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IMMS 2026 Organized by IIM Delhi Chapter

International Metals & Metallurgy Summit (IMMS) 2026, organized by ***The Indian Institute of Metals (IIM) – Delhi Chapter***, in association with DIIA Event Solutions, was held at the India International Centre, New Delhi, under the theme ***"Advanced Rolling Technologies for Metals & Alloys"*** on 25th Feb. 2026

Industry leaders from SAIL, JSW Steel, Danieli, SMS India, Yogi Ji Digi, Jindal Stainless, Tata Steel Sahibabad, Jindal Steel etc. discussed sustainable rolling innovations, digital solutions and green steel production pathways. Industry titans converged to deliberate the transformative trajectory of rolling technologies.

Shri Manoranjan Ram, Chairman of IIM Delhi Chapter and Vice President at Danieli India Limited, articulated the organization's unwavering dedication to knowledge dissemination while emphasizing the summit's strategic focus on addressing contemporary industry challenges. The summit's thematic foundation encompassed cutting-edge rolling technologies, capital investment optimization, artificial intelligence integration and renewable energy adoption within metallurgical operations. This gathering represented more than a conventional conference, it manifested as a crucible where traditional manufacturing wisdom intersected with futuristic technological innovations.

Danieli India's presence at IMMS 2026 underscored the company's strategic commitment to India's manufacturing renaissance under the Make in India initiative. Guest of Honour, Shri Gajendra Panwar, CEO & MD of Danieli India, delineated the organization's extensive project portfolio spanning diverse geographical regions and industrial applications.

The company's impressive track record includes successful installations at Jai Raj Steel in Hyderabad, Rungta Steel, Tata Steel etc., demonstrating their technological prowess across varied operational scales. Recent project acquisitions encompassing Mukund Steel, Arjun Metals, Viraj Profiles, MIDHANI, NMDC Steel Plant and IISCO Steel Plant reflect Danieli's expanding footprint within India's metallurgical ecosystem. This comprehensive project spectrum showcases the company's versatility in addressing diverse client requirements while maintaining technological excellence.

Shri Panwar emphasized Danieli's commitment to localizing advanced rolling mill technologies, thereby reducing dependency on imports while enhancing domestic manufacturing capabilities. The organization's strategic approach involves not merely equipment supply but comprehensive technological transfer, ensuring Indian steel manufacturers achieve operational excellence comparable to global standards. This philosophy aligns seamlessly with national objectives of achieving self-reliance in critical industrial sectors while fostering innovation-driven growth trajectories.

The summit witnessed a paradigmatic shift towards digitalization. As Guest of Honour Shri Navneet Singh, Managing Director of Yogi Ji Digi, presented revolutionary digital solutions transforming modern rolling processes.

These technological interventions encompass sophisticated strip processing methodologies and advanced coating technologies that optimize operational efficiency while minimizing resource consumption. Digital transformation in metallurgical operations represents a fundamental departure from traditional manufacturing approaches, integrating real-time monitoring systems, predictive maintenance algorithms and automated quality control mechanisms.

Shri Navneet Singh's presentation highlighted how artificial intelligence applications enhance process optimization, reduce material wastage and improve product consistency across diverse rolling mill configurations. These digital solutions facilitate proactive decision-making, minimize unplanned downtime and optimize energy consumption patterns throughout the production cycle.

Shri V R Sharma, Vice Chairman, Advisory Board,Jindal Steel Limited, delivered a compelling keynote address emphasizing the critical importance of establishing dedicated Research & Development centers for specific metallurgical technologies. His discourse highlighted the strategic necessity of leveraging India's abundant coal resources while simultaneously pursuing progressive transitions toward green steel production methodologies. Shri Sharma's vision encompasses a balanced approach that maximizes existing resource utilization while investing in future-ready technologies that ensure long-term sustainability. The emphasis on dedicated R&D infrastructure can enable steel manufacturers to develop proprietary technologies tailored to Indian operational conditions while addressing unique challenges posed by local raw material characteristics and market requirements. The keynote underscored the importance of collaborative research initiatives between industry players, academic institutions and government organizations to accelerate technological innovation.

Shri Sharma advocated for a phased transition strategy for green steel production that maintains operational continuity while progressively incorporating cleaner production technologies, ensuring economic viability throughout the transformation process. This strategic framework positions Indian steel manufacturers to achieve environmental compliance while maintaining competitive advantages in global markets.

Chief Guest Dr. A K Panda, Director Finance holding additional charge as Director Commercial at Steel Authority of India Limited, outlined SAIL's ambitious expansion trajectory from the current production capacity of approximately 21 million metric tons to 30 million metric tons.

This substantial capacity enhancement reflects SAIL's commitment to meeting India's growing steel demand while implementing comprehensive decarbonization initiatives across all operational facilities. The expansion strategy encompasses adoption of cleaner production technologies, implementation of energy-efficient processes and systematic reduction of carbon emissions throughout the production cycle.

SAIL's approach demonstrates how large-scale steel manufacturers can achieve growth objectives while addressing environmental sustainability concerns through technological innovation and operational optimization. The organization's decarbonization roadmap includes investments in renewable energy infrastructure, implementation of carbon capture technologies and adoption of hydrogen-based steel production processes where economically viable.

IMMS 2026 Souvenir was released during the inaugural session

The summit's panel discussion on "Emerging Trends in Rolling Technologies" facilitated dynamic exchanges between distinguished industry experts, fostering collaborative insights into future technological trajectories.

Chaired by Dr. Sanak Mishra, Professor of Practice at COEP Technological University Pune, the panel featured luminaries including Shri Sashi Shekhar Mohanty MD & CEO of Essar Minmet, Mr. Jozi Shuli Vice President Flat Products from Danieli Group Italy, Mr. Rajesh Kumar Garg Senior Vice President, Head Flat Products at SMS India, and Shri PVNP Rama Rao, Senior Vice President at JSW Steel. This diverse representation ensured comprehensive coverage of technological perspectives spanning equipment manufacturing, steel production and academic research domains.

The panel deliberations addressed critical challenges facing the rolling mill industry, including energy efficiency optimization, product quality enhancement and integration of sustainable production methodologies. Participants shared practical experiences from implementing advanced rolling technologies, highlighting both successes and challenges encountered during technology adoption processes. The discussions revealed emerging trends toward automation, digitalization and environmental compliance that will shape future rolling mill operations. These expert insights provided attendees with actionable intelligence for strategic decision-making regarding technology investments and operational improvements. The collaborative format enabled knowledge transfer between technology providers and end users, fostering partnerships that accelerate innovation adoption across India's steel industry

IMMS 2026 featured comprehensive technical sessions addressing "Advances in Hot & Cold Rolling Technologies" & "Enhancing Microstructure Properties & Product Performance Through Innovative Rolling."

These specialized sessions encompassed ten detailed presentations from leading organizations including Danieli Italy, SMS India, Bhilai Steel Plant, RDCIS Ranchi, JSW Steel, Jindal Stainless, Tata Steel Sahibabad, Yogi Ji Digi, HDFC and Umbrella Protection System. Each presentation provided deep technical insights into specific aspects of rolling mill operations, from fundamental process improvements to advanced material science applications, power cost saving and logistics. Danieli Italy and SMS India showcased their latest technological innovations, demonstrating how cutting-edge equipment design enhances operational efficiency while reducing environmental impact. The technical content addressed practical challenges encountered in rolling mill operations, offering evidence-based solutions that can be implemented across diverse operational contexts. An innovative presentation from HDFC Bank addressed the economics of round-the-clock captive renewable power for steel plant operations, highlighting financial strategies that support sustainable manufacturing initiatives. These technical sessions provided attendees with actionable knowledge that can be directly applied to improve rolling mill performance, reduce operational costs and enhance product quality across various steel grades and applications.


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25 February
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The International Metals & Metallurgy Summit 2026 brought together diverse group of metallurgical industry engineers and executives which engaged in technical discussions around advanced rolling technologies with sustainable steel production. The event highlighted India's transition toward green steel manufacturing while leveraging existing resources and implementing cutting-edge rolling mill technologies. The summit addressed critical challenges facing modern steel production including energy efficiency and environmental sustainability.

IMMS 2026 concluded successfully with the enthusiastic participation and in-depth deliberations among industry leaders, subject experts and experienced rolling mill technologists.

Global Steel Output Down 2% in 2025

Global crude steel production fell 2 per cent to 1,849.4 million tonnes (mt) in 2025 compared with 1,886.8 mt in 2024.

China, the world's largest producer, reported a 4.4 per cent decline in output to 960.8 mt, while India bucked the trend with a 10.4 per cent rise to 164.9 mt.

The US produced about 82 mt of steel, up 3.1 per cent year-on-year.

In December 2025, global steel output declined 3.7 per cent to 139.6 mt from 144.5 mt in the year-ago period.

China Drags

China's steel production slid 10.3 per cent in December to 68.2 mt whereas India produced 14.8 mt, marking a 10.1 per cent increase.

US steel output rose 3.6 per cent to 6.9 mt while Japan's steel production fell 4.8 per cent to 6.6 mt. Russia's output declined 4.4 per cent to 5.8 mt, and South Korea recorded a 2.4 per cent drop at 5.2 mt.

Iran's steel production climbed sharply by 16.2 per cent to 3 mt, while Türkiye posted a strong 18.5 per cent increase to 3.5 mt.

Germany's output edged lower by 0.2 per cent to 2.7 mt and Brazil produced 2.6 mt, down 1.9 per cent.

Regional Trends

Region-wise, Africa's steel output dipped 0.3 per cent year-on-year to 1.9 mt in December. Asia and Oceania saw a sharper 6.3 per cent fall to 99.7 mt, while the EU (27) recorded a 3.9 per cent increase to 9.9 mt.

Steel production in other parts of Europe rose 13.8 per cent to 3.8 mt, and West Asia posted a 13.9 per cent jump to 5.3 mt.

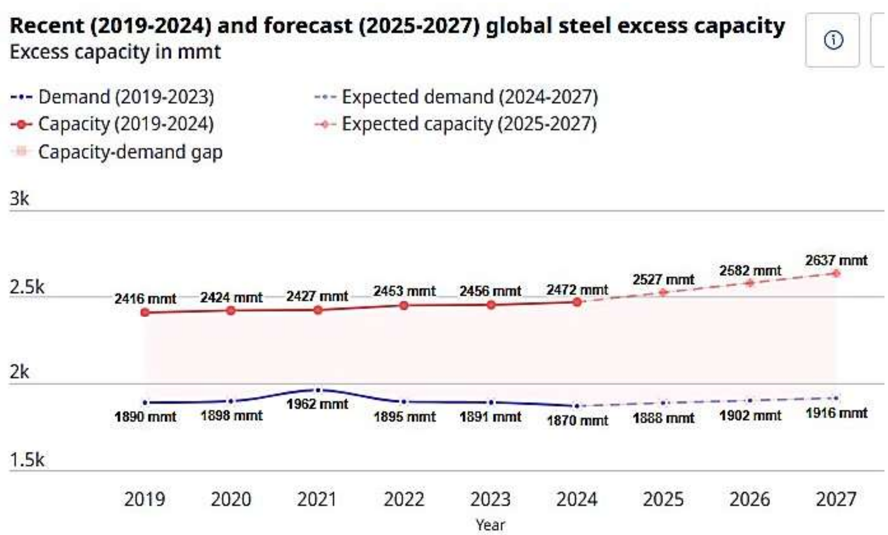
North America's output inched up 0.4 per cent to 9 mt, while production in Russia & other CIS countries, including Ukraine, slipped to 2.7 per cent to 6.9 mt. South America produced 3.2 mt of steel, up 1.2 per cent.

Global Steel Excess Capacity

Global steelmaking capacity has risen for seven consecutive years and the OECD projected it to reach 2,547 million metric tonnes (mmt) by the end of 2025. Asia—particularly India and the ASEAN economies—and the Middle East have been a key source of capacity growth in recent years. Planned projects globally indicate that an additional 109 mmt could become operational by 2028, reaching a record-high level of around 2,656 mmt. Most of these projects are concentrated in Asia. In China, while steel capacity replacement rules are being tightened, enforcement challenges raise questions regarding the possibility of further net capacity increases. At the same time, Chinese steel companies, including state-owned enterprises, continue to invest in steel projects overseas, especially in ASEAN and Africa.

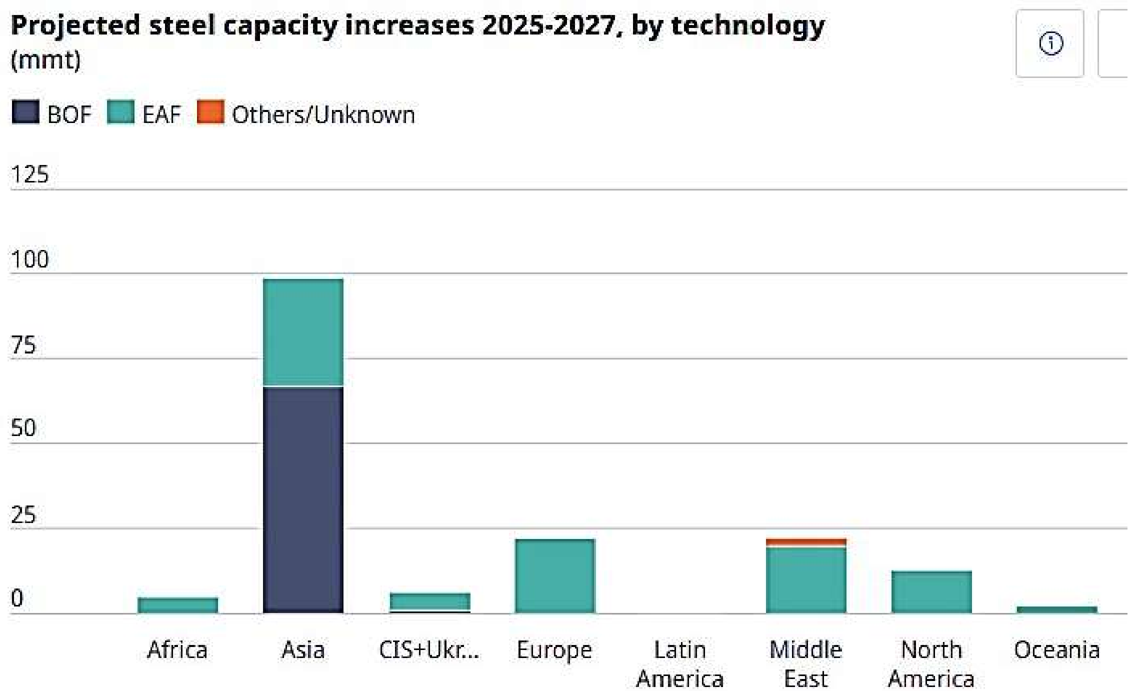
Steel producers are facing significant challenges as a result of growing excess capacity

The OECD Steel Outlook 2025 shows an accelerating trend in global steelmaking capacity, which will outpace steel demand and lead to an increase in global steel excess capacity to a level of 721 mmt by 2027. With demand growth expected to be sluggish, capacity utilisation could once again decline towards 70%, putting enormous pressure on the viability of even highly competitive steelmakers.



Steel excess capacity on the rise: projected capacity increases

Global steel capacity is projected to increase by 165 mmt in 2025-27 despite only modest growth in steel demand. Slightly more than 40% of new capacity entering the market is expected to be based on the BF/BOF process.



Excess capacity & challenges to achieving steel industry decarbonisation

The ongoing excess capacity problem is reducing the steel industry's profitability and the capital available for investing in new technologies, hampering the industry's efforts to decarbonise. Moreover, more than 40% of the 165 mmt of new steelmaking capacity entering the market during 2025-27 is expected to be based on the relatively emission-intensive blast furnace-basic oxygen furnace (BF-BOF) process. Reducing emissions in the steel industry requires profound and costly changes in steelmaking operations. The changes include: 1) improved performance through improved energy efficiency; 2) the switching of fuels away from gas and coal; 3) the development and deployment of new technologies to produce steel; and 4) expansion of carbon capture utilisation and storage efforts. Given the longevity of steelmaking equipment, investing in new production technologies requires confidence that the investments will be economically viable over the very long term, preconditions for which include healthy market conditions characterised by a level playing field and the absence of excess capacity.

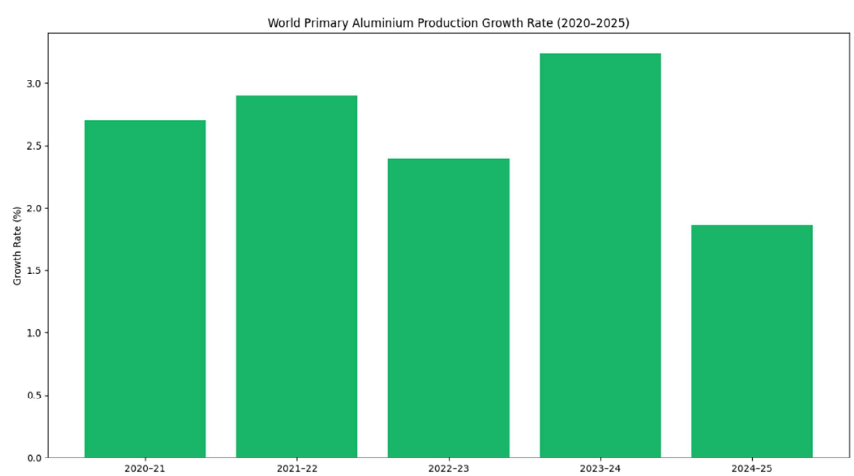
The cost and methods to decarbonise steelmaking across and within countries will ultimately vary significantly depending on the steelmaking technologies employed and the condition of steelmaking facilities. A survey of major producers reveals that 74% of companies intend to use carbon capture, utilisation and storage technologies in their integrated (BF-BOF) facilities to control emissions, while 11% are exploring groundbreaking iron oxide technologies. With respect to electric furnaces, 52% of the companies intend to use hydrogen-based technologies to produce iron for electric furnace steel production.

Significant attention has recently been given to hydrogen-based processes for producing iron-intermediate products, such as direct-reduced iron and hot-briquetted iron. These technologies rely on high-grade iron ores and substantial renewable energy availability, both of which are unevenly distributed globally. As a result, steel production locations and international trade flows in iron and steel are likely to undergo significant shifts in the future.

Industry efforts to move towards lower emission production are stalling. Several announced projects, corresponding to 19% of the total expected lower-carbon project pipeline until 2027, have been put on hold amid trade policy shifts and worsening global excess capacity effects. Excess capacity is impairing the ability of companies to conduct the necessary research and development activities, slows their investment in the deployment of lower-carbon technologies at commercial scale, and hinders the development of markets for lower-carbon products. It does so through its impact on prices and profitability. Addressing the global structural problem of excess capacity and levelling the playing field would foster improved business conditions that would support the industry's efforts to innovate and invest in new technologies for greater efficiency and lower emissions.

Source: OECD Steel Outlook 2025

World Primary Aluminium Production



Going by the world primary aluminium production trend since 2020, 2025 saw the slowest pace in half a decade. According to the International Aluminium Institute, world primary aluminium production grew by only 1.06 per cent, a sharpest deceleration from the 3.24 per cent growth recorded in 2024. Between 2020 and 2023, the world primary aluminium production growth remained between 2.4 and 2.9 per cent.

Slow growth rate in the world primary aluminium production was not only due to China's tightened output. Asia (ex-China), Europe, and also the Americas delivered slower growth in their respective domestic output, while Gulf Cooperation Council (GCC) countries churned out lowest volume since 2020.

Global output: modest growth, muted momentum

The world primary aluminium production reached 73.784 million tonnes at the end of 2025, up marginally from 73.009 million tonnes in 2024. The daily average output was 202,100 tonnes through the year, compared to 199,500 tonnes in 2024.

GCC: First production decline since 2020

A key drag on global growth came from the Gulf Cooperation Council, where primary aluminium production declined for the first time since 2020. Output in the region stood at 6.162 million tonnes, down by 2.9 per cent from 6.346 million tonnes in 2024.

China: growth slows as cap nears

Besides GCC countries, China, the world's largest primary aluminium producing country, also played a central role in tempering global growth. In 2025, China's output increased by 1.86 per cent – marking its slowest in last five years when the country witnessed 3 to 4 per cent of growth. In 2024, China's primary aluminium production rose 4.15 per cent, while that in the preceding year increased by 3 per cent.

The slowdown in 2025 reflects China's proximity to its 45-million-tonne production ceiling, imposed to curb overcapacity and environmental impact.

Subdued expansion in Asia (ex-China)

Outside China, Asia also recorded muted growth in 2025 primary aluminium production, which stood at 4.862 million tonnes, up by 1.04 per cent from the previous year. In 2024, Asia's (ex-China) primary aluminium production was 4.812

million tonnes, registering an increase of 2.97 per cent from 4.673 million tonnes in 2023.

Bright spots – Africa and Oceania

In contrast to the dominant slowdown narratives, Africa and Oceania provided modest upside surprises. These are the two continents that both recorded decreased primary aluminium production in 2024. In Africa, the full-year primary aluminium production in 2025 stood at 1.616 million tonnes, up by 2.54 per cent from 1.576 million tonnes in 2024, marking a recovery after two consecutive years of decline. In 2024, the output had dropped by 1.13 per cent Y-o-Y, and in 2023, it had shrunk by 1.6 per cent.

Oceania's production, on the other hand, gained 0.81 per cent Y-o-Y, following a decline of 1.11 per cent in the previous year. In 2025, Oceania's aluminium production was 1.878 million tonnes versus 1.863 million tonnes in 2024.

Summing up

The subdued growth of primary aluminium production in 2025 was not the result of a single disruption but the outcome of converging structural forces - China's capacity cap, supply-chain shocks in the GCC, and slower expansion in Asia (ex-China).

Source: AL CIRCLE Article, 26 JANUARY 2026

India's Decarbonisation Path for Aluminium

Aluminium industry belongs to the most energy-hungry sectors and play a vital role in industrial emissions. Therefore, it is vital to develop decarbonisation efforts for this sector to fulfil India's climate commitments while also ensuring long-term economic competitiveness.

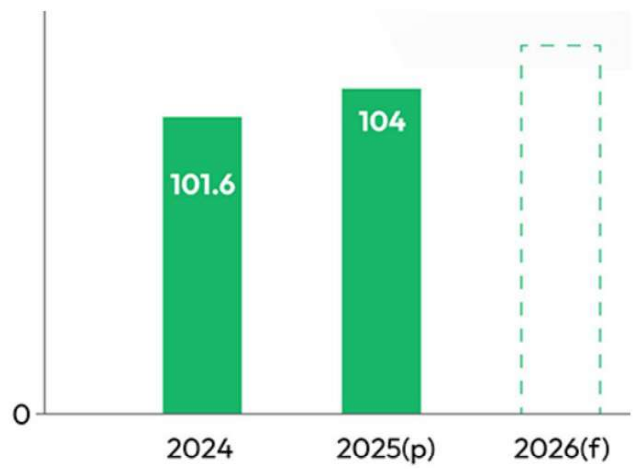
At the event in New Delhi, NITI Aayog shared three reports which talked about the roadmap for decarbonisation for sectors like aluminium, cement and other MSMEs. This roadmap outlines a vision to assist the aluminium sector in reducing emissions while still pursuing growth and maintaining their competitive edge.

Indian aluminium production will shift from 4 million tonnes in 2023 to 37 million tonnes by 2070. The decarbonisation roadmap lays out a three-phase strategy:

- First, in the short term, which will focus on transitioning to Renewable Energy–Round the Clock (RE-RTC) and improving grid connectivity.
- Second is the medium term, where the country will bring nuclear power into the mix and finally,
- In the long term, the government will embrace CCUS technologies to reduce emissions.

Source: AL CIRCLE Article, 26 JANUARY 2026

Global Aluminium Consumption Trend



million metric tonnes

End-users in the Aluminium Industry

Across automotive, construction, packaging, aerospace, electrical & electronics and renewable energy sectors, aluminium's role shifts from a commodity to a strategic industrial material. These end-use industries are the key consumption sectors: they decide how much, what type and where aluminium is deployed. When these sectors grow, the raw aluminium produced upstream, from bauxite to primary metal, and the metal made from aluminium scrap, find demand. When they slow, excess supply can pressure prices. The underlying strength of end-user demand is why the aluminium market isn't just cyclical, it's structurally anchored. Demand stay strong even when prices are high.

Structural demand growth

Aluminium isn't just a raw material, it's a solution material for sectors focused on performance and sustainability:

- Automotive lightweighting improves fuel efficiency and extends EV range.
- Construction benefits from corrosion resistance and longevity.

- Packaging demands recyclable, lightweight materials.
- Renewables and electrification require conductive, durable components.

These trends aren't temporary; they're embedded in long-term industrial strategies, so demand stays resilient even when prices rise.

Substitution and value creation

Even with higher prices due to tariffs or local premiums, many end-users prefer aluminium over steel or plastics because of its better strength-to-weight ratio, lower lifecycle cost and environmental advantages. This substitution effect sustains demand.

Different types of market segmentation in aluminium

By end-user sector

- Automotive & Transportation
- Construction & Infrastructure
- Packaging & Consumer Goods
- Electrical & Electronics
- Renewable Energy Systems

Each segment has distinct drivers. For example, EV adoption propels automotive aluminium demand, while urban housing and infrastructure investments boost construction consumption.

By product form

- Primary Metal
- Extrusions
- Flat-Rolled Products
- Castings
- Wire-rods
- Recycled / Secondary Aluminium

This segmentation reveals how demand and value differ across applications, enabling targeted commercial approaches.

By region

Demand dynamics vary by geography: China continues to dominate consumption and production, while Western markets face tariff and energy cost pressures that influence end-user pricing dynamics.

Global market trends shaping aluminium outlook

Primary aluminium capacity additions are slow due to energy costs, regulatory hurdles and capital intensity. Inventories remain tight, underpinning higher price levels.

Downstream dominance

Downstream sectors, like extrusions, flat-rolled products and castings, are now central in determining market direction because they represent where aluminium translates into industrial output.

Sustainability & recycling

Recycled aluminium is rising in importance as consumers and regulators demand lower-carbon products. Secondary production reduces energy use significantly and opens new pricing segments.

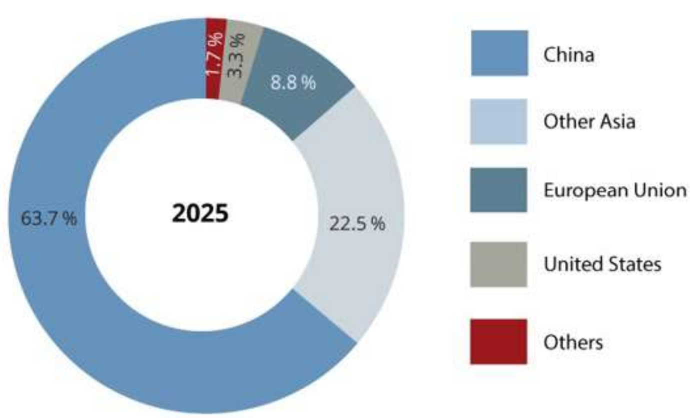
Conclusions

The aluminium industry's success story is rooted in relevance at the point of industrial value creation. End-users across sectors are choosing aluminium not just for cost but for performance, sustainability and innovation. Global trend projections point toward continued growth and transformation through 2026.

Source: AL Circle Blog February 2, 2026

Stainless Steel Melt Shop Production Increases in 2025

In the year 2025, total stainless steel melt shop production was 64.2 million tonnes, an increase of 2.1% compared to 2024.



World stainless steel production in 2025

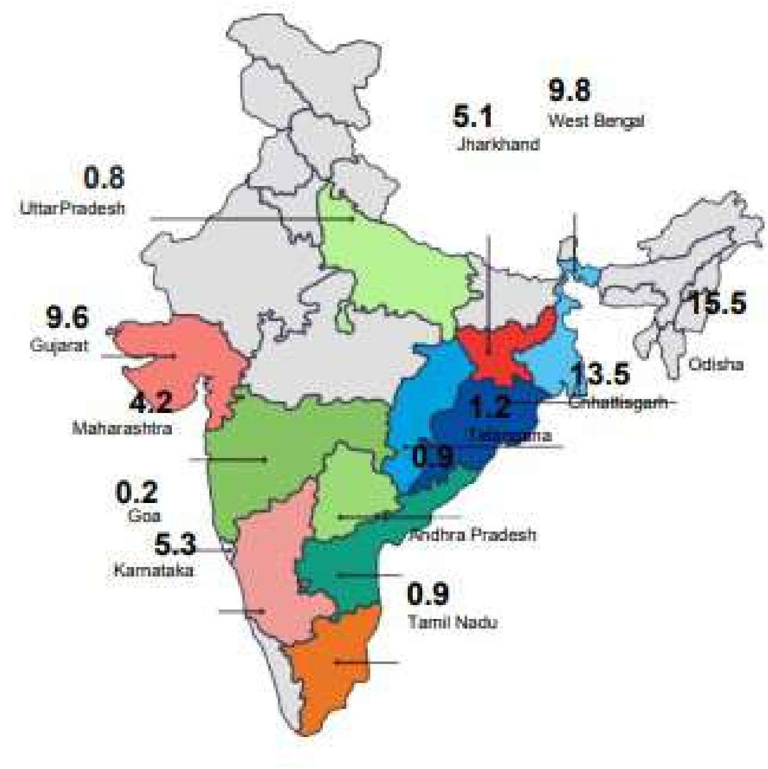
Regional shares of stainless steel meltshop production

Asia produced 55.3 million tonnes, an increase of 2.7% compared to 2024. The European Union produced 5.7 million tonnes, which is a decrease of 1.9%. The United States produced 2.1 million tonnes, an increase of 7.6%. Other countries produced 1.1 million tonnes, which is a decrease of 11.3%.

Source: world stainless association, 27 February 2026

India's DRI sector

India's DRI sector, which underpins the secondary steel segment, has emerged as a global leader accounting for nearly 39% of the world's sponge iron output. With annual DRI production projected to reach 65–70 million tonnes by FY2030 and a CAGR of 6%, the country is poised to capitalize on new opportunities in both domestic and international markets. DRI's strategic importance is further underscored by its essential role as a metallic input for electric arc furnaces (EAFs) and induction furnaces (IFs), enhancing charge mix flexibility, reducing reliance on scrap, and supporting the industry's decarbonization ambitions.



DRI capacity spread across states

As the secondary sector, which represents almost 60% of India's steel output, evolves with greater focus on technology and innovation, it continues to foster local employment, entrepreneurship, and distributed growth across semi-urban and rural India. Meanwhile, the global steel and scrap markets are experiencing rapid changes due to shifting policies, environmental regulations, and supply chain dynamics creating new avenues for Indian mills to secure diverse raw material sources and strengthen their export capabilities.

Despite strong prospects, the industry also faces headwinds such as raw material price volatility, higher energy costs, logistics challenges, and decarbonization pressures, compounded by global trade dynamics and environmental regulations. Addressing these challenges will require cohesive policy reforms, increased R&D, technological upgrades, and multi-stakeholder collaboration.

Source: Bigmint

Nagoya University Develops Heat-resistant, Recyclable Al

While aluminium is being valued for its top-notch recyclability and strength, prolonged exposure to heat causes conventional aluminium alloys to lose strength, limiting their use in engines, turbines, and aerospace systems. However, this long-standing limitation is addressed by a research team of Nagoya University in Japan, who have developed a new family of aluminium alloys.

The new version of aluminium retains strength even under extreme heat. Simultaneously, it remains highly recyclable and suitable for metal 3D printing. Designed specifically to address the aerospace and automotive uses in mind, the new family of aluminium is a bold step towards expanding aluminium's role in high-temperature applications.

Turning weakness into a strength

The research team took an unconventional take in designing this alloy by using iron as a key element in the new alloy. Though iron is usually avoided in aluminium alloy due to its tendency to cause brittleness and corrosion, the team focused on controlling the behaviour of iron in aluminium structure, rather than excluding it completely. A careful combination of iron with selected elements facilitates solidification and overcoming its typical drawbacks.

Rewriting aluminium's internal structure with 3D printing

The breakthrough fundamentals are based on laser powder bed fusion, which is a 3D printing process where metal melts and solidifies within seconds, creating rapid cooling that shapes the alloy's structure from the core. This technology locks iron and other elements into metastable forms, which is otherwise not achieved through conventional manufacturing techniques. Leveraging a systematic design approach, the research team identified elements which reinforce the aluminium matrix and form protective micro and nano-scale structures, improving strength and heat-resistance without affecting printability.

Al-Fe-Mn-Ti: a standout alloy composition

Among the newly developed alloys, the formulation of Al-Fe-Mn-Ti proved particularly successful. Composed of iron, aluminium, manganese, and titanium, Al-Fe-Mn-Ti comes with the rare balance of properties, which helps in retaining its strength in temperature conditions as high as 300°C while being flexible at room temperature.

In terms of performance, this one surpassed other aluminium alloys produced through 3D printing and showed fewer issues than conventional high-strength alloys during fabrication. While the latter is subject to cracking or warping when processed under laser power bed fusion.

Aluminium's feasibility in the automotive and aerospace Industries

In the high-temperature automotive components, the new alloy could easily replace heavier metals. Thus, improving field efficiency and lowering emissions. In aerospace, they may enable lighter engine parts, such as turbines and compressor rotors, without sacrificing performance. Precisely, the research offers a blueprint for designing metals, specifically for additive manufacturing, potentially accelerating material development across industries.

Wider shift in aluminium additive manufacturing

Nagoya University's research is a part of the global effort to enhance aluminium's performance in additive manufacturing. Lately, there's an increasing focus in the research labs in overcoming the material limitations that have so far put a restriction in aluminium's use in demanding environments.

In September, the US Department of Energy's Oak Ridge National Laboratory tested a new aluminium alloy known as DuAlumin-3D for high-temperature automotive applications. The tests showed that the alloy performed better than some conventional aluminium materials during laser powder bed fusion, where cracking is a common problem. Simultaneously, it can perfectly retain its thermal properties better than the established alloys, supporting its key role in the lightweight vehicle design and optimum fuel efficiency.

Elsewhere, Aluminium Materials Technologies worked with the University of Birmingham to examine the metallurgy of another 3D-printed aluminium alloy, A20X. Their research covered both laser powder bed fusion and direct energy deposition techniques, examining how composition, heat treatment, and processing parameters influence performance.

A20X is known for its isotropic properties and a high-strength aluminium-copper alloy, which remains consistent in various environments. This is widely being used in aerospace and motorsport applications, and the collaboration aimed to better understand how additive manufacturing could further enhance its capabilities.

Recent developments reveal a decisive shift towards designing aluminium alloys for additive manufacturing rather than simply adapting existing materials. The research at Nagoya University made it clear that the metals once considered unsuitable for crafting aluminium alloys can ideally perform better if paired with the right processing methods. As demands grow for lighter, stronger and heat-resistant materials, such innovative discoveries could reshape aluminium's role in future engineering.

Source: AL Circle Article, 26 December 2025

No Escape from CBAM Lavy for Steel, Aluminium

The India-EU Free Trade Agreement does not provide any relief to Indian exporters from the bloc's Carbon Border Adjustment Mechanism (CBAM) regulation, which exposes identified goods, notably steel and aluminium products shipped from India, to carbon taxes.

However, a technical dialogue has been agreed to, which will identify the pathway for Indian industry to access the EU markets despite the CBAM, including possible accreditation of verifiers on CBAM in India. Further, any flexibility that is offered by the bloc to another trading partner in the future will automatically be extended to India.

CBAM is a horizontal regulation, which is applicable to all partner countries across the globe. Under FTA, there are certain provisions that we have agreed under CBAM. A technical dialogue has been agreed to be set up, which will address the pathway for our industries to access the market inspite of the CBAM regulation.

CBAM is part of the EU's climate policy that places a carbon price on certain carbon intensive goods imported into the EU. This is to prevent carbon leakage, which means EU based companies should not feel encouraged to move production to countries with weaker climate laws to avoid carbon costs.

From January 1, financial liability for six of the initially identified sectors, which include steel, aluminium, cement, fertilizers, electricity and hydrogen has kicked in, with Indian exporter of steel and aluminium expected to face the brunt of the legislation.

EU will work together with India to make the implementation of CBAM easier for Indian industry. Verifiers for CBAM in India are also to be accredited by use agencies, so that Indian industry is able to access them. Also India and EU worke together to see and understand the technical processes through which the CBAM measurement will be done in both economies.

The EU has assured India that it will be extended flexibility that is offered by the bloc to another trading partner in the future.

To India’s larger comfort, EU has given the commitment that in case they are able to bring in any flexibility under CBAM for any partner country across the world, that will automatically flow out to India also.

Although CBAM currently applies only to six products, including steel and aluminium, it is designed to expand to all industrial goods, potentially eroding much of the FTA's tariff benefits.

India may be in a position to challenge any expansion of CBAM taxes to other products in the future under the FTA, but that is potentially a grey area.

Aluminium’s Electrical Future

The International Annealed Copper Standard (IACS) defines the electrical conductivity of copper as 100%. This has fostered the belief that copper is a better electrical conductor material than aluminium, when the exact opposite is true.

Aluminium has 200% of the **weight conductivity** of copper. IACS is based on **volume conductivity**. What is the difference between volume and weight conductivity?

Weight conductivity factors in density, volume conductivity does not. Aluminium is about 1/3 of the density of copper, so when conductivities are adjusted for weight, aluminium has twice, 200%, the conductivity of copper!

How can such an oversight happen? The answer is in the history of IACS, branding and the tendency to not recognise change that has occurred over a long period of time.

IACS was created in 1914 by copper wire manufacturers to standardise the purity of copper because the resistance of wires made by different copper companies varied.

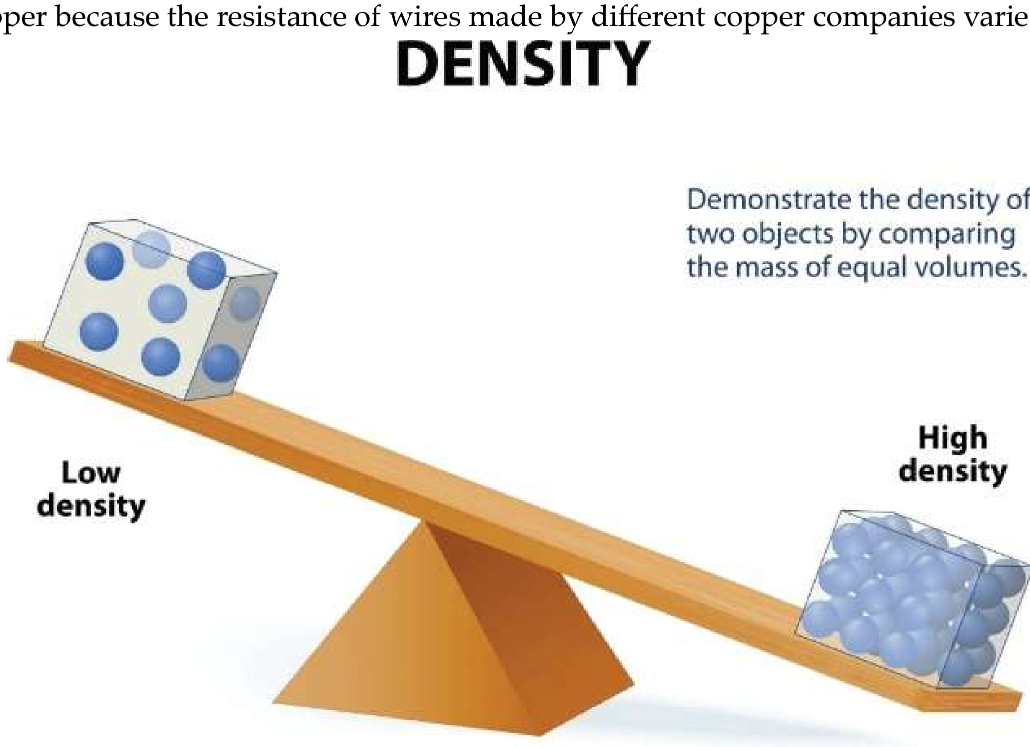


Figure 1. Equal volumes with differing densities

According to Wikipedia, the **International Annealed Copper Standard** (**IACS**) is a standard established in 1914 by the United States Department of Commerce. It is an empirically derived standard value for the electrical conductivity of commercially available copper. Sometime around 1913, several copper samples from 14 important refiners and wire manufacturers were analysed by the U.S. Bureau of Standards.

The 100% IACS rating for copper is just a benchmark, a nominal value selected to reduce copper variability. It is not the ultimate in conductivity. It does not consider weight because the weight of copper is constant. IACS is a COPPER PRODUCT STANDARD that was never intended to be used for other metals!

By 1944, when aluminium first became available for use as a base metal, copper had enjoyed a 60-year monopoly and was branded as the "Metal of Electrification". This resulted in copper being the basis of all electrical codes and standards. The National Electrical Code, for example, originally just listed wire sizes with the understanding that they were copper.

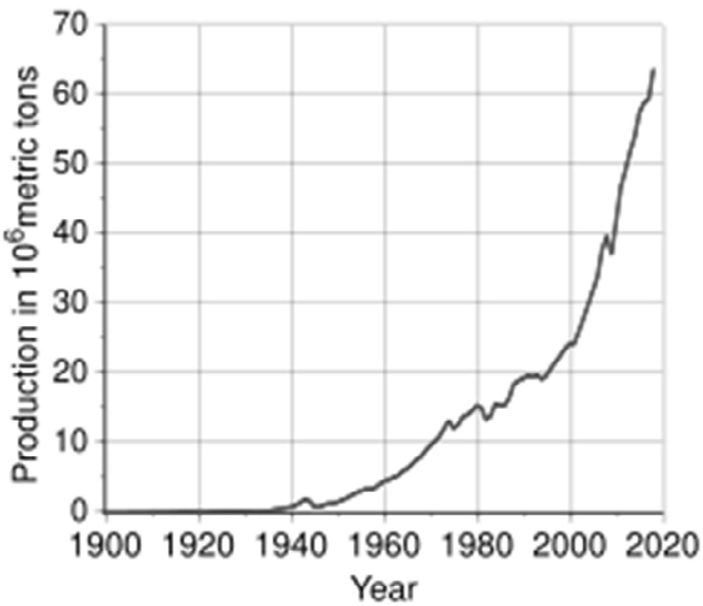


Figure 2. World Production of aluminium since 1900

The "Copper, Metal of Electrification" brand has become synonymous with electricity, much like "Band-Aid" has become synonymous with adhesive bandages.

It was only after WWII that aluminium became available for electrical wire and by then IACS was just routinely used without regard to its original intent. The purpose of the standard which was the reduction of copper variability, had long been forgotten.

If a weight-based aluminium conductivity standard were created with the conductivity of pure aluminium set as a 100% benchmark, copper would have a conductivity of only 50%! The following summarises the two methods of assessing conductivity:

Conductivity	*Weight*	*Volume*
Aluminium	100%	61%
Copper	50%	100%

Figure 3. Weight and Volume Conductivity Ratings

The use of IACS to rate aluminium conductivity without factoring in weight is at the heart of the misconception that copper is a better conductor. It is not.

Furthermore, because IACS ignores density, the conductivity per dollar is not apparent and the value proposition of the two competing metals is hidden. Aluminium's conductivity per dollar is 8 times, 800%, that of copper (2 times the price ratio of copper/aluminium, 4/1).

It will be interesting to see how long it takes artificial intelligence to conclude that when all relevant factors are considered, particularly weight and cost, aluminium is a much better conductor than copper.

The distinction between volume conductivity and weight conductivity is interesting as it shifts the frame to weight conductivity completely changes the perception of aluminium's performance. This kind of clarification could really help more engineers rethink material choices based on actual application needs rather than long-standing assumptions.

Source: AL Circle Blog December 18, 2025

Recovery of Alloying Elements from Scrap along with Aluminium Recycling

Three important issues for the aluminium industry today and in the coming period are: flexibility, independence and sustainability.

But in order to follow sustainability agenda, we need more metallic materials, especially aluminium.

It is possible to define this contradictory situation in economic terminology as a *rebound effect* or *take-back effect*. For example, we want to build more solar power plants to replace fossil fuels, but for this, we need to produce more metals. 1 MW solar power plant requires 35-45 tonnes of steel, 4.5 tonnes of copper and 3.5-8 tonnes of aluminium (framed vs frameless panels).

At this point, the most important tool we have is recycling. With recycling, it's possible to both produce secondary aluminium and recover some of the alloying elements from scrap.

Why do we need to alloy pure aluminium?

Aluminium, which we can define as a modern material in terms of its usage areas, varies according to its pure and alloyed forms. While pure aluminium finds use with its properties such as low melting temperature, high thermal and electrical conductivity, high reflectivity and elevated ductility, its mechanical properties are not particularly good.

A number of technologically important characteristics of aluminium can be changed by an order of magnitude or more by suitable means such as alloying additions, plastic deformations or heat treatment.

Pure aluminium doesn't have good mechanical properties. For example, its tensile strength is about 90 MPa (13 ksi). However, with the addition of alloying elements and tempering, aluminium's strength is much higher. One of the strongest aluminium alloys is AA7068-T6, which has an ultimate tensile strength of 710 MPa (103 ksi).

This means that, as a result of alloying, tailor-made solutions can be produced for almost any industry in terms of material selection.

What is the advantage of recovering alloying elements from scrap?

Resource Efficiency

Let's take an example of UBC smelting due to its short life time and easy availability. Although it varies depending on the melting technology, based on our experience, let's assume that UBC scrap has the following chemical composition after melting, with a pessimistic estimate:

Table 1: Molten UBC composition (experimental)

Si%	Cu%	Mn%	Fe%	Zn%	Mg%
0.30	0.20	1.00	0.50	0.20	0.90

This table shows us that when approximately 1 tonne of UBC scrap is recycled, 9 kg of magnesium and 10 kg of manganese can be recovered in addition to aluminium.

Energy Saving

On average, producing 1 tonne of metallic magnesium from dolomite ore requires 18,500 kWh of electricity by electrolysis, 2,200 Nm^3 natural gas and 2,200 kWh by the Pidgeon process and 2,200 Nm^3 natural gas and 1,700 kWh electricity by the modified Pidgeon process.

By recycling 1 tonne of UBC, we recover 9 kg of magnesium, which also saves the energy of approximately 20 Nm^3 natural gas and 15,3 kWh electricity by the Pidgeon process.

GHG Saving

Assuming that the magnesium used to alloy aluminium is produced from primary ore, the average carbon footprint of the process per kg of magnesium is: *21.8 kg* (*China's average. which produces more than 85% of global magnesium)*

Again, let's take an optimistic approach and note that magnesium, used as an alloying element, is produced by the modified Pidgeon method. By recycling 1 tonne of UBC, we recover 9 kg of magnesium, which also prevents the emission of approximately 52 kg of carbon equivalent.

Minimisation of Alloying Costs and Difficulties

In aluminium alloying, if the alloying additives' (hardeners') melting point is lower than the liquid aluminium temperature, melting occurs (for example, magnesium alloying); if the alloying additives' melting point is higher than the liquid aluminium temperature, then dissolution occurs (for example, silicon alloying). Dissolution rate is controlled by temperature and increases with temperature.

- <u>Oxidation</u>

Magnesium is the most problematic alloying element because of its higher oxygen affinity than aluminium. Magnesium acquires into the dross due to selective oxidation during alloying, causing some aluminium loss.

Selectively oxidising elements (e.g. Mg, Sr and Ca) have a higher affinity for oxygen than aluminium. They tend to oxidise out of the melt at a high rate and form separate phases, where the oxidation rate increases with the increasing temperature of the melt and with increasing content. In non-selective oxidation (of e.g. Cu, Fe, Zn), which takes place at a low rate, the oxides that form are incorporated into the Al_2O_3 lattice depending on the atomic or ionic size of the element and generate a change in the oxidation behaviour by altering the oxide layer's structure and density.

- Enthalpy Change

The enthalpy changes due to melting and dilution (that is, not only the sensible heat) can have a large effect on the temperature of the aluminium bath.

As an example, aluminium alloying with 1 mass % Silicon, assuming an adiabatic system (no heat transport in or out), the temperature will drop by around 12.1 ^{0}C of the melt due to the enthalpy change.[6]

Table 2: Calculated enthalpy change (ΔH) and temperature change (ΔT) when adding 1 mass % of an alloying element

Alloying additives	***ΔH (kJ/kg)***	***ΔT (^{0}C)***
$Si_{(s)}$	1.43	-12.1
$Zn_{(l)}$	0.16	-1.4
$Cu_{(s)}$	-0.07	+0.6
$Mg_{(l)}$	-0.36	+3.1
$Mn_{(s)}$	-1.16	+9.9
$Fe_{(s)}$	-1.50	+12.7
$Li_{(l)}$	-3.89	+33.1

- Stirring

The main target in alloying practice is to achieve the target metal composition quickly and with minimal cost. In most cases, it is necessary to use a stirrer to shorten the alloying time and to ensure homogeneous distribution of the alloying elements in the liquid aluminium bath.

Conclusion

Sustainability is a top priority in modern metallurgy. In addition to recycling aluminium, it's possible to reduce the carbon footprint and energy saving of alloy production by recovering alloying elements from scrap.

Source: AL Circle Blog, 24 October 2025

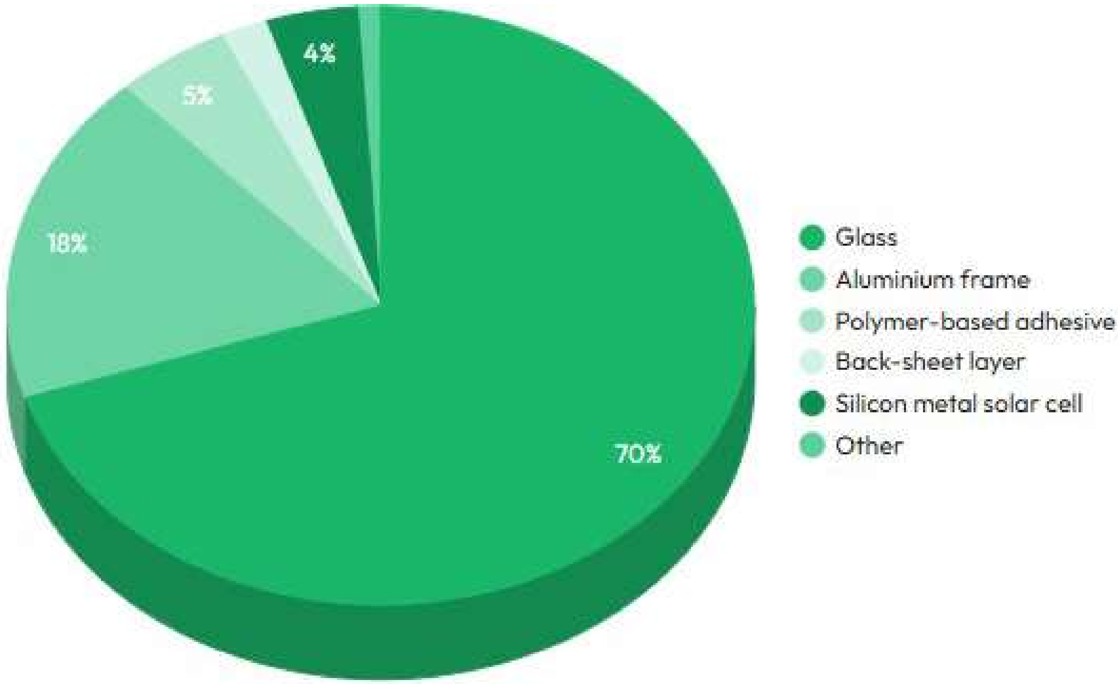
Circularity of Aluminium Used in Solar Photovoltaic Systems

End-of-life management of solar photovoltaic (PV) systems is fast emerging as a challenge and a strategic priority for manufacturing industries worldwide. Especially, aluminium circularity is becoming a focal point considering the metal accounts for more than about 85 per cent of PV component materials like frames and mounting structures. Truth to be told, solar waste is a growing concern now with the rapid rise in PV installations globally. In 2024, global installed capacity exceeded 2.2 TW, with nearly 600 GW added in a single year. Going by the International Renewable Energy Agency's (IRENA) estimation, around 8 million tonnes of waste are likely to be generated from PV modules by 2030, and that by 2050, is expected to soar to between 60 and 78 million tonnes, a substantial share of which will consist of aluminium scrap.

Currently, PV module waste and scrap by material type looks like this:

Component	***Share***
Glass	70
Aluminium frame	18
Polymer-based adhesive	5
Back-sheet layer	2
Silicon metal solar cell	4
Other	1

Source: IAI



Present usage and projection of aluminium usage in solar PVs

Aluminium is an integrated material of solar panels in both distributed and utility scale systems. 6-series aluminium primarily serves as a structural material in module frames and racking systems. In 2024, about 8 million tonnes of aluminium was used in the manufacture of PV systems, of which 4 million tonnes was used only in China's domestic PV capacity. By 2030, in Europe alone, an additional 4 to 10 million tonnes of aluminium would be required for photovoltaic structures as there is a projection of twofold increase in solar PV capacity to more than 750 GW. On average, manufacturing 1 MW of PV capacity requires 21 tonnes of aluminium. In concentrating solar power (CSP) systems, aluminium intensity is even higher than twice that amount, at approximately 47 kg per kW.

Hindrance and solutions to aluminium waste from PVs

So, if such large volume of aluminium goes into PV structures, then it is no longer a choice but imperative to scale up the recycle and reuse of aluminium waste generated from solar photovoltaic. Rethink, reuse, and recycle must become foundational principles for managing the growing aluminium scrap stream from PV systems.

Upstream design and material selection remain critical challenges to achieving aluminium circularity in solar PV. Often due to cost, PV manufacturers choose alternative materials to aluminium such as polycarbonate and composites, but these materials pose end-of-life challenges as they are difficult to recycle. Conversely, aluminium is recyclable but upstream players in the solar PV industry are majorly driven by material suitability, aesthetics, and cost requirements of customers, with limited end-of-life considerations.

Concerns around recycled aluminium quality further complicate adoption. PV manufacturers worry about residual trace element comprising alloy strength and corrosion resistance that could create liability risk. However, according to the International Aluminium Institute, these concerns can be mitigated through improved supply chain transparency, certification standards, and contractual protections. IAI further highlights that certain aluminium components, particularly distributed racking systems, often outlast PV modules and offer strong potential for reuse in secondary applications. So, scaling the reuse of end-of-life aluminium components in PV systems would require supply chain standardisation and certification infrastructure, which still remains nascent globally at this moment.

Collaboration plays a key role here

To unlock aluminium circularity in the solar PV sector, responsibility must be shared across the value chain, with coordinated action from governments, industry stakeholders, and recyclers.

The Government must -

- Strengthen policy and market signals through enforced product stewardship (e.g. EPR schemes for PV modules)
- Support recycling and reuse infrastructure with dedicated grants or low-interest finance
- Enable reuse pathways with national standards for second-life PV and racking with regulatory assurance for exports

Project developers and installers must –

- Establish end-of-life offtake arrangements with recyclers
- Work with certified refurbishers to test, grade and document removed modules and racking for reuse

Disassemblers and PV recyclers must –

- Reduce contamination and module damage during disassembly and develop co-located hubs with scrap traders to leverage existing infrastructure
- Work with standards bodies, governments and refurbishers to certify recovered materials and PV modules for reuse

Scrap metal traders must –

- Create dedicated streams and invest in sorting to verify alloy composition and improve PV aluminium feedstock quality
- Build direct relationships with solar PV supplying casthouses and extruders to align specifications and secure offtake

The twin advantage of aluminium recycling in solar PV

Material-wise, glass and aluminium make up nearly 90 per cent of solar photovoltaic structure, while the remaining 10 per cent is consisted of silicon, polymers, and traces of precious metals. PV frames typically use 6063-T5/T6 aluminium billets, while racking systems rely on alloys such as 6063-T5/T6, 6061-T6, and 6005-T5.

Despite structural challenges, the opportunity for aluminium circularity is significant. Notably, up to 30 per cent of decommissioned PV panels are removed prematurely due to degradation or early failure, creating an early and growing scrap stream. At present, most PV systems rely heavily on primary aluminium sourced through linear supply chains. Continued dependence on primary aluminium poses both supply risks and environmental costs, given that primary aluminium production carried an average emissions intensity of 14.8 tCO_2e per tonne as of 2023.

In contrast, recycled aluminium emits just 0.5–2 tCO_2e per tonne, compared with 12–17 tCO_2e for primary production. As global PV installations accelerate, enhancing aluminium circularity is not merely an environmental imperative—it is a strategic necessity to ensure material security, cost stability, and the long-term sustainability of the solar energy transition.

Source: AL Circle Article 21 Jan. 2026

Critical Mineral Recovery and Construction Use of Red Mud

Red mud, which is a result of alumina extraction, for decades now, has been treated as a hazard to the environment by the aluminium industry. But there shall be a change by an Indian aluminium company, which makes the entire industry rethink about its being a concern for the environment. India's NALCO is currently undergoing research to discover ways to turn "red mud", into usable building materials as well as the recovery of vital minerals.

NALCO has a stockpile of nearly 7.13 million tonnes of red mud after producing alumina at its Odisha Damanjodi refinery. This accumulation is deemed to be rising as NALCO predicts it will extract about 2.4 to 2.5 million tonnes of red mud each year as a byproduct from its refining process.

Red mud extraction = rise in critical minerals

NALCO is partnering with CSIR labs, which include the Institute of Minerals and Materials Technology (IMMT) in Bhubaneswar and the National Metallurgical Laboratory (NML) in Jamshedpur. This partnership will focus on developing technologies which shall aid in extracting valuable minerals like alumina, rare earths like scandium from the bauxite residue, lithium and iron.

To make the initiative a further success, the firm is undertaking a plan to start a recycling plant, which will be capable of handling 10 tonnes per day and act as a test to determine whether this can be extended to a larger scale.

If the entire plan works out, this will create a significantly bigger leap for the country as the possibility of sourcing critical minerals, which are vital for clean energy tech and high-tech manufacturing, domestically will increase and the dependence on imports will subsequently decrease.

Apart from critical minerals, it benefits building and construction

NALCO has already been experimenting, converting the red mud into bricks, which are highly used in the building and construction sector. For this initiative, NALCO has already commenced a pilot brick plant in Nagpur by collaborating with Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC). The idea behind this plant is to scale the brick production by producing nearly 10 lakhs bricks per year. In this process, red mud is mixed with additives and clay, followed by moulding and firing it in a kiln.

Not just industry, but the community as a whole

NALCO’s brick project is forecasted to hold a total cost of INR 30 million, which shall further support the community with greater job opportunities for nearly 40 to 50 people within the local communities near NALCO’s Odisha operations. Not only in terms of job, but the community will decrease the use of conventional clay bricks, resulting in a reduced number of red mud ponds.

On one side are the critical minerals and other holds bricks production, NALCO's dual approach is now altering the industrial idea of a waste hazard into a profit. These projects, as of now, are in their initial stages, where the representatives of the firm are buoyant about scaling that will not only reduce the environmental concerns but also change red mud from a nuisance to a genuine economic driver.

Source: AL Circle Article 21 Jan. 2026

Iron Ore Sector in India

India's iron ore industry, contributing over 90% of production from Odisha and Chhattisgarh with reserves exceeding 34 billion tonnes, faces stagnant output at 270 – 280 MT annually despite ranking second globally.

Year	Crude Steel Capacity (MTPA)	Iron Ore Requirement (Mn tons)	Iron Ore Production (Mn tons)	Iron Ore Export (Fines & Pellets) (Mntons)	Availability of Iron Ore After Export (Mn tons)	Shortfall in Requirement vs Availability
FY 2022-23	161	273	258	21.2	237	13%
FY 2023-24	180	306	275	48.0	227	26%
FY 2024-25	205	349	289	33.5	255	27%

Exports exceeding 40 MT last year have strained domestic steel mills amid coking coal costs rising 15-20% and logistics at ₹1,200-1,500 per tonne, while global steel demand nears 1.95 billion tonnes by 2027.

India aspires to achieve 300 MT of crude steel capacity by FY 2030-31. However, the last three years, growth in iron ore production has not kept pace with the expansion in crude steel capacity, resulting in a widening supply gap.

India’s iron ore production currently stands at around 289 Mn tons. However, huge exports of low-grade fines and pellets have led to a domestic shortage. In FY 2024-25, India exported approximately 33 MT of iron ore. Despite having adequate reserves, India was compelled to import nearly 6.5 MT of iron ore due to domestic scarcity. This shortage poses a serious risk to planned steel capacity expansion.

The demand – supply mismatch is also reflected in pricing trends. While IBM 60–62% Fe prices increased from₹4,445 in Apr’24 to ₹5,100 in Dec’25 (+15%), and OMC Gandhamardhan 60–62% Fe fines rose from ₹4,550 to₹5,200 (+14%), TMT prices declined from ₹47,023 to ₹39,656 (-16%) during the same period. This inverse trend has severely squeezed margins of secondary steel producers, making operations unviable, increasing NPAs, and risking large-scale job losses.

Major Issues:

1. **OMC Dispatch Performance (FY 2025–26)**:

For FY 2025–26, OMC has an Environmental Clearance (EC) target of 50 MT per annum (MTPA), equivalent to approximately 4.17 MT per month. Against the cumulative EC target of 33.50 MT for the period April–December 2025, actual dispatches amounted to only 26.10 MT, reflecting a shortfall of about 31%. Additionally, OMC dispatches during April–December 2025 declined by 11% compared to the corresponding period of the previous year.

2. **Underutilization of SAIL's EC Capacity**:

There has been significant underutilization of SAIL's EC capacity. In FY 2024–25, production fell short by 46% against the approved EC capacity of 80 MTPA. Further, during FY 2025–26 (April–November 2025), against the same EC capacity of 80 MTPA, SAIL achieved an average production of only 22.78 MT per month, indicating an approximate production shortfall of 36%.

3. **Decline in Supplies from Auctioned Mines and Odisha:**

Supplies from auctioned mines declined by 23% during April–December 2025 on a year-on-year basis. Overall dispatches from Odisha also registered a year-on-year decline of 7% during the same period.

4. **Iron Ore Exports (FY 2024–25)**:

During FY 2024–25, total exports of iron ore, including fines and pellets, amounted to 33 MT.

Source: Metalogicmymetalogic.com