

The Bright World of Metals 2027 – Technical Article No. 1

India as a steel production location

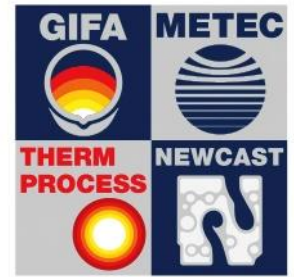
Steel industry as growth driver to become greener

From 27 to 29 November 2024, METEC India will take place in Mumbai alongside wire India, Tube India and INDIA ESSEN WELDING & CUTTING - the largest metal trade fair in India. More than 600 exhibitors from 22 countries will showcase the latest technologies and products for metal processing. As part of the trade fair, the METEC India Conference on 29 November will address key issues such as the Indian steel industry's decarbonisation targets by 2047.

Economic development is a key promise of the government under Narendra Modi, who wants to turn India into a developed country by 2047. The focus is on the Indian steel industry as a growth driver – and thus the challenge of aligning growth with the reduction of CO² emissions. A current roadmap outlines possible solutions.

India is not only the most populous country in the world, but also one of the fastest growing global economies. The OECD expects economic growth of 6.2% this year and 6.5% next year. A key driver of growth is the steel industry, which contributes around two percent to the national GDP. The Indian steel industry has grown by an average of 7% per year since 2004 and, according to an official statement, will reach a steel production capacity of 179.5 million tonnes in the current financial year with a crude steel production of 144.3 million tonnes. Growth is largely driven by the demand for steel in infrastructure, housing construction and the automotive industry.

The subcontinent is pursuing a clear growth strategy while still taking its climate targets into account. According to the Indian government, the country has already made considerable progress in expanding its renewable energy capacities. However, in order to meet ambitious climate targets such as the net-zero target for 2070, India must also decarbonise its industrial sector. The country's main focus is on the steel industry, which is responsible for 10–12% of India's total CO² emissions.



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

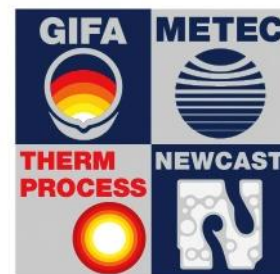
www.tbwom.com



A few large steel companies such as Tata Steel, JSW Steel, Jindal Steel and Power (JSP) as well as state-owned companies such as Steel Authority of India (SAIL) dominate the Indian steel market, supplemented by several smaller manufacturers. In the ranking of the world's largest steel-producing countries issued by the international steel organisation worldsteel, India's crude steel production of 140.8 million tonnes in 2023 puts it in second place after China (1,019 million tonnes), but well ahead of Japan (87 million tonnes), the United States (81.4 million tonnes) and Germany (35.4 million tonnes). However, the per capita consumption of steel in India was only 97.7 kg in 2024, compared to the global average per capita consumption of 221.8 kg in 2022. National steel policy aims to increase per capita consumption to 160 kg by 2030.

The government plans to invest heavily in infrastructure. Steel is needed to build new houses, roads and railway lines. The Indian government's ambitious goal of increasing steel production capacity to over 300 million tonnes by 2030, almost double the current level, highlights the crucial role that the steel industry plays in the country's development. According to the Indian Ministry of Steel, domestic production is expected to exceed this target. Decarbonisation of the sector is therefore imperative if India is to achieve its climate targets. As at other steel locations, the focus is on CO²-intensive pig iron production.

The very heterogeneous Indian steel industry essentially pursues three methods of iron production: in blast furnaces (BF) that use coke for the reduction and smelting of iron ore to liquid pig iron, as well as two processes for the production of solid, directly reduced iron (sponge iron or DRI). The first process uses shaft furnaces, which work with natural gas, syngas or sometimes industrial waste gases, and the second works via rotary kilns, which use coal as a reducing agent for iron ore. The pig iron produced is then converted into steel via three main processes. Molten blast furnace pig iron is turned into steel in a basic oxygen furnace (BOF), while DRI is smelted into steel in an electric arc furnace (EAF) or, more rarely, in an induction furnace (IF). Steel scrap is also converted into steel in electric arc or induction furnaces. The larger integrated steel plants (ISP) generally use the BF-BOF and DRI-EAF



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

www.tbwom.com



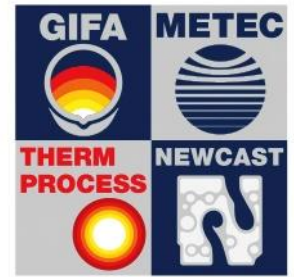
Messe
Düsseldorf

methods, while smaller plants use the coal-based DRI-IF method. The crude steel is then processed into flat or long products in rolling mills.

India is not only the second largest producer of steel in the world, but also built up the world's largest production capacity for sponge iron (direct reduced iron, DRI) of 55 million tonnes in 2023. India is one of the few countries in the world where coal-based DRI technology predominates, accounting for almost 20 percent of the country's total steel capacity. The importance of coal-based DRI in India is primarily due to the easy availability of a type of coal which is not very suitable for coke production, relatively low investment costs, especially with regard to the widespread DRI production with rotary kilns, and the limited access to natural gas, which is the preferred option for direct reduction in many industrialised countries. As a result, according to the Indian Energy and Resources Institute (TERI), there are nearly 300 low-capacity (100 tonnes per day or less) coal-based direct reduction plants that use coal as their primary fuel and have low energy efficiency.

Coal-based DRI production plays a key role in the Indian steel industry, as Deependra Kashiva, Managing Director of the Indian DRI association Sponge Iron Manufacturers Association (SIMA), emphasises. According to the expert, domestic demand for steel cannot be fully covered by the conventional blast furnace to basic oxygen furnace route (BF-BOF), as the investment costs are high and the availability of bituminous coal for this route is limited in India. "This is why the DRI industry has a crucial role to play when it comes to increasing India's future steel production to meet the growing demand", says Kashiva.

The structure of the steel sector in India differs considerably from that of other countries. Developed countries have a higher proportion of scrap in total steel production, the use of iron ore pellets is more widespread, the electricity grid is less carbon-intensive and lower-carbon fuels such as natural gas are available at comparatively affordable prices. In contrast, the comparatively recent industrial development in India means that the availability of scrap metal is limited and natural gas is very expensive. In addition, India has low-grade raw materials such as coal and iron ore, the use of which increases overall energy consumption and emissions. To summarise, a report by the Ministry of



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

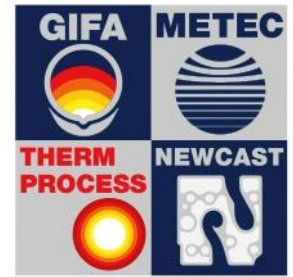
www.tbwom.com



Steel concludes that the Indian steel industry will be forced to continue using coal-based blast furnaces and rotary kilns for steel production in future due to a lack of affordable alternatives. Consequently, at 2.54 tonnes of CO² per tonne of crude steel (tCO²/TCS), the carbon emission intensity of steel produced in India is significantly higher than the global average of 1.91 TCS.

In response to India's climate commitments and in an effort to create a globally competitive and sustainable steel industry, the Ministry of Steel has recently unveiled its decarbonisation roadmap named "Greening the Steel Sector in India". The 14-point action plan set out in the roadmap includes various decarbonisation measures. In addition to the development of a taxonomy for green steel, including certified monitoring to monitor emissions, the Indian government is also focusing on green priority markets, at least for public procurement. One declared aim is to focus on and optimise the entire value chain. From the procurement of raw materials to final processing, the goal is to reduce costs and increase efficiency. One focus of the proposed decarbonisation measures and of India's industrial policy in general is carbon capture, including carbon capture and storage (CCS) and carbon capture and utilisation (CCU). Renewable energies also play an important role in steel production, as does (green) hydrogen as a future technology with potential. Considering the process transition from coal-based DRI to gas-based DRI with natural gas as a bridge fuel for green hydrogen in the steel sector is also important. Specifically, this involves shifting DRI production from coal-based rotary kilns to gas-based shaft furnaces to enable a seamless transition to green hydrogen. In addition to natural gas, this also includes process conversion using other options such as industrial waste gases, synthesised gas and the injection of coal bed methane into blast furnaces, for example. Coal bed methane (CBM) is an unconventional form of natural gas that occurs in coal deposits or coal beds.

The iron and steel sector is primarily dependent on coal and coke to cover the demand for process heat and as a reducing agent in steel production. With a view to the country's decarbonisation targets, the action plan also focuses on environmentally friendly and sustainable substitutes for coal and coke in steel production. Biochar, obtained from



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

www.tbwom.com



the biomass of regrowing plants, is considered a promising candidate for reducing emissions in steel production. However, its widespread introduction in the industry faces tough competition from traditional coal-based fuels, as the report points out.

Without giving up their growth targets despite the industry's heavy dependence on coal for years to come, Indian steel companies are already pursuing various decarbonisation projects. The most important measures include:

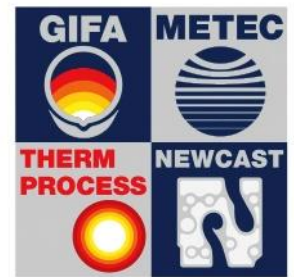
- Renewable energy: One of the aims is to increase the use of renewable energy sources in order to meet energy requirements, particularly in electric steel production.
- Recycling: The steel industry is focusing on increasing the proportion of recycled steel in order to reduce the need for primary steel and the associated emissions.
- Innovation: The introduction of new technologies, such as hydrogen-based steel production, is intended to reduce dependence on fossil fuels.

Innovation and technology play a decisive role in this process. The steel industry invests in research and development in order to develop innovative products and more efficient production processes. To this end, Indian steel companies are entering into partnerships with international steel companies and leading metallurgical plant manufacturers such as SMS group and Primetals Technologies, as the following examples show.

SAIL: Carbon capture and digitalisation

The country's largest steel producer, the state-owned Steel Authority of India Limited (SAIL), has signed a comprehensive memorandum of understanding with plant manufacturer SMS group for the development of processes to decarbonise iron and steel production at its Indian plants.

SAIL has entered into a partnership with Primetals specifically for the Rourkela pipe mill in the Indian state of Odisha. Technologies such as CCU, hydrogen-based steel production, electric steel production and



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

www.tbwom.com



Messe
Düsseldorf

The logo for Messe Düsseldorf, consisting of a stylized 'M' made of three vertical bars of varying heights, followed by the text 'Messe Düsseldorf'.

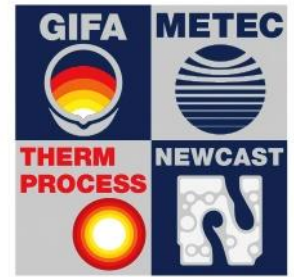
digitalisation to optimise production processes are also on the agenda there.

Tata Steel: carbon avoidance and capture

India's globalist Tata Steel, one of the most geographically diversified steel producers in the world with operations in 26 countries, has pledged to reduce its emission intensity to below 1.8 tonnes of CO² per tonne of crude steel by 2030 and reach net zero by 2045. At its Indian sites, Tata Steel is pursuing a two-pronged approach to decarbonisation, focusing on carbon dioxide avoidance (CDA) and carbon capture and utilisation (CCU). The steel producer relies on technologies such as the injection of coal bed methane and hydrogen at the blast furnace, as well as the operation of a pilot-scale CCU plant for carbon capture and utilisation. The measures taken also include increasing the amount of scrap used in the blast furnaces. At the Ludhiana site, the company plans to build a modern long product steel plant based on an electric arc furnace (EAF), which has a minimal carbon footprint and a capacity of 0.75 million tonnes per year.

Tata Steel is pursuing another decarbonisation path with its green hydrogen project at the Jamshedpur site, which is still in the initial phase. At the end of April 2023, the company reports that it launched a globally unique test run using hydrogen instead of injection coal and coke in blast furnace E at the Jamshedpur plant. Around 6 kg of hydrogen per tonne of pig iron was used over four days, and around 40% of the blast furnace's injection systems were used for hydrogen injection. According to Tata Steel, this is the world's first attempt to continuously inject such a large quantity of hydrogen into a blast furnace. The aim of the pilot project is to find out how much coal dust can be replaced by hydrogen in order to reduce the consumption of fossil fuels and thus the CO² emissions of the steel production process. The adoption of this technology on a large scale and its widespread introduction will depend on how quickly the cost of hydrogen falls to a more competitive level.

Tata Steel has also taken an important step towards decarbonising its production at the Meramandali site and commissioned plant manufacturer SMS group with the modernisation and installation of



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

www.tbwom.com



Messe
Düsseldorf

The logo for Messe Düsseldorf consists of a large, bold, black 'M' shape formed by three vertical bars of varying heights, with the text 'Messe Düsseldorf' positioned below it.

injection technology for coke oven gas in June of this year. Coke oven gas is a by-product of the production of coke from coal in coking plants. The project is the first of its kind in India. By utilising the chemical potential of coke oven gas (COG), the new process can save around 0.65 kilograms of coke per kilogram of COG injected, which significantly reduces operating costs and the carbon footprint at the same time.

Tata Steel Kalinganagar is the first Indian plant to be included in the World Economic Forum's Global Lighthouse Network for its leading role in the application of Industry 4.0 technologies.

JSW: carbon capture and renewable energies

JSW Steel, one of the country's leading steel producers, is planning to increase its domestic capacity from 27.5 million tonnes to 38.5 million tonnes by 2024/25. Just recently, JSW and Korea's Posco signed a memorandum of understanding to develop an integrated steel plant in India with an initial capacity of 5 million tonnes per year. The two groups will also look into cooperations in the areas of battery materials for electric vehicles and renewable energies in order to cover the planned integrated steelworks' own requirements.

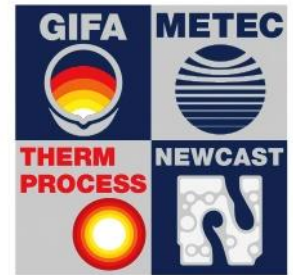
JSW Steel has set itself the goal of reducing CO² emissions from steel production by 42% by 2030 compared to the base year 2021 and achieving net zero by 2050. In 2022, SMS and JSW Steel concluded an agreement for projects to reduce CO² emissions.

By 2030, JSW Steel aims to achieve an output of 20 GW of renewable energy and a storage capacity of 40 GWh. JSW is also focusing on the processing of raw materials, scrap-based steel and the use of green hydrogen in the steel sector. Sister company JSW Energy, for example, is planning to commission a large plant for green hydrogen, which will be used in the production of low-carbon steel.

At the Dolvi DRI plant, JSW Steel also operates a pilot plant for carbon capture with a capacity of 100 tonnes per day (TPD).

JSP: India's number three with a strong focus on carbon capture

JSP aims to reduce carbon emissions by 35% by 2030 and reach net zero by 2047. JSP's decarbonisation strategy focuses on carbon



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

www.tbwom.com



minimisation, carbon avoidance and carbon circular economy with carbon capture and pathways to carbon utilisation as well as CO² sequestration. JSP operates a 2,000-TPD carbon capture unit in its Syngas plant and a 1,500-TPD carbon capture unit in the DRI section.

Adani: planning green integrated steelworks

The industrial conglomerate Adani Group announced a cooperation with the South Korean steel giant Posco at the beginning of 2022. Together, the partners want to build an integrated steel plant in Mundra, Gujarat, which is based on Posco technology and utilises renewable energies and green hydrogen.

(Author: Gerd Krause, Mediakonzert, Düsseldorf)

Press Contact The Bright World of Metals 2027

Larissa Browa
Tel. +49(0)211/4560 -549
BrowaL@messe-duesseldorf.de

Düsseldorf, 18.11.2024



The Bright World of Metals

21–25 June 2027
Düsseldorf/Germany

16th International
Foundry Trade Fair
with Forum

12th International
Metallurgical Trade Fair
with Congresses

14th International Trade Fair
and Forum for Thermo
Process Technology

7th International
Trade Fair for Castings
with NEWCAST Forum

www.tbwom.com

