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Jawahar Dhatu Bhawan
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Near Batra Hospital, New Delhi-110 062
Tel: 011-29955084, 21820057
E-mail: iim.delhi@gmail.com; Visit Us: www.iim-delhi.com

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EXECUTIVE COMMITTEE MEMBERS : CONTACT DETAILS			
NAME	DESIGNATION	CONTACT NO.	E-MAIL
Dr. Mukesh Kumar	Chairman	9650080849 9584032329	drmukeshkumar@gmail.com
Shri Manoranjan Ram	Vice Chairman	9910014989 9999303008	manoranjanram@yahoo.com m.ram@danieli.com
Dr. Ramen Datta	Secretary	9958084110	dattaramen@gmail.com
Shri Ramesh Kumar Narang	Treasurer	9899298857	rknarang62@gmail.com
Shri N Vijayan	Joint Secretary	9818695690	technothermaindia@gmail.com
Shri B D Jethra	Member	9818326878	jethra@yahoo.com
Shri Anil Gupta	Member	9899414000	indiantrader@gmail.com
Shri S C Suri	Member	9650936736 46584279/26949167	scsuri.iimdc@gmail.com
Shri K L Mehrotra	Member	9810203544	klmehrotra48@gmail.com klm91048@gmail.com
Shri K K Mehrotra	Member	9868112514 9968653355	kishorekmehrotra@gmail.com
Shri G I S Chauhan	Member	9717302437 7048993116	gisc.delhi@gmail.com
Shri R K Vijayavergia	Member	9650155544	rkv.sail@gmail.com
Shri N K Kakkar	Member	9871008505	nirmalkakkar@gmail.com
Shri Deepak Jain	Member	9868640986 8368622619	deepakjain7177@gmail.com
Shri K R Krishnakumar	Member	9818277840	kuduvak059@gmail.com
Shri M P Sharma	Member	9212202084 9818508300	aluminiumconsultant@yahoo.com aflmps@rediffmail.com
Prof. Jayant Jain	Member	9582513867	jayantj@iitd.ac.in
Dr. Lakshmi Narayan R	Member	26591494	rlnarayan@iitd.ac.in
Shri Gaurav Verma	Member	7042914069	gaurav.v@dastur.com gaurav.iiftk@gmail.com

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Editor-in-Chief
S C Suri

Meeting with Chairman, SAIL

Shri Amarendu Prakash assumed the charge of Chairman, SAIL on 31.05.2023.

A team of IIM Delhi Chapter, consisting of the following members paid a courtesy call to Chairman, SAIL on 9.6.2023.

1 Shri K K Mehrotra
2 Dr. Ramen Datta
3 Shri R K Vijayavergia
4 Shri K R Krishnakumar

Shri K K Mehrotra, Past Chairman, IIM Delhi Chapter, briefed Chairman, SAIL about the activities of IIM Delhi Chapter. He informed that Delhi Chapter is one of the most active Chapters of IIM. The Chapter is organising a number of programmes to promote the metallurgical activities. It was informed that since 1996, MMMM (Minerals, Metals, Metallurgy & Materials) event, consisting of International Conference and Exhibition, is being held by Delhi Chapter once every two years.

Dr. Ramen Datta, Hon. Secretary, IIM Delhi Chapter, informed that Materials Science & Engineering Department of IIT Delhi is also associated with IIM Delhi Chapter to promote the metallurgical activities. Our Chapter also held a programme some time back at IIT Delhi. Materials Science & Engineering Department of IIT Delhi is also helping our Chapter to enrol new IIM memberships. About 30 members of IIT Delhi joined our Chapter in 2022-23. These members included the faculty and students of IIT Delhi.

On this occasion, it was also informed that our Chapter is planning to hold a one day programme on "Iron Ore Beneficiation and Pelletization", sometime in second quarter in 2023.

IIM, Delhi Chapter requested Chairman SAIL to extend support to the Chapter activities, for which he readily agreed.

SAIL's Capex Plan

SAIL readying Rs 1 Lakh crore capex plans

The Steel Authority of India Ltd (SAIL) is eyeing an over ₹1,00,000 crore capex over a 10-year period as it plans to up capacities to around 35 million tonnes (mt) per annum. Capex plans include setting up capacities, ramping up existing facilities, de-bottlenecking, maintenance and replacement of coke oven batteries, apart from investing in new product lines.

The CPSE, amongst the largest steel-makers in the country currently has an installed capacity of 20 mtpa. Crude steel production last fiscal was 18.3 mt.

According to Anil Tulsiani, Director (Finance), SAIL, most of the capex plans are already in a drawing board stage; an "in-principle approval from the board has been received". Over the next six months — "towards August or September" — these plans should be ready and the tendering process should be over in "another four to five months" (by FY24 end), he added.

Capacity Expansion

"Work towards capacity expansion would start around FY25. In actual terms, peaking of investments will happen in and around FY28 and FY29, with 35 mt going on-stream by FY32. So, we are envisaging a capex of over ₹1,00,000 crore across these years," he said, during an analyst call.

Tulsiani said, investments are being spread out to avoid “bunching up” or tying up of funds. For instance, in the first year, capacity expansion would be carried out at IISCO — Burnpur that would see capacity ramp up by 4.5 mtpa; followed by expansion at Bokaro by 3 mtpa. The following year, expansion is planned at the Durgapur Steel Plant.

“De-bottlenecking of existing capacities would add 2.5 – 3 mtpa over the next 3-4 years,” he added.

For FY24, the company has earmarked a capex of ₹6,000 crore, primarily for maintenance purposes that include refurbishment and replacement of coke-oven batteries. The saleable steel target is set at 19.7 mt- a 15 per cent increase y-o-y.

The steel-maker said it would look at keeping debt-equity in the 1:1 range, despite the huge capex plans. Current debt to equity ratio is 0.59. In FY23, borrowings were over ₹30,000 crore; while net debt stood at ₹28,400 crore-odd.

“Profitability in FY23 had been impacted due to high input costs majorly imported coking coal and foreign exchange variation loss,” Tulsiani said. The steel-major’s EBITDA (earnings before interest, tax, depreciation and amortisation) dropped 58 per cent y-o-y to ₹9,379 crore last fiscal (from ₹22,364 crore).

Source: Hindu Business Line, New Delhi, 31 May 2023

Tata Steel Growth Plans for 40 mnt Capacity in India

Tata Steel sees enough growth opportunities within its existing facilities to actualise an expansion plan to achieve 40 million tonne capacity in India by 2030, almost double of its current capability in the country. The company has planned capital expenditure to the tune of Rs 12,000 crore for India operations. In India, Tata Steel already have around 21 mnt capacity. It will be 25 mnt soon because the Kalinga Nagar expansion is going on. Other plans include - Neelachal, Kalinga Nagar and Meramandali or Angul to achieve 40 million tonne capacity by 2030. There are multiple ongoing projects at various locations in India and the company has "prioritised completion of the 5 MTPA Kalinga Nagar expansion. The company is in the process of expanding its plant

capacity in Odisha's Kalinga Nagar to 8 mnt from 3 mnt. Within nine months of acquisition, Tata Steel has successfully ramped up the capacity of Neelachal Ispat Nigam Ltd. to one million tonne on annualised basis.

The steel company, through its wholly-owned subsidiary Tata Steel Long Products Ltd., had completed the acquisition of Odisha-based one million tonne per annum steel mill NINL for a consideration of Rs 12,100 crore in July 2022.

The capex of Rs 12,000 crore in India will be at that level for the next three years at least. Entire growth plan is based on "organic" expansion, and there is no plan for any "inorganic" growth in the near future. Within our facilities, there are enough opportunities, and no need to acquire anything to achieve growth aspiration.

Tata Steel owns a 5 mnt facility at Port Talbot, which is the UK's largest steelworks employing around 8,000 people. Tata Steel group is among the top global steel companies with an annual crude steel capacity of 35 million tonne. The group recorded a consolidated turnover of USD 30.3 billion in the financial year ending March 31, 2023.Tata Steel Limited, together with its subsidiaries, associates, and joint ventures, is spread across five continents with an employee base of over 65,000.

Source : https://economictimes.indiatimes.com/industry/indl-goods/svs/steel/enough-growth-opportunities-within-facilities-to-take-capacity-to-40-mt-in-india-tata-steel-ceo/articleshow/ 100226543.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

India is Net Copper Importer for 5th Year in a Row

India’s copper imports increased 15 per cent year-on-year during the 2022-23 fiscal. The government’s thrust on infrastructure coupled with a strong rebound in economic activities in sectors ranging from real estate to consumer durables and electric vehicle manufacturing have pushed the demand for the red metal.

As per Commerce Ministry data, India imported 2,75,341 tonnes of copper in the previous financial year. These include both refined and finished copper. Refined copper is the end product where impurities are removed from copper ore. Finished copper, on the other hand, refers to copper that has been processed and shaped into its final form such as wires, tubes, pipes sheets etc.

Manish Gupta, Senior Director, CRISIL Ratings Ltd., said strong domestic demand for copper and supply challenges due to nil capacity additions in the domestic market are the two factors that pushed copper imports in FY23.

He said in fiscal 2023, domestic demand for copper grew at 18-20 percent year-on-year mainly on account of weak base since demand for the previous two fiscals was impacted due to Covid pandemic. He said, post Covid, strong growth was witnessed in key sectors such as power, automobile, infrastructure and construction, which have spiked the demand for copper, "Usage of copper in EVs manufacturing is 2-3 times higher as compared to fuel-based vehicles," Gupta pointed out.

Spiking Imports

values on tonnes

Year	Exports	Imports	Net
FY18	4,19,138	2,38,874	1,80,264
FY19	61,516	3,44,48	(2,83,233)
FY20	42,293	3,57,423	(3,15,130)
FY21	93,900	2,38,483	(1,44,583)
FY22	1,20,302	2,38,694	(1,18,392)
FY23	61,057	2,5,341	(2,14,284)

Import

India's copper import in fiscal 2021 and 2022 stood at 2,38,483 tonnes and 2,38,694 tonnes, respectively. However, copper imports in FY23 were still lower than the Covid high of 3,57,323 tonnes recorded in FY20.

Copper is the third most used industrial metal after steel and aluminum, Gupta said while the demand for copper increased in the previous fiscal, there has been no capacity addition in the country.

India used to be a net exporter of copper until FY18. In May, 2018 Tamil Nadu government ordered the State pollution control board to seal and "permanently" close Vedanta's Sterlite copper smelter plant at Tuticorin in

Tamil Nadu citing pollution concerns and following violent public protests. Sterlite Copper Plant was catering 40 percent of the domestic demand until its closure.

According to estimates India's total refined copper production capacity is about 7.85 lakh tonnes, out of which Hindalco has about 5-lakh tonne capacity, Sterlite Copper has four lakh tonnes per annum (LTPA) capacity but it is not operational since 2018. Hindustan Copper roughly has a capacity of about 70,000 tonnes.

While the production has come down sharply since 2018, domestic demand has been going up consistently every year due to increase in annual capacity of renewable energy, rising use of copper in smart home appliances, rapid growth in the construction industry. According to the International Copper Association India, demand for red metal rose to 12.5-lakh tonnes in FY22 compared to 9.78-lakh tonnes in FY21. This is further set to go up in FY23.

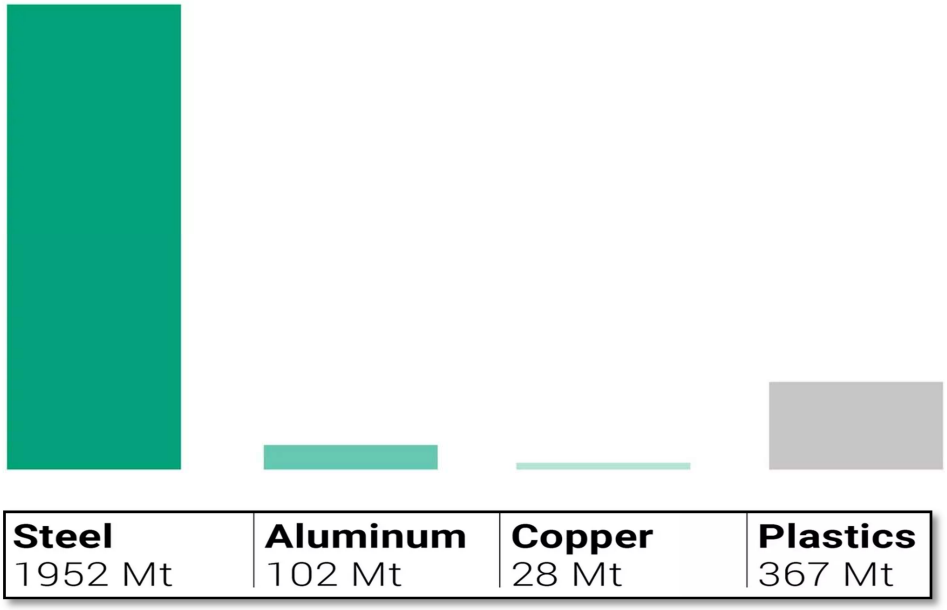
500 GW TARGET

India has set a target of 500 GW of renewable energy capacity by 2030. According to estimates, 3,000 kg of copper is required for generating 1 MW of power via the solar photovoltaic and onshore wind platforms. Power generation via offshore wind is even more copper-intensive, requiring over 8,000 kg of copper per MW.

Why Metals Production Have to Turn Green

Metals production have to *Turn Green* it is essential to create a carbon-neutral and sustainable metals industry for stopping global warming.

Metals constitute a rather large group of chemical elements. Metals make up around 80 percent of all chemical elements in the periodic table.



Production of major metals and plastics in 2021 (million tons)

Metals from an industrial perspective

Steel

With a share of more than 90 percent, iron is the metal that is most processed worldwide. Iron is the main component of **steel**. Steel is an alloy made from iron and carbon and, thanks to its strength and toughness, is an enormously versatile material with around 3,500 different grades. Whether it's mechanical engineering, vehicle construction, the electrical industry, shipbuilding, or when used in conjunction with concrete, steel can be found practically everywhere. About 1.9 billion tons of steel was produced in 2022. The most significant steel-producing country is the People's Republic of China, where more than one billion tons of steel were produced

Aluminum

The second most important metal from an industrial point of view is **aluminium** Although aluminum is the third most common element in the world, bauxite is the only raw material that can be processed industrially. Aluminum is more expensive than iron or steel, but it weighs less. For this

reason, aluminum is used predominantly when designs that are more lightweight are required – for example in the aerospace industry. Aluminum also has a permanent place in the packaging industry, for instance in the manufacture of cans or coating of packaging material. Global aluminum production totalled around 102 million tons in 2021. China also tops the list of aluminum-producing countries. Aluminum is the material of choice when it comes to lightweight construction.

Copper

In third place is **copper**. This is a metal characterized in particular by its good electrical conductivity. That is why around 70% of copper is used for power transmission applications. Copper power lines are found wherever current flows: whether it's in cables or on printed circuit boards, coils in electric motors, or in transformers. The construction industry also needs copper, for example for pipes or cladding. A total of 28 million tons of copper were produced globally in 2021. the world's biggest copper-producing country is Chile, followed by Peru.

70% of copper is used for power transmission applications.

Why metal production has to turn green

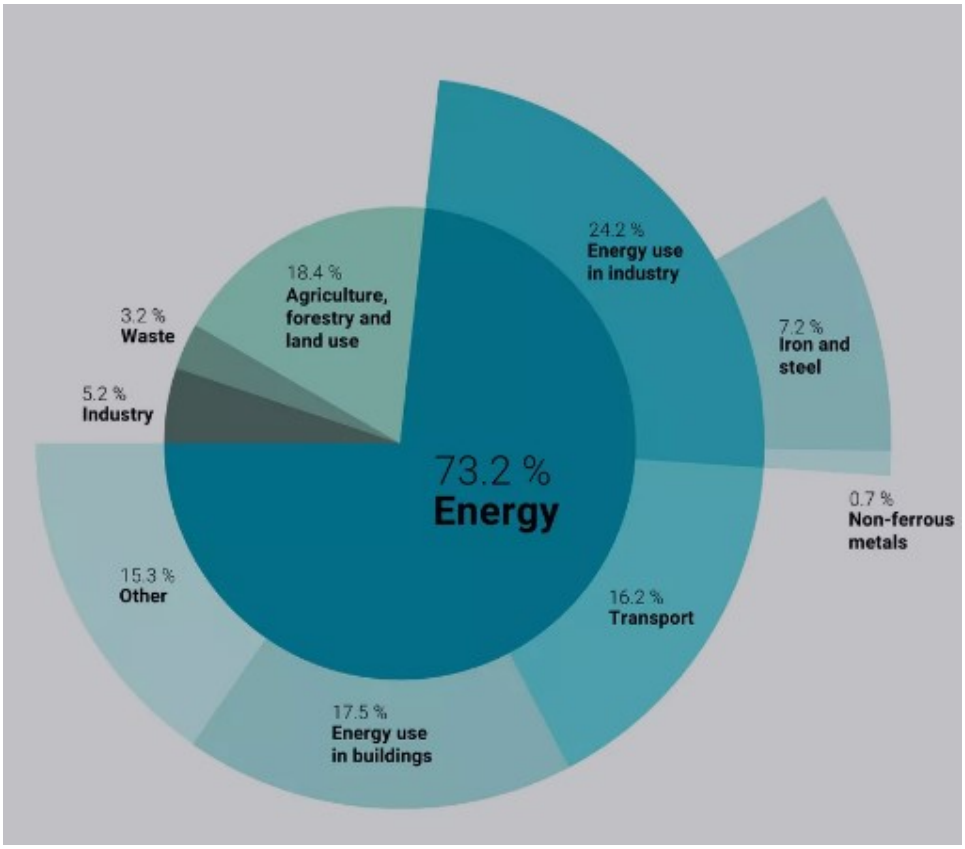
Metals are indispensable for humankind. Their significance is also reflected in the fact that their names bear testament to whole periods of human history, such as the Bronze Age or the Iron Age. However, the production of metals accounts for around 10 percent of global greenhouse gas emissions, which contributes significantly to global warming.

1.5 degrees: For years now, hardly any other number has been such a hot topic of debate. What's meant by it is that 1.5 degrees centigrade is the average target figure for the amount of global warming that ought to take place between 1850 and 2100. The year 1850 is taken as the reference point because it marks the start of industrialization. This alone shows how important the role that global industry will play in general in the years ahead in our quest to achieve global climate objectives.

The metals industry has a key position here. After all, the production of metals makes up around ten percent of all global greenhouse gas emissions. The

figures vary depending, among other things, on whether the calculation takes into account the production of ores and other raw materials that are ultimately used to manufacture metals.

The spotlight here is especially on the steel industry. Around 7-9 percent of worldwide CO_2 emissions are caused by steel production alone. In order to grasp the implications of this, it is worth making two comparisons: global road traffic makes up about twelve percent of all greenhouse gas emissions. And around eleven percent of total CO_2 emissions are from heating homes all around the world. Which begs the question: What exactly causes such high CO_2 emissions during metal production?



Global greenhouse gas emission by sector (2016)
Total: 49.4 billion tonnes of CO_2e
Source: Climate Watch, The World Resource Institute (2020)

Energy-intensive processes

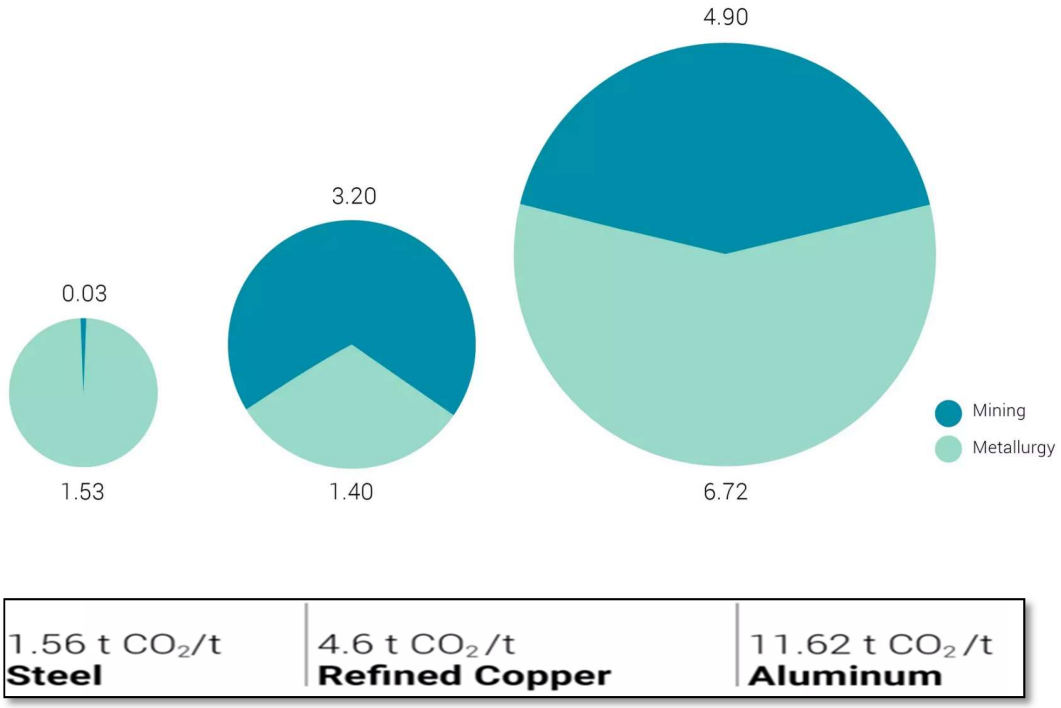
CO_2 emissions are generated even before the aluminum, copper or steel is actually made, namely during the mining and processing of the ores. The ores

obtained from open-pit or underground mining have to be processed in several stages to increase the metal content and prepare them for the metallurgical processes.

This is followed by other energy-intensive processes during the actual manufacture of aluminum, copper, or steel. Pure aluminium is obtained through the electrolysis of molten aluminum oxide. Electrolysis is a process in which electrical energy is converted into chemical energy using electricity. It's a similar story with copper production: The first step is to recover raw copper from the copper ores by roasting. The raw copper is then cleaned by electrolysis to produce pure copper. This process is also referred to as electro-refining. In other words, electrolysis used in copper and aluminum production requires large quantities of electrical energy. Depending on how the electricity is generated, this process creates a significant amount of CO_2.

Steelmaking also has an energy-intensive process, even if it is different compared with copper and aluminum production. In the first step, crude iron is usually recovered from iron ore in a blast furnace. At the same time, the iron-oxygen compounds in the ores are dissolved. Carbon monoxide, which is produced by burning coke in the blast furnace itself, is used as a reducing agent. Out of all the stages in the production of steel, this chemical process causes most CO_2.

It should be noted here that, regardless of whether it's steel, copper or aluminum, all three processes generate greenhouse gas emissions. The following table shows how where emissions levels stand for mining, processing and manufacturing:



Comparison of steel, aluminum, and copper (average GHG emissions intensity for production of selected commodities, mining + processing)
Source : International Energy Agency

Metals are part of the solution

Two things have become clear so far: It is impossible to imagine our day-to-day lives without metals. Yet the manufacturing process generates considerable quantities of CO_2. The good news is: when it comes to achieving global climate targets, metals are part of the solution. After all, the environmental transition requires fundamental changes in several areas. Wind farms, for example, are a major factor in the production of electricity from renewable energy sources. The expansion of rail transport can also drastically reduce CO_2 emissions. In addition, electromobility is the global key to more climate-friendly traffic. All of these measures have one thing in common: They cannot be implemented without the use of metals. Without steel, there cannot be any expansion of wind power or of the rail network. Without copper, the transition to electromobility will not succeed. And without aluminum – that is, without

lightweight components – hardly any emissions can be cut, particularly in the transport sector.

Advantages: Longevity and recyclability

In our efforts to combat climate change, sustainability is another important aspect. Moreover, sustainability is also linked to the subject of longevity – one of the major benefits of metals, especially steel. The average useful life of steel is around 60 years. Famous buildings such as the Eiffel Tower in Paris or San Francisco's Golden Gate Bridge bear testament to the longevity of steel structures.

Another advantage of metals is their recyclability, because in theory they can be melted down indefinitely without affecting their properties. This is what makes metals a real resource pool. Thanks to recycling, it is estimated that around 75 percent of all aluminum ever produced is still in use today. In Europe at present, 95 percent of aluminum scrap from vehicles is recycled. In total, recycled copper, aluminum, and steel enable achieve energy savings of between 75 and 95 percent compared to new production.

Metals, therefore, are an important part of the solution on the road to saving the climate. Yet the far greater solution and challenge here is not only to use metals for climate-friendly innovations, but also to achieve better climate neutrality in the way they are produced. In the end, you need the right technology to turn metals into "green metals".

Source : SMS Group Magazine April 2023

Import of Coking Coal from Russia may Double

After crude oil, the import of yet another key Russian resource is set to flood the Indian market in the years ahead: coking coal. The reasons remain the same lower prices, quicker deliveries, and supply diversification.

Russia’s supply of coking coal – the prime raw material in steelmaking – may more than double in FY24, led by state-owned Steel Authority of India Ltd and private steel-makers such as JSW Steel Ltd and Jindal Steel and Power Ltd (JSPL), two officials aware of the matter said. India’s coking coal imports stood at 54 million tonnes (mt) in FY23, and these import will account for a fifth of its

this year, they said on condition of anonymity. Imports of Russian coking coal in FY23 stood at a mere 4 mt.

About 90% of India's coking coal requirement of 60 mt is currently imported of which Australia alone contributes more than 70%. India has been looking to diversify its imports of steel making coal and identified a few markets. Russia has now emerged as a preferred source due to its pricing and ability to deliver it quickly, one of the two officials cited above said.

"Diversification of sources of import is always good as it prevents choking of supplies on account of various environmental disturbances and the emergence of sudden geo-political events. However, it is for the companies to decide on new import markets based on their assessment of quality and the price matrix, "steel secretary Nagendra Nath Sinha said in an interview.

India's steel and energy ministries signed a memorandum of understanding with Russia in October 2021 to develop coking coal sources. Procure the raw material and collaborate on mining and steel manufacturing technologies. JSW and JSPL began procuring Russian coking coal in 2022, and SAIL has begun making test purchases. All three have plans to increase procurement from FY24, said one of the two officials quoted above.

"SAIL imports around 17 mt of metallurgical coal on an annual basis from different sources. To enhance the vendor base and reduce dependence on existing sources, SAIL had been looking to add new geographics such as Russia for procurement of coking coal," the company said in an emailed response to a query.

"During FY23, about 300,000 tonnes of coking coal was procured from Russia as a trial. As the coal was found suitable, a process for entering into an agreement with the Russian supplier has been initiated, and the quantity may go up during the current fiscal year," the company added.

Queries sent to spokespeople for JSW and JSPL remained unanswered. But executives at these companies said on condition of anonymity that Russia has been supplying coking coal for their domestic steel operations, and this arrangement would continue.

Russia is also providing technical help to Indian steel companies in making special steel that comes under the production-linked incentive (PLI) scheme for the sector. Memorandums of cooperation in technological collaboration to

produce special steels, which is valid up to 2025, have been signed by SAIL, JSPL and JSW Steel with Russia's TsNIIchermet I.P. Bardin.

For India, securing coal supplies to meet the needs of its growing power and steel sectors is critical as the two segments form critical elements of the strategic infrastructure space. India's overall coal imports (coking and thermal coal) increased by 30% to 162.46 mt in FY23, according to a recent report by Mjunction, a business-to-business services provider. The import of coking coal in FY23 rose 5.44% to 54.46 mt from 51.65 mt in FY22, it said. The imports were largely from Australia. Small amounts were also imported from South Africa, Canada and the US.

Source: Mint, New Delhi, 31 May 2023

Coal Consumption Likely To Stay Till 2030 Despite Push For Clean Energy

By 2030, as India seeks to add new plants for electricity generation and includes record clean energy installations to hit climate changes, coal will still remain to be India's biggest source of power consumption.

India being the world's third-largest emitter, is looking to fulfil surging electricity demand, pushed by rising per-capita energy consumption and a post-pandemic situation at the same time, it initiating to decarbonise its power sector, as per the power ministry's Central Electricity Authority. Availability of affordable and reliable electricity is a key factor in the sustainable growth of the country.

Coal will contribute to 54% of electricity generation by the year 2030 with 46 gigawatts of required additional capacity along with new renewables.

Currently, fossil fuels amount to almost three-quarters of generation and mines are attempting to dig out materials as quickly as possible to avoid shortages that caused blackouts recently.

Solar, wind, hydro, biomass and nuclear plants will be reaching more than 500 gigawatts by the year 2030, amounting to just triple of current levels.

Prime Minister Narendra Modi's government, a year back scaling up its environmental ambitions, had set higher targets for clean energy capacity and

to limit the emissions intensity of the economy. With this, India is also offering incentives to set up more solar and wind power, aiming to be a global hub for the production of green hydrogen and green ammonia.

On the other hand, releases from India's power sector are expected to rise about 11% on current levels by the end of this decade, adding up to 1,114 million tons of carbon dioxide, according to the authority.

Source: https://thenationalbulletin.in/coal-consumption-likely-to-stay-till-2030-despite-push-for-clean-energy

Coal Imports Rose to 30% in FY 23 to 162 MT

India's coal imports increased by 30% to 162.46 million tonnes in the 2022-23 financial year against 124.99 MT in the year-ago period, according to a report. The import of coking coal rose 5.44% to 54.46 MT over 51.65 MT in FY22, mjunction said a report.

In March alone, the non-coking coal import stood at 13.88 MT against 12.61 MT in the same month last year. Coking coal imports were 3.96 MT against 4.76 MT. India is among the top five coal-producing countries in the world.

However, some parts of its coal requirement are met through imports as the country is also among the major consumers of the dry fuel.

For coking coal — a key raw material used in steel making — the country remains heavily dependent on imports.

"The persistently high demand for steam coal in India coupled with the weakening of seaborne prices led to increased volumes during March. This trend is likely to continue in coming months in view of the above-normal average temperature expected this summer," mjunction CEO Vinaya Varma said.

Along with other varieties of coal like anthracite, pulverised coal injection (PCI coal), met coke and pet coke, the total imports in FY23 were at 249.06 MT, up from 200.71 MT FY22, a rise of over 24%.

Source: PTI

India Diversifying Coking Coal Sources

In FY'23, India reduced coking coal imports as it boosted its own output. The country also diversified material supply and cut imports from Australia, owing to more attractive prices from Russia. Last year Indian coking coal imports dropped by 1.8% to 56.05 million said Ministry of Commerce India has been increasing its own coking coal production to reduce its dependency on third sides. Last year its output went up by 17.5% to 60.77 million t, according to the official data. India cut shipments from Australia by26% to 30.1 million t. However, its share went down from 70% in the previous year to 54% last year.

Australian prices have been highly volatile due to solid demand for high-quality materials and unfavourable weather conditions affecting supply. Coking coal price swings were extremely sharp during the financial year, reaching $100/t and more in just a few months, according to Metal Expert data. Indian steelmakers successfully diversified raw material supply. In particular, they boosted procurement from Russia, which was ready to provide lower prices to India because of sanctions.

China's Green Iron Ore Masterplan

China has unveiled plans for achieving peak carbon emissions in the iron ore mining industry before 2030, with the state-backed Metallurgical Mines' Association of China (MMAC) announcing green iron ore production guidelines.

This is the first time the MMAC has published guidelines for green iron ore mines and production after the country set targets for carbon peak and carbon neutrality in 2030 and 2060 respectively.

The MMAC's guidelines will work in tandem with the China Iron & Steel Association's (CISA) "Cornerstone" plan, previously announced in 2022, to resolve China's iron ore shortage and dependency on imported ore.

The MMAC guidelines aim to:

- Accelerate the construction of 25 iron ore mining hubs and develop 28 state-backed mining projects domestically and eliminate low-efficiency and high-energy consumption iron ore mines.

- Ensure that by 2025, 40% of Cornerstone mining projects have commenced, with that percentage increasing to 90% by 2030. Output from these mines will account for more than 60% of total domestic iron ore production by 2025 and 70% by 2023.
- Establish a "green" iron ore production system, cutting carbon emission per GDP growth down by more than 5% by 2025 and 18% by 2030 compared with 2020.
- Accelerate the application of clean energy and green transportation in the mining process.

What is the impact?

The impact from the new guidelines is likely to be minimal in the short term because output from these iron ore projects is limited, and production costs will be higher than the other miners [from Australia and Brazil]. It usually takes more than five years to develop a large-scale mine, while it usually takes three to five years to develop medium-scale domestic mines.

Most effective way for China to decarbonize will be to reduce crude steel production and capacity, along with developing a "green" or low-pollution system for domestic iron ore production. It is only a matter of time before demand for iron ore moves toward high-grade iron ore under China's decarbonization plan. Domestic run-of-mine [ROM] usually has lower iron content, so it requires further processing to produce concentrates with higher content.

Another industry source said this guideline from MMAC focuses more on green and high-quality iron ore mines with a low-carbon emission mining process, which ties in with a focus on increasing domestic supply as part of the "Cornerstone" plan.

Currently, as part of CISA's Cornerstone plan to increase overseas iron ore production, boost domestic output to 370 million tonnes and steel scrap consumption to 300 million tonnes by 2025, China is developing large-scale overseas mining operations, including the Simandou mines in West Africa, which are believed to be the world's biggest untapped high-grade iron ore deposits.

Large domestic mines include the West Anshan mine in north-eastern China.

The development of these overseas and domestic mines will increase iron ore supply and China's negotiating power to ensure the stability of iron ore prices.

Source: Fastmarkets, May 10, 2023

Chinese Steelmaker HBIS Produces Green Direct Reduced Iron Products

Chinese steelmaker HBIS Group Co Ltd. has successfully and continuously produced direct reduced iron (DRI) products from its 120-tonne hydrogen metallurgy project.

With a metallization ratio currently at 94%, these DRI products could replace high-quality steel scrap, feedstock of electric arc furnace-based steelmaking, representing an important milestone for the transition to hydrogen metallurgy from the traditional carbon metallurgy in the steel industry, claims North China-based steel producer.

Compared with the same scale of traditional blast furnace-based steelmaking, the phase-one hydrogen metallurgy project will reduce emissions of carbon dioxide (CO_2) by 800,000 tonnes a year, according to HBIS. It will also capture around 125 kilograms of CO_2 when producing a tonne of DRI.

Unlike internationally common natural gas-based DRI production, HBIS innovatively adopted coke oven gas, which contains between 55% and 65% of hydrogen. The application of hydrogen is important in the path to achieving decarbonization and producing "green" steel.

HBIS agreed with global miner BHP Group Ltd. last March to trial carbon capture, utilisation and storage (CCUS) technologies.

The steelmaker in 2021 set a target to start cutting carbon emissions after 2022, reduce carbon emissions by more than 10% from the peak by 2025, and achieve carbon neutrality by 2050.

Source: Reuters, May 29, 2023

How China's Shanxi Province is Strategizing to becoming a Green Steel Leader

Shanxi, a top coal-producing province in North China, which has been struggling with high levels of air pollution, is on its way to becoming a green steel leader in the country following the steps it has taken to prepare for the energy transition and to upgrade its steel industry over the past decade

Shanxi is one of the key regions being targeted amid China's plan to reach peak carbon emissions by 2030 and carbon neutrality by 2060, because it is a major source of steel, coal and carbon emissions.

Shanxi's Department of Industry and Information Technology has detailed how the northern Chinese province will promote the transformation and upgrading of its steel industry to achieve high-end and green steel production, to reduce the carbon emissions as well as maintain the competitiveness of its steel products.

Hydrogen Metallurgy

Shanxi is encouraging hydrogen-based metallurgy, with hydrogen power believed to be an important part of China's future energy system amid the country's move to "green, low-carbon development" as well as the development of "emerging industries of strategic importance

Most of hydrogen in the country comes from coal – a large amount of hydrogen is produced in the coking process of coal. As a coal-rich province, Shanxi has a natural advantage in hydrogen production costs.

Coke oven gas, a by-product of coke production, has a hydrogen content of approximately 60%, from which 14 billion cubic meters of hydrogen can be extracted per year in Shanxi.

In September last year, Shanxi Jincheng Steel Holding Group (Jingang Group) tested the injecting of hydrogen-rich gas into one of its sintering projects and successfully met production requirements, while a second facility finished heating testing last month.

Compared with the conventional process, hydrogen-rich sintering can reduce the consumption of solid fuel by 0.9-1.3 kg in the production of a tonne of

sintered ore, according to Jingang Group. After Jingang Group puts four hydrogen-rich sintering machines into operation, its consumption of solid fuel will be reduced by about 15,000 tonnes a year, while carbon dioxide emissions will decrease by about 40,000 tonnes.

In December 2022, Zhongjin Metallurgical Technology (Zhongjin), another major steelmaker in Shanxi, had a 300,000-tonne-per-year hydrogen-based direct reduced iron (DRI) project put into trial operation. With 100% coke oven gas as the fuel source, the project can produce DRI with a high Fe grade of above 92% and the DRI can be used in surrounding mills' electric-arc furnaces (EAFs).

The hydrogen-based shaft furnace DRI project can reduce CO_2 emissions by more than 50% and energy consumption by more than 20%, compared with the hydrogen-rich reduction blast furnace (BF), according to Zhongjin.

Advanced Facilities

Shanxi will also add bigger and more advanced steelmaking facilities to replace BFs with a volume below 1,200 cubic meters, basic oxygen furnaces (BOF) and EAFs under 100 tonnes and ferro-alloy EAFs under 50 tonnes, aiming to have advanced steelmaking facilities account for more than 90% of total capacity by 2025.

More advanced and bigger steel-making facilities means higher requirements of raw materials and lower carbon emissions. For instance, a large BF requires higher coke strength after reaction to make sure coke will not break into breeze when it falls from the top of the furnace to the bottom. Less the coke breeze (fine coke), higher the efficiency of the utilization of raw materials in furnaces. BFs with a volume below 1,200 cubic meters make up 42% of the total molten iron capacity in Shanxi. That means demand for high-strength coke will likely increase rapidly in the next few years. Coking plants should raise the quality of coke accordingly after the new, big BFs are set up.

Shifting Steel Products Mix

Shanxi plans to increase the proportion of non-construction steel products by 3 percentage points in 2023.

Steel mills are encouraged to speed up the research and development of high-end non-construction steel, including stainless steel, oriented silicon steel, thin cold-rolled flat steel and special bar and wire. This change in steel product structure is in line with the province's plan to revitalize the industrial equipment manufacturing industry.

Shanxi aims to raise the revenue of the industrial equipment manufacturing industry by 12% year on year to 430 billion yuan ($63 billion) in 2023, according to a 2023 action plan released on April 12 by the Department of Industry and Information Technology. The industrial equipment manufacturing industry comprises such sectors as metallurgy, transportation, electrical machinery, communication, computer and other electronic technology, instrument and office machinery.

A second 2023 action plan for the high-end equipment manufacturing industry released on April 11 said the total revenue of the high-end equipment manufacturing industry (rail transit, coal machinery equipment and engineering machinery) would exceed 88 billion yuan by the end of 2023, compared with 75 billion yuan in 2022.

Shanxi province is trying to contain the crude steel production and carbon emissions by raising high-end steel output but reducing common steel output. Steel mills can adopt advanced production processes, such as hydrogen metallurgy to produce high-end green steel because users of high-end steel are more willing to accept green steel premium than users of common steel.

The approach of jointly improving the quality of steel production and demand is worth being learned by other regions. Local governments find consumers of high-end steel for steel mills, so that steel mills are willing to invest in high-end steel.

Raising the proportion of non-construction steel may cause the output of construction steel to drop, but market participants didn't concern too much about the potential output reduction of construction steel in Shanxi because the housing market is still on a downward trend. The supply of construction steel is sufficient even though it may drop, and Shanxi's construction steel is rarely sold to regions outside of the province

Shanxi, top coal source and major steel-producing province in China, produced 1.31 billion tonnes of raw coal in 2022, accounting for 29% of China's total output of 4.56 billion tonnes. Shanxi's production of coke was 98 million tonnes in 2022, making up 21% of the country's total output of 473.44 million tonnes. Crude steel production in Shanxi totalled 64.23 million tonnes last year, representing 6% of the total output of 1.01 billion tonnes in the country.

Source : Fastmarkets, May 16, 2023

Vale's Green Briquette Megahubs

Major Brazilian iron ore miner Vale's plan for *green briquette megahubs* in the Middle East has sparked much curiosity and interest.

Many miners are looking to take a share of the decarbonization "pie" by ramping up their offerings of direct-charge materials in their attempts to eliminate sintering. This is because China – the largest steelmaker and raw material consumer in the world – continues to favour the blast furnace route for steelmaking due to its efficiency and economies of scale. Consider these factors alongside the relatively young age of many large blast furnaces in the country – which means that steelmakers would be unlikely to abandon them in the mid- or long term – and efforts to drive the adoption of electric-arc furnace (EAF) shall progress only slowly.

Vale's efforts also support the steel industry's drive toward eliminating Scope 3 emissions, which remains a tall order in the near- and mid-terms. It hopes for a 15% reduction in emissions from its own value chain by 2035, and to achieve net-zero carbon emissions by 2050.

The miner is planning three *megahubs* in Ras Al-Khair Industrial City in Saudi Arabia, the Khalifa Economic Zone in Abu Dhabi and at Duqm in Oman. It will supply concentration fines to these hubs and then beneficiate them into pellet-feed concentrates, which will then be processed into briquettes. It will build and operate concentration and briquetting plants within these hubs, to provide a regular supply of high-grade agglomerated products to downstream consumers. Vale expects iron ore fines from all its systems in Brazil to contribute to the blend that will compose the feed for the concentrators.

Vale sees its green briquettes as versatile and able to support its buyers' decarbonization goals. Vale's green briquettes are produced with very flexible low-carbon technology. Since it is an agglomerate from iron ore fines, the resulting direct-charge material has all the necessary attributes to be used directly in conventional, mature and existing ironmaking reactors such as blast furnaces and direct- reduction furnaces. The green briquettes being produced with high-grade iron ore will also allow high furnace performance with lower slag volumes, and this is aligned with decarbonization goals of steelmakers.

Vale is confident in the production process because of internal efficiencies and product flexibility. Industrial trials of briquettes were done with several customers and achieved good results. Binder material availability is manageable mainly because sand is used from their own iron ore concentration process.

While a cold agglomeration process can be applied in different forms, such as pellets and extruded agglomerates, Vale has selected a briquetting process because it is the most flexible solution, considering iron ore feed and processing characteristics.

Vale's investors and clients will construct and operate the plants that will produce hot-briquetted iron (HBI) or any other steel product. Similarly, investors and clients will then offtake the briquettes. Local parties will promote the construction of the required logistics infrastructure and attract or invest in renewable and hydrogen production.

Vale's green briquette production is expected to feed the HBI and other steel products plants that will be constructed in the *megahubs*. Saudi Arabia's National Industrial Development Center has signed a Memorandum of Understanding with Vale to develop a 4 million tonne per year iron ore pellet plant in Ras Al-Khair Industrial City.

Vale's efforts shine a spotlight on the increasing emphasis on metallics and direct-charge materials in the steel industry. This is happening even as Asia continues to try to move up the value chain to emulate European steelmakers, which have a higher ratio of direct-charge materials in their furnace burden, or the US, where steel production is based largely on EAFs.

But the supply quantities of metallics and direct-charge materials to be fed into Asia's major blast furnaces are still low, and will not be achievable on a sustainable, economic scale any time soon, especially because supply of high-grade pellet-feed iron ore concentrates remain tight. This is why miners are also studying and experimenting with the agglomeration of lower-grade iron ore fines in hopes of producing them on a large scale, including from 60-62% Fe sinter-grade fines.

Scarcity of the required high-grade concentrates will remain the main bottleneck for the expansion of the direct-reduced iron-EAF route of primary steel production, and that improving technologies will make it a reality. Technology developments for smelting reduction are required. Metso Outotec recently launched a proprietary direct-reduction iron smelting technology, which – for example, if used in combination with 100% hydrogen-based Circored direct-reduction technology – will accept lower-grade iron ore fines as well.

Source: Fastmarkets, May 11, 2023

Blast Furnace Hydrogen Injection Trial by Cleveland-Cliffs

Cleveland-Cliffs Inc. completed a hydrogen (H_2) injection trial at its Middletown Works blast furnace. Introduction of hydrogen gas as an iron reducing agent in the blast furnace is the first ever use of this carbon friendly technology in the Americas region. The successful use of hydrogen gas represents a significant step toward the future decarbonization of blast furnaces, which are necessary for the continued service of the most quality-intensive steel applications, particularly for the automotive industry.

During the trial completed on May 8, 2023, hydrogen gas was injected into all 20 tuyeres at the Middletown #3 blast furnace. Hydrogen was used as a partial substitute for the coke necessary for iron reduction, ultimately replacing the release of CO_2 with the release of H_2O (water vapor) with no impact to product quality or operating efficiency. The hydrogen was delivered to the Middletown facility via the existing pipeline and transportation infrastructure in place for the facility's other hydrogen uses, including for its annealing furnaces.

Cleveland-Cliffs Inc. is the first Company in the Americas to inject hydrogen into a blast furnace. This achievement will ensure ability to use green hydrogen

when it becomes readily and economically available, including in their seven blast furnaces and the state-of-the-art direct reduction facility.

Source: Business Wire, May 08, 2023

ArcelorMittal to Set up Electrolysis Plant

ArcelorMittal has announced plans to set up a pilot electrolysis plant and a hydrogen filling station at its Eisenhutternstadt site in Germany, together with energy supplier *Vulkan Energiewirtschaft Oderbrucke* (VEO), and plant supplier *McPhy Energy*. The plant will feature a total power capacity of 2MW, provided by two electrolysers to be supplied by McPhy. The electrolysers will be used to produce hydrogen, which will initially be utilised in the cold rolling mill, where steel is strengthened by changing its shape without using heat.

The new hydrogen filling station will refuel forklifts of articulated lorries, and oxygen that is generated during electrolysis will be reused on site for production.

The demonstration plant will serve the use of hydrogen in steel production as well as the logistical use of hydrogen-powered vehicles for steel production. With this project, it is aimed to show and test the possibilities of hydrogen in industrial use and further optimise it before production is completely converted to climate neutrality in the coming years with a complete change of technology and the use of more hydrogen. The partners also intend to use the project as a testing ground for newly developed 'smart operating modes'.

The Brandenburg Technical University (BTU) Cottbus-Senftenberg will provide scientific support for the project and will analyse data related to hydrogen use at the plant to increase energy efficiency and support the further development of electrolysers. Increasing energy efficiency through the use of intelligent operating modes in electrolysis is a challenging topic to work on scientifically in order to make contribution so that this important futuristic technology can be used in energy-intensive steel industry to enable climate-neutral operation.

Source: Weekly News from Steel Times International, 19 April 2023

Can Ammonia be just as Effective at Producing Green Steel as Hydrogen?

No formation of NOx greenhouse gases was observed in NH_3-based direct iron reduction, according to a scientific study. Ammonia is just as effective as hydrogen in zero-emission green steel production, the study has found, offering potential cost savings of about 18% when relying on imported H_2.

Steel production is currently responsible for about 7-9% of the world's greenhouse gas emissions, and while renewable energy can be used in electric arc furnaces to melt scrap steel for re-use, the only currently available method to remove emissions during the extraction of iron from ore (i.e., iron oxide) is to use green hydrogen, rather than the coal or natural gas used today. This is because oxygen has to be removed from the ore via a chemical reaction at the same time as it is melted, so a fuel that both reacts with oxygen and provide high-temperature heat is required to produce raw iron.

Because of the huge amounts of hydrogen that would be needed to replace fossil fuels in iron production, countries such as Germany are looking to import green H_2 at scale in the coming years, most of which will arrive at European shores in the form of ammonia — which is far easier to transport across long distances than pure hydrogen (compressed or liquefied) and also has a higher energy density by volume, making it an economically efficient method of transporting H_2.

But this would mean that imported ammonia would have to be cracked into hydrogen (and nitrogen) for use in green steel production — an expensive energy-intensive process (requiring about 30% of the energy stored in the H_2 and the use of the rare metal, ruthenium, as a catalyst) that would add significantly to the cost of green hydrogen.

Being able to use imported ammonia directly would therefore reduce costs by about 18%, according to the study, *Reducing Iron Oxide with Ammonia: A Sustainable Path to Green Steel*, written by researchers from the Max Planck Institute for Iron Research. And while burning ammonia usually results in high emissions of nitrogen oxides (NOx) — one of which (N_2O) is 273 times more potent a greenhouse gas than CO_2 over a 100-year period — "no formation of any ozone-destroying NOx molecules were observed during ADR [ammonia direct reduction]", the paper says.

It seems that oxygen in the air, which would normally react with the nitrogen in ammonia to form NOx, is removed in the process in the same way that oxygen

from the iron oxide is removed, leaving mainly pure nitrogen instead at temperatures of around 350°C — allowing the remaining hydrogen to work its magic — while a small proportion of the nitrogen temporarily attaches to the iron as iron nitride (Fe_4N).

Moreover, nitrogen, a nontoxic, non-greenhouse gas, as a by-product of ammonia decomposition can act as a heat carrier in a shaft furnace to maintain the reaction temperature and thus enhance the efficiency for the endothermic [i.e., heat-absorbing] reduction of iron oxide with hydrogen, the study says.

It adds that the Fe_4N formation is actually a benefit to the quality of the iron produced. The nitride formation is another key advantage of ADR, as nitriding improves the aqueous [i.e., water] corrosion resistance of iron. The nitride passivated [i.e., added a thin inert layer to make the metal less reactive] the otherwise highly active reduced iron, offering a safety-critical benefit for handling and logistics. Otherwise, for the downstream processing of the reduced material, the porous sponge iron [i.e., direct-reduced iron] is prone to re-oxidation and strong exothermic [i.e., heat-producing] reactions with oxygen or moisture due to its high surface-to-volume ratio. Thus, the sponge iron produced by HyDR [hydrogen-based direct reduction] must be compacted into hot briquetted iron to reduce the porosity for shipping and handling, which is not necessary with ADR.

In addition, after melting, the protective nitride is almost completely removed, resulting in a final material with 99.4% iron, but the advantageous structure remains, due to it having far less pores than hydrogen-derived sponge iron.

In summary, ADR is kinetically as effective for producing green iron as HyDR at 700°C. The direct utilization of ammonia in the reduction process offers a process shortcut, alleviating the need for a preliminary ammonia cracking step into hydrogen and nitrogen," the study explains.

ADR provides a novel approach to deploying intermittent renewable energy for an unprecedented and disruptive technology transition toward sustainable metallurgical processes. With these benefits, it connects two of the currently most greenhouse gas intense industries (namely, steel and ammonia production industries) and opens a pathway to render them more environmentally benign and sustainable.

At the same time, it can eliminate logistic and energetic disadvantages associated with the use of pure hydrogen.

Source : Hydrogen Insight 26 April 2023

New Process for Fossil-free Sponge Iron

A Swedish company, FerroSilva, has developed a completely new process for the production of fossil-free sponge iron, in collaboration with KTH Royal Institute of Technology, chalmers University of Technology, Sveaskog and Ovako, among others.

The ambition is that a first factory, with the capacity to produce 50kt of fossil-free sponge iron per year, will be completed in 2026. It is claimed that the process required less than a tenth of the electricity per ton of sponge iron produced compared to the electrolysis-based initiatives.

The much-discussed hydrogen-based methods for producing fossil-free sponge iron are very electricity-intensive, claims FerroSilva, as its process requires less than a tenth of the electricity per ton of sponge iron produced, as most of the energy used in FerroSilva process is stored in forest residues that we gasified, claims FerroSilva.

FerroSilva began as a project originating from the Department of Processes at the Department of Materials Science at the Royal Institute of Technology, KTH, in Stockholm. In the spring of 2020, Peter Samuelsson and Rutger Gyllenram won KTH Innovation's prize with FerroSilva as the best proposal for reducing greenhouse gas emissions, and in the spring of 2021, the Norwegian Energy Agency, STEM, decided to part-finance a feasibility study that was completed in the fall of 2022.

The FerroSilva project is a collaboration with KTH and Chalmers and is supported by Lantmännen, Sveaskog, Ovako, Uddeholm and Alleima (formerly Sandvik Materials Technology).

FerroSilva has developed a new process to produce fossil-free sponge iron. In the autumn of 2022, an extensive feasibility study was completed and FerroSilva's calculations showed that the production method would be more cost-effective than other currently known initiatives to produce fossil-free sponge iron in Europe.

It is claimed that the FerroSilva is the first in the world to commercialize this process, which is particularly suitable for countries with good access to

biomass and where access to electricity is a limiting factor, The FerroSilva process also does not require an extended electricity grid infrastructure. Sponge iron that is been created with negative carbon dioxide emissions.

The plan is to break ground as soon as possible for FerroSilva's first factory at Ovako's Hofors plant, with a planned start-up in 2026 and a capacity to produce 50kt/yr of fossil-free sponge iron. The energy-efficient process is claimed to generate and capture several useful industrial inputs such as biochar and captured biogenic carbon dioxide that can be used, for the production of electrofuels.

Letters of intent are in place with Sveaskog for our input material and with Ovako for land use, as well as an off-take agreement with Ovako for parts of our future production of fossil-free sponge iron. In addition, there are letters of intent with OX2 and Linde for parts of the future production of liquid biogenic carbon dioxide.

Source : Steel Times International, Weekly News, 10 May 2023

Automation and Control Systems Cybersecurity Standards

The ISA/IEC 62443 series of standards define requirements and processes for implementing and maintaining electronically secure *industrial automation and control systems (IACS)*. These standards set best practices for security and provide a way to assess the level of security performance. Their approach to the cybersecurity challenge is a holistic one, bridging the gap between operations and information technology as well as between process safety and cybersecurity.

The ISA/IEC standards set cybersecurity benchmarks in all industry sectors that use IACS, including building automation, electric power generation and distribution, medical devices, transportation, and process industries.

Background

The International Society of Automation (ISA) established the ISA99 standards committee in 2002, recognizing the need to secure equipment and operations that make up critical infrastructure against cyberattacks. Since then, ISA99 has published a comprehensive family of standards and technical reports purpose-built to address securing automation and control systems.

The ISA/IEC 62443 standards are submitted to the International Electrotechnical Commission (IEC) for global adoption as international standards ISA/IEC 62443. The ISA/IEC 62443 series of standards are endorsed by the United Nations. With use cases from more than 20 different industries, the ISA/IEC 62443 series of standards have demonstrated their utility in all industry verticals that use operational technology. In 2021, IEC recognized the series as a *horizontal standard*, meaning that the standards have been proven to apply to a broad range of different industries.

Getting Started with the ISA/IEC 62443 Standards

A founding principle of the ISA/IEC 62443 standards is the concept of shared responsibility as an essential building block of automation cybersecurity. Key stakeholder groups must align to ensure the safety, integrity, reliability, and security of control systems.

The standards define requirements for key stakeholder groups who are involved in control system cybersecurity. Stakeholder groups include asset owners (end users), automation product suppliers, integrators who build and maintain control system solutions and their components, and service suppliers who support the operation of control systems.

People, processes, and technology all play critical roles in securing automation and control systems. The ISA/IEC 62443 series addresses the security of industrial automation and control systems (IACS) throughout their lifecycle (which applies to all automation and control systems, not only industrial).

The ISA/IEC 62443 standards provide guidance that includes:

- Defining common terms, concepts, and models that can be used by all stakeholders responsible for control systems cybersecurity
- Helping asset owners determine the level of security required to meet their unique business and risk needs
- Establishing a common set of requirements and a cybersecurity lifecycle methodology for product developers, including a mechanism to certify products and vendor development processes

- Defining the risk assessment processes that are critical to protecting control systems

The ISA Global Cybersecurity Alliance: Advancing the Adoption of 62443

ISA founded the *ISA Global Cybersecurity Alliance (ISAGCA)* in 2019 to advocate for the importance of automation cybersecurity and to advance the worldwide adoption of the ISA/IEC 62443 series of standards. Today, ISAGCA consists of more than 50 member companies representing more than $1.5 trillion in aggregate revenue across more than 2,400 combined locations around the globe. Automation and cybersecurity provider members serve 31 different industries, underscoring the broad applicability of the ISA/IEC 62443 series of standards.

2G to 6G Telecom Journey

Throughput: The data rate supported by each generation has increased significantly over time. 2G networks had a throughput of 9.6 Kbps to 236 Kbps, 3G increased this range to 384 Kbps to 42 Mbps, and 4G further improved it from 100 Mbps to 1 Gbps. 5G has made a massive leap with a throughput of 10 Gbps to 20 Gbps, while 6G is expected to reach an impressive 100 Gbps to 1 Tbps.

Speed: The average user experience in terms of speed has also improved with each generation. 2G networks provided speeds of around 20-40 Kbps, 3G increased this range to 500 Kbps to 2 Mbps, and 4G delivered speeds of 10-50 Mbps. With 5G, users can expect speeds between 50 Mbps and 10 Gbps. 6G is projected to offer speeds from 1 Gbps to 100 Gbps.

Latency: Latency, or the time it takes for a signal to travel from the sender to the receiver, has decreased significantly with each generation. 2G had a latency of 300-1000 ms, 3G reduced this to 100-500 ms, and 4G further decreased it to 30-100 ms. 5G has dramatically lowered latency to 1-10 ms, and 6G is expected to achieve sub-millisecond latency.

Spectrum Efficiency: The ability to transmit more data using the same spectrum has improved. 2G had low spectrum efficiency, while 3G and 4G made significant improvements. 5G has very high spectrum efficiency thanks

to massive MIMO *{Multiple-Input Multiple-Output (MIMO) is a wireless technology that uses multiple transmitters and receivers to transfer more data at the same time. The technology helps allow to reach higher speeds }* and beamforming technologies. 6G is expected to push the limits of spectrum efficiency even further with the use of THz frequencies and advanced network architectures.

Do we really need that kind of specs for 6G? Maybe, smart factories and some backbone infrastructure will need it. The applications that require the speeds offered by 6G probably haven't been invented yet.

2G 3G 4G 5G 6G

Generation	Technology	Spectrum	Use Cases	Channel Model	Energy Efficiency	Cell Size	Network Architecture	Throughput	Speed	Latency	Spectrum Efficiency
2G	GSM, CDMA	850 MHz-1900 MHz	Voice calls, SMS, limited mobile data	Okumura-Hata, COST-231	Low	Macro cells	Centralized	9.6 Kbps - 236 Kbps	20-40 Kbps	300-1000 ms	Low
3G	WCDMA, HSPA	850 MHz-2100 MHz	Voice calls, mobile data, video calls	ITU M.1225, COST-259	Medium	Macro cells, Micro cells	Centralized	384 Kbps - 42 Mbps	500 Kbps-2 Mbps	100-500 ms	Medium
4G	LTE, LTE-A	700 MHz-2600 MHz	Mobile broadband, VoLTE, video streaming	ITU M.2135, 3GPP TR 36.814	High	Macro cells, Micro cells, Pico cells, Femto cells	Decentralized	100 Mbps - 1 Gbps	10-50 Mbps	10-100 ms	High
5G	NR, mmWave	600 MHz-100 GHz	IoT, AR/VR, autonomous vehicles, smart cities	3GPP TR 38.901, ITU M.2101	Very high	Macro cells, Micro cells, Pico cells, Femto cells, Massive MIMO	Virtualization, Cloud-native, Decentralized	10 Gbps - 20 Gbps	50 Mbps-10 Gbps	1-10 ms	Very High
6G (Projected)	THz, AI integration	100 GHz-3 THz	Holographic communication, AI services, real-time sensing	Under development	Extreme	Smart cells, Metasurfaces, Reconfigurable intelligent surfaces	Ubiquitous AI, Distributed, Heterogeneous	100 Gbps - 1 Tbps	1 Gbps-100 Gbps	Sub-millisecond	Extreme

Global Steel Climate Council Releases a Steel Climate Standard

An international group of steel manufacturers, The Steel Manufacturers Association (SMA), comprised of EAF steel producers in the U.S. and Europe, has formed the *Global Steel Climate Council (GSCC)*, a coalition, to urge the United States and European Union to adopt a global emission standard that incentivizes steelmakers to use the cleanest steel production process available.

SMA, the founding member of GSCC, has nearly 40 member companies. Together they have steelmaking or scrap processing operations in 79 countries.

GSCC is a non-profit organization created to lead an effort to reduce steel carbon emissions and encourage investments in lower emission technology as part of the global effort to decarbonize economies and societies. GSCC members are steel manufacturers, associations and other organizations in the steel supply chain that have a presence in 79 countries around the world.

The GSCC supports a global standard to accelerate the transition to low-emission steel and recognize the potential of the recycled, circular steel model to reduce carbon emissions.

The GSCC asserts that any agreement on a new emissions standard for steel production should focus on the amount of emission generated, not on how steel is made. Much of world's steel production is extremely carbon-intensive because it primarily relies on mined and processed coal, iron ore and limestone. However, other steelmakers, including those producing more than 70 percent of all U.S. and more than 40 percent of all European manufactured steel today, use electric arc furnaces (EAFs) that principally input recycled scrap to produce steel, generating significantly lower carbon emissions. EAF technology, using mainly recycled scrap, reduces carbon emissions in steel production by 70 percent. The global industry needs to build on the innovation that leads to cleaner steel production because the green and digital economies around the world are going to be built with steel.

A *"sliding scale"* standard supported by high-emission steelmakers would set greenhouse gas emission standards ceilings up to nine times higher for extractive versus recycled products, the GSCC says, penalizing EAF producers and permitting higher-emission steel to be erroneously labelled as "green." Under a sliding scale, two steel products could be classified as equally "green," even though one was produced by creating multiple times more carbon emissions than the other, the coalition adds.

Steel is essential for our economies, including the world's essential infrastructure. GSSC feels that this new standard will accelerate the actual reduction of green- house gas emissions and provide key decision-makers with accurate data to make informed decisions.

The GSCC says a number of principles should guide standard development:

- reducing GHG emissions from the global steel industry;

- establishing a standard that is technology/production method agnostic;
- establishing a standard that has a system boundary that includes Scopes 1, 2 and 3 emissions;
- establishing a standard that aligns with a science-based glide path to achieve a 1.5-degree scenario by the year 2050; and
- providing relevant information on sustainable steelmaking to appropriate decision-makers.

The GSCC single standard will encourage all producers to reduce their carbon emissions and create a level playing field for all manufacturers.

The Global Steel Climate Council (GSCC) has released a draft of *The Steel Climate Standard*, a global standard to measure and report steel carbon emissions. The standard focuses on reducing greenhouse gas (GHG) emissions from the global steel industry with a science-based glidepath to reduce emissions in line with the goal of the Paris Climate Agreement to achieve a 1.5° C scenario. The standard offers a single, technology-agnostic protocol that would apply to all steel producers equally on a global basis and would enable steel customers to know and compare the actual carbon emissions associated with steel products.

GSCC is one of several groups and companies advocating for a global standard. Some in the United States and Europe are promoting a standard that features a "ferrous scrap usage sliding scale" – one standard for steel made from traditional production processes and another for steel made from circular processes. GSSC says that "Creating a dual standard would allow high-carbon emissions steel to be prioritized over lower-carbon steel. This is a form of greenwashing and serves to discourage innovation and allows high-carbon steelmakers to postpone making changes in their production process.

GSCC's proposed standard is comprised of two main components:

(1) product certification criteria that allows customers to know if the steel they are buying is on the glidepath to achieve the goals of the Paris Climate Agreement; and
(2) a corporate-wide, science-based target-setting framework based on a 1.5-degree glidepath.

The GSCC standard would measure all key greenhouse gas emissions (GHG) pollutants from Scope 1, 2 and 3 emissions. Producers would have to report independent verification of their emissions and reduction targets. The GSCC standard's product intensity goals for the steel industry are based on the International Energy Agency's (IEA) carbon budget for the iron and steel sector, which is aligned with the 1.5° C scenario for net zero emissions by 2050.

Steel will also contribute to the transition to a greener economy with the production of electric vehicles, wind turbines, solar arrays and other clean technology products. The GSCC standard aims for a clear future for steel in a decarbonized economy and aims to achieve the lowest overall emissions from the sector by 2050.

Source: The Global Steel Climate Council website