The Indian Institute of Metals – Delhi Chapter

MET INFO

DECEMBER 2025

The Indian Institute of Metals Delhi Chapter

39, Tughlakabad Institutional Area, M B Road
Near Batra Hospital, New Delhi-110 062

Tele: 011-29955084

@ iim.delhi@gmail.com

www.iim-delhi.com

An Inhouse Publication

For internal Circulation Only

CONTENTS

Editor-in-Chief: R. K. Vijayavergia

Associate Editors: R. K. Singhal, Chandana Arjun

IIM DELHI CHAPTER

EXECUTIVE COMMITTEE: 2025-26

Manoranjan Ram
Chairman

Deepak Jain
Vice Chairman

N K Kakkar
Vice Chairman

K R Krishnakumar
Hon Secretary

R K Narang
Hon Treasurer

M P Sharma
Jt. Hon Secretary

Ms Chandana Arjun
Jt. Hon Secretary

Members

K K Mehrotra

R K Vijayavergia

Dr. Ramen Datta

N Vijayan

G I S Chauhan

B R Jain

R K Singhal

R K Sinha

Neeraj Nautiyal

Vijay Gupta

Ashok Kumar

Special Invitee

Prof. S Basu

Executive Committee Members: Contact Details

Name / Designation	Affiliation	Contact No / E-Mail
Shri Manoranjan Ram *Chairman*	Vice President – Sales & marketing Danieli Group	9910014989 manoranjanram@yahoo.com m.ram@danieli.com
Shri Deepak Jain *Vice Chairman*	Former Dy. Director General (W) BIS	9868640986, 8368622619 deepakjain7177@gmail.com
Shri N K Kakkar *Vice Chairman*	Former Vice President Somani Kuttner India Pvt. Ltd.	9871008505 nirmalkakkar@gmail.com
Shri K R Krishnakumar *Hon. Secretary*	Ex CGM SAIL & Former Consultant, Ministry of Mines	9818277840; 01202773861 kuduvak059@gmail.com kuduvakrishna@yahoo.co.in
Shri Ramesh Kumar Narang *Hon. Treasurer*	Former Head (Corporate Affairs) BALCO New Delhi	9899298857 rknarang62@gmail.com
Shri M P Sharma *Hon. Jt. Secretary*	Scientific & Technical Consultant Aluminium Industries	9212202084; 9818508300 aluminiumconsultant@yahoo.com aflmps@rediffmail.com
Ms Chandana Arjun *Hon. Jt. Secretary*	Manager - Design Technotherma India Pvt. Ltd	8547621796 chandanacalicut@gmail.com
Shri K K Mehrotra *Member*	Ex CMD MECON Limited	9868112514; 01203645267 kishorekmehrotra@gmail.com
Shri R K Vijayavergia *Member*	Ex Executive Director (Operations), SAIL & Former Consultant, SRTMI	9650155544 rkv.sail@gmail.com
Dr. Ramen Datta *Member*	Ex General Manager, RDCIS, SAIL & Former Consultant, SRTMI	9958084110 dattaramen@gmail.com
Shri N Vijayan *Member*	Director Technotherma India Pvt. Ltd.	9818695690 technothermaindia@gmail.com
Shri G I S Chauhan *Member*	Ex Executive Director I/c, RDCIS, SAIL	9717302437; 7048993116 gisc.delhi@gmail.com
Shri B R Jain *Member*	Sr. Adviser Engineering Council of India	9313190011 jainbinay@gmail.com brjeci@gmail.com
Shri R K Singhal *Member*	Consultant, SRTMI & Ex Executive Director (Corporate Affairs), SAIL	9910055630 rksh.singhal@gmail.com
Shri R K Sinha *Member*	Ex Director (Operations) Modern Steels Ltd	8968684955 rksinha555@gmail.com
Shri Neeraj Nautiyal *Member*	Senior Vice President Yogiji Digi Pvt Ltd	9811956565 nautiyal_n@yahoo.co.in
Shri Vijay Kumar Gupta *Member*	Ex Director (Engg.) AIR & DD, New Delhi	9810135561 vijay_gupta_m@yahoo.com
Shri Ashok Kumar *Member*	Ex General Manager SAIL, New Delhi	8076904331 akdel12@gmail.com
Prof. Suddhasatwa Basu *Special Invitee*	FIPI Chair Prof. (HAG) IIT Delhi	7838134181 drsbasu@gmail.com

Visit of Prof. B S Murty, President IIM

During the visit of Prof. BS Murty, President IIM and Director IIT Hyderabad, on 4th Nov. 2025, at New Delhi, IIM Delhi Chapter organised an interaction program for him to interact with Delhi, Roorkee and Hisar Chapters, and students and faculty of IIT Delhi. The program was held at IIT Delhi, in association with the Department of Materials Science & Engineering (DMSE). Shri L. Pugazhenthy, Past President, IIM and Executive Director, ILZDA, Prof. Suddhasatwa Basu, FIPI Chair Professor, IIT Delhi and Special Invitee of Executive Committee of IIM Delhi Chapter, and Brig. Arun Ganguli (Retd.) Secretary General of IIM were also present. IIM Members affiliated with Delhi Chapter, representatives of Roorkee and Hisar Chapters and faculty members and students of DMSE attended the programme. About 80 attendees were there in the event.

Prof. Suresh Neelakantan, Officiating In-charge of DMSE, IIT Delhi welcomed the gathering. He enumerated the activities of DMSE and the various projects being undertaken by them in the area of polymers, metals, ceramics, fundamental and computational materials. Prof. Neelakantan mentioned that a newsletter by DMSE is being published periodically which, among other information, contains achievements of students and faculty of DMSE.

Shri Manoranjan Ram, Chairman, IIM Delhi Chapter, welcomed Prof. B S Murty, and other dignitaries on the dais and participants present in the programme. Shri Manoranjan stated that the last time the IIM President interacted with the Delhi Chapter was in 2017, when Prof. Indranil Manna visited the Delhi Chapter. Shri Manoranjan mentioned that the Delhi Chapter is unique as the IIM members affiliated to Delhi Chapter are from 6 NCR cities (Delhi, Ghaziabad, Noida, Greater Noida, Faridabad, Gurgaon) and also Bhiwadi in Rajasthan. He mentioned that Delhi Chapter is one of the important Chapters of IIM. He enumerated the activities undertaken by Delhi Chapter. He talked about innovations in processing of Steel and Aluminium. He invited students to become members of IIM.

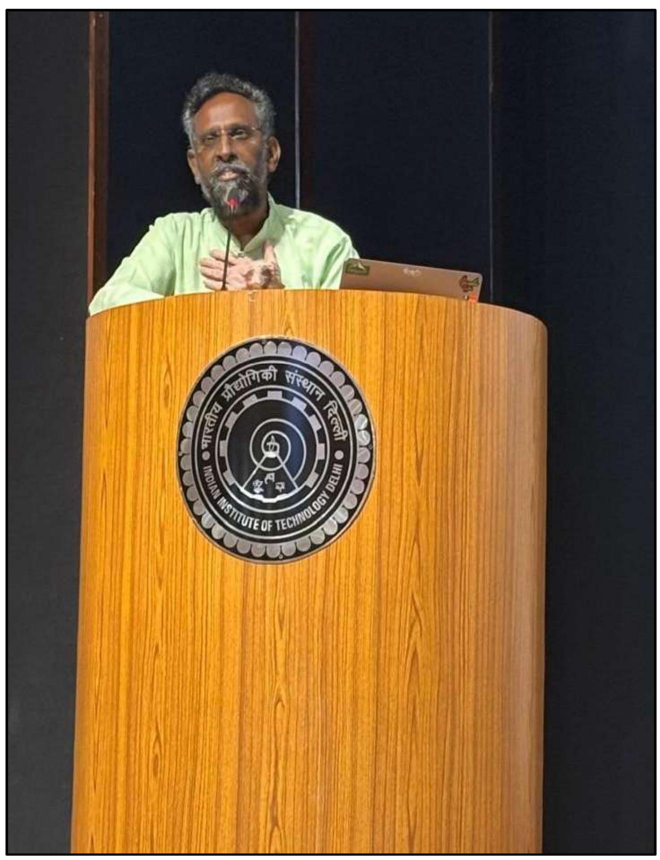

The Indian Institute of Metals – Delhi Chapter
DMSE
Welcome Prof. B. S. Murty
President, Indian Institute of Metals (IIM)
Director IIT Hyderabad
Department of
Science and Engineering, IIT Delhi
Time: 8:00 PM - 10:00 PM


The Indian Institute of Metals – Delhi Chapter
DMSE
Welcome Prof. B. S. Murty
President, Indian Institute of Metals (IIM)
Director IIT Hyderabad
Department of Materials Science and Engineering, IIT Delhi
Date: 4th November 2025 | Time: 8:00 PM - 10:00 PM

Shri L Pugazhenthy, talked about Material Science and Non-ferrous Metallurgy. He stated that metals are everywhere in our day-to-day life and play a catalytic role in the promotion of industrial activities. Professional bodies like IIM are playing a major role in this. He requested the students to join the IIM fold. This will increase their networking and give them the opportunities to widen their perspective in the metal and materials science sectors.

Brig. Arun Ganguli (Retd.), spoke about the various initiatives taken by IIM in the field of metallurgy. He mentioned that IIM takes special care of students. Presently IIM has about 3000 student members. IIM intends to increase student membership manifold. IIM membership, which is free for students, gives opportunities to them for free access to IIM publications, namely *Transactions of IIM* and *IIM Metal News*. IIM also recognise students with various accolades He invited students to come forward and become student members of IIM.

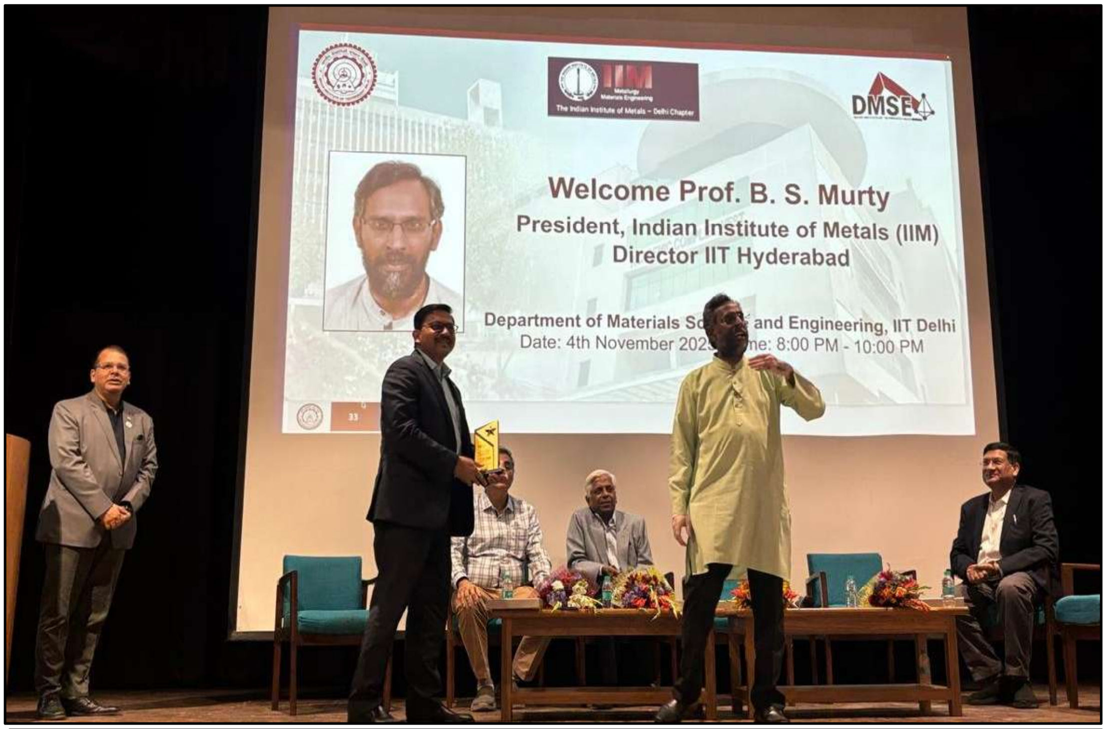
Prof. S Basu, spoke about mineral beneficiation and extractive metallurgy. He mentioned that material science students should join IIM fold. He requested students and faculty to take up recycling of spent battery materials. The student membership of IIM gives free access to various publications and journals of IIM which are heavily subscribed.

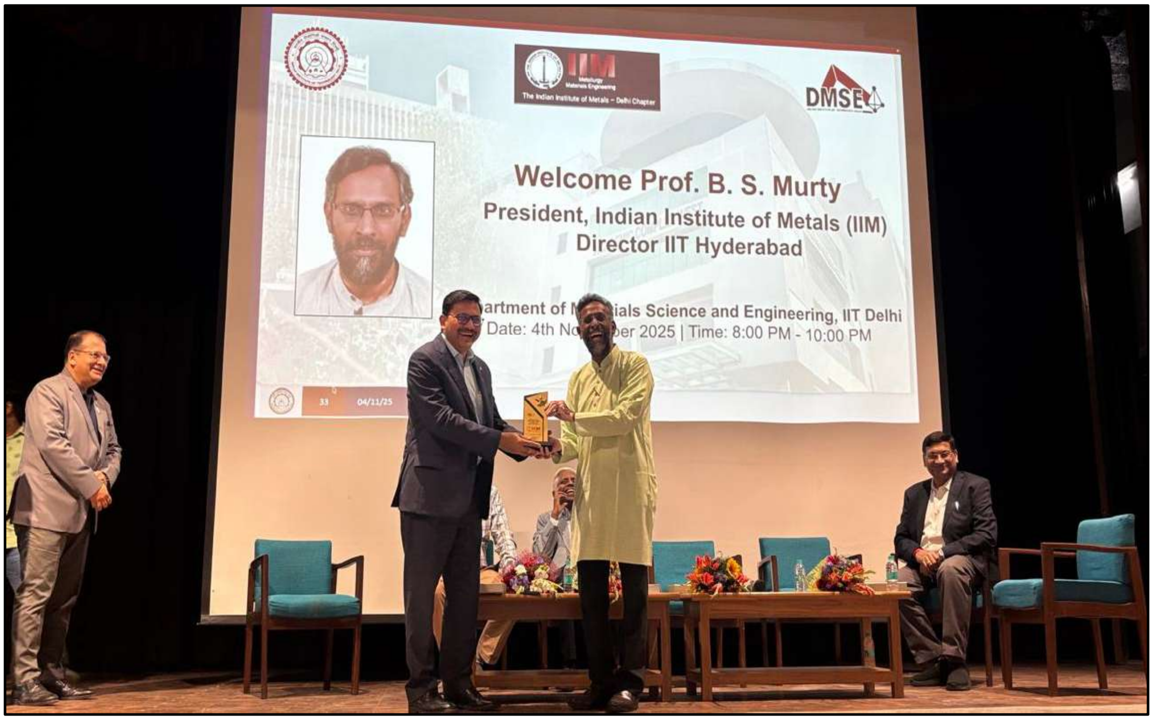


Prof. B S Murty spoke about the role being played by IIM in the promotion of metallurgy in India. He mentioned that IIM is a very old professional body and has a membership of about 11000. IIM has international collaborations with overseas professional bodies in the area of metallurgy. He exhorted the student community to become members of IIM. The polytechnic students can also become members of IIM. The girl students are most welcomed to become IIM member. IIM gives high importance to student affiliated Chapters. He spoke about critical minerals and extractive metallurgy. IIM conducts short-term courses also, which facilitate continuous learning.

There was a lively question and answer session in the event.

Shri Deepak Jain, Vice Chairman, IIM Delhi Chapter delivered vote of thanks. He conveyed his sincere thanks to Prof. B S Murty to spare his valuable time for interaction with IIM Chapters of Delhi, Roorkee and Hisar and also students and faculty of IIT Delhi. He also thanked IIT Delhi for extending the facilities for the programme.




IIM
The Indian Institute of Metals – Delhi Chapter
DMSE
Welcome Prof. B. S. Murty
President, Indian Institute of Metals (IIM)
Director IIT Hyderabad
33
04/11/25


Director IIT Hyderabad
Department of Materials Science and Engineering, IIT Delhi
Date: 4th November 2025 | Time: 8:00 PM - 10:00 PM
33
04/11/25

The programme was followed by dinner. During the dinner there was informal interaction of Prof. B S Murty, Brig. Ganguli (Retd.) and Chairman IIM Delhi Chapter and members of Executive Committee of IIM Delhi Chapter with students and faculty of IIT Delhi.

The Brass Age is Back

It was possibly the invasion of stainless steel in our lives that exiled brass from our homes. Stainless steel, which lived up to its name, shone in its low maintenance glory as opposed to brass that veered towards tarnished blackness and then sulked in verdigris if it was neglected for a while. Ceramic, glass, crystal and even plastic came in as brass stayed away. But not any longer. The metal is back in décor and how.

It is the metal of the moment, says Delhi-based interior designer Lipika sud. “We are not really reviving it, we are just rediscovering its warmth and versatility,” says Sud, who calls brass the new quiet luxury in décor and says designers are using it in lighting furniture accents, tableware and art objects.

Various artists and brands have been working to give brass a fresh appeal. Delhi-based multidisciplinary designer Vikram Goyal, known for his work with brass, has now translated his signature style into a range of products as part of his lifestyle brand Viya, launched in January. Goyal says the renewed interest in brass is part of a larger revival of traditional materials that speak to both heritage and sustainability. He adds. "For me, working with brass has always been about reinterpreting a centuries-old legacy within a contemporary framework. Brass carries the warmth of the handmade and the endurance of something meant to last, which deeply resonates with today's conscious consumers seeking meaning in their personal spaces."

Sud says that after the pandemic, people are seeking to connect with materials that matter to them emotionally and feel more authentic and timeless. And brass ticks all those boxes.

Showing their Metal

Even fashion designers are making the switch from clothes to brass. Like Jenjum Gadi. Last year, he showcased his first exhibition of artefacts – a series of brass fruits and vegetables – inspired by his village Deke in Arunachal Pradesh. Priced between Rs 2 lakh and Rs 12 lakh, the first series is almost sold out. This year he has 14 one-of-a-kind pieces. Gadi has pared down his clothing work and is having "fun" exploring this new medium.

"Brass has been a good creative outlet for me," says Gadi, whose pieces look traditional yet modern.

What makes brass attractive to designers is that it is cheaper than many metals, estimated to cost about Rs 900 a kilo, and easy to work with. These two reasons resonate with designer Payal Khandwala who recently launched her Home collection, crafted in brass, to add to her fashion line. Incidentally, she already has a line of brass jewellery.

Another pull for designers is brass's connection to the past. Khandwala says nostalgia plays a big role in its continuation if not revival. "Brass was the mainstay of so many households. Perhaps it is subliminal to be drawn to something that lives in memory," she says. "Maybe the warm familiarity it brings becomes the reason for brass iterations in design over the years."

Khandwala has a limited range of everyday objects in brass that she felt were mostly neglected or overlooked like toothpick holder, bottle opener, etc. "I wanted to make them with the care and attention they deserved, so that they didn't have to be tucked away after use. They became objects of art," she says.

Top Brass

Brass has a long history in Indian homes but it is now seeking a new space, says designer and décor expert Krsnaa Mehta, senior vice president and executive director at India Circus by Krsnaa Mehta, a brand by Godrej. Mehta crafts many contemporary pieces with the metal, making sure it suits today's needs. "The modest brass piece – once confined to lamps and ritual lighting – has gracefully migrated to dinnerware and beyond," he says. Mehta has crafted pieces like stirrers and napkin rings in brass and says the designs appeal to modern consumers as they are very unlike the "conventional" dinnerware.

One of their bestsellers is the brass tumbler set that evokes the ritual of filter coffee. Mehta is now working on brass dinnerware, from katoris to thalis.

Utensils and cookware are the speciality of P.TAL, which was started by cofounder Aditya Agrawal as a college project in 2018, when he and his friends came across the Thathera community of Jandiala Guru in Punjab. Its artisans are behind India's only UNESCO-listed craft for hand-beaten brass and copper. Says Agrawal: "What struck us was the paradox – here was a craft of global cultural importance, practised by highly skilled artisans, yet it was on the verge of fading out. Not because the craft lacked value, but because it had lost relevance in modern homes."

He says brass lost its sheen because of many reasons: the rise of cheap, mass-produced materials, the idea that brass is high maintenance, designs that were just ceremonial or outdated. "The craft was alive, but the context bad disappeared."

Agrawal says their customers have grown from a handful of early adopters to lakhs across India and outside, with consistent double digit annual growth: "The demand is not trend-driven: it's values-driven," he says. Their customers include young people who are building homes and people returning to slow living and rooted aesthetics. Khandwala, who is scaling her home segment, says her audience is super niche: "They have a discerning eye and want everything in their home to reflect that."

Goyal, on his part, experiments with centuries-old craft like repousse, in which a metal is hammered on the reverse side to create a design in relief, and their signature hollowed joinery technique. He also trains new generations of artisans to develop forms that push the boundaries of scale and expression. He says, "I see revival not as preservation but as evolution where innovation and tradition coexist, allowing a timeless material like brass to find new relevance in the modern world."

Patina of Past

Gadi says that one must learn to love the patina that brass develops naturally. If you want to buff up brass, that is not difficult, says architect and interior designer Taral Jadhav. "Brass ages gracefully. So, I always tell clients to embrace its patina instead of over polishing. Gentle cleaning with lemon juice and baking soda works well," she says, adding that the warmth of brass works well with materials like marble, stone and matte wood.

Agrawal says the patina is simply a way anything natural ages – leather, solid wood, metal. He says people, who once moved towards what was convenient, now realize there is more to brass. "The story is not that brass is difficult – it's that were never taught how to live with real materials." It's time to get real.

Source: The Economic Times, 9th November 2025

India to Produce 500 t of Neodymium by FY27

The crisis of rare earth globally has fast-tracked India's ambitions in the sector, and the country is expected to clock a nine-fold rise in production to 500 tonnes of neodymium by the end of the financial year 2027, and may close the current fiscal at around 200 tonnes by the end of this fiscal.

Neodymium is considered the backbone of the rare-earth magnet industry, and India produced around 10 tonnes of this last year when the rare-earth crisis was at its peak.

IREL, which comes under the Department of Atomic Energy, currently handles mining and initial processing of these rare earth elements. IREL is working to ramp up the production of neodymium and praseodymium, very much required by the industry now. It is aimed to double the production within a year.

Earlier 20-40 tonnes of neodymium was being produced when the magnet industry was struggling. Soon it will be ramped up to produce 200 tonnes by the end of this fiscal year, and by the end of the next fiscal, it will touch 500 tonnes with indigenous engineering.

IREL has an extraction plant of rare earths in Odisha and a refining unit in Kerala. Rare earths are crucial components in electric vehicles, electronics, clean-energy technologies such as wind turbines and electric vehicles (EVs), defence systems, medical equipment (MRI), and various industrial applications.

Out of 17 rare earths, eight are already being produced in the Kerala unit – lanthanum, cerium, neodymium, praseodymium, gadolinium, samarium europium, and dysprosium. It has also set up pilot plants for terbium and europium.

China has around 44 percent of the total rare-earth business in the world, while India has around 5-6 percent. However, China is number one in production, controlling about 90 percent of it, while India is third in the world. We are also sixth in terms of reserves.

IREL has already set up a rare-earth permanent magnet (REPM) plant for indigenous production of samarium-cobalt magnets exclusively for use in the defence and atomic energy sectors.

Central government, in January this year, through the National Critical Mineral Mission (NCMM), proposed an expenditure of Rs 16,300/- crore and an expected investment of Rs 18,000/- crore by PSUs and other stakeholders, over a period of seven years starting from FY25 to FY31. The NCMM aims to secure a long-term sustainable supply of critical minerals and strengthen India's critical mineral value chains encompassing all stages from mineral exploration and mining to beneficiation, processing, and recovery from end-of-life products.

Source: Business Standard, 9th November 2025

Mining Silver and Other Materials from Retired Solar Panels

With global solar energy installation continuing to move north, the number of solar panels reaching their retirement will also increase, resulting in waste. To lower the environmental burden, the concept of solar panel recycling is gaining ground.

Beyond Renewables & Recycling, a startup launched in 2024 is building a large-scale solar waste recycling ecosystem in Rajasthan. Solar panels recycling was already happening in developed nations like the US, Germany, Italy, China, Singapore, and Australia.

How does it work?

The startup has developed a proprietary process to recover over 95 percent of materials – including silver, silicon, and glass – from end-of-life solar panels, turning hazardous waste into a high-value, circular resource.

India's rapid solar adoption is expected to generate nearly 1.2 million tonnes of solar PV waste by 2040. This wastage could climb to 4.8 million tonnes in an early-loss scenario – the failure of numerous solar panels before their expected lifespan.

Much of this e-waste is currently handled by the informal sector, which often lacks the infrastructure to safely process hazardous materials, leading to low recovery rates and environmental damage.

Beyond Renewables & Recycling started developing its own blueprint for recycling panels to allow for not just high recovery of raw materials, but also eco-effectiveness, to ensure that the recycling process to be designed does good for the environment.

Logistics and Land

The facility will follow the norms set by the Central Pollution Control Board in the storage and handling of solar waste modules. It will be equipped to recycle 10-15 tonnes of waste modules daily.

Incentives

There is a policy push on solar waste recognition. In the e-waste management rules of 2022, the government included solar waste in the e-waste category. Today, any producer of waste – whether a solar panel manufacturer, an asset developer, or an EPC company – is required by the pollution board to hand over waste solar panels only to registered recyclers, he explains.

Revenue

The company targets becoming fully operational on February 1, 2026. "The materials that we extract after recycling are metals mostly, which are usually sold openly in the metal scrap markets, or jewellers for silver.

Funding

The start-up recently raised Rs 5 crore in a pre-seed funding round led by Momentum Capital, with participation from Venture Catalysts, IIMA Ventures, Oorjan Cleantech, and Gautam Das.

Source: The Hindu Businessline, 24th November 2025

Aluminium Prices Poised to Remain Elevated

Aluminium prices are expected to stay elevated over the next few months on hopes of stronger global growth despite geopolitical uncertainties, driven by demand from the clean energy value chain (solar, wind, grid and electric vehicles).

Concerns over limited supply have also kept prices firm, and they are set to persist as China is nearing the 45 million tonnes (mt) smelting cap it has set, constraining domestic expansion.

China's primary aluminium production was up 0.4 percent year-on-year in October at 3.8 mt, but was down 9 percent from September.

Aluminium, which is used in transportation, packaging, construction, consumer goods and electrical transmission, has been gaining ground of late as the risk of lower supply has returned to the market.

The end of the US government shutdown on November 12 has renewed market optimism and contributed to a weaker dollar, adding a further tailwind.

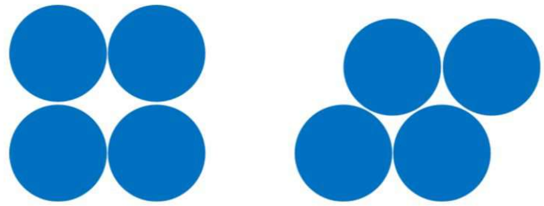
Growing global demand for new, energy-efficient cars and technologies and increased electrification efforts are expected to lift aluminium demand over the medium term.

Stronger global manufacturing and China's rapid renewable buildout were supporting aluminium prices.

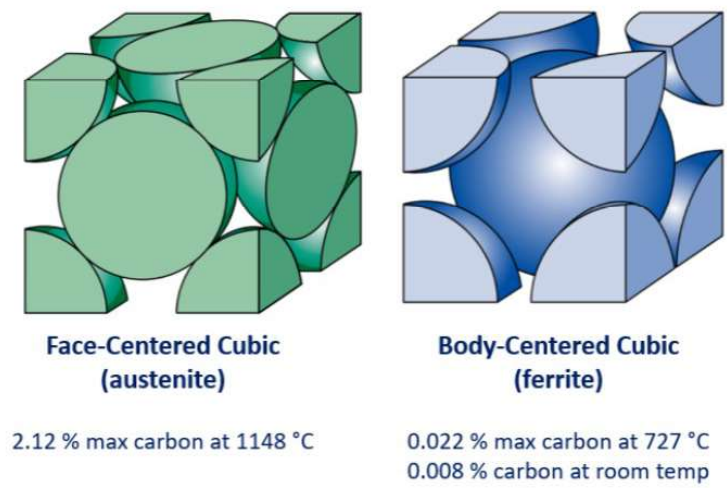
Source: The Hindu Businessline, 21st November 2025

Mild Steels to Advanced Steels: The Phases Make The Difference

Atoms arrange themselves in three-dimensional patterns called lattices. Think about billiard balls in multiple layers. The balls can be one layer directly above the prior one, or they can be shifted and rest in the crevice formed by adjacent balls in the layer below. The balls are all the same material, but the gap size changes with different arrangements.



A crystal lattice shows atoms in a defined, repetitive pattern. In this simple example the atoms can arrange in a square or triangle pattern. The atom size is the same, but the gap size where small elements like carbon can go depends on the lattice arrangement.



Ferrite and Austenite: The Building Blocks of Steel

This is what happens with steel, which for most automotive grades are at least 97% iron. At temperatures below 725 °C, a maximum of only 0.02% carbon fits in the gap between the iron atoms. This orientation is called **ferrite**. At higher temperatures, a different atomic orientation is stable, which we call **austenite**. Up to 2% carbon can fit into this arrangement of atoms. For low-carbon steels under normal conditions, austenite cannot exist at room temperature – when the steel is slowly cooled, it changes from austenite to a combination of ferrite and a mixture of phases called **pearlite**.

Ferrite: Soft, Ductile, and Low-Strength

100% iron is very soft. Ferrite at room temperature is iron with no more than 80 parts per million of carbon. That's really close to pure iron, so when discussing ferrite, think of something soft, low-strength, and ductile.

Carbon-Manganese Steels: Structural Strength

If additional strength is needed, then more alloying elements must be used in addition to carbon. The next most cost-effective alloying element for strengthening is manganese which produces higher-strength steels called **carbon-manganese** steels. These grades have limited ductility, especially at higher carbon and manganese contents, so they are used in structural applications that do not need a lot of formability and are therefore also called structural steels (SS).

Microalloying: The Birth of HSLA Steels

Around 1980, steelmakers rolled out a new approach to getting higher strength levels while minimizing the loss of elongation usually seen with higher strengths. They accomplish this by strengthening the ferrite through the addition of very small quantities of titanium, niobium, and vanadium to form carbide and nitride precipitates. These microalloying additions are used in precipitation hardening of the ferrite to create **High Strength Low Alloy (HSLA)** steels.

Rapid Cooling Enables Martensite Formation

The steels discussed to this point are produced with relatively slow cooling. However, investments by the steel industry resulted in equipment capable of reaching rapid cooling (quenching) rates that allow for production of a very high strength phase called **martensite**.

Martensite wasn't commonly found as a **microstructural component** during most of the history of automotive sheet steels due to the limited number of companies having an annealing line with appropriate quenching capabilities. This started to change around the turn of the millennium when newer annealing lines were installed with capability to achieve complex thermal cycles. This allowed for production of the first generation of Advanced High-Strength Steels (AHSS), including grades that have a microstructure of only martensite.

Dual Phase (DP) Steels: Balancing Strength and Ductility

Dual Phase (DP) steels are the most common AHSS. Ferrite and martensite are the two phases in DP steels: ferrite is super-soft and comprises the majority of the microstructure, while martensite is super-hard and takes up 10% (590DP) to 40% (980DP) of the microstructure. The more martensite, the stronger the steel. Since most of the structure is ferrite, these steels have exceptional **elongation** as measured in a **tensile test** for the strength level.

TRIP Steels: Transformation-Induced Plasticity

For as good as DP steels are in tensile ductility, **TRIP steels** are even better. The magic of these grades comes from retained austenite. Austenite is a very ductile phase. What makes this a special phase is that as austenite-containing steels deform, the atoms rearrange and the austenite transforms into martensite, giving the steel enhanced ductility — which researchers state as greater plasticity. Another way of saying that this enhanced ductility comes from austenite transforming to martensite is that these steels have Transformation Induced Plasticity (TRIP).

Ferrite-Bainite and Complex Phase (CP) Steels: Improved Edge Ductility

In both DP and TRIP steels, the large hardness difference between ferrite and martensite leads to crack initiation sites and results in poor cut-edge ductility during stretch flanging. For applications like stretch flanging that need improved cut-edge ductility, one option are the **Ferrite-Bainite** grades. Bainite is a little lower in strength than martensite but has higher elongation and toughness. Another option are **Complex Phase (CP) steels**, which have a microstructure of bainite and precipitation-strengthened ferrite, with martensite and retained austenite also present in lower amounts. Lacking soft ferrite, these steels have relatively high yield strength and low elongation as measured in a tensile test, but the bainite leads to exceptional cut-edge ductility as measured in a hole expansion test.

TWIP Steels: Twinning-Induced Plasticity

TWIP steels containing only austenite, and as such are a high-strength, high-ductility steel. These may be written like TRIP steels, but these steels get their plasticity differently. TWIP steels deform by a mechanism known as twinning, so they are described as Twinning Induced Plasticity Steels (TWIP). Unfortunately, achieving the combination of high strength and fantastic formability requires a lot of alloying. This drives up the steelmaking complexity and cost. The alloying elements also make welding much more challenging. TWIP steels are considered second-generation advanced high-strength steels.

3rd Generation AHSS: Tailoring Microstructures for Performance

Nearly all **3rd Generation Advanced High-Strength Steels (3rd Gen AHSS or 3rd Gen)** have retained austenite in the microstructure and therefore benefit from a high strength, high ductility combination through the TRIP Effect. The latest annealing lines allow for the creation of an engineered balance and distribution of ferrite, bainite, martensite, and austenite in the microstructure, providing the resultant alloy with properties that can be tailored to address the requirements and challenges of each automotive part.

The Future of Automotive Steels

Together, there are nearly 70 grades of advanced high strength steels available globally. The days of steel being simply a commodity are in the past as it relates to these highly engineered higher strength steels.

Source: WorldAutoSteel Update, 26 Oct. 2025

Nippon Steel's Advanced Manufacturing Technologies

Nippon Steel's advanced manufacturing technologies, developed over decades of research, span revolutionary hydrogen-based steelmaking, advanced electrical steel production, and cutting-edge blast furnace optimization systems.

The groundbreaking **COURSE50 technology program** uses *heated hydrogen injection* into blast furnaces to partially replace traditional coke-based reduction processes, achieving unprecedented carbon emissions reductions. Recent trials at Nippon Steel's Kimitsu test facility have demonstrated a **43% CO_2 reduction**. The technology maintains thermal balance within blast furnaces while dramatically reducing carbon footprint, proving that environmental sustainability and operational efficiency can coexist in heavy industry.

Hydrogen metallurgy advancement through the **Super COURSE50 program** represents Nippon Steel's most ambitious technological development. The program targets **50% or greater CO_2 emissions reduction** by 2029 through advanced hydrogen direct reduction processes combined with sophisticated heat recovery systems. This technology addresses the fundamental challenge of hydrogen-based steelmaking–the endothermic nature of hydrogen reduction that traditionally requires external heat input. Nippon Steel's breakthrough involves heated hydrogen injection combined with optimized furnace operation that maintains production efficiency while achieving unprecedented environmental performance.

The **NSCarbolex Neutral green steel program,** the certified green steel product uses mass balance methodology to allocate CO_2 emissions reductions from Nippon Steel's decarbonization projects to specific steel products, enabling customers to reduce their Scope 3 emissions.

Nippon Steel's Carbon Neutral Vision 2050 represents one of the steel industry's most ambitious decarbonization commitments, targeting **30% CO_2 emissions reduction by 2030** and complete carbon neutrality by 2050. The strategy encompasses two primary approaches: developing breakthrough technologies for low-emission steel production and providing high-performance products that enable customer emissions reductions across value chains. This environmental transformation is proceeding despite current financial constraints, reflecting management's belief that sustainability leadership will drive long-term competitiveness.

Electric Arc Furnace expansion represents the cornerstone of Nippon Steel's near-term decarbonization strategy. EAF technology enables steel production using recycled scrap metal with dramatically lower carbon emissions compared to traditional blast furnace operations. The company's EAF investment program will increase annual production capacity by **2.9 million tons** while positioning Nippon Steel as a leader in low-emission steelmaking.

Hydrogen-based technologies offer the most promising path to deep emissions reductions in primary steel production. The Super COURSE50 program aims to achieve **50% CO_2 reduction by 2030** through advanced hydrogen direct reduction of iron (H_2-DRI) processes. The company's Hydreams R&D Center, representing a ¥1.7 billion investment, is accelerating commercialization of hydrogen technologies that could revolutionize steel production. However, technical challenges including hydrogen embrittlement and energy costs remain significant barriers to widespread deployment.

Decarbonization in Latin America

Every region must align its decarbonization strategy with local resources, energy costs, and regulatory frameworks. In this article, the conditions in Latin America are examined highlighting opportunities that position the region as a favorable environment for sustainable transformation.

The steel industry is undergoing a profound transformation. While decarbonization is undoubtedly the most critical long-term challenge, it is just one of many pressing issues today. Amid these uncertainties, steel producers – both in Latin America and globally – face a pivotal question: Act now or wait? In this transformative period, identifying the right pathway is essential. The decision must account not only for investment volumes but also for regional factors, market dynamics, raw material availability, and utility costs. These considerations are key to crafting a strategy that balances sustainability with economic viability.

Smart Solutions Available

The green transformation of the steel industry hinges on substantial investments. However, significant progress can also be achieved through operational optimizations that reduce both CO_2 emissions and costs. The convergence of automation, electrification, and digitalization is accelerating this transformation by improving energy efficiency, minimizing waste, maximizing recycling, and enhancing overall performance:

- Automation improves process control, reduces energy losses, and optimizes equipment performance.
- Electrification replaces fossil fuel-based systems with cleaner alternatives, directly curbing emissions.
- Digitalization leverages real-time monitoring, predictive analytics, and data-driven decision-making to enhance resource utilization and operational efficiency.

These principles are applied by integrating real-time data collection, advanced analytics, and process optimization to support decarbonization in industrial environments. The solutions focus on enhancing energy efficiency by identifying performance gaps, detecting leaks, optimizing resource distribution, and forecasting energy demand. Additionally, they offer tools for tracking, managing, and reporting emissions, thus providing transparency in energy use and emissions tracking. This can empower steel companies to take proactive steps in reducing their carbon footprint. By combining automation, electrification, and digital intelligence, these tools enable companies to take proactive steps toward sustainability without disrupting ongoing operations.

Integrated level 2 process control system for blast furnace operations can help in optimizing fuel consumption, delivering measurable reductions in CO_2 emissions.

Combination of advanced tools to evaluate and compare production pathways, optimizing the carbon footprint, operational costs (OPEX), and electricity consumption. can enables steelmakers to conduct a tailored assessment of possible adaptations and/or evolutions in the production route. Smart solutions offer a great potential for CO_2 and cost reductions.

Structural Advantages

Latin America offers unique advantages compared to other regions. Brazil, Argentina, and Chile are particularly well placed to accelerate the transition to low-carbon steel production. Brazil's energy matrix is predominantly renewable, with almost 90% of its electricity generated from clean sources. Investments in wind and solar energy are expanding this capacity annually. Similarly, Argentina generates 36% of its electricity from hydroelectric, wind, and solar sources – outpacing major industrial nations such as China, Japan, and the United States.

The substantial availability of renewable energy, especially in Brazil, combined with existing infrastructure, is considerably beneficial in terms of the capacity to produce green hydrogen at a competitive cost. The hydrogen-based reduction of iron ore significantly reduces greenhouse gas (GHG) emissions.

In addition to renewable energy, Latin America benefits from significant biomass availability. The substitution of fossil fuels with carbon-neutral biomass, such as charcoal, is a viable alternative in Brazil. Various players in the steel sector invest in production units for charcoal derived from sustainable eucalyptus cultivation. SMS group in Brazil has experience in designing pulverized charcoal injection installations in small blast furnaces, an interesting alternative aimed at reducing costs and the carbon footprint. There are other applications where biomass can be used for bioelectricity generation and biochar production, contributing to carbon emission reductions.

Private sector initiatives are also gaining momentum. For example, Vale, Eletrobras, and Porto do Açu are jointly developing decarbonization hubs, while ArcelorMittal is investing in renewable energy and green hydrogen projects at the Pecém complex in Ceará, Brazil.

In this complex regional and geopolitical context, Brazil has also made progress in carbon market regulation, creating a favorable environment for investment in sustainable technologies. Recently, the Federal Senate in Brazil approved a bill regulating the carbon credit market in Brazil. This legal framework establishes the foundations for a regulated carbon market, like the one currently operating in the European Union, encouraging companies to adopt more sustainable practices and contributing to lower greenhouse gas emissions.

Conclusions

Latin America is uniquely positioned to lead the global decarbonization of the metals industry. Its abundant renewable energy resources, green hydrogen potential, and biomass availability provide an unparalleled foundation for sustainable steel production. The region's progress in renewable energy investments and carbon market regulation further solidifies its position.

The question remains: Act now or wait? By acting now, companies can capitalize on these advantages, reduce emissions, and secure long-term economic and environmental benefits. Waiting, on the other hand, risks missing out on these opportunities.

Source: SMS group #Connect update, Sept. 1, 2025

Emission Measurement Methodologies for Steel sector

Measurement standard	Current status and frequency of review	Focus of the standard	Verification and accreditation
worldsteel CO_2 methodology	Latest guidance published in 2023, regular review is possible.	Production (all routes)	NA
worldsteel LCI methodology	Latest guidance published in 2017, regular review is possible.	Product (covering 17 finished products)	NA
ISO 14404 series	Part 1 and 2 under review from 2023, part 3 under review from 2022, part 4 under review from 2025. Systematic review every 5 years.	Production (all routes, specific standards for BOF, scrap EAF, DRI)	NA
ISO 20915: 2018	Under review from 2023. Systematic review every 5 years.	Product (exact products not specified)	NA
ResponsibleSteel	V2.0 published in 2022; V2.1 to be published Q4 2023 following a test phase Standard revision at least every 5 years; next version due Dec 2024.	Production (all routes) and products	Independent verification
WRI GHG Protocol Corporate Standard	Last published in 2008, no plans for update.	Production BOF, scrap EAF, DRI	Independent verification
Emissions trading systems, e.g. EU ETS	Last update published in 2018.	Production (all routes)	Independent verification
Science Based Targets initiative	Under consultation.	Production (all routes)	Under development
Sustainable STEEL Principles	Launched in 2022.	Production (all routes)	[checking]
CBI Steel Criteria	Launched in 2022.	Production (all routes)	Standard body

Notes: LCI = Life Cycle Inventory; BOF = basic oxygen furnace; EAF = electric arc furnace; DRI = direct reduced iron; WRI = World Resources Institute; EU ETS = European Union Emissions Trading System; CBI = Climate Bonds Initiative.

Source: IEA Emissions Measurement and Data Collection for a Net Zero Steel Industry

Hertha Metals

Hertha Metals, a startup backed by tech billionaires Bill Gates and Vinod Khosla claims that it has successfully tested a new approach for making steel that minimizes planet-warming emissions without raising costs above traditional steel and says that it's ready to ramp up production. Hertha Metals is focused on revolutionizing the iron and steelmaking industry by significantly reducing carbon emissions. The company offers innovative steel manufacturing processes that are compatible with existing infrastructure, aiming to cut emissions by 95% and provide cost-effective, sustainable steel production. Hertha Metals primarily serves the steel production sector, offering solutions that enable steel mills to meet emissions standards and transition to sustainable practices without sacrificing profitability.

Hertha Metals is transforming steelmaking with Flex-HERS™, their proprietary platform technology powered by natural gas, hydrogen, and electricity. Unlike conventional processes, Flex-HERS™ enables steel production from any grade of iron ore or waste oxide, in any format-including fines and lumps-not just high-cost, DRI-grade pellets. This semi-continuous, single-step process delivers tunable iron and steelmaking, and has been demonstrated at their pilot facility in Conroe, Texas at a tonnage-per-day scale.

With Flex-HERS™, Hertha Metals can tap into domestic iron ore resources and produce low-emission steel today using abundant natural gas. And as clean hydrogen becomes more available and affordable, it can switch fuels-without changing the furnace. That means no stranded assets, and a future-proof path to sustainable steel.

Flex-HERS™ Technology - Impact

- Enables iron and steel production from low-grade ore, fines and waste oxides
- Single-step production using abundant natural gas or clean hydrogen
- Scalable technology to serve multiple markets
- High-performance steel alloys under development

Electric Heating and Thermal Energy Storage Technology

ArcelorMittal has announced an investment in *Electrified Thermal Solutions* ('Electrified Thermal') through its XCarb® Innovation Fund. The Fund, launched in 2021, invests in companies developing disruptive technologies that have the potential to support the decarbonisation of steelmaking.

Electrified Thermal, a US-based company, has developed a breakthrough technology that electrifies industrial heat generation. Originating at Massachusetts Institute of Technology and developed over the past decade, Electrified Thermal's patented firebricks sit at the heart of its Joule Hive™ Thermal Battery (JHTB) system. The JHTB is a stack of electrically and thermally conductive firebricks in an insulated steel container. It charges by running renewable electricity directly through the bricks, storing low-cost, carbon-free thermal (or heat) energy at temperatures proven up to 1,700°C. The thermal energy is then discharged by running air or gas through the brick channels, providing heat to industrial applications.

High temperature thermal energy, most commonly created by burning steel plant gases or natural gas, is used throughout the steelmaking process. Applications include hot stoves in a blast furnace, reheating slabs before rolling, and heat treatment in finishing processes such as quenching or annealing. Electrified Thermal's JHTB system therefore holds the potential to be a key enabler for decarbonising the steelmaking process and reducing reliance on fossil fuels to create thermal energy.

Construction is underway on a 1MW/5MWh commercial demonstration plant at the Southwest Research Institute in Texas, with commissioning scheduled for the second half of 2025.

Alongside the investment, ArcelorMittal and Electrified Thermal have signed a Memorandum of Understanding to explore technology validation tests at ArcelorMittal's GasLab facility in Asturias and pilot deployment pathways within ArcelorMittal operations.

Source: ArcelorMittal News, 4.9.25

EMSTEEL's Multi-lever Net-zero Strategy

A defining milestone in EMSTEEL's Net-Zero Decarbonisation Strategy was the launch of the region's first green hydrogen steel pilot in 2024, developed in partnership with Masdar. Green hydrogen, produced via PEM electrolysis using renewable electricity, is injected into EMSTEEL's direct reduced iron (DRI) plant to partially displace natural gas, directly reducing scope 1 emissions. This breakthrough has catalysed offtake partnerships with Aldar and Modon—making them the first UAE developers to use hydrogen-based steel in landmark projects.

EMSTEEL has operated a carbon capture utilisation and storage (CCUS) facility since 2016, in collaboration with ADNOC and Al Reyadah. While the technology itself was already established, improved operational alignment and efficiency in 2024 enabled the capture of over 500,000 tonnes of CO_2, covering 22% of Scope 1 emissions from steelmaking— representing one of the highest industrial CO_2 capture rates in the region.

Progress on clean energy adoption has also been substantial. In 2024, 86% of the electricity used in EMSTEEL's steel operations was sourced from clean and renewable sources, including I-RECs with a plan of a 31.5 MWp rooftop solar project in partnership with Yellow Door Energy—significantly reducing Scope 2 emissions.

To further lower direct emissions, EMSTEEL is piloting the electrification of gas heating in the DRI process through collaboration with Danieli, using e-PGH (electrical process gas heater) technology to replace fossil combustion with renewable electricity. Energy performance is optimised through ISO 50001-certified energy efficiency programmes, delivering continuous improvements in operational consumption. In parallel, increasing the share of recycled steel scrap in production is helping reduce reliance on virgin iron ore and lowering upstream and process-related emissions.

By 2024, EMSTEEL achieved a 28% reduction in GHG emissions intensity compared to 2019, reaching 0.67 t CO2e per tonne of steel. Seven third-party verified Environmental Product Declarations (EPDs) were also completed, enabling low-carbon procurement and CBAM-compliant exports.

Source: World Steel Association, 16th Steelie Awards, Oct. 14, 2025

Green Hydrogen Production Pathways for India

India's green hydrogen journey has been marked by ambitious goals and growing investments in renewable energy (RE) sources like solar and wind, aiming to position the country as a global leader in the clean energy transition.

The government launched the National Green Hydrogen Mission in January 2023, focusing on boosting the production of green hydrogen, decarbonizing heavy industries, and enhancing energy security.

This study is an attempt to provide a detailed understanding of the dynamics of green hydrogen — to unpack cost economics, key project development considerations, and project risks, offering insights into India's evolving landscape at the national and state levels. Using the lens of a project developer, it examines 17 distinct project locations across 17 states. The study examines convergence driven by national-level policies as well as local divergences resulting from state-specific renewable potential and policy support.

1. **State policy waivers, alongside national mission support, can reduce renewable power costs for green hydrogen projects by over 90%.**

In renewable-rich states like Gujarat, Maharashtra, and Rajasthan, on-site solar power costs are as low as ₹2.1 per kilowatt-hour (US$0.26/kWh) and may drop to ₹1.5/kWh ($0.018/kWh) by 2030 due to technological advancements. Off-site projects face transmission charges that can raise the landed cost of power by as much as 104%, depending on state-specific charges and regulations. Under subnational policies, some states, including Odisha and Maharashtra, offer lower or waived surcharges for green hydrogen projects, improving affordability and project feasibility. Waivers in transmission charges across states can reduce landed power costs up to more than 90%. Odisha is leading in this respect by offering an additional ₹3/kWh ($0.036/kWh) waiver. Telangana offers a similar waiver, yet higher up-front charges restrict the reduction in landed power costs to 50%. On-site projects can also benefit from capital subsidies, cutting costs by 30% on average. Odisha's aggressive policies make it one of the most competitive states for green hydrogen production, slashing landed power costs by up to 94%.

2. **Stand-alone on-site green hydrogen projects with subnational capital expenditure (capex) subsidies can reduce the production cost by 20%–22%. However, these projects come with land and demand co-location constraints.**

Stand-alone green hydrogen projects are among the most cost-competitive arrangements for hydrogen production, with costs ranging from $4.4/kg to $4.8/kg. Various states, including Maharashtra, Uttar Pradesh, and Odisha, offer capital subsidies of 25% to 35%, reducing power costs by 20%–22%. However, the cost gap between green and grey hydrogen remains significant — ranging from $1.6/kg to $3.2/kg. Scalability is also constrained by land availability and proximity to industrial demand centers, as transportation costs can undermine economic advantages. The optimal sizing of these projects depends on local renewable energy potential — with required solar capacities varying from 1.9 to 2.8 gigawatts (GW) to produce 50 kilotonnes per annum (ktpa) of hydrogen, which also requires large parcels of land.

3. **Projects connected to the Inter-State Transmission System (ISTS) or the Central Transmission Utility of India (CTU) are the first choice for most developers, because they offer production prices that are 20% to 30% lower**

than projects without subsidies connected to State Transmission Utilities (STU).

Green hydrogen production costs for projects connected to the ISTS range from \$4.1/kg to \$5.0/kg, influenced by factors like renewable energy sources, grid availability, and storage solutions (placement and technology). CTU-connected projects can offer 20% to 30% lower costs than STU-connected projects, which bear different types of state transmission charges. Although capital subsidies for green hydrogen initiatives can help reduce costs, they typically apply only to specific equipment like electrolyzers and batteries. For ISTS projects sourcing renewable energy from different states, local subsidies may not be applicable, limiting cost-saving potential. For example, in Uttar Pradesh, a 35% capital subsidy can lower the green hydrogen production cost by about 10% for battery-supported solar projects.

4. **At least 50% reduction in green hydrogen production cost across off-site projects is required to put them in a competitive range with grey hydrogen.**

Transmission-related charges can raise the landed cost of power to 1.5–2.5 times the base electricity generation cost from renewable energy. Key factors in incentivizing green hydrogen production include the magnitude and duration of subsidies, which affect the final production costs. State-specific reductions due to waivers and incentives vary widely, from 1% in West Bengal to 61% in Odisha. Long-term economies of scale will enhance competitiveness, with production costs decreasing as projects scale up due to better resource utilization and technology. Odisha has emerged as a leader in cost competitiveness for green hydrogen. The state's comprehensive incentive package could bring down green hydrogen costs to as low as \$3/kg, which is roughly 42% below the average production cost across other states. Given the importance of waivers in the cost economics of STU-connected projects, in the long run, prices are bound to rise if state waivers are discontinued.

Critical considerations for project development

1. ***Better system utilization beyond a threshold yields marginal gains only***

Lower utilization rates of around 25% require approximately 2.5 GW of electrolyzer capacity for a project producing 100 ktpa, whereas increasing the utilization to 85% reduces the required capacity by 70% to 720 megawatts (MW). Currently, alkaline electrolyzer costs range from \$500/kW to \$1,400/kW, and at an average of \$741.5/kW, capital requirements decrease from nearly \$1.8 billion to ~\$537 million when utilization rises from 25% to 85%. Thus, higher system utilization is one of the key priorities for developers. Higher system utilization also significantly reduces the levelized cost of hydrogen (LCOH), with a 22% reduction when increasing system utilization from 25% to 50% and an additional 9% reduction when increasing to 75%. However, gains beyond 75% system utilization are marginal, about 2%. By 2030, as electrolyzer costs decline, the need for up to 100% utilization becomes less critical, allowing for system oversizing without prohibitive capital outlay.

2. ***Choice between battery energy, hydrogen storage or a combination offers flexibility to developers depending on their business models.***

When planning green hydrogen projects, developers can optimize for battery storage, hydrogen storage, or a combination of both, significantly influencing project size. Battery storage enables theoretically up to 100% utilization, reducing the size of the electrolyzer required to 610 MW for a 100 ktpa project, but requires over 7 GW of oversized renewable energy (solar and wind) capacity. In contrast, hydrogen storage leads to around 33% utilization, necessitating a larger electrolyzer of approximately 1.9 GW but just 3 GW of renewable capacity. Whereas hydrogen storage limits excess power generation to nearly 20%, battery storage can yield up to 70% excess. The optimal configuration depends on the developer's business model — and is likely to change as demand for renewable energy grows in India. Although battery storage is currently less economically favorable, cost differences are expected to narrow, potentially making the two options equally viable by 2030. High utilization rates from battery storage may lead to excess generation challenges but can also create additional revenue streams to offset investment costs. An ideal and optimized green hydrogen project would involve a strategic combination of both battery storage and hydrogen storage. This hybrid approach offers multiple advantages, balancing operational flexibility, cost-effectiveness, and resilience.

3. ***The excess power produced from the oversizing of green hydrogen projects can generate additional revenue, helping to offset the LCOH.***

Excess solar generation can vary significantly, ranging from 11% to 41% of total solar electricity produced, whereas excess generation with wind power is lower, between 0% and 12%. Wind is usually a complementary source to solar, resulting in smaller-scale installations. In resource-rich states like Rajasthan and Tamil Nadu, excess generation becomes more predictable, with 14% for solar and 2% for wind. This excess generation can unlock an additional flow of revenue through participation in the electricity market. For instance, Maharashtra's combined solar-wind project has an excess of 22% for solar and 2% for wind. Selling this excess power at the fixed Green Day Ahead Market (GDAM) price can offset the green hydrogen production cost by 15%, lowering it by \$3.9–\$4.6/kg, considering state transmission charge waivers. In Gujarat, similar project arrangements could reduce production costs by nearly 33%, bringing them down by $3.2–$4.7/kg — with the potential to decrease further with electricity charge waivers.

4. ***Beyond cost considerations, the path from conceptualization to operationalization of green hydrogen projects faces numerous risks that can affect project viability.***

There are numerous risks in the project development cycle that can impact their viability. Key risk factors include fluctuating renewable energy costs, regulatory uncertainties, technological challenges, and financial limitations. Green hydrogen production demands substantial capital and operational expenditures for installing electrolyzers and renewable infrastructure. Moreover, the technology, particularly electrolyzers, needs advancements to improve efficiency and durability, which are currently limiting factors. The availability and reliability of renewable power sources also play a crucial role, as variability can affect hydrogen production rates. Infrastructure development for grid integration, storage, and transportation is essential yet costly and underdeveloped. A complex regulatory landscape varies by region, complicating project navigation. Securing end-user adoption is vital for commercial viability, while financing hurdles arise from high costs and perceived risks. Additionally, supply chain disruptions from global dependencies can hinder raw material availability. Addressing safety concerns related to hydrogen handling and investment uncertainty in volatile markets is critical for the long-term success of green hydrogen initiatives.

The way forward

To unlock the full potential of green hydrogen in India, the following areas should be prioritized for future activities:

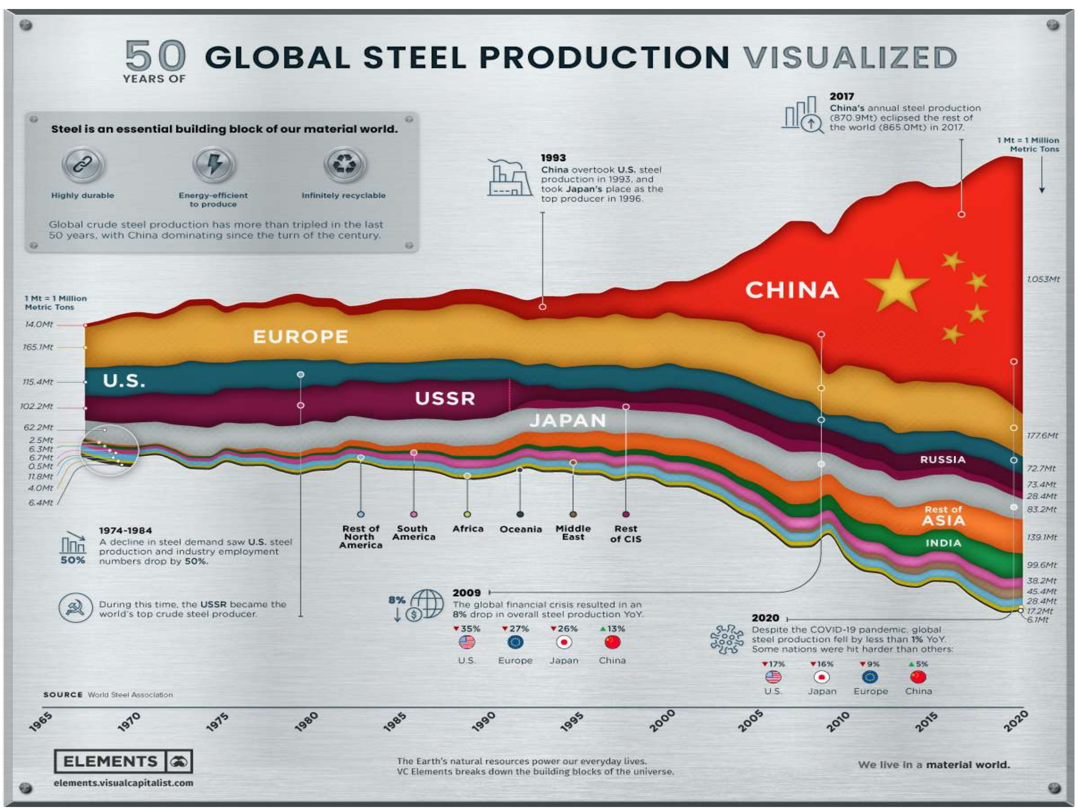
- Infrastructure development: Policymakers should focus on building robust infrastructure for grid integration, energy storage, hydrogen storage, and transportation. This will be crucial in order to support large-scale green hydrogen production and ensure reliable distribution across industrial hubs, minimizing variability in supply and optimizing energy usage.

- Assessment for India's Green Hydrogen Backbone: The findings of this report should guide the creation of a comprehensive "Green Hydrogen Backbone" study. This will help design the necessary infrastructure and regulatory framework to support long-term growth, laying out the pathways to develop a robust green hydrogen ecosystem that can meet domestic and international demand.

- Enhanced local supply chains: Strengthening domestic manufacturing of key components like electrolyzers and renewable energy systems is vital. This will reduce India's dependence on international markets, mitigate potential supply chain disruptions, and ensure a stable and scalable development pipeline for green hydrogen projects.

- Market creation and de-risking opportunities: The study primarily focuses on green hydrogen production pathways, but without addressing offtake risks, the sector may struggle to succeed. Stimulating market demand is essential, including demand aggregation and offering incentives to offset the green premium. Financial instruments or risk-sharing mechanisms can help ensure that a demand pull is created, complementing policy efforts to promote green hydrogen production.

Source: RMI Spark Newsletter, July 31, 2025



Dr. Suryanarayana Vikrant Karra

- B. Tech. in Materials and Metallurgical Engineering from IIT Kanpur.
- Ph. D. in School of Materials Engineering from Purdue University, USA.

Experience and Expertise

Dr. Vikrant is an Assistant Professor in the Department of Materials Science and Engineering (DMSE) at Indian Institute of Technology (IIT) Delhi. Before joining IIT Delhi, he served as a Postdoctoral Research Associate in the Computational Science and Engineering Division at Oak Ridge National Laboratory (ORNL).

Over the past 13 years, Dr. Vikrant has developed and designed materials in ionic solids and metals using advanced engineering techniques and computational frameworks. His interrelated research interests span (1) Computational Materials Science, (2) Energy Storage and Conversion Materials, (3) Lithium-ion Batteries and Solid Oxide Fuel Cell Materials, (4) Microstructural Evolution in Metals and Ceramics, (5) High-Temperature Structural and Functional Materials, (6) Multi-physics Modelling, and (7) Waste-integrated green steelmaking.

Dr. Vikrant is also advancing emerging areas of national importance, including green steelmaking, large-format metal–air battery technologies, and integrated AI–physics frameworks for sustainable, high-performance materials and energy systems—key domains aligned with India's strategic energy and materials roadmap. He has authored **over 30 scientific publications** in reputed international journals and has **secured competitive funding from government agencies and leading funding bodies** to support his research programs.

Contact details:

E-mail ID: ksnvikrant@iitd.ac.in; Mob. No: 9573365386