

Green hydrogen for steelmaking in India will only catch up by 2050, says report

It is expected that challenges towards green transition of Indian steel sector will allow coal to remain as the primary fuel for steelmaking for more than a decade



India plans to promote green hydrogen for steel making. (The Photo: Bloomberg)

New Delhi: India's plan to decarbonize its steel industry will take longer than anticipated, with green hydrogen becoming the primary fuel for steel making in the country only by 2050, a report by two research institutes said on Thursday.

According to the report, Steel Decarbonisation in India, brought out by Institute for Energy Economics and Financial Analysis (IEEFA) and JMK Research, the shift towards green steel will be longer because the cost of green hydrogen needs to come down, while a price penalty must be imposed on carbon emissions for Indian steelmakers to switch to hydrogen-based steelmaking.

Strict enforcement of renewable purchase obligations (RPO) on the steel sector can also help in the greater use of clean energy that would clear the path for successful transition to net zero, the report said.

Greening India's steel industry is important as the statistics on steel production suggests that carbon emission intensity of India's steel industry is much higher than global standards. As per an assessment done by JMK and IEEFA, the domestic steel sector accounts for about 12% of India's carbon dioxide emissions, with an emission intensity of 2.55 tonne of carbon/tonne of crude steel compared with the global average of 1.85 tonne of CO₂/tonne of crude steel.

Moreover, the steel industry is responsible for around 240 million tonne of carbon emissions annually, which is expected to double at an exponential rate by 2030, considering the Indian government's infrastructure development targets.

Apart from the challenge of net zero transition, green steel production has also become important because of global measures such as EU's Carbon Border Adjustment Mechanism (CBAM) that proposes to put tax on embedded carbon imports from various sectors, including steel, aluminium, cement, hydrogen, electricity, and fertiliser from January 1, 2026.

The report said that to start the move towards green steel production in the country, it is important that a legal definition for green steel is provided by the government that would help guide the industry in making the right investments for decarbonisation.

"India's steel industry contributes to around 2% of its gross domestic product, but also accounts for 12% of its carbon dioxide (CO₂) emissions. The decarbonization of the sector is at a nascent stage. To aid the industry in making the right investments, the government needs to define green steel since there is no legal definition for the same," said the report.

"It also needs to create a market and demand for green steel, since all current technologies will substantially increase costs. A penalty on carbon emissions will also help bridge the cost of green steel and traditionally produced steel," it added.

To promote active usage of green steel, the research report said, the government can mandate the use of such steel in public infrastructure and nudge the private sector through the use of green steel certificates, tradable in the national carbon market, to offer them a new revenue stream.

It is expected that challenges towards green transition of Indian steel sector will allow coal to remain as the primary fuel for steelmaking for more than a decade and will only be replaced in the latter part of the 2030 to 2050 period.

There are multiple technology pathways that could help in the transition from traditional methods to low emission intensity technology like green hydrogen, renewable energy, carbon capture, usage and storage technology with Blast Furnace (BF)/Basic Oxygen Furnace (BOF) or Direct Reduced Iron (DRI)-Electric Arc Furnace (EAF), scrap-based Electric Arc Furnace (EAF) etc. Of these technologies, the green hydrogen-based route is the cleanest method of producing steel. However, green hydrogen is expensive and investing in the technology could render steelmakers uncompetitive as they sell a highly commoditised product.

The government has taken initiatives to decarbonise the steel sector, including the Steel Scrap Recycling Policy 2019, the Perform, Achieve and Trade (PAT) scheme and the announcement of 13 task forces by the Ministry of Steel for developing a green steel roadmap.

The most important initiative though is the National Green Hydrogen Mission (NGHM), under which the Ministry of Steel has been allocated 30% of the pilot project budget, i.e., ₹14.66 billion (\$ 177 million), to promote the use of green hydrogen in steelmaking.

Under this mission, the Solar Energy Corp. of India (SECI) has issued two tenders under Strategic Interventions for the Green Hydrogen Transition (SIGHT) programme in July 2023. The first is a 1.5 gigawatts (GW) tender for scaling up localised manufacturing in the electrolyser space, and research and development in indigenous stack technology. The second tender is for producing 450,000 tonnes of green hydrogen per annum on technology-agnostic and biomass pathways. The tenders are aimed at bringing down the price of green hydrogen.

According to industry estimates, to make hydrogen technology viable for expansion, the required price should be around \$1.2/kg and a carbon penalty of at least \$ 50 per tonne of emissions should be applicable on steel manufactured through traditional methods. This can make green steel competitive and catalyse a 150 million tonne shift from coal-based to hydrogen-based steelmaking, the report said.

As per the analysis done by JMK and IEEFA, India's steel sector decarbonisation trajectory until 2070 has been mapped with different cycles in each period. As per it, up to 2030, the Indian steel sector is likely to see a reduction in the share of coal-based technologies, from 92% in 2021 to 70% by 2030. This transition is possible by replacing coal-based EAF technologies with green hydrogen. Several pilot projects and trials for green hydrogen projects started in India in 2020. By 2030, green hydrogen production is likely to start on a commercial scale in India.

The second scenario worked out by the analysis is for the period between 2030 to 2050 when green hydrogen projects will be deployed on a large scale across India due to high demand. This is likely to phase-out coal-based routes at a faster pace. IEEFA and JMK Research estimate that the steel industry will replace around 25-30% of its grey hydrogen requirements with green hydrogen. This will increase to 80% by 2050.

The third scenario, from 2050-2070, will see large projects using green hydrogen coming up across the country, and the cost of green hydrogen will be significantly reduced due to a highly competitive market. The green hydrogen-based route is, therefore, likely to completely replace coal and natural gas-based conventional technology.