720 kt/a through technological advancements and uses the Bayer process. The Aluminium Smelter, also from 1962, has undergone significant energy conservation efforts, reducing specific energy consumption from 16 500 to 13 800 kWh/t Al through over 500 projects and partial automation. The Fabrication Plant, evolving since 1965, now produces ingots, wire rods, flat-rolled products, and extrusions, incorporating advanced casting technologies. As Hindalco's "mother plant," Renukoot drives company-wide improvements through continuous technology adoption and automation. The complex is deeply committed to sustainability, aiming for 100 % bauxite residue utilization, net-zero liquid discharge, and landfill and emissions by 2050, alongside ongoing energy reduction and efficiency initiatives. To maintain its competitive edge and secure its future, Renukoot is undergoing a "Parivartan RKT 2.0" transformation, shifting to a dynamic, process-based organizational model that fosters ownership, innovation, and resilience. Hindalco Renukoot being an integrated aluminium complex, transforms the aluminium value chain into a high-efficiency ecosystem, offering reduced costs, energy savings, operational control, and sustainability—all of which are critical for long-term competitiveness and profitability in the aluminium industry.

7. References

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