ISSN: 0976-4232

VOL. 16 NO. 2 JANUARY, 2022

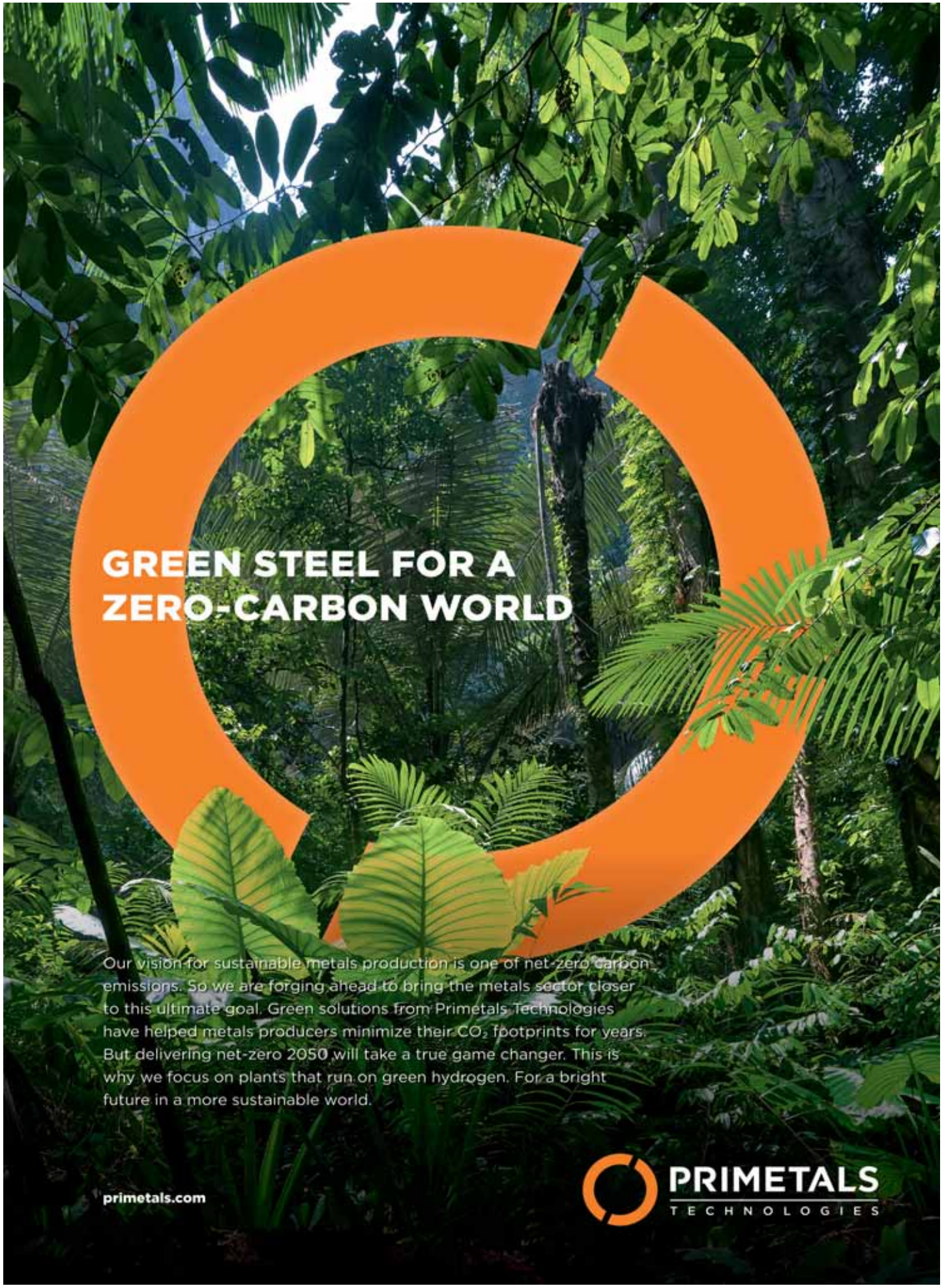
STEEL TECH

FOCUS OF THIS ISSUE

Green Steelmaking: Evolving and Sustainable Technologies

A quarterly publication


TURN INFORMATION
INTO VALUE
Building the Learning [Steel] Plant
SMS digital develops innovative solutions to boost your business.
Benefitting from cutting-edge development methods, our solutions for plant and process condition, product quality, production planning, and energy management contribute in streamlining your maintenance efforts, decrease quality deviations and optimize plant utilization, even down to a short-term rescheduling.
The digital future has already begun
Also visit us online:
www.sms-digital.com/solutions/the-learning-steel-plant
SMS group


GREEN STEEL FOR A
ZERO-CARBON WORLD
Our vision for sustainable metals production is one of net-zero carbon emissions. So we are forging ahead to bring the metals sector closer to this ultimate goal. Green solutions from Primetals Technologies have helped metals producers minimize their CO_2 footprints for years. But delivering net-zero 2050 will take a true game changer. This is why we focus on plants that run on green hydrogen. For a bright future in a more sustainable world.
primetals.com
PRIMETALS
TECHNOLOGIES

DANIELI

710
PROCESS CONTROL SYSTEMS

Danieli Automation automates plants through integrated systems for equipment, process and power control, handling jobs from order placement through product delivery. Event-prediction and problem-solving operator assistance are ensured by the innovative 3Q system.

647
SHEARS, BALERS AND SHREDDERS

38
ENERGIRON DIRECT REDUCTION PLANTS

259
ELECTRIC ARC FURNACES

Danieli Environment offers a full range of proprietary technologies for air pollution control, water treatment, solid waste recovery, noise reduction and energy savings.

386
ENVIRONMENTAL PLANTS

147
BLAST FURNACE AND CONVERTER PROJECTS

405
SECONDARY METALLURGY STATIONS

Through planning, complete systems integration and construction with our own heavy lifting equipment, provide our teams with full operational flexibility. Danieli Engineering and Danieli Construction International: your trusted partner with 37 years of experience in on-time project delivery and cost management.

138
TURNKEY PLANTS SUPPLIED WORLWIDE

2521
CASTING STRANDS FOR SLABS, BLOOMS, AND BILLETS

665
SLAB, BLOOM, AND BILLET GRINDING MACHINES

Via Nazionale, 41
33042 Buttrio (UD) Italy
Tel (39) 0432.1958111
Fax (39) 0432.1958289
info@danieli.com

DANIELI TEAM
A CENTURY
OF PARTNERSHIP
EXPERIENCE

DANIELI THE RELIABLE INNOVATIVE PARTNER TO BE A STEP AHEAD

Our original technology, process know-how, in-house design and manufacturing along with proprietary automation systems, environmental solutions and customer service for a competitive and sustainable steel and nonferrous metals industry. Strength and reliability presented by numbers.

Danieli Centro Combustion and Danieli Olivotto Ferrè provide the most efficient and low consumption heating and heat treatment systems for all steel and NF metals production processes.

1000
HEATING AND HEAT TREATMENT SYSTEMS

333
HOT STRIP, PLATE AND COLD MILLS

526
HEAVY SECTION, RAIL, BAR AND WI-REROD MILLS

115
SEAMLESS AND WELDED TUBE AND PIPE PLANTS

390
EXTRUSION AND FORGING PRESSES

150
ALUMINIUM HOT AND COLD MILLS

1799
STRIP PROCESSING AND FINISHING LINES

508
DRAWING AND PEELING MACHINES

INTERNATIONAL SEMINAR
Organized by

STEEL TECH

on

Technological Advancement in Ferroalloys & Opportunities for Growth

11th APRIL (MONDAY), 2022 | ITC SONAR, KOLKATA, INDIA

KEY ISSUES TO BE DISCUSSED

FERRO-ALLOYS

- INTERNATIONAL & DOMESTIC MARKET - SUPPLY, DEMAND BALANCE & OPPORTUNITIES FOR INDIA
- SUPPLY OF CHROME & MANGANESE ORE TO FERRO ALLOY PRODUCERS
- INNOVATIVE TECHNOLOGIES FOR REDUCING PRODUCTION COST OF FERRO ALLOYS
- NOBLE FERROALLOYS- AVAILABILITY OF ORE AND PRODUCTION PROCESS

MINING

- MINING LAWS, REGULATIONS, RESTRICTION
- MODERN TECHNOLOGIES

RAW MATERIAL

- AVAILABILITY OF RAW MATERIAL FOR PRODUCTION OF FERRO ALLOYS
- INNOVATIONS & EMERGING TECHNOLOGIES IN UTILISATION OF LOW GRADE RAW MATERIALS
- INFRASTRUCTURE, MODERN LOGISTICS
- WAYS AND MEANS TO MEET RAW MATERIAL REQUIREMENT FOR 300 MT CRUDE STEELMAKING

POWER & ENERGY (INCLUDING GREEN ENERGY)

- LOCATING FERRO-ALLOY PLANT TO AVAIL POWER AT THE LOWEST COST
- UTILISATION OF WASTE HEAT TO REDUCE COST
- SOURCING OF REDUCTANT AT LOWER COSTS

TECHNOLOGY

- DIGITIZATION / INDUSTRY 4.0 / IOT / MACHINE LEARNING

SAFETY, HEALTH & ENVIRONMENT

ADDRESS FOR COMMUNICATION

MR. PRITISH K. SEN
Email: psen2008@yahoo.co.in
info@steeltech-india.com
Mobile: +91 9230639343

MR. JAYANTA K. CHATTERJEE
Email: jkchatterjee916@gmail.com
Mobile: +91 98300 22261

MR. ARNAB BANERJEE
Email: i_arnab@rediffmail.com
info@steeltech-india.com
Mobile: +91 84508 14381

STEEL TECH

PARTICIPATION AND SPEAKERS FROM:

OUTOTEC, SMS, PYROMET, TRAFIGURA, TATA STEEL, SAIL, MOIL, JINDAL STAINLESS STEEL, JSW STEEL, JSPL, IMFA, OUTOKUMPU, VEDANTA GROUP, ADHUNIK, IMMT, NML, MECON, M N DASTUR, IIT, JU & MANY MORE...

STEEL TECH

VOL. 16 NO. 1 OCTOBER, 2021

Green Steelmaking - Evolving and Sustainable Technologies

Steel technology for today and tomorrow

Editor's Office: Mr. Pritish K. Sen, Sunny Apartments, 61E, Manick Bandyopadhyay Sarani, Kolkata - 700 040, India, Mobile: +91-9230639343 / 87773 41510, Email: psen2008@yahoo.com & info@steeltech-india.com

Printed at M/s. CDC Printers Pvt. Ltd., Tangra Industrial Estate, 45, Radhanath Choudhury Road, Kolkata 700 016.

Registered Office & Published from: Sunny Apartments, 61E, Manick Bandyopadhyay Sarani, Kolkata - 700 040, India,

Website: www.steeltech-india.com

Owned and Published by: Mr. Pritish K. Sen, Sunny Apartments, 61E, Manick Bandyopadhyay Sarani, Kolkata - 700 040, India

Price: Rs. 400/- per copy

Editorial

Dear Readers,

A very Happy, Prosperous and Safe 2022 to all our Readers, Authors, Advertisers, Subscribers and other stakeholders

COVID-19 pandemic which started about two years back has been still haunting globally with no exception to India which is under third wave of Omicron. However, unlike the first two waves, India incorporate has managed to take the current rise in the COVID infections largely in its stride and ensured relatively less disruption to business even though sub-sectors such as tourism, hospitality, multiplexes and the likes face hurdles on account of restrictions on indoor gatherings and weekend lockdowns.

The President of India, on the eve of 73rd Republic Day in his address said the government has shown relentless focus on reforming every economic sector and providing helping hand wherever necessary which is a testimony to India's spirit in the face of diversity & the economy in the move again.

In a special virtual address at the Davos, organised by the World Economic Forum, PM of India Shri Narendra Modi said it is the best time to invest in India pointing to the government's commitment to deep economic reforms, ease of doing business and a favourable corporate tax rate. Although the country is fighting a new wave of pandemic but it is infused with self-confidence having administered over 1500 million vaccines in less than a year and on the path of self-reliance and is encouraging investments as evident from the PLI schemes.

According to a survey, 99% of CEOs in India believe the country's economic growth will improve over the next 12 months. It is also observed that the Indian companies raised $6 Billion selling offshore bonds during January 1-14, the most in the first fortnight of a year showing the confidence of international investors in India's economy despite looming uncertainties globally. The IMF also raises FY23 growth at 9% up from 8.5% previously anticipating an investment and consumption recovery on the back of improved credit flow.

Similarly, the Indian steel industry is quite optimistic. Although steel prices have come down from their peak from last year, these are still good enough to make substantial profits for the industry, particularly for the integrated steel plants. The annual steel production in 2021 has touched all time high of over 118 Mt.

With a better financial health, leading companies are now better placed to undertake expansion projects than they were in the past several years. SAIL is concentrating to finish their projects in hand and reduce debt. Tata Steel is expanding its Kalinganagar plant from the present 3 to 8 Mtpa. Tata Steel has acquired NINL recently and they have plan to make this as a long product plant from existing 1 Mtpa to 10 Mtpa by 2030. JSW Steel has expanded its Dolvi unit from 5 to 10 Mtpa and now taking steps to expand its Bellary plant from the present 12 Mt to 18 Mtpa. The negotiation on land acquisition for proposed 13.20 Mtpa Greenfield plant at Odisha is under process. JSPL has big plan for its Angul plant. The 6-Mtpa plant will be expanded to 12 Mtpa by 2023 and then to 15 Mtpa by 2025 using the existing route of coal gasification a, blast furnace and Electric furnace route. Additionally, NMDC's Nagarnar Steel Plant, is expected to commission its 3 Mtpa greenfield steel plant within next few months. AMNS is expanding its pelletisation plant at Paradeep to 12 Mtpa. It has a much bigger ambition to set up a 24 Mtpa at Odisha near Kendrapara district at an investment of Rs 1.02 lakh crore. Along with the steel complex, the company will also develop a downstream industry park to promote the MSMEs and help import substitution. All these projects auger very well for technology providers and Equipment suppliers and their hands are already full in terms of orders placed on them. India should now lay stress on indigenous technology for steel production of steel based on the local raw material characteristics and manufacture all vital equipment locally to become 'atmanirvar'.

The Indian steel plants have been adopting the latest technologies for steelmaking. They are also aware of the global trend in decarbonisation and CO2 emission reduction. India has already achieved 40% energy generation through the renewable routes. Tata Steel has started a pilot CCS (carbon capture and sequestration) project at its Kalinganagar plant and its success will be a great achievement in the country.

Our January issue is focussed on Green steelmaking and sustainable technologies and covers many interesting articles. Carbon-neutrality theme is high on the agenda of steel industry which coincided with India's promises towards emission control at the United Nations Climate Change Conference in Glasgow.

We hope the Readers will find the articles and coverage informative and interesting..

Happy Reading

Pritish K. Sen

Contents

Proceedings and DVD of STEEL TECH's International Seminar

The International Seminar Proceedings and DVD's/ Soft Copies are available as follows:

1. **Alternative Routes for Iron making (2009)**
2. **Ironmaking in Blast Furnaces (2010)**
3. **Steelmaking Technology in India (2011)**
4. **Optimisation of Iron and Steelmaking Operations (2012)**
5. **Technological Developments in Iron and Steel: Production to Final Processing (2013)**
6. **Developing a Competitive Steel Industry in India: Technology, Policy and Products (2014)**
7. **Innovative Technologies for Clean, Green & Automated Steel Plants: A Better Tomorrow (2015)**
8. **Technologies for Making Iron & Steel at Competitive Costs (2016)**
9. **Advancement in Technology for Production & Processing of Steels: Application of Industry 4.0 (2017)**
10. **Technologies & Process Routes for Attaining 300 Mtpa Steelmaking Capacity in India by 2030 (2018)**
11. **Innovative Technologies for Production and Processing of Iron & Steel to remain Competitive & Sustainable (2019)**
12. **Ferro Alloys Industry of India, Raw materials & Future Perspective-Atma Nirbhar Bharat (2020-21)**

Price: It is Rs. 400/- (US$/Euro 10) per copy for any of the above Proceedings for each of hard or soft copy. The Rate is the same for any old STEEL TECH journal. Postal charge for overseas hard copy will be levied in addition.

Advertisers' Index

Focus Subjects for STEEL TECH in 2022

- **April:** State of Secondary Steel Producers including Sponge Iron Manufacturing in India, its Role and Future Perspective in India
- **July:** Raw Material, Refractories and Additives for Steelmaking
- **October:** Steel Plant Equipment Supplier both Domestic and Overseas in view of India's targeted capacity of 300 million tonne by FY31.

Decarbonization of Iron Production

Tim Kleier and Jörg Brinkmann
SMS group, GERMANY

Abstract

In order to accelerate the decarbonization of the steel industry, it is essential to focus on the primary stage of iron making, as this stage accounts for more than 80 percent of the greenhouse gas emissions from steel production. We are our customers' partners in defining and realizing their individual road map towards carbon-neutral production processes.

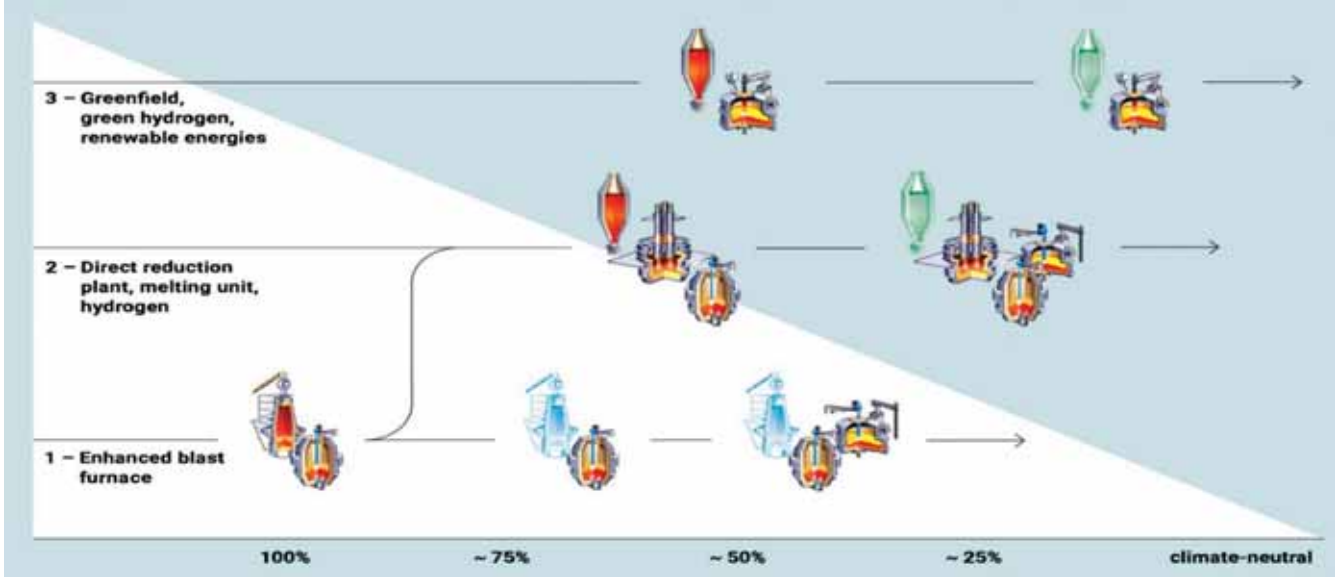
The steel industry stands at a cross roads: Its products are indispensable for all modern societies. However, its current production processes need to be adapted in order to drastically reduce green house gas emissions to limit climate change.

Full range of decarbonization technologies for brownfield and Greenfield projects

In order to support our customers on their path towards decarbonization even more efficiently, we have fully integrated Paul Wurth – the global leader in blast furnace technology - which has been part of SMS group since 2012. Together, we can focus on metallurgical challenges and on advancing hydrogen technologies. In addition, SMS group boasts considerable expertise in direct reduction plants, environmental protection solutions and recycling technologies. We place special emphasis on the development and implementation of technologies promoting CO_2-neutral steel production. Both companies can build on 150 years of experience each in their respective fields.

The roadmap to climate-friendly production

In general, there are considered to be three main routes to produce high-quality low-carbon steel at scale, using significant amounts of virgin material while still being able to process scrap in order to reduce the carbon foot print depending on final product specifications. SMS group is in the unique position to supply fully integrated



solutions and leading technologies from iron ore to final products on all three routes. This is particularly important, as there is no one-size-fits-all 'best' option.

Local conditions have a huge impact on the economic viability and feasibility of each of the routes. Many decarbonization options rely on the availability of large amounts of – preferably low-carbon – electrical energy and, occasionally, on an appropriate short circuit power. Other factors, such as raw material availability and local policies, rules and regulations play a major part in technology selection.

- In new, 'greenfield' facilities, the key to reducing greenhouse gas emissions to below 100 kg CO_2 per ton of hot rolled coil is the combination of green hydrogen, direct reduction and the electrification of all downstream processes.
- In existing integrated steelworks – also called 'brownfield' sites - we can enable the transformation of assets and infrastructure step-by-step – with significant potential to replace carbon-based fuels. This process requires the on going reassessment and reorganization of energy balances and flows. As a full liner, SMS group and Paul Wurth have the integrated solutions to bring about this change. Using this approach, we can develop a roadmap for all of our customers on their way towards carbon-neutrality.

Brownfield project: "Blue" blast furnace and BOF converter

The integrated Blast Furnace-Basic Oxygen Furnace (BF-BOF) route uses large amounts of iron ore – in many cases, ore with only low iron content (typically 65% Fe or less). In this process, also known as the 'primary' route, limited quantities of scrap (about 20 percent) can be added during the BOF process. Due to the use of large amount of coke for iron ore reduction, the BF-BOF route is the steelmaking route with the highest CO_2 emissions.

Technology pains takingly developed by Paul Wurth provides a substantial enhancement of both blast furnace and coke-making processes, reducing the coke rate to as little as 200 kg per ton of hot metal, with reduced CO_2 emissions as a result.

In order to maximize the scrap rate, electric arc furnaces or, for example, the SMS CONPRO technology, can be used in the steelworks. This approach is limited only where by specific product quality requirements that may rule out the use of lower quality grade of (potentially contaminated with Cu, Sn, Ni, Mo) scrap.

Brownfield project: Direct reduction with OBF and BOF converter

In this route, the blast furnace is substituted by a combination of the MIDREX® direct reduction process and an Open Bath Furnace (OBF). Initially, it is possible to run the direct reduction process on a natural gas basis and with the use hydrogen in place of natural gas at gradually higher rates.

The OBF, created by our SMS group subsidiary Metix, is similar in design to a conventional Submerged Arc Furnace (SAF) operated in a so-called 'brushed arc' mode. Here, we count on several hundreds of references for these kind of furnaces. The main feedstock on this route remains BF-grade iron pellet, while scrap can again be added in the steelmaking plant. One note worthy advantage is the ability to add iron bearing wastes (up to 3 to 5% of overall charge), such as BF and BOF dust, mill scale and others within the smelter.

When integrating this route into an existing integrated plant, SMS's and Paul Wurth's respective 150 years of experience in iron and steelmaking are a valuable asset when designing the interfaces and maximizing emissions reduction while maintaining, or even boosting, competitiveness.

Greenfield project: Direct reduction – Electric Arc Furnace

In a green field project and with green hydrogen available at competitive prices in sufficient quantities, a completely different approach can be adopted. Pre-reduced DR grade iron ore pellets from a MIDREX® shaft are hot charged into an electric arc furnace. No intermediate step is required and – depending on the specified final grade – only minor carburization is needed to reduce the nitrogen in the steel. From the very beginning, scrap can be added to the furnace at higher rates, with only the quality requirements of downstream processing stages setting an upper limit here.

Due to the immediate connection of all facilities, this route has the potential to come closest to carbon neutrality. This is especially so when the lean concept is extended downstream with a highly efficient CSP®or CSP® Nexus plant, which is a combined thin slab casting and direct rolling plant.

Best decarbonization roadmap for any given case

These three pathways represent the major options for decarbonizing primary steelmaking today. The pathways can be mixed, combined or modified to meet specific requirements.

However, all the options are subject to limitations. Each has individual strengths and weaknesses. Consequently, it is very important to study carefully the conditions for each case in order to choose the best relation between carbon efficiency and competitiveness. As SMS group has experience and references in all the presented technologies and processes, we are in a unique position to evaluate the best-suited roadmap for any given case.

Contact: tim.kleier@sms-group.com; joerg.brinckmann@paulwurth.com

Near-Term Emissions Reduction for Blast Furnace Operation: The Transitional Steps towards Carbon Neutrality

Colin Morrison, Blast Furnace Product Sales & Marketing; Martin Smith, Blast Furnace Business Development

Primetals Technologies Ltd., UNITED KINGDOM

INTRODUCTION

The global challenge faced by all steelmakers to eliminate green house gas (GHG) emissions, reduce raw material and energy consumption in pursuit of carbon neutrality is well documented. The route to achieving this is less clear and will be different for most producers. With around 7-10% of industrial GHG emissions being attributed to the steel industry and 70% of the total global steel production reliant on thermal reduction via the blast furnace / basic oxygen steelmaking route, replacement of carbon-based fuels will be necessary. Hydrogen as a reduction agent is seen as the natural successor.

Improvements in the circular economy of steel to increase the availability of high-quality scrap and support the transition to the electric arc furnace as the primary production route is also underway. Alternatively, complimentary processes such as carbon capture and storage (CCS) or utilization (CCU) could negate discharge to atmosphere. The final picture is likely to be a complex combination of these options for many steelmakers as this transformation evolves.

IMMEDIATE CHALLENGES

Whilst there appears to be a general acceptance of the global imperative and requirement by steel producers to change, the technologies and infrastructure to do so are not fully realized. Availability and utilization of higher proportions of hydrogen, plentiful supplies of cheap 'green' energy, high quality scrap and mass-capture and utilization of emissions remain frustratingly distant technical and economically viable options for operators. In each of the routes, there are substantial hurdles both technically and commercially to facilitate a change at pace. This is in addition to what could be considered an overwhelming financial investment.

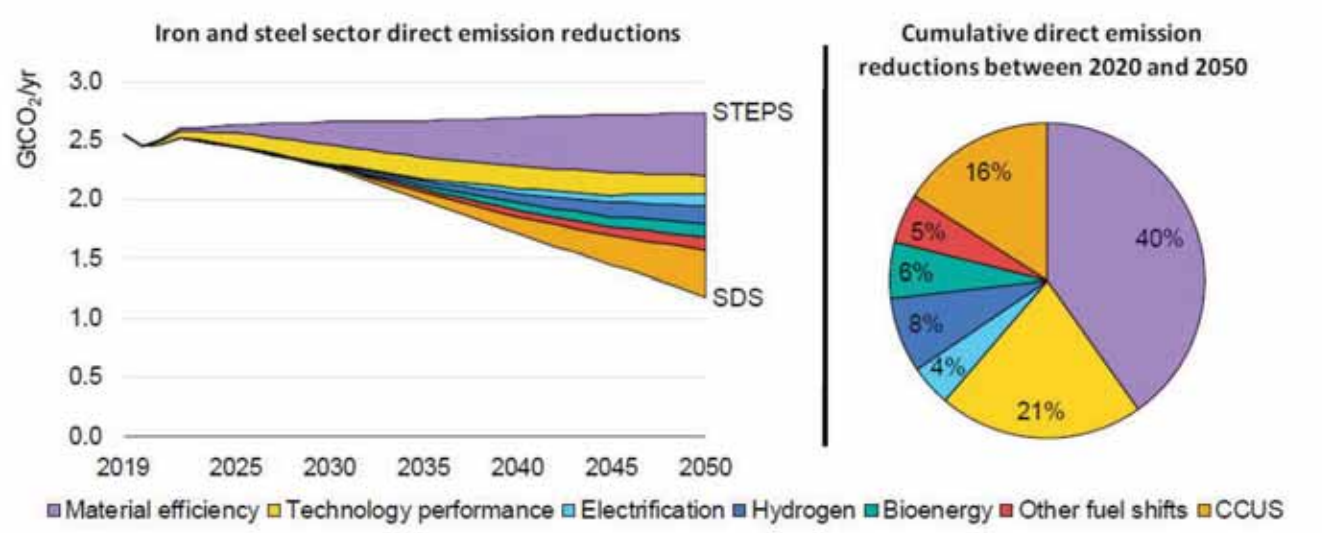
Summarizing the forward-outlook:

- Decline in dominant BF-BOF route to ~45% by 2050
- DR–EAF increase to 18% (1/3 'green' share) by 2050
- Carbon capture expected to be 270 Mt per year by 2050
- 45% Renewable power cost drop by 2050
- 75% Electrolyzer CAPEX reduction by 2050
- Reduction in price of green hydrogen:
  - < $3/kg by 2030
  - $1-2 / kg by 2040 i.e. **'Green' hydrogen unlikely to be competitive before 2035**
- Decarbonisation expected to increase steel costs by $100/t or more (source: IEA, 2020)

It is probable that significant undertakings by governments, businesses and consumers globally will be required to provide both the legislative and commercial drivers to ensure the shift can happen to meet the ambitious, international goals set out. This will take lengthy and protracted negotiation, resulting in extended time scales to realise the necessary outcomes. What can be concluded therefore is that the movement to new steelmaking routes is coming, but not today or tomorrow and more likely not within the next decade.

CO_2 Emissions – Mitigating Measures

When considering how emissions are expected to reduce, it is anticipated that the overall scenario will take until approximately 2035 to begin to develop and realise meaningful impact from the applied technologies:



Source: IEA, 2020

Fig. 1: Iron and steel sector direct CO_2 emission reductions in the Sustainable Development Scenario by mitigation strategy

Material efficiency technologies (those that reduce steel demand) alongside technology performance play the most significant role through the entire transition period. Summarizing the development of mitigation, available technologies that enhance existing asset performance will continue to be key to steelmakers and only in the longer term will these begin to make way to new process routes and innovations that can deliver at scale eg hydrogen-based iron making and carbon capture, storage and utilization.

The Immediate Conclusion

Clearly then, the challenge for blast furnace operators to accelerate this transition is immense - but they must continue to produce competitively in the interim. Whilst the task seems daunting, it also presents opportunities where the greatest gains can be made. The blast furnace represents the single highest contributor to the production of GHGs in the process route. As carbon trading markets continue to rapidly develop, operators are facing increasing cost pressure based on their existing footprint. Many have already declared their own ambitious plans but must act now. The reality remains that there is desperate need for effective technologies to support their roadmap towards carbon neutrality. Implementing technology that can have a significant impact in the blast furnace would represent a major stepping-stone for operators globally.

Whilst the fundamental characteristics of the blast furnace have changed little over the last 100 years or so, designers and operators have implemented incremental developments for the main vessel and process equipment. This has continued to push the productivity to ever higher levels, whilst simultaneously reducing hot metal cost. Lower fuel and energy input along side optimization of raw material quality have become paramount. In the current environment, carbon scope costs, widening climate-goal awareness and sensitivity to climate-based topics generally are increasingly influencing markets and consumers such that every marginal gain allows operators the opportunity to enhance their competitiveness.

What if that gain could be achieved now whilst also complementing and making significant contribution towards a carbon neutral production?

Reducing Blast Furnace Carbon Emissions

Blast furnace operators can currently utilise a number of key technological solutions to reduce carbon emission as operators must simultaneously maintain their assets whilst developing their longer-term transitional plans. Some of these are available now whilst others are emerging and require additional research and development to realise the theoretical potential. The list is not exhaustive but is seen as are alistic categorization for steelmakers that would fall within the realms of technological and economic viability within the time scales described:

Category	Technology/Process	CO_2 Reduction Potential	Developmental Status
Reduction with materials and gas	Sequence Impulse Process (Tuyere O_2 Pulsing)	1-2%	Available
	HBI/ scrap feed	10%	Available
	COG injection	7%	Available
	Expert System	2.5%	Available
	H_2 injection	15-20%	In development trials
Reduction with available technology	Copper Stave Hexagonal Inserts	1%	Available
	Stove optimization & WHR*	6%	Available
	Top-gas recovery turbine (TRT)	2%	Available
	TRT & MERIM Dry dedusting system (DDS) with increased TRT efficiency	1.5%	Available
	Dry slag granulation WHR	2%	Demonstration plant

*WHR = Waste Heat Recovery

Through a combination of technological and material/ gas alterations to the blast furnace process, it is anticipated that CO_2 emission could be reduced by as much as 40%. In terms of the CAPEX expenditure against benefit, there is a need to understand a potential for rapid payback to be effective in the limited operating window through the transitory period:

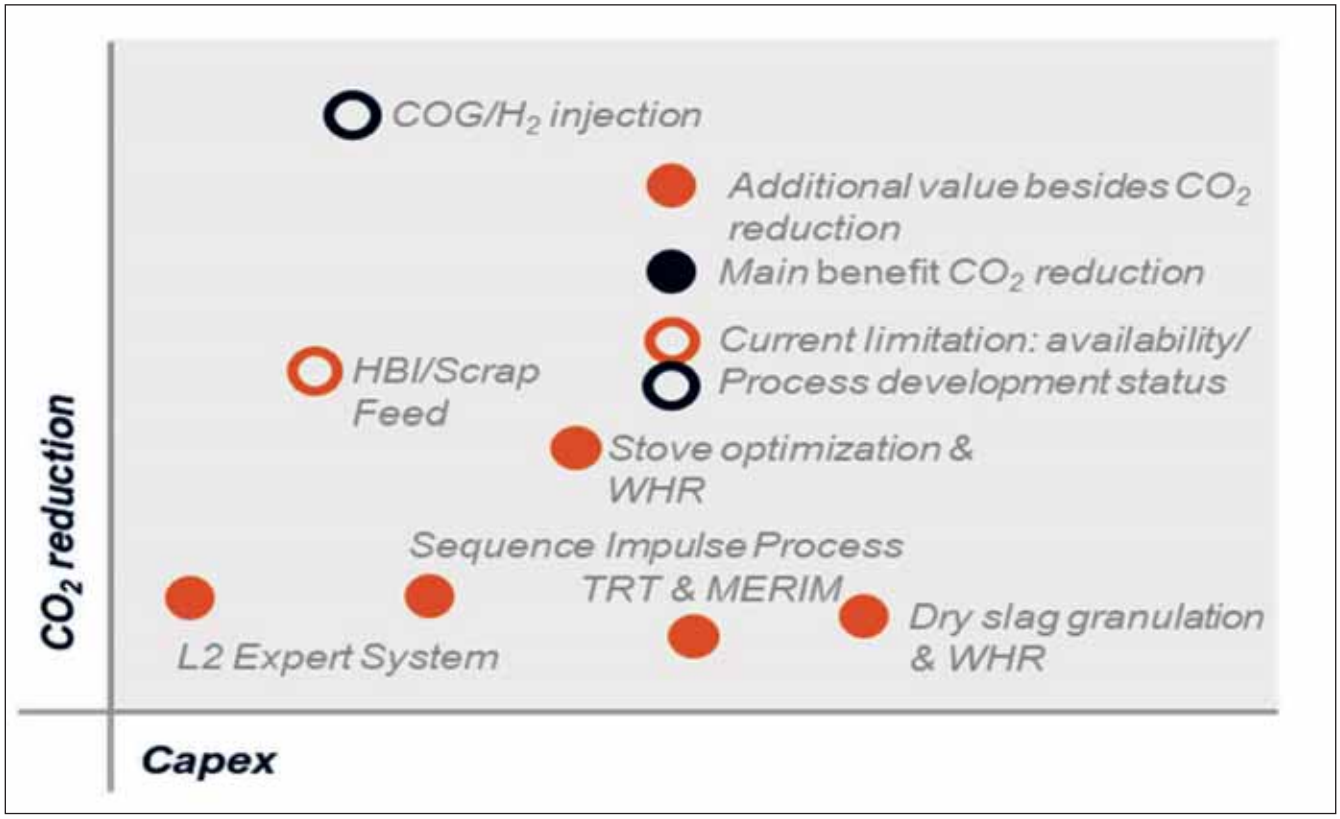


Fig. 2: Relative CAPEX versus CO_2 reduction potential *Source: Primetals Technologies*

Current Technological Options – Benefits & Challenges

Expert System

Use of an expert system is a well-established means of using process feedback loops to tune operational characteristics and optimise material and energy consumption. As such, they do not constitute a new process option per se and payback can be rapid,

typically within 1 year.

Alternative Mitigation Processes and Technologies

Newer methodologies and technological advances are now making in-roads to become options for future CO_2 mitigation steps. These come with specific benefits and challenges for their implementation:

Sequenced Impulse Process – Tuyere Oxygen Pulsing

The Sequence Impulse Process was developed by thyssenkrupp AT.PRO. tec GmbH and successfully adapted for blast furnaces from proven foundry furnace applications.

Transfer of the technology to blast furnaces from initial trials in 2015 culminated in a full-scale system installation on Schwelgern blast furnace 1 of thyssenkrupp Steel Europe. Operational start-up took place in December 2020. Primetals Technologies was granted a world-wide, exclusive license for the marketing, sales and project implementation using the technology in summer 2021.

Technology Principle

Coal injection into the blast furnace results in char (unburnt) materials accumulating, such that penetration ofthe 'dead-man' of coke is restricted. This limits the flow distribution into the center of the furnace and reduces gas utilization.

By pulsing high-pressure oxygen in a pre-determined sequence to each tuyere, shock waves penetrate deep into the raceway of the blast furnace, combusting the fine char and improving coke permeability.

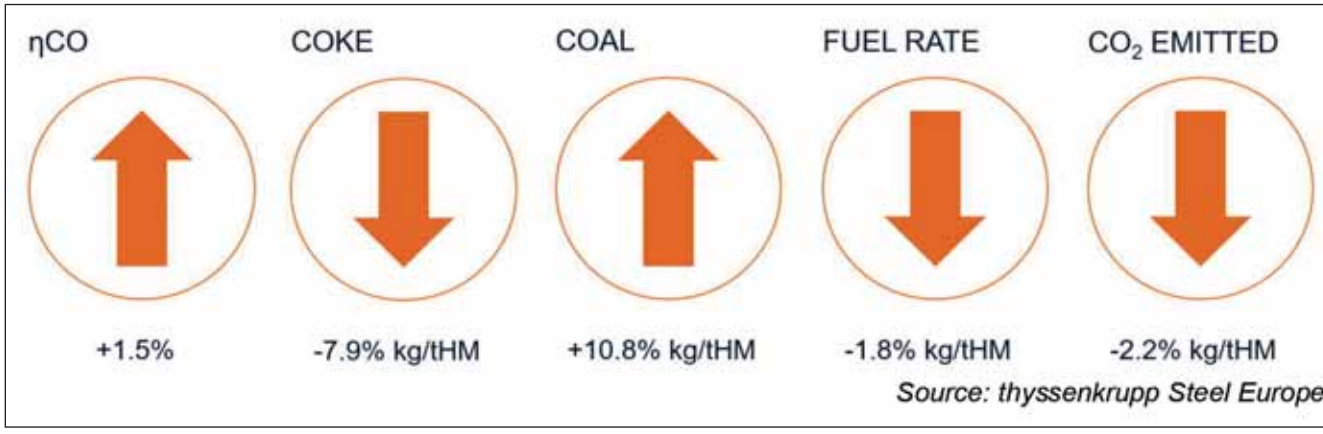
This improves gas utilization and the potential for better furnace drainage.

The control of the system with regard to pulse frequency and the admission of individual tuyeres is freely selectable and depends on the furnace operation and oxygen demand.

Economically, the use of the technology at the blast furnace is expected to allow more cheap injection coal to be used in exchange for more expensive coke. In addition, the reduction of less thermally converted coal particles can be expected to improve the through put and drainage, which ultimately leads to increased production.

Operational Results

Once fully operational the benefits of process were quickly apparent as experienced at Schwelgern. Overall fuel rate was reduced with the accompanying emitted CO_2 benefits. It should be noted that the results from the initial period, although impressive, remain to be further optimised and future gains will be pursued as the system was operating significantly below capacity, utilising approximately only 50% of the available oxygen:



Return on Investment

Based on the process OPEX benefits, rapid payback can be achieved, typically between 12-18 months for fuel replacement only (dependent on furnace productivity, coke, injected coal, and utility costs):

Figure 3: Typical Sequence Impulse Process Payback [Fuel Replacement Only]

Source: Primetals Technologies

Where CO_2 emission can also be credited, payback can be achieved with 12 months as demonstrated by the Schwelgern blast furnace 1 data:

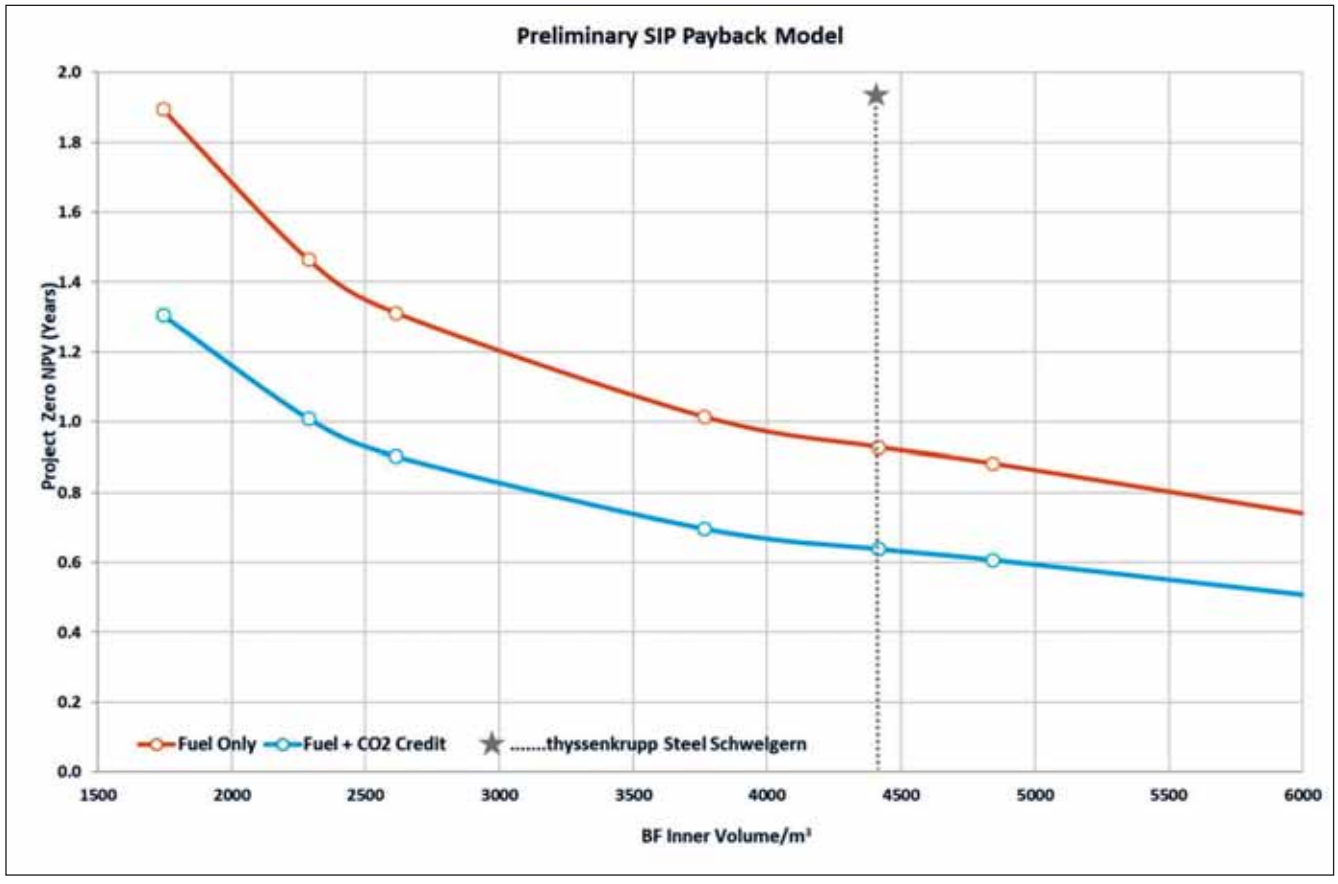


Fig. 3: Typical Sequence Impulse Process Payback [Fuel Replacement & CO_2 benefit]

Source: Primetals Technologies

Copper Staves with Hexagonal Wear-resistant Inserts

Primetals Technologies has developed a revolutionary technology for use in copper stave coolers that notonly provides long operational life against wear from the descending burden but has also been seen to deliver OPEX benefit through energy savings.

Capture of burden material which protects the softer, copper stave material provides an insulative layer which reduces energy loss to the cooling circuit.

The equivalent coke consumption reduction has been calculated to be typically in the range of 3-5kg/tHM and can be more in the periods of process instability. The requisite emitted CO_2 reductions would accompany this.

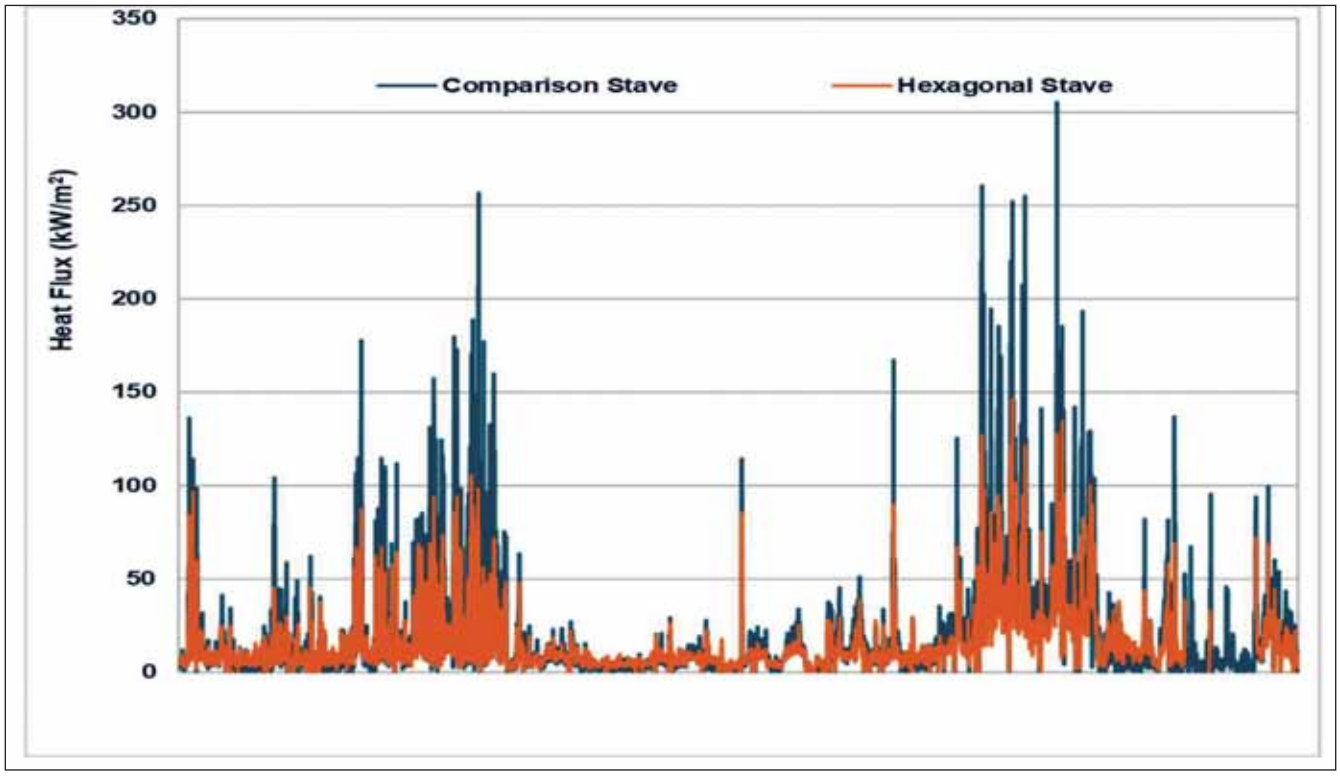


Fig. 4: Operational Data: Hexagonal Inserts Performance against a conventional, comparison stave

Source: Primetals Technologies

Test stave data, January to December 2020

Period	Hexagonal Stave (GJ)	Comparison Stave (GJ)	% heat load difference	Coke saving kg/tHM*
Overall (330 days)	842	1111	32%	3 – 5
Stable Operation (283 days)	534	626	17%	2 – 3
Unstable period (54 days)	216	345	60%	4 – 8

** Depending on coke quality, productivity, etc.*

Top-Fired, Hot Blast Stove Technology & Waste Heat Recovery/Oxygen Enrichment

Hot Blast Stoves and the ancillary processes offer the blast furnace operator a multitude of opportunities to reduce fuel consumption leading to the additional associated lowering of emitted CO_2.

To expand their current technology portfolio, Primetals Technologies have begun a collaboration with Yuxing to bring Top-Fired Hot Blast stove to a wider global market.

The unique features of the top-fired design mean that the Dome to Straight-line Hot Blast Temperature can be greatly reduced from that observed in either conventional, internal, or external combustion chamber hot blast stoves. This means for the same stove thermal capacity; higher blast temperature can be achieved leading to coke savings in the furnace.

A reduction of 10-12kg/tHM can be achieved with the associated emitted CO_2 benefits.

Additionally, an exceptional environmental performance in terms of NOx is achieved.

Where this can be done in conjunction with Waste Heat Recovery to heat the fuel/air mixture to the stove, further savings are possible in enrichment fuel consumption or stove size optimisation which potentially realises significant CAPEX savings through reducing the required thermal mass of refractory or shell and structural steel necessary for a particular stove and the specified duty.

If enrichment COG fuel could be saved, there is the potential to repurpose the fuel in the blast furnace as described previously.

HBI charging

Extensive tests for HBI charging have been carried out by POSCO/Korea, voestalpine/Austria, Baosteel/ China. In addition, one blast furnace in the US (AK Steel, Middle town) has been operating at a typical level of 250 kg/tHM for more than 20 years. Kobe Steel suggest that 300kg/tHM is theoretically viable.

For the blast furnace process, the effects of HBI charging are proven. Such effects described are:

- Increase of BF productivity

  +8% for each +10% increase in burden metallization but cost penalty for raw material. This does afford the operator flexibility in targeted production level as it could be increased to meet peak metal demands
- Reduced coke consumption and therefore, reduction of emitted CO_2.

Based on tests at voestalpine that were carried out together with Primetals Technologies, approx. 50,000 t ofHBI have been charged to the blast furnaces in Linz and Donawitz/Austria. The reaction of the process to the HBI charging have been found in line with the literature. The productivity increase was confirmed as wascoke consumption. For the larger furnace, the reduction was less significant as coke consumption was already close to the minimum, being mainly structural in supporting the burden. The CO_2 reduction goes in proportion with the coke consumption.

A major consideration required is then the transportation of HBI with specific design requirements that must be observed to ensure material quality and long-term equipment integrity. Primetals Technologies has specific experience in this design.

Voestalpine is continuing to use HBI from their Midrex HBI plant in Corpus Christi, USA.

COG Injection

COG injection at the tuyere level can substitute coke/PCI/natural gas/heavy oil/plastics and supplies additional reduction gas to the blast furnace. The cooling effect of COG to the RAFT is low when compared to, for example natural gas.

However, increased COG injection also increases the demand for a higher coke quality in order to maintain good furnace permeability.

Primetals Technologies has installed a COG injection system at blast furnaces 5 and 6 of voestalpine in Austria in 2003 which is still in operation and a COG injection for a BHP blast furnace in Port Kembla, Australia.

Key considerations of the system design are the cleaning of the COG and the appropriate compression system which demands significant investment for suitable equipment.

Clearly, however, availability is the major stumbling block for the majority of blast furnace operators so COG injection would be attractive where spare gas can be given over to injection into the furnace. Being a rich fuel, COG is conventionally utilised within the site network for enrichment and reducing energy import. If the COG were to be utilised in the blast furnace, such re-purposing would demand alternatives be employed as replacements, potentially increasing overall costs.

H_2 Injection

The basic idea of Hydrogen injection into a blast furnace is to reduce the amount of coal required for injection and to replace it by Hydrogen to reduce CO_2 emissions as the combustion product is water vapour.

Theoretical investigations show that a CO_2 reduction of approx. 15-20% can be achieved vs. a PCI rate of 120 kg/t HM. Investigations conducted in the US have found the theoretical limit, thought to be in the region of 40kg/tHM cannot be practically achieved for a number of reasons that impact on furnace stability and fuel rate. It is anticipated that perhaps 25-27kg/tHM will be the upper limit.

Trials for Hydrogen injection into a blast furnace have been carried out at thysennkrupp Steel Hamborn and are now progressing to a full-scale system with a capacity of just under 12kg/tHM.

Current hydrogen generation costs (high electricity requirement) clearly identifies PCI operation as more cost effective when considering CO_2 emission costs although this will likely shift in the future-looking scenario albe it the time scale remains undetermined and so not available for at least the near to medium-term.

Summary

The Blast Furnace will remain as a key iron making unit in the near to mid-term as a minimum as operators evaluate and engage in transitioning to alternative steelmaking routes. To achieve the ambitious goals setout with regards CO_2 emission will demand transition at an unprecedented pace and scale as well as enormous political and commercial will. Inevitably, this will result in ongoing uncertainty for operators. Some have already committed to stringent limits sooner than the 2050 end-point for climate change obligations. As such, their ambition means they must act now.

Competitive hydrogen and green energy in necessary volumes/supporting infrastructure arguably remains more than a decade away and conversion in the interim will therefore rely on specific emission mitigation driven investment. This dictates that operators will be required to source and implement available, proven technological solutions at scale with rapid payback potential.

Primetals Technologies offers a superior portfolio to support blast furnace operators in this endeavor.

colin.morrison@primetals.com / Martin.P.Smith@primetals.com

Primetals Technologies Ltd. Ashmore House,7 Fudan Way,Thornaby-On-Tees,TS17 6ER, UNITED KINGDOM

De-carbonation of Ironmaking – The Global Environmental Goal

Partha S. Ghose, Director
Kalyani Steels Ltd, INDIA

Abstract

On December 15, 2021, the European Commission has published its vision for Carbon Dioxide Removal (CDR) in the coming decades. The plan, takes several important steps on accounting, transparency, verification and industrial decarbonisation, but cautions against the use of CDR as an offsetting tool, particularly in the context of carbon farming and the use of carbon in products[9].

There are many claims and counter claims globally as to how massive de-carbonation can be brought into reality and save the world from getting virtually cooked in next couple of years. CO_2 emission is a part and parcel of human living and rapid industrialisation. While all industry sectors have their role to add to the greenhouse gases, Global iron and steel plants are largest polluting industry with about 7 to 9% of CO_2 contribution to the atmosphere by itself alone and hence the drive to de-carbonate this industry is also massive.

The present article tries to highlight the specific aspects of CO_2 emission, what are the research works currently being pursued and the current outlook on this de-carbonation work in the steel sector.

INTRODUCTION

Today's greatest challenge for environmental sustainability is reduction of greenhouse gas emission most of which is carbon dioxide and methane with major contribution from steel plants (7 to 9%)[1].

For making steel through integrated route, first iron has to be extracted from iron ore which is available in oxide form in nature and the process to isolate the oxides is known as reduction process. The two popular processes are through Blast Furnace and Direct Reduced iron making. Both the processes use carbon as reductant which generates tons of CO_2.

As per available data in public domain integrated steel plants operating in BF-BOF route generate approximately 1.85 tons of CO_2 per ton of finished steel[2], while the generation through DRI-EAF route stands at 0.97 ton.

Since these are the two areas where drastic CO_2 reduction is possible, this article has endeavoured to cast some light on these two processes, highlighting their limitations.

THE WORLD OF BLAST FURNACE IRON MAKING

When it comes to making of steel using iron as the base charge, there are two process route combinations, BF-BOF and DRI – EAF. There are couple of other processes but their use in today's steel world is insignificant. To elaborate a little more:

- Majority of steel today is made through BF-BOF route, which produces pig iron, i.e., liquid iron saturated in C, in BF and converted to steel in BOF using oxygen supplying the energy required for making steel.
- The other processes are the so-called direct reduction (DR) processes, product of which is solid iron (DRI-direct reduced iron, also named sponge iron and HBI–hot briquetted iron). The reduction occurs as a series of gas-solid reactions with the reactant gases CO and H_2. DRI is subsequently melted in Electric furnace, in which energy required for melting the solid DRI charge and making the steel is supplied through electrical energy.

To summarise as per WSA figures for 2020[3], the following figures emanate:

Total Steel Production	Process Routes (%)				Total
1876.3 (Mt)	Oxygen	Electric	Open Hearth	Others	
	73.2	26.3	0.3	0.2	100

During this period Pig iron and DRI production figures stand at 1319.4 and 106 MTPA respectively[3].

Looking at these numbers which has not significantly changed today, it directs our thought towards blast furnace to decarbonise global steel making significantly. Although tremendous R&D is continuously pursued globally, it has been found that some reduction in CO_2 generation is possible by using hydrogen or Hydrogenous fuels / gases as auxiliary reductant only. This means the auxiliary reductant which is widely used as pulverised coal injection (PCI) can be replaced with hydrogen / Hydrogenous injection like natural gas, oil, pure hydrogen etc. Further, some additional reduction is possible by recycling top gas through tuyere, carbon capture and storage (CCS) etc. However, with all such measures applied alone or in combination, the reduction in CO_2 generation remains limited to a typical value of 20 %.

The reason why the main "reductant" in blast furnace which is metallurgical coke cannot be replaced with hydrogen is summarised in the following numerical simulation of blast furnace operation as cited below[4].

The simulations were carried out under the conditions of constant bosh gas flow rate, adiabatic flame temperature and hot metal temperature. The simulation results showed that the temperature level in the stack part was decreased with increase in the hydrogen injection ratio. This resulted in the lowering of the top gas temperature and retarded the reduction of iron oxide especially one of magnetite. The injection of the hydrogen remarkably decreased the coke rate. The converted reducing agent rate, that is sum of coke rate and six times (molecular weight ratio of carbon to hydrogen gas) as hydrogen rate showed small change. Although this decrease in coke rate deteriorated the permeability of the burden materials in the furnace, pressure drop in the furnace was reduced. Since the molar flow rate of the reducing gas was kept constant, the decrease in the gas density due to the increase in the hydrogen content was mainly considered to lead the decrease in the pressure drop. The water gas shift reaction played an important role in the generation of the field of gas composition, thus this reaction has to be carefully discussed for further utilization of hydrogen in blast furnace.

The hydrogen reduction of iron oxide is endothermic reaction while the reduction by CO is exothermic, namely the reaction heat of $Fe_2O_3 + 3\ H_2 \rightarrow 2\ Fe + 3\ H_2O$ is 100 kJ (endothermic, at 298 K) while one of $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$ is –23.5 kJ (exothermic, at 298 K). Further more the water gas reaction, which is an endothermic reaction between carbon and water vapour ($C + H_2O \rightarrow CO + H_2$), is expected to increase. Therefore hydrogen iron making is possibly to require more energy to compensate these endothermic reaction heats which is not possible since basic purpose of the exercise is the reduce iron ore!

Therefore, becoming carbon – neutral through BF-BOF route can be a vision but not a reality in the near future.

So, let us explore the other strong option close to maturity, which is DRI production and melting in EAF.

DRI BASED STEEL PRODUCTION – THE EMERGING TECHNOLOGY[5]

Gas based DRI making process by default is a more environment-friendly process. Prevailing technology of DRI making uses natural gas which is pre-reformed to split H_2 and CO in the reformer and these gases are used for reducing iron ore lumps and pellets in solid form itself.

Obviously, since substantial part of reduction of the oxide is performed by H_2 in the reformed process gas, CO_2 generation is drastically reduced. In fact, the employed used gas based DRI technology today are two, though the basic process principles are similar, Midrex and Energiron (Hyl III).

MIDREX:

Midrex is an ironmaking process, developed for the production of direct reduced iron (DRI). It is a gas-based shaft furnace and process is a solid state reduction process which reduces iron ore pellets or lump ore into DRI without their after melting, using reducing gas generally formed from natural gas. The principle of the reduction process using reducing gas is shown in Fig. 1.

HYL III (ENERGIRON):

Though fundamentally similar reduction process, HYL III process has certain key advantages, most important of which is that the technology uses much more hydrogen compared to Midrex process.

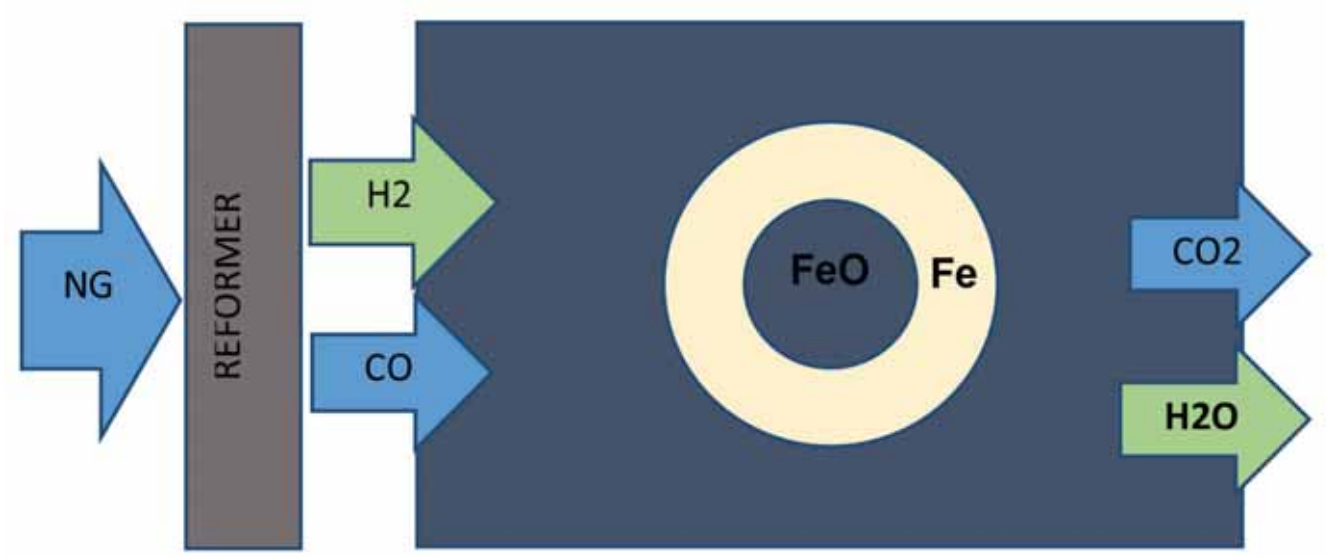


Fig. 1: Principle of reduction process using Reducing gas (Reformed NG)

- MIDREX – Using reformer to crack Natural Gas into CO and H_2 with process recycled gas (H_2 /CO = 1.6)
- HYL III – Using reformer to crack natural gas into CO and H_2 with steam (H_2 /CO = 3)

Further, as HYL III reforms the gas using steam reforming, additional H_2O is added to the system.

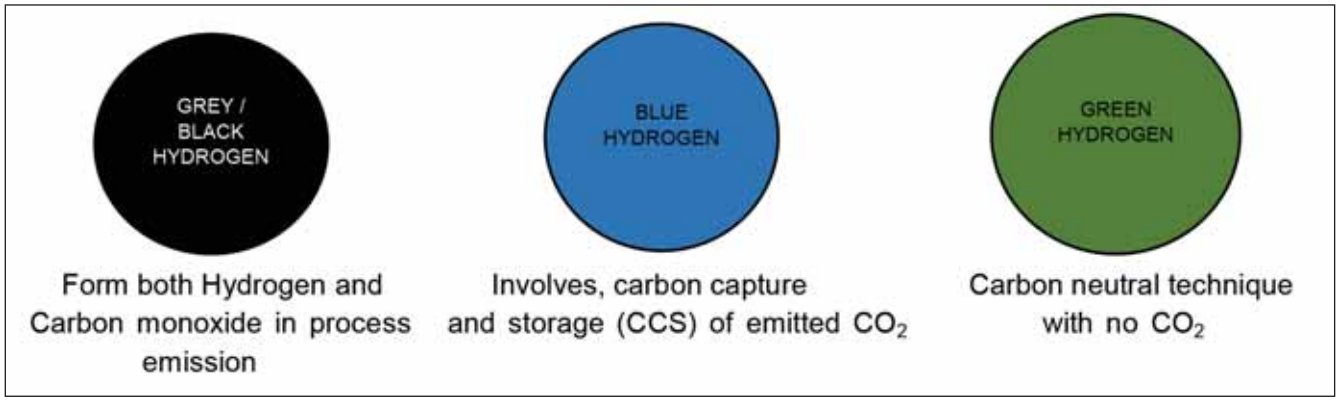
Basically, what is to be noted is that DRI technology is already replacing some portion of the CO reductant by H_2 and therefore, the technology has some maturity in using hydrogen as reductant and handle the hydrogen related issues. However, these are not the pure form of Green hydrogen.

Hydrogen is normally classified in three categories as under:

So, when we say we are using H_2 as reductant, it is not clear what kind of hydrogen we are using. In fact, today's DRI process also use H_2 as reductant, but these are grey or blue.

Green Hydrogen is generated by water electrolysis where there is no traces of carbon. Ironically, water electrolysis demands enormous electrical power which when generated in a thermal power plant generate CO_2 which means, we are trying to make DRI using hydrogen but for water electrolysis the thermal power or fossil power required generates enormous amount of CO_2. Therefore, in the complete ecosystem of hydrogen to DRI making, we created some CO_2 which actually we wanted to avoid! We can actually make the entire process green, if we do not use fossil fuel based power replacing it by renewable power like, solar, wind or hydroelectric or combination of the three. Not only the reductant, also all the energy requirement for running the BOPs and auxiliaries for running the plant in entirety needs to be green, i.e., renewable energy sources.

This is until making green DRI. However, if we are talking of green steel making using this DRI through DRI-EAF route, we need much more energy to melt, cast, roll and finish the steel in saleable form, which also must come from green energy (Renewable energy).



THE HYBRIT TECHNOLOGY

This is precisely what SAAB steel has done using the unique HYBRIT technology (Hydrogen Break through Ironmaking Technology). HYBRIT, a joint-venture project between SSAB, LKAB and Vattenfall, that selected TENOVA HYL Direct Reduced iron Solution for its 1- ton/hour pilot plant at Lulea, Sweeden[6]. TENOVA HYL, a company based at Mexico who had matured the gas based DRI technology using NG as reducing gas with or without reforming (Zero Reforming Technology or ZR reactor technology) had a distinct advantage in DRI making using green hydrogen.

SSAB has now produced the world's first fossil-free steel and delivered it to a customer. The trial delivery is an important step on the way to a completely fossil-free value chain for iron- and steelmaking and a milestone in the HYBRIT partnership between SSAB, LKAB and Vattenfall[7].

SALCOS®

With a view to achieving their decarbonisation goal, Salzgitter AG conceived the SALCOS® (Salzgitter Low CO_2 Steelmaking) project that maps a realistic path toward the gradual reduction of CO_2 and, in the long term, steel production that is virtually free of CO_2. As part of this project, hydrogen generated from renewable energies is to replace the carbon so far required for the smelting of iron ore.

On May 17, 2021, the German steel producer Salzgitter AG organized the ground-breaking ceremony of μDRAL, within the framework of SALCOS. μDRAL is a demonstration plant for the production of Direct Reduced Iron (DRI), designed to operate flexibly with natural gas and hydrogen, and TENOVA was the technology partner for the project. Production will commence in the first half of 2022. The demonstration plant has a DRI capacity of 2500t/day.

CONCLUSION

The foregoing discussion, though may not be very exhaustive brings out the following salient points:

- The possibility of CO_2 reduction in blast furnace is limited to ~20%, since only the auxiliary reductant PCI can be replaced by hydrogen injection through tuyeres and not the main reductant coke, owing to process limitations. However, drastic de-carbonation can happen from blast furnace only, extensive research with Government support must continue.

  ULOCS, COURSE – 50, Japan, ThyssenKrupp Steel - Duisburg are in the process of trial / implementing partial replacement of pulverised coal injection in blast furnace[8].
- Hence in the prevailing scenario, gas based DRI can be considered more environment-friendly since the process that can avoid generating CO_2 is by Suspension Reduction (Green Hydrogen Reduction) of iron ore / pellet to produce DRI.
- This is why most of the current projects like ULCORED, HYBRIT; with H2FUTURE, GrlnHy, Primetals-HYFO etc. consider using pure hydrogen in a shaft furnace for iron making[8].
- Now that DRI making technology using green hydrogen is by and large established by SAAB Steel through HYBRIT technology, the commercial feasibility of this disruptive technology can really flourish if the cost of hydrogen and its major cost driver renewable power at low landed cost can be made available to the steel plants and hydrogen producer through electrlysers.
- This will need a strong Governmental commitment and aggressive policy reforms to be undertaken by Government as a fast track program if we have to move forwards with our decarbonisation commitment.
- As a note of caution, hydrogen produced by electrolysis using grid power and injected through tuyeres actually increases CO_2 footprint by 36.9%[9].
- Using grey hydrogen through Natural gas reforming can reduce emission by 2.1%. Blue hydrogen can reduce emission close to that of green hydrogen.
- Finally, in the middle of many claims, close attention must be paid to avoid that any emission reductions are automatically equated to "climate-neutral" or "green" steel.

REFERENCES

1. 'Cleaning up the Steel Industry: Reducing CO_2 Emission with CCUS'; January 28, 2021, James Halls, R&D Manager, Carbon Clean. Retrieved from: https://www.carbonclean.com/blog/steel-co$_2$-emissions
2. 'Decarbonization Challenge for Steel', June 03, 2020 I Article; McKinsey & Company; Retrieved from:https://www.mckinsey.com/industries/metals-and-mining/our-insights/decarbonization-challenge-for-steel

3. 2021 World Steel in Figures: Retrieved from:https://www.worldsteel.org/en/dam/jcr:976723ed-74b3-47b4-92f6-81b6a452b86e/World%2520Steel%2520in%2520Figures%25202021.pdf

4. 'Simulation of Blast Furnace Operation with Intensive Hydrogen Injection' - Hiroshi NOGAMI,1)* Yoshiaki KASHIWAYA2) and Daisuke YAMADA3); ISIJ International, Vol. 52 (2012), No. 8, pp. 1523–1527; Retrieved from: https://www.jstage.jst.go.jp/article/isijinternational/52/8/52_1523/_pdf

5. Midrex Process for Direct Reduction of Iron Ore – Satyendra (April9 2017); Ispat Guru; Retrieved from: https://www.ispatguru.com/midrex-process-for-direct-reduction-of-iron-ore/

6. Sustainable solutions for metals & Mining, News: HYBRIT Chooses TENOVA DRI Technology; Retrieved from: https://www.tenova.com/news/detail/hybrit-chooses-tenova-dri-technology/

7. The world's first fossil-free steel ready for delivery I AUGUST 18, 2021 15:00 CEST; Retrieved from:https://www.ssab.com/news/2021/08/the-worlds-first-fossilfree-steel-ready-for-delivery

8. Hydrogen Ironmaking: How It Works; by – Fabrice Patissonand Olivier Mirgaux; Institut Jean Lamour, CNRS, Université de Lorraine, Labex DAMAS, 54011 Nancy, France; Source : https://www.mdpi.com/2075-4701/10/7/922/htm#table_body_display_metals-10-00922-t003

9. Hydrogen in steel production: what is happening in Europe – part one; Published on March 4, 2021 by Bellona Europa; Retrieved from: https://bellona.org/news/climate-change/2021-03-hydrogen-in-steel-production-what-is-happening-in-europe-part-one.

Innovative Solutions for Requirements of Modern Day Steel

Atul and S. Rajanish
SMS India Pvt. Ltd., INDIA

Abstract

Today's world, including the current market situation, throws up many challenges. Only those who adapt to the situation and adopt solutions to the many & varied challenges will survive. Among the many challenges, most important ones are

- reduced OPEX,
- process suiting available raw material,
- utilizing lower skilled man power without any effects on quality & productivity
- reducing emission
- minimizing overall carbon foot print.

SMS group, as a pioneer in innovations, strives to provide solutions in its delivered plants for all challenges. Recent innovations in primary steel making include the CONPRO (flexible EAF capable of utilizing 0-85%HM), which when backed up by various energy recovery measures, results in reduced carbon foot print also.

STEEL MAKING: CHALLENGES TODAY

India being a growing country needs more steel because per capita consumption of steel in India is still below the average per capita consumption of the whole world. Hence, expectation is that steel production in India will keep increasing.

The capacity addition can happen only if steel production in India is competitive on various aspects. First most obvious challenge would be the cost of production that would depend upon raw material, process route, manpower etc. but the other most important challenge is environment and carbon foot print. Inthis regard, whatever capacity additions are planned now, should be able to cater the requirements of the future also.

HANDLING CHALLENGES

In the present economic situation on one hand, steel produced in India by BOF route is quite competitive in price but on the other hand, EAFs are looking unviable. This is because, in the past, DRI melting in EAF used to be a preferred choice. With increasing prices of coal based DRI and higher electrode costs these EAFs are less viable. SMS group has developed the CONPRO (CONverterPROcess in EAF) where steelmaking is performed by charging higher amount of hot metal (up to 90%) in EAF. Implementation of energy recovery can also be planned.

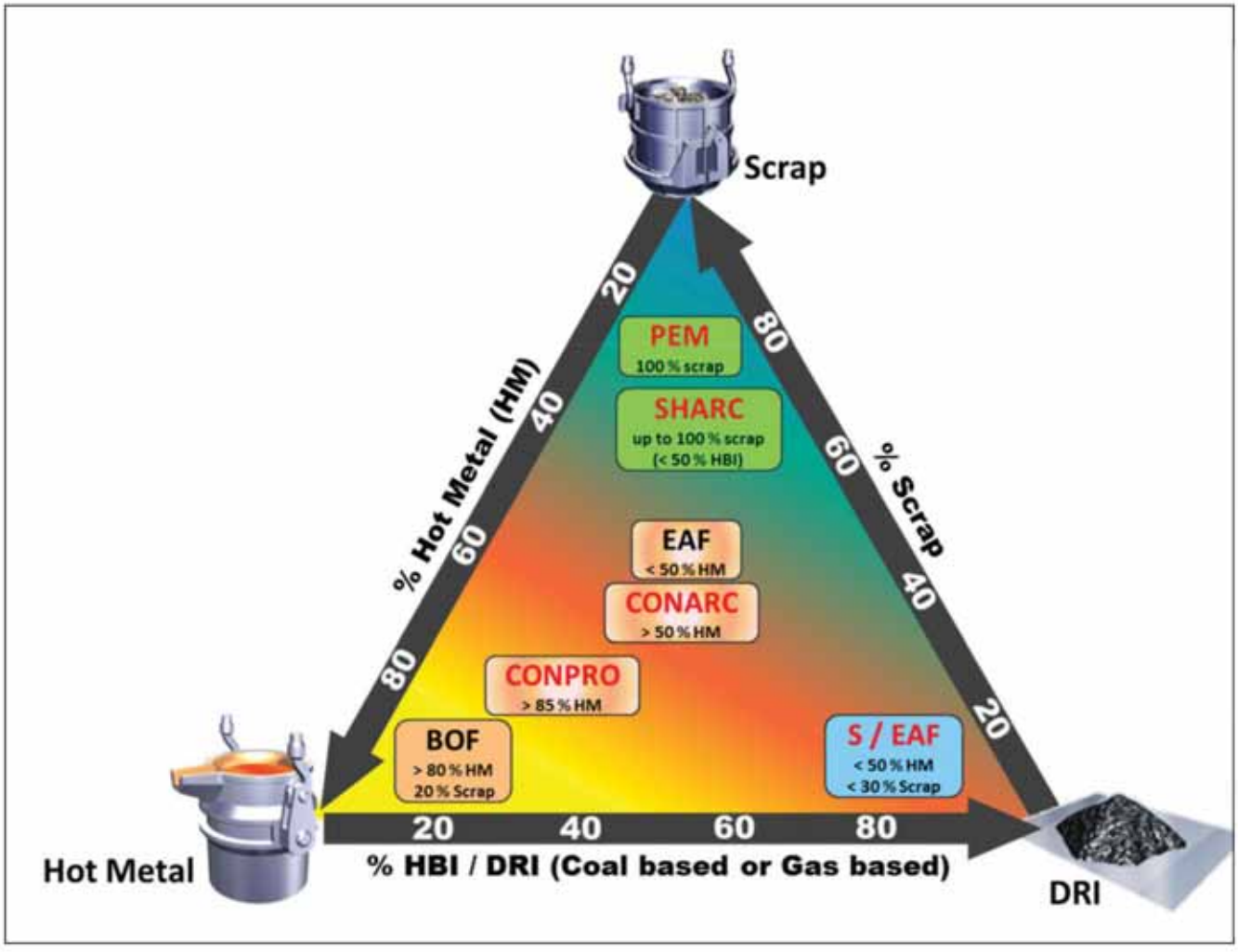
In addition, if we look at the future of iron making where use of carbon would be minimized, the iron will mainly be available in solid form and / or with low level of 'Carbon' in it, an equipment like CONPRO ismuch suitable for primary steel making.

CONPRO

Selection of steel making process depends upon the type of raw material, the overall concept can be represented in the form of below triangle showing family of optimum operation based onthe type of raw material available.

If three main raw materials - Scrap, Hot Metal or DRI availability is changing from 0% to 100% as shown on the three sides of the above triangle, a suitable steel making route can be identified i.e. BOF, EAF etc.

Alternatively, the triangle also indicates that which steel-making process can take up which of raw material. Eg. BOF takes mainly hot metal where as S/EAFs are designed to take mainly DRI with some amount of hot metal. EAF, CONPRO and CONARC are shown in the middle and suitable for any charge mix – hot metal,



Raw material vs suitable melting unit

scrap or DRI.

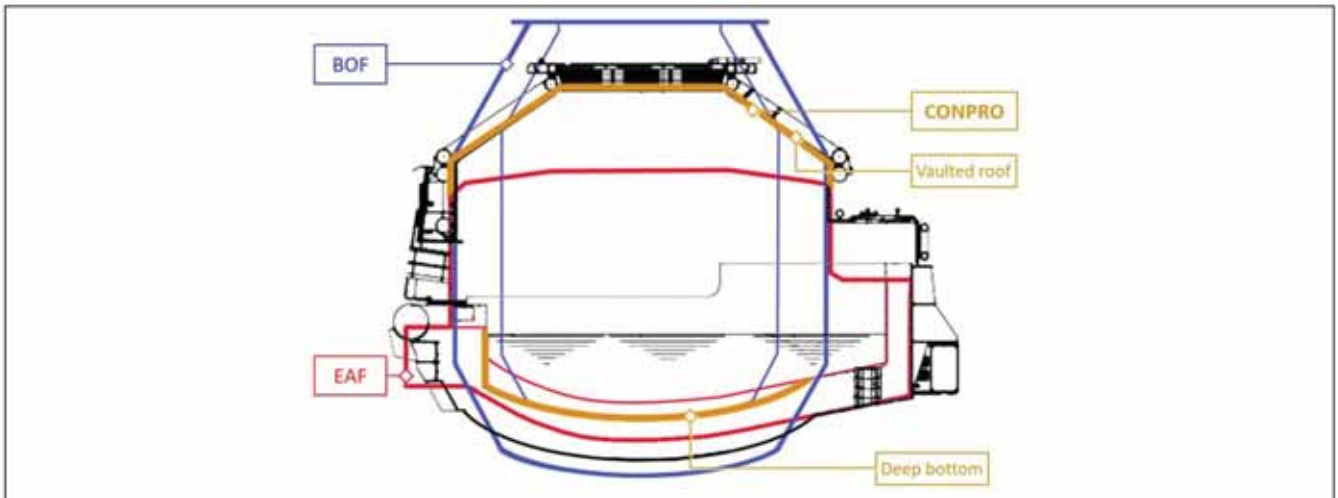
Steel making process normally involves two steps – melting and decarbonizing. If we compare two standard steel making process – EAF is strong in melting but not strong enough for decarbonizing whereas CONVERTER is very strong for decarbonizing but very week for melting.

SMS thought of combining the two processes so that only one equipment can provide both the strengths, hence introduced CONPRO to the steel makers.

In the present scenario in India, this solution is best suited for those who have already operating an electric arc furnace but because of non-availability of DRI or higher cost of DRI, the steel produced by EAF has become costlier. The first step is to switch to liquid iron or hot metal as raw material. For processing this hot metal for making steel, only a small modification of EAF is necessary.

For configuring a CONPRO following need to be ensured:

- Suitable design modification of the bottom shell to handle oxygen carbon reaction.
- Suitable upper shell to install strong sidewall injectors, handle fumes and avoid splashes.
- Redesigning EAF roof for extraction of fumes and installation of large exhaust elbow.
- Redesigning fume extraction system to handle higher fume generation.
- A suitable method for charging hot metal in the EAF without much stoppage.
- Installation of cost effective, efficient oxygen injections.



SMS combines expertise from its BOF and EAF references in the development of a hybrid furnace design

Hence, on the first look it's an electric arc furnace but having all the features to be utilized for a CONverterPROcess in it. Based on the campaign or usage of raw material, electrical energy input facilities may be installed or plan for future.

It also requires sufficient space for installation of a hot metal ladle tilter since in case of maximum hot metal usage, lots of hot metal is to be poured gradually for controlled continuous decarburization.

A hybrid of BOF and EAF technologies enables low-emission, cost-reduced production

The world's first-ever CONPRO (CONverterPROcess) facility is already in operation in India.

Customer is operating an EAF in the shop. Since excess hot metal was available, a decision was to be made about the type of melting unit to be installed. Considering the flexibility in operation and usage of raw material, CONPRO was preferred.

As stated above, design of a CONPRO is much more than modification of an EAF. Although, this plant is using CONPRO for utilization of hot metal but CONPRO's versatility for green steel production is to be highlighted further.

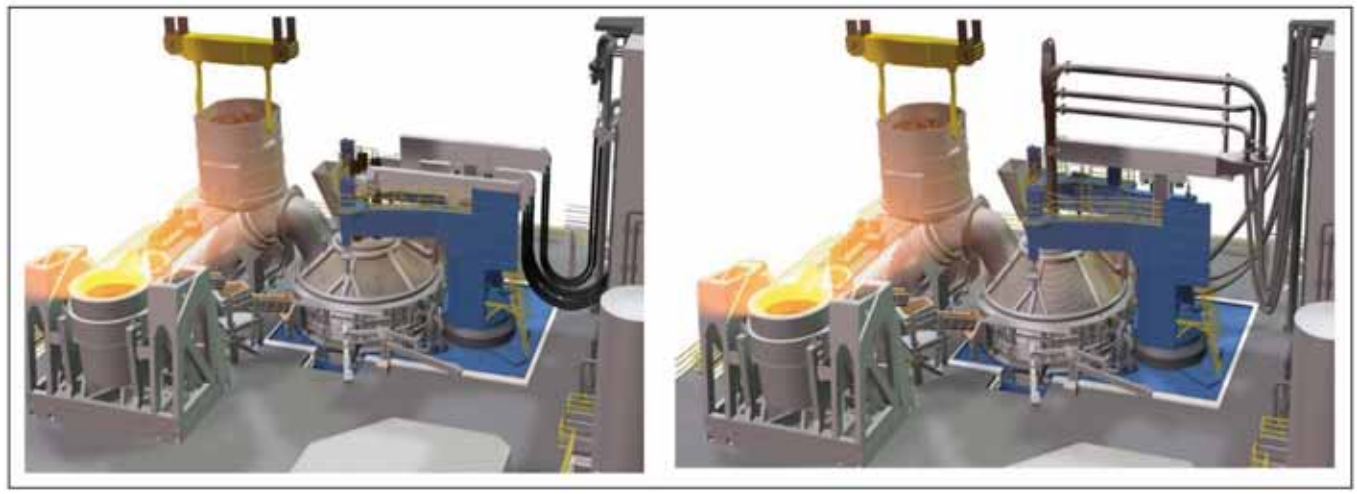
CONPRO makes use of the proven BOF converter and electric arc furnace technologies, providing the most efficient and flexible combination of energy sources. The furnace can be charged with up to 85 percent of hot metal, which can be processed without use of any electrical energy in continuous mode. CONPRO ingeneral can take 100 percent scrap or DRI/HBI.

Versatility of the CONPRO technology is beneficial to all steel producers who are planning to shut down their blast furnaces in near future and whose BOF are at the end of its life cycle. Substitution of BOF is a need of hour to achieve carbon neutral steel making by taking care of environment at the same time reducing the production cost by eliminating the charges of CO_2 certificates.

Chief Technology Officer of SMS group, says: "We have developed the CONPRO technology with the objective to design a highly flexible furnace that provides maximum versatility in terms of charge material, enabling and promoting the next steps on the road to the decarbonization of the steel industry."

The CONPRO furnace has an up to 30 percent larger volume than a comparable EAF thanks to its bigger vessel and the vaulted roof. This design optimizes down times due to reduced skull formation at the roof. When running in the BOF mode, the oxygen blowing rate via side-wall injectors and, optionally, by means of a TOP lance is comparable to a conventional BOF converter. An installation of high voltage system can be planned so that higher amount of solid charge can also be processed.

Currently, oxygen is injected exclusively via oxygen injectors installed on the side-walls. This injector technology uses compressed air instead of oxygen as shroud gas, resulting in a considerable reduction in operational costs.



CONPRO is designed with Option of Electrodes or Top Lance

The vessel volume analysis on the above figure shows that converter vessels are designed for handling much rigorous Oxygen Carbon reaction. For a converter, oxygen blowing capacity is designed as >3Nm /t/min, for an EAF it is in the range of ~1 Nm /t/min however in case of CONPRO, the design canhandle >2Nm /t/min.

SUMMARY

CONPROs are equipped with stronger side wall injectors and designed for stronger fume extraction systems. These can process hot metal upto 90% in the charge mix. As the name suggests, it is CONverter PROcess at an EAF. It also gives flexibility that if hot metal is notavailable, electrodes can melt and process solid charge.

Hence the design provides the flexibility with side wall injectors to install top lance or electrodesas the case may be and use the equipment in the most optimum mode.

Contact : atul.v@sms-group.com; rajanish.s@sms-group.com

Paving the Way for Our Future

Gianpietro Benedetti
Danieli Chairman, ITALY

This write-up summarize the most significant and pioneering technological milestones, in terms of both pure operational performance and environment sustainability, that have characterized Danieli research activities in recent years and today are successfully in operation.

1. DIRECT REDUCTION PLANTS TO REPLACE BLAST FURNACES

The Energiron Direct Reduction technology, jointly developed by Tenova and Danieli, makes it possible to operate with natural gas and up to 100% hydrogen. Moreover, the Hytemp® system, where by hot DRI is directly and continuously charged into the electric furnace, which was first implemented at Ternium Monterrey plant in 1998 and then at Emirates Steel in operation for more than 10 years and then at Suez Steel in operation for more than 6 years has been further improved and now is able to exceed 600^{0}C, the EAF melting temperatures.

These technologies, together with some others under development, will make it possible for a direct reduction plant equipped with Danieli Digital Melter to compete with blast furnaces in terms of OpEx, but above all they will render it significantly more attractive in terms of carbon-dioxide emissions, which will be lowered by 64% or more, not to mention the drastic reduction in the other, even more noxious polluting emissions related to the integrated production cycle. Obviously, much depends on the availability of natural gas and on its cost, which is expected to become more competitive in the coming years, especially compared to Hydrogen, thanks to the discovery of new gas sites in the Mediterranean region.

2. DIGITAL MELTER

The invention of Q-ONE by Danieli Automation has made it possible to design the Digital Melter which is going to replace the already more than 100-year-old EAF concept. This is a revolution not only for the advantages in terms of OpEx it will bring in relation to melting costs, but also because the Digital Melter allows the use of renewable energies.

The invention of Q-ONE by Danieli Automation has made it possible to design the Digital Melter which is going to replace the already more than 100-year-old EAF concept.

This is a revolution not only for the advantages in terms of OpEx it will bring in relation to melting costs, but also because the Digital Melter allows the use of renewable energies. Together with the first H-MIDA (Hybrid Mini mill Danieli), now under construction for CMC, USA, these two historic innovations in continuous casting and the Digital Melter reconfirm Danieli as the leader in the field of minimills and also a front-runner in environmentally friendly technologies (green steel).

3. LONG PRODUCTS NEW-GENERATION MINI MILL, MIDA

Thanks to the high-speed continuous casters now operating at 8 mpm-though, we are studying improvements to reach 10 mpm-it is possible to produce up to w1 Mtpy with only one strand, and therefore to feed the rolling mill in endless mode.

Moreover, with two lines running in semi-endless mode, plus a welding machine, it is possible to achieve a production capacity of up to 1.8–2 Mtpy. Obviously, all this is done without a reheating furnace.

Yes, the new generation MIDA no longer requires the use of the reheating furnace to make commercial steels, and so this also will be the case for future revamps of existing plants.

The resulting advantage is that OpEx is reduced by 15 to 20%

4. FLAT PRODUCTS MADE WITH DUE (DANIELI UNIVERSAL ENDLESS)

The successful start-up of the DUE thinslab rolling plant at Shougang Jingtang (China) has evidenced the advantages of the DUE concept: — It offers the possibility to roll in endless, semi-endless and coil-to-coil modes, depending on the targeted steel grades and strip thicknesses; — The start-up of the Shougang Jingtang DUE has confirmed with facts that this is the only thin-slab rolling plant capable of producing an almost unlimited range of steel grades, with excellent surface quality, mechanical properties and shape tolerances, excluding grades for automotive exposed parts. However, now we have started a continuous casting research program to attempt to make the more demanding automotive exposed parts as well as other, similarly demanding products.

Thanks to our key MIDA and DUE technologies, Danieli has repeatedly confirmed, for the last 10 years, its leadership in the supply of endless rolling plants for both long and flat products, especially thanks to the OpEx and product quality results we've been able to achieve. Of course, a similar outcome can be seen with our other technological milestones I referred to in the list above.

Together, they make up Danieli's latest research efforts and industrial setup activities over the recent period, paving the way towards true environmental sustainability by virtue of green steel production and the adoption of a circular economy model, as seen in the successful results achieved at CMC (USA), Nucor (USA), Shougang (China), OMK (Russia), Ezz's DRP (Egypt), Suez eSteel (Egypt), Emirates Steel (Arab Emirates), Ferriere Nord (Italy), Logan Aluminum (USA) and many other plants.

All of this is made possible thanks to our ability to handle the entire process through break through automation technologies which, for the last forty years, served us to guarantee the entire line process, from scrap to the finished product. This is a testament of Danieli being not just a company, but first and foremost a team who lives by the motto:

"Danieli, the innovative and reliable partner to be front runners in OpEx, CapEx, and product quality", adding from now on "and environmentally friendly".

Carbon-Lean Integrated Steelmaking – Reducing CO_2 Emissions of Existing BF-BOF Plants by up to 50%

Nico Bleijendaal, Executive Vice President
Danieli, EUROPE

New Technologies improve process route efficiency and drastically cuts emissions

The decarbonization of our industry has rapidly evolved from a local concern about a global problem to a global concern about a global problem. Sufficiently widespread commitment to effecting the required transition process is proving to be the single most important enabler for shifting our focus from the drawing board to the investment board. The shape of the steel industry during the final stages of the transition will be determined, to a large extent, by how markets for raw materials such as different ore grades, coal, natural gas and scrap from region to region either limits steel producers in their development or offer them a competitive advantage, and future plant configurations will be far more diverse than today's options that roughly divide our industry into BF-BOF and (DRI)-EAF players.

For many DRI technology has become the prevailing option for significant reduction of existing large-scale BF-BOF steel plants CO2 emissions, especially given its longer emission reduction potential when operating on green hydrogen: And while emission reduction targets for neither 2030 nor 2050 can be achieved without such a fundamental shift, neither can they be without implementing some or all of the other options that are available.

Based on "Best Practice" modern blast furnace ironmaking operations, crude steel production via BF-BOF route typically emits around 1800 kg of CO_2 per ton of steel. However, the majority of steel producers emit up to 40% more. While part of the underperformance may be connected to challenges that are impossible to overcome (e.g. raw material qualities), the vast share of our industry in global greenhouse gas emission emphasizes the urgency of improving emission performance wherever possible and as quickly as possible. For plants operating at or near "Best Practice" level, three decarbonization options are available – ready for implementation today and representing solid steps towards emission reduction targets for both 2030 and 2050.

First of all, low-Cap Ex CO_2 reduction can be accomplished by revising the blast furnace's raw material feed-stock and practices for the injection of reduction agents. Replacing the injection of pulverized coal with injection of natural gas or coke-oven gas represents a more significant emission reduction than ultra-high PCI levels. And while replacing the sinter burden with pellets and charging pre-reduced iron units such as hot briquetted iron (HBI) do not significantly change the ironmaking process's performance, emissions reduction upstream are substantial, potentially amounting to 15%. These proven low-CapEx options have limited consequences in terms of plant equipment but do rely on advanced know-how of the blast furnace ironmaking process. Revised operational practices and process set points need to be developed, the success of which may be ensured by souring external expertise.

Medium CapEx CO_2 emission reduction can be accomplished by maximizing scrap input in the BOF converter. Whereas this input is traditionally driven by price dynamics of scrap versus pig iron as well as temperature control requirement, maximum scrap input eliminates the upstream CO_2 emissions of the hot metal that is replaced without compromising the BOF process capability to produce the widest variety of steel grades.

Currently, the scrap input in the BOF is limited to around 20% of the heat's total weight. Pre-melting scrap by means of Electric Arc Furnace pushes this limit to around 40%. As such this anticipated CO_2 emission reduction could amount to 20%.

The blast furnace iron making industry has been exploring scenarios based on improved utilisation of top gas – either for its calorific value or residual reduction capability – and the injection of syngas and hydrogen in the tuyeres or blast furnace shaft for considerable time already. While the advantages for the blast furnace process may be limited, the CO_2 emission reduction potential of such scenarios is very attractive. Whether via application of process equipment proven in other industries, CapEx and foot print for these options are high. The anticipated CO_2 emission reduction could amount to another 15-25%, with all options being under evaluation for all performance as well as viability. In the end, it may be possible to reduce BF-BOF CO_2 emissions to 50% of current levels, retaining the existing assets, infrastructure and logistics.

A transition to a green steel industry cannot rely on the application of DRI alone. With or without future availability of sufficient quantities of green hydrogen, additional decarbonisation measures need to be implement on top of any (near future) investment in DRI: the options available today are proven, secure and can be implemented as soon as possible at more favourable CapEx. And more critically, emission reduction targets for 2030 and 2050 will not materialise completely without them.

All of the technology required for any large-scale integrated steel plant to enter its green transition is readily available. Within whichever scenario is feasible given local raw material markets, technology is not limiting factor for solving the highly urgent global problem we are facing today.

Influence of Return Sinter Size on Productivity and Quality of Iron Ore Sinter

Dharmendra Kumar Rajak, Mrigandra Singhai, Rupram Sahu, Amit Keshavdas Bairagi, and Sujoy S Hazra

JSW Steel, R&D Dept.; Dolvi, INDIA

Abstract

The return sinter (-5 mm), which is produced inadvertently in sintering process, is recycled back and makes up to 25-30% of total sinter feed mix. However, due to the change in the screen efficiency over a period of time at commercial plant, fraction of +6 mm size return sinter increases from 8 to 15%, which is finally added in the sinter feed mix. It is well known that increasing the coarseness of iron ore in sinter feed mix affects sinter properties, however, no such findings with addition of coarse return sinter was reported. Therefore, to understand the effect of addition of +6 mm size return sinter on the sinter properties, pot tests were carried out by varying the +6 mm size percentage of return sinter from 5 to 15% in steps of 5 along with -5 mm size return sinter. It was observed that with increasing the percentage of +6 mm size return sinter from 0 to 15%, sinter yield decreased from 84.9 to 82.4% and productivity decreased from 2.43 to 2.26 t/sq.m/hr. The deterioration in sinter properties were mainly attributed to decrease in bulk density which advances the movement of flame front inside sinter bed. The advancement in FFS leads to loss of heat from sinter bed indicated by rise in burn through temperature.

Effect of +6 mm return sinter size was also evaluated in industrial scale plant trial. Plant data analysis validates the findings from the lab trials. It was established in plant trial that increased percentage of +6 mm size return sinter in sinter feed mix leads to decrease in sinter yield by & productivity.

Keywords: Return sinter; bulk density; void fraction; FFS; BTP; iron ore sinter.

1. Introduction

Iron ore sinter, a blast furnace feed stock is made by incipient fusion of iron ore, fuel and fluxes. The combustion of solid fuel supplies the heat required for sintering to achieve incipient fusion and on cooling, the different mineral phases crystallizes and bonds the particles together to form strong sinter. The parameters which influence melt information and subsequent solidification of mineral phases are of great importance in sintering process. During sintering process airflow rate, flame front speed in sintering process and bed bulk density has been found to guide the performance of sinter plant and these parameters mainly depends on the sinter bed permeability. The permeability of the sinter bed in turn, controls the productivity of sinter bed as well as microstructure and properties of the product sinter. Sinter bed permeability depends on several factors size distribution of sinter feed mix is one of the important among them[1,2]. In the sinter mix, compared to other materials, return sinter proportion is at higher side after iron ore proportion. Return sinter is undersize (-5 mm) sinter products produced at sinter plant and blast furnace [BF] stock house due to the breakage during transportation, falls between sinter plant and stock house and vibration of screen feeder[3]. In general, most of the sinter plants use -5 mm size of return sinter however, this contains 10 to 15% of +6 mm size return sinter also. The presence of +6 mm size return sinter is due to wear and tear of screens used for screening the produced sinter before its final charging to Blast furnace bunkers.

It is well known that increasing the coarseness of iron ore in sinter feed mix affects sinter properties, however, no such findings with addition of coarse return sinter was

reported. Therefore, to understand the effect of addition of +6 mm size return sinter on the sinter properties, pot grate experiments were carried out by varying the +6 mm size of return sinter from 5 to 15% in steps of 5 along with -5 mm size return sinter to study its effect on properties and productivity of sinter. Subsequently, these findings have been validated in commercial sinter plant at JSW Steel Dolvi, sinter properties like sinter yield and productivity have been found to deteriorate with increased percentage of +6mm size return sinter in sinter feed mix.

Numerous effort has been made on blend[4,5] and sintering parameters[6,7] optimisation to reduce the return fine generation. Recently, Y. Ogasawara et.al used agglomerated return sinter of size -4 mm and -0.15 mm and after agglomeration used directly to BF[8]. Researchers have reported that use of return sinter in sinter making affects the sintering properties. R.P Bhagat[1] used -5 mm return sinter from 20 to 40% and reported improvement in sinter yield with 33.5% return sinter usage in sinter feed mix. Matsumura[9] added return sinter in combination of +1mm, -1 mm and -5 mm during and post granulation and reported improvement in productivity in lab and plant scale.

2. Sinter pot examination

2.1 Experimental

Fig. 1 shows the pot sinter experimental set up[10]. The sinter pot (dia. = 300 mm and H = 600 mm) was used. All the raw materials for sinter feed mix such as iron ore, limestone, dolomite, coal and return sinter were obtained from industrial scale sinter plant. Chemical composition of the materials used for experiments is listed in **Table 1.** Blending condition of raw material is

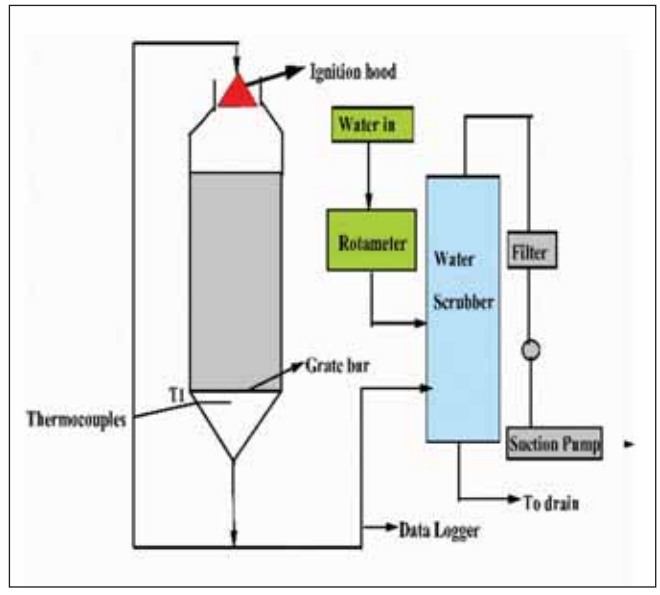


Fig.1:Schematic of pot sinter[10]

shown in **Table 2.** Basicity (B2) and MgO% in product sinter were maintained at 2.2 and 2.0 % respectively. Initially the sinter feed mix were dry mixed in a mixer drum (length: 1000 mm, diameter: 600 mm) and afterwards wet mixing was done with water addition as per **Table 3**. The mixing of material after water addition causes granulation. The granulated sinter feed mix were fed into the sinter pot, (approximately 75 kg/ batch) and hearth layer (approximately 7.5 kg/batch) of size 10-12 mm was used. Pot sinter test parameters were maintained as per **Table 3**. Blending condition of sinter feed mix was shown in **Table 2**. After the pot test, the sinter cake was raised to a height of 2 metres in a shatter index machine and dropped, twice[11] to simulate the discharge of product sinter from sinter pallet car in industrial practice. Sinter yield was estimated as the fraction of +5mm size of product sinter in total sinter

Table 1: Chemical composition of sinter feed mix (wt.%)

Raw Materials	Fe(T)	SiO_2	Al_2O_3	CaO	MgO	Moisture	LOI
Orissa-Iron ore	61.75	3.58	3.06	0.13	0.07	7.85	3.76
Limestone	2.01	0.39	0.21	49.73	4.19	0.28	42.2
Dolomite	2.66	0.33	0.62	35..54	14.38	0.23	44.37
Lime	0.78	1.07	0.46	89.45	2.08	--	6.2
Coal	0.63	7.72	4.43	0.67	0.16	7.34	84.07
Return sinter	54.66	5.6	3.05	11.62	1.89	--	--

weight. Tumbler index was determined as per IS 6495-1994. Bed bulk density was calculated as weight of sinter raw materials in pot at charging divided by inner volume of the sinter pot except the volume occupied by hearth materials[9]. Burn through point (BTP) an important part of sintering process is measured by temperature probe installed in wind box. Flame front speed is calculated by dividing the green bed height by the time taken for waste gas temperature to reach peak temperature indicating BTP.

Table 2: Blending ratio of sinter feed mix (%)

Raw material				
Iron ore	51.4	51.4	51.4	51.4
Limestone	5.4	5.4	5.4	5.4
Dolomite	6.4	6.4	6.4	6.4
Lime	2.3	2.3	2.3	2.3
Coal	4.7	4.7	4.7	4.7
Return Sinter	0.0	5.0	10.0	15.0
Return sinter (+6 mm)	0.0	0.62	1.23	1.8
Return sinter (-5 mm)	29.8	29.2	28.6	28.0

Table 3: Pot sinter test conditions used for pot sinter experiments

Parameters	Value
Bed height	0.60 m
Hearth layer/weight	0.06m/7.5 kg
Ignition time	60 s
Suction during ignition	500 mm WC
Suction during sintering	1250 mmWC
Moisture	7.5 +/- 0.2 %

3. Results

3.1 Return sinter size distribution

The size distribution of return sinter is shown in Fig.2. The return sinter had 16.5% +6 mm and 82.8% -6 mm and 0.7% +8 mm particles. To investigate the effect of +6 mm return sinter size on sintering performance, three levels of +6 mm size return sinter were prepared (Table 2). These fractions were then blended with sinter feed mix to investigate the effect of coarsening of granules formed after granulation. Fig.3 shows the distribution of granules mean size with the addition of +6 mm size return sinter. The mean size of granules was increased with increasing the percentage of +6 mm size return sinter. It can be seen that the mean size of granules increased from 4.48 mm to 4.79 mm as +6 mm size return sinter increases from 0% to 15%. The effect of +6 mm size return sinter on granulation effectiveness is also evaluated by calculating balling index. Fig.3 shows that balling index shows minor changes with 5% +6 mm size return sinter addition while with 10% +6 mm size return sinter balling index was 1.53 and to 1.60 with 15%.

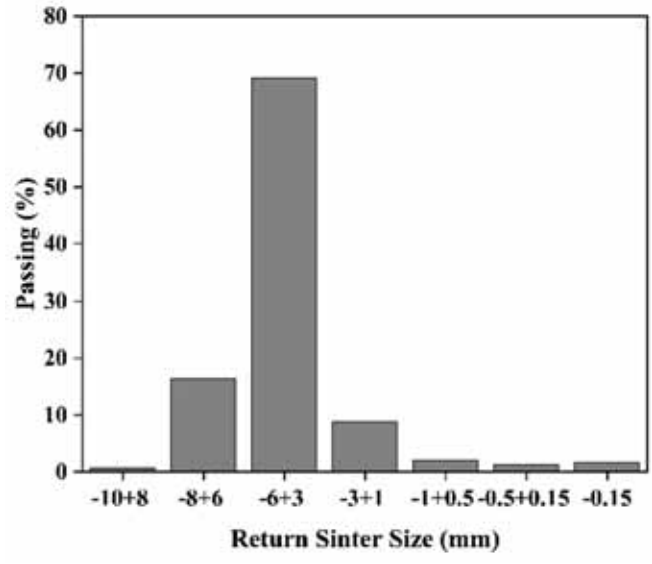


Fig.2: Size distribution of return sinter

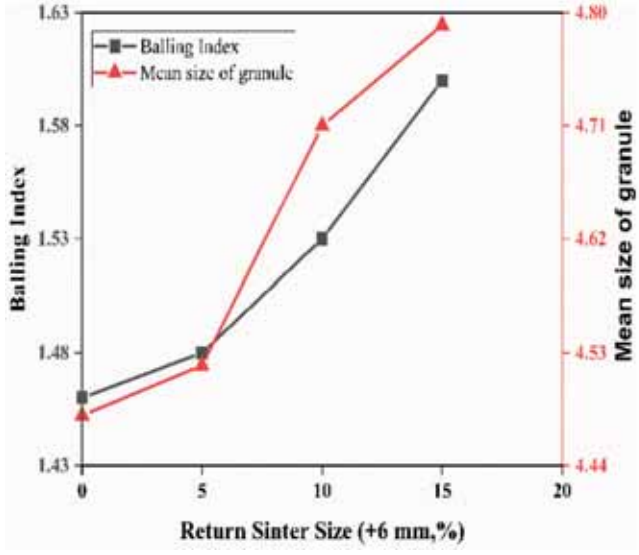


Fig.3: Mean size and balling index distribution of granules

3.2 Influence of +6 mmsize return sinter on flame front speed and bulk density

Fig.4 shows the effect of +6 mm return size sinter on FFS and bulk density. With the increasing percentage of +6 mm return size sinter, FFS increased and bulk density decreases. In case of 10%, +6 mm return size sinter,

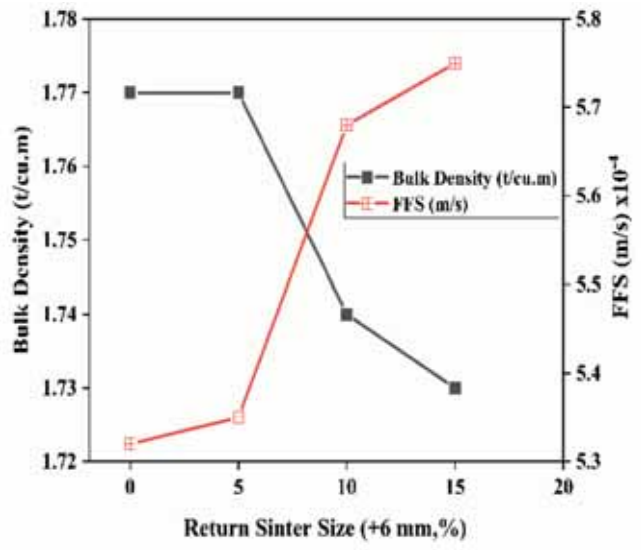


Fig.4: Change in FFS and bulk density with the addition of +6 mm size return sinter

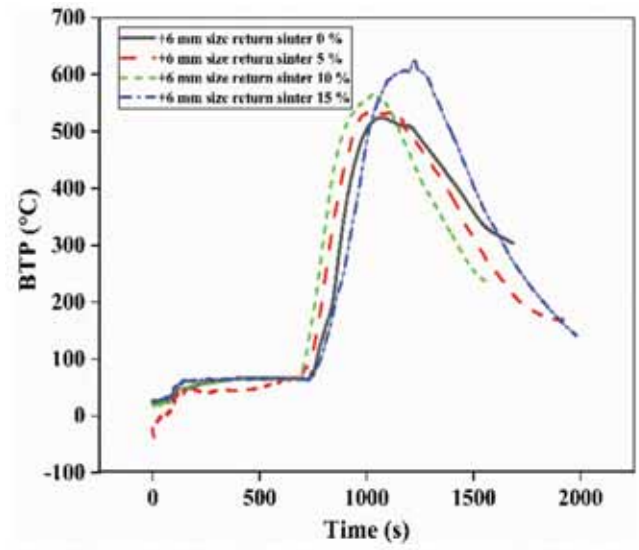


Fig.5: Typical BTP temperature for each +6 mm size sinter addition

FFS increased by 6.7% and bulk density decreases by 1.7% compared to base case. FFS further increased by 1.2% and bulk density decreases by 0.6% compared to 10% +6 mm return size sinter. Insignificant change in FFS and bulk density is observed with 5% +6 mm return size sinter compared to base case.

3.3 Influence of +6 mm size return sinter on Burn through point (BTP)

BTP is the measurement of gas temperature in wind boxes and are controlled by adjustment of sinter machine speed. BTP thermal profile is considered for analysis as this temperature indicates that flame front has arrived at the bottom part of sinter bed[12]. Fig.5 shows the maximum BTP temperature with each percentage of +6 mm size return sinter. BTP temperature was 522^{0}C with base case which increases by 17^{0}C with 5% +6 mm size sinter. It further increases to 566^{0}C and 572^{0}C with 10 and 15% +6 mm size return sinter addition respectively.

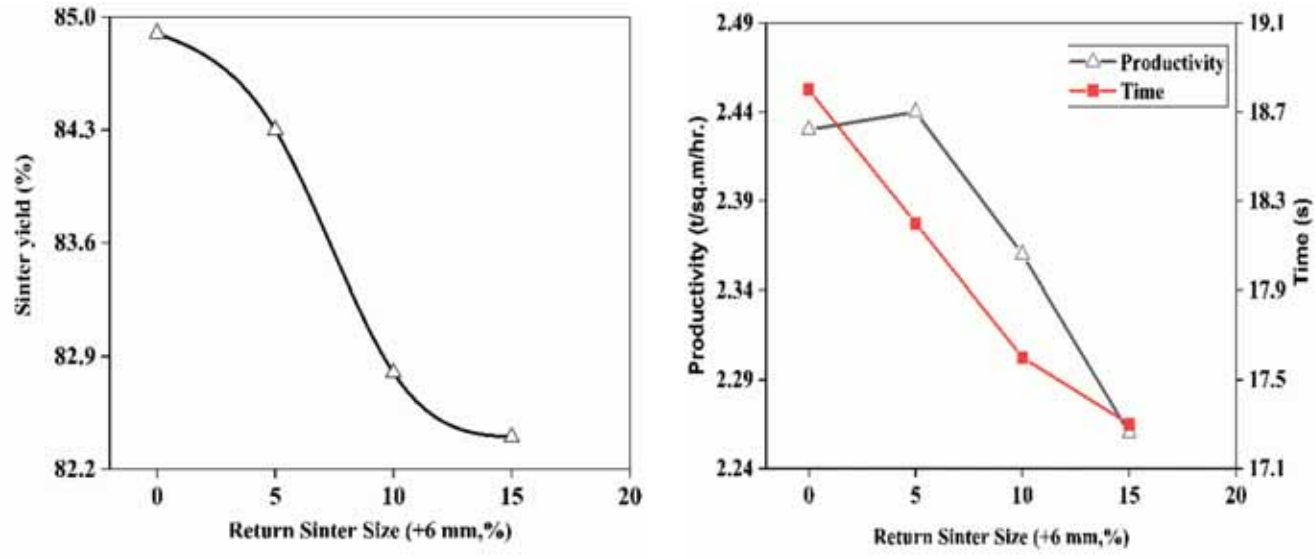
3.4 Influence of +6 mm size return sinter on sinter properties

The pot test result described here show that addition of +6 mm size return sinter significantly affects sintering time, sinter yield and productivity. From fig. 6 a), it can be seen that when +6 mm size return sinter was increased in sinter feed mix, significant change in sinter yield was observed. Sinter yield with base case was 84.9% which decreased to 82.8% with 10% +6 mm size return sinter addition which further decreased by 2.9% with 15% +6 mm size return sinter compared to base case. Negligible change in comparison to base case was observed with 5% +6 mm size return sinter addition. Fig 6 b) shows the change in productivity with sintering time. Sintering time obtained with base case was 18.8 minutes (min) which decreases to 17.6 and 17.3 min with 10 and 15% +6 mm size return sinter addition. Slight change in sintering time was observed with 5% +6 mm size return sinter addition. Productivity also shows trend similar to sintering time. Productivity with base case was 2.43 t/sq.m/hr. which decreases to 2.36 and 2.26 t/sq.m/hr. with 10 and 15% +6 mm size return sinter addition.

4 Discussion

4.1 Effect of +6 mm size return sinter on mean size of granule

Granulation of sinter feed mix is a particle size enlargement process where in adhering fine particles (size) layers on to the coarse nucleus (size) particle[13,14]. Water added during granulation help in bridging particles and enhance granulation. The mean size of granule obtained after varying percentage of +6 mm size return sinter is shown in fig.3. It is clear that mean size of granules increases with increase in percentage of +6 mm size return sinter. The increase in mean size is attributed to improvement in granulation process as the available water for granulation of sinter feed mix might have increased due to poor wettability of return sinter. Also, the balling index post granulation is also evaluated with different return sinter size e.g.



(a) (b)

Fig.6: Effect of +6 mm size return sinter on a) sinter yield and b) sinter productivity and sintering time

1 mm, 3 mm and 4 mm to confirm the wettability effect of return sinter. Test result shows that balling index is 1.45, 1.6 and 1.65 mm with 1, 3 and 4 mm return sinter respectively. This shows thatthe bigger size of return sinter dispenses more water than the smaller size return sinter. Thus, water dispersion among the other sinter feed mix has improved which helps in improvement of granulation process forming bigger size granule[15].

4.2 Influence of mean size of granule on bulk density and FFS

Based on granulation index analysis, increase in granulation efficiency will influence sinter bed permeability, air flow rate in sinter bed, rate of movement of flame front and sinter bed temperature [16, 17]. It is seen from the fig.7 that FFS increases with increase in mean size of granule[18]. With the increase in mean size of granule, void fraction increases which leads to the increase in the total volume occupied by the granules in pot leading to the decrease in bulk density of sinter feed mix[19]. The increase in FFS with decrease in bulk density is in line with the findings of Loo[20].

4.3 Effect on sinter yield and productivity

Increase in granule mean size, with the addition of +6 mm size return sinter increases the sinter bed permeability which is manifested by increase in FFS and bulk density. With increase in FFS, sinter properties like sinter yield and productivity decreases. A possible explanation for decrease in sinter yield is related to the low bulk density as low bulk density have a lower

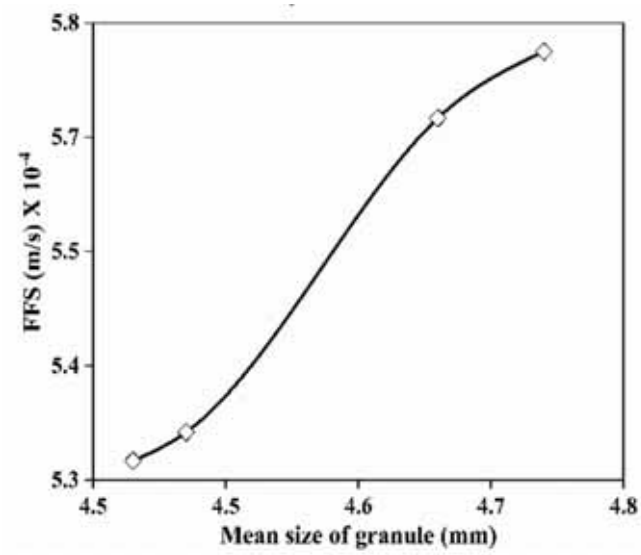


Fig.7: Effect of mean size of granule on FFS

thermal load which enables the flame front to advance faster[21] (Fig.8). Thus, advancement in FFS means lower sintering time and higher bed permeability, leading to incomplete sintering reactions and inferior sinter strength[22,23]. The decrease in sinter strength due to higher FFS is validated with the BTP temperature. The BTP temperature increases with increase in +6 mm size return sinter which indicates that heat loss has increased due to low bulk density and high FFS. Productivity is expressed as ratio of +5 mm product sinter to per square meter of the pot/sinter machine per hour. Fig.6 b) shows that productivity decreases with +6 mm size return sinter even though decrease in

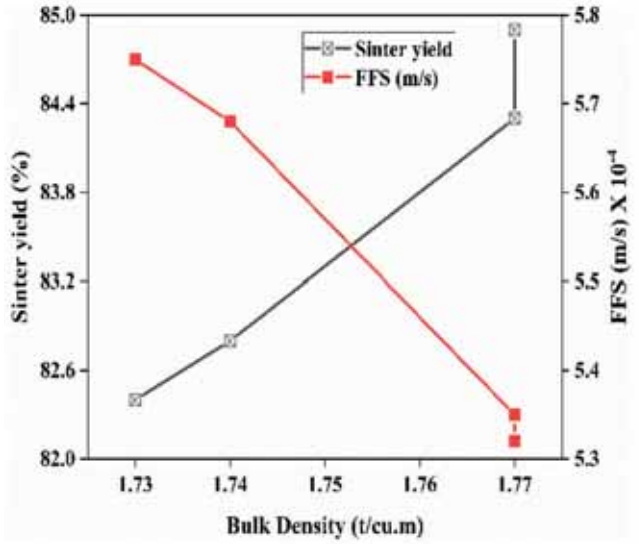


Fig.8: Effect of bulk density on sinter yield and FFS

sintering time is observed. The decrease in productivity is attributed to decrease of sinter yield[20].

5. Evaluation at commercial plant

5.1 Analysis atindustrial scale data

Fig. 9 shows the evaluation of sinter properties with the usage of return sinter. In the industrial plant data analysis, keeping all the process parameters constant, the ratio of return sinter size was observed in the ratio of 8,10 and 13%. It was found that sinter production and plant productivity decreased with increase in +6 mm size return sinter in sinter feed mix. Sinter production was 8078 tons when return sinter in feed mix was 8%. With the presence of 10%, return sinter, the sinter production decreased by 1.8% and 2.3% with the presence of 13%, return sinter. Productivity also follows the similar trend with that of sinter production. Productivity was 1.5 t/cu.m/hr with 8%, return sinter which decreased to 1.46 with the presence of 13% return sinter. Deterioration in sinter properties hence can be attributed to the increase of mean size of granule and formation of low density in sinter bed. These factors seemed to have contributed an increase in FFS.

6. Conclusion

In this study, conclusion drawn are as follows:

1. Addition of +6 mm size return sinter in the sinter feed mix increases the mean size of granule. The increase in granule mean size is attributed to enhanced water dispersion during granulation due to poor wettability of return sinter

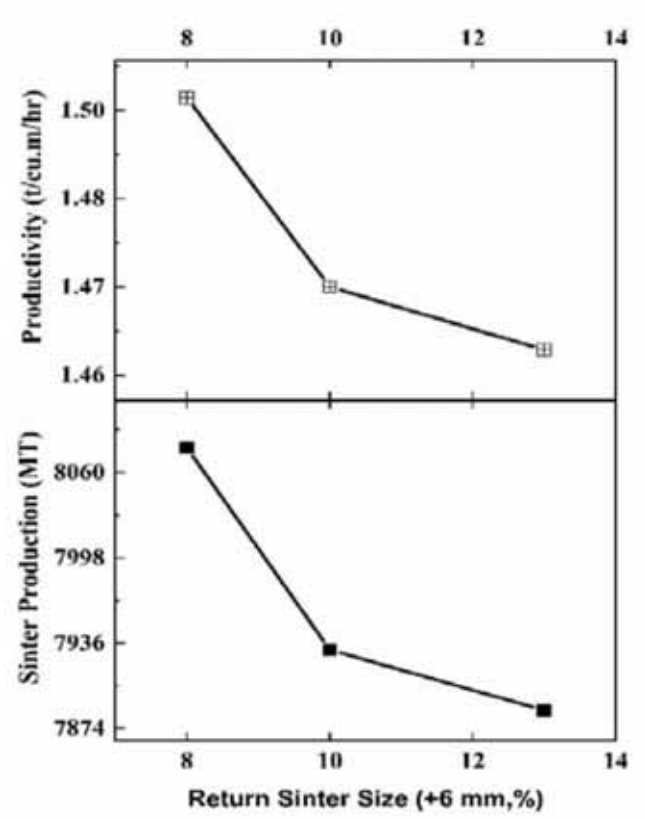


Fig.9: Operational performances with the presence of +6 mm size return sinter

2. FFS of sinter bed is improved with the addition of +6 mm size return sinter. Improvement in FFS is due to increase in permeability and decrease in bulk density of sinter bed

3. Sinter yield decreases with decrease in bulk density and increase in FFS. The low thermal load associated with low bulk density advances the FFS. This lead to increase in loss of heat to sinter bed

4. Productivity of the sinter, which is dependent more on sintering time than yield, decreases since the degree of decrease in sinter yield is more than the sintering time

5. Plant data validates the trend of deterioration in sinter property observed in lab scale.

Acknowledgement

The authors are grateful to the management of JSW Steel, Dolvi for the encouragement and support of this work.

References:

[1] B. G. Ellis, C. E. Loo and D. Witchard: Ironmaking Steelmaking, 34 (2007), No. 2, 99.

[2] T. Maeda, C. Fukumoto, T. Matsumara, K. Nishioka and M. Shimizu: ISIJ Int., 45 (2005), No. 4, 477.

[3] Ram PraveshBhagat, H.S Ray and S.K Gupta: ISIJ Int., 31 (1991) 669

[4] S. Wu, H. Han, H. Li, J. Xu, S. Yang and X. Liu: Int. J. Min.Met. Mater., 17 (2010) 11

[5] Z.Huang, L. Yi, B. Hu and T . Jiang: Iron Steel., 47 (2005) 9

[6] E. Kasai, S. Komarov, K. Nushihiro and M Nakano: ISIJ Int., 45 (2005) 538

[7] T. Otomo, N. Taguchi and E. Kasai: ISIJ Int., 36 (1996) 1338

[8] Y. Ogasawara, T. Sato, J. Ishii, R. Murai and S. Watakabe: ISIJ Int., 60 (2020) 1389

[9] M. Matsumura, Y. Yamaguchi, M. Hara, C. Kamijo, T. Kawaguchi and Y. Nakagawa: ISIJ Int., 53 (2013) 34

[10] D. K. Rajak, N.B.Ballal, N.N Vishwanathan and M. Singhai: ISIJ Int., 61 (2021) 79

[11] M.K Choudhary and B. Nandy: ISIJ Int.,46 (2006) 611

[12] P. Morvan, "Modelling and automatic control of the iron ore bed combustion at the sintering plant", 2018-2019

[13] R. W. Roller, BHP Tech. Bull 26 (1982) 44

[14] T. Furui, K. Sugawara, M. Kagawa, S. Uno, M. Kawazu, T. Fujiwara and A. Sawamura, Nippon Steel Tech. Rep. Overseas 10 (1977) 36.

[15] Y. Ogasawara, T. Sato, J. Ishii, R. Murai and S. Watakabe: ISIJ Int., 60 (2020) 1389

[16] C. E. Loo: 2nd Int. Cong. on the Science and Technology of Ironmaking and 57th Ironmaking Conf., Toronto, Canada, (1998), 1299

[17] D.K Rajak, M. Singhai, R. Sahu, S.S. Hazra: Trans Indian Inst Met., (2021)

[18] WU Shengli, ZHU Juan, FAN Jiaxin, ZHANG Guoliang and CHEN Shaoguo: ISIJ Int., 53 (2013) 1561

[19] C.Kamijo, M. Matsumura and T. Kawaguchi: ISIJ Int.,45 (2005),544

[20] C.E. Loo and D.J.Wong: ISIJ Int.,45 (2005),449

[21] Roy R. Lovel, Keith R. VINING and Mark DELL AMICO: ISIJ Int.,49 (2009),195

[22] C. E. Loo: ISIJ Int.,45 (2005),436

[23] C. E. Loo: Trans. Inst. Min.Metall.C,109 (2000), C11

Corresponding author email address: dharmendra.rajak@jsw.in (0000-0002-8916-7004)

Effect on Coke Quality of Pet Coke in Coal Blend through Pilot Oven Carbonization

Anup Kumar, R.Srivastava, Dr.B.K.Sahoo, Dr. P.K.Jha, P.K.Pankaj, S.K.Kushwaha and K K Manjhi*

R & D Centre for Iron and Steel, SAIL, Ranchi, INDIA

Abstract

Scarcity of metallurgical coal and its high price is a challenge to coke oven operators, and it remains the most important issue for them to reduce the cost of coal blends without affecting coke quality as coking coal contributes about 50% of the cost of hot metal. Various techniques are adopted worldwide, ranging from using non coking coals, petroleum coke, sub-bituminous coal in addition to metallurgical coal in blends to reduce its cost. In this work petroleum coke was used in the blend for the replacement of high value coking coals. Petroleum coke having very low ash, high carbon has potential to increase the carbon value in coke without affecting cost of the blend. The experiment was performed by varying the petroleum coke usage percentage in coal blend for both top charging and stamp charging through pilot oven carbonization and evaluating its effect on coke quality. The effect on coke quality has been discussed in this paper.

Keywords: Hard Coking Coal (HCC), Petroleum Coke, Micum Indices

1. INTRODUCTION

Scarcity of metallurgical coal and availability at very high price is a challenge to coke oven operators, as also the issue of reduction of the cost of coal blends without affecting coke quality. Coking coal contributes about 50% of the cost of hot metal. Various ideas ranging from using non coking coals, pet coke, sub-bituminous coal addition to metallurgical coal blends are being practiced worldwide to reduce the cost of coal blend. In this work the objective was to evaluate coke quality using pet coke in coal blend for its suitability in BF coke making in SAIL blends.

Petroleum cokes (pet coke) can be categorized as either Green or Calcined coke. Petroleum coke (both green and calcined) is a black-colored solid produced by the high pressure thermal decomposition of heavy (high boiling) petroleum process streams and residues. Green coke is the initial product from the cracking and reforming of the feed stocks to produce a substance with a high carbon-to-hydrogen ratio. As per the studies on the activity of the petroleum coke in Coke Making, the presence of unreacted pitch and “isotropic sacks” in green petroleum cokes has been considered a source of volatile matter evolution, and the extent of their movement within the coal particles may improve the caking ability of the blend[1,2]. Petroleum coke generally contains low ash (<1%). Since coking coals generally contain high ash, the usage of petroleum coke as additives in production of coke can reduce the ash content of coal blends and as well as its coke. Petroleum coke addition can be considered as an effective additive in dissipating wall pressure developed during the carbonization process and reducing expansion of the system due to the partially inert nature of petroleum coke[3,4].

Petroleum Coke was added at varying percentages to the base blend for both top and stamp charging and changes in coking properties were studied and evaluating its effect on coke quality.

EXPERIMENTAL

Blend composition & Carbonization Conditions

The blend composition and carbonization conditions for evaluation of coal blends by Pilot Oven carbonization tests are presented in Table-1.

Base blend: Total Hard – 70%, Total Soft - 10%, Total Indigenous -20%.

There were four test blends –

I. **Test blend-1:** Total Hard – 65%, Total Soft – 10%, Total Indigenous -20%, Total Petroleum Coke – 5%.

II. **Test blend-2:** Total Hard – 70%, Total Soft – 5%, Total Indigenous -20%, Total Petroleum Coke – 5%.

III. **Test blend-3:** Total Hard – 70%, Total Soft – 0%, Total Indigenous -20%, Total Petroleum Coke – 10%.

IV. **Test blend-4:** Total Hard – 70%, Total Soft – 0%, Total Indigenous -15%, Total Petroleum Coke – 15%.

All carbonization tests were planned at crushing level of 81±1% -3.2 mm content, total moisture content of 8±1% and coking period of 18 hours and end centre coke mass temperature of 1000±10^{0}C for top changing.

And all carbonization tests were planned at crushing level of 90±1% -3.2 mm content, total moisture content of 11±1% and coking period of 20 hours and end centre coke mass temperature of 1000±10^{0}C for stamp changing.

Table-1: Blend composition for pilot oven carbonization tests for evaluation of usage of raw petroleum coke in coal blend for top & stamp charging.

Blend	Base Blend	Test Blend-1	Test Blend-2	Test Blend-3	Test Blend-4
HCC-1	50	50	50	50	50
HCC-2	15	15	15	15	15
HCC-3	5	0	5	5	5
Imported soft	10	10	5	0	0
Indigenous Prime	20	20	20	20	15
Pet Coke	0	5	5	10	15
Total	100	100	100	100	100

Testing of Individual Coals

All individual coking coals were emptied from their respective bags and representative master sample of each coal was drawn after crushing the +25mm fraction, homogenization and air-drying, wherever necessary. Subsequent to homogenization followed by coning & quartering, the respective coal samples were prepared for the proximate analysis, Gieseler's Plastic Properties, CSN and LTGK Coke type tests.

Pilot Oven Carbonization Tests

Carbonization tests were carried-out in the electrically heated movable wall pilot coke oven of Carbolite Make, UK. The carbonization conditions of coking period was maintained at 18 hrs for Top charging and 20 hrs for Stamp charging, End Centre Coke Mass Temperature was maintained at 1000±10^{0}C during the test campaign. Coking pressure during each carbonization test was monitored.

Testing of Coke Samples

Coke obtained from the respective carbonization tests after wet quenching was allowed to dry to a moisture level below 3% in coke dryer. The gross dried coke was subjected to screen analysis before and after stabilization. Coke stabilization was carried out by allowing run-of-oven coke to fall twice from a standard height of 1.73 m followed by 25 revolutions in the Micum drum.

The respective coke samples were subjected to following tests: Screen analysis before and after stabilization, Micum indices (M_{10} & M_{40}), CRI-CSR, Porosity and Proximate Analysis.

RESULTS & DISCUSSION

Characteristics of coal blends

Since the raw petroleum coke contains low VM-7.1% adb and very low ash-0.4%, so, both VM and ash content in the blends were affected. VM & ash contents of blend reduced from 22.7% to 20.0% and 12.4% to 10.1% respectively. VM content of the blends reduced by about 1.0 to 2.7 unit depending upon the level of usage of imported coal and petroleum coke in the blends. Ash content of the blends also reduced by 0.4 to 2.3 units depending upon the usage of imported coal & petroleum coke in the blends. Sulfur content in coal blend significantly increased from 0.46% to 0.64% with higher usage of petroleum coke.

Laboratory characterization results presented in Table-2 of the coal blends show deterioration in coking properties with the use of petroleum coke in the blends. CSN reduced from 4.5 to 3.5 and LTGK varied from G3 to G depending upon usage of petroleum coke in coal blend. Maximum fluidity varied from 72 to 25. This may be because of weathering of the coals and usage of raw petroleum coke in the coal blend.

Table-2: Properties of blends for evaluation of usage of raw petroleum coke in coal blend

Sample Details:	Base Blend	Test Blend-1	Test Blend-2	Test Blend-3	Test Blend-4
Volatile Matter, % (adb)	22.7	21.3	21.7	20.5	20.0
Ash, % (adb)	12.4	12.0	11.7	11.4	10.1
Crucible Swelling Number	4.5	4	4	3.5	3.5
LTGK Coke Type	G3	G	G	G1	G1
Initial Softening Temperature ^{0}C, (1ddpm)	419	418	423	420	422
Maximum Fluidity Temperature, ^{0}C	458	457	459	461	458
Solidification Temperature, ^{0}C	489	487	491	487	487
Plastic Range, ^{0}C	70	69	68	67	65
Maximum Fluidity, ddpm	175	135	145	127	125
Sulfur	0.46	0.49	0.50	0.62	0.64

Characteristics of Coke

Top Charging

- Ash content of coke reduced with use of petroleum coke in the blends by 0.5 to 2.3 unit.
- M10 values of coke deteriorated at 5% usage level replacing HCC-3 and Imported Soft, at 10% usage level replacing Imported Soft and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%).
- M40 values of coke deteriorated at 5% usage level replacing HCC-3 and Imported Soft, at 10% usage level replacing Imported Soft and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%).
- Porosity values of coke deteriorated at 5% usage level replacing HCC-3 and Imported Soft, at 10% usage level replacing Imported Soft and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%) respectively.
- CRI values of coke deteriorated at 5% usage level replacing HCC-3, at 10% usage level replacing Imported Soft and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%) respectively. Whereas remained same at 5% usage level replacing Imported Soft
- CSR values of coke deteriorated at 5% usage level replacing HCC-3 and Imported Soft, at 10% usage level replacing Imported Soft and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%) respectively.

Stamp Charging

- Ash content of coke reduced with use of petroleum coke in the blends by 0.8 to 2.9 unit.
- M10 values of coke deteriorated at 5% usage level replacing HCC-3 and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%). Whereas remained same at 5% usage level replacing Imported Soft and improved at 10% usage level replacing Imported Soft.
- M_{40} values of coke deteriorated at 5% usage level replacing HCC-3 and Imported Soft, at 10% usage level replacing Imported Soft and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%).
- Porosity values of coke deteriorated at 5% usage level replacing HCC-3 and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%). Whereas improved at 5% usage level replacing Imported Soft and at 10% usage level replacing Imported Soft.
- CRI values of coke improved at 5% usage level replacing HCC-3 and Imported Soft, at 10% usage level replacing Imported Soft and at 15% usage

Table-3: Coke properties of usage of raw petroleum coke in coal blend for Top Charging

Coke Details	Base Coke	Test Coke-1	Test Coke-2	Test Coke-3	Test Coke-4
Ash,% (adb)	15.3	14.8	14.9	14.5	13.0
M40, %	80.6	79.9	80.2	77.5	78.3
M10, %	12.1	12.5	12.3	14.2	13.3
CRI, %	30.8	30.9	30.8	31.2	31.0
CSR, %	40.3	37.5	39.1	37.1	37.5
Porosity, %	48.5	48.7	48.7	50.1	49.2

Table-4: Coke properties of usage of raw petroleum coke in coal blend for Stamp Charging

Coke Details	Base Coke	Test Coke-1	Test Coke-2	Test Coke-3	Test Coke-4
Ash,% (adb)	15.7	14.9	15.1	14.2	12.8
M40, %	83.3	81.1	82.8	82.3	80.4
M10, %	7.9	8.8	7.9	7.4	8.4
CRI, %	30.6	28.2	28.4	25.8	25.7
CSR, %	50.2	52.9	53.8	54.9	56.1
Porosity, %	45.8	46.8	45.7	45.4	46.2

level replacing Imported Soft & Indigenous Prime (10% & 5%).

- CSR values of coke improved at 5% usage level replacing HCC-3 and Imported Soft, at 10% usage level replacing Imported Soft and at 15% usage level replacing Imported Soft & Indigenous Prime (10% & 5%).

CONCLUSIONS

Top Charging

- At the level of 5% HCC-3 replacement by pet coke shown deterioration in Micum indices, CRI, CSR and porosity. However 5% Imported Soft coal replacement by pet coke in the coal blend less deterioration observed in Micum indices, CRI, CSR and porosity.
- At the level of 10% Imported Soft coal replacement and 15 % replacement of Imported Soft & Indigenous Prime (10% & 5%) by pet coke deterioration in Micum indices, CRI, CSR and porosity was observed from the base blend. However in 15% replacement by pet coke showed less deterioration from the 10% replacement of Imported Soft coal. This may be because of replacement of 5% Indigenous Prime.

Stamp Charging

- At the level of 5% HCC-3 replacement by pet coke shown deterioration in Micum indices and porosity but improvement in CRI, CSR was observed. However 5% Imported Soft coal replacement by petcoke in the coal blend no significant changes were observed in micum indices and porosity but improvement observed in CRI, CSR.
- At the level of 10% Imported Soft coal replacement by pet coke deterioration in M40 but improvement in M10, CRI, CSR and porosity was observed. However 15% replacement of Imported Soft & Indigenous Prime (10% & 5%) by pet coke deterioration in Micum indices and porosity but improvement in CRI, CSR was observed from the base blend.

It is concluded from the above study that usage of pet coke in coal blend for top charging is not suitable. However, in case of stamp charging raw petroleum coke can be used up to 10% without affecting coke quality.

REFERENCES

1. K S Phani Kiran, B. Sivalingaraju, Siddaling Reddy, Y Venkateswarlu, Dr.K.Marutiram, T.K.Naha: Use of Petroleum Coke as an Additive in Metallurgical Coke Making, In: Proceeding of the International Conference on Science and Technology of Ironmaking and Steelmaking, December 16-18, 2013, CSIR-NML Jamshedpur.
2. Mene´ndez, J. A., Pis, J. J., Alvarez, R., Barriocanal, C., Fuente, E. and M. A. Dı´ez : Characterization of Petroleum Coke as an Additive in Metallurgical Cokemaking. Modification of Thermoplastic Properties of Coal, Energy & Fuels 1997,Vol 11, pp 379-384
3. Urbana, Illinois: Effect of high carbon components and other additives upon character of cokes: laboratory scale study. John a. Harrison Illinois state geological survey.,1960 http://hdl.handle.net/2142/44632
4. Akpabio, E.J. and Obot, O.W.: Optimizing Utilization of Petroleum Coke in Nigerian Metallurgical Industry. Journal of Minerals & Materials Characterization & Engineering, Vol. 10, No.3, 2011, pp.267-278.

* *anupkumar@sail.in*

Investigation into Aspects of Cooling Water Quality Management in a Reheating Furnace of a Steel Plant

S.Mitra Mazumder, Praveen Kumar, S.N.Singh and P Banerjee*
RDCIS, SAIL, Ranchi, INDIA

Abstract

In the reheating furnace of a steel plant, closed loop water is used for the purpose of non-contact cooling of skid posts and pipes. The cooling posts of skid pipes were prone to damage, particularly at locations below the hearth level of furnace. The tendency of increased deposition and pipe inner surface brittleness were often observed. This entailed that there was a need to find the root cause and approach for ensuring desired cooling water quality in furnace zone since it directly relates to plant productivity. Under the investigative study, time series data were generated to develop water quality profiles in terms of relevant individual parameters, as well as resulting saturation indices indicative of corrosion-deposition potential. Recirculating cooling water was found to be 'balanced' in nature in terms of both Langelier Saturation Index(LSI) and Ryzner Stability Index (RSI), comprising of multiple water quality parameters. However, there was significant fluctuation in Total Suspended Solids (TSS) level, which enhanced probability of erosion-deposition. Besides, absence of oxygen scavenging chemical in water treatment regime increased possibility of interfacial oxygen induced corrosion due to comparatively lower dissolution level of oxygen at higher temperature attained during cooling phase. Based on analytical understanding and observations root cause of the problem were identified and specific measures were recommended.

INTRODUCTION

The cooling water posts of skid pipes in the reheating furnace zone of a steel plant are prone to damage, particularly at locations just below the hearth level. Metallurgical analysis had shown that while there was no issue with pipe material, there were whitish deposits inside the pipe primarily consisting of $CaCO_3$, $MgCO_3$, $CaSiO_3$ and SiO_2. The layer below these scale deposits was found primarily to be Fe_2O_3. Considering frequent inner surface brittleness observed, as well as tendency of increased deposition in water carrying skid pipes & posts, there was a need to investigate the issue holistically from water quality perspective, in order to ensure uninterrupted plant productivity.

Aspects of furnace cooling

Fig. 1 provides the zone of concern in Walking Beam type Reheating Furnace (WBRF). The skids (Fig.2) are cooled using circulating water. Fig 3 shows the deposition observed in some pipes replaced earlier.

Make-up water is stored in a chamber (Cold Well) and recirculated as shown in the water flow schematic (Fig 4). There exists a stand-alone self cleaning filtration unit attached to cold well where water is re-circulated at an average rate of 100 m^3 / hr. From Cold Well, water is sent to reheating furnace circuit at an average rate of 1000 m^3 / hr as and when the furnace remains operational. The basic characteristics of the WBRF cooling water system is as follows:

Maximum water recirculation rate	: 1060 m^3/hr
Emergency water recirculation rate	: 600 m^3/hr
Maximum increase in recirculated water temperature	: 12^0C
Source of make-up water	: Industrial Water
System Metallurgy	: Mild Steel

Fig. 1: Reheating furnace zone

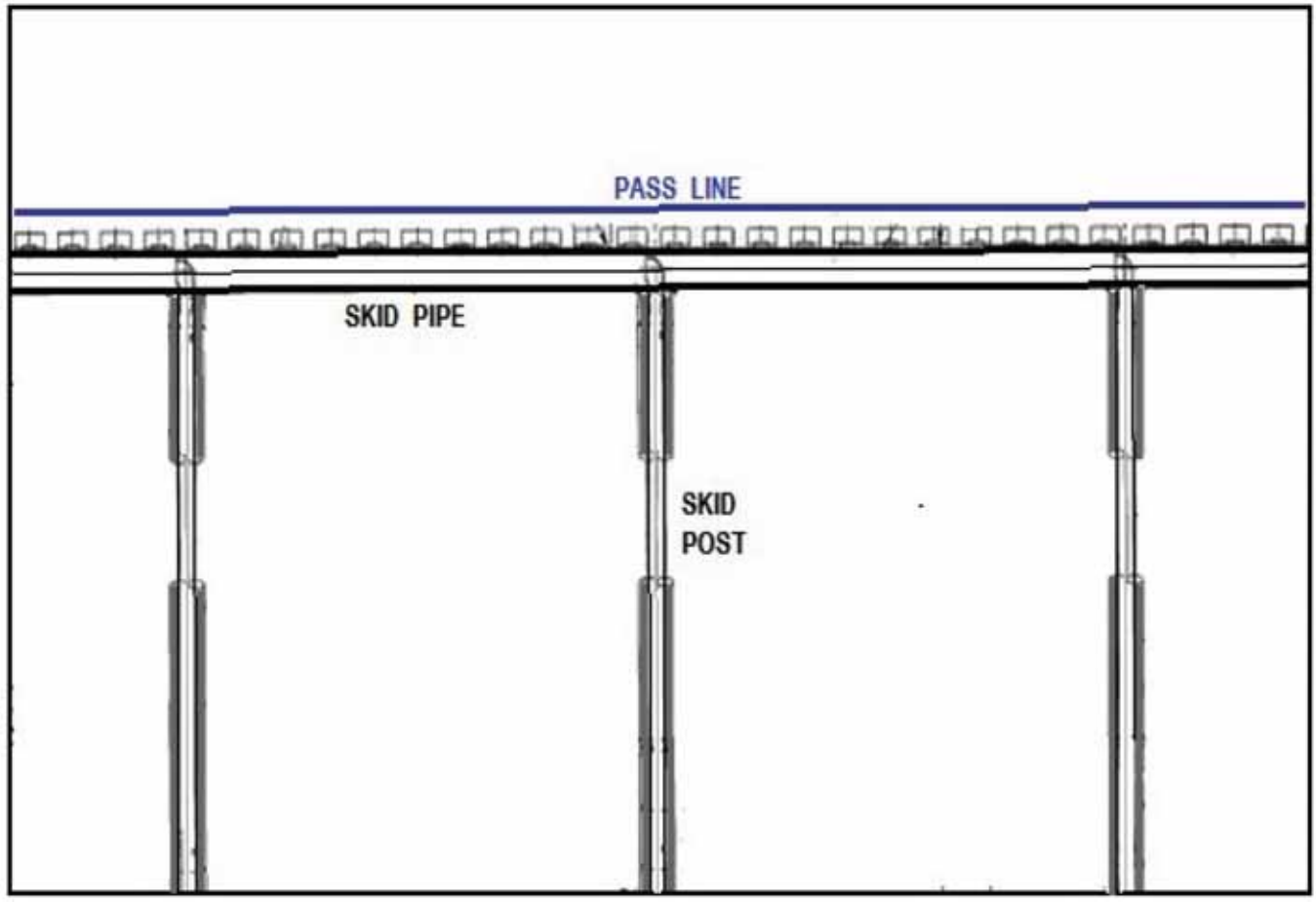


Fig.2: Basic configuration of furnace cooling system

Fig. 3 : Deposits in replaced pipes

Parameters of relevance[1, 2, 3,4,5,6]

There are a number of variables which can influence water interfaces in a system, especially for mild steel water systems. A compilation of key variables impacting mild steel systems, in no particular order, are:

- Water Quality.
- Temperature.
- pH.
- Water Velocity.
- Oxidant.
- Biomass or Slime.
- Chloride and Sulfates.
- Calcium Hardness.
- Metallurgy.
- Corrosion Inhibitors.

In a cooling circuit, make up water is used for the purpose of maintaining the hold-up volume which also adds to dissolved oxygen content in the closed circuit water. Since closed circuit water remains at a positive pressure, presence of any amount of oxygen is detrimental to the system. Therefore, in order to attain improved water quality and reduced water side effects, following parameters can be considered most important for cooling water circuits:

- TDS/ conductivity
- TSS
- pH
- Alkalinity

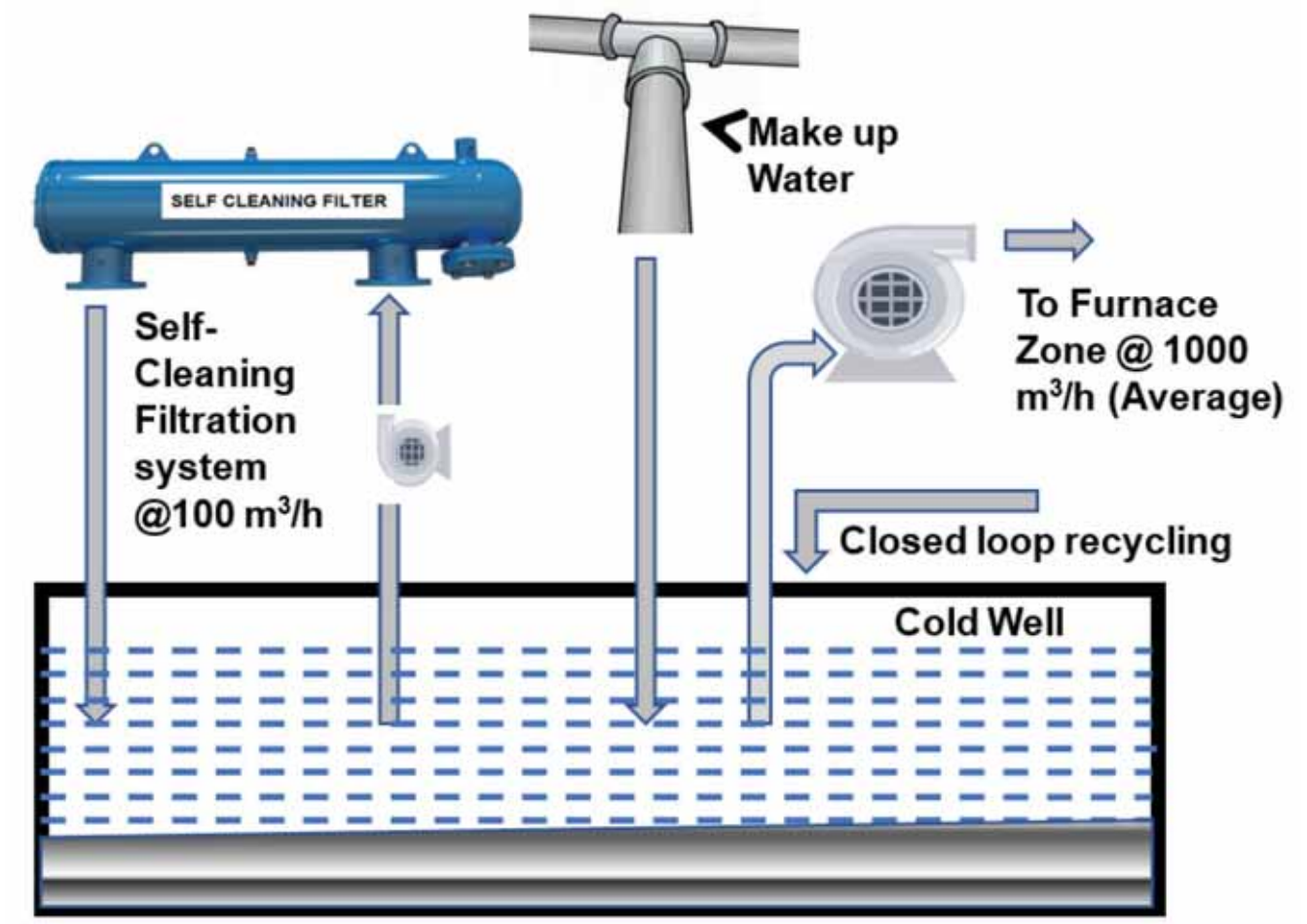


Fig.4: Schematic of furnace cooling water recirculation system

- Hardness
- Temperature
- Dissolved oxygen

Relevant aspects of monitoring

Effect of water quality in cooling water systems in terms of scaling, corrosion, erosion and fouling depends on a large number of parameters and their complex interactions and relationships. Under ideal circumstances exact effects can be ascertained based on on-line as well as real-time data generation of a large number of parameters and consequent computational model based analyses. However, from a practical perspective, for in-situ determination of water quality effects, a number of empirical tools can be used based on specific context. Discussion on these tools is beyond the purview of current treatise. As per literature, in the given context, the most appropriate tools which have been found to be applicable are Langelier Saturation Index (LSI) and Ryzner Stability Index (RSI)

Langelier Saturation Index (LSI)[7]

LSI is a measure of a solution's ability to dissolve or deposit calcium carbonate and is often used as an indicator of the corrosivity of water. The index is not related directly to corrosion, but is related to the deposition of a calcium carbonate film or scale; this covering can insulate pipes and other components of a system from contact with water. When no protective scale is formed, water is considered to be aggressive, and corrosion can occur. Highly corrosive water can cause system failures or result in detrimental effects because of dissolved constituents. An excess of scale can also damage water systems, necessitating repair or replacement.

In order to calculate the simplified version of LSI (Eqn 1), it is necessary to know the Alkalinity (mg/L as $CaCO_3$), the calcium hardness (mg/L Ca^2+ as $CaCO_3$), and Total Dissolved Solids(TDS, in mg/L), the actual pH, and the temperature of the water (^{0}C).

$LSI = pH – pHs$ ... (1)

Where,

pH is the measured water pH

$pHS = (9.3 + A + B) – (C + D)$

$A = (Log_{10} [TDS] – 1) / 10$

$B = -13.12 \times Log_{10} (^0C + 273) + 34.55$

$C = Log_{10} [Ca^{+2} \text{ as } CaCO_3] – 0.4$

$D = Log_{10} [\text{Alkalinity as } CaCO_3]$

Ryznar Stability Index (RSI)[8]

Simplified version of RSI(Eqn 2) attempts to correlate an empirical database of scale thickness observed in municipal watersystems to the water chemistry. Like LSI, the RSI has its basis in the concept of saturation level. Ryznar attempted to quantify the relationship between calcium carbonate saturation state and scale formation. The RSI takes the form:

$$RSI = 2(pHs) - pH.... (2)$$

Where:

pH is the measured water pH

pHsis the pH at saturation in calcite or calcium carbonate

Tables 1 & 2 shows the values of these saturation indices, their implications and general approach to management in cooling water systems

Table 1: Langelier Saturation index and implications

Langelier Saturation Index	Description	Generic water quality management approach
-5	Severe Corrosion	Strong Corrosion Inhibitor Treatment
-3	Moderate Corrosion	
-2	Moderate Corrosion	
-1	Mild Corrosion	Scale Treatment
-0.5	None- Mild Corrosion	
0	Near Balanced	Balanced Treatment
0.5	Some Faint Coating	Scale Preventive Treatment
1	Mild Scale Coating	
2	Mild to Moderate Coatings	
3	Moderate Scale Forming	Strong Scale Preventive Treatment
4	Severe Scale Forming	

Table 2 : Ryznar Stability index and implications

Ryznar Stability Index	Description	Generic water quality management approach
4 - 5	Highly Scale Forming	Polymer Scale Preventive Treatment
5 - 6	Slightly Scale Forming	General Scale Preventive Treatment
6 - 7	Slightly Scale Forming / Corrosive	Treatment according to other parameter
7 - 7.5	Corrosive	Corrosion Inhibitor Treatment
7.9 - 9	Highly Corrosive	Strong Corrosion Inhibitor Treatment
>9	Very Highly Corrosive	

Although effect on water systems depends on combined impact of a number of water quality parameters, the generally acceptable range of parameters for circulating cooling water, as reported in application literature in various contexts are as under (Table 3):

Table 3: Generally Acceptable range of some relevant water quality parameters used in circulation loop

Parameter	Generally Acceptable Range
pH	7.5-8.5
Conductivity	100-300 s/cm
Total Hardness	100-150 mg/l
Total Alkalinity	100-150 mg/l
TDS	100-200 mg/l
TSS	< 5 mg /l

Experimental

Thirty two (32) sets of water samples were analyzed through standard methods for a period of over 3 months. The sampling period and frequency was randomized in such a manner so that true representative picture of water quality at various points of relevance in water circuit is obtained.

The samples were collected from 4 locations, namely

a) Make-up Water in furnace circuit,

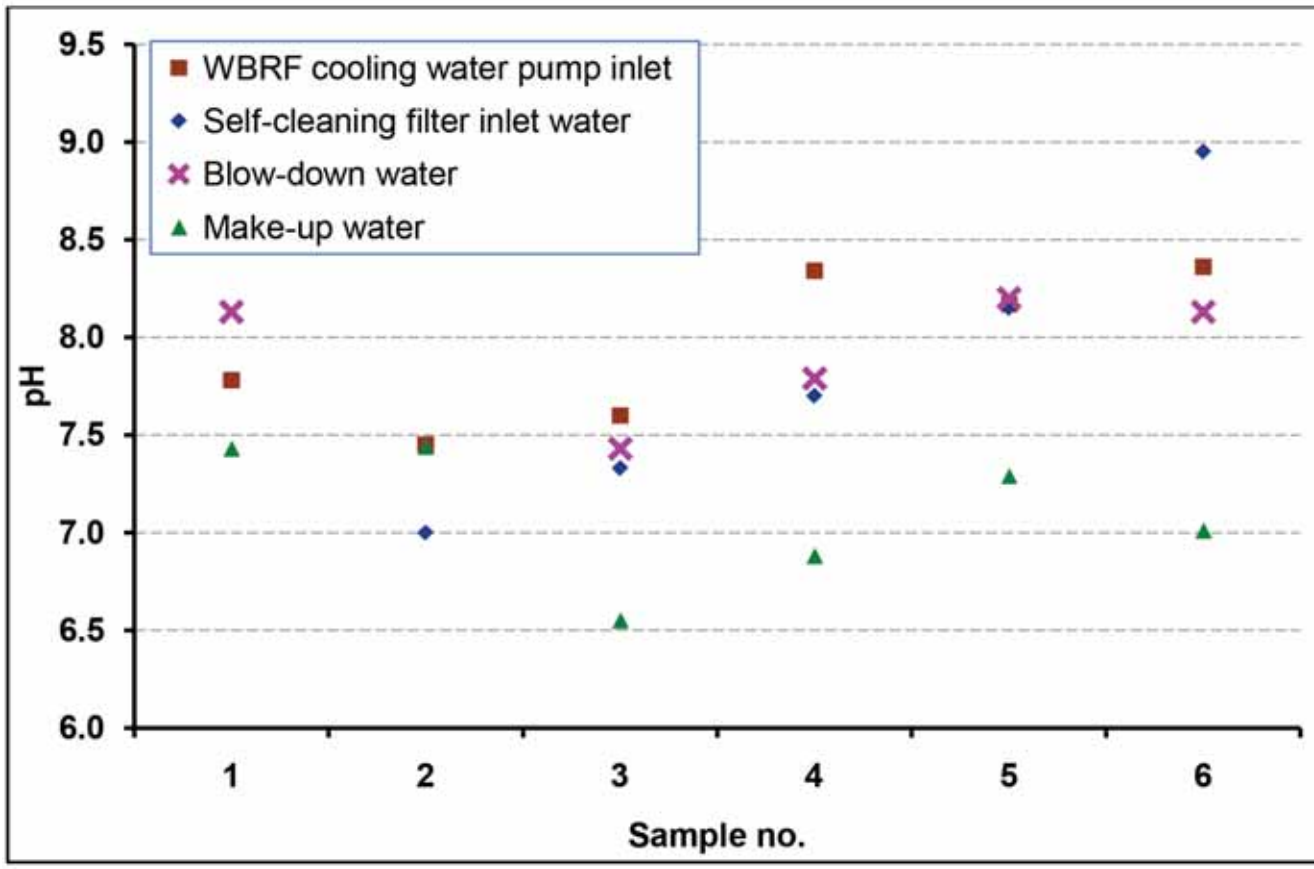


Fig.5 : pH of water at different sampling points on random days

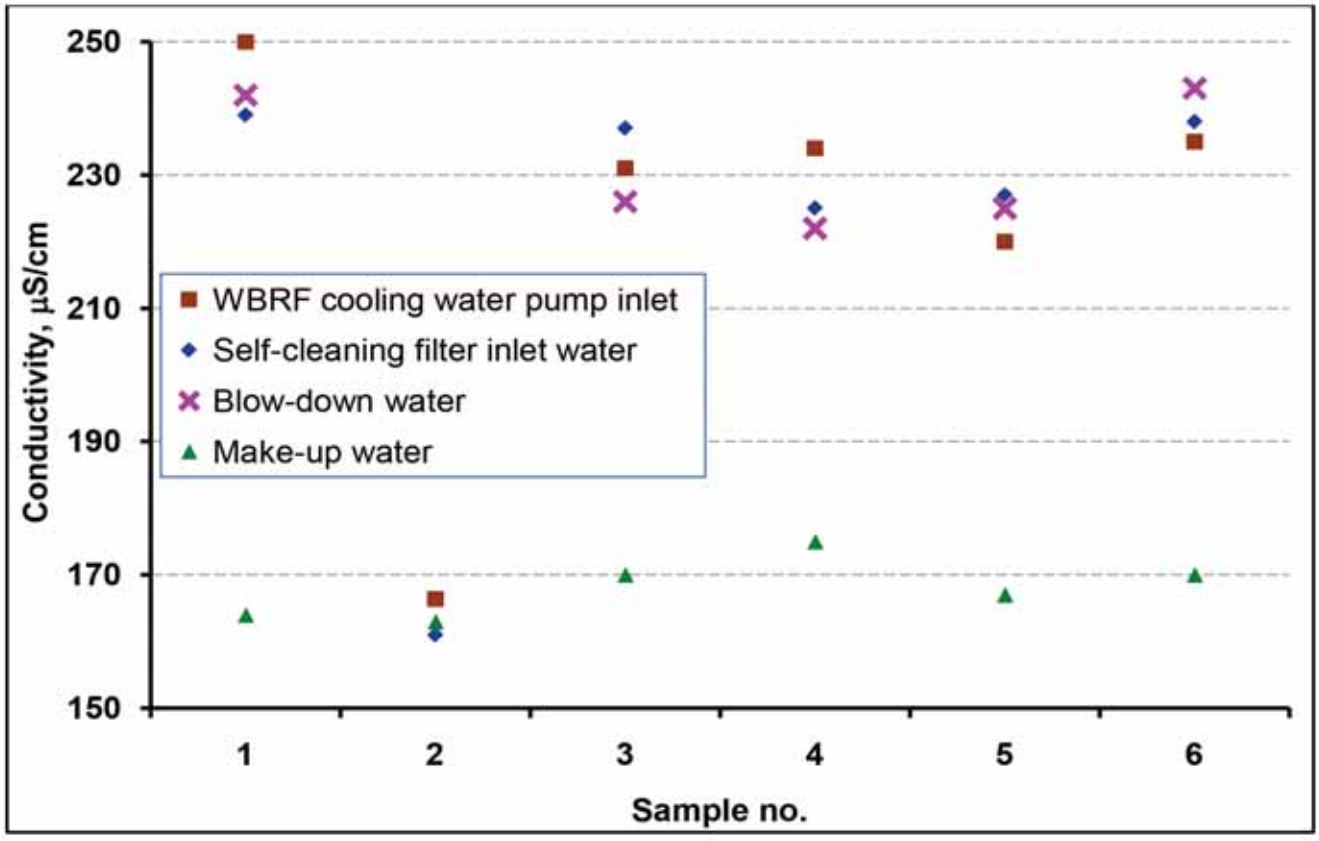


Fig.6 : Conductivity of water at different sampling points on random days

b) Blowdown water of Cooling Tower or Furnace circuit,
c) Pump Area, and
d) Self Cleaning circuit

Each set was then analyzed for the following quality parameters

i) pH,
ii) Total Hardness,
iii) Alkalinity,
iv) TDS/Conductivity, and
v) Total Suspended Solids (TSS)

Results and Discussions

Figs (5-10) shows the profile of relevant water quality parameters measured over a period at various points in the circuit. By comparing these profiles with Table 3 it could be concluded that except TSS all other parameters were within acceptable range.

Combined effect of parameters,as estimated through calculation of LSI &RSI and comparison of Figs 11 & 12 with Tables 1 & 2, also corroborates the trend obtained from individual parameters. It can be observed that except make up water, LSI and RSI of all other locations are generally in acceptable range and amenable to moderate chemical treatment in water circuit. This is expected since make up water is generally more aggressive that recirculating water, the very reason of requirement of regular chemical treatment in water circuit.

Therefore, It could be reasonably ascertained that the parameters included in LSI and RSI, which are often considered part of inherent characteristics of water, are not primarily responsible for erosion-corrosion-deposition in the circuit; In view of this, it could be concluded that root cause of the problem may lie in suspended solids as well as dissolved oxygen carryover to cooling water skids and pipes. The settling phenomenon of suspended solids could be validated through significant quantity of settled sludge as could be visually observed in cold well. This is because, due to complex flow properties even low level of suspended solids can lead to setting-deposition-erosion phenomenon in the circuit and oxygen carryover can lead to surface corrosion.

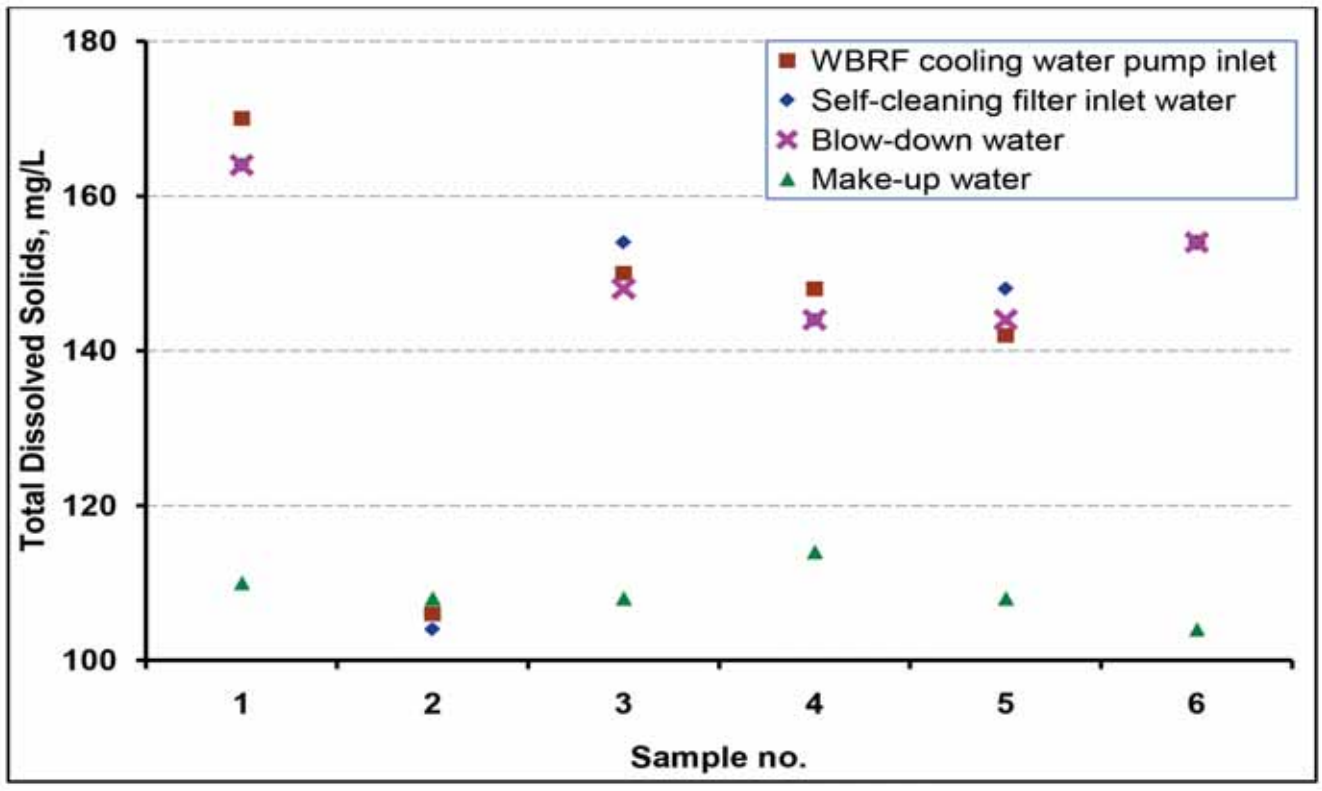


Fig.7 : TDS of water at different sampling points on random days

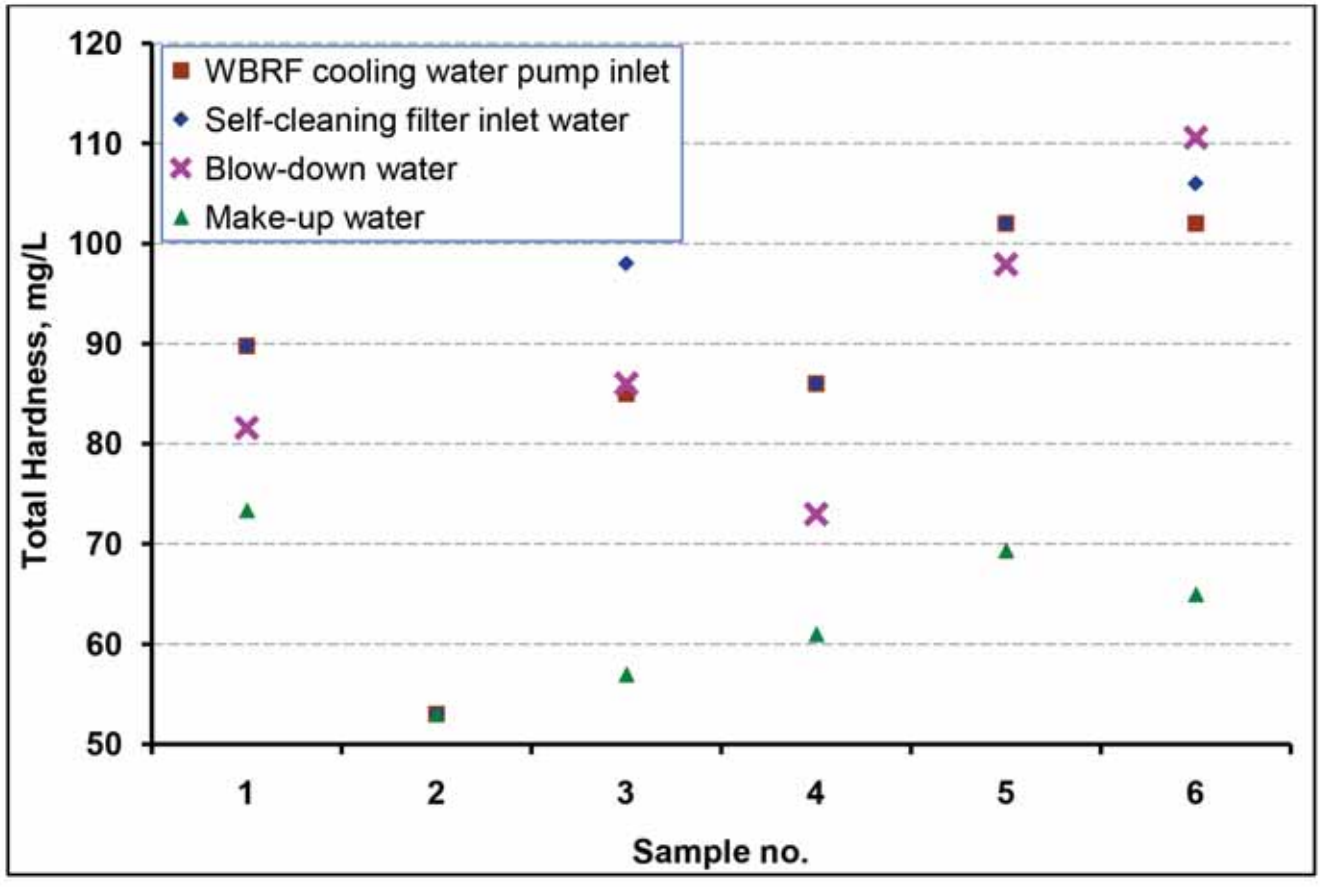


Fig.8 : Total Hardness of water at different sampling points on random days

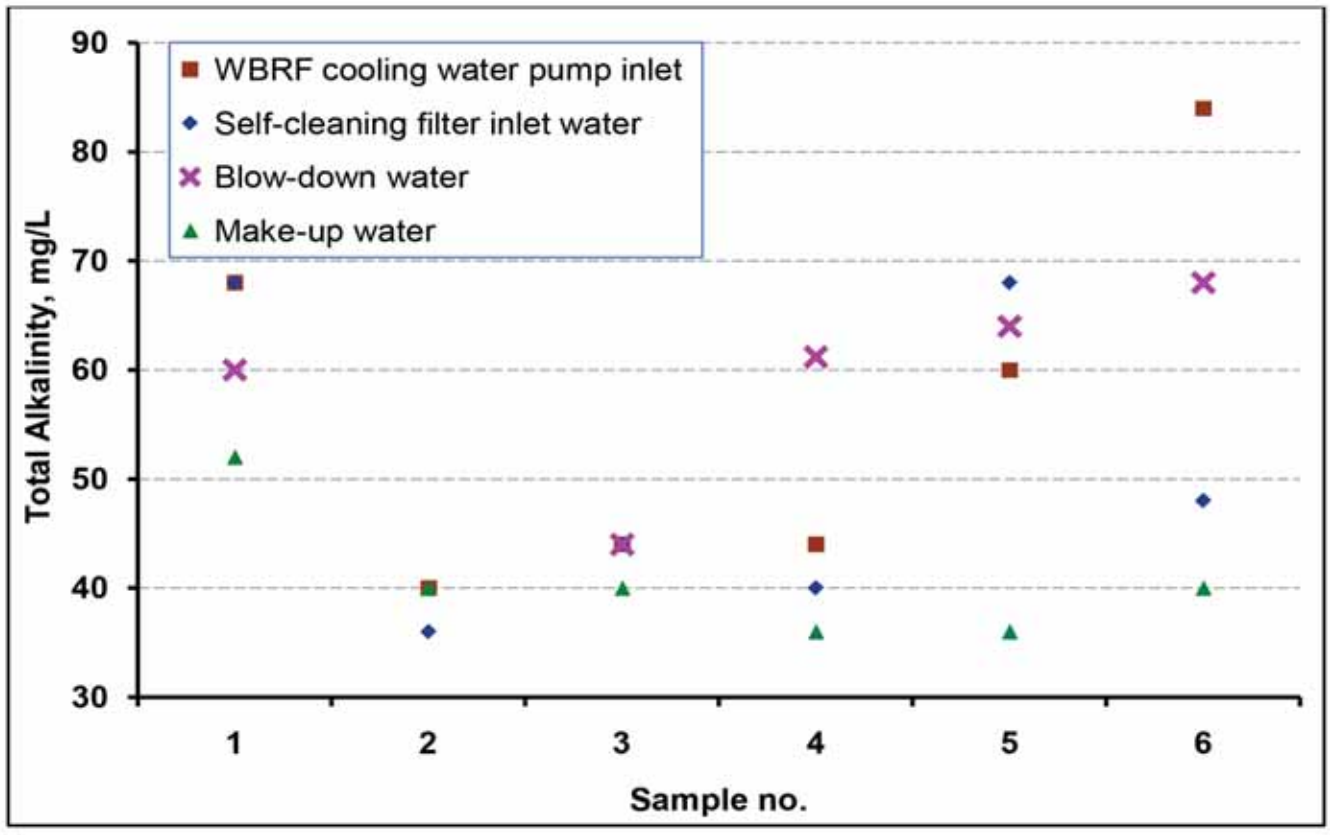


Fig.9 : Total alkalinity of water at different sampling points on random days

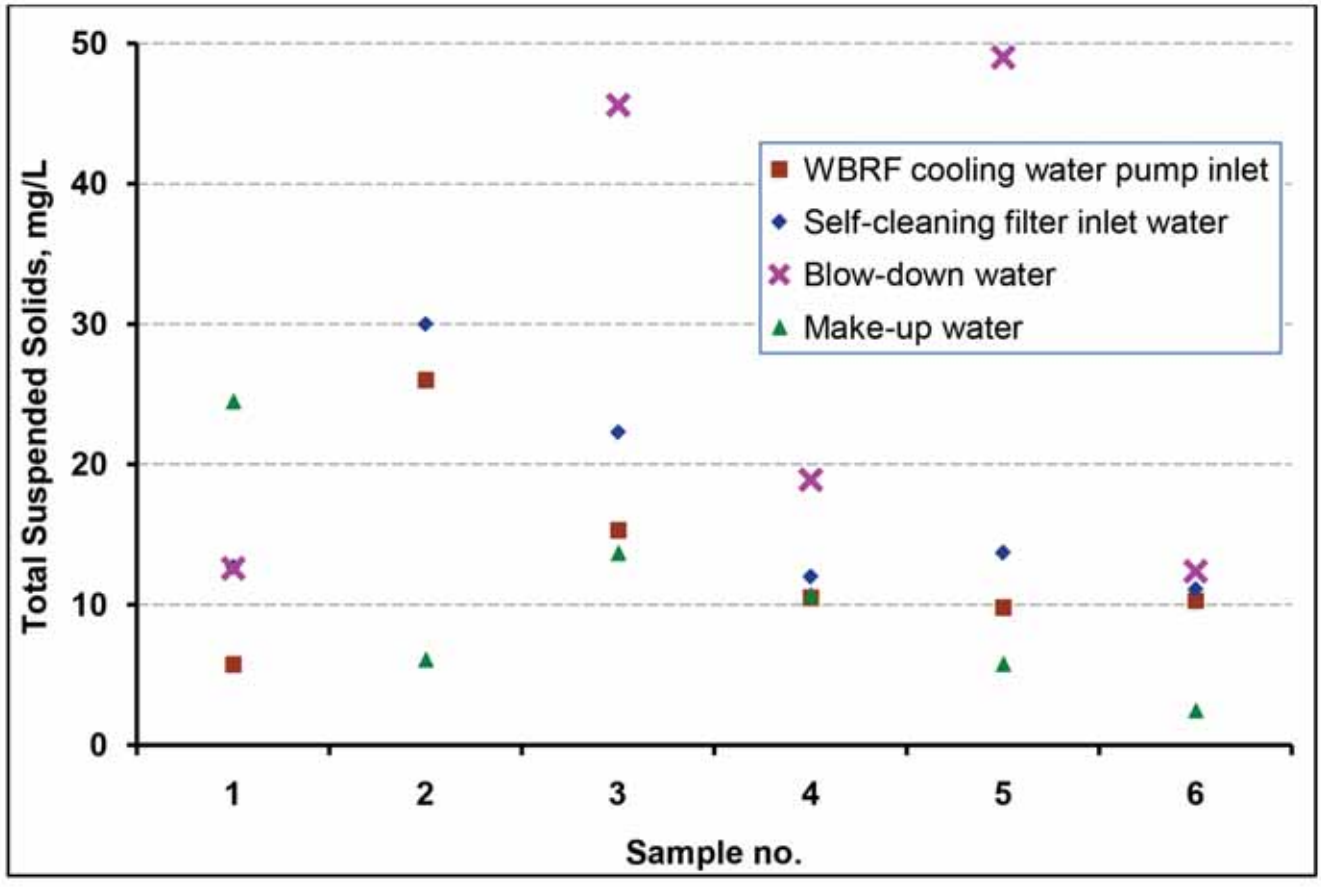


Fig.10 : TSS in water at different sampling points on random days

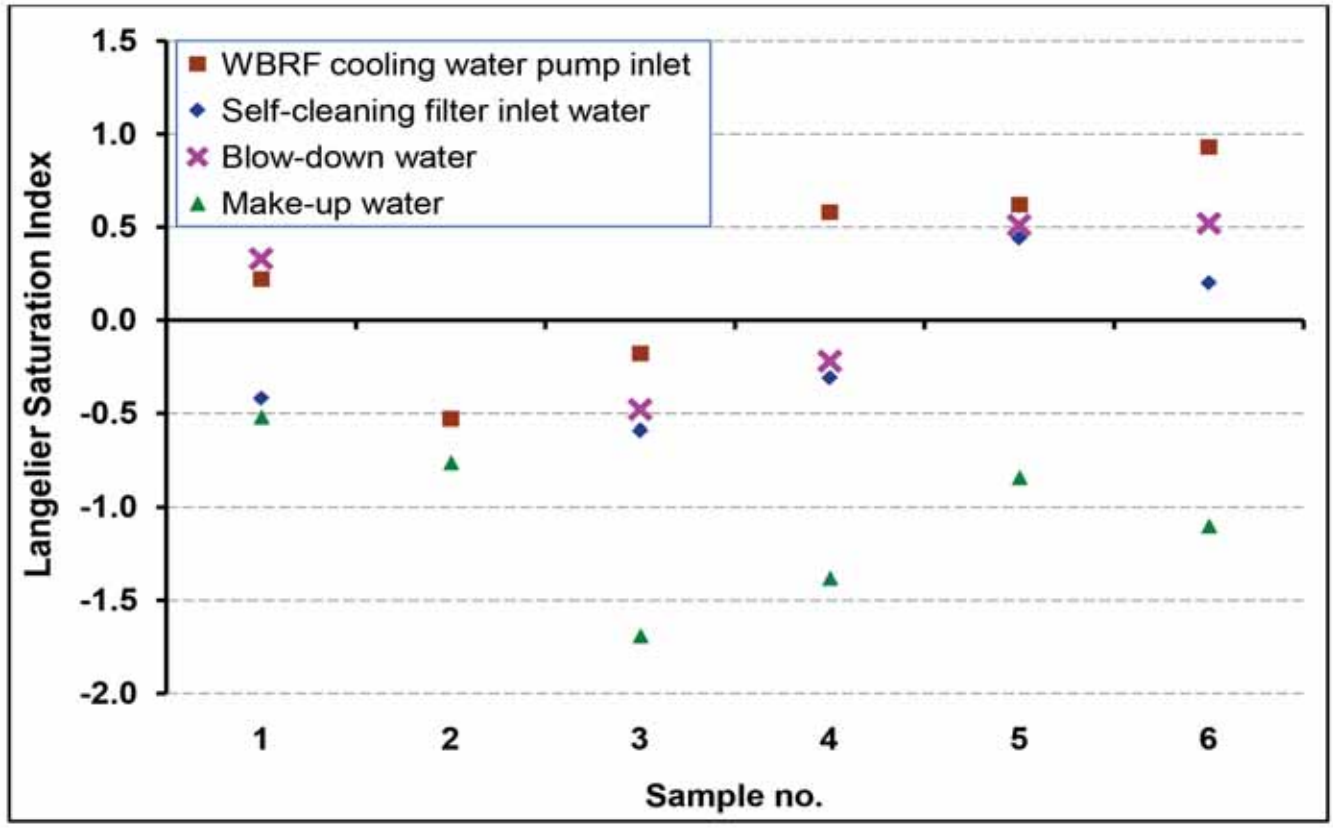


Fig.11 : LSI of water at different sampling points on random days

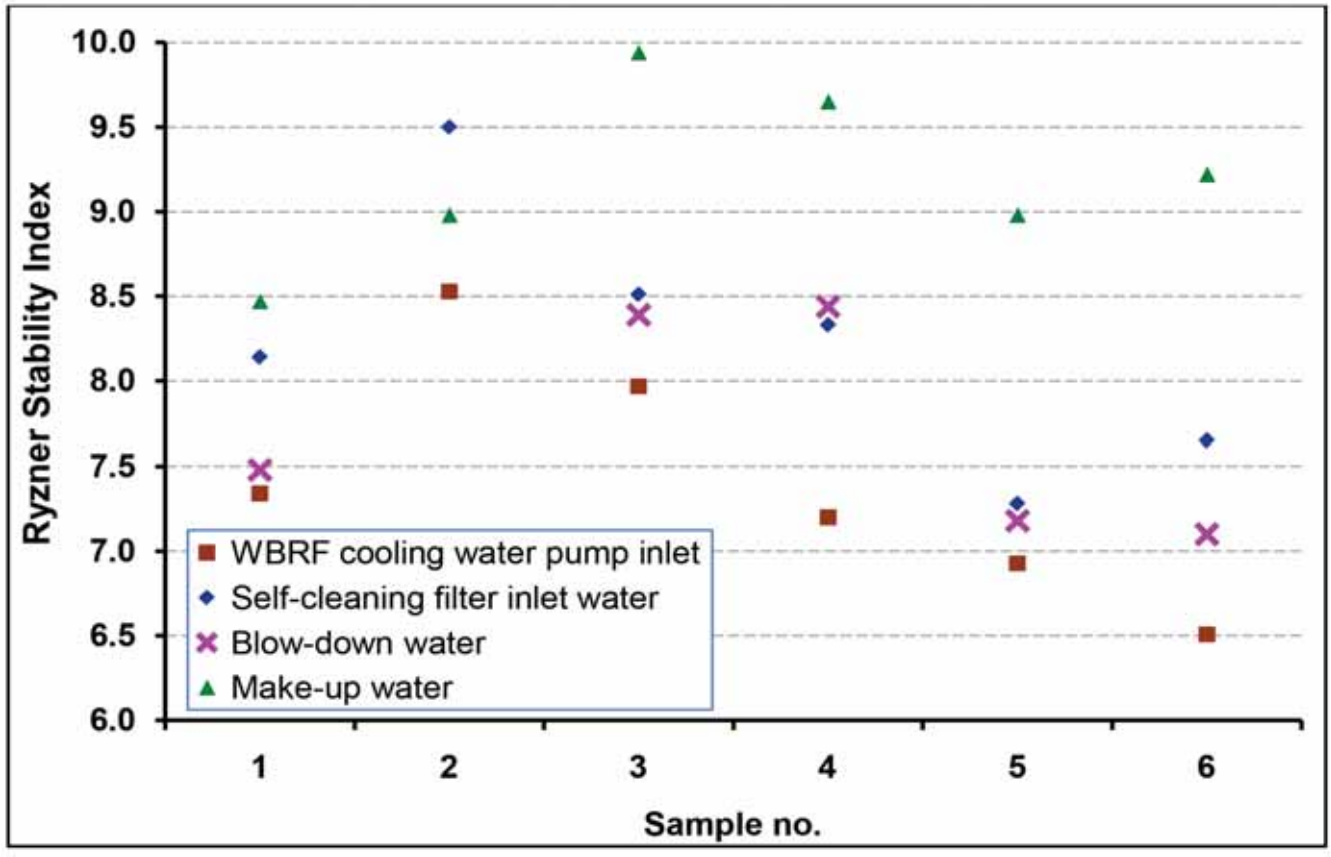


Fig.12 : RSI of water at different sampling points on random days

A presumptive quantitative estimation of possibility of such deposition is shown below.

Assumptions

- Average flow of water in WBRF cooling water circuit 1,000 m^3/h
- WBRF monthly operation (25 days @ 20 hr/day) 500 hrs
- Minimum Avg. TSS of water in WBRF cooling water circuit 10 mg/L
- Presumptive fraction of suspended particles that may settle in WBRF cooling water circuit due to inner pipe surface roughness and inherent water flow properties 5 %
- Presumptive fraction of particles settling in WBRF cooling water circuit that may get converted into solid deposits in association with colloidal and dissolved solids 20 %

Calculations

- Amount of settable suspended particles that may settle in WBRF cooling water circuit = 10 mg / L x 5 %
  = 0.5 mg / L
  = 0.5 g / m^3
- Presumptive accumulation of settable suspended particles = 0.5 g / m^3 x 1,000 m^3/h x 500 h
  = 250 kg
- Presumptive Monthly solid deposition = 300 kg x 20 %
  = 50 kg

No treatment for Dissolved Oxygen (DO) is practiced for furnace cooling water circuit. As per quality standards of Industrial water, as well as ambient temperature, in inlet make-up water DO varies between 3.5 – 4.5 mg/L. Considering the lower dissolution rate of oxygen at higher temperature, release of DO in water in pipe inner surface may lead to erosion-corrosion of pipe surface.

A presumptive quantitative estimation of possibility of such erosion corrosion is given below.

Assumptions

- Average flow of water in WBRF cooling water circuit 1,000 m^3/h
- WBRF monthly operation duration 500 hrs
- Minimum oxygen level in inlet make-up water 3 mg/L
- Presumptive level of Oxygen coming out of water during heat transfer 10%
- Presumptive percent of released oxygen reacting with Iron 10 %
- In watery environment most of the corrosion products formed from steel is Fe_2O_3

Calculations

- Oxygen coming out of water during heat transfer = 3 mg / L x 10 %
  = 0.3 mg / L
  = 0.3 g / m^3
- Moles of O available for reaction = 0.3 g / m^3 ÷ 16 g O / mole O
  = 0.018 mole O/ m^3
- Moles of Fe consumed after reaction with O to form Fe_2O_3 = 0.1 X (2/3) mole Fe / mole O x 0.018 mole O/m^3
  = 0.0012 mole Fe/ m^3
- Presumptive Monthly erosion -corrosion-depletion of iron = 0.0012 mole Fe / m3 x 1,000 m^3/h x 500 h X 55.8 g Fe/Mole
  = 33.8 Kg/Month

Recommendations

- Mechanical deaeration system needs to be introduced before water enters the cooling circuit of furnace zone. Considering that separation of this circuit may need systemic change, oxygen scavenging chemicals need to be used in the cooling water circuit of WBRF zone, along with scaling and corrosion inhibitors, to prevent oxidative corrosion of inner surface of closed loop water system as preventive measure.
- A baffle/separator wall need to be erected in the cold well (Fig 4 schamtic) to separate make up water input zone and furnace water pump inlet zone so that possibility of ingress of settled suspended solids in furnace cooling water circuit gets considerably reduced.
- Stand alone self cleaning filtration system need to be kept in furnace water pump inlet zone side of baffle/

separator; a separate drain line may be introduced at the cold well bottom of makeup water input zone for regular flushing of settled slurry.

- Further, considering variable levels of suspended solids in makeup water, capacity of self-cleaning filtration system of cold well is low when compared to flow rate of input water to furnace circuit. Preferably a higher capacity (i.e. similar to make up water flow rate) in-line self Cleaning filtration System may be introduced before water is sent to Furnace circuit.
- On-line conductivity monitoring system may be introduced at Cold well and blowdown line for ensuring variable level of blowdown for maintaining desired Cycle of Concentration in furnace water circuit.

CONCLUSIONS

It is evident from analysis of scaling and corrosion related water quality parameters (i.e. relevant dissolved mineral constituents) that chemical treatment has been working satisfactorily in keeping these effects under check. Same has also been corroborated by analysis of saturation indices. In view of this, there is no need of feed water softening.

As per industrially reported practice, an amount up to 25 mg/L is allowed in cooling water circuit when Type 304 stainless steel is used as pipe material. Prima facie, this may be considered as tolerable level for make-up water when full scale self-cleaning filtration system is in place. Therefore, current level of suspended solids in furnace pumping loop is higher than desirable considering very low flow rate of self-cleaning filtration system. Currently there is no removal or treatment system for dissolved oxygen in cold well. Since furnace cooling system involves rise of temperature of cooling water, it entails release of oxygen which significantly enhances probability of oxidizing inner pipe surface and produce iron oxide deposition.

Therefore, suspended solids induced surface deposition and internal release of oxygen during cooling phase is the most probable reason for inducing deposition-corrosion in cooling water circuit. These have been corroborated by regular sludge deposition in the bottom of cold well and presence of iron oxides in pipe surface. Recommendations were made to comprehensively address these identified root cause/s.

REFERENCES

1. Nalco Water Handbook
2. Performance Improvement for Cooling Water Systems, Dawn C Eden, David A Eden, David Delve Honeywell Process Solutions, White Paper, 2007
3. A performance based approach to cooling water chemistry control, Power Plant Chemistry, 2004, 6(4), pp 203-222
4. Treatment and Corrosion Control of Cooling Water, Technical Note, Rose Corrosion Services
5. Chemical Treatment of Water for cooling and heating systems , Technical document, Georgia Institute of Technology
6. An Industrial facility's guide to cooling tower water treatment, M/S SAMCO Technical e-book
7. Langelier and Aggressiveness Indices , HACH method 8073 description
8. Studies on Performance of indices in cooling water system, S Sathish Kumar et al, Indian Journal of Chemical Technology, Vol 19, January 2012, pp 75-80

Corresponding author email: smm@sail.in

Energy, Environment & Ecology

COP26: Together for Our Planet

The UN Climate Change Conference in Glasgow (COP26 31Oct-12 Nov 2021) brought together 120 world leaders and over 40,000 registered participants, including 22,274 party delegates, 14,124 observers and 3,886 media representatives. For two weeks, the world was riveted on all facets of climate change — the science, the solutions, the political will to act, and clear indications of action.

The outcome of COP26 – the Glasgow Climate Pact – is the fruit of intense negotiations among almost 200 countries over the two weeks, strenuous formal and informal work over many months, and constant engagement both in-person and virtually for nearly two years.

"The approved texts are a compromise," said UN Secretary-General António Guterres. "They reflect the interests, the conditions, the contradictions and the state of political will in the world today. They take important steps, but unfortunately the collective political will was not enough to overcome some deep contradictions."

Cuts in global greenhouse gas emissions are still far from where they need to be to preserve a liveable climate, and support for the most vulnerable countries affected by the impacts of climate change is still falling far short. But COP26 did produce new "building blocks" to advance implementation of the Paris Agreement through actions that can get the world on a more sustainable, low-carbon pathway forward.

What Was Agreed?

Recognizing the emergency

Countries reaffirmed the Paris Agreement goal of limiting the increase in the global average temperature to well below 2^0C above pre-industrial levels and pursuing efforts to limit it to 1.5^0C. And they went further, expressing "alarm and utmost concern that human activities have caused around 1.1^0C of warming to date, that impacts are already being felt in every region, and that carbon budgets consistent with achieving the Paris Agreement temperature goal are now small and being rapidly depleted." They recognized that the impacts of climate change will be much lower at a temperature increase of 1.5^0C compared with 2^0C.

Accelerating action

Countries stressed the urgency of action "in this critical decade," when carbon dioxide emissions must be reduced by 45 per cent to reach net zero around mid-century. But with present climate plans – the Nationally determined Contributions — falling far short on ambition, the Glasgow Climate Pact calls on all countries to present stronger national action plans next year, instead of in 2025, which was the original timeline. Countries also called on UNFCCC to do an annual NDC Synthesis Report to gauge the present level of ambition.

Moving away from fossil fuels

In perhaps the most contested decision in Glasgow, countries ultimately agreed to a provision calling for a phase-down of coal power and a phase-out of "inefficient" fossil fuel subsidies – two key issues that had never been explicitly mentioned in decisions of UN climate talks before, despite coal, oil and gas being the main drivers of global warming. Many countries, and NGOs, expressed dissatisfaction that the language on coal was significantly weakened (from phase-out to phase-down) and consequently, was not as ambitious as it needs to be.

Delivering on climate finance

Developed countries came to Glasgow falling short on their promise to deliver US$100 billion a year for developing countries. Voicing "regret," the Glasgow outcome reaffirms the pledge and urges developed countries to fully deliver on the US$100 billion goal

urgently. Developed countries, in a report, expressed confidence that the target would be met in 2023.

Stepping up support for adaptation

The Glasgow Pact calls for a doubling of finance to support developing countries in adapting to the impacts of climate change and building resilience. This won't provide all the funding that poorer countries need, but it would significantly increase finance for protecting lives and livelihoods, which so far made up only about 25 per cent of all climate finance (with 75 per cent going towards green technologies to mitigate greenhouse gas emissions). Glasgow also established a work programme to define a global goal on adaptation, which will identify collective needs and solutions to the climate crisis already affecting many countries.

Completing the Paris rulebook

Countries reached agreement on the remaining issues of the so-called Paris rulebook, the operational details for the practical implementation of the Paris Agreement. Among them are the norms related to carbon markets, which will allow countries struggling to meet their emissions targets to purchase emissions reductions from other nations that have already exceeded their targets. Negotiations were also concluded on an Enhanced Transparency Framework, providing for common timeframes and agreed formats for countries to regularly report on progress, designed to build trust and confidence that all countries are contributing their share to the global effort.

Focusing on loss & damage

Acknowledging that climate change is having increasing impacts on people especially in the developing world, countries agreed to strengthen a network—known as the Santiago Network – that connects vulnerable countries with providers of technical assistance, knowledge and resources to address climate risks. They also launched a new "Glasgow dialogue" to discuss arrangements for the funding of activities to avert, minimize and address loss and damage associated with the adverse effects of climate change.

New deals and announcements

There were many other significant deals and announcements – outside of the Glasgow Climate Pact – which can have major positive impacts if they are indeed implemented. These include:

Forests

137 countries took a landmark step forward by committing to halt and reverse forest loss and land degradation by 2030. The pledge is backed by $12bn in public and $7.2bn in private funding. In addition, CEOs from more than 30 financial institutions with over $8.7 trillion of global assets committed to eliminate investment in activities linked to deforestation.

Methane

103 countries, including 15 major emitters, signed up to the Global Methane Pledge, which aims to limit methane emissions by 30 per cent by 2030, compared to 2020 levels. Methane, one of the most potent greenhouse gases, is responsible for a third of current warming from human activities.

Cars

Over 30 countries, six major vehicle manufacturers and other actors, like cities, set out their determination for all new car and van sales to be zero-emission vehicles by 2040 globally and 2035 in leading markets, accelerating the decarbonization of road transport, which currently accounts for about 10 per cent of global greenhouse gas emissions.

Coal

Leaders from South Africa, the United Kingdom, the United States, France, Germany, and the European Union announced a ground-breaking partnership to support South Africa – the world's most carbon-intensive electricity producer— with $8.5 billion over the next 3-5 years to make a just transition away from coal, to a low-carbon economy.

Private finance

Private financial institutions and central banks announced moves to realign trillions of dollars towards achieving global net zero emissions. Among them is the Glasgow Financial Alliance for Net Zero, with over 450 firms across 45 countries that control $130 trillion in assets, requiring its member to set robust, science-based near-term targets.

Analysis of COP26 Meet and Outcome

The 26th Conference of parties to the United Nations Framework Convention on Climate Change (COP26) is done and dusted, and the world has signed on to the Glasgow Climate Pact.

The question now is whether this pact will go far enough to keep the world at a 1.5 degree Celsius temperature rise above the pre-industrial levels — necessary to avoid the catastrophic impacts of a changing climate. My verdict is a resounding "no".

This is not only because the commitments to cut greenhouse gas emissions are way below the required level, but also because COP26 has once again highlighted the deep distrust between the already rich and the emerging world. It did little to acknowledge that

combating climate change requires cooperation at a scale never seen before.

But as all of us are looking to clutch onto some signs of hope. The fact is the world came together after a gap of two years and back-breaking lockdowns and economic losses — due to the novel corona virus disease (COVID-19) — to acknowledge that the threat of climate change is real and that urgent transformational actions are needed.

We are seeing the onslaught of weird and extreme weather events and increased energy prices across the world. It is clear that there is no going back — Planet Earth needs drastic emission reductions now, by the end of this decade, not later.

However, the Glasgow Climate Pact's fundamental and fatal flaw is engraved in its very first page. "It notes", rather dismissively, "the importance for some of the concept of climate justice". From this point, the entire architecture of ambitious and effective action collapses.

Climate change is about the past, the present and about the future. We cannot erase the fact that certain countries (the US, EU-27, UK, Canada, Australia, Japan and Russia, and now China) have consumed roughly 70 per cent of the carbon budget — the space in the atmosphere that is available to limit the temperature rise to 1.5 C.

But some 70 per cent of the world's people still need the right to development. As these countries grow, they will add emissions and take the world to catastrophic levels of temperature rise. It is for this reason climate justice is not an add-on concept for some, but the pre-requisite for an effective and ambitious agreement.

This lack of understanding is at the core of the problem. It is for this reason that the closing plenary working overtime to reach a deal saw the delegate from the EU– which incidentally has still not phased out coal — chastise the recalcitrant "natives" about the imperative of climate change.

This is when the world of the "natives" is reeling under devastation caused by the cumulative emissions of the already developed nations, including the EU. It is also nothing less than shameful that the world has reneged on the fact that it needed to act on "loss and damage", and it needs to do this, not with lofty words and promises of new committees and discussions, but with hard money for reparation.

It is the same with the need for adaptation — countries have to find ways to deal with the growing ravages of extreme weather. The Glasgow Climate Pact's only achievement — if you can call it so — is that it acknowledges and reiterates the need for financial support for adaptation. But it does nothing more than this.

There is no seriousness or intent shown by the already rich countries to pay for these costs, including the cost of mitigation in the still developing world. The Glasgow Climate Pact "notes with deep regret" that the goal of developed countries to mobilise US $100 billion by 2020, has not been realised. Climate finance is still considered to be part of the narrative on "charity" and the rich world is frankly no longer interested to make the payments.

But the fact is this finance is for climate justice — the same that has been dismissed in the text as important for some. It is needed because the global pact on climate change demands that the countries that have created the problem — countries that are the cause of the cumulative carbon dioxide emissions in the atmosphere — must reduce the emissions drastically based on their contribution.

The rest of the world, which has not added emissions, must get the right to development; to ensure that this growth is low-carbon, finance and technology will be provided. It is part of the cooperative agreement of this interdependent world.

But post COP26, the world is nowhere close to staying within the 1.5 C temperature rise. In fact, as against the goal of cutting emissions by close to 50 per cent below the 2010 levels by 2030, the world will see an increase in emissions in this decade. There is no question that coal must be phased out — but differentially and with real intent to provide funds for transition.

We cannot move the burden of the energy transition to developing countries that are also the most vulnerable to climate change impacts. Climate change is an existential threat and what CoP26 should teach us is that it needs more than kindergarten diplomacy to keep the world safe.

Five things one need to know about the Glasgow Climate Pact

The COP26 UN climate talks in Glasgow have finished and the gavel has come down on the Glasgow Climate Pact agreed by all 197 countries.

If the 2015 Paris Agreement provided the framework for countries to tackle climate change then Glasgow, six years on, was the first major test of this high-water mark of global diplomacy.

So what have we learnt from two weeks of leaders' statements, massive protests and side deals on coal, stopping fossil fuel finance and deforestation, plus the final signed Glasgow Climate Pact?

From phasing out coal to carbon market loopholes, here is what you need to know:

1. Progress on cutting emissions, but nowhere near enough

The Glasgow Climate Pact is incremental progress and not the breakthrough moment needed to curb the worst impacts of climate change. The UK government as host and therefore president of COP26 wanted to "keep 1.5 C alive", the stronger goal of the Paris Agreement. But at best we can say the goal of limiting global warming to 1.5^{0}C is on life support – it has a pulse but it's nearly dead.

The Paris Agreement says temperatures should be limited to "well below" 2^{0}C above pre-industrial levels, and countries should "pursue efforts" to limit warming to 1.5^{0}C. Before COP26, the world was on track for 2.7^{0}C of warming, based on commitments by countries, and expectation of the changes in technology. Announcements at COP26, including new pledges to cut emissions this decade, by some key countries, have reduced this to a best estimate of 2.4^{0}C.

More countries also announced long-term net zero goals. One of the most important was India's pledge to reach net zero emissions by 2070. Critically, the country said it would get off to a quick start with a massive expansion of renewable energy in the next ten years so that it accounts for 50% of its total usage, reducing its emissions in 2030 by 1 billion tonnes (from a current total of around 2.5 billion).

Fast-growing Nigeria also pledged net zero emissions by 2060. Countries accounting for 90% of the world's GDP have now pledged to go net zero by the middle of this century.

Nigeria's population is expected to overtake China's this century.

A world warming by 2.4^{0}C is still clearly very far from 1.5^{0}C. What remains is a near-term emissions gap, as global emissions look likely to flatline this decade rather than showing the sharp cuts necessary to be on the 1.5^{0}C trajectory the pact calls for. There is a gulf between long-term net zero goals and plans to deliver emissions cuts this decade.

2. The door is ajar for further cuts in the near future

The final text of the Glasgow Pact notes that the current national climate plans, nationally determined contributions (NDCs) in the jargon, are far from what is needed for 1.5^{0}C. It also requests that countries come back next year with new updated plans.

Under the Paris Agreement, new climate plans are needed every five years, which is why Glasgow, five years after Paris (with a delay due to COVID), was such an important meeting. New climate plans next year, instead of waiting another five years, can keep 1.5^{0}C on life support for another 12 months, and gives campaigners another year to shift government climate policy. It also opens the door to requesting further NDC updates from 2022 onwards to help ratchet up ambition this decade.

The Glasgow Climate Pact also states that the use of unabated coal should be phased down, as should subsidies for fossil fuels. The wording is weaker than the initial proposals, with the final text calling for only a "phase down" and not a "phase out" of coal, due to a last-second intervention by India, and of "inefficient" subsidies. But this is the first time fossil fuels have been mentioned in a UN climate talk's declaration.

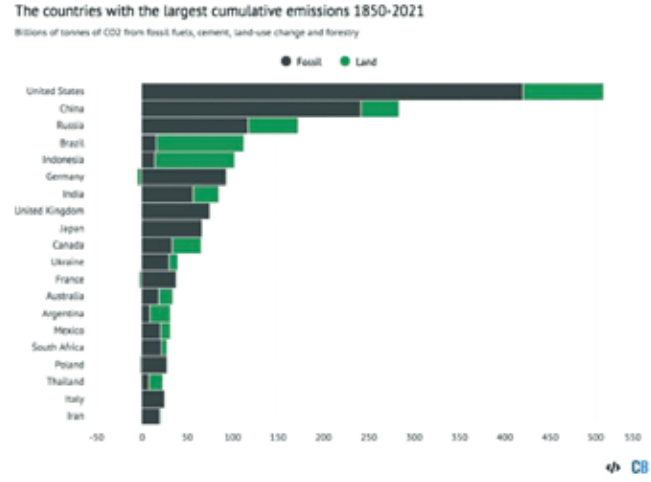
In the past, Saudi Arabia and others have stripped out this language. This an important shift, finally acknowledging that use of coal and other fossil fuels need to be rapidly reduced to tackle the climate emergency. The taboo of talking about the end of fossil fuels has been finally broken.

3. Rich countries continued to ignore their historical responsibility

Developing countries have been calling for funding to pay for "loss and damage", such as the costs of the impacts of cyclones and sea level rise. Small island states and climate-vulnerable countries say the historical emissions of the major polluters have caused these impacts and therefore funding is needed.

Developed countries, led by the US and EU, have resisted taking any liability for these loss and damages, and vetoed the creation of a new "Glasgow Loss and Damage Facility", a way of supporting vulnerable nations, despite it being called for by most countries.

The UK has one twentieth the population of India, yet has emitted more carbon from fossil fuels.



4. Loopholes in carbon market rules could undermine progress

Carbon markets could throw a potential lifeline to the fossil fuel industry, allowing them to claim "carbon offsets" and carry on business as (nearly) usual. A tortuous series of negotiations over article 6 of the Paris Agreement on market and non-market approaches to trading carbon was finally agreed, six years on. The worst and biggest loopholes were closed, but there is still scope for countries and companies to game the system.

Outside the COP process, we will need much clearer and stricter rules for company carbon offsets. Otherwise expect a series of exposé from non-governmental organisation and the media into carbon offsetting under this new regime, when new attempts will emerge to try and close these remaining loopholes.

5. Thank climate activists for the progress – their next moves will be decisive

It is clear that powerful countries are moving too slowly and they have made a political decision to not support a step change in both greenhouse gas emissions and funding to help income-poor countries to adapt to climate change and leapfrog the fossil fuel age.

But they are being pushed hard by their populations and particularly climate campaigners. Indeed in Glasgow, we saw huge protests with both the youth Fridays for Future march and the Saturday Global Day of Action massively exceeding expected numbers.

This means that next steps of the campaigners and the climate movement matter. In the UK this will be trying to stop the government granting a licence to exploit the new Cambo oil field off the north coast of Scotland.

Expect more action on the financing of fossil fuel projects, as activists try to cut emissions by starving the industry of capital. Without these movements pushing countries and companies, including at COP27 in Egypt, we won't curb climate change and protect our precious planet.

Greta Thunberg has already pronounced the novel coronavirus disease (CoP26) climate conference a failure. In important respects, the Swedish activist is correct.

The commitments made at the conference are insufficient to hold global heating to 1.5^0 this century. Leading producers and users of coal, including Australia, rejected a proposed agreement to end the use of coal in electricity generation by 2030. The Australian government went further and refused to commit to reducing methane emissions – a position endorsed by the Labor opposition.

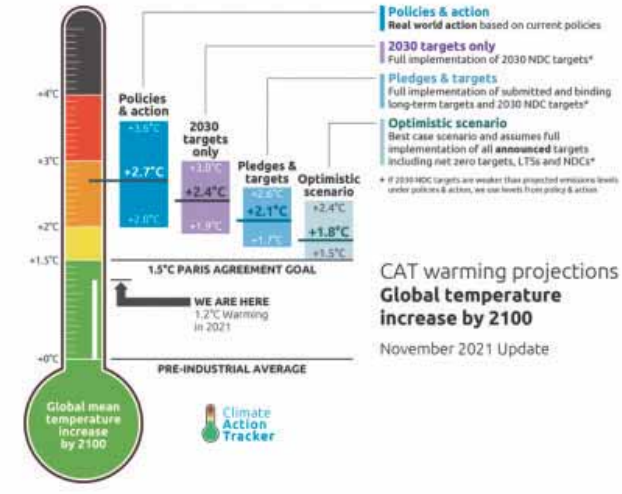
And the rapid economic recovery from the novel coronavirus disease (COVID-19) pandemic has produced an equally rapid recovery in demand for all forms of energy, resulting in spikes in the prices of coal, oil and gas.

On the other hand, considered over a longer term, the outcomes of the Glasgow conference look rather better.

At the Copenhagen climate summit in 2009, participants agreed to aim at holding global heating below 2^0 this century, but did not deliver policy commitments to achieve this goal. The scenarios considered most plausible at the time yielded estimated heating of around 3^0.

The worst-case scenario, commonly described as "business as usual", implied a catastrophic increase of up to 6^0 in global temperatures by 2100. As a result of all this, the Copenhagen talks were considered a spectacular failure.

But heading into the final days of the Glasgow summit, the goal of limiting heating below 2^0 looks attainable, and 1.5^0 is still possible. Despite the inevitable disappointments in the decade or so since Copenhagen, there is still room for hope.



1.5^0 to stay alive

Ahead of COP26, commitments by each nation had the world on track for 2.7^0 warming this century.

The ten days of the talks so far, however, have yielded new binding commitments. According to one analysis, the commitments put the world on a trajectory to 2.4^0 warming. This assessment is based on current submitted climate pledges by each country, known as nationally determined contributions or NDCs, together with legally binding net-zero commitments.

When we account for additional pledges announced — but not yet formalised — by the G20 countries, the projected temperature rise this century lowers to to 2.1^0, according to analysis by Climate Action Tracker released in September.

So that's the good news. And of course, those optimistic trajectories assume all pledges are fully implemented.

It has become clear, however, that even 2^0 of global heating would be environmentally disastrous.

Even under the current 1.1^0 of warming since the beginning of large-scale greenhouse gas emissions, Earth has experienced severe impacts such as devastating bushfires, coral bleaching and extreme heatwaves resulting in thousands of human deaths. Such events will only become more frequent and intense as Earth warms further.

This underscores the vital importance of urgently pursuing the 1.5^0 goal. It is, quite literally, a matter of life and death for both vulnerable human populations and for natural ecosystems.

The idea of a target of 1.5^0, supported by many developing countries, was rejected out of hand by major countries at the Copenhagen conference.

The Paris conference in 2015 marked an important, but still partial move towards the 1.5^0 goal. There, nations agreed on a goal to hold global average temperature rise to well below 2^0 above pre-industrial levels, while pursuing efforts to limit the increase to 1.5^0.

We're yet to see the final communique from Glasgow, and every word in it will doubtless be subject to lengthy negotiation. But it's almost certain to include a strengthening of the language of the Paris Agreement, hopefully with a formal commitment that warming will be held to 1.5^0.

Australia has already borne the brunt of climate-related disasters such as bushfires. Dan Himbrechts/AAP

Reason for hope

As with previous conferences, policy commitments at Glasgow will be insufficient to reach the 1.5^0 target. Most notably, the commitment to reduce methane emissions is, at this stage, merely an aspiration with no concrete policies attached.

And as analysis released found, real-world action is falling far short despite all the net-zero promises. If that "snail's pace" continues, a temperature rise of 2.4^0, or even 2.7^0, remains a distinct possibility.

But the technologies and policies needed to hold warming to 1.5^0 are now available to us. And they can be implemented without condemning developing countries to poverty or requiring a reduction in living standards for wealthier countries.

The fact we have these options reflects both remarkable technological progress and the success of policies around the world, including emissions trading schemes and renewable energy mandates.

Thanks largely to government support, advances in solar and wind technology kicked off in the early 2000s. This ultimately pushed the cost of carbon-free electricity below that of new coal-fired and gas-fired plants.

The technology to address the climate crisis is already here

The biggest impact was felt in the European Union, where carbon prices and emissions trading drove a rapid transition. The EU has a clear path to the goal of net-zero emissions by 2050.

The most important requirement is to accelerate the transition to carbon-free electricity. This involves rapidly expanding solar and wind energy and replacing petrol- and diesel-powered vehicles with electric alternatives.

These changes would incur a one-off cost in scrapping existing power plants and vehicles before the end of their operational life, but would reduce energy and transport costs in the long run.

Other important steps are already beginning. They include reducing methane emissions, and adopting carbon-free production methods for steel, cement and other industrial products. Hydrogen produced from water by electrolysis will be crucial here.

There is no guarantee these outcomes will be achieved. The leading national emitters — China, India and the United States — have all been inconsistent in their pursuit of stabilising Earth's climate.

China is currently wavering as economic difficulties mount. In the US, Donald Trump has not ruled out a presidential bid in 2024 which, if successful, would almost certainly reverse progress there.

Global action on climate change is still not nearly enough, but we're undeniably moving in the right direction. By the time of the next major COP, presumably in 2026, Earth could finally be on a path to a stable climate.

A new, grim projection, released overnight by Climate

Action Tracker, has dashed the cautious optimism following last week's commitments at the UN climate talks in Glasgow. It found the world is still headed for 2.1^0 of warming this century, even if all pledges are met.

Similar new analysis from Climate Analytics suggests if global warming is to be limited to 1.5^0, an enormous ambition gap remains for this decade.

Last week, national leaders shared their plans to cut carbon pollution and to transition to a net-zero emissions economy. Some countries made much more ambitious commitments than others.

The UK for example, as summit hosts, pledged to cut emissions by 68 per cent this decade, while Australia — a clear laggard among developed countries — refused to strengthen the target it set in 2015 to cut emissions by 26-28 per cent by 2030.

Taken together, national announcements clarify that the world has made some progress since the 2015 Paris climate summit, but not nearly enough to avoid climate catastrophe. So what needs to happen in the final days of frantic negotiations at CoP26 to close the ambition gap?

Global ambition in this decisive decade

While most world leaders have headed home, negotiators remain locked in late night talks aimed at securing a "Glasgow Package", including a final political outcome that will keep the goals of the Paris Agreement in reach. Their discussions are now focused on achieving a political outcome that will accelerate climate action this decade.

The 2015 Paris Agreement requires countries to set new and more ambitious targets to reduce emissions every five years and national pledges aren't due again until 2025. But if the world is to keep the Paris Agreement goal of limiting global warming to 1.5^0 in reach, countries will need to increase ambition before then.

More than 100 countries are calling for strengthened ratchet mechanisms to be established in Glasgow, which could require countries like Australia to set a new 2030 target as soon as next year. These proposals have support from major powers, including the United States, but achieving consensus for an ambitious Glasgow package will be a tough ask.

The current 2030 targets (without long-term pledges) put us on track for a 2.4^{0}C temperature increase by the end of the century.

The good news is countries have committed to greater climate action than they did in 2015. This provides hope that the Paris Agreement — which requires stronger commitments over time — is working.

Projections from the International Energy Agency suggested that, if they are fully funded and implemented, Glasgow commitments give the world a 50 per cent chance to limit warming to 1.8^0 this century.

But the bad news? This is a big "if". As it is, Earth is still on track for catastrophic warming. Emissions are projected to rebound strongly in 2021 (after an unprecedented drop in 2020 because of the global pandemic).

Indeed, alongside the sobering findings overnight that we're still on track for at least 2.1^0 global warming, the UN Environment Programme updated its Emissions Gap Report.

Taking last week's pledges into account, it found we're on track to reduce global emissions by just 8% by 2030, falling well short of the 55 per cent reduction needed to keep global warming to below 1.5^0.

Limiting warming to 1.5^0 this century is key to avoiding the worst impacts of climate change, and is a matter of survival for some Pacific island nations.

In Glasgow, groupings of countries at the frontline of climate change — including 55 members of the Climate Vulnerable Forum, 48 Least Developed Countries, and 39 members of the Alliance of Small Island States — have put forward proposals that would require accelerated emissions cuts this decade.

These proposals have won support from key developed nations, including the United States, as part of the High Ambition Coalition – a grouping of countries that unites developed and developing nations which have traditionally not acted in concert.

This coalition was crucial to securing the 2015 Paris Agreement. Last week, it stressed the need to halve global emissions by 2030 and called on parties to deliver more ambitious national commitments well before CoP27 "in line with a 1.5^0 trajectory".

This provides renewed hope Glasgow will deliver a political outcome that will require countries to ratchet up short-term climate action.

Finding a 'landing zone' for a Glasgow deal

The COP26 presidency has tasked the nations of Grenada and Denmark with finding a landing zone for

a Glasgow decision that would "keep 1.5⁰ alive". In October, Denmark released a summary of consultations they held with country negotiators to that point.

It provided options including:

- A requirement for countries that have not yet submitted enhanced targets to do so in 2022
- An annual review of pre-2030 ambition
- A leaders-level event to consider 2030 ambition.

All these options made it to an early draft of the Glasgow final decision text released at the weekend and a new draft is expected on Wednesday morning (Glasgow time).

However, significant differences between countries remain, and negotiators will now try to hammer out a final political outcome. Saudi Arabia, for example, has already tried to head off an ambitious commitment to new action before 2030.

The Australian government might have been cheering Saudi Arabia from the sidelines. Australia is the only advanced economy that didn't bring a strengthened 2030 target to Glasgow. An ambitious political statement in the COP26 decision text could require the federal government to set new 2030 targets — and devise policy to meet them — as soon as next year.

Reaching consensus

The UN climate talks are built on consensus among 190-odd countries. Achieving meaningful outcomes is a diplomatic balancing act built on trust among negotiating parties.

Central to building trust is a commitment by wealthy nations to provide climate finance, to help developing countries deal with the impacts of climate change and to transition to low-emissions development.

More than a decade ago, wealthy nations promised the developing world they would provide US$100 billion per year by 2020. So far they have failed to deliver on this promise.

However, US climate envoy John Kerry says rich nations will meet the goal by 2022 (and exceed it over the 2020-2025 period).

Wary of broken promises, developing countries are looking for renewed commitments on climate finance, especially for the period after 2025. Countries most clearly in the firing line of climate impacts are also pressing for finance to compensate for unavoidable loss and damage.

Progress in the UN climate talks, both at CoP26 and beyond, may involve a "grand bargain" encompassing new promises on climate finance from wealthy countries, and new commitments to reduce emissions from both developed and developing countries.

It is no overstatement to say the fate of our planet depends on the next few days of complex multilateral diplomacy in Glasgow.

Source: This story is part of The Conversation's coverage on COP26, the Glasgow climate conference, by experts from around the world..

Wesley Morgan, Research Fellow, Griffith Asia Institute and Climate Council researcher, Griffith University

This article is republished from The Conversation under a Creative Commons license.

The Hydrogen Debate

'Hydrogen' is fast becoming a sustainability buzz word. There has been announcements from Emirates Global Aluminium about its shift towards using hydrogen and BNEF Bloomberg launched a report entitled: "Decarbonizing Steel: A Net-Zero Pathway", which outlines how a combination of falling hydrogen costs, cheap clean power, and increased recycling could reduce emissions to net zero, while total output increases.

So, is hydrogen the answer? The SIM Europe Conference aims to find out, with 'The Hydrogen Debate' planned to take place in the Energy Zone on 9th March, 2022.

This panel discussion will look at the wave of hype about hydrogen and explore if this is the only viable pathway to decarbonise hard-to-abate sectors

Market

Steel Market Scenario

BUDGET 2022

The Finance Minister of India presented the budget on 1st February 22 in the parliament which clearly votes for growth.

Economic growth is the underpinning of this budget and the seven focus areas are PM GatiShakti, inclusive development, Productive Enhancement, Sunrise Opportunities, Energy Transition, Climate Action and Planning of Investments. The big highlight is the use of Technology in every important project being announced.

This is a balanced growth oriented budget with a strong emphasis on long-term growth with no signs of throwing populist measures despite the coming election in five states. It is focused on productivity, climate action, financing investments, and infrastructure & has laid a roadmap for economic revival against the backdrop of uncertainty amidst the pandemic situation. It has focused on rising Capex levels (up by hooping 35%) and investments in infrastructure and forwards steps have been announced in renewables, defense, PLI schemes, digital economy, ELCGS scheme extension for MSMEs.

The disinvestment target of 65 thousand crore appears to be conservative considering the well-oiled disinvestment process that government has successfully disinvested NINL (latest one) and Air India, probably the most difficult one to divest. With buoyant tax collection (as evident over the last few months) it is quite possible that the budget will surpass revenue assumption which will help fiscal consolidation and will improve tax-to-GDP ratio. Despite a phenomenal revenue boom in this current year, the fiscal deficit will end at 6.9% against budgeted 6.8%. It is projected to slide to 6.4% in FY23 which is more than double of the FRBM (Fiscal Responsibility and Budget Management) target of 3%. This clearly indicates that the government views the economy still Covid stricken and need stimulus. The government presented the economic survey on the eve of the budget showing the economy is well placed with fiscal room to support growth backed by multiple drivers such as widespread vaccine coverage, easing of regulations, gains from supply-side reforms, robust export growth, pickup in private sector investment and financial system in a good position suggesting continuation of fiscal stimulus to support the economy, if necessary.

According to a survey conducted sometime back, 99% of CEOs in India believe the country's economic growth will improve over the next 12 months. It is also observed that the Indian companies raised $6 Billion selling offshore bonds during January 1-14, the most in the first fortnight of a year showing the confidence of international investors in India's economy despite looming uncertainties globally. The IMF also raises FY23 growth at 9% up from 8.5% previously anticipating an investment and consumption recovery on the back of improved credit flow.

Core sector industries such as steel and cement are likely to be the big beneficiary of this union budget for the proposed infrastructure push. The Gati Shakti master plan in the sector such as railways (400 new Vande Bharat Trains), roadways (25,000 km road expansion), 100 multimodal logistics parks, extension of ECLGS (Emergency Credit Line Guarantee Scheme) by one year for MSME and cover expanded by 10% to INR 5 trillion and push in energy sector will spur the demand for metals and cement. The steel industry also very positive about the budget. As per Mr. T V Narendran, CEO & MD of Tata Steel "to address the climate change concerns, the budget includes long-term plans to enable transition to a green economy. Inclusion of sovereign green bonds in the government borrowing programmes, PLI schemes for manufacturing of high efficiency solar modules, financing of projects to reduce carbon intensity are welcome steps that will help

achieve our net zero ambition."

The antidumping duties on certain steel products imported from countries including China has been revoked, a move aimed at containing high prices of metals and promoting domestic manufacturing. On the raw material side, the extension of custom duty waiver on ferrous scrap in FY23 is a welcome development for steel manufacturers including secondary sectors.

Key Highlights: Budget 2022

- GDP growth for FY 22 expected to be 9.2%, the highest for any large economy.
- PLI (Production Linked Incentive scheme) in 14 sectors forAatmanirbhar Bharat to create 6 million jobs, additional allocation of Rs 19,500 crore for PLI in solar PV module manufacturing.
- Promoting Fintech and digital economy a focus area for this Budget.
- 75 digital banking systems in 75 districts by scheduled commercial banks.
- IBC to be amended to improve efficiency of resolution process including cross border.
- Core Banking Services to start in Post offices
- PM Gati-shakti master plan has scope to enhance Multimodal communication through 7 engines, 2000 km of rail network to be brought under KAVACH & Highway network to grow by 25,000 km in FY23.
- Contracts for implementation of multimodal logistics parks at 4 locations to be awarded in 2022-23, in PPP Mode
- ECLGS (Emergency Credit Line Guarantee Scheme) to be extended up to March 2023, guaranteed cover extended by another Rs 50,000 crore
- 8 million new dwelling in rural, urban areas to be completed under PM Awasyojana
- Rs 2.37 trillion worth of MSP direct payments to wheat and paddy farmers.
- Rs 2 trillion outlay for MSMEs, Additional loans for 13 mn MSMEs.
- Rs 48,000 crore allocated to housing projects under PM Housing Scheme for FY23
- Rs 1,500 crore allocated for development of the Northeast in FY23 & Desh stack e-portal to be launched to promote Digital infra
- New provision to file updated return within 2 years of relevant assessment year.
- Alternate minimum tax for cooperative societies down from 18.5% to 15%
- Tax deduction limit for state govt employees to NPS raised from 10% to 14%
- Surcharge on Corporate tax pruned from 12% to 7%; Surcharge on transfer of long-term capital gains tax capped at 15%
- Tax exemption to start-ups extended to March 2023.
- GST collection for January 2022 at a record Rs 1.41 trillion
- Electric Vehicles battery-swapping policy to be brought out with interoperability standards.
- Concessional duty on import of capital goods to be phased out.
- Duty on unpolished diamonds to be reduced to 5%
- Customs duty exemption on steel scrap by one year
- RBI led digital rupee using blockchain to be launched in FY23, 1% TDS on transfer of virtual digital assets & income to be taxed at 30%
- 68% of capital outlay for Domestic defence industry.
- Revised Fiscal Deficit 6.9% of GDP in FY22 as against 6.8% in Budget estimates, Fiscal deficit at 6.4% in FY23
- Total expenditure in FY23 estimated at Rs 39.45 trillion; total resources mobilisation to be Rs 22.84 trillion other than borrowing.

Steel Industry's Expectation from Government & its Outlook

The steel industry was looking for providing the steelmakers with a level playing field by the government by reducing the levies and continue imposing duties on anti-dumping by export-intensive nations.

The steel industry is facing a twin blow that could further derail the developing Indian economy. First, it was the announcement of withdrawal of anti-dumping and countervailing duty on certain steel products in the 2021 budget, along with reduction in customs duty.

Unfair dumping by the exporters from China, Japan and South Korea during the 2015-16 period witnessed the insolvency of several Indian steel companies carrying a cumulative debt of over Rs. 2 lakh crore, burdening the banking sector.

Anti-dumping duty becomes more relevant in the current climate, as the 'Global Medium-term Demand Forecast' predicts that India is the only country with a 6.2 per cent projected increase in steel consumption during the period 2021-2025.

This directly hints at the propensity for increased imports into India. Even a percentage increase in steel supply

from China, which is about 10 Mt equivalent to one month's consumption in India, would mean mayhem for the Indian steel industry.

The slew of existing levies and cesses on the domestic industry add up to $80- $100 per MT of steel produced making the price of local produce higher than export-intensive countries like Japan, South Korea, and China.

The steel industry which contributes to two per cent of India's GDP, employing about 7,00,000 people, directly and indirectly, would be disadvantaged if the government pushed for any further reduction or removal of basic customs duties. The steel capacity building as envisaged in the vision of NSP2017 would stand jeopardised. This will have a domino effect on several interrelated businesses, which will hurt the Indian economy.

To provide relief to the domestic steel industry, it is imperative to revert to the pre-budget 2021-22 basic customs duty rates for steel and continuation of the existing anti-dumping duties on countries exporting to India for five years for hot rolled and cold rolled flat steel products.

It is important for the government to take right steps at the right time to provide the Steel makers a level playing field. In order to do so, it would need to reduce the levies and continue imposing duties on anti-dumping by export-intensive nations. It is the only way forward to bolster the domestic steel industry and, in turn, keep the Indian economy going.

Steel industry can steer India towards $5 trillion economy by 2025: EY-CII report

Steel industry can play an integral role in steering India into $5 trillion economy by 2025, as per the EY-CII report titled 'Steering India into a US$5 trillion economy with Steel'.

Growth of crude steel production in India has not kept pace with the growth in capacity of production, according to the report.

Steel industry can play an integral role in steering India towards a $5 trillion economy by 2025, as per the EY-CII report titled 'Steering India into a US$5 trillion economy with Steel'. "The India steel sector has been vibrant and has been growing at a CAGR of about 5 percent-6 percent y-o-y. With a V-shaped demand recovery post-COVID, policy announcements made by the government across sectors, including rail, road, aviation, gas pipeline, and housing and changes in global supply demand equations, the industry has made record production and growth," the report read.

Growth of crude steel production in India has not kept pace with the growth in capacity of production, according to the report. As per this report, steel sector contributes ~2 per cent to India's GDP and employs half a million people directly and 2 million people indirectly.

This report illustrates as of FY21, India is the world's second largest steel producer with ~102.5 MT production and an installed capacity of 142.2 MT. On the consumption front, India is the third largest steel consumer in the world and has a finished steel consumption of 94.9 MT in FY21.

Sectors that have emerged as leaders in using finished steel are - construction (62 percent); capital goods (15 percent); automotive (9 percent); intermediate products (6 percent); consumer durables (5 percent); and railways (3 percent) as of July 2021.

Reasons behind growth in steel exports:The growth in steel exports is also aided by lower domestic demand and the foreign trade agreements that India has with countries like Japan and South Korea. While countries like Japan and South Korea export value-added steel products to India compared to India which exports hot rolled coils (HRCs) to these countries, markets like EU and USA have protectionist policies like quota restrictions and Middle East is also considering the same.

The Union Government has also formulated policies aimed at bolstering the domestic steel sector and some of these policies are National Steel Policy, 2017; Steel scrap policy; Domestically Manufactured Iron and Steel Products (DMI&SP) policy in government procurement.

The government has also rolled out Production Linked Incentive (PLI) scheme for specialty steel to ensure raw material security for steel sector particularly focused on iron ore and coal. The PLI scheme also aims to provide support to MSMEs of EEPC for exports promotion, thus, enhancing the scope of Quality Control orders on steel and setting up of an Empowered Group of Secretaries (EGoS) and Project Development Cells (PDCs) in Ministries/Departments for attracting investments and to streamline investment inflows.

Here's how steel sector can steer India into $5 trillion economy:According to this report, the government needs to take more steps to enhance export orientation and presence in attractive products and markets, strengthen domestic steel industry through policy support, efficient resource utilisation, achieve sustainable operations in steel industry and research and development led production innovation.

"The government is providing support to the steel industry for rapid growth through policy formulation and strict governance. Industry players will have to play

their part in demonstrating discipline in capital spends and foresights of investing in the right technologies for expansion. The forces of global trade and sustainability would need to work in sync to execute existing strategic plans, update them basis emerging threats and opportunities which are unique and relevant to India, and draw up a collaborative game plan to nurture the future of a robust and sustainable steel industry," SaurabhBhatnagar Mining and Metals Consulting Leader at EY India said.

Domestic steel demand & production unlikely to be impacted in FY22

In a report published recently, Moody's Investors Service has said the combination of steady progress in vaccinating people and rising government spending on infrastructure will support a sustained recovery in Indian economic activity. This, in turn, will give a fillip to demand for steel and cement required for infrastructure building and construction activities.

Besides Moody's, which foresees a high single-digit percentage growth in Indian steel use, the World Steel Association in its latest global demand forecast for the metal says after significant demand destruction of 12.9% in 2020 due to Covid-induced lockdown, the world's second-largest steel producing country will experience demand growth of 6.8% in 2022 following strong recovery in the past year. That all such positive demand and production forecasts are likely to be proved right unless of course a fresh health scare forces lockdown find confirmation in the industry's working in the December quarter.

After the battering the economy got during the first two Covid waves, the governments, both at the Centre and in the states, have enforced discipline during the current spread of Omicron variant in a way so as not to upset industry and construction activities. Such display of prudence, along with vaccination push, created an ideal environment for steel majors such as Tata Steel, JSW Steel, JSPL, ArcelorMittal Nippon Steel and government-owned SAIL to produce more in the three months to December, both on the quarter-on-quarter and year-on-year bases. For example, JSW's third quarter production of 5.35 million tonne (MT) was up 6% on the previous three month output. As for Tata Steel, there was a rise of 1.5% QoQ in crude steel production to 4.80 MT in the December.

Improvements in steel production and deliveries are made possible by efficient movement of raw materials from mines and ports and despatch of finished products from mills, both in very large volumes by normal operation of rail, road and water transport.

This, however, was not the case in 2020 when Indian crude steel production, according to the WSA, at 99.6 MT was down 10.6% over 2019. Logistics were in disarray and mobilisation of manpower became an insurmountable challenge. Domestic demand contraction during the first Covid-19 lockdown found local steelmakers becoming aggressive exporters to clear stocks. The country's finished steel exports during 2020-21 were a record 10.785 MT, against 8.3 MT in 2019-20. Exports of semi-finished steel were up an impressive 133% at 6.6 MT.

At the same time, however, the country was required to import 4.75 MT of some high grade steel for which domestic capacity needs to be built. Hopefully, the production linked incentive (PLI) scheme for the industry will lead to filling capacity gaps in speciality steel and also lead to enhancement of production from 18 MT to 42 MT in five years. The scheme, for which the government has made an outlay of Rs 6,322 crore, hopefully will incentivise the industry to make an investment of at least Rs 40,000 crore to build speciality steel capacity.

But ahead of this, Tata Steel and JSW Steel are strengthening their R&D and technology prowess to be able to make import substituting steel. Tata Steel says: "Backed by strong R&D, we have launched several value-added products. We forayed into advanced steel grades for future mobility needs and are developing alternatives to imported steel grades in construction segments."

Similarly, as JSW Steel is working to raise capacity to 37.5 MT by 2024-25 from 28 MT, development of grades of steel for which the country remains dependent on imports remains a focus area. Last year, the company introduced quite a few new grades of steel, including high strength low alloy steel and galvanealed ultra low carbon grade for automotive OEMs as it launched other new products, including electrical steel grades for general engineering application.

In the meantime, steelmakers are drawing comfort from the Reserve Bank's observation that the trajectory of Omicron found in the third wave will not adversely impact the aggregate demand condition that is to remain resilient. However, the ones engaged in building new capacity through either greenfield or brownfield route have once again got to put up with the challenge of mobilising casual migrant labourers at worksite. This is because Covid related curbs imposed by various state governments are impinging mobility across the country. Be that as it may, CEOs of major steel groups have confirmed that health issues have not impacted demand and production of the metal.

On the contrary, the earlier suspended steel demand is now being realised. The steel ministry's forecast of 2021-22 production and demand being 120 MT and over 100 MT, respectively, is more than likely to be proved right.

A point of concern, as we go forward, will be the behaviour of steel prices which peaked in October-end but started softening since December. The 12 to 14% fall in hot rolled coil prices from the peak no doubt has got to do with retreat in prices of the two major steelmaking ingredients, iron ore and metallurgical coal. However, the fuel, which works as a reductant in iron making process, bought at high October prices is still in use here. The Argus premium low-volatile hard coking coal index was $432.35 a tonne, cfr India on October 21 after climbing a record high of $437.75 a tonne on September 23.

Correction in raw materials prices is linked to fall for the first time in six years in China's steel production to 1.03 bn tonne in 2021 as Beijing steps us efforts to curb emissions. Under government direction, Chinese steel output may further contract in 2022. For environmental considerations, South Korea, too, is reducing steel output.

Steel sector looks to Increase Production, Enhance Raw Material Security in 2022

Increasing per capita steel consumption and production of special steel as well as enhancing raw material security will remain the key focus areas of the government in 2022.

Minister of State (MoS) Faggan Singh Kulaste said the focus will also be on finding new markets as the production of steel continues to grow in the country.

However, Indian economy rebounded back very quickly and steel industry also was put back on rails with the revival of domestic demand growth. Upfront liquidity in infrastructure projects in the pipeline coupled with the government's emphasis on close project monitoring is driving the steel demand in 2022," he said.

ISA is the apex industry body representing the domestic steel players.

In a statement, the state-owned Steel Authority of India Ltd (SAIL) said 2021 was achallenging year for the company and the entire industry.

In the April-June period of the passing year, the company faced one of the "severest calamities" in the form of the coronavirus pandemic.

However, in 2022, SAIL said it would aim to reduce the borrowings of the company. Its gross borrowings stood at Rs 22,478 crore as of September 30, and the same was at Rs 35,350 crore at the end of March this year.

"In the medium term, we would like to plan our next phase of modernisation and expansion. Our low debt-equity ratio of about 0.44 gives us the confidence and the opportunity to embark on this next phase of capacity expansion.

We would put more thrust on operational efficiency, digital initiatives, enhanced mining operations, maintaining status as a preferred supplier of steel, etc. in the coming year," the company said.

Tata Steel CEO and MD T V Narendran said the initial few months saw the world and India come out of the COVID crisis with accelerated economic recovery, aided by a concerted focus on vaccination, liquidity push by central banks, policy support and massive investment in infrastructure.

During the second COVID wave in April and May, when India bore the brunt of the humanitarian crisis, the steel industry was able to supply liquid medical oxygen and various COVID-related infrastructure support.

We are optimistic about 2022 and believe that the current strong up-cycle will sustain for a longer horizon. The government's focus on infrastructure, ongoing reform measures, including divestment, rationalisation of the Goods and Services Tax, and unwavering thrust on initiatives like 'Aatmanirbhar Bharat' will provide momentum to India's growth story," he said.

On the business front, Narendran said, "We expect continued focus on enhancing the ease of doing business while also reducing the overall cost of doing business. We look forward to policy measures to promote usage of steel industry by-products like steel slag, implement a national mining index and revamp the mines auction process".

In a statement, JSW Steel CFO and Joint MD Seshagiri Rao said the importance that has been given to the infrastructure and the National Infrastructure Pipeline (NIP) has created a huge demand for steel. With the kind of policies that are being followed by the government "I am sure that in the Indian steel industry we will become the 300 MT country... before 2030".

V R Sharma, Managing Director of Jindal Steel and Power Ltd (JSPL), said that in 2022, the steel industry would enhance its role in national development, employment generation and continue to participate meaningfully in economic developments.

"We at JSPL is advancing in our quest of making available world-class steel products at an affordable price for building nation of our dream. We are going to enhance our production during 2022, which will further increase the availability of steel in the domestic market," he said.

Men that Matter

Our Tribute to Dr.Subir Bhattacharyya

With deep sorrow and regret we would like to inform our readers about the sad demise of Dr. Subir Bhattacharyya, the former President of the Indian Institute of Metals (2003-04) on 31st January 2022.

Dr. Bhattacharya did his B.E (Met) from B.E. College, Sibpore (now called IIEST) in 1966 where he stood first in his batch. Then he obtained his doctoral degree from M.I.T, U.S.A.

Dr. Subir Kumar Bhattacharyya started his professional career in R&D Section, Alloy Steels Plant, Durgapur in 1974 where became Head of the Department. The development of Hadfield Manganese Steel Plates and of coloured stainless steels were some of his notable achievements.

Under Dr. Bhattacharyya's leadership as Managing Director of Durgapur Steel Plant from May 2001 to December, 2005, there has been all round development in DSP in turning around the perennially loss-making plant into a profit-making vibrant organization, in surpassing the rated capacities of major shops in bringing improvements in the major techno-economic parameters, cost control measures, new value-added products and in creation of new marketing opportunities.

He had to his credit 50 publications in national and international journals of repute as well as 5 Indian and foreign Patents. He had been closely associated with various educational institutions. Starting with Gold Medal in 1966 from BE College, Dr. Bhattacharyya won many Awards and Distinctions. In 1984, he received the National Metallurgists' Day Award of IIM. Other notable Awards & Distinctions are: Distinguished Alumnus Award of BE College in 1989, OP Jindal Gold Medal Award of IIM in 1997, Life Fellow of IIM in 1996 and Member of National Academy of Engineering [INAE] in 1997.

During his long association with IIM starting as a Student Member in 1961, Dr. Bhattacharyya took keen interest in the activities of IIM all along. He served IIM in various capacities: as Member, Chapter Secretary, Chapter Chairman, Council Member, Vice President and Chairman of Ferrous Division before taking up the baton as President in 2003. His stewardship as the Chairman of the Administrative cum Finance Review Committee [AFRC] till 2019 was characterized with diligent efforts, invaluable suggestions to the Institute's management in order to enhance the credibility and visibility of the Institute.

Dr. Subir Kumar Bhattacharyya (25.12.1945-31.01.2022)

We remember Dr. Bhattacharyya as an affable person and a simple soul. We at STEEL TECH join the bereaved family in praying to the Almighty to grant the departed soul to rest in peace, and give his family enough strength and courage to bear this irreparable loss.

Our Tribute to Malay Mukherjee

With deep sorrow and regret we would like to inform our readers about the sad demise of the steel magnet Mr. Malay Mukherjee on 29th January 2022 at Delhi after a brief illness following COVID-19 complications.He had over 40 years of experience in a range of technical, commercial and managerial roles in the mining and steel industry.

Born in Asansol on January 26, 1948, Mukherjee went to St Patrick School in the steel town before graduating from IIT, Kharagpur. He later earned a master's degree from the then USSR's State Commission in Moscow.

Mr. Mukherjee began his career with Eastern Coalfield Ltd. before joining IISCO, Burnpur. He quickly rose within the ranks of Steel Authority of India Ltd (SAIL) to become the youngest Executive Director in the history of Bhilai Steel Plant, the crown jewel of the Company.

He joined Mittal's then Ispat International in London in 1993. During his stint with Mittals, he held various posts before rising to the Board of Directors at ArcelorMittal and worked in various geographies. He worked for more than one-and half decade closely with Mittal who acquired steel assets across the globe to create the world's largest steel empire.

Post retirement from ArcelorMittal, he took up the role of CEO of Essar Steel Global and joined the board of JSW Steel.

Paying tribute to 'Malayda' Sajjan Jindal, Chairman of JSW Group, wrote on Twitter: "Malay Mukherjee

Malay Mukherjee (29.01.1948 - 29.01.2022)

was an outstanding steel industry veteran. His global experience, technological expertise and eye for details in project management made his inputs very valuable at JSW Steel. We will miss his warmth, directness and experience. Rest in peace, Malayda!"

We at STEEL TECH join the bereaved family in praying to the Almighty to grant the departed soul to rest in peace, and give his family enough strength and courage to bear this irreparable loss.

A **Trusted Friend** for

Ferro Alloys and Aluminium

M/s. Carlmann Schmidt (I) Pvt. Ltd.

Jai Vijay Apartments, Flat 1C,
61B, Palm Avenue, Kolkata - 700019
Email : marketing@carlmann.in
Contact : Mobile No. 9331050577/ 8582820497
Website: **www.carlmann.in**

Items:

- High Carbon Ferro Manganese
- Medium Carbon Ferro Manganese
- High Carbon Silico Manganese
- Low Carbon and Medium Carbon Silico Manganese
- Ferro Silicon
- High Carbon Ferro Chrome
- Low Carbon Ferro Chrome
- Aluminum Deox materials such as Aluminum shots, Aluminum cubes, Aluminum notch bars and Aluminum Alloy ingots of specific requirement.
- Silicon Metal
- Carbon Paste and Calcined Petroleum Coke (CPC)
- Graphite Electrodes tools and Tackles.
- Expansion Joints / Bellows of all types.

WE ARE INTECO

SUCCESSFUL SINCE 1973

INTECO Group has been a supplier and partner to the steel and special steel melting industry since 1973 INTECO is proud to be until today the only single source supplier worldwide who offers and has already put into operation all production processes for the treatment of steel, ferroalloys and super alloys such as...

- Melting
- Remelting
- Casting
- Rolling Mills
- Special Melting & Remelting
- Automation and Production Management Systems (IMAS)
- Industrial Furnaces
- Powder Technology
- Titanium Technology

During the last decades INTECO has grown to a reputable provider of customer specific solutions for the specialty steel industry. Its competence in engineering, management services and technology transfer as well as a strong customer dedication was and is the key to success for our customers and this is again the driver for INTECO to further develop the service and product portfolio in the future.

COMMISSIONING OF TWO 100T INGOT CASTING CARS AT OVAKO, SWEDEN

Two 100t casting cars are being commissioned at Ovako One of the largest casting cars that INTECO has ever designed is due to be commissioned shortly. The first of the two 100t cars, which are being installed at the Swedish steel producer Ovako, has already been delivered and on-site erection is progressing despite all the current obstacles. A particular challenge to be managed is that erection has to take place during casting operation. The hot commissioning was planned for the 1st quarter, but the restrictions imposed as a result of the coronavirus pandemic have delayed the hot commissioning to the 2nd quarter.

Finally, the first casts were successfully made shortly after the Swedish Midsommar Fest. The installation of the second casting carriage, which will be installed at a later date due to the limited space available, is planned for the summer of 2020.

The clients and INTECOs project teams are very proud about this successful project.

INTECO special melting technologies (India) Pvt. ltd.
Office no. 1103, Antriksh Bhawan, 22 K.G. Marg,
Connaught Place, New Delhi 110001
E: Gaurav.Mehta@inteco.in | www.inteco.at

INTECO melting and casting technologies GmbH
Wiener Strasse 25, A-8600 Bruck an der Mur,
Austria – Europe
Tel: T: +43 3862 53 110 - 0 | F: +43 3862 53 844
E: inteco.austria@inteco.at | www.inteco.at

Special Features

Indian Institute of Metals (IIM) Celebrates its 75 Glorious Years of Service to the Nation

- 75th Annual Technical Meeting of IIM and International Conference titled "IIM ATM 2021, International conference & NMA" is being organized from Nov 13-15, 2021
- The 3-day event will witness panel discussions, expert sessions, research paper presentations by academicians, professional & industry leaders, technical exhibitions, metallography contest and more
- The event is being hosted by Jamshedpur and Kolkata Chapters of the Indian Institute of Metals in association with Tata Steel

This year, the Indian Institute of Metals (IIM) is celebrating its 75 years of glorious service to the Nation. The International Conference and 75th Annual Technical Meeting (ATM) of IIM, an annual mega event, was organised virtually, from November 13-15, 2021to celebrate the legacy of the institution.

The highly interactive virtual International Conference and ATM 2021 brought together eminent personalities, experts and researchers from the materials science, metals and mining industry to drive engaging speaker sessions,paper presentations, metallography contest, technical exhibition and much more.

On the occasion, **Mr.T V Narendran, President, The Indian Institute of Metals and CEO & MD, Tata Steel,** said: "This is the Platinum Jubilee year of the Indian Institute of Metals. Celebrations for the Platinum Jubilee started in February 2021. Several competitions and webinars have been held. It is a landmark for any professional body to continue its journey for 75 years.

The legacy of IIM, in many ways, is deeply intertwined with the legacy of the Indian metals sector. IIM was created around the same time India gained its independence and has since played a vital role as a nation-building institution. Over the last seven and half decades, IIM has not only been a temple of knowledge for metallurgists and other professionals in the metals industry, but also an active participant enabling its growth in India. The 75 years celebration marks a new chapter for IIM and its members and an opportune time to explore new frontiers of innovation, sustainability and excellence to enable India in becoming a manufacturing hub.

I congratulate the Members, Fellows, Past Presidents and all the contributors and well-wishers of the Indian Institute of Metals for nurturing, guiding and leading the organization through 75 years of glorious contribution to the Nation and the professional fields."

OnNovember 13, 2021 - day one of the online event, an International Conference titled "Advanced materials and manufacturing for sustainable future" was organized, where renowned academicians, professionals and industry leaders from India and abroad presented their research papers. Presentations focusing on material synthesis, development, design, modern application development and trends, along with a panel discussion on sustainability (cradle to grave) covering Ferrous wereorganized.The opening day also witnessed the inauguration of technical exhibition and poster & metallography contest.

The IIM Annual Technical Meet (ATM) was inaugurated

by Mr T V Narendran, President, The Indian Institute of Metals, in the morning of November 14, 2021 - day 2. Mr P K Tripathi, Secretary Ministry of Steel, was the Chief Guest of the function. The meeting was also attended by Dr S V Kamat, the senior most Vice President of IIM, Mr Sudhansu Pathak, Chairman Core Organizing Committee of IIM ATM 2021, International Conference and NMA, and Mr KushalSaha, Secretary General, IIM. Mr. Tripathi, in his address to the gathering, congratulated the IIM for its illustrious journey for 75 years and mentioned that along with IIM's Platinum Jubilee year, this year 'AzadiKaAmritMahotsav' (75 years of independence) has also been celebrated. He told that 21st Century is the century of Materials Science and we need to overcome challenges related to skill gap and reskilling, and low quality of existing iron ore. It is essential to have a collaborative effort to harness the talent pool that the country has and is proud of. Dr Kamat said that we should leverage all stakeholders (industry, R&D institutions and academia) to achieve the issues faced by the fraternity and the nation.

In his Presidential address, Mr Narendran stressed upon that going forward IIM should play a prominent role in the emerging eco-system of start-ups. IIM could provide a platform where young, energetic entrepreneurs with bright ideas would meet industries that would provide mentorship and opportunities to scale up.

This was followed by the annual award function. Individual metallurgists and materials scientists as well as organisations have been recognised by IIM for contributions towards industrial, academic brilliance and societal well-being. Post this, three memorial lectures, two plenary lectures were conducted, and eight parallel sessions commenced. Finally, on November 15, 2021 – day 3, the event comprised the eight parallel sessions, valedictory session, and ATM prize distribution.

The ATM sessions were conducted on themes including raw material, ferrous process metallurgy, non-ferrous metals, products, industry 4.0, and safety. In the run-up to the event, abstracts of up to 300 words in length were invited from authors for oral and poster presentations.

The 3-day IIM ATM 2021 virtual event was being graced by eminent speakers including Dr. Anil Kakodkar (Chairman of Rajiv Gandhi Science & Technology Commission and Former Chairman, Atomic Energy Commission), Sir H.K.D.H. Bhadeshia, Emeritus Tata Steel Professor of Metallurgy, University of Cambridge, UK, Professor B. Ravi (IIT Bombay), Prof. David Worsley (Swansea University), and Prof. Philip Withers (University of Manchester), Prof. Shrikant Joshi, University West, Sweden, and others who spoke on a series of insightful and thought-provoking sessions on various interesting themes.

This year, the national organizing committee was led by Mr. T V Narendran, President IIM and CEO & MD, Tata Steel, S V Kamat, Vice President & Chairman, Metal Science Division, and Distinguished Scientist and Director General Naval Systems and Materials, DRDO. Sudhansu Pathak, former Vice President of Steel Manufacturing at Tata Steel, was the convener of the national organizing committee as well as Chairman Core Organizing Committee. The international conference committee is chaired by Dr Debashish Bhattacharjee, Vice President, Technology and New Materials Business, Tata Steel.

About IIM and IIM ATM 2021

The idea of formation of an Indian Institute for Metallurgists was conceived as early as in 1945. The final shape took place in the year 1947 and The Indian Institute of Metals (IIM) was founded. Since then, the Institute has grown phenomenally into a reputed Institution, devoted for promotion and advancement in the study, practice and research of metallurgical science and technology. The vision of the Indian Institute of Metals is to "Build a community of scientists, engineers and technologists that will take India to global leadership in minerals, metallurgical and materials science and engineering, and be the premier advocate for materials and manufacturing innovation".

The annual mega event of the Institute is Annual Technical Meet (ATM) which is recognized as a platform for metallurgists, material scientists, academia, industries and R&D institutions to come together and deliberate on the latest developments and share their experiences. IIM recognises institutional and personal contributions across industry and academia through different awards during the ATM.

Indo German Business Forum – Strengthening Bi-lateral Relations in theEngineering Sector

India and Germany marked the 70th anniversary of the establishment of diplomatic relations in March this year. The relationship has progressed satisfactorily over the years. Germany is the seventh largest FDI provider in India since 2000. Cumulatively Germany has invested $12.39 billion in India since 2000, mainly in automotive, transportation, electrical equipment, metallurgy, insurance, services, chemicals, and construction and trading. 1,600 German companies are reportedly functioning in India, including 600 joint ventures.

In pursuit of the strengthening the networking and cooperation further among the VDMA members, Indo-German fraternity with the local manufacturing industry, VDMA India organised a symposium for the first time, on **"Indo-German Business Forum: Strengthening Bi-lateral relation in the Engineering Sector"** at WillamsonMagor hall, Bengal Chamber Kolkata, on 15th December 2021.

In this day-long event, reputed speakers from VDMA members and other organisations deliberate on various topics starting from technology, automation and digitization - offerings to the engineering industry to compliance, regulatory affairs, ease of doing business and business opportunities for the local industry.

The event covered various representations and demonstrations ranging from simulation, machinery, processes, imaging products and materials. More than 85 delegates comprising of industry representatives, academia and media participated at the symposium. The knowledge partner of the event was Rödl Partner whereas VDMA members like Emerson, Automation Solutions, HARTING, Schmersal, SMS Group were the "Technology Partners".

The event started with the traditional lighting of the lamp by the Chief Guest – Mr. Manfred Auster, Consul General, Consulate General of the Federal republic of Germany, Kolkata, Guest of Honour – Mr. Abraham Stephanos, Managing Director, Tata Steel Downstream Products Limited, Mr. IndrajeetSen, Managing Director, International Combustion Ltd.; Ms. Ritika Arora, Senior Associate, Rödl Partner and Mr. Rajesh Nath, Managing Director, VDMA India.

Mr. Nath in his welcome address, discussed the challenges that the Indian engineering Industry has faced during the Covid 19 pandemic as well as future challenges that they face to achieve the goals and expectations that are present now and in the near future. He emphasized the significant recovery and drastic growth that these industries have achieved in 2021 and the new challenges that will arise after COP26 and the need for sustainable development and integration of Industry 4.0 for a green initiative and advancement of the Indian Engineering Industry.

This was followed by an insightful address by Mr. Manfred Auster who mentioned the current change in the German Government and a brief overview of the agendas and goals set by eachparty of the three-part coalition government and how is might impact the Indo German Trade Relations and what changes to expect in the future interactions.

Mr. Abraham Stephanos shared a beautiful personal story to emphasize the exceptional craftsmanship and superior quality that German products who had always been regarded. He also touched upon various topics like sustainability efforts by TATA Group, Indo-German relations, constraints in supply chain, data handling, and support of the government to spur demand.

In her presentation on" Ease of Doing Business in India-Emerging Trends and Developments in Indian Regulatory regime", Ms. Ritika Arora from Rödl Partner, the Knowledge partner, and gave an in-depth knowledge of difficulties faced with International as well as Domestic Companies from commencement of a business and hassle-free operating of the business. She shed light on different scheme and change in regime to facilitate the running of businesses and making it more convenient and easier to operate business. She also gave a brief overview of speculation of changes and merging of certain laws and what impact they will have on operating businesses in India and what it shall mean for foreign companies investing in India.

The post tea break session was devoted to technical presentations by the VDMA members.

In the first presentation, Mr. Vijay Jawade, Director, Sales and Marketing, Fluid Control and Pneumatic, Emerson Automation Solutions gave a very comprehensive but easy to understand description of what his company does. He gave a detailed presentation on Safety and

Risk Evaluation and spoke about Digital Dust and Pulse Technology and IIOT for Factory Automation and Energy Preservation.

The next speaker was Dr. Girish Rao, CEO and managing Director, Harting India Pvt. Ltd. who presented on Smart Solutions for Industry power cables. He spoke about customized and standard solutions for Power Data and Connection focusing process Industry, material handling/ conveying, Food Processing & Packaging industry.

This was followed by a presentation by Mr. PrashantErande, Head- Industry Verticals, Schmersal India Pvt. Ltd. who elucidated upon the concept of Industry 4.0 and need for digitisation that has been expedited by the pandemic and how this digitization occurs in respect of Conveyor Belt Systems and new and innovative development by Schmersal in the realm of Conveyor Belts.

The last presentation was done by MrAtanuDey, Vice President, Head COE Electrics/ Automation & COE Digital Solutions, and Mr. Sanjay Dasgupta, Vice President - Sales and Marketing India and Asia Pacific Region, SMS group. While Mr. Dey covered in digitization of manufacturing and digital twins, Mr. Dasgupta laid emphasis on in-depth analysis of the change in metallurgy and steel production process with cost optimization and the way forward to produce green steel by the user industry.

Mr. Sandip Roy, Regional Head-East, VDMA India moderated both the sessions and thanked all the participants for their gracious presence.

The event concluded with a sumptuous networking Lunch which allowed guests to interact with the partners of the Symposium.

Technology, Product Development and Application

Blast Furnace Decarbonization Technology for MMK

SMS group of Germany is to improve the efficiency of Russian steelmaker Magnitogorsk Iron & Steel Works' processes with the use of 'syngas', a combination of hydrogen and carbon monoxide which replaces a portion of the solid carbon fuels and sets the stage for greater decarbonization in the future.

"We are excited to be able to work further with MMK to develop and deploy these innovative solutions", said André Schneider, CEO of SMS group Region CIS. "With our support, our customer will be able to quickly achieve substantial CO2 emission reductions with a relatively limited investment".

Blast Furnace 11 was ordered in June 2021. It will use enhanced techniques, developed by SMS group company Paul Wurth and will achieve very high standards of environmental performance. These new technologies can also be used in existing blast furnaces, thus enabling CO_2 emissions to be reduced at existing sites around the world.

"Part of our contribution to these projects is the production technology and workflow for the use of syngas – which can be injected into the blast furnace shaft", said Dr. Thomas Hansmann, head of metallurgy for SMS group and CTO for Paul Wurth. "The degree of emissions reduction possible from this technique is potentially substantial. The system is flexible, allowing for a general increase in productivity".

Source: Steel Times International

Snam and Tenova initiate a collaboration to Decarbonize The Metals Industry

- The two companies will work together over the next three years to design integrated solutions based on the use of green hydrogen
- The synergy will result in concrete applications in productive sites, by contributing to the decarbonization process of the metals sector through a significant reduction in CO_2 emissions

San Donato Milanese (Milan) / Castellanza (Varese), January 13th, 2022 – An agreement to foster the decarbonization of the metals sector in Italy and abroad: Snam, Europe's largest energy infrastructure operator, and Tenova, leading developer and provider of sustainable solutions for the green transition of the metals industry, committed to conducting joint strategic studies and market analysis to implement specific infrastructure and metals production systems by using green hydrogen.

The aim is to bring integrated, turnkey commercial solutions tested in industrial plants to implement a substantial reduction of CO_2 and NOx emissions in the metals production process – from melting to processing of half-processed products.

"Through this agreement – CosmaPanzacchi, EVP Hydrogen at Snam commented – we further develop our network of partners and projects to introduce green hydrogen into the relevant productive processes of the metals industry. Hydrogen is essential to cut emissions from the production of steel and other metals, as well as from all hard-to-abate sectors such as cement, ceramic,

chemistry and refining. Snam is willing to contribute through its technologies and know-how by enabling, as fast as possible, the hydrogen transition of such crucial commodity chains for the Italian economy".

Snam will provide its expertise in hydrogen technologies as well as transport, whereas Tenova will contribute through its know-how in this sector, more specifically in combustion systems for reheating and heating treatment, and in electric arc furnaces. The collaboration between the two companies will develop through specific tests in the laboratory under construction at Tenova's headquarters (in Castellanza, Varese), and through installations and production tests on industrial sites.

"Everyone talks about green hydrogen, but the reality is that its supply and use are still limited, and, at the same time, pressures to mitigate climate change are getting stronger. For this reason, we are developing a ready-to-use solution for our customers, directly at their production sites. The expertise of Snam and Tenova is complementary, and together we are ready to face the challenge of decarbonization, on which Tenova has been working for years thanks to solutions that make us the ideal technological partners to improve environmental performances without compromising the economic ones", commented Roberto Pancaldi, Tenova CEO.

Tenova's combustion systems, a key part of the agreement with Snam, represent an extremely innovative solution and unique on the market. First, they enable CO_2 emissions reduction in a scalable and flexible fashion: once installed, these systems can work through a blend of natural gas and hydrogen in variable percentages, up to 100% of hydrogen, whereby maintaining emissions well below the most restrictive limits. Furthermore, they can be integrated with advanced 4.0 technologies, offering significant advantages in terms of management and maintenance, thanks to Tenova's digital infrastructure. Through its know-how on hydrogen technologies and transportation, Snam will be able to secure an optimized integration across the entire value chain, thus meeting this industry's needs.

Danieli Decarbonization Technologies for BF and Steelmaking Processes

MMK and Danieli to work together to reduce carbon-dioxide emissions and improve environmental conditions

PJSC "Magnitogorsk Iron and Steel Works – MMK" and Danieli signed a five-year memorandum of understanding documenting the intention of the companies to collaborate on the use of decarbonization technologies to reduce and potentially eliminate carbon dioxide (CO_2) emissions.

The document was signed by PavelShilyaev, General Director of PJSC MMK, and GiacomoMareschi, CEO of Danieli

The memorandum notes that the parties are interested in identifying potential technologies, conducting research and introducing decarbonization technologies at MMK, which will increase economic performance and improve the environmental situation due to the absence or reduction of carbon dioxide emissions.

Within the framework of this cooperation agreement, the parties intend to assess the technical and commercial feasibility of introducing Danieli decarbonization technologies for blast furnace and steelmaking processing at MMK's Magnitogorsk production site in the Chelyabinsk region, Russia. The result of these joint efforts within the framework of the memorandum should be a list of projects and initiatives on decarbonization for possible implementation at the Magnitogorsk Iron and Steel Works.

Commenting on the Signed Agreement, PavelShilyaev, said: "Our company fully supports the global efforts to prevent climate change and implements modern practices to reduce greenhouse gas emissions. This line of business is a key principle of MMK's sustainable development. The agreement with Danieli will help us fight climate change more effectively and will reduce the man-made impact on the environment."

GiacomoMareschi, in turn, added that Danieli is ready to provide specific technologies to effectively reduce the carbon footprint, claiming: "I am confident that after testing new Danieli developments at MMK's production facilities, we will be able to assess the technical and

economic feasibility of their implementation, as a result of which we will identify those projects that will increase economic efficiency and environmental safety"

Green Steel offering from Voestalpine

Austrian steelmaker Voestalpine, a globally leading steel and technology group, is now offering a CO2-reduced edition of all flat steel products manufactured by the company's steel division in Linz, Austria.

The company claims that the direct emissions generated during the manufacture of its greentec steel Edition products have been reduced by around 10% as a result of 'an innovative raw materials mix and even more efficient processes'.

According to voestalpine, several customer orders are currently being processed and, it is claimed, there are signs that there will be significant demand for 'greentec steel edition' products going forward, especially as hot-rolled steel strip, isobar electrical steel and phs-ultraform.

Herbert Eibensteiner, CEO of voestalpine, said that the company is currently working at full speed at its Linz and Donawitz sites 'to develop technical scenarios which will drive forward the decarbonization of steel production'.

Directly saving 10% of the carbon emissions compared to conventional production methods is achieved by modifying the reducing agent and the charge, explains voestalpine, as well as by maximizing the share of scrap, and converting to green electricity. Continuously applying optimization measures will successively reduce carbon emissions, gradually approaching the inherent limits of the process, says the company. At the same time, voestalpine claims that it maintains its high-quality standards.

Moving forward, voestalpine's phased plan will include the partial replacement of the existing blast furnace route with a hybrid-electric steel pathway, which could reduce carbon emissions by around a third by 2030. Liquid pig iron and sponge iron (HBI)will join scrap as the most important pre-materials for tomorrow's carbon-neutral production of high-quality steel, claims voestalpine. In parallel, the company is intensively researching so-called 'breakthrough technologies' in order to increase the use of green hydrogen in the steel production process over the long term and achieve carbon-neutral steel production by 2050.

Source: STI

Taller than the QutubMinar; World's Tallest Railway Bridge Coming up in Manipur

After independence, many states of India, especially the north-eastern states, were left behind in therace of development. Difficult hilly terrains and other topographical situations in the region needed astrong infrastructure to bring them in the mainstream of development. The scene has however changedsince 2014 as new infra projects are coming up in these states. The reason for this is the commitment ofPrime Minister NarendraModi, who considers the Northeast as the engine of India's development.

Construction of the world's tallest bridge pier in Manipur is just another expansion of the commitmentof the government for boosting infrastructure in the North east India.The ambitious project in Manipuris part of the 111 km long Jiribam-Imphal railway line to connect the capital of Manipur with the broad-gauge network of the country. The bridge is being made earthquake resistant. It can easily withstand thetremors of an earthquake measuring 8.5 on the Richter scale. With the completion of the project, the111 km of distance will be covered in 2.5 hours. Presently, the distance between Jiribam-Imphal (NH-37)

is 220 km, which takes about 10-12 hours of travelling. After the construction, the bridge crossing Noneyvalley will become the world's highest pier bridge. The bridge will be completed by December 2023.

News Watch

Indian Steel Plants

SAIL selects HPE GreenLake to Modernize Critical SAP Environment and Data Management

Steel Authority of India Limited (SAIL) has selected the HPE GreenLake edge-to-cloud platform for its Central Marketing Organization (CMO) to accelerate digital transformation and reduce their environmental footprint through an innovative on-premises cloud with capacity available on demand.

SAIL's CMO is responsible for the marketing of carbon, alloy and special steel products produced by the steel plants of SAIL across India. The organization is backed by a robust ERP system running on HPE technology which underpins all business-critical applications and processes from lead generation to shipment and enables SAIL to deliver quality steel to every corner of the country. Prior to the HPE GreenLake platform migration, SAIL's existing infrastructure was reaching end of life and they needed to prepare for a migration to S/4 HANA and improve application availability and business continuity.

Customer data is one of the most valuable assets for companies and SAIL recognized the importance of protecting and extracting full value from these data being generated across the entire organization. They were looking for a cloud experience with a flexible consumption model and capacity available on demand to be able to handle its constant growth in data but also wanted to keep its data in their own data center.

SAIL selected the HPE GreenLake edge-to-cloud platform to accelerate their digital transformation and deliver an on-premises cloud with capacity available on demand. HPE Pointnext Services worked closely with SAIL to manage the entire system integration project and full end-to-end implementation. HPE designed a new architecture based on open standards together with a complete storage refresh. The HPE team delivered a seamless Unix to Linux migration with minimal upfront investment and application downtime. The new, modernized environment significantly lowered the data center footprint and has therefore resulted in reduced power consumption and operational complexity, improved operating costs and environmental footprint.

The HPE GreenLake platform offers scalability and delivers the cloud experience through a pay-per-use model while also meeting compliance and regulatory requirements with the data remaining on-premises. HPE GreenLake Central also gives SAIL a dashboard to monitor and plan the daily consumption of IT to provide complete visibility of IT spend to improve budget planning and forecasting.

HPE led the entire end-to-end solution design and full implementation covering all HPE and third-party products including all surrounding data center deliverables. As a result, SAIL's full edge-to-cloud infrastructure for the SAP environment is now ready to meet both the current ERP application requirements and future S/4 HANA workloads.

TATA STEEL

Intimation regarding the fold back of Tata Steel BSL Limited into Tata Steel Limited

Tata Steel BSL Limited (hereinafter referred to as'TSBSL') has amalgamated to Tata Steel Limited vide order of the National Company LawTribunal dated 29th October 2021 and w.e.f. the 11th of Nov 2021, the company is nowregistered under the ROC as a single entity - Tata Steel Limited.

Tata Steel focuses on Increasing Iron Ore Production to 45 Mtpa in 5 years

Tata Steel will focus on augmenting iron ore production from 30 Mtpa to 45 Mtpa in the next 5 years. The total iron ore production from the steelmakers' captive mines in Noamundi in Jharkhand and in Katamati, Joda and Khondbond blocks in Odisha, is about 30 Mtpa. The Company informed that the present capacity is sufficient to meet the iron ore requirement in Tata Steel's manufacturing facilities in Jharkhand's Jamshedpur and Odisha's Kalinganagar.

The steelmaker had started its iron ore mining operation at Noamundi in 1925 and the mine will turn 100 in 2025. During the 5th National Conclave on Mines & Minerals in New Delhi on November 23, Noamundi iron ore mine was accorded the 'five-star rating' for three consecutive years from 2017-18 for sustainable development.

Asked about the use of drones in the mining sector, the company representative said it is being deployed for surveying and monitoring purposes. As part of the sustainable development of the block, a solar power plant spread over 19.2 acres of mined-out land was installed in 2017 in Naomundi, and the green cover has also been increased in the area.

Source: PTI

Tata Steel Long Products declared the Winning Bidder for NeelachalIspat Nigam Limited (NINL)

Tata Steel Limited announces on January 31, 2022 that Tata Steel Long Products Limited, a subsidiary of Tata Steel has been announced as the winner of the bidding process to acquire a 93.71% stake in the 1 Mtpa Neelachal Ispat Nigam Limited (NINL) in accordance with the process being run by Department of Disinvestment & Public Asset Management ('DIPAM'), Government of India.

While Tata Steel's growth in Flat Products would be pursued through the Kalinganagar and Meramandalli sites in Odisha apart from the existing capacity in Jamshedpur, NINL will become the hub for its Long Products business in the future. Located in the close proximity to Tata Steel's world class site of Kalinganagar, this is a strategic acquisition for the Tata Steel business in India with around 1 Mtpa of steel-making capacity, 2500 acres of land for future growth and iron ore reserves of around 100 million tons. The acquisition of NINL provides a significant opportunity for Tata Steel to not only restart the steel plant expeditiously but also begin work immediately to build a 4.5 Mtpa state –of-the -art long products complex in the next few years, and further expand it to 10 Mtpa by around 2030. The acquisition of NINL is critical for Tata Steel to build such a dedicated long products complex which will also be best positioned to leverage synergies with the shared infrastructure of Tata Steel in the area. It is Tata Steel's endeavour to utilise its expertise in operating excellence, mining and project management to transform NINL into a state- of- the- art, competitive and sustainable enterprise in the future. This investment also reflects Tata Steel's commitment to the state of Odisha and the communities around our operations.

The long products segment in India is poised to witness significant growth as India builds its infrastructure and industrialisation through the Atmanirbhar Bharat Program of the Government. Tata Steel will leverage its capability in the long products business using its strong brand equity, particularly in the retail construction segment, and its extensive, pan-India retail and distribution network to drive scale and profitability in Long Products. The acquisition will also facilitate growth in downstream solutions and specialty high end products catering to customers in the construction, heavy engineering and automotive space.

The total consideration of Rs.12,100crore reflects the enterprise value (including all recorded liabilities) as part of the acquisition of 93.71% equity stake in NINL. The acquisition is being financed through a combination of internal accruals and bridge loans which are expected to be paid down through internal generation of Tata Steel over the next few quarters. The transaction is scheduled for closure within the next couple of months as per the process timelines announced by DIPAM, Government of India.

There were three major bidders namely Tata Steel, JSW and JSPL. It's a big news for MMTC who has more than 49% stake in NINL. After Air India disinvestment this is a big disinvestment being done by the GoI.

Steel industry can lead the way in Private Investment Revival in India, says Tata Steel MD

The steel industry will lead private sector investments in India as producers make wholesome earnings throughout the ongoing cycle of excessive commodity costs, stated TV Narendran, Managing Director of Tata Steel.

The profits that we make, pretty much all of that is flowing back into the country as investments," he stated in an interview. Tata Steel continued to deliver strong operating and financial performance in 3QFY22 with year on year EBIDTA growth of 64% and Profit after Tax growth of 139%. "And when you look at triggering private sector investment, I think the steel industry can certainly lead the way and we should allow the steel industry to do that with more capacity in India."

Top three producers – Tata Steel, JSW Steel, and ArcelorMittal-Nippon Steel – have mentioned plans of investing as much as `1.5 lakh crore over an unspecified interval.

Being an iron ore producing nation, India ought to be exporting extra metal than it presently does, in contrast with different nations like China, he stated.

"Why should countries which have no iron ore be exporting 50-100 million tonnes of steel? And India, which has iron ore, is hardly exporting 20 million tonnes of steel," he stated. "If you want to make in India, you should convert the iron ore into steel for India and for the world."

Neelachal Buyout

Explaining Tata Steel's rationale of shopping for NeelachalIspat Nigam Limited (NINL) for 12,100 crore, which many termed as a costly buy, Narendran stated that the asset was an ideal match for India's oldest metal maker. "Neelachal for us, in many ways, is an ideal fit, because it is 2,500 acres of land across the road from our Kalinganagar plant," he said.

The proximity of the plant to Tata Steel's present setup in Kalinganagar would assist it leverage higher economies of scale. The asset may even assist the firm plug a gap round lengthy merchandise in its enlargement plans. Tata Steel has ample capability for flat merchandise however wanted natural or inorganic progress alternatives in lengthy merchandise.

Moreover, the asset got here with 100 million tonnes of iron ore reserves, he stated. "We bid in a manner that we would have no regrets if we lost it at that price or higher. There is a huge opportunity for us in Neelachal that is unique to us, nobody else has that strategic value."

With this acquisition, Tata Steel can sufficiently meet its progress ambitions for the coming decade and organically attain as much as 50 mtpa of manufacturing capability, as per Narendran. The Kalinganagar plant has a capacity of three mtpanow which is being elevated to eight mtpa and may very well be taken as much as 16 mtpa as demand will increase. The plant at Angul has 5 mtpa capability which can be elevated to 10 mtpa and the Jamshedpur plant has a put in capability of 10 mtpa. Meanwhile, the Neelachal plant can be ramped as much as produce as much as 10 mtpa, he stated.

Volatile Prices

He expects the elevated commodity costs that turned the fortunes of steelmakers over the previous 12 months to stay "volatile at a higher level." While metal costs are unstable, so had been enter prices like coal and iron ore for steelmakers.

Tata Steel's revenues remained flat sequentially in the December quarter, however its margins took a dip as a result of sharp commodity costs.

Narendran stated that there will probably be additional margin squeeze throughout the ongoing quarter.

Tata Steel initiates a 'first-of-its-kind in the world trial for Continuous Injection of Coal Bed Methane (CBM) in Blast Furnace to Reduce Emissions

This process, part of the larger effort to enable hydrogen-based steel making, is yet another step towards achieving the Company's vision of net zero emissions

As part of its continuous efforts to move toward sustainable steel production, Tata Steel has initiated the trial for continuous injection of coal bed methane (CBM) gas in one of the Blast Furnaces (E Blast Furnace)atits Jamshedpur Works, making it the first such instance in the world where a steel company has used CBM as injectant.

This process is expected to reduce coke rate by 10 kg/thm, which will be equivalent to reducing 33 kg of CO_2 per tonne of crude steel. The trial will take place over the next few weeks.The technology, design, and development of the entire system at E Blast Furnace for facilitating CBM injection has been done by the in-house team of Tata Steel.

Debashish Bhattacharjee, Vice President, Technology & New Materials Business, Tata Steel,said:

'The conversations around climate change have gained unprecedented momentum in the recent years. Given

this imperative, the steel industry, also considered hard to abate, too will need to urgently explore sustainable options to mitigate its environment footprint. At Tata Steel, we are on a journey to decarbonise and this initiative is yet another step towards this objective. We will continue to innovate and make investments to transition towards sustainable manufacturing.'

Uttam Singh, Vice President,Iron making, Tata Steel,said: "Technologies to decarbonise steel at scale are not ready yet. Tata Steel has undertaken various technology initiatives including pilots and trialsto explore new and scalable solutions for decarbonisation.This initiative of CBM injection in blast furnace will provide us with useful insights into Blast Furnace operation with hydrogen based injectantsand help reduce emissions. We are on a mission to bring down the CO_2 emissions to 1.8 tonne of CO_2 per tonne of crude steel by 2030."

This trial will help in quantification of the reduction in coke rate used in the blast furnace, its impact on productivity and will provide useful insights regarding operation of blast furnaces with hydrogen-based injectants. These insights will be used to design a framework for future sustainable operations of blast furnaces with greener fuels containing more hydrogen.

Tata Steel deploys its first Bio-Fuel Powered Ship for Imported Raw Material Transportation

In line with its sustainability objectives and initiatives on reduction of scope 3 Greenhouse Gas (GHG) emission in ocean trade, Tata Steel has deployed a ship powered by biofuel. The bulk carrier named Frontier Sky, owned by NYK and operated by Tata NYK Shipping Pte. Ltd., has successfully completed trial use of biofuel to transport cargo provided by Tata Steel. The voyage involved a cargo of ~1,60,000 tonnes of coal transported from Gladstone, Australia to Dhamra, India.

Tata Steel's objective to reduce scope 3 emissions in marine transportation matched those of NYK, who wanted to further verify safe vessel operation along with GHG emission reduction during its second successful trial use of biofuel. NYK provided technical support including biofuel refueling arrangements and engine operation planning. Tata NYK provided operational know how and extensive support during the entire voyage. The knowledge gained from this test voyage will be shared between the three companies, and they will continue to collaborate towards decarbonisation.

Biofuels are carbon-neutral because the carbon dioxide that is absorbed by the source of the biomass is equal to the carbon dioxide that is released when the fuel is burned. GHG emissions are expected to be reduced by ~9% when biofuels are used as compared to traditional bunkers.

Tata Steel's Noamundi Iron Mine accorded the Five Star Rating for 3 Consecutive Years

The Noamundi Iron Mine (NIM) of Tata Steel has been accorded the 'Five Star rating' for sustainable development for three consecutive years i.e. 2017-18, 2018-19 and 2019-20. The award ceremony was organised today during the 5th National Conclave on Mines & Minerals in New Delhi.

D B Sundara Ramam, Vice President (Raw Materials), Tata Steel received the award on behalf of Tata Steel from Pralhad Joshi, the Union Minister for Coal, Mines and Parliamentary Affairs, Government of India.

Expressing happiness on receiving the award, D B Sundara Ramam, VP Raw Materials said, "Sustainability is not new to Tata Steel. It is seeded in our principles and values. Sustainable mining demands the judicious use of technology at each stage of the mine's life. Our current focus is on digitalization and smart solutions aimed at creating sustainable future for our stakeholders. This award is a testimony to our sustainable mining practices and it further reinforces our commitment towards sustainable development."

Tata Steel features amongst the top 10 Companies in the steel industry in the Dow Jones Sustainability Indices (DJSI) Corporate Sustainability Assessment 2021

Tata Steel has featured amongst the top 10 steel companies in Dow Jones Sustainability Indices (DJSI) Corporate Sustainability Assessment 2021. The Company has retained its position in the DJSI Emerging Markets (EM) Index for the 10th consecutive year. Tata Steel is also one of the top 15 companies from Indiawho made it to the EM Index that currently comprises 109 companies.

For the 2021 Corporate Sustainability Assessment, 5,300 companies were eligible for inclusion and were invited to participate. A record 1,843 companies participated in the assessment this year. The participating companies now represent 45% of global market capitalisation relative to the S&P Global BMI (Broad Market Index), up from 32% in 2020.

Under sustainability, Tata Steel scored the highest score in the following categories such as codes of business

conduct, risk and crisis management, environmental reporting, operational eco-efficiency, corporate, citizenship and philanthropy, and social reporting.

Tata Metaliks Limited reports Financial Results for the quarter ended December 31, 2021

Tata Metaliks Limited (TML) declared its Financial Results for the third quarter of FY'22. TML recorded Revenue from Operations of Rs.690Crores and Profit before Tax (PBT) of Rs.50 Crores for the quarter ended December 31, 2021.

While the Revenue saw an increase of ~7%, PBT for the quarter (Q3 FY'22) was ~38% lower than the previous quarter (Q2 FY'22). Profits took a hit this quarter mainly due to lower production in one of the Blast Furnaces owing to planned shutdown and much higher cost of raw materials - cost of coke and iron ore increased by ~30% and 50% respectively compared to Q2.The overall impact was howevermitigated to some extent by the buoyant Finished Goods prices and much higher sales volumes of Ductile Iron Pipe (DIP). The Companyachievedan EBITDA margin of 10.3% for Q3 FY'22.

For the period of nine months ended December 31, 2021, TML recorded Revenue from Operations of Rs.1,938Crores and PBT of Rs.266 Crores. This was higher year-on-year by ~54% and 46% respectively.

Highlights of the Company's Q3 performance are:

- Production of Hot Metal was ~5% lower than previous quarter because of ~10 days shutdown of one furnace, but production of DIP was higher by ~20% compared to Q2 FY'22.
- Pig Iron (PI) quarterly deliveries at75 kt was lower by ~17% compared to Q2 FY'22. DIP deliveries,however, were highest ever recorded in any third quarter and was higher by ~30% compared to Q2 FY'22.

Sandeep Kumar, Managing Director of Tata Metalikssaid: "While the DIP business of the Company has been able to deliver on its planned volumes, the Pig Iron business got impacted due to lower production from one of the blast furnaces which went for maintenance shutdown and had a few operational problems, post start-up. Profits got impacted due to this as well as due to significant increase in raw material prices. Demand for DI Pipes continues to remain robust on the back of significantly increased allocation in this year's Union budget for water infrastructure. Pig iron demand is also stable and prices are moving up which is expected due to raw materials cost push.

The DI Pipe expansion project being built on Industry 4.0 concept with high levels of automation and digitalisation has been put on fast track and the 1st phase is expected to be commissioned by end of the current fiscal despite uncertainties on account of Covid 3rd wave."

Tata Metaliks Limited is a subsidiary of Tata Steel which started its commercial production in 1994. It has its manufacturing facilities at Kharagpur, West Bengal, India which produces Pig Iron and Ductile Iron pipes. The plant annually produces around 550,000 tonnes of hot metal, out of which over 200,000 tonnes is converted into DI Pipes and the rest into Pig Iron.

OTHER STEEL PLANTS

AM/NS to Invest over Rs 1 trn in a 24 Mt Steel Plant in Odisha

The company had earlier this year signed anMoU for setting up a 12 Mt steel plant at Kendrapara, Odisha, at an investment of Rs 50,000 crore.

A High-Level Clearance Authority of the Odisha government has approved a proposal from ArcelorMittal Nippon Steel (AM/NS) to set up a 24 million tonne (Mt) integrated steel plant at an investment of more thanRs 1 trillion.

In a statement, IPICOL (Industrial Promotion & Investment Corporation of Odisha), the single-point of contact for all industrial investments in the state, said that under the chairmanship of Chief Minister Naveen Patnaik, the 27th meeting of the High-Level Clearance Authority has approved ArcelorMittal Nippon Steel's (AM/NS's) proposal to set up a 24 Mtpa integrated steel plant at Mahakalpara block of Kendrapara district against an investment of Rs 1.02 trillion.

However, the state government officials said after studying the land it was found to be suitable for 24 Mt and an application was made. IPICOL said the approved project is the largest project in the manufacturing sector in the country.

According to the state's nodal agency for investment, AM/NS will produce 24 Mt of various grades of steel with its latest green steel making technology. It will also produce high value-added steel downstream products.

Besides, the facility will also produce 18.75 Mt of cement annually, making it one of the largest cement manufacturing plants in the country.

The project will generate direct employment opportunities to 16,000 people and create significant indirect employment opportunities through ancillary and downstream industries and services.

Along with the steel complex, the company will also develop a downstream industry park to promote the MSMEs and help import substitution.

According to IPICOL, a large number of ancillary manufacturing companies are expected to put up their units in this region to support the huge steel making facility.

"The infrastructure to be developed for the Kendrapara projects facility will give a boost to the logistics and overall development of the region. This modern, green and environment friendly steel making facility will put Kendraparaand Odisha on the world steel map," the IPICOL statement said.

A number of international equipment manufacturers will be stakeholders in this project and catalyse more employment opportunities to the state, the statement further said.

The project will get completed in seven years in phases, IPICOL said.

With this investment, Odisha's total investments garnered in the past 12 months stand at Rs 2.7 trillion, generating employment opportunities for over 77,000 people.

JSW Steel to invest Rs 15,000 crore to expand Vijayanagar facility to 18 Mtpa by FY 24

JSW Steel announced a 15,000-crore brownfield expansion project at its Vijaynagar Steel Works to increase capacity by 5 Mtpa by FY 24.

"This expansion reiterates our commitment to be a significant partner in building a stronger India through sustainable means," said JSW Group's Chairman, Sajjan Jindal

JSW said that it has received the environmental clearance for the project and is planning to complete 1 Mtpa expansion through upgradation of the current facility to achieve 13 Mtpa capacity within the next 12 months. The company aims to take its Vijayanagar facility 18 Mtpa by FY24.

"We will create new job opportunities as well as generate immense value for all our stakeholders. Through the introduction of Artificial Intelligence and other Industry 4.0 interventions at this facility, it will become an integral part of our network of digitally connected smart steel factories in India," Jindal said.

Union Steel Minister Ram Chandra Prasad Singh laid the foundation stone for the new 5 Mtpa project. The steel minister conveyed that the expansion projects would also help. in augmenting the availability of world-class steel and the progressive plans of the Ministry of Steel.

The new brownfield expansion will be spread across 600 acres and includes establishing 4.5 Mtpa Blast Furnace, two Steel Melt Shops 350 tons each and 5 Mtpa Hot Strip Mill along with other allied and auxiliary facilities.

JSW Steel, as part of its next phase of growth, is targeting an overall capacity of 37.5 Mtpa from its current 28 Mtpa in India & USA by FY25. The brownfield expansion at JSW Steel Vijayanagar Works is part of this broader target.

Primetals Technologies starts up Two Continuous Slab Casters at JSW Steel DolviPlant

- Production capacity is 4.5 million metric tons of slabs per annum
- Technology packages ensure high slab quality
- JSW Steel already has two similar plants in operation in Toranagallu
- Casters supply slabs to the new Primetals Technologies hot rolling mill

In October 2021, JSW Steel Ltd. started up two continuous slab casters at its Dolvi plant in Maharashtra. Together, the two two-strand casters have an initial annual capacity of around 4.5 Mt of slabs with future capacity potential for 6 Mt. A number of technology packages ensure that the slabs have high internal and surface quality. Primetals Technologies supplies also a hot rolling mill to the new Dolvi expansion plant. The hot rolling mill has an annual capacity of 5 Mtpa. JSW Steel already operates three continuous casting plants from Primetals Technologies at its steel works in Toranagallu, Karnataka.

The steel works in Dolvi currently has an installed production capacity of around 5.0 Mtpa. The new casting plants and new hot rolling mill from Primetals Technologies, together with other capital investments, will substantially increase the location's capacity. In the medium term, JSW Steel has the vision to increase its total production capacity to 40 Mtpa.

The two continuous casting plants from Primetals Technologies are designed as bow caster with straight SmartMold and have a machine radius of nine meters and a metallurgical length of 34.5 meters, with a provision of 36.9 meters in future. Slabs will be cast with a thickness of 220 and 260 millimeters in widths ranging from 900 to 1,650 millimeters. The maximum casting speed will be just under two meters per minute with a provision of 2.1 meters per minute in future.

Primetals Technologies installed a number of technology packages to ensure not only a trouble-free casting process, but also slabs with high surface and internal quality. The packages include the Mould Expert breakout detection system, the LevConmold level control, the DynaFlexmold oscillator, and the Quality Expert inline quality assurance system. Primetals Technologies also supplied the complete basic (level 1) and process automation (level 2) systems. DynaGap Soft Reduction in combination with Dynacs 3D cooling model enables slabs to be cast from high-quality pipe grades and other micro-alloyed steels. Primetals Technologies supervised installation and commissioning of the continuous casting plants and trained the customer's personnel. Continuous slab caster from Primetals Technologies installed in the Dolvi plant of JSW Steel in India

Jindal Stainless launches first branded Chequered Stainless Steel sheet 'Infinity'

Jindal Stainless, India's largest stainless steel manufacturerlaunchedIndia's first hot rolledstainless steel chequered sheet with brand name JindalInfinityat the International Railway Equipment Exhibition 2021 organized by CII.This is Jindal Stainless' second foray in the branded category after the launchof Jindal Saathi, the co-branded stainless steel pipes and tubes products. With the launch of Infinity, the company aims to capture 20% market share over the next 3 years, amounting to an additional business potential of ~INR 500 crores. According to industry estimates, the current size of chequered sheet market in India is 2,00,000 tons annually and is growing at an annualrate of 8%.

Speaking on the launch of 'Infinity', Managing Director, Jindal Stainless, Abhyuday Jindal said "The launch of our brandedstainless steelchequered sheet, Infinity, is another step towards bringing in quality consciousness for the end-customer. We are targeting annual sales of 40,000 tons of this brandin the next couple of years. Albeit chequered sheets have been in usefor transport and industrial applications, stainless steel chequered sheets, given their remarkably superior offerings, are sure to change the dynamics within this category."

The new stainless steel chequered sheet is made from high-end 409M grade stainless steel. As per studies conducted by Division of Materials, Science and Technology, CSIR, South Africa, sheets made from this grade of stainless steel are over 150 times more corrosion resistant than those made from mild steel.Its wear resistance is greater by five times, and its weight is 30% lower due to reduced material thickness. These qualities render the stainless chequered sheet a far superior and cost efficient alternativefor any application. In the transport segment, it also brings about higher fuel efficiency due to reduced vehicular weight. The non-corrosive nature of stainless steel makes it a safer and more hygienic choice. As Jindal Stainless produces stainless steel through the scrap route, Infinity is also more environment friendly than its competitors in the category.

In a growing economy like India, undergoing rapid urbanizationand large scale infrastructure development, the growth potential of stainless steel Chequered Sheets is immense. With applications ranging from flooring of factories and plants, automobile (bus and trucks) steps and floors, railway track bridges, architectural stairs and flooring etc, Infinity is expected to both create a market for itself and replace alternate materials in this segment.

Jindal Stainless has been supplying innovative and customized material for the Indian Railways for over two decades. As leading producers of stainless steel, Jindal Stainless has been supplying material for LHB coaches, wagons, metro rails and infrastructure applications. The Research and Development team of Jindal Stainless works in close collaboration with the Railways' Research Designs and Standards Organization (RDSO) to develop tailor made solutions for the Indian Railways.

POSCO, Adani Group Sign Pact to Set up Steel Plant in Gujarat

Industrialist GautamAdani-led Adani Group has signed a pact with South Korea's POSCO to explore business opportunities in sectors like steel, renewable energy among others.Both the entities have signed a memorandum of understanding (MoU) to this effect.

In a statement, Adani Group said the investment under the MoU is estimated to be up to USD 5billion. Adani Group said it "has agreed to explore business cooperation opportunities, including the establishment of a green, environment-friendly integrated steel mill at Mundra, Gujarat, as well as other businesses.

The non-binding MoU intends to further collaborate at the group business level in various industries such as renewable energy, hydrogen, and logistics in response to carbon reduction requirements, the statement said.

Danieli Bar-in-Coil Line for Arjas Steel, India

Special steel producer Arjas Steel has selected Danieli to supply a new bar-in-coil line (Garret coiler line) to be installed at its integrated steel plant in Tadipatri, India, to produce bars in coil for both the domestic and international markets.

This new line will specifically produce alloyed and micro-alloyed smooth rounds ranging from 13 to 45-mm-dia, in coils, at maximum speed of 15 m/s. In addition to a Garrett coiler, the line will include a pinch roll, a combined shear and two Danieli Automation Hi-Profile electronic devices for online bar dimension measurement and surface-defect identification. A transfer conveyor equipped with rollers will ensure scratchproof transfer of bars up to the coilers.

Furthermore, the water-cooling line will include two specifically designed beam-type water boxes for online temperature control; two rotary coilers for coil formation, including a coil unloader; a coil evacuation system by the walking beam cooling conveyor, with the facilities for natural, retarded and fast cooling with six high-intensity blower fans.

The cooled coils will be handled by a vertical coil-handling system installed together with a modern SundBirsta PCVA model coil compactor, with an online coil strapping facility based on an SBHX5 strapping unit. Weighing and tagging stations will complete the line.

The new line, powered and controlled by Danieli Automation advanced devices and control systems, is scheduled to be put in operation by end of 2022.

Indian Steel Plants Spread Wings

Vedanta explores investment opportunities in Saudi Arabia

- To partner with the Gulf Nation which is fast becoming a mineral hub
- Company exploring opportunities to invest in zinc mining projects

Vedanta, a global natural resources company, has said that it plans to invest in the mineral sector in Saudi Arabia. The company is in discussions to identify investment opportunities in Saudi Arabia, which aims to transform itself into a mineral hub in the Middle East.

Vedanta Chairman Anil Agarwal who was invited as a guest speaker at the Future Minerals Forum 2022 held in Riyadh, Saudi Arabia, spoke of the huge potential that the country has in minerals including zinc, gold and silver. Considering the strong demand for zinc and its expected shortage globally, Saudi Arabia is looking to team up with global companies to become a leading producer of the metal.Vedanta group company Hindustan Zinc is one of the world's largest producers of zinc.

Addressing the Future Minerals Forum, Anil Agarwal, Chairman, Vedanta Ltd, said: "The strong collaboration between India and Saudi Arabia is bringing to the fore big opportunities. We are in the process of identifying investment options in the mineral sector which we believe the country has in abundance. Mining and minerals will play a critical role in the transition to a cleaner and more sustainable world, and we at Vedanta are committed to play an important part in this journey."

Saudi Arabia has tremendous potential in non-oil minerals and the Government wants to make the country a future hub for minerals. It has set a target of generating half of its energy from renewable sources by 2030. Vedanta with its portfolio of green metals, strong ESG (Environmental, Social and Governance) focus and thrust on technology would like to be the ideal partner to bring about the transformation.

Prime Minister NarendraModi's vision is to build strong ties with Saudi Arabia, a country with which India shares a lot in common. Saudi Arabia is planning to invest $100 billion in the country in areas of energy, refining, petrochemicals, infrastructure, agriculture, minerals and mining. Saudi Arabia is also a key pillar of India's energy security, being the source of 17 per cent of crude oil and 32 per cent of LPG requirements of India.

Vedanta is planning to be the ESG leader in the natural resources sector and has committed to reduce carbon emissions to zero by 2050 or sooner. The company has pledged $5 billion over the next 10 years to accelerate the transition to net zero operations.

Vedanta has been at the forefront of sustainable practices and is leveraging new technologies to safeguard the environment and communities. Guided by the philosophy of `Zero Harm, Zero Waste, Zero Discharge', Environmental, Social and Governance (ESG) practices are at the heart of Vedanta's operations which are focused on delivering sustainable and responsible growth thereby creating value for all stakeholders.

GFG issues Operating Update as Work Continues to Stabilise and Move the Business Forward

GFG Alliance (GFG), owner of LIBERTY Steel Group, today reports further progress in its operational performance as well as the continued work by the specially appointed Restructuring and Transformation Committee at LIBERTY Steel to secure an environmentally and economically sustainable future for its businesses.

Bolstered by strong demand and record prices for steel, iron ore, and aluminium in global markets, alongside

improvements in systems and operations, GFG notes strong performance for its core businesses.

Jeffrey S. Stein, Chief Restructuring Officer (CRO) said: "The RTC has been working closely with LIBERTY Steel Group and its stakeholders globally to develop new business plans and restructure the business. It is encouraging that discussions with creditors continue to progress well and our global restructuring plans continue to develop. In many cases, refinancing options have been oversubscribed. Our core markets in steel, aluminium, and iron ore are performing beyond expectations, bolstered by high demand and record prices. This in turn has led to our core assets achieving strong financial results. While there remains much to do, we are pleased with the progress made to date and confident in the resilience of the business going forwards. We will continue to publish regular updates on the restructuring and refinancing for the benefit of all of its employees and stakeholders."

Actions taken

- Activity is underway to complete LIBERTY Primary Metals Australia's (LPMA) refinancing, as global refinancing efforts continue.
- At ALVANCE, a strategic deal cementing a long-term commercial relationship with two of the largest trading houses in the world, has been agreed. The deal involves the supply of the raw material requirements of Dunkirk and Duffel, assistance in the marketing of products and provision of hedging facilities. Under the agreement ALVANCE's debt will be refinanced allowing creditors to be repaid. GFG expects the agreement to be finalised shortly once the reservations of one of the businesses' creditors over early repayment has been resolved.
- GFG reached an agreement with Tata Steel, bringing to an end proceedings launched against LIBERTY Speciality Steels, LIBERTY House Group PTE, and Speciality Steel UK earlier this year.
- GFG is now back in control of its 41% stake in sustainable energy generator SIMEC Atlantis Energy following the cessation of the receivers' appointment over the shares of SIMEC UK Energy Holdings Limited in SIMEC Atlantis Energy and the resignation of the receivers as directors of SIMEC UK Energy.
- GFG has settled a post completion dispute with Rio Tinto Group over the acquisition of the Dunkirk aluminium smelter in 2018.

Regional updates:

United Kingdom

Followingthe introduction of the new LIBERTY Steel UK (LSUK) management team, led by Subhajit Roy Chowdhury, a new organisational structure has been developed. The new structure lays the foundation for developing LSUK into a competitive, two million tonnes per year GREENSTEEL business with clear centralised functions and operations-focused units. The new management composition will oversee the separation of the Stocksbridge, Brinsworth Narrow Strip, and Performance Steel assets.

New business plans are being developed for the LSUK businesses which would allow the LSUK to resume production in the short term and create a more sustainable future for the assets over the longer term. Plans are being shared with unions and creditors for their input, including working with a leading strategic consultancy to validate plans.

LIBERTY Steel's Newport mill achieved its best-ever financial results in the first quarter, with the outlook looking even brighter for the second quarter. The business improved profitability last year despite challenging market conditions caused by covid-19 and significant health and safety improvements have been made under the stewardship of LIBERTY's site management. The Newport plant recently welcomed MPs from the BEIS Select Committee, who witnessed the strength of operations first-hand.

GFG and LIBERTY Steel continue to engage with the BEIS Select Committee inquiry into 'Liberty Steel & the future of steel industry in UK'. In addition to the positive site visit to Newport in July, GFG has submitted written evidence to the Committee, in which it articulated its vision for sustainable steel industry as a backbone of the UK's economic infrastructure and the role that its GREENSTEEL strategy can play in achieving it. GFG has also responded in writing to detailed questions from the Committee.

Europe

LIBERTY Ostrava, GFG's business in the Czech Republic, has followed up its strong Q1 results with its best production quarter since 2017. For the quarter to 30 June 2021, it shipped more than 600,000 tonnes of steel products, with production for each month around 200,000 tonnes, the highest sustained monthly levels since 2008. Production for the quarter was almost 80% higher than the covid-19-affected Q2 2020.

LIBERTY Gala i, the largest integrated steel producer in Romania, has reported its strongest quarterly results since 2008, building on the production improvements

made in 2020. The company reported turnover of EUR 359 million and EBITDA of EUR 52 million for the quarter ending 31 March 2021. This continued the positive progress from the second half of last year. The plant has now raised its production target for 2021 and is accelerating the planning for the strategic projects required to transform the plant to carbon neutrality by 2030.

During a visit to Romania last month, representatives of the RTC and Sanjeev Gupta took the opportunity to meet with creditors and potential new lenders to continue positive dialogue and deepen the understanding between parties.

On 22 July a Memorandum of Understanding (MOU) was signed to create a Technical and Research Collaboration Framework with the Romanian Energy Centre, the international engineering group MTAG as well as a Romanian research institute. The framework will promote, facilitate, and consolidate collective work in research, innovation and business development of novel energy production technologies and fuels, particularly hydrogen, which will be pivotal to LIBERTY's GREENSTEEL plans in Romania.

LIBERTY Magona has now restarted production due to receiving Hot Rolled Coil (HRC) from LIBERTY Galati, which has now become primary supplier of HRC to our European downstream plants following the operational reorganisation announced at the end of June. LIBERTY expects the ramp up to full production at Magona to be completed in September and at LIBERTY Liege-Dudelange in October.

LIBERTY Steel Group has completed the sale of LIBERTY Ascoval and LIBERTY Rail Hayange to SHS – Stahl-Holding-Saar (SHS). Following on from the recent collaboration between the two groups to explore construction of an industrial scale hydrogen-based steel making project in France, Liberty believes SHS/ Saarstahl has a strong industrial concept similar to LIBERTY's GREENSTEEL model that will help secure the future of the businesses.

Australia

The Whyalla Steelworks team in South Australia has continued their site-wide continuous improvement programme, with 85 initiatives across the business now positively impacting bottom line performance through increased efficiency and value realisation.

SIMEC Mining's Tahmoor Coking Coal Operation posted record annual production and output on the back of significant capital investment by GFG, new state-of-the-art equipment, strong market conditions, and continuous improvement initiatives. The Tahmoor South Project also received conditional approval earlier this year, facilitating a 10-year extension to the mine's lifespan and the creation of an anticipated 170 jobs.

Governance

As a family-owned business that has grown rapidly worldwide to a total of 35,000 employees across 30 countries, GFG was in the process of evolving its governance structure and processes before the business was impacted by the collapse of Greensill Capital and the covid-19 pandemic. GFG recognises that this is a crucial process and is aware that stakeholders are looking for it to provide more transparency in the group's corporate structures, reporting arrangements, and governance.

Since 2019, a workstream has been underway to evolve GFG's governance and this has accelerated since the RTC was established on 5 May 2021 to restructure LIBERTY's operations and support GFG's progress on refinancing the group. Against a backdrop of seeking to secure the future of a number of challenged operations in the wake of the Greensill collapse, the RTC has supported and advanced this workstream. The work of the RTC includes installing external independent Directors, the Chief Governance Officer, and the Chief Financial Officer to individual operating companies to review operations and reporting arrangements for the future.

The purpose of the governance workstream, and of the Chief Governance Officer in particular, is to review company structures and advise on the best future structures – to serve the interests of shareholders and of stakeholders – for the group going forward post-refinancing.

GFG will continue to update on developments as they arise.

Outlook

In response to the progress achieved by the RTC, Sanjeev Gupta, Executive Chairman of GFG Alliance, commented: "The update of the RTC shows that, despite the challenges, our core businesses continue to perform very well, and we are taking advantage of the excellent market conditions we face. Much remains to be done, but we believe that we are now making rapid progress in building faith with our creditors and other stakeholders through our restructuring plan. We are moving with significant momentum towards a profitable, restructured and focused business capable of delivering our GREENSTEEL vision and strong returns"

International Steel

Yukun I&S Chooses Danieli QSP- DUE Technology for HRC Quality and Production Flexibility

This is the unique technology to perform in endless, semi-endless and coil-to-coil mode in a single line

Convinced by the excellent performances of Danieli QSP DUE technology in operation at SGJT, Chinese private entrepreneur Yunnan YuxiYukun Iron & Steel Group contracted Danieli for its new quality-strip plant, which will be the new most productive thin-slab casting rolling plant in the world.

Danieli-patented Dysencaster will produce 110/120-mm-thick slabs after soft reduction, and feed the 3+5 stands hot-strip mill, where thermomechanical rolling will be performed.

The caster will consist of two casting strands and will operate in endless and semi-endless modes on strand #1, or coil-to-coil mode operating on strands #1 and #2, reaching the maximum production capacity.

A swivel furnace will connect casting strand #2 with the mill. Original Danieli Q-Heat induction heaters will be installed between roughing and finishing mills.

Controlled by Danieli Automation advanced process control, featuring Q3 intelligence, the plant will produce quality hot-rolled strip in thicknesses from 0.8 to 25.4 mm in any steel grade, except automotive exposed.

Danieli Universal Rolling is a sustainable, green technology that allows low energy consumption and emissions: a step toward net-zero emissions steelmaking.

The plant will be installed in, Yuxi city, Yunan province, China and the startup is scheduled for the second half of 2023.

Excellent Performances at Egyptian Steel By Danieli MidaQlp Endless Casting Rolling Minimills

The Danieli-patented Octocaster mould further improves overall competitiveness

Featuring the Danieli endless casting rolling process, the two twin MIDA QLP minimills of Egyptian Steel in BeniSuef (IIC) and Al Ain Al Sokhna (NPSS), Egypt, have been producing quality rebar at high-performance levels since their startup in 2016 and 2017, respectively.

After an initial very quick learning and fine tuning, during these years the two sites scored impressive results, including:

- 36 heats/day, 900 heats/month
- 1813 tons/day on a single-strand caster
- 60 heats in a 47-hour sequence
- 14.79 km of single endless cast and rolled billet.

Despite the great results achieved, recently NPSS minimill has adopted the latest Danieli QLP innovation – Octocaster mould– to enhance productivity and reduce operational costs.

The octagonal-section mould applied to a 165-mm square casting section has been recently installed and has been operating at speeds up to 8 m/min. Final target of 9 m/min will be achieved in the next months thanks to the installation of upgraded mill gearboxes and motors to sustain Octocaster operations 90 tph productivity.

Consistent savings in rolling mill electrical energy have been immediately achieved, with a major reduction in maintenance costs thanks to the extremely simple and reliable Octocaster configuration.

Octocaster allowed Egyptian Steel to improve its record billet length, which now is 16.62 km.

Severstal and Fives launched an Innovative Reheating Furnace at Cherepovets Steel Mill in Russia

Severstal, a leading Russian steel producer, and Fives, an international engineering group, launched an innovative reheating furnace at Cherepovets Steel Mill in Russia.

Furnace 2, symbolically named "Spark" following a tender within Severstal Russian Steel, is the first of three slab-heating furnaces launched within a major upgrade program covering furnace facilities at Mill 2000, which produces 65% of Cherepovets Steel Mill's (CherMK) output.

Severstal has placed an order for two high-performance Stein Digit@l Furnace® from Fives in 2019 to replace existing reheating furnaces 1 and 2, and for a third one in 2021.

"The construction of the first reheating furnace is the beginning of a major upgrade of furnace facilities of Mill 2000. Our goal is to increase the productivity and energy efficiency of the equipment while reducing production costs. This furnace is completely innovative - it has a different heating concept, on/off burners, and a different level of automation control. Its productivity is twice as high as any of the existing furnaces at Mill 2000: 400 tons per hour for cold slab charging and 500 tons per hour for hot slab charging. Therefore, new equipment allows to achieve higher quality heating to obtain rolled products with guaranteed high quality", commented NikolaySavatin, Head of CherMK Rolling Production Revamping Department.

"Dismantling the old equipment and erecting a new furnace in the frame of existing production was a large and complex project. Despite difficult conditions related to the pandemic and global logistics challenges, the international team completed this project in a record-breaking 11 months, thanks to collaboration and commitment to a single goal," explained Kirill Bogachev, Project Manager of CherMK Rolling Production Revamping Department.

Fives has more than 150 years of experience in developing and supplying thermal equipment for the steel industry. The Stein Digit@l Furnace® is a crown jewel within the range of Fives' technologies for reheating and heat treatment, providing:

- Consistent flame shape and heating quality
- Ultra-low NOx
- Substantial fuel saving
- Minimized scale loss and decarburization
- Reduced OPEX due to lower maintenance and fuel consumption

Since 2000, more than 80 Stein Digit@l Furnace® from Fives have been designed and supplied to steel makers in the USA, Spain, France, Russia, Turkey, India, China, Vietnam and other countries

Bronx Finishing Equipment World Take-over

Fives has signed several orders on Bronx straighteners for delivery to various countries, such as Mexico, Spain and Russia.

A new 6-roll straightening machine has been ordered by a leading manufacturer of steel for its tube facility in Mexico. The Bronx machine, designed for mechanical tubing processing, is scheduled for the delivery in the second quarter of 2022.

A heavy-duty 10-roll straightener has been contracted by a global steel pipe manufacturer for a plant located in south-eastern Russia. The new fully motorized machine will process high-yield seamless stainless steel pipes up to 280 mm in diameter and wall thicknesses of up to 30 mm.

A European heavy industry solution provider has passed an order for the 5th Bronx section straightener with equipment delivery scheduled for early 2023. It's a fully automatic, fully motorized 11-roll straightening machine equipped with the very latest COMPASS, a computer automatic setting system, customized to provide management, maintenance and quality control information.

"Our successes are built on three pillars – reputation, reliability and experience," says Jon Dunn, Chief Executive Officer of Fives Bronx, a Fives' subsidiary designing and supplying finishing equipment worldwide. "The machines are rigidly constructed and designed to meet high standards of straightness and surface finish for reliability and accuracy of seamless and welded tubular products," he adds.

Global Steel Alliance formed to Cut Emissions

A global alliance of steelmakers and mining companies has been brought together by the Chinese steel giant China Baowu Steel Group. The idea was first mooted in late 2019.

The idea behind the new alliance is to tackle climate change and cut greenhouse gas emissions, according to a recent online media report.

Alliance member companies include ArcelorMittal, BHP

Group, Rio Tinto, Vale, Fortesque Metals Group, Tata Steel, ThyssenKrupp, Angang Group, HBIS Group and Shagang Group.

According to HouAngui, vice general manager at Baowu, tackling climate change alone is a big ask. Hou is also the secretary-general of the new alliance.

Baowu has announced funding of $5.5 million annually to research low-carbon metallurgy.

China Baowu Steel Group's current steel output is something like 115Mt and the company hopes to reach peak carbon by 2023 and carbon neutrality by 2050.

Source: Financial Post

Algoma Steel selects Danieli Digimelter for Full Transition from Integrated to Electrical Steelmaking

With a 70% carbon emission reduction, Algoma will fully convert from BF to EAF steel production with this transformation

Leading Canadian producer of hot- and cold-rolled steel sheet and plate products Algoma Steel chose Danieli as sole technology supplier for its full transition from integrated to electrical steelmaking.

The selected Digimelter melting technology powered by Q-One digital power system will lead to a reduction of approximately 70% of carbon emissions, positioning Algoma as a leading provider of green steel in North America.

To be installed at Algoma Steel in Sault Ste. Marie, Ontario, Canada, the new green steel shop will have a design capacity of 3.7 million tons of liquid steel, with two 250-ton electric arc furnaces at its core, powered by two Q-One digital power systems with a rated capacity in excess of 190 MVA each. Q-One is a patented technology capable of continuously varying the frequency during each of the melting phases, improving energy efficiency and electrode consumption.

The new Digimelter will produce high-quality liquid steel from recycled steel scrap, with the option for the direct addition of a wide range of other iron inputs. The new technology is optimized for process quality, low operating costs, and enhanced safety through extensive application of mechatronic technologies.

Danieli Digimelter is the only technology that allows the direct use of renewable energies for electric steelmaking.

The design provides for best-in-class environmental performance with engineered enclosures encapsulating the two furnaces to minimize noise and emissions, while the Q-Melt automatic process control delivers superior energy efficiency. Two new off-gas treatment plants including bag houses and a dedicated recirculating water treatment plant will combine to provide best available technology for emission control and filtration, and water conservation.

Rounding out the package, the facility will include a Danieli automated scrap yard featuring automatic cranes, scrap visual recognition, and automatic scrap sorting and charging. A new Danieli twin-tank vacuum degasser with oxygen-blowing facility also will be added to the process route to deliver advanced grades of steel and further enhance steel cleanliness and final product quality.

The new Digimelter-based steelmaking facility is expected to be put in operation in early 2024.

HoaPhat Celebrated 3 Mt HRC produced at Dung Quat Steel Complex

Operating Danieli QSP technology, the line allows flexible production of quality and commercial strip grades

Vietnam's leading steelmaker, HoaPhat Group, celebrated its first 3 million tons cumulative hot-rolled coil production reached on December 2, since the line was commissioned.

The QSP thin-slab casting rolling line supplied by Danieli allows flexible production of quality –including API– and commercial grades, with excellent geometrical and mechanical strip properties of strip thicknesses ranging from 1.5 to 12.0 mm, and widths from 900 to 1,500 mm.

The two vertical-curved casters produce 70- to 85-mm-thick slabs after dynamic soft reduction, covering the whole product mix with a single mould.

A Danieli Centro Combustion twin-strand shuttle furnace connects the casters to the 2+4 hot-strip mill, with separation of high-reduction and finishing units allowing dual step rolling.

The QSP control system is based on the Danieli Automation HI-PAC industrial platform.

HoaPhat Orders Two More Blast Furnaces from Danieli Corus

This new plant will add 5.6 Mtpy of steel to Dung Quat steel complex

HoaPhat Dung Quat Steel relies again on Danieli Corus for the design and supply of two blast furnaces for the Dung Quat steel complex II. This new plant will add 5.6 Mtpy of liquid steel to HoaPhat's annual production

capacity – with 5 Mtpy currently being produced at the Dung Quat steel complex I that was recently completed.

The two, 2500 m working-volume blast furnaces will form the heart of the new integrated steel plant – each with a nominal annual hot metal production rate of 2.5-2.8 million tons. Both furnaces will be equipped with the Danieli Corus high-conductivity cooling and lining design based on copper-plate coolers and graphite refractories – designated "the indestructible bosh" by some steel producers for its unparalleled campaign length capability.

This contract follows 2017 order for four 1080 m working-volume blast furnaces, all of which are now in operation (the first having been commissioned within 24 months after the contract was signed). The stable and uninterrupted ironmaking operations with these furnaces, as well as the very effective project execution experienced by both parties have been at the basis for selecting Danieli Corus as the key technology provider for this second phase.

In addition to the blast furnaces, level 2 process automation systems, pulverized-coal injection systems and part of the hot-blast systems are included in the present contract's scope.

The project will be executed following a schedule equally ambitious as that for the phase one project. Given the excellent partnership developed during that project, HoaPhat and Danieli Corus are confident that phase two will contribute greatly and quickly to HoaPhat's continued rapid growth.

Start-up of Two Continuous Slab Casters Modernized by Primetals Technologies at Angang Iron & Steel

- Slab quality is improved by further implementing DynaGap soft reduction
- Caster availability is increased
- State-of-the art automation features and technological packages implemented
- Startup 16 days ahead of schedule

Recently, two continuous slab casters modernized by Primetals Technologies commenced operation at Chinese steel producer Angang Iron & Steel Group Co. (Angang) in its steelworks No. 2 in Anshan. The objectives of the project were to further improve slab quality by implementing DynaGap soft reduction and to increase the caster´s availability. To these ends, state-of-the art automation features and technological packages were installed. Despite current quarantine challenges for the project team, CCM5 was started 7 days ahead of schedule and CCM4 went in operation 16 days earlier than planned.

WuzhouYongda issues FAC for EAF Quantum Electric Arc Furnace and Ladle Furnace supplied by Primetals Technologies

- EAF Quantum furnace designed to handle scrap of varied composition and quality
- Electrical energy consumption per metric ton of liquid steel is very low, as are operating costs and CO2 emissions
- Ready for Industry 4.0

In November 2021, Chinese steel producer WuzhouYongda Iron and Steel Co., Ltd. (WuzhouYongda) issued the final acceptance certificate (FAC) for an EAF Quantum electric arc furnace and twin ladle furnace supplied by Primetals Technologies for a greenfield project of in Wuzhou city, in Guangxi Zhuang Autonomous Region. The EAF Quantum furnace is designed to handle scrap steel of very varied composition and quality. The electrical energy requirement of the electric arc furnace is extremely low because the scrap is preheated. This reduces both the operating costs and the CO2 emissions. The twin ladle furnace sets the desired steel grades and the correct casting temperature.

Danieli Signs the Science Based Target Initiative (SBTI)

Committing to net-zero greenhouse emissions by 2050

Danieli has submitted its commitment to reach zero CO_2 emissions by 2050 to SBTi (Science-Based Target Initiative) on November 2, 2021.

Danieli is continuing down its path towards carbon neutrality with determination thanks to the gradual decarbonization of its production processes and value chain.

For the CEO GiacomoMareschi Danieli, this is a fundamental strength to ensure the enduring

competitive edge of a company.

In June of 2019, Danieli had already received from SBTi the validation and certification of its emissions reduction targets, approved with a well-below 2 C trajectory, in line with the requirements of the Paris Agreement and the Paris COP21 conference.

Below are Danieli's targets based on a holistic approach for Scope 1, Scope 2 and Scope 3 emissions:

Industry 4.0 Intelligent Guides-

Introducing new digital guide equipment to reach the highest safety standard and excellent guiding - taking rolling mills to Industry 4.0

The future of rolling long products will be achieved in a safe way. Thanks to the technological development over recent years with the introduction of sensors and actuators, roller guides have progressed from mechanical devices to fully developed machines. It is no longer necessary to enter the mill floor when rolling: the operator controls and receives feedback from a system in a safe location of the plant. Besides the main benefit of safety, the new design provides excellent guiding, increases productivity and reduces plant OpEx. RX-guide series and WSG, Wide Smart Guide

Danieli Morgårdshammar Guide Systems is ready to introduce automatic and motorized guides for any type of rolling mill, from bar to wirerod, to make the rolling mill plant smart, digital and safe.

The intelligent guide setting enables a setup to be changed in seconds from a safe location, either from a local pulpit or mill control. This will significantly improve overall equipment efficiency. The operator will receive real feedback about the production of each billet that will give an indication of groove wear and variation in stock. Operators can act in a predictive way and reconsider the standard production.

The new patented force controlled regulation will reduce peak and constant force, measured up to 25% less force in a comparison between RX-guide and an conventional guide. With dynamic force control and self-adapting roller positioning, the guide controls and handles dimensional variations of stock that will decrease roller wear, prolong bearing lifetime, reduce maintenance and extend mill service intervals.

Main features

Safety: No need for personnel to enter the mill floor; reassign experience in the pulpit and workshop.

Quality: Predict and enhance finished product quality. Excellent guiding thanks to dynamic force-controlled roller position handles stock dimensional variations.

OpEx: Optimize roll-pass design and groove life. Increased service life for consumables and spares (RFID). Increased rolling mill flexibility.

Know-How: Constant feedback on rolling mills' operating performance, maintaining every sequence and every billet at peak production level. Analyze and find new process rules considering all rolling mill factors - temperature, steel grade, speed, alignment, wear etc. - all in one dedicated app.

1944 Morgårdshammar patented the first roller guide and now is the first to patent an automatic roller guide series.

Industry 4.0 signals a new era for steelmaking, and Danieli Morgårdshammar Guide Systems is ready to support customers in this transition with new machines and services to increase plant profits.

Just one click on the control desk will completely set up a rolling mill, and significantly improve overall equipment efficiency. This is the concept of Danieli Intelligent Guides.

Two Danieli 1200-mm-Dia Bloom Caster Projects under Execution in China

ChengdeJianlong and Jiangsu Yonggang chose Danieli jumbo bloom-casting technology for product quality and process reliability

Danieli was awarded two contracts to supply brand-new, large-round continuous casting machines to Chinese steelmakers ChengdeJianlong and Jiangsu Yonggang, to meet the growing demand of components required by the power-generation industry, worldwide.

The 18-m radius casters will be able to produce large round sections from 700 to 1200 mm dia, with total production capacities exceeding 1 Mtpy.

1200-mm-dia blooms will become the largest continuously cast sections in the world.

Danieli jumbo caster technology foresees the intensive

use of electromagnetic stirring systems –mould, strand and final– that ensure best internal quality with very low values of carbon segregation and central porosity, for a wide range of steel grades dedicated to power generation.

The combined application of the innovative, patented "Q-DTC – Dual Temperature Control system" and the new "High-force withdrawal and straightening modules" will guarantee smooth product unbending to maximize surface quality, and safe and reliable operations during the casting process.

The startup of the four-strand jumbo bloom caster for Jiangsu Yonggang is scheduled for January 2022, whilst the three-strand jumbo caster for ChengdeJianlong is foreseen starting a few months later, in April.

Primetals Technologies receives Final Acceptance for replaced Laminar Cooling at Baosteel in China

- Replacement of entire strip cooling
- Extends product mix and product range
- Executed remotely due to pandemic conditions

Recently, Primetals Technologies received the final acceptance certificate for the replaced laminar cooling section installed at the 2050mm hot strip mill in the Shanghai, China production site of Baoshan Iron & Steel, Co., Ltd. (Baosteel). The new laminar cooling enables Baosteel to extend its product range up to a thickness of 19 millimeters for high toughness line pipe grades at low temperature, and dual -phase and multi-phase steel grades in a thickness range of 2 to 8 millimeters. The project was executed remotely due the ongoing pandemic conditions.

Fujian Dingsheng starts up First Eco-Friendly Minimill for Flat Products combining EAF Quantum and Arvedi ESP by Primetals Technologies

- First minimill for flat products with lowest environmental impact in operation
- 85% CO_2 savings compared to integrated production route
- Coils for sales market directly produced during first heat
- New products for further CO_2 savings by omitting cold rolling process

Recently, Chinese steel producer Henan Yaxin Steel Group Co., Ltd. (Henan Yaxin) has started up its eco-friendly minimill for flat products consisting of two EAF Quantum electric arc furnaces and an Arvedi ESP line at its Fujian Dingsheng plant. Tapping weight of each EAF unit is maximum 115 metric tons. This set-up allows for 85% CO_2 savings compared to integrated production route. The Arvedi ESP line has a design capacity of 2.5 million metric tons per year and a reproducible strip thicknesses down to 0.8 mm. This enables Henan Yaxin to produce high-quality, ultra-thin strip to enter new market segments with direct application products omitting cold rolling. Coils for the sales market were directly produced during first heat.

Primetals Technologies to supply Gas Cleaning Plant for Blast Furnace to ArcelorMittal Poland

- Reduces energy consumption
- Increases dry dust recycling
- Improves green credentials
- Reduces maintenance requirements

Recently, ArcelorMittal Poland S.A. placed an order with Primetals Technologies and Mostostal Zabrze Realizacje Przemyslowe S.A. (MZRP) to supply a gas cleaning plant for its blast furnace #2 in D browaGórnicza, Silesia Voivodeship. The gas cleaning plant constitutes a pilot installation to be built under one of the ArcelorMittal Poland's R&D projects co-financed from the funds of the European Regional Development Fund. The gas cleaning plant, which includes a cyclone dust separator and wet gas scrubber, will be set up as full turnkey installation. The new equipment will reduce maintenance requirements and energy consumption, increase dry dust recycling and improve the environmental footprint of the site. Work on site is scheduled to start in 2022.

Tulachermet Contracts Danieli Corus for BF Upgrade

It will feature Danieli DANCU top-charging technology

Russian steel producer Tulachermet has awarded Danieli Corus with an order for a new top-charging unit for the blast furnace #3 at the integrated steel plant in Tula. The furnace will be upgraded to chute-based charging as part of a modernization project, preparing

it for a next campaign at increased productivity and efficiency.

The DANCU distributor will be the core part of the new burdening system. This type of distributor was developed based on hydraulic design with the objective of reducing maintenance time and complexity. Redundancy and the use of "failure-free" components have led to a marked increase in furnace availability. The reduction in the number of moving parts makes this charging unit the most robust design available. It is the only design with a proven capability of charging hot sinter with temperatures up to 700^{0}C.

The upgraded blast furnace #3 is scheduled to be put back in operation in 2022 with a design productivity of 6000 tons of hot metal per day.

Primetals Technologies and SICON sign cooperation agreement for Digitalization Of Scrap Yards

- Joint development of integrated solutions for the digitalization of complete scrap yards
- Portfolio enables processing of input materials into a "design scrap" for the production of high-quality end products
- Holistic solution is modular and provides standardized interfaces
- First preliminary projects are already up and running

Primetals Technologies and SICON recently signed a cooperation agreement concerning the development of holistic solutions for the digitization of complete scrap yards. Primetals Technologies specializes, among other things, in optical scrap identification and the automation of production processes and logistics. SICON is a specialist in the processing, analysis and sorting of scrap. For the production of high quality steel grades, steel producers usually need solutions to all these issues, as well as a scrap composition matched to the end product. This "design scrap" allows a greater amount of scrap to be used in higher quality grades. This means that, when transforming a scrap yard into a digitalized and thus "smart" scrap yard, an integrated solution from Primetals Technologies and SICON saves a lot of work at the implementation stage and enables the processing of input materials for the production of high-quality end products.

Primetals Technologies to supply new AOD line and to Upgrade Existing AOD line for Aperam Genk, Belgium

- Increased safety through automatic vessel exchange
- Improves operating costs
- Dedusting system with provisions for heat recovery system reduces environmental impacts

In September, Primetals Technologies received an order from Aperam Genk in Belgium to supply a new argon oxygen decarburization (AOD) production line and to upgrade the existing AOD 1 production line. The objectives of the project are to increase operational safety, to improve operating costs, and to further reduce environmental impacts via a dedusting system with provisions for heat recovery. Primetals Technologies will be responsible for mechanical equipment, electrics and automation as well as auxiliary equipment. The project will be carried out in a consortium with Austrian erection company SGS Industrial Services. Start-up is expected for mid-2023.

Statistics Revelation

GLOBAL IRON & STEEL SCENARIO

Provisional worldsteel report indicates that global DRI output stood at 86.93 Mt in January-October 2021, up 12.7% over same period of last year. Such production growth was driven by India (32.21 mt, 37% share, up 18.7%) at the number one spot and Iran, where production stood at 27.12 Mt (31% share), up 6.7% over same period of last year. The two countries together accounted for 68% of global DRI output during this period. Together, the top five countries accounted for 87% of the world DRI production during this period and saw their cumulative output go up 11.2% over same period of last year.

Table 1: Global DRI Production

Rank	Country	Jan-Oct 2021* (Mt)	Jan-Oct 2020* (Mt)	% change
1	India	32.21	27.13	18.7
2	Iran	27.12	25.41	6.7
3	Russia	6.39	6.43	-0.7
4	Mexico	4.85	4.27	13.6
5	Saudi Arabia	4.72	4.45	6.1
	Top 5	**75.29**	**67.70**	**11.2**
	World	**86.93**	**77.13**	**12.7**

Source: JPC bulletin

Global Crude Steel Production

The annual crude steel production has reached 1,950 million tonnes (Mt), for 2021. This figure is a new peak for global steelmaking, and represents year-on-year growth of 3.4%.

Recent reductions in Chinese melting activity has led to lower figure as compared to the last year. Calls by the government to cap annual output, at the levels recorded in 2020, were initially ignored. By the second half of the year, local officials more rigorously enforced restrictions on domestic mills. Production in highly polluting industries, including steelmaking, is being closely monitored. Improving air quality ahead of the Beijing Winter Olympics in 2022 is a priority for the Chinese administration. Consequently, total output is expected to decrease by 3.0% this year.

Crude steel projections for North America are range-bound. There is a significant increase in steel production this year. A figure of 120 Mt of liquid steel is forecast for 2026. Substantial government investment in infrastructure projects is planned for the next ten years. However, regional economic growth is expected to slow following the initial post-pandemic recovery.

In the European Union, annual production is predicted to increase by more than 15 %, to 153 Mt in 2021. Output should grow, in the coming years, but the figure is unlikely to return to the recent peak recorded in 2017. Germany and Italy will consolidate their positions as the primary producers in the region. Existing plants are expected to decarbonise their operations. Furthermore, newly installed capacity is likely to focus on low emission “green” steel. However, these should only come on stream from 2026 onwards.

Indian production will continue to soar over the next five years, due to large investment in steelmaking capacity. New plants are expected to use a mix of basic oxygen and electric arc furnace technology. Planned modernisation of towns and cities in the country will drive rising steel consumption. A continued widening of the gap between Indian and Japanese annual production is envisaged.

In Japan, restructuring in the domestic steel industry should lead to muted output growth, in the medium term. Uncompetitive blast furnace facilities are being closed. This should prevent the total outturn of crude steel climbing above 100 million tonnes over the next five years. A similar trend of consolidation is predicted to occur in South Korea and Taiwan. There is little scope for these mature markets to increase crude output, as steel consumption is already at a high level.

In percentage terms, the largest regional production growth is expected to transpire in the Middle East. By 2026, an additional 14 Mt of steel is forecast to be melted, annually, over the 2020 figure. Iran will be the main driver of rising output, due to significant investment in new electric arc furnace plants.

Source: MEPS Steel Price Outlook

Global crude steel production in 2021

World crude steel production for the 64 countries reporting to the World Steel Association (worldsteel) was 158.7 million tonnes (Mt) in December 2021, a 3.0% decrease compared to December 2020.

China produced 86.2 Mt in December 2021, down 6.8% on December 2020. India produced 10.4 Mt, up 0.9%. Japan produced 7.9 Mt, up 5.4%. The United States produced 7.2 Mt, up 11.9%. Russia is estimated to have produced 6.6 Mt, the same as in December 2020. South Korea produced 6.0 Mt, up 1.1%. Germany produced 3.1 Mt, up 0.1%. Turkey produced 3.3 Mt, down 2.3%. Brazil produced 2.6 Mt, down 11.4%. Iran is estimated to have produced 2.8 Mt, up 15.1%.

Total world crude steel production was 1,950.5 Mt in 2021, a 3.7% increase compared to 2020.

Table 2: Country-wise crude steel production for top 15 in terms of size (Mt)

Rank	Country	2021	2020	% 2021/2020
1	China	1032.8	1064.7	-3
2	India	118.1	100.3	17.8
3	Japan	96.3	83.2	15.8
4	United States	86	72.7	18.3
5	Russia (e)	76	71.6	6.1
6	South Korea	70.6	67.1	5.2
7	Turkey	40.4	35.8	12.7
8	Germany	40.1	35.7	12.3
9	Brazil	36	31.4	14.7
10	Iran (e)	28.5	29	-1.8
11	Italy	24.4	20.4	19.7
12	Viet Nam (e)	23.6	19.9	18.4
13	Taiwan, China(e)	23.3	21	10.9
14	Ukraine	21.4	20.6	3.6
15	Mexico (e)	18.4	16.8	9.5
	World	**1950.5**	**1880.4**	**3.7**

Table 3: Top 10 steel-producing countries(Mt) in 2021

Country	Dec 2021	% change Dec 21/20	Jan-Dec 2021	% change Jan-Dec 21/20
China	86.2	-6.8	1032.8	-3.0
India	10.4	0.9	118.1	17.8
Japan	7.9	5.4	96.3	14.9
United States	7.2	11.9	86.0	18.3
Russia	6.6e	0.0	76.0	6.1
South Korea	6.0	1.1	70.6	5.2
Turkey	3.3	-2.3	40.4	12.7
Germany	3.1	0.1	40.1	12.3
Brazil	2.6	-11.4	36.0	14.7
Iran	2.8e	15.1	28.5	-1.8

e -estimated. Ranking of top 10 producing countries is based on year-to-date aggregate

Source: worldsteel

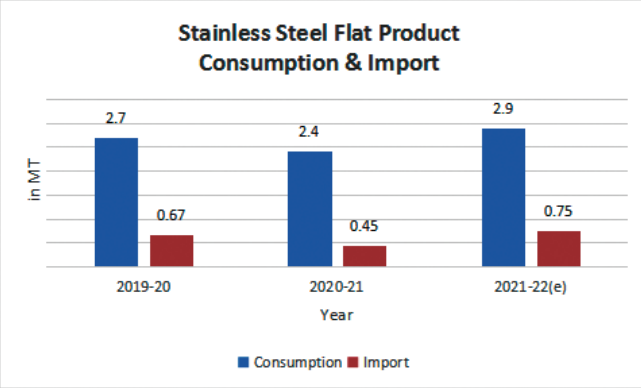
STAINLESS STEEL SCENARIO

Import Surge may affect India's Global Ranking in Stainless Steel

Indian Stainless Steel Development Association (ISSDA) has urged the government to restore the countervailing duty (CVD) on stainless steel products from China and Indonesia. The decision to suspend the CVD in Union Budget 21-22 has led to a surge in imports from Indonesia and China. The imports are being largely driven by Chinese companies operating from Indonesia, which got a boost after the suspension of CVD in February 2021. Rising imports have adversely affected the MSME stainless steel producers and dampened the sentiment for further investment in the stainless steel industry. Import intensity for stainless steel flat product market is five times, at about 25% against 5-6%, for the overall steel industry. CVD was suspended for a period of nine months in the Union Budget 2021-22, and subsequently extended up to 31st January, 2022.

Going forward, Chinese production may slide but a sharp rise is expected in the stainless steel production by Chinese companies in Indonesia. ISSDA's apprehension that Indonesia will displace India as second-largest stainless steel producer in CY 2021 is about to become a reality as per the latest internationally published report. The production in Indonesia is primarily directed to export markets, with India also providing free market access under India-ASEAN free trade agreement.

The import trend of stainless steel flat products indicates that one-fourth of the Indian market will continue to be captured by imports during the year, following the pattern of the last two years.



Stainless steel has proved to be essential for the development and growth of our country. In alignment with the National Steel Policy 2017 vision, overall stainless steel capacity of the country need to be increased from 6 Mt to 9 Mt by the year 2030. Sadly, the total capacity utilization for the domestic stainless-steel industry stands at a mere 60%, under pressure of imports. The gravity of the situation can be understood from the fact that by revoking the Trade remedial measures against China and Indonesia, stainless steel imports from these two countries into India during H1 FY22 increased by 172%. Moreover, Indonesia is set to replace India as the second largest stainless-steel producer in the world.

Indian Stainless-steel supply ecosystem has a unique structure wherein 30% producers are operating in MSME sector. The domestic industry has sufficient capacity to meet the demand, however, unwarranted imports are hindering the industry to realize its true potential. Government policy support is necessary to not only reclaim India's position as the world's second largest stainless-steel producer, but also enable the next phase of industry growth in line with Prime Minister's vision of Atamanirbhar India.

The International Stainless Steel Forum (ISSF) has released figures for the first nine months of 2021 showing that stainless steel melt shop production increased by 16.9% y-o-y to 43.0 million tons.

Table 4: Stainless steel melt shop steel production [000 metric tons]

Region	Quarter	9 months				+/- % y-o-y
	1/2021	2/2021	3/2021	2020	2021	
Europe	1,909	1,919	1,586	4,590	5,413	17.9%
USA	624	654	552	1,575	1,830	16.1%
China	8,198	8,045	7,588	21,904	23,831	8.8%
Asia w/o China and S. Korea	1,880	1,845	2,044	4,593	5,769	25.6%
Others	1,901	2,052	2,184	4,092	6,137	50.0%
Total	**14,512**	**14,514**	**13,954**	**36,754**	**42,980**	**16.9%**

Others: Brazil, Russia, S. Africa, S. Korea, Indonesia

r: revised, e:estimate

INDIAN STEEL SCENARIO

India's crude steel production in 2021 reached a significant jump to 118.1Mt showing rise of 17.8% as compared to the last year. The production in 2020 was greatly affected by covid. However, several factors helped the industry to recover though the pandemic is not over. These are higher prevailing steel prices, rise in exports volume combined with higher international prices, lower production and export from China and the steps taken to counter the effect of covid situation. The higher prices has enabled all the steel plants, especially the integrated plants to earn much higher profits which has their debt burden and allowed them for expansion and modernisation of their plants. Most of the plants like Tata Steel, JSW Steel, JSPL, AMNS have announced their plan to increase their plant capacity and set up Greenfield steel plants, mainly in Odisha, Interstingly, POSCO has signed MoU with Adani to set up a new plant of 5 Mtpa capacity at Mundra, Gujarat.

The production is expected to rise further in 2022 as NMDC's new Nagarnar Steel Plant will be commissioned shortly. Heating of their coke oven has already started.

Table 5: Performance of Indian steel industry: April-December'21 (Mt)

Item	April-December 2021	% Change April-December '21/20
Crude steel production	88.007	19.9
Pig iron production	4.443	29.0
Finished steel production	83.005	23.2
Export of finished steel	10.329	24.2
Imports of finished steel	3.458	7.7
Consumption of total finished steel	76.646	17.2

*All figures provisional

Source: JPC

Higher international steel prices and lower supply from China have helped Indian steel plants to raise their exports. Pig iron exports has jumped almost 50% in 2021. There is also good demand abroad for long products like billets.

As the allocation by Govt of India is expected to be high for infrastructure in the coming yars, it is expected that steel demand and prices will remain at elevated level. Profits and production of steel will remain higher in 2022.

Forthcoming Events

59th National Metallurgists' Day (NMD; February 2022)
Venue: New Delhi
Contact: vpsmoffice@tatasteel.com

6th Steel Plate Conference Europe March 10-11, 2022
Duesseldorf, Germany
Contact: events@metalexpertgroup.com

STEEL TECH's Annual Conference on Ferro Alloys; April 11, 2022 (Monday)
Venue: Hotel ITC, Kolkata, India
Contact: psen2008@yahoo.com

AISTech 2022, 16- 19 May 2022
Venue: Pittsburgh, Pa., USA
Contact: Stacy Varmecky, 1.724.814.3066

Future Steel Forum, Grandior Hotel, Prague, 8-9 June 2022.
Venue: Prague, Czech Republic
Contact: Stacy Varmecky, 1.724.814.3066

Steel in Cars and Trucks, 19- 23 June 2022
Venue: NH Milano Congress Centre, Assago, Milano, Italy
Contact: Steel Times International

METEC India Exhibition & Conference, 23-25 November 2022
Venue: Bombay Convention & Exhibition Centre, Mumbai, India.
Contact: www. metec-india.com

STEEL TECH

Advertisement / Subscription Form

To
Pritish K. Sen
Publisher, Steel Tech Journal
Sunny Apartment, 61 E, Manick Bandyopadhyay Sarani
Kolkata 700 040
India

SUBSCRIPTION

We would like to subscribe/renew Steel Tech quarterly journal for ☐ year(s).

ADVERTISEMENT

We would like to advertise in Steel Tech quarterly journal in ☐ months 1 year (4 issues) in colour B/W in size.

☐ We enclose payment by cash/cheque/DD No. ..... dated ..... for Rs. ..... on bank ..... branch ..... drawn in favour of "STEEL TECH' payable at Kolkata.

☐ We shall be paying on receipt of your invoice/journal.

Your faithfully

(Signature)

Advertiser's/Subscriber's details

Name : .....

Designation : .....

Organisation: .....

Address: .....

.....

.....

..... Pin : .....

Address for dispatch : .....

.....

.....

..... Pin : .....

Tel: .....

Email : .....

Steel Technology for Today and Tomorrow

Dear Readers,

STEEL TECH is the most reputed technical journal in India on iron and steel.

Please **SUBSCRIBE** to remain abreast with the latest technological advancement on steel and keep updated on recent trends in steel industry.

We welcome your **ADVERTISEMENT** support, which will reach your targeted clients.

ADVERTISEMENT RATE

Position	Adv. rate per issue			Adv. rate for annual 4 issues		
	Rs.	US$	Euro	Rs.	US$	Euro
Full Page (colour)	20000	900	800	70000	3200	3000
Full Page (black & white)	10000	450	400	35000	1600	1500
Double Page (colour)	35000	1200	1100	120000	4000	3600
Double Page (black & white)	20000	900	800	70000	3200	3000
Half Page (colour)	12000	500	450	42000	1800	1600
Half Page (black & white)	6000	250	225	21000	900	800
Half Page Inside Front	20000	900	800	70000	3200	3000
Outside Front/Back Cover (colour)	50000	1500	1350	150000	5500	5000
Inside Back Cover (colour) & Inside Front Cover (colour)	35000	1200	1100	120000	4000	3600

* GST @5% will be applicable additionally for advertisement
Steel Tech GST No.: 19AJDPS7852C1ZY

Full Page bleed size 286 mm x 216 mm, finish size 280 mm x 210 mm
Half Page bleed size 143 mm x 216 mm, finish size 140 mm x 210 mm

SUBSCRIPTION RATE

Single copy: Rs. 400/- / US $35 / Euro 30

- Annual (4 copies): Rs. 1500/- / US $130 / Euro 110
- Cheque to be drawn in favour of 'STEEL TECH'.
- Our A/c. No. Our A/c No. 919020095595464
  at AXIS Bank, Kudghat WB, Kolkata-700 040, India
  IFSC Code: UTIB0004005, 9-digit code no. of the Bank & Branch : 700211149
  Swift Code: AXISINBB255

Contact:

Mr. Pritish K. Sen, Publisher, Steel Tech Journal
Tel: +91-92306 39343 /+91-87773 41510
E-mail: psen2008@yahoo.co.in & info@steeltech-india.com, Website: www.steeltech-india.com


making steel production more efficient
Industry 4.0
40 %
... loading ...
Are you still waiting or are you ready
to optimize your production?
Contact for India
Vinay Sethi
+91 997 131 22 33 | vinay.sethi@qoncept.at
qoncept dx GmbH | 8700 Leoben | Austria
www.qoncept.at
qoncept
delivering future technologies

Printed, published and owned by: Pritish K. Sen: Sunny Apartments, 61E, Manick Bandopadhyay Sarani, Kolkata-700 040, India
Printed at M/s. CDC Printers Pvt. Ltd., Tangra Industrial Estate, 45 Radhanath Choudhury Road, Kolkata - 700015
RNI Regn. No. WBENG/2006/18989
Rs. 400/-