DRI UPDATE

SIMA

Sponge Iron Manufacturers Association

Indian voice for the ore based metallic & steel industry

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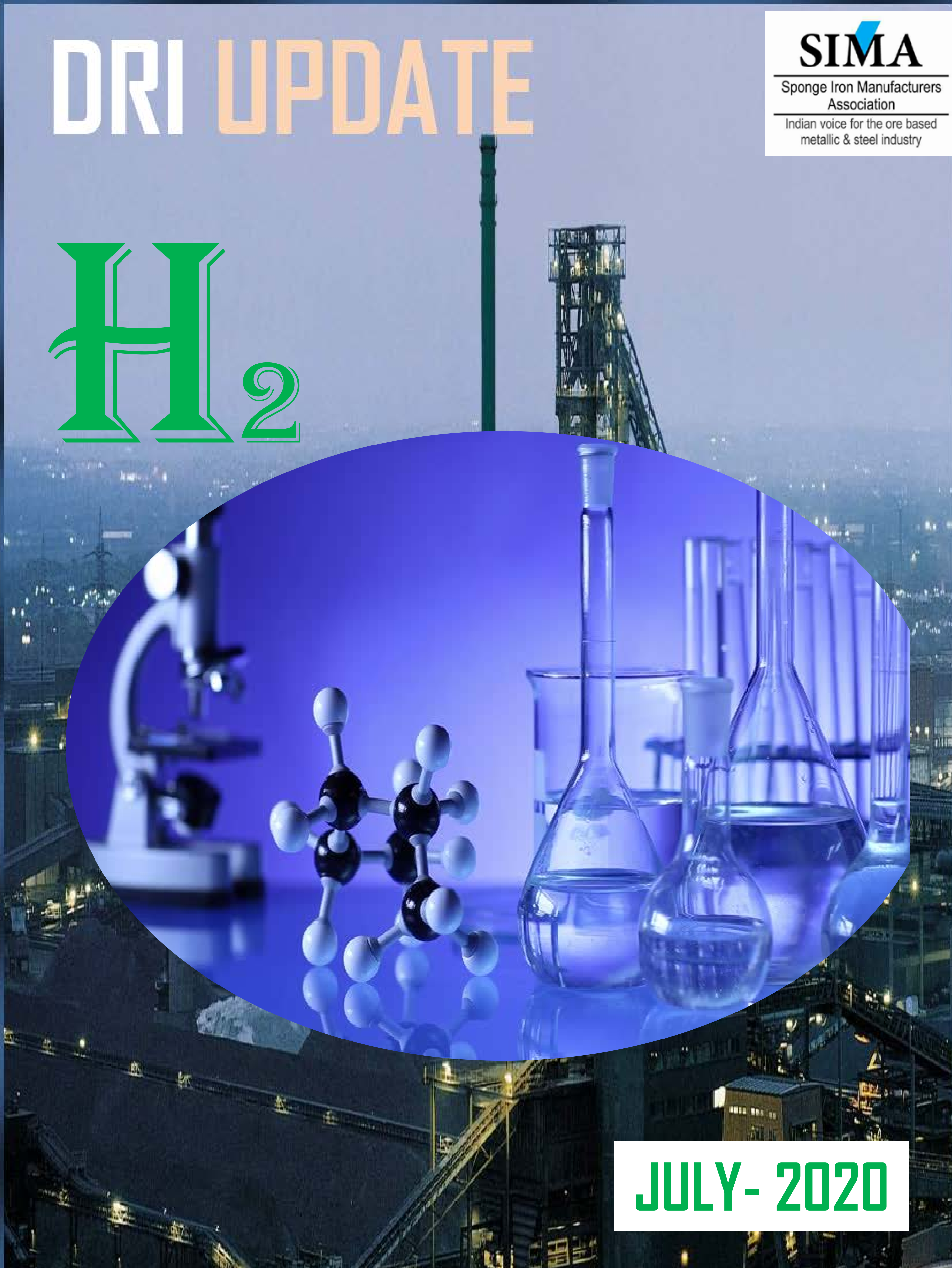

JULY- 2020

Editorial

The unprecedented situation we are facing today created by Covid -19 has changed almost everything in our life. It has severely impaired global economy. Our country has also be affected badly. It is not that in the past country have not faced challenges but we have come out successfully. This time we are facing multiple challenges at a time like demand, liquidity, uncertainty in price of vital inputs like iron ore & coal, logistic and migrant labour related issues etc. In this situation where Government have to focus on defense, health &social welfare schemes, it is unlikely that uncompleted and new infrastructure projects would take off in near future. Likewise automobile and housing sectors will take some time to gather earlier pace. Nevertheless, we should hope for the best.

This issue of 'DRI UPDATE' focus is on exploring the possibility of usage of Hydrogen in DRI & Steel making. Slowly but surely, we have to move away from coal although presently there are many techno-commercial challenges. This may not be possible in near future in India but we have to start thinking in this direction.

We wish our readers all the very best.

Deependra Kashiva
Executive Director

ArcelorMittal commissions Midrex to design demonstration plant for hydrogen steel production in Hamburg

This news item explore the possibility of using initially grey hydrogen from natural gas and subsequently green hydrogen from renewable energy sources. It is an interesting development to demonstrate large scale production and use of DRI made with 100% hydrogen as a reduction

Editor

Hamburg, 16 September 2019 – ArcelorMittal announced today that it has commissioned technology provider Midrex Technologies to design a demonstration plant at its Hamburg site to produce steel with hydrogen. Both companies have now signed a Framework Collaboration Agreement (FCA) to cooperate on several projects, ranging from research and development to the implementation of new technologies. The FCA will be governed by a number of Project Development Agreements, incorporating the expertise of Midrex and ArcelorMittal. The first Project Development Agreement is to demonstrate in Hamburg the large-scale production and use of Direct Reduced Iron (DRI) made with 100% hydrogen as the reductant.

In the coming years, the demonstration plant will produce about 100,000 tons of direct reduced iron per year – initially with grey hydrogen sourced from natural gas. Conversion to green hydrogen from renewable energy sources will take place once available in sufficient quantities and at an economical cost. Energy for hydrogen production could come from wind farms off the coast of Northern Germany. The plant will be the world's first direct reduction plant on an industrial scale, powered by hydrogen.

“We are working with a world class provider, Midrex Technologies, to learn how you can produce virgin iron for steelmaking at a large scale by only using hydrogen. This project combined with our ongoing projects on the use of non-fossil carbon and on carbon capture and use is key to become carbon neutral in Europe in 2050. Large scale demonstrations are critical to show our ambition. However it will depend on the political conditions, how fast transformation will take place”, comments Carl de Maré, Vice President at ArcelorMittal and responsible for technology strategy.

ArcelorMittal Hamburg already produces steel using DRI technology. During the process, iron oxide pellets are reduced to metallic iron, the raw material for high quality steel, by extracting oxygen using natural gas. “Our site is the most energy-efficient production plant at ArcelorMittal”, says Dr Uwe Braun, CEO at ArcelorMittal Hamburg, adding that the existing Midrex plant in Hamburg is also the plant with the lowest CO_2-emissions for high quality steel production in Europe. “With the new, hydrogen-based DRI plant we are now planning, we will raise steel production to a completely new level, as part of our Europe-wide ambition to be carbon neutral by 2050”, Dr Braun concludes. “This commercial scale project will show the path for hydrogen based iron and steel making”, commented Stephen C. Montague, President & CEO of Midrex Technologies Inc. “We are excited to work with ArcelorMittal as pioneers for using renewable energy in our industry.”

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Are We Moving Towards Green Hydrogen for Steel Making ?

Initially it was explored to use Hydrogen through the electrolysis process using the thermal energy for DRI & steel making. But if we use thermal energy, then how can it be carbon neutral. Secondly, cost of thermal energy is very high in India which will make this concept unviable. In this article, German energy company RWE and thyssenkrupp Steel Europe have came up with an idea of using Green Hydrogen which generated through the renewable energy. As we all know, solar energy is going to take over thermal energy in India in near future. This will also make economic sense as solar energy per unit price is much more competitive viz-a-vz thermal energy price. This is a welcome development and takes us closer to carbon free steel making.

Editor

German energy company RWE and thyssenkrupp Steel Europe have agreed to work together toward a long-term hydrogen partnershiup, under which green hydrogen fro an RWE Generation electrolyzer could help thyssenkrupp Steel Europe sustainably reduce CO2 emissions from steel production in the futhre. The first hydrogen is set to flow to thyssenkrupp's Duisburg steel mill by the middle of the decade.

The hydrogen required iron production is to be produced by electrolysis, in which water is broken down into hydrogen and oxygen. The companies agree that only electricity from renewable sources should be used to operate the eletrolyzers. At its power plant site in Lingen, RWE is already planning to build electrolysis capacities that could supply green hydrogen for the iron production of Germany's biggest steelmaker. A 100MW electrolyzer could produce 1.7 tons of gaseous hydrogen per hour, corresponding to around 70 per cent of the quantity required by the Duisburg steelmaker's blast furnace earmarked for hydrogen use. This would translate theoretically into around 50,000 tonnes of climate-neutral steel. The conversion of the blast furnace is to be carried out by 2022 – the first important stage of a fundamental transformation process at the end of which the company's entire steel production will be carbon-neutral.

In a separate project,hydrogen-powered steel production is currently being piloted in Sweden by Ovako and Linde. Globally, many organizations are developing sustainability and energy initiatives centered around hydrogen, including projects in the U.S., Australia, Singapore,Germany, Chile, Poland,France,Denmark and Japan. Earlier this week, thyssenkrupp industrial solutions announced that it significantly expanded its manufacturing capacities for green hydrogen electrolysis systems.

One of the prerequisites for the collaboration is the development of a dedicated hydrogen network to transport the gaseous hydrogen from Lingen to tkSE's steel mill site in Duisburg. Pipeline transport of the hydrogen is the most eonomical delivery option. In dialogue with gas network operators and the authorities, RWE and tkSE therefore want to drive solutions for timely network connection. They believe hydrogen pipeline gransport will be possible on the basis of regulations corresponding largely to those currently applying to natural gas delivery. The GETH2 initiative, in which RWE is involved, is already promoting corresponding solutions. The gas network development plan published on May 4, 2020, in its "green gas vaaaariant" for the first time includes calculations for initial hydrogen sections parallel to the natural gas network.

Roger Miesen, CEO of RWE Generation, says: "Hydrogen is of central importanced for green houls gas abatement in Germany. The national Hydrogen Strategy and the Euro 9 billion funding to be made available will give this future technology the necessary kick-start. In order for a hydrogen infrastructure in Germany to really pick up speed, rapid implementation is now needed, because investment decisions for green hydrogen projects need planning certainity".

Bernhard Osburg, Chairman of thyssenkrupp Steel: The planned cooperation with RWE is an important step on our path to climate neutrality. The aimed-for supply quantity would be largely sufficient to supply a blast furnace with green hydrogen and allow the production of climate-neutral steel for around 50,000 cars per year. This shows that climate-neutral steel is possible and we are pressing ahead with the conversion of our production. Nowhere else than in the steel industry can hydrogen be used with a comparable climate protection effect. We therefore expressly welcome the adoption of the National Hydrogen Strategy".

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Hydrogen-based steelmaking in India

Girish Sethi and Will Hall, TERI, New Delhi

In the previous news items we have discussed the limitations of Hydrogen based steel making. As we all know, The Energy and Resources Institute (TERI) is working for quite some time on carbon free economy / steel making. This article brings out the prospects of using Hydrogen for steel making but has also expressed another challenge i.e. huge requirement of water for electrolysis process of generating hydrogen.

We are bound to face many challenges wherever out of the box technological concept is conceived and explored for techno economic considerations. We are sure in times to come India will find out the solution of these challenges and will move towards carbon free DRI & steel making.

Editor

Background

Steel is the foundation of a developed economy. It supports the infrastructure that facilitates growth, the housing that drives urbanization, and the machinery and tools that power industrialization. No country has achieved high levels of income per capita without substantially raising steel consumption per capita. India's steel consumption per capita is still very low at only 64 kg per year, consistent with India's low GDP per capita. This is only 27% of the world average, a clear indication of the large growth in steel consumption required to raise Indian GDP per capita and improve the welfare of its citizens.

Although critical for economic growth, the iron and steel sector is energy- and resource-intensive. As such, rapid growth of steel demand, using conventional production methods will have significant environmental consequences. Today, the iron and steel sector is already the largest industrial sector in terms of energy consumption and also contributes a significant amount to carbon dioxide emissions.

Even with expected energy efficiency improvements in the iron and steel sector, emissions are set to more than treble out to 2050, from around 242 MtCO2 today to 837 MtCO2 (Hall, Spencer & Kumar, 2020). Clearly, this level of GHG emissions is a concern. Incremental measures to improve energy and carbon efficiency in the iron and steel sector are not enough to place it on a trajectory consistent with limiting warming to less than 2°C. As a result, we need to look at more radical changes to the technologies we currently use to produce steel; one of these being hydrogen-based direct reduction.

Hydrogen Direct Reduction

Hydrogen direct reduction is a way of producing direct reduced iron (DRI) by replacing the use of coal or natural gas with very high levels of hydrogen gas (>90%). The natural gas-based direct reduction route currently makes up around 6% of global steel production (Midrex, 2019). Whilst use of hydrogen at high quantities in the steelmaking process is relatively novel, the use of different blends of different gases, from natural gas to various SynGases, is well understood. As a result, the technology for hydrogen-based direct reduction of iron does not represent such a significant step for the industry. Three technology providers for gas-based direction are detailed below: Midrex, Tennova HYL, and Circored.

The Midrex Process, which is the dominant process for natural gas-based steelmaking, is already operating with hydrogen concentrations of 55–75%. This could be increased to 90% based on technology currently being developed. The balance would be made up of CO, CO2, H2O, and CH4, to reduce the melting point, provide additional energy, and provide the alloying element required for steel (Midrex, 2018).

ArcelorMittal in Germany plans to construct a further 0.1 Mt Midrex plant at its Hamburg site, which will be fed with the remaining hydrogen from the exhaust gas of the existing natural gas-based Midrex plant that has a capacity of 0.5 Mt. The use of hydrogen from the exhaust gas of the existing Midrex plant in this way means that production is already cost-effective today (ArcelorMittal, 2019).

The HYL process is the second commercially available direct production process that has a significant share in today's gas-based DRI production. Since it does not require a gas reformer that splits the gas used into its components, it can use different gases almost simultaneously. Both the Swedish HYBRIT project and the German SALCOS project have opted for the HYL process (Tenova HYL, 2018).

A third available technology, which is not in use today, is the Circored process. It is a fluidized bed reactor that uses hydrogen to produce direct reduced iron. The hydrogen can be supplied from natural gas or other sources such as water electrolysis (Outotec, 2019). A plant with a capacity of 0.5 Mt of DRI was operated in Trinidad from 1999 (Millenium Steel, 2006).

Pilot plants are being established in Europe to use hydrogen in the direct reduction process, similar to existing natural gas-based direct reduction processes, which are far more common in steel industries outside of India. The HYBRIT project in Sweden aims to have a demonstration plant up and running by 2025, a full-scale plant operating in 2035, with the intention to have switched over their entire fleet by 2045 (SSAB, 2019). If supplied with zero-carbon hydrogen and combined with an electric arc furnace supplied with zero-carbon electricity, this has the potential to reduce emissions by over 94% compared with conventional technologies. Residual emissions occur from the use of graphite electrodes in the EAF, as well as use of lime and natural gas. These could be brought down to zero with further research and development (Vogl and Ahman, 2019).

Another option, instead of a one-time switch from natural gas or coal to hydrogen, is to start using fossil-based gas, such as natural gas or SynGas and slowly blend in higher degrees of hydrogen, to steadily decarbonize the direct reduction process. This is the approach being trialled by Salzgitter in their plant in Austria, where under the SALCOS project, they plan to use electrolytic hydrogen from wind energy to decarbonize steel production (Salzgitter, 2019).

The capital costs for this route are not expected to be significantly different from existing capital costs for natural gas-based direct reduction plants and will likely reach parity after several plants are established (Vogl and Ahman, 2019). The main cost element in this production route is hydrogen, which needs to be produced from low carbon electricity or use CCUS technology to be low carbon.

Low Carbon Hydrogen Supply

One of the major challenges with using hydrogen to reduce emissions from the steel sector is producing sufficient quantities at low enough cost. The below table provides an overview of our assessment of the suitability of hydrogen production technologies for future, large-scale use in India. Green represents a positive score, amber is mixed, and red is negative. Technology readiness is also given a numerical value based on Technology Readiness Levels, which go from 1 (basic principles) to 9 (extensive implementation).

Suitability of hydrogen production technologies for India in the medium term

Technology	Resource availability	Scalable	Cost	Tech readiness	Emissions	Overall suitability
Steam methane reformation				TRL 9		
Steam methane reformation + CCS				TRL 5		
Coal gasification				TRL 9		
Coal gasification +CCS				TRL 5		
Electrolysis				TRL 9		

Source: (Hall, Spencer & Kumar, 2020)

Today, around the world, most hydrogen is produced through **steam methane reformation** (SMR) (IEA, 2019). In India, the fertilizer industry is a major consumer of hydrogen through this route, using hydrogen to create ammonia-based fertilizers. To reduce emissions from this production route would require CCS technology, which has its challenges in India, due to geographical limitations and risks of seismic activity. Moreover, this production requires large quantities of natural gas to be used in the reformation process. Given the existing challenges of using natural gas for direct reduction in India, primarily cost and availability using natural gas through reformation would only add to these challenges as a result of the efficiency penalty of the process, which is around 70% (BEIS, 2018). Therefore, the overall suitability of SMR for future, large-scale hydrogen production, with or without CCS, is limited.

Another fossil fuel-based route for hydrogen production is **coal gasification**. Coal gasification has received growing interest in China and India alike as a way to mitigate energy import shocks and make best use of domestic energy reserves. In their 14th Five-Year Plan, China is expected to target a significant ramp-up of coal to gas technologies, to be used throughout industry (China Energy Portal, 2019). Recent supply-side oil shocks in India, as well as concerns over coal import costs, have also motivated greater interest in coal to gas in India.

The low cost and sufficient availability of coal in India make this a potentially cost-effective route for hydrogen (or SynGas) production. It will nonetheless be relatively capital intensive requiring additional infrastructure for the transport and storage of coal, including railways. Moreover, the process would be highly emissions intensive without CCS. The efficiency penalty in the coal gasification process for hydrogen production is typically around 75%, resulting in emissions intensity of 500–600gCO_2/kWh (IEA, 2019). Again, the same issues with deploying CCS in India apply here.

Given India's significant potential for renewable electricity generation, through both wind and solar, **electrolysis** appears to be a promising route for hydrogen production. The electrolysis process applies an electrical charge to H_2O, splitting it into its constituent parts H_2 and O. It is a relatively electricity-intensive process, consuming around 1.5 kWh of electricity for every 1 kWh of hydrogen, although this is set to fall to around 1.3 kWh with further technology improvements (IEA, 2019). As a result, to produce hydrogen from electrolysis at scale will require significant expansions in renewable capacities, over and above what is already planned by the GoI.

Apart from being electricity-intensive, the electrolysis process is also very water-intensive, requiring large quantities of freshwater to avoid contaminating the catalyst. India is a water-scarce country and, therefore, facilities running electrolysers would need to maximize water recycling where possible. Furthermore, there is work being planned to assess the viability of direct seawater electrolysis, to help mitigate the impact on freshwater supplies (MNRE, 2019).

The cost of electrolytic hydrogen remains a barrier, particularly when factoring in the requirement of renewable electricity to ensure hydrogen is low carbon. Currently, the high capital costs of electrolysers mean that they need to be run at high capacity utilization factors to be cost-effective. This requires grid electricity, which is currently very carbon intensive. Nevertheless, as the emissions of grid electricity declines, this will ensure that hydrogen can be lower carbon. Moreover, as the capital cost of electrolysers decline, which is expected with the future scale of deployment, the utilization factor plays a less significant role (Hall, Spencer & Kumar, 2020).

Opportunities for India

Hydrogen direct reduction is a promising technology for the Indian steel sector, as the industry further reduces emissions from its operations. The key benefits of such a technology are:

- E**missions reduction :** Hydrogen direct reduction, when paired with electric furnaces using renewable electricity, can reduce emissions from steel production by over 90% compared with conventional technologies.

- **Cost-competitive :** Whilst costlier in the near-term, with fast reducing costs of renewable electricity, as well as electrolyser technologies, renewable hydrogen will soon be cost-competitive with natural gas as a direct reduction agent.

- **Energy independence**. Low carbon hydrogen can be produced domestically, using renewable electricity, greatly reducing energy imports for the sector. Greater control over energy supply can also reduce risk of energy price fluctuations.

- **Air quality**. Reduced use of coal in the steelmaking process will greatly improve the air quality around industrial facilities, which in turn will improve the working conditions for employees.

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Leadership Group Meeting for Industry Transition at the UNFCCC COP25 on 7th July,2020

Ministers from 9 countries call for ambitious action to accelerate the low carbon transition of industry. In a joint ministerial statement released on **7 July 2020**, Denmark, Finland, Germany, India, Ireland, Luxembourg, the Netherlands, Sweden and the United Kingdom have called for continued momentum and ambitious action to ensure an industry transition that tackles the climate crisis, creates decent jobs and delivers prosperity for all. The statement reads as: "In this statement, we reaffirm our commitment to accelerating the transition of all industry sectors to low carbon pathways in line with the goals of Paris Agreement, while pursuing efforts to reach net-zero carbon emissions by 2050, and to working in partnership with industry to make this happen"

The statement is signed by Mr. Prakash Javadekar, Hon'ble Minister of Environment, Forest and Climate Change, Information and Broadcasting, and Heavy Industries and Public Enterprises, India.

This calls for stringent action plans by Indian Steel and other industries to phase out or minimize use of carbon bearing inputs in iron and steel making. In a study by TERI, it has been concluded that approaching net zero carbon emission by Indian steel industry is not possible, though it can be reduced drastically through adoption of all available efficiency improvement measures including adoption of some of the carbon neutral possibilities by 2040 onwards.

Minister Prakash Javadekar, Minister Isabella Lövin, and Robert Watt, SEI, at a meeting of the Leadership Group for Industry Transition at the UNFCCC COP 25

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INDIAN STEEL& METALLICS TRADE– TREND & CHALLENGES

Pankaj Saini(MBA, BTech – Metallurgy, BHU)

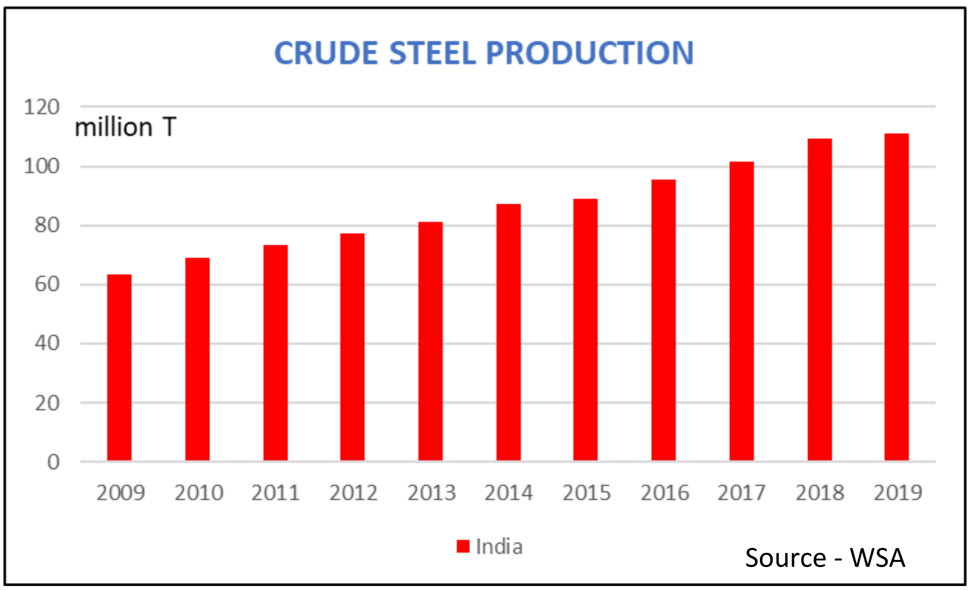
Background

Indian Steel industry is strategic for economic development of the country with a share of 2.3% of GDP and aoutput multiplier of 1.4 times and employment multiplier of 6.8 times.The indirect contribution of steel is much larger,owing to the large dependence of other sectors.

India is the 2nd largest steel producer and consumer in the world during CY2019 and CY2018 moving up from 3rd largest during CY2017.

INDIA'S SHARE CY 2019			(million mt)
	World	India	% Share
Production	1868.8	111.2	5.8%
Consumption	1767.5	101.5	5.7%
Per capita kg	229.3	74.3	
Export	436	13.4	3.0%
Import	436	8.9	2.0%
	Source – WSA		

India has strong growth and strengthened its steel industry considerably over the last decade with a wave of consolidation in last few years and now poised again for a rapid growth in current decade.Crude steel production increased @ 7.5% pa from 63.5 mt in CY 2009 to 111.2 mt in CY 2019.



TRADE BALANCE

India became a net exporter of iron and steel (pig iron + semis + finished steel) since 2016–17 with exports of 9.82 mT and imports at 7.25 mT during 2016-17 and net export of 2.57 mT. Net exports have improved further to 4.63 mT in 2017-18. With rising global protectionism and the ongoing trade war initiated by US, India has seen a steep decrease in exports during 2018-19 to8.86 mT from 12.13 mT in 2017-18 a sharp fall of 27%, whereas imports saw an increase of 5.3% and stood at 7.9 mT, resulting in drop of net export to 0.96 mT.

IRON & STEEL TRADE										
million ton	IMPORTS			EXPORTS				NET TRADE	PRODUCTION	CONSUMPION
	Pig iron	Finished Steel	Total	Pig iron	Semis	Finished Steel	Total		Finished Steel	Finished Steel
2009-10	0.011	7.38	7.39	0.36	0.62	3.25	4.23	-3.16	60.62	59.33
2010-11	0.009	6.66	6.67	0.36	0.35	3.63	4.34	-2.33	68.62	66.42
2011-12	0.008	6.86	6.87	0.49	0.2	4.58	5.27	-1.60	75.69	71.02
2012-13	0.021	7.92	7.94	0.41	0.14	5.37	5.92	-2.02	81.68	73.48
2013-14	**0.034**	**5.45**	**5.484**	**0.94**	**0.49**	**5.98**	**7.41**	**1.926**	**87.67**	**74.09**
2014-15	0.023	9.32	9.34	0.54	0.64	5.6	6.78	-2.56	91.46	76.99
2015-16	0.022	11.71	11.73	0.297	0.64	4.08	5.02	-6.72	106.6	81.52
2016-17	**0.034**	**7.22**	**7.254**	**0.387**	**1.19**	**8.24**	**9.817**	**2.563**	**120.14**	**84.04**
2017-18	**0.016**	**7.48**	**7.496**	**0.52**	**1.99**	**9.62**	**12.13**	**4.634**	**126.85**	**90.71**
2018-19	**0.067**	**7.83**	**7.897**	**0.32**	**2.18**	**6.36**	**8.86**	**0.963**	**101.29**	**98.71**
2019-20	**0.011**	**6.77**	**6.781**	**0.42**	**2.83**	**8.36**	**11.61**	**4.829**	**102.06**	**100.07**
Source : JPC										

During 2019 – 20 exports have again jumped by 31% to 11.61 mT with net exports rising sharply to 4.83 mT, consisting of 1.587 mT of finished steel, 2.83 mT semis and 0.41 mT Pig Iron. Domestic steel demand and prices remained depressed for most part of 2019-20, giving a boost to export of finished steel and semis, whereas demand started to rebound from end Nov 2019 onwards driven by favourable US-China trade negotiations and subsequent covid19 outbreak in China disrupting steel supplies from China. However global outbreak and spread of covid19 by Mar 2020 put a halt to the demand with lockdowns in place in all major markets except China, which provided a boost to export of semis to China.

GLOBAL SHARE IN STEEL TRADE

Steel prices are now increasingly aligning to global export prices as markets strike a balance between imports and domestic demand. Movement of currencies against the US dollar also have a significant impact on the movement of global steel and raw material prices.

India was the world's 12th largest steel exporter in CY2019 with 13.4 mT having 3% share of global exports of 437 mT. It was the 17th largest steel importer with 8.9 mT. Top five exporters being China, Japan, S Korea, Russia, EU and top five importers being EU, US, Germany, Italy , Thailand. India was the 9th largest net exporter, top ones being China, Japan, Russia, Ukraine, S Korea.

Major importers and exporters of steel 2019

million tonnes

Rank	Total exports	Mt
1	China	63.8
2	Japan	33.1
3	South Korea	29.9
4	Russia	29.5
5	European Union (28)[1]	27.8
6	Germany[2]	24.1
7	Turkey	19.7
8	Italy[2]	17.9
9	Belgium[2]	17.2
10	Ukraine	15.6
11	France[2]	13.6
12	India	13.4
13	Brazil	13.3
14	Taiwan, China	11.2
15	Netherlands[2]	10.1
16	Iran	8.7
17	Spain[2]	8.7
18	United States	7.3
19	Austria[2]	7.0
20	Poland[2]	5.8

Rank	Total imports	Mt
1	European Union (28)[1]	40.2
2	United States	27.1
3	Germany[2]	23.1
4	Italy[2]	20.1
5	Thailand	16.7
6	South Korea	16.4
7	China	15.5
8	Vietnam	15.4
9	France[2]	14.5
10	Indonesia	13.4
11	Mexico	13.0
12	Belgium[2]	12.9
13	Turkey	12.4
14	Poland[2]	10.9
15	Spain[2]	10.1
16	Netherlands[2]	9.7
17	India	8.9
18	Malaysia	7.4
19	Canada	7.3
20	Taiwan, China	7.3

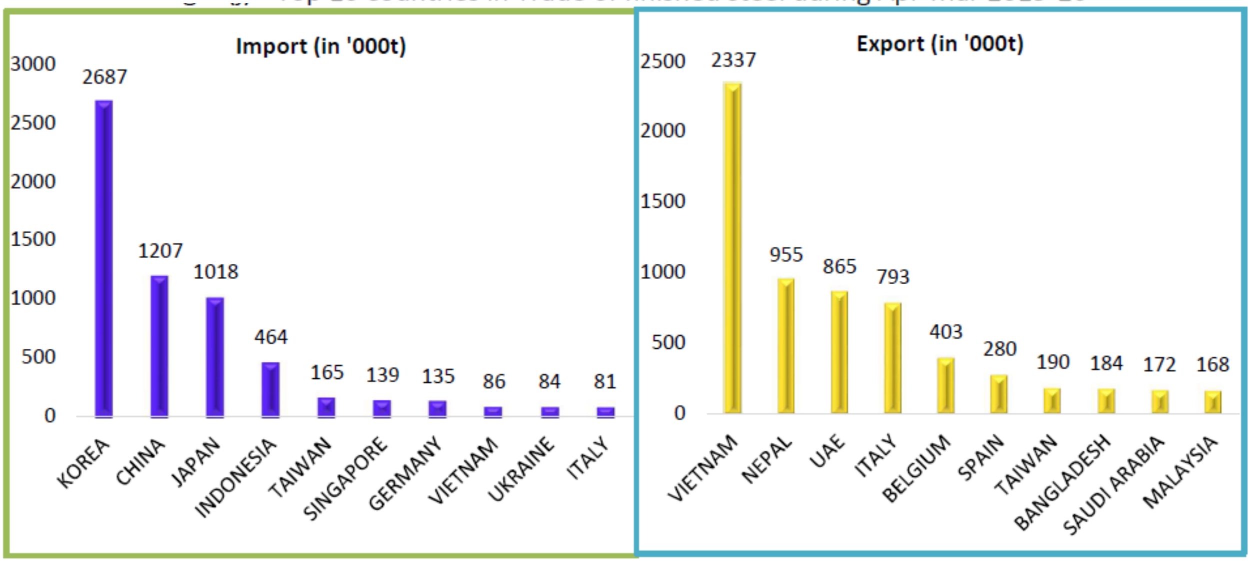
Rank	Net exports (exports - imports)	Mt
1	China	48.3
2	Japan	26.7
3	Russia	22.7
4	Ukraine	14.0
5	South Korea	13.6
6	Brazil	11.0
7	Iran	7.9
8	Turkey	7.4
9	India	4.4
10	Belgium[2]	4.3
11	Taiwan, China	3.9
12	Austria[2]	2.8
13	Luxembourg[2]	1.8
14	South Africa	1.5
15	Slovakia[2]	1.3

Rank	Net imports (imports - exports)	Mt
1	United States	19.8
2	Thailand	15.1
3	European Union (28)[1]	12.4
4	Vietnam	10.3
5	Indonesia	9.2
6	Mexico	7.8
7	Philippines	7.2
8	Poland[2]	5.1
9	Saudi Arabia	3.9
10	Algeria	3.2
11	Israel	3.1
12	Bangladesh	3.0
13	United Kingdom[2]	2.9
14	Colombia	2.6
15	Czech Republic[2]	2.4

Source - WSA

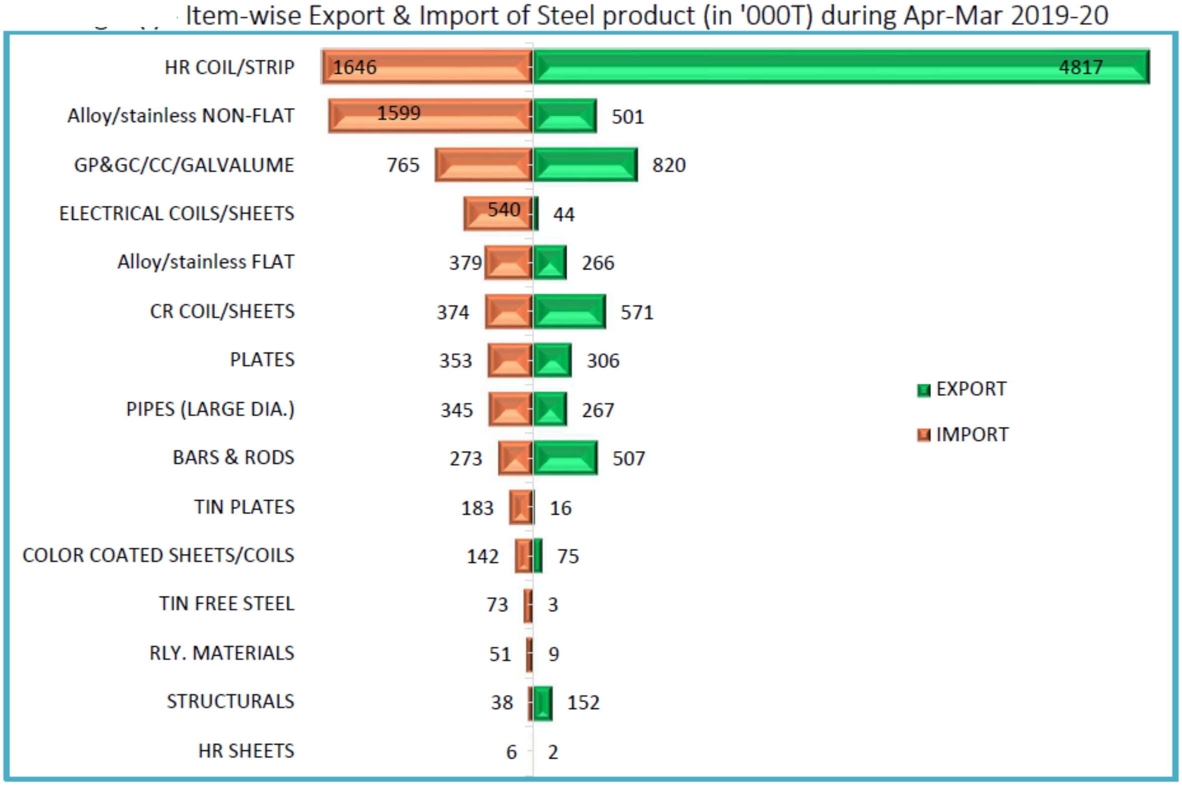
In 2019-20 India has mainly exported Flat steel, Stainless steel, semis. Main export destinations have been Vietnam, Nepal, UAE, EU. Major imports consists of Flat steel and Alloy / Stainless steel. Major import sources are S Korea, China, Japan, Indonesia. 4.82 mT HRC was exported in 2019-20 out of which 2.31 mT was exported to Vietnam (48%). Almost 70% of HRC was imported from S.Korea and 36% of Alloy/Stainless Steel was imported from China.

Top 10 countries in Trade of finished steel during Apr-Mar 2019-20



Source: JPC

Item-wise Export & Import of Steel product (in '000T) during Apr-Mar 2019-20



Source: JPC

TRADE IN STEEL RAW MATERIALS

IRON ORE - Imports of Iron ore in 2019-20 have dropped sharply by 90% from 2018-19, with major fall in imports of Pellets and Fines, driven by improved domestic availability , poor demand for finished steel, resulting in domestic prices below import parity and preferred over

Import of Iron Ore/Pellet (Quantity million tonnes, Value Rs Cr)

Description	2018-19			2019-20(p)			% growth (Qty)
	Quantity	Value	% share	Quantity	Value	% share	
Iron Ore Lumps	3.196	1973.58	25%	0.543	452.18	44%	-83%
Iron Ore Fines	8.436	2897.68	66%	0.223	129.13	18%	-97%
Iron Ore Conc.	0.533	353.24	4%	0.421	305.77	34%	-21%
Pellets	0.640	683.33	5%	0.054	44.32	4%	-92%
Iron Ore	12.804	5907.82	100%	1.240	931.41	100%	-90%

Source: JPC & Commerce

Import of Iron Ore---Top 4 country (Quantity million tonnes, Value Rs Cr)

Country	2018-19			2019-20(p)			% growth (Qty)
	Quantity	Value	% share	Quantity	Value	% share	
SOUTH AFRICA	2.653	1760.21	21%	0.543	451.99	44%	-80%
BRAZIL	1.873	1046.73	15%	0.301	229.05	24%	-84%
AUSTRALIA	7.217	2145.12	56%	0.171	87.45	14%	-98%
CANADA	0.164	107.99	1%	0.119	74.78	10%	-27%
OTHERS	0.913	730.22	10%	0.898	847.76	7%	0.106
GRAND TOTAL	**12.804**	**5907.82**	**100%**	**1.240**	**931.412**	**100%**	**-90%**

Source: JPC & Commerce

Imports. Lumps only from South Africa and Concentrate remained the major import items in 2019-20.

Exports of Iron Ore has jumped sharply by 125% in 2019-20, driven by depressed domestic demand , improved demand in China and disruption in supply from Vale, Brazil. Major increase witnessed in exports of Fines (5.95 mT in 2018-19 increased substantially to 22.33 mT in 2019-20) and Pellets (9.41 mT in 2018-19 increased to 12.53 mT in 2019-20). The major destination for export in 2019-20 remained China with increase of 154% and a share of 84.6% of total exports

Export of Iron Ore/Pellet (Quantity million tonnes, Value Rs Cr)

Description	2018-19			2019-20(P)			% growth (Qty)
	Quantity	Value	% share	Quantity	Value	% share	
Iron Ore Lumps	0.831	313.89	5%	1.479	878.08	4%	78%
Iron Ore Fines	5.955	1616.10	37%	22.332	8332.26	61%	275%
Iron Ore Conc	0.001	0.14	0%	0.083	24.53	0.2%	10554%
Pellets	9.412	7334.43	58%	12.534	9319.98	34%	33%
Iron Ore	16.199	9264.56	100%	36.428	18554.84	100%	125%

Source: JPC & Commerce

Export of Iron Ore--- Top 9 country wise (Quantity million tonnes, Value Rs Cr)

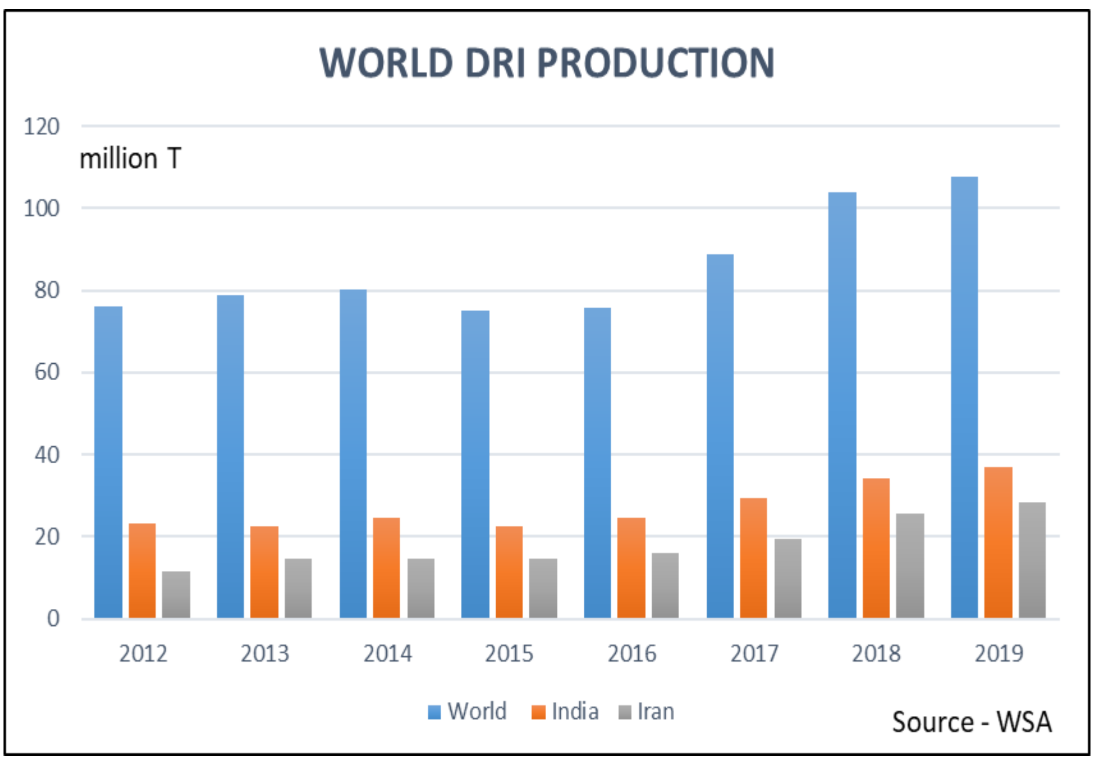
Country	2018-19			2019-20(P)			% growth
	Quantity	Value	% share	Quantity	Value	% share	
CHINA P RP	12.153	6708.52	75.0%	30.819	14598.45	84.6%	154%
JAPAN	1.160	605.31	7.2%	1.956	1283.91	5.4%	69%
KOREA RP	1.055	743.81	6.5%	1.016	718.66	2.8%	-4%
FRANCE	0.000	0.00		0.709	553.59	1.9%	
OMAN	0.253	174.58	1.6%	0.531	392.78	1.5%	110%
TURKEY	0.067	46.88	0.4%	0.433	333.36	1.2%	547%
MALAYSIA	0.344	157.32	2.1%	0.266	167.82	0.7%	-23%
U K	0.372	268.80	2.3%	0.184	146.26	0.5%	-50%
NEPAL	0.077	10.11	0.5%	0.117	36.87	0.3%	53%
Others	0.871	319.149	3.6%	0.719	549.233	4.4%	0.396
Grand Total	**16.199**	**9264.560**	**100.0%**	**36.428**	**18554.845**	**100.0%**	125%

Source: JPC & Commerce

SPONGE IRON (DRI / HBI)

World Sponge iron production was 107.6 mT in CY2019, with a growth of 3.5% over CY2018. India continues to be the largest producer of Sponge iron for more than a decade, producing 36.9 mT in CY2019 with a growth of 7.9% over CY2018 and global share of 34%. Iran was the 2nd largest producer with 28.5 mT during CY2019, a growth of 10.9% over CY2018.

In global trade of Sponge Iron, Russia was the dominant exporter, with total exports about 4 mT in CY2018, followed by Trinidad and Tobago with about 1.5 mT bound for the US. Lowered profitability caused by extraordinarily high iron ore costs for DR Pellets has restricted international trade in 2019.



With improved availability of iron ore at cheaper prices, Indian Sponge Iron production has increased by 7.02% to 37.14 mT during 2019-20, going mainly for domestic consumption in secondary sector.

	Producer wise Production of Sponge Iron in India (in million tonnes)					
	Mar-20	Mar-19	% change	Apr-Mar 2019-20	Apr-Mar 2018-19	% change
ESSAR	0.33	0.42	-22.07	4.81	4.80	0.19
JSPL	0.12	0.11	11.02	2.08	1.33	56.59
JSWL	0.16	0.22	-26.59	2.00	2.37	-15.70
OTHERS	1.92	2.25	-14.29	28.26	26.21	7.82
Total Production	**2.53**	**2.99**	**-15.39**	**37.14**	**34.71**	**7.02**

Source - JPC

Small volumes of DRI continue to be imported mainly from Middle East, total 58562 Ton in 2019-20.

IMPORTS OF SPONGE IRON			TON	
S.No.	Country	2018 - 19	2019-20	%Growth
1	U ARAB EMTS	24991	20726	-17%
2	SOUTH AFRICA	14636	18089	24%
3	EGYPT	4265	12458	192%
4	OTHERS	3547	7290	106%
	Total	**47439**	**58562**	**23%**
Source - DGCIS				

India exported 0.89 mT of Sponge iron during 2019-20 an increase of 32%, major export destinations being Bangladesh, Bhutan, Nepal, Malaysia.

EXPORTS OF SPONGE IRON			TON	
S.No.	Country	2018 - 19	2019-20	%Growth
1	BANGLADESH PR	406970	432963	6%
2	BHUTAN	96319	188169	95%
3	NEPAL	110678	181060	64%
4	MALAYSIA	40181	56498	41%
5	SUDAN	1545	15954	933%
6	KENYA	7437	4353	-41%
7	SRI LANKA DSR	1103	2855	159%
8	ETHIOPIA	999	2160	116%
9	SAUDI ARAB	270	1990	637%
10	INDONESIA	1414	1919	36%
11	THAILAND	25	1020	3980%
12	OTHERS	5297	437	-92%
	Total	**672238**	**889378**	**32%**
Source - DGCIS				

STEEL SCRAP – India continued to depend on imports of Ferrous scrap to support the secondary steel sector, importing 6.78 mT during 2019-20 , with a marginal drop of 1.6% due to delayed shipments during Mar’2019 resulting from lockdown related to covid19 virus.

IMPORTS OF FERROUS SCRAP			million T		
S.No.	HSCode	Commodity	2018 - 19	2019-20	%Growth
1	72044900	OTHER WASTE AND SCRAP	5.45	5.06	-7.1%
2	72042190	OTHR WST AND SCRP OF STAINLESS STEEL	1.13	1.32	16.8%
3		OTHERS	0.30	0.40	31.0%
		TOTAL	**6.88**	**6.78**	**-1.6%**
Source - DGCIS					

SCRAP HSC 72044900 - TOP SOURCES			million T	
S.No.	Country	2018 - 19	2019-20	%Growth
1	U ARAB EMTS	1.14	0.89	-22%
2	U K	0.79	0.68	-14%
3	U S A	0.55	0.58	5%
4	SOUTH AFRICA	0.38	0.39	3%
5	SINGAPORE	0.46	0.36	-21%
6	AUSTRALIA	0.17	0.18	8%
7	BELGIUM	0.13	0.18	41%
8	NETHERLAND	0.12	0.12	-1%
9	BRAZIL	0.03	0.10	198%
10	CANADA	0.07	0.10	45%
Source - DGCIS				

The top sources for ferrous scrap imports during 2019-20 remained UAE, UK, US, EU, South Africa.

SCRAP HSC 72042190 - TOP SOURCES			million T	
S.No.	Country	2018 - 19	2019-20	%Growth
1	U S A	0.136	0.198	46%
2	U ARAB EMTS	0.095	0.114	20%
3	NETHERLAND	0.071	0.078	10%
4	MALAYSIA	0.075	0.075	0%
5	SINGAPORE	0.080	0.074	-7%
6	THAILAND	0.076	0.073	-5%
7	KOREA RP	0.074	0.065	-13%
8	CANADA	0.054	0.058	6%
9	VIETNAM SOC REP	0.053	0.049	-7%
10	U K	0.040	0.048	20%
Source - DGCIS				

Major sources for Stainless steel scrap during 2019-20 were US,UAE,EU

Global trade in Ferrous scrap

million tonnes

	Exports		Imports	
	2018	2019	2018	2019
Austria	1.2	1.2	1.1	1.1
Belgium	4.0	3.8	4.5	4.5
Bulgaria	0.4	0.4	0.2	0.2
Czech Republic	2.2	2.2	0.4	0.4
Finland	0.4	0.5	0.0	0.0
France	6.4	6.5	1.8	1.5
Germany	8.1	7.9	4.0	4.0
Greece	0.1	0.0	0.9	0.8
Italy	0.5	0.5	5.6	5.2
Netherlands	6.2	6.2	2.8	3.2
Poland	1.7	2.1	0.9	0.7
Slovak Republic	0.6	0.8	0.4	0.1
Spain	0.7	0.5	3.8	3.9
Sweden	1.3	1.5	0.3	0.2
United Kingdom	8.7	8.1	0.4	0.3
Other EU	7.6	7.1	5.5	5.3
European Union (28)	50.0	49.3	32.7	31.5
Turkey	0.2	0.2	20.7	18.9
Others	1.8	1.9	1.0	1.0
Other Europe	2.0	2.0	21.7	19.8
Kazakhstan	0.1	0.2	0.0	0.0
Russia	5.5	3.7	0.6	1.0
Ukraine	0.3	0.0	0.0	0.0
Other CIS	0.1	0.1	1.9	1.6
CIS	6.1	4.0	2.6	2.7
Canada	5.1	4.4	3.5	2.1
Mexico	0.8	0.8	1.9	1.5
United States	17.3	17.7	5.0	4.3
NAFTA	23.2	22.9	10.4	7.9
Brazil	0.4	0.7	0.3	0.2
Other Central and South America	1.6	1.4	0.8	0.7
Central and South America	1.9	2.1	1.1	0.9
South Africa	0.5	0.5	0.1	0.1
Other Africa	0.9	1.2	0.5	0.5
Africa	1.4	1.7	0.6	0.7
Middle East	2.5	2.2	1.0	1.1
China	0.3	0.0	1.3	0.2
Japan	7.4	7.7	0.2	0.1
South Korea	0.4	0.2	6.4	6.5
Taiwan, China	0.1	0.1	3.6	3.5
Other Asia	4.1	3.3	21.6	23.7
Asia	12.4	11.3	33.2	34.1
Australia and NewZealand	2.6	3.0	0.1	0.0
World	102.1	98.5	103.3	98.7

Source - WSA

Global imports of ferrous scrap in CY 2019 was 98.7 mT a drop of 4.5% over CY 2018. Major exporters were US and EU. Major net importers in CY 2019 were Turkey with 18.7 mT and Asia with 22.8 mT.

TRADE CHALLENGES

India's domestic steel industry is especially vulnerable to cheaper imports and demand fluctuation. The slump in domestic steel consumption and decrease in investment across sectors in last few years have affected the overall growth and profitability of the steel industry. The current wave of protectionism and trade wars are further impacting the industry. Corporate tax cuts are a positive step towards driving investment and demand. Measures are needed to increase consumer confidence and the credibility of the financial sector.

Indian steel industry is often regarded as uncompetitive globally. A report by NITI Aayog-2019 explains a USD 80–100 cost difference in the table below:

(USD/tonne)	
Logistics and infrastructure	25–30
Power	8–12
Import duty on coal	5–7
Clean Energy Cess	2–4
Taxes and duties on iron ore	8–12
Finance	30–35
Total cost disadvantage	80–100

Source: NITI Aayog

Author is partner in Elan InterTrade, a trading company dealing in iron & steel (www.elanintertrade.com)

Business resilience with crisis management and auditing in Sponge Iron and Steel Industry

By

Ms. MicolNorsa (Italy), Ms. Manjushri Shah (USA) and Mr. S.K. Bhatnagar (India), Rauch Education

OVERVIEW

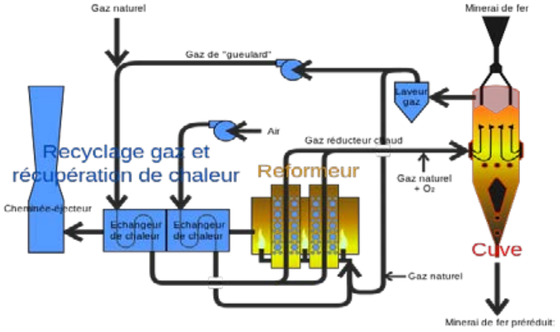
Sponge iron is formed through the reduction of iron ore to metallic iron through reaction with carbon in the form of coal, etc. at approx. 1100 degree Celsius. Sponge iron is also referred to as direct reduced iron, metalized iron, or hot briquetted iron.

Sponge iron is used in the iron and steel industry as a substitute for steel scrap in induction and electrical arc furnaces. Over the years, the shortage of expensive melting steel scrap has made sponge iron a significant raw material for manufacturing high quality steel. In India, the abundance of iron ore deposits has led to absorption of the renowned by the Indian industry and use of ore lumps and fines has led to the country becoming the largest producer of sponge iron in the world.

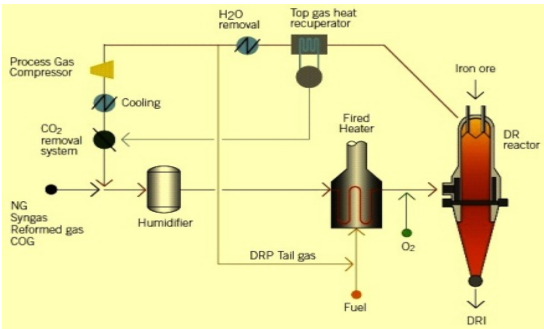
Today with a production of nearly 26 million tones, India is the largest producer of sponge iron in the world. Growth of this sector is an evidence of the growing resilience of the Indian steel industry and its ability to adapt its workings to changing dynamics of the input and products markets. The primary push for the growth of this sector has come from the rapid expansion of secondary steel making in India in the last three decade.

Routes of sponge iron production in India

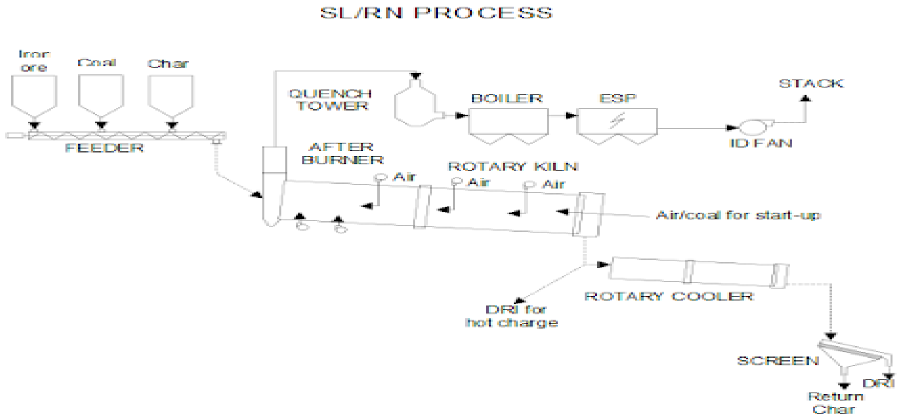
There are two routes of sponge iron making namely Gas based and coal based route. In gas based sponge iron, high grade iron ore and natural gas are used. The natural gas is the source of heat for reduction of iron ore is gas based process. In coal based route of sponge iron, high grade iron ore andnon-coking coal are used. In coal based, non-coking coal is the source for reduction of iron ore. The Gas based sponge iron is produced through HYL and Midex process and coal based sponge iron through SL/RN technology. Sketches of process diagrams under:



MEDRIX PROCESS



HYL PROCESS



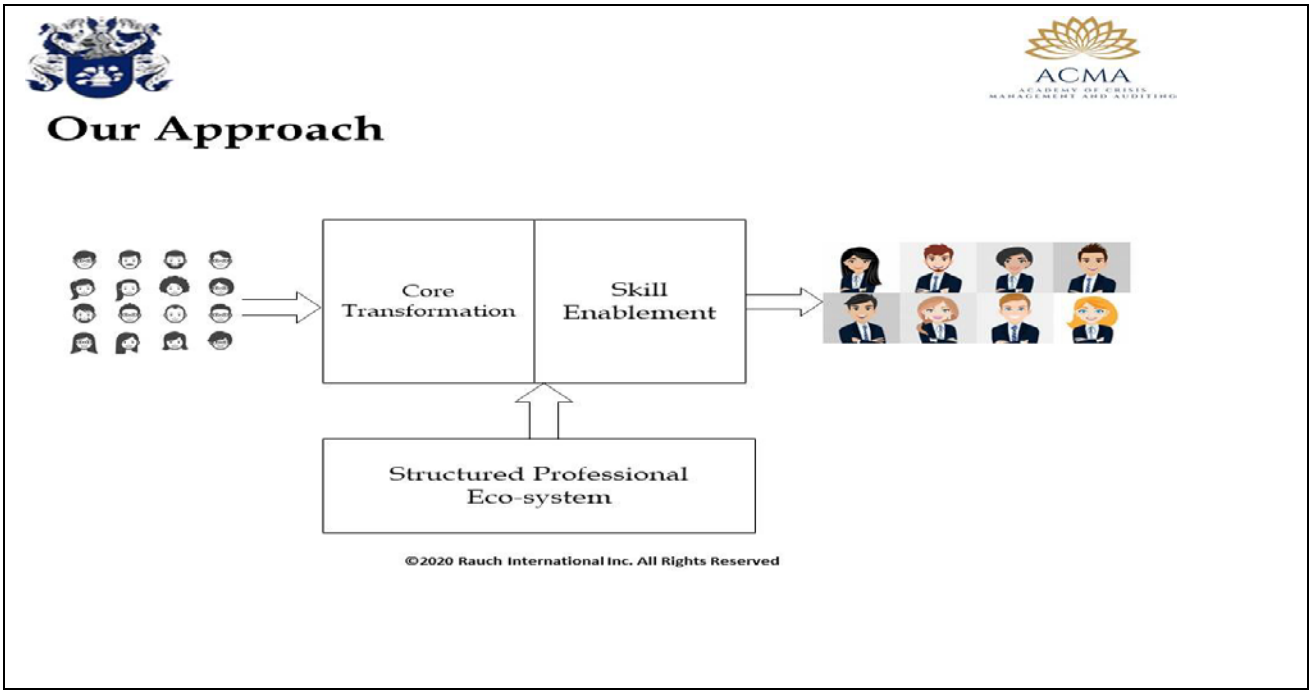
SL/RN PROCESS

<u>**CONTRIBUTION OF SPONGE IRON INDUSTRY IN INDIA'S ECONOMY AND IMPORTANCE OF CRISIS MANAGEMENT**</u>

The sponge iron and steel industry is the strongest pillar of the Indian Economy and one of the biggest drivers of the socio-economic reforms in India. Hence, the success and sustainability of this sector are of paramount importance. Today, with the COVID-19 scenario, winning back the stake-holders' confidence is an unprecedented challenge faced by almost all the sectors across the globe. Prudent business practices like Crisis Management and Auditing not only help renew this confidence but also assist to identify the new vulnerabilities which can be potentially detrimental to growth and re-enablement and plan for them.

With the advent of new technologies and intervention of social media, the insecurities of stake-holders have compounded. To cater to this issue, well-designed and executed crisis preparedness plans when communicated with internal and external stake-holders provide concrete grounds for them to instill their confidence in the organizations.

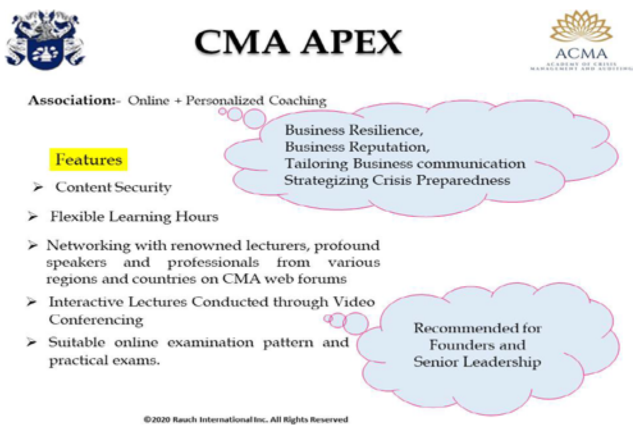
CMA Programs from Rauch Education provide a Holistic approach on Crisis Management and Audit for the leaders of tomorrow

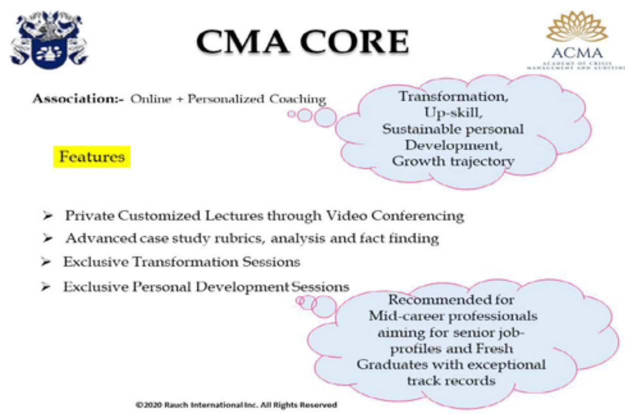


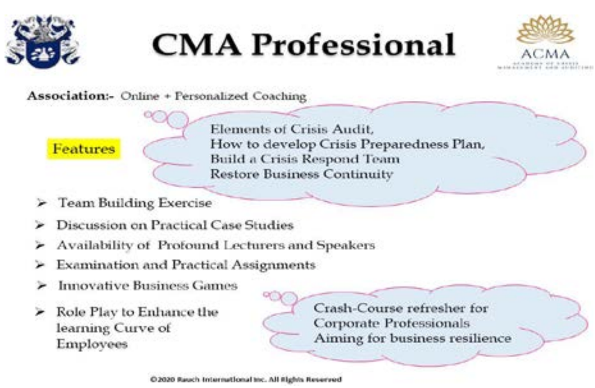
Thinking that crisis management and auditing would be useful only because of COVID-19 and would not be required in business, as usual, would be myopic. Crisis auditing is one of the keys to business resilience. Crisis auditing when adopted as a normal business process can facilitate organizations in systematically identifying business vulnerabilities. These vulnerabilities are required to be planned for. Two point-of-views are central to this planning exercise. Firstly, the prevention of the potential crisis scenarios and the second one being the reduction of impact on account of the occurrence of a crisis. Crisis auditing can help organizations demonstrate their values in action. The negative realities giving rise to panic and denial can be converted to action and reputation.

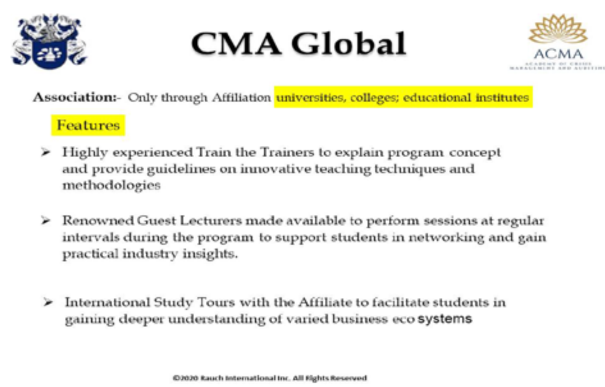
In a nutshell, capacity building for crisis management and auditing along with preparedness exercise can lay strong foundations to business resilience and also make organizations in the Iron and Steel Industry navigate through an unforeseen crisis that appears in the form of 'Black Swans'.

Glossary of CMA Programs









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Statistics for 2019-20

Item	April-March 2019-20(MT)	April-March 2018-19(MT)	%age Change
Crude Steel Production	109.215	110.921	-1.5%
Hot Metal Production	73.007	74.376	-1.8%
Pig Iron Production	5.507	6.414	-14.1%
Sponge Iron Production	37.143	34.705	7.0%

Total finished steel (alloy/stainless – non alloy)

Production	102.059	101.287	0.8%
Import	6.768	7.835	-13.6%
Export	8.355	6.361	31.4%
Consumptiom	100.067	98.708	1.4%

Source: JPC

Summary: Statistics

S No	Item	Performance of Indian Steel Industry in 2019-20 (April 2019-March 2020) in Million Tonnes
1	**Crude Steel Production**	109.215
2	**Hot Metal Production**	73.007
3	**Pig Iron Production**	5.507
4	**Sponge Iron Production**	37.143
5	**Finished Steel Production**	102.059
6	**Finished Steel Import**	6.768
7	**Finished Steel Export**	8.355
8	**Domestic Consumption**	100.067

Source: JPC

Important Statistics during 2020-21

Item	Performance of Indian Steel Industry		
	April-June 2020*(mt)	April-June 2019(mt)	% Changes*
Crude Steel Production	**15.867**	**27.876**	**-43.1**
Hot Metal Production	**12.995**	**18.763**	**-30.7**
Pig Iron Production	**0.532**	**1.632**	**-67.4**
Total Finished Steel (alloy/stainless + non-alloy)			
Production	**12.544**	**26.543**	**-52.7**
Import	**1.211**	**1.802**	**-32.8**
Export	**3.266**	**1.331**	**-145.3**
Consumption	**10.694**	**24.773**	**-56.8**

Source: JPC; *provisional; mt=million tones

AUCTION OF COAL MINES FOR SALE OF COAL
LIST OF COAL MINES

(11th TRANCHE OF AUCTION UNDER THE COAL MINES (SPECIAL PROVISIONS) ACT, 2015)
(1st TRANCHE OF AUCTION UNDER THE MINES AND MINERAL (DEVELOPMENT AND REGULATIONS) ACT, 1957)

S. No.	Coal Mine	Act	State	Category
1	Bander	CM(SP) Act, 2015	Maharashtra	Fully Explored
2	Brahmadiha	CM(SP) Act, 2015	Jharkhand	Fully Explored
3	Chakla	CM(SP) Act, 2015	Jharkhand	Fully Explored
4-5	Chendipada & Chendipada-II	CM(SP) Act, 2015	Odisha	Fully Explored
6	Chitarpur	CM(SP) Act, 2015	Jharkhand	Fully Explored
7	Choritand Tiliaya	CM(SP) Act, 2015	Jharkhand	Fully Explored
8	Fatehpur East	CM(SP) Act, 2015	Chhattisgarh	Fully Explored
9	Gare-Palma-IV/1	CM(SP) Act, 2015	Chhattisgarh	Fully Explored
10	Gare-Palma-IV/7	CM(SP) Act, 2015	Chhattisgarh	Fully Explored
11	Gondulpara	CM(SP) Act, 2015	Jharkhand	Fully Explored
12-13	Gotitoria (East) & Gotitoria (West)	CM(SP) Act, 2015	Madhya Pradesh	Fully Explored
14-15	Machhakata & Mahanadi	CM(SP) Act, 2015	Odisha	Fully Explored
16	Madanpur (North)	CM(SP) Act, 2015	Chhattisgarh	Fully Explored
17	Marki Barka	CM(SP) Act, 2015	Madhya Pradesh	Fully Explored
18	Marki Mangli-II	CM(SP) Act, 2015	Maharashtra	Fully Explored
19	Morga II	CM(SP) Act, 2015	Chhattisgarh	Partially Explored
20	North Dhadu	CM(SP) Act, 2015	Jharkhand	Fully Explored
21	Radhikapur (East)	CM(SP) Act, 2015	Odisha	Fully Explored
22	Radhikapur (West)	CM(SP) Act, 2015	Odisha	Fully Explored
23	Rajhara North (Central & Eastern)	CM(SP) Act, 2015	Jharkhand	Fully Explored
24	Sayang	CM(SP) Act, 2015	Chhattisgarh	Partially Explored
25	Seregarha	CM(SP) Act, 2015	Jharkhand	Fully Explored
26	Sahapur East	CM(SP) Act, 2015	Madhya Pradesh	Fully Explored
27	Sahapur West	CM(SP) Act, 2015	Madhya Pradesh	Fully Explored
28	Shankarpur Bhatgaon II Extn.	CM(SP) Act, 2015	Chhattisgarh	Fully Explored
29	Sondhia	CM(SP) Act, 2015	Chhattisgarh	Fully Explored
30	Takli-Jena-Bellora (North) & Takli-Jena-Bellora (South)	CM(SP) Act, 2015	Maharashtra	Fully Explored
31	Thesgora-B/ Rudrapuri	CM(SP) Act, 2015	Madhya Pradesh	Fully Explored
32	Urtan North	CM(SP) Act, 2015	Madhya Pradesh	Fully Explored
33	Urma Paharitola	CM(SP) Act, 2015	Jharkhand	Partially Explored
34	Bandha	MMDR Act, 1957	Madhya Pradesh	Partially Explored
35	Brahmanbil & Kardabahal	MMDR Act, 1957	Odisha	Fully Explored
36	Dhirauli	MMDR Act, 1957	Madhya Pradesh	Fully Explored
37	Kuraloi (A) North	MMDR Act, 1957	Odisha	Fully Explored
38	Marwatola Sector-VI & Sector-VII	MMDR Act, 1957	Madhya Pradesh	Fully Explored
39	Morga South	MMDR Act, 1957	Chhattisgarh	Fully Explored
40	Phuljhari (East & West)	MMDR Act, 1957	Odisha	Fully Explored
41	Urtan	MMDR Act, 1957	Madhya Pradesh	Fully Explored

Note: The above list is indicative. Mines may be added / deleted from the list.
Source: Ministry of Coal