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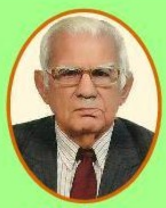
 B D Jethra	 S C Suri	 K L Mehrotra	 K K Mehrotra
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STEEL INDUSTRY CAN LEAD THE WAY IN PRIVATE INVESTMENT REVIVAL IN INDIA, SAYS TATA STEEL MD

Elevated community prices may remain volatile at a higher level, says Narendran.

The steel industry will lead private sector investments in India as manufacturers make healthy profits during the ongoing cycle of high commodity prices, said 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," Narendran said in an interview.

For the record, Tata Steel reported net profit of ₹9,573 crore for the December quarter. "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 discussed plans of investing up to ₹1.5 lakh crore over an unspecified period. Being an iron ore producing country, India should be exporting more steel than it presently does, compared with other countries like China, he said. "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 said. "If you want to make in India, you should convert the iron ore into steel for India and for the world."

Explaining Tata Steel's rationale of buying Neelachal Ispat Nigam Limited (NINL) for ₹12,100 crore, which many termed as an expensive purchase, Narendran said that the asset was a perfect match for India's oldest steel 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," Narendran said. The proximity of the plant to Tata Steel's existing setup in Kalinganagar would help it leverage better economies of scale. The asset will also help the company plug a hole around long products in its expansion plans. Tata Steel has ample capacity for flat products but needed organic or inorganic growth opportunities in long products, Narendran said.

Moreover, the asset came with 100 million tonnes of iron ore reserves, he said. "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 growth ambitions for the coming decade and organically reach up to 50 million tons per annum (mtpa) of production capacity, as per Narendran. The Kalinganagar plant has installed capacity of 3 mtpa which is being increased to 8 mtpa and could be taken up to 16 mtpa as demand increases. The plant at Angul has 5 mtpa capacity which can be increased to 10 mtpa and the Jamshedpur plant has an installed capacity of 10 mtpa. Meanwhile, the Neelachal plant can be ramped up to produce up to 10 mtpa, he said.

The company has been using the current commodity price upcycle to repay its debt and has reached a debt to EBITDA ratio of just under 1, having repaid ₹17,376 crore in 9MFY22. Narendran said that a debt-EBITDA ratio between 1 and 2 was ideal for a capital-intensive industry like steel manufacturing during a growth cycle and the company will now invest the cash it generates to fund growth rather than repay debt.

Volatile Prices

He expects the elevated commodity prices that turned the fortunes of steelmakers over the past year to remain "volatile at a higher level." While steel prices are volatile, so were input costs like coal and iron ore for steelmakers. Tata Steel's revenues remained flat sequentially in the December quarter, but its margins took a dip due to sharp commodity prices. Narendran said that there will be further margin squeeze during the ongoing quarter.

Source: The Economic Times

GREEN STEEL THROUGH HYDROGEN DIRECT REDUCTION

A study on the role of hydrogen in the Indian Iron and Steel Sector

Direct Reduction of Iron Ore

Currently, over 90% of iron production is through the blast furnace route, with direct reduction making up a growing share since its commercialisation in the 1970s. Since the year 2000 direct reduced iron (DRI) production has increased by 250%, illustrating the rapid growth of the sector. Global DRI production rose by 7.3% to 108 Million tonnes (Mt) in 2019, representing the fourth consecutive record year for annual growth in DRI production (see Figure 1).

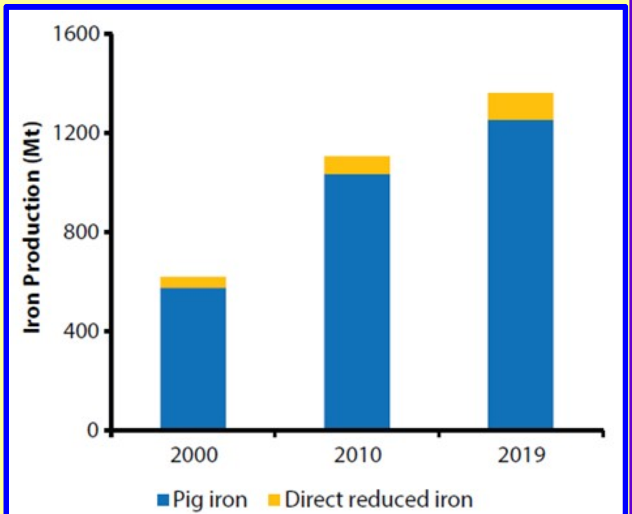


Fig 1: Iron production, 2000, 2010, 2019

India is the country with the largest DRI production, reaching 34 Mt in 2019, accounting for around a third of global DRI (WSA, 2020). The majority of Indian DRI is produced via the coal based route, using rotary kilns, making partly use of domestic coal. Elsewhere in the world, direct reduction based on natural gas dominates, driven by availability of low-cost natural gas and reduced emissions. Due to limited availability of natural gas at competitive prices, gas-based direct reduction has seen limited growth in India. There are currently several gasbased direct reduction units in India, using natural gas, syngas, and off-gases (Arcelor Mittal Nippon Steel, JSPL, JSW

Toranagallu, JSW Dolvi, JSW Salav). Natural gas based direct reduction is a well-established technology, operating for many decades with a production rate of nearly 82 Mt in the year 2019. There are two dominant shaft based direct reduction processes, with MIDREX® leading the market with an 80% market share in 2019, followed by Tenova HYL™ being the next largest (see Figure 2). This paper will predominantly focus on the MIDREX® technology due to the authors' experience with this technology.

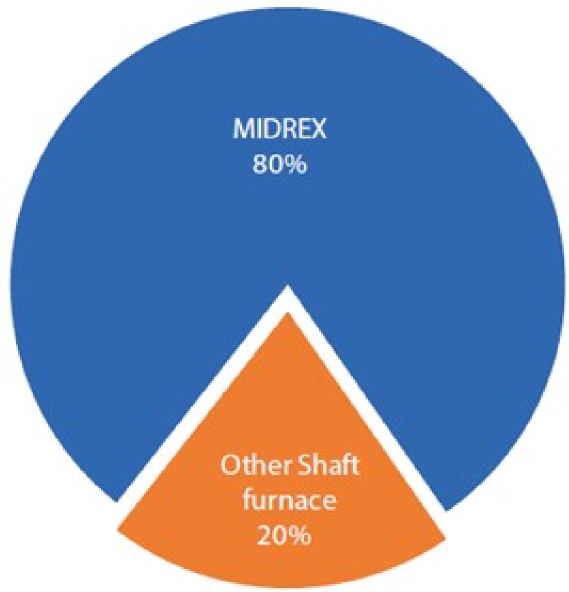


Fig 2: Global shaft Furnace Production by process, 2019

The MIDREX® process is highly flexible regarding the source of energy for direct reduction. It has been demonstrated on an industrial scale with natural gas, syngas (from coal gasification), coke oven gas, COREX® off-gas, and other combinations. The reducing gas ratio (H_2:CO) in a standard natural gas based plant is typically in a range of 1.5 to 1.7 (equal to H_2 content of 55% in the reducing gas) while there are industrial MIDREX® plants also operating up to a H_2/CO ratio of 3.2 to 3.9 (close to 70% H_2 content in the reducing gas). The natural gas based direct reduction and EAF route can already reduce CO_2 emissions by around 60% compared to the conventional blast furnace (BF) and basic oxygen furnace (BOF) route. A MIDREX® direct reduction plant consists of a reduction furnace, a top gas scrubber, a reformer, process gas compressors and heat recovery. The reduction gas is generated and heated in the reformer and used for reduction of iron oxide material in the reduction furnace in a counter-current flow to the solid material. Thereby the oxygen of the oxide material is removed by the hot reducing gas consisting mainly of hydrogen (H_2) and carbon monoxide (CO) and the material is metallized. The direct reduced iron is discharged in either hot (HDRI) or cold (CDRI) condition or is hot briquetted into iron briquettes (HBI). Whilst natural gas is the most used feedstock for the direct reduction process, MIDREX® also offers its MXCOL™ technology which can use coal-based syngas as the reducing agent. This has potential in India, where natural gas supplies are limited/high in cost, and the government has recently announced an expansion in activity around coal gasification.

Hydrogen based Direct Reduction

As a highly flexible technology, a MIDREX® plant can be operated using hydrogen in a range between 0 to 100%, resulting in further CO_2 reduction. The MIDREX® H_2 process flow sheet for use of H_2 is shown in Figure 3. The hydrogen can be supplied via an external pipeline 'over-the-fence' or can be produced on-site. The process does not require high purity hydrogen, making it suitable for fossil-fuel derived hydrogen (grey), fossil-fuel derived hydrogen with CCUS (blue), or hydrogen produced from renewables via an electrolyser (green). A more detailed discussion of green hydrogen can be found in Section 3.

The natural gas MIDREX NG™ plant can be converted in stages to a MIDREX H_2™ plant as low carbon hydrogen becomes available at a suitable cost, allowing steelmakers to reduce CO_2 emissions immediately and further reduce them in the future without major additional capital expenditure (see Figure 4). Such an approach provides steelmakers with a large degree of flexibility that can ensure plants built today are 'transition-ready', minimizing stranded asset risk as policies on emission reductions become increasingly strict.

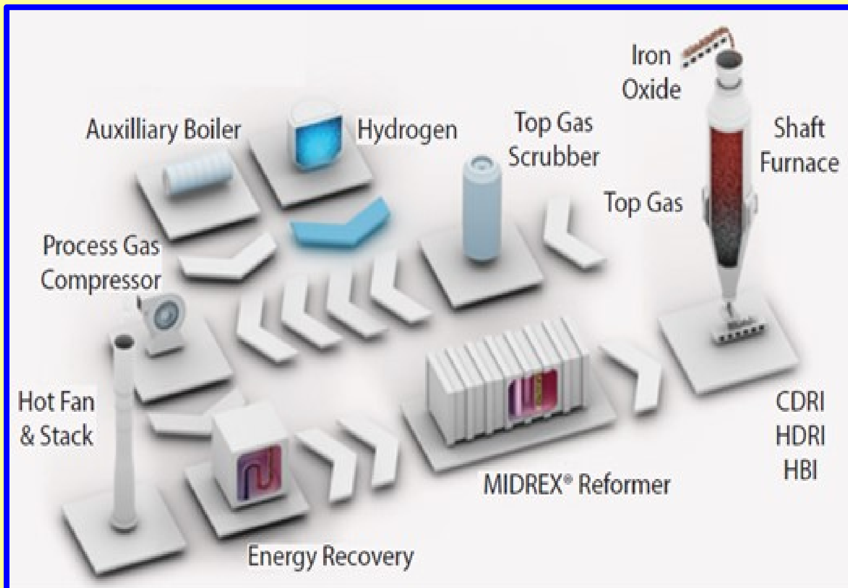


Figure 3: MIDREX™ process based on hydrogen

Figure 4: A stepwise approach to reducing CO2 emissions via the direct reduction route

Techno-economic analysis of the hydrogen direct reduction process

This section covers the energy and raw material requirements for the hydrogen direct reduction process, establishing costs of production based on average cost figures. Exact costs of production will vary on project basis. To produce virgin metallics (DRI or HBI) from lump iron ore or pellets require approximately 650 Nm^3 of hydrogen (or 58 kg) per ton of DRI (see Table 1). Hydrogen with a purity of 99.8% is required for this process, which can be produced from a range of technologies, including gas reformation and electrolysis. For reference, hydrogen for use in fuel cell electric vehicles requires a purity of 99.999999% to avoid degradation of the fuel cell. Hydrogen for use in this process does not need to be of high purity, allowing for more flexibility of the production processes.

PARAMETER	UNIT	VALUE
H_2 amount:	Nm^3/t DRI kg/ t DRI	650 58
H_2 purity:	vol%	99.8
H_2 pressure (at TOP):	bar_g	min. 4.5

Table 1: Specific hydrogen consumption and requirements for direct reduction

In addition, energy is required for reducing gas heating, due to the endothermic nature of the direct reaction between H_2 and Fe. In the conventional direct reduction process, available CO in the reducing gas results in an exothermic reaction and so an additional heat source is not required. Such a heat source could be provided by top gas fuel and/or natural gas. In future, as steel producers seek to further reduce their emissions, this heat source can be provided by biomass or electric heaters, although this needs to be better understood. For a comparison of direct reduction based on hydrogen with the conventional route, the below main unit costs (Table 2) are used for the natural gas based MIDREX® plant, which provides a 'base case' (CASE 1).

	DR PLANT BASED ON NG (BASE CASE)	UNIT RATES (INDIA)
Rough Investment budget (Core Area Turn-key India)	\$250m	
DRI Capacity	1 Mtpa	
Hourly DRI production:	125 t_{DRI}/h	
Consumption figures:		
– DR grade pellets	1.42 tons/t DRI	\$100 /t Oxide
– Natural gas	2.5 net Gcal	\$10 /mmBTU
– Electric power	120 kWh	\$0.036 /kWh
– Water (assuming cooling towers)	1.5 m^3	\$1 /m^3
– Labor (including administration)	0.12 man-hours	\$20 /manhour
– Maintenance and supplies	\$4.00	

Table 2: Capacity and typical consumption figures for CASE 1

CASE 2 and CASE 3 consider the installation of a 50 MW and 350 MW Proton Exchange Membrane (PEM) electrolyser plant, respectively, and use the hydrogen from these plants for the production of DRI. The amount of hydrogen, the energy inputs as well as the operation costs (OPEX) are listed in Table 3. The CASE 2 and CASE 3 reflect the 'Step 2' and 'Step 3' as set out in Figure 4, whereby a share of green hydrogen is blended into the gas feedstock initially, before switching to 100% hydrogen.

	CASE 1 DR Plant based on NG (BASE CASE)	CASE 2 DR Plant with H_2 addition (50 MW electrolyser)	CASE 3 DR Plant with H_2 addition (350 MW electrolyser)
Electrolyser capacity (MW)	n.a.	50	350
H_2 used (Nm³/h)	0	11,000	75,000
(kg/h)	0	1,000	7,000
Energy input:			
– Hydrogen (H_2) (mmBTU)	0.0	0.9	6.1
– Natural gas (mmBTU)	9.9	8.9	3.0
– Total (mmBTU)	9.9	9.8	9.1
– H_2 energy/total energy	0% H_2	9.2 % H_2	67.2 % H_2
Carbon content in DRI	2.5 wt%	~2 wt%	~0 wt%
Operation cost (OPEX) per ton of DRI	$ 252.97		
– H_2 price 1.0 $/kg		$ 250.73 (-1.2%)	$ 237.69 (-6.0%)
– H_2 price 2.0 $/kg		$ 258.64 (+2.2%)	$ 291.63 (+15.3%)
– H_2 price 3.0 $/kg		$ 266.55 (+5.4%)	$ 345.57 (+36.6%)
– H_2 price 4.0 $/kg		$ 274.46 (+8.5%)	$ 399.51 (+57.9%)
– H_2 price 5.0 $/kg		$ 282.37 (+11.6%)	$ 453.45 (+79.2%)

Table 3: Cases for direct reduction plant operation

The calculation of the OPEX has been carried out for hydrogen prices ranging between $1/kg and $5/kg. This price range reflects the range of potential cost of green hydrogen, which is discussed in more detail in Section 4., as well as elsewhere for the Indian context. If the hydrogen is produced via electrolysis using renewable electricity, emissions from the direct reduction process can be reduced by around 20% in CASE 2 and up to 100% in CASE 3, versus CASE 1. As can be seen from this analysis (see Figure 5), at an assumed natural gas price of $10/mmBTU, using hydrogen is competitive at a hydrogen price between $1/kg and $2/kg only. Natural gas prices in India have fluctuated considerably in recent years, currently showing lower prices due to reduced demand. In the longer term, it is expected that prices will align to LNG price at around $10/mmBTU.

The installation of a PEM electrolyser can also be used to increase the MIDREX® plant capacity. It is possible to use the by-product oxygen from the PEM electrolyser in the direct reduction shaft, particularly for DRI production. The oxygen could be added to the bustle gas to increase the reducing gas temperature and enhance the plant productivity for HDRI plants by up to 5%. Alternatively, the oxygen can be used in the EAF

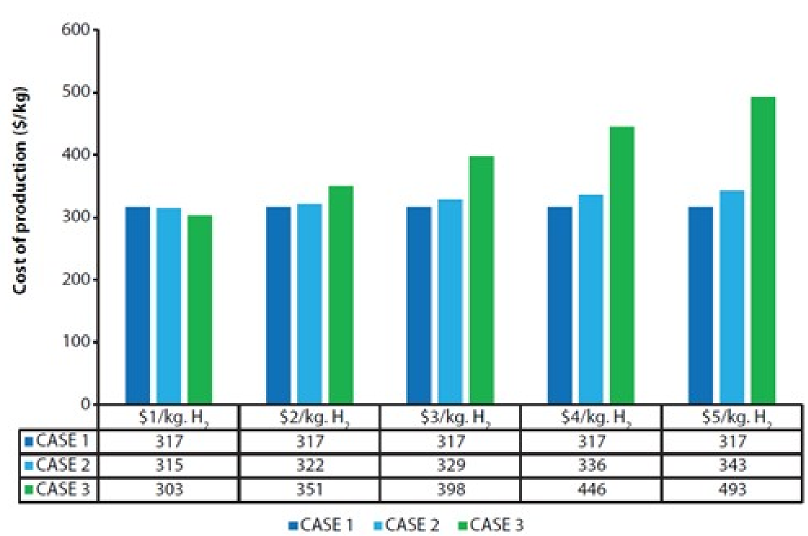


Fig 5: OPEX comparison for the DRI + EAF route

(in oxyfuel burners / lancing) or for oxygen enrichment in a blast furnace. This can provide an additional revenue stream for the electrolyser, improving the cost-competitiveness of operation. Besides comparing steel production cost for the DR/EAF route based on natural gas versus hydrogen, it is also necessary to compare the steel production costs for the BF-BOF route, which is the major route for primary steel production in India. As can be seen in Figure 6, the production costs of a BF-BOF route tend to be slightly lower than natural gas-based DR-EAF route, mainly due to the relative price differences of coking coal and natural gas. The range for these production costs reflect the 5-yearly range of natural gas and coking coal prices for India. DR-EAF can compete with BF-BOF at prices between \$6-8/mmBTU.

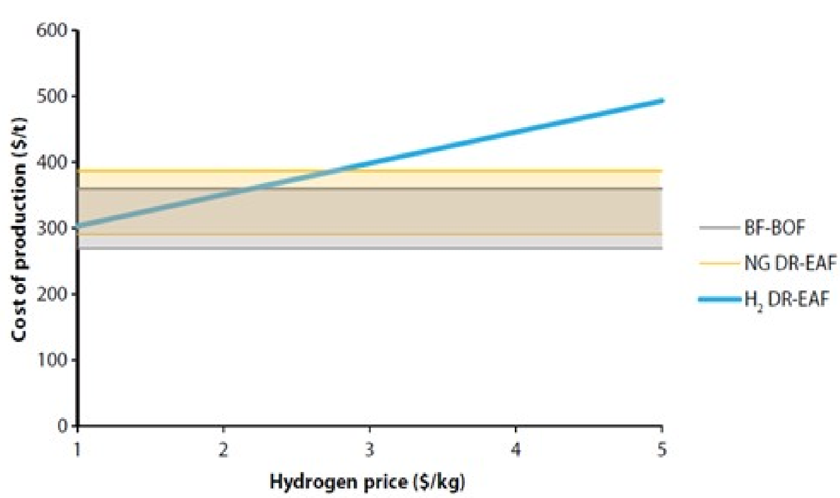


Fig 6: Costs of steel production for various routes

BF-BOF = blast furnace – basic oxygen furnace, NG DR-EAF = natural gas based direct reduction with electric arc furnace, H_2 DR-EAF = hydrogen based direct reduction with electric arc furnace. Range for BF-BOF and NG DR EAF based on range of coking coal and natural gas prices. Assume 100% DRI share in the EAF.

Even with low hydrogen costs, the BF-BOF route could still be competitive without further policy measures. To accelerate the speed of transition from fossil fuels towards low carbon hydrogen policies a carbon price could be introduced. By 2030, costs of hydrogen in India could be around \$2/kg (TERI, 2020), at which point a carbon price of around \$40/tCO_2 would be needed to support the transition from BF-BOF to the DR-EAF route.

Table 4: Projection of CO_2 intensity of grid electricity in India

YEAR	2020	2030	2040	2050	2060
CO_2 intensity of grid electricity (g CO_2/kWh)	698	567	300	100	0

Emission reduction potential

When comparing the specific CO_2 emissions from the three cases above with emissions from the BF-BOF route, large savings across all emission scopes are possible. Emissions reductions are heavily dependent on the CO_2 intensity of the electricity being used in the production of hydrogen and for the EAF. Table 4 sets out an emissions pathway for grid electricity CO_2 intensity in India, reflecting the high dominating share of coal-fired power generation, but also indicating the potential of renewables to start to replace coal out to 2060.

An alternative model would be for electricity for both the hydrogen and the EAF to be sourced directly from renewable electricity sources, via stand-alone renewable projects that are off-grid. For such projects the CO_2 emission factor can be assumed as zero. This is already a model being used by Indian industry to avoid expensive grid charges, which are higher on industry versus other electricity customers. We discuss the impact of this on the cost of hydrogen in the subsequent

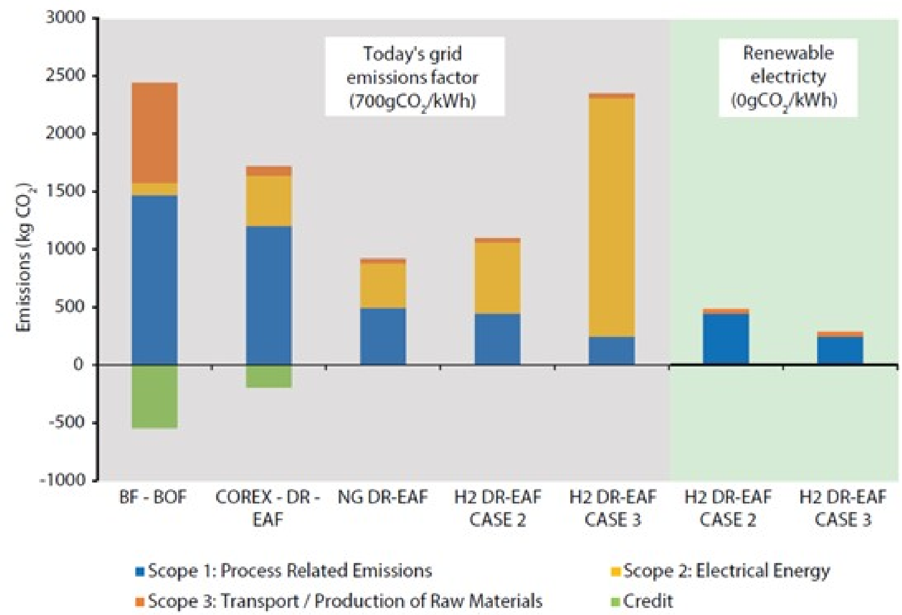


Fig 7: CO2 emissions for different steel production routes

Table 5: Emissions reduction potential for the different routes

Route	BF-BOF	COREX/ DR-EAF	NG DR-EAF CASE 1	H_2 DR-EAF CASE 2	H_2 DR-EAF CASE 3	H_2 DR-EAF CASE 2	H_2 DR-EAF CASE 3
CO_2 of grid electricity (gCO_2/kWh)	698	698	698	698	698	0	0
Emissions without credits ($kgCO_2/t_{LS}$)	2440	1721	920	1099	2349	485	289
Emissions reduction versus BF-BOF		-29%	-62%	-55%	-4%	-80%	-88%

section. Figure 7 shows the CO_2 emissions per ton of crude steel for the different production routes using electricity based on the current grid emission intensity factor (around 700 g CO_2/kWh) or the emissions based on electricity from renewables (0 g CO_2/kWh). Credits are recorded for the BF-BOF and COREX-DR-EAF routes based on slag utilisation.

This Figure shows the potential for emission reduction of more than 60% for the natural gas DR route (CASE 1) versus the conventional BF-BOF, when considering Scope 1, 2 and 3 emissions without credits. In 2020, establishing a hydrogen DR plant in India using grid electricity would increase emissions, making it important that steel producers look to increasingly to build renewable electricity assets allowing to generate the required hydrogen.

Many are already doing this via 'open access' or off-grid projects, to help to reduce the cost of energy, as well as local pollution. We can see here that the emission reduction potential for CASE 3 is close to 90% versus the conventional BF-BOF route, assuming all required electricity is sourced from renewables. If the hydrogen is produced from grid electricity based on the current specific CO_2 intensity of the grid electricity, the emissions savings will be minimal.

Producing Green Hydrogen

Background

Hydrogen is the most basic and plentiful element in the universe. However, it is not naturally occurring on earth and requires extraction from other compounds, such as methane (CH_4) or water (H_2O). The main routes include natural gas reformation, biomass, waste or coal gasification, and electrolysis, of which alkaline and Proton Exchange Membrane (PEM) technologies are the main commercially available options.

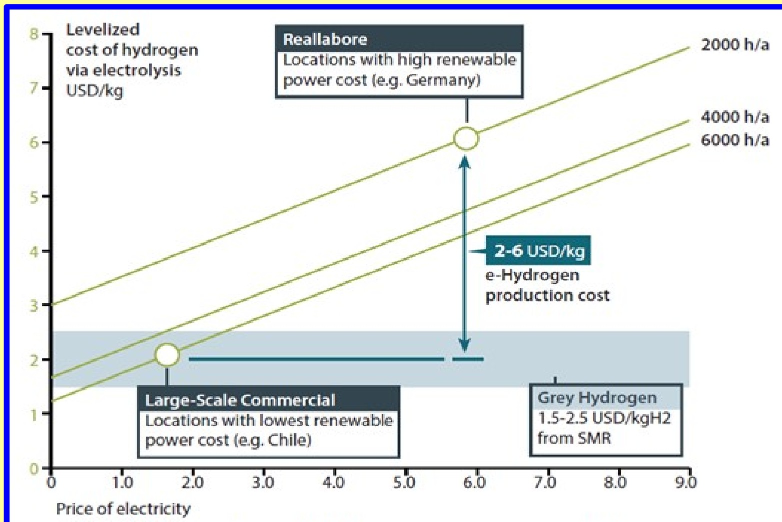


Fig 8: Typical cost of hydrogen versus price of electricity

To generate low carbon hydrogen at the scale needed to decarbonize global energy systems, Siemens has invested in generating hydrogen from water, using PEM electrolysis technology. Simply put, the PEM process uses low-cost renewable energy sources to split water - H_2O - into its constituent elements without generating carbon emissions, which is known as 'green hydrogen'. This section will draw data and findings from Siemens' experience of manufacturing and deploying PEM electrolysis technology based on the authors' experience in this area. Traditional methods of producing hydrogen, such as natural gas reforming (the leading technology being steam-methane reforming) or coal gasification, use fossil fuels and therefore generate carbon emissions. In fact, steam methane reforming (SMR) methods using natural gas as feedstock generate 8-10 kg of CO_2 for each kilogram of hydrogen produced

PEM electrolysis

PEM electrolysis is a proven high-efficiency hydrogen production technology that has been commercially deployed since the early 2000s. PEM electrolysis uses a cathode-anode cell that features a solid polymer electrolyte that conducts protons, separates water into hydrogen and oxygen, and protects the cell's electrodes. Developed as a more efficient alternative to traditional alkaline water electrolysis, PEM electrolysis has three main advantages:

Responsive and flexible: PEM electrolysis can be coupled directly to renewable energy sources. It has black-start capabilities, which means it does not need an external power source to restart from a partial or total shutdown. With an extended operating range, PEM technology can ramp up to 10 percent or more in its operating capacity in less than one second. It can operate from 5 – 100 percent of capacity, providing exceptional operating flexibility. This can be used to support grid operations, particularly as countries seek to integrate higher and higher shares of variable renewables.

Inherently clean operation: With only water, green hydrogen, and oxygen in a PEM electrolysis system, the technology requires no aggressive chemical electrolytes, such as the potassium hydroxide (KOH) electrolyte required by alkaline electrolysis systems. As with alkaline electrolysis, it produces hydrogen that is more than 99.9 per cent pure and without any CO_2 emissions.

Economically competitive: Compared to alkaline electrolyser systems, PEM electrolysers have a smaller footprint, and require less maintenance, often resulting in lower operating expenses and total cost of ownership (exact cost differences will vary project by project). While 95% of today's global production of hydrogen is via SMR and coal gasification methods with both generating significant CO_2 emissions, PEM electrolysis can produce emission-free hydrogen at competitive prices when electricity from renewable sources costs less than $40/MWh. Costs of power generation from renewables, such as solar and wind, are already around $30/MWh in India, with further cost reductions expected.

Achieving scale

It's clear that there is a path to competitiveness for electrolyser technologies to produce green hydrogen, but most projects today are relatively small, at a low megawatt (MW) scale. A commercial-scale steel plant of 1 MTPA production capacity would require a 350 MW electrolyser facility for the almost complete amount of hydrogen used for reduction of iron ore (see Table 3). A step-change in electrolyser manufacturing capacity would therefore be required to allow steel sector decarbonisation using green hydrogen. As a result, Siemens is scaling up its manufacturing capability to meet the demands of future industrial users. In 2015 Siemens deployed the SILYZER 200 electrolyser, a MW-scale, commercial PEM electrolyser, which currently represents one of the world's largest Power to Gas (PtG) plants in Germany.

Cognisant of the need for further expansion, Siemens has taken that technology into its 3rd generation with the deployment of the SILYZER 300 at the H_2FUTURE project, in partnership with VERBUND Solutions GmbH, voestalpine Stahl GmbH, K1-MET GmbH and the Austrian Power Grid AG. The SILYZER 300 consists typically of 24 PEM electrolytic modules that together draw 17.5 MW of power to produce up to 340 kg/h of high purity hydrogen with no CO_2 emissions. This is one of the highest output rates of any electrolyser currently on the market. The system operates at 75 to 88% efficiency depending on the load, which contributes towards achieving cost effective green hydrogen production.

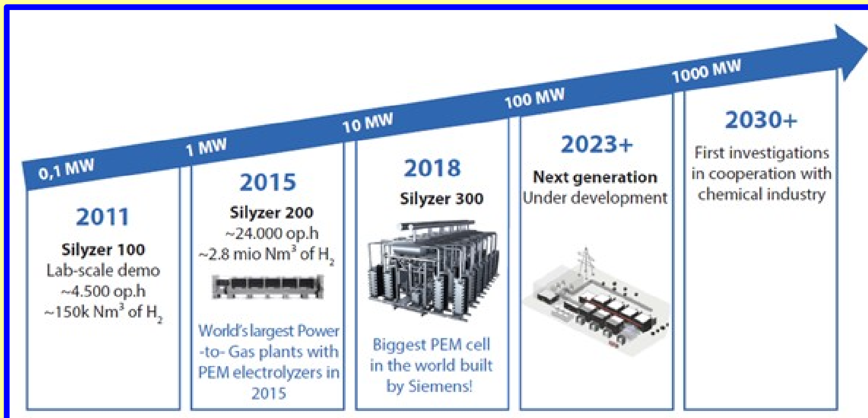


Fig 9: Siemens SILYZER Development Roadmap

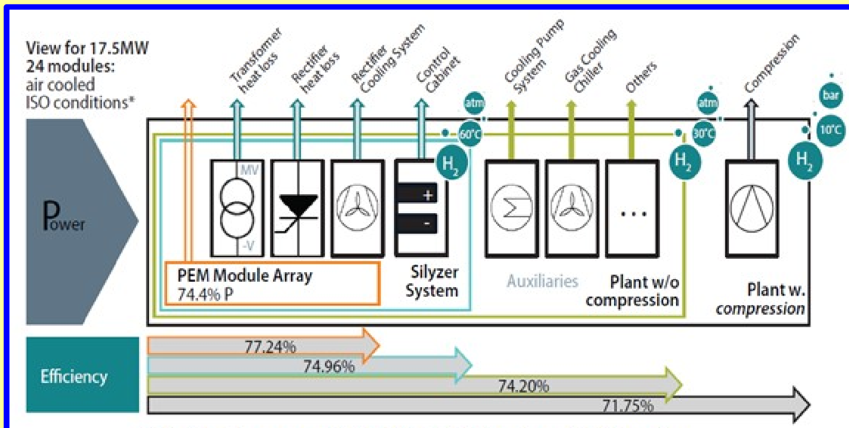


Fig10: Siemens SILYZER 300 System Efficiencies

SILYZER 300 is the

latest, most powerful product line in the double-digit megawatt range of Siemens' PEM electrolyser portfolio. Its modular design makes unique use of scaling effects to minimize investment costs for large-scale industrial electrolysis plants resulting in very low hydrogen production costs thanks to high plant efficiency and availability. Such a system would pair well with DRI production, as the high output rate of hydrogen is well-suited to the requirements of the direct reduction shaft.

The Siemens SILYZER development roadmap targets fourth generation hydrogen plants that by 2023 can draw more than 100 MW of power for hydrogen production at even greater efficiencies. By 2030 and beyond, Siemens envisions building 1,000 MW, fifth-generation plants, making it an ideal technology for use in large-scale direct reduction plants based on hydrogen.

Costs of producing green hydrogen

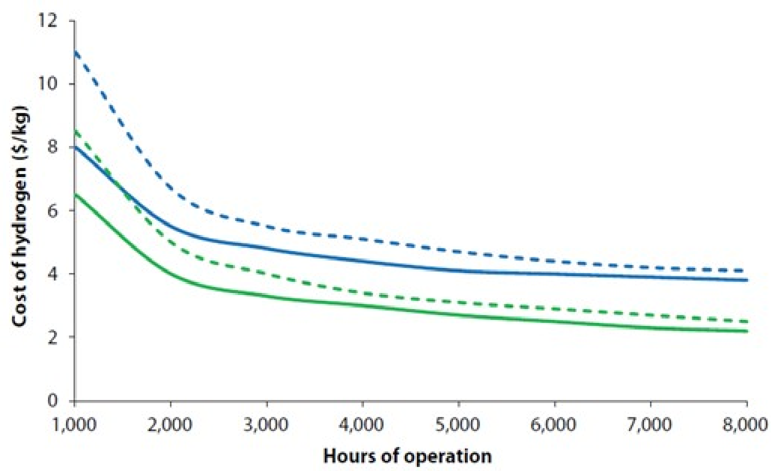


Figure 11: Costs of electrolytic hydrogen production in 2020

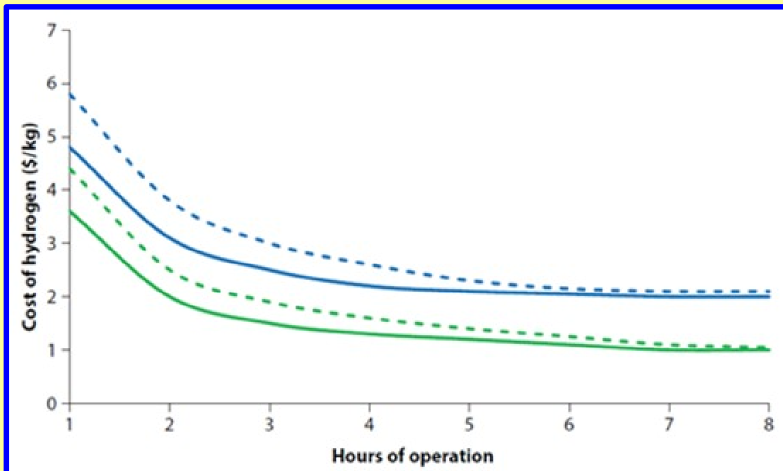


Fig12: Costs of electrolytic hydrogen in 2050

The cost of electricity, operating costs, annual operating time (or utilisation rate), efficiency, and capital investment costs have the greatest influence on hydrogen production costs. With a reduced specific investment cost over time, with increased scale of manufacture, higher annual operating times hydrogen production becomes more cost-effective. Estimating total hydrogen production cost is useful for comparing PEM electrolysis to other technologies, as it incorporates CAPEX, OPEX, efficiency, power price and yearly operating time. Figures 8 and 9 below show hydrogen production costs for a 50 MW PEM plant (in 2020 and 2050), taking into consideration electricity cost, cost for compression and oxygen removal (DeOxo), and operation hours. Hydrogen cost from electrolysis can range from around $3/kg to $10/kg in the less favourable conditions. Costs of grey hydrogen in India are around $1.5-2/kg hydrogen, meaning hydrogen from electrolysis would find it difficult to compete, without additional policy support.

Over the longer-term, as cost of electrolysers along with the cost of renewables will fall, the hydrogen cost from electrolysis will reduce significantly. Under favourable conditions, costs of hydrogen would be around $1/kg, rising to $2-3/kg in the less favourable conditions. At these costs, electrolytic hydrogen will start to compete with grey hydrogen, helping to reduce fossil fuel consumption. It is worth noting that the investment cost for electrolysers depends on the scope of supply and the plant size (MW). The larger the plant, the lower the specific cost. For example, for a 50 MW plant, including rectifier, feed water treatment, cooling, installation, and commissioning, $550-650/kW can be assumed in the near-term. Over time this could fall to $300/kW, due to economy of scale (see Figure 13). Gas treatment (DeOxo, compression to 30-100 bar) would add approximately $175-350/kW, which is not required for use in DR plants.

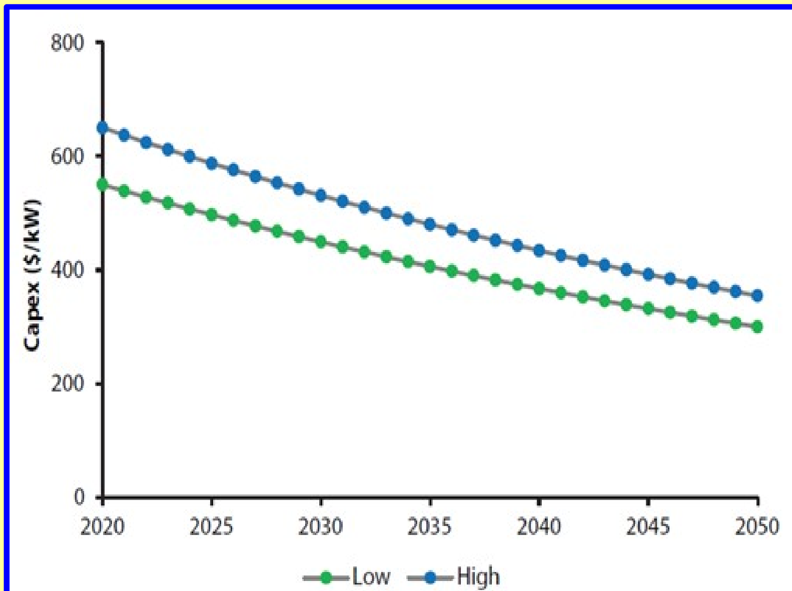


Fig13: Capex reductions for PEM electrolysers, 2020 to 2050

To conclude, electrolyser technology, such as PEM, provide a viable option for producing green hydrogen for direct reduction at the scales required. A clear pipeline of projects will be required to allow scale-up manufacturing capacity, which can deliver on these cost targets and achieve deep decarbonisation of iron and steel production.

Hydrogen Direct Reduction for India

Based on the preceding analysis, this section lays out an illustrative deep decarbonisation scenario for the Indian iron and steel sector. This scenario assumes a large-scale adoption of the hydrogen direct reduction technology a near 100% adoption by 2060, resulting in a significant reduction in carbon emissions, equivalent to net-zero.

Steel demand

Steel demand in India today sits at around 100 Mt of crude steel, equating to approximately 75 kg of steel per capita. Production is slightly higher, at 111 Mt of crude steel per annum, being met by an installed capacity of 142 Mt (MoS, 2020). Domestic demand is largely met through domestic production, with low imports or exports (although exports slightly exceeding imports). Whilst the near-term outlook is highly uncertain, as a result of the COVID-19 pandemic and subsequent economic impacts, there will likely be a return to strong growth in steel demand in India in the medium- to long-term. The fundamentals underpinning demand for steel, namely economic growth and urbanisation, which require new infrastructure and the supply of modern goods, will remain.

Through the development of an econometric forecasting model, we can develop an understanding of the scale of potential demand growth. In the scenario outlined in Figure 14, we assume some level of resource efficiency measures have been put in place, lowering the steel demand from its baseline. This includes increasing the lifetime of goods, maximizing recycling, and structural shifts, such as ridesharing, which reduces steel consumption for vehicles. These demand projections imply significant new capacity in the coming years. Whether this capacity is primary, currently mainly through the BF-BOF route or the direct reduction and EAF route (or some combination of the two), or secondary – the use of scrap steel in EAFs, will be largely down to the availability of scrap.

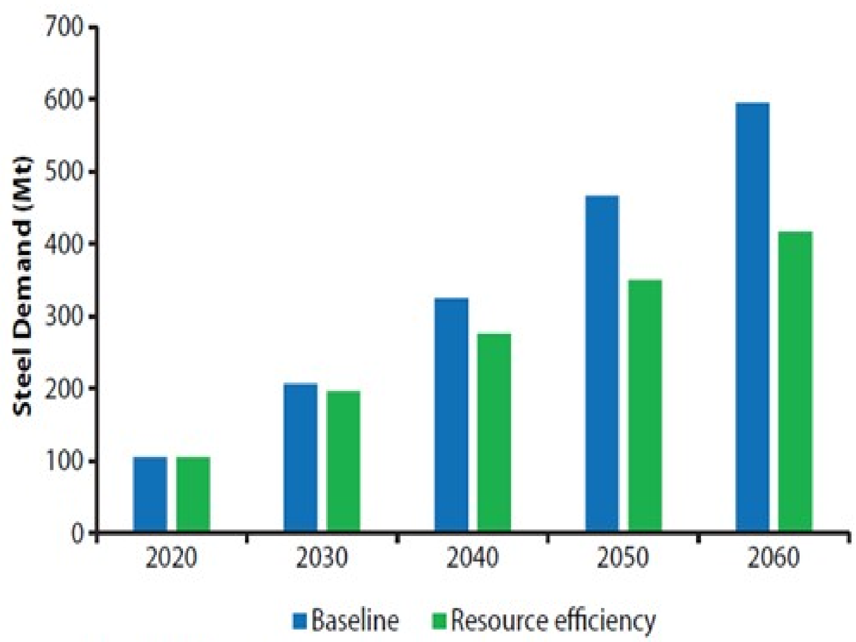


Fig14: Steel demand under a baseline and resource efficiency scenario, 2020-2060

Scrap availability

It is estimated that India currently uses around 30 Mt of scrap, 7 Mt of which is imported). Domestic scrap availability has been rising but given the low stock of steel relative to the growth in demand, this only accounts for around 20% of new demand growth (MoS, 2019). Imported scrap largely comes from developed countries, with the top 5 export countries including the UAE, the USA, the UK, Singapore, and the Netherlands. The import of higher quality scrap has been important in helping to maintain the quality of steel produced via the electric route, which is often a combination of local scrap and direct reduced iron (DRI). It is also used to reduce energy consumption in the BF-BOF route, by using up to 20% scrap steel in the basic oxygen furnace, although this is typically 'in-house' and not imported. Limited scrap availability in India means typically less than 10% is used in most BOFs today.

It is expected that the availability of scrap for import will steadily reduce as developed countries begin to implement tougher emissions reduction policies, including net-zero targets. To achieve such targets, it will require greater scrap recycling rates at these countries, to reduce domestic production of steel via the primary route. In line with an internationally reducing scrap availability, the Steel Scrap Recycling Policy assumes that no scrap steel will be imported by 2030, setting out a strategy to increase the domestic availability of steel scrap through improved recycling. As a result, the Ministry of Steel expects domestic steel scrap availability to increase to approximately 50 Mt by 2030 (MoS, 2019). As a share of the total steel demand, this equates to around 20%, illustrating that even with an ambitious policy on steel scrap, new primary steelmaking capacity will be needed to meet growing demand.

Scenario for hydrogen direct reduction

For this scenario, it is assumed that gas based direct reduction plants are installed during the 2020s, primarily using natural gas. Limited domestic gas supplies would mean imports would need to increase, with some support provided to steel producers given the higher prices. When low-cost hydrogen is available, these plants can switch over to hydrogen. From 2030 onwards, it is assumed that further direct reduction plants using high shares of green hydrogen from the beginning will be constructed. The

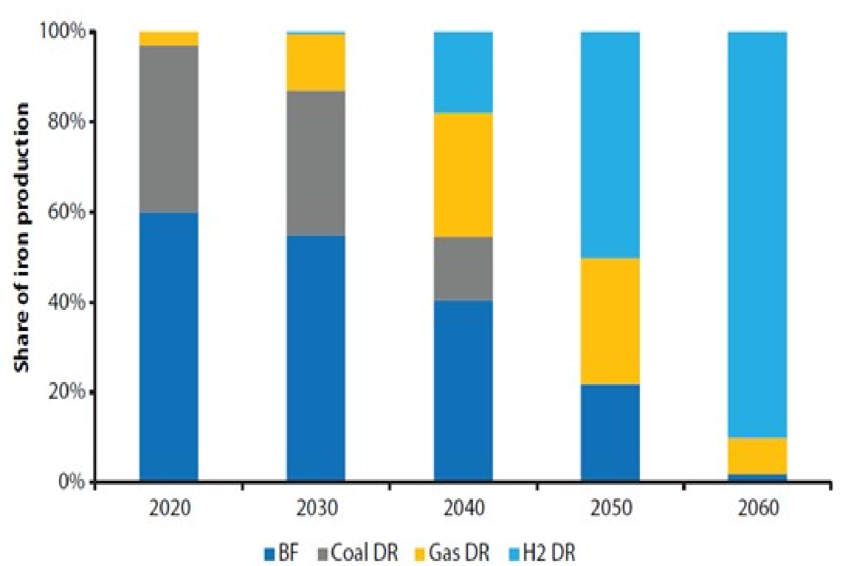


Fig15: Scenario for hydrogen direct reduction in India

existing blast furnaces are steadily decommissioned as they reach the end of their economic life. By 2060, a limited number of blast furnaces remain, and those that do would be fitted with carbon capture technology. Coal-based direct reduction units have a shorter lifetime versus blast furnaces and so, in this scenario, these units are phased out before 2050, with natural gas and hydrogen based direct reduction units being deployed in their place.

In such a scenario, demand for key fuels in the iron & steel sector change significantly. At present, the iron & steel sector consumes around 60 Mt of coking coal, over 80% of which is imported. Demand for coking coal starts to fall over the 2020s, as gas-based capacity is introduced, paving the way for higher shares for hydrogen direct reduction out to 2060. By 2060, the sector could consume approximately 20 Mt of low carbon hydrogen (which in turn would require approximately 1,000 TWh of electricity), alongside 250 TWh of electricity for EAFs using DRI and scrap steel. Whilst there would be a significant benefit to reducing energy imports of coal and, eventually, natural gas, the pace and scale of renewable electricity expansion would prove to be a challenge. To achieve this, we estimate that a carbon price in the steel sector would need to be approximately \$40/tCO_2 in 2030. This would make hydrogen direct reduction competitive with BF-BOF plants, assuming a cost of hydrogen at \$2/kg. An increasing carbon price from this point onwards would ensure a steady phase-out of natural gas in the direct reduction process, aided also by the falling cost for green hydrogen.

Conclusion and Recommendations

This paper has illustrated that deep decarbonisation of the Indian iron and steel sector is technically possible and companies, such as Primetals Technologies and Siemens, have the technologies available to deliver this vision. However, it is clear that in the near-term, the cost of producing green steel using these methods would exceed the cost of steel production from conventional routes. It is therefore important that the public and private sector can work together to implement policies that can accelerate this transition, to help to realise the benefits of steel sector decarbonisation, which include tackling climate change, reducing air pollution, and delivering sustainable economic growth. To deliver an accelerated transition of the steel sector from the wide-scale use of fossil fuels to the use of low carbon energy sources, such as hydrogen, would require a holistic policy framework that provides a ‘supply push’ along with a ‘demand pull’. This would give companies clear direction for future investments, reducing their risk of investing in low carbon production processes.

	SUPPLY PUSH	DEMAND PULL
Near Term Medium Term	**Access to natural gas or syngas** To facilitate immediate term expansion of natural gas-based capacity, which provides an easier switch to green hydrogen in the medium term, access to natural gas or syngas at suitable prices is required. Prices between \$6-8/mmBTU are necessary to be competitive with blast furnaces (Hall, Spencer, & Kumar, 2020). **Demonstration plants** Medium to large-scale demonstration plants should be established to familiarize the sector with the technology, start scale-up of technology manufacture, and signal a serious intention for deep decarbonisation. Several demonstration projects are under construction or under consideration. **Large-scale green finance** To enable large demonstration projects and ultimately commercial-scale plants, significant financial capital will be required. This will require working with consortia of finance providers, including multi-lateral development banks, institutional investors, public sector banks, export finance, and large climate funds (e.g. the Green Climate Fund). **Emissions penalty on production** To provide a clear, sector-wide direction for deep decarbonisation will require ambitious policy to limit CO2 emissions. The most common method for doing so would be the implementation of a carbon tax, so that high-polluting steel plants would pay more. This could be paired with a carbon border tax, so that cheaper, dirty steel would not be imported, thus protecting the domestic industry. **Transition support for small-scale plants** The Indian DRI sector mostly consists of small coalbased plants, serving local markets. As these are the most polluting, they would pay the highest carbon tax. These plants would be best suited to switching from coal to hydrogen direct reduction, given the output product would be the same. Public support will be required to help transition these smaller plants, helping to retain local employment and supply chains.	**Green product standards** There will be a need to distinguish between 'dirty' steel and 'green' steel, to help consumers decide between more or less sustainable products, as they seek to decarbonize their supply chains. GreenPro being developed by the Confederation of Indian Industry (CII), as well the ResponsibleSteel standard, are both examples of private sector initiatives in this area. **Corporate buyers' clubs** To send clear demand signals to steel producers to start producing green steel, groups of corporates who use steel can band together to create clubs which achieve a critical mass of demand. Over time, such clubs could provide guaranteed markets for green steel, helping to de-risk investments for producers. SteelZero is an example of such an initiative. Although discussions are at an early stage in India, companies such as Mahindra Lifespaces have expressed an interest in such initiatives (TERI, 2020). **Public procurement** To drive initial large-scale demand for green products, governments and public bodies should commit to procuring environmentally sustainable products, such as 'green' steel. Infrastructure accounts for around 27% of steel demand in India, most of which is used in public projects such as roads, bridges, railways, metros, etc. (Hall, Spencer, & Kumar, 2020). Public Works Departments could help drive this initial demand, providing a guaranteed market for domestic green steel producers

Source: www.teriin.org

STEEL HELPS POWER THE VEHICLES OF THE FUTURE

As the next wave of electric vehicles (EVs) begins to hit the roads, steel is set to play a vital role in the chassis, engines and charging stations that will power the cars of the future.

The world is in the middle of an evolution of its mobility systems. Electric vehicles are more aesthetic, high-performing and efficient than ever. And thanks to government policies supporting greener transport, there is set to be a dramatic increase in the number of EVs on our roads over the next five years. In Europe, the number of EVs rocketed to more than a million in 2018, while China's car market continues to lead the way. In recent years, steel has increasingly been favoured over aluminium as the metal of choice in EV construction, largely because of its lower cost and superior strength. Materials like Advanced High Strength Steels are playing a vital role in lowering vehicle weight while still offering high passenger protection. EV manufacturer Tesla, for example, shifted to steel for its first mass market offering, the Model 3. Other manufacturers who have opted for steel in their vehicles include Nissan, for its Leaf model – the best-selling all-electric car worldwide – and Volkswagen for the e-Golf.

Magnetic appeal

The engines that power EV are also reliant on the unique properties of steel. Electrical steel, which is manufactured to contain specific magnetic properties, is a key component in transformers and generators. This material is also vital for its use in the stators and rotors in the motor of an electric vehicle. Here it has a critical influence on the efficiency of the motor, minimising core energy losses and boosting the vehicle's range. Motors used in industrial machinery typically operate at between 5,000-8,000RPM, but the electric motors in modern vehicles can reach speeds four times higher than this. This generates significant heat, which can increase core losses and negatively impact vehicle performance. At this many revolutions, the motor components undergo extreme mechanical stress and here electrical steel can be relied upon for its high durability. In 2015, steel manufacturer thyssenkrupp developed a new electrical steel that raised the bar for EV performance. This has resulted in core losses nearly 30 percent lower when compared with motors made from conventional steel. It also displays extreme strength that allows for more compact high-speed motors, lowering weight and reducing the space they take up.

Leading the charge

But while EVs are becoming increasingly efficient, popular and affordable, one key stumbling block has the potential to disrupt this growth – a comprehensive charging network. And as it stands, the infrastructure is not where it needs to be. In fact, according to a recent study by Emu Analytics, a London-based data science and software company, there is a projected 83% shortfall in the required number of charging points for electric vehicles by 2020. This could lead to enormous congestion at charging stations. Tasked with the responsibility of lightening this load, a number of electric vehicle charging options are being explored, and steel is often a key component. Chargers such as the CHAdeMO charging system are leading the way, with many EV manufacturers – including Nissan, Mitsubishi and Tesla – investing in this model. Manufacturers of CHAdeMO stations use steel for the chargers' housing because of its strength and durability in all weather conditions, even in salty climates like coastal cities. As the number of charging stations across the world expand, including to more rural and remote areas, a strong steel shell with low to no maintenance requirements will play a critical role in service reliability.

The future has never looked greener for EVs, but failing to deploy charging points could be a major barrier to ownership. According to Richard Vilton, CEO of Emu Analytics, the key is to invest in expanding this network early on. "Companies that do this are not only poised to become global leaders in electric vehicles, but also have the opportunity to play an instrumental role in shaping a sustainable future," he concludes. Whether its improving their efficiency, lightening their load without compromising on safety, or enabling the rollout of vital charging infrastructure, steel will play a key role in realising the electric vehicle revolution.

Source: worldsteel.org

NEW LIGHTWEIGHT MATERIAL IS STRONGER THAN STEEL

The new substance is the result of a feat thought to be impossible: polymerizing a material in two dimensions.

Using a novel polymerization process, MIT chemical engineers have created a new material that is stronger than steel and as light as plastic, and can be easily manufactured in large quantities. The new material is a two-dimensional polymer that self-assembles into sheets, unlike all other polymers, which form one-dimensional, spaghetti-like chains. Until now, scientists had believed it was impossible to induce polymers to form 2D sheets. Such a material could be used as a lightweight, durable coating for car parts or cell phones, or as a building material for bridges or other structures, says Michael Strano, the Carbon P. Dubbs Professor of Chemical Engineering at MIT and the senior author of the new study. "We don't usually think of plastics as being something that you could use to support a building, but with this material, you can enable new things," he says. "It has very unusual properties and we're very excited about that." The researchers have filed for two patents on the process they used to generate the material, which they describe in a paper appearing today in *Nature*. MIT postdoc Yuwen Zeng is the lead author of the study.

Two dimensions

Polymers, which include all plastics, consist of chains of building blocks called monomers. These chains grow by adding new molecules onto their ends. Once formed, polymers can be shaped into three-dimensional objects, such as water bottles, using injection moulding.

Polymer scientists have long hypothesized that if polymers could be induced to grow into a two-dimensional sheet, they should form extremely strong, lightweight materials. However, many decades of work in this field led to the conclusion that it was impossible to create such sheets. One reason for this was that if just one monomer rotates up or down, out of the plane of the growing sheet, the material will begin expanding in three dimensions and the sheet-like structure will be lost. However, in the new study, Strano and his colleagues came up with a new polymerization process that allows them to generate a two-dimensional sheet called a polyaramide. For the monomer building blocks, they use a compound called melamine, which contains a ring of carbon and nitrogen atoms. Under the right conditions, these monomers can grow in two dimensions, forming disks. These disks stack on top of each other, held together by hydrogen bonds between the layers, which make the structure very stable and strong.

“Instead of making a spaghetti-like molecule, we can make a sheet-like molecular plane, where we get molecules to hook themselves together in two dimensions,” Strano says. “This mechanism happens spontaneously in solution, and after we synthesize the material, we can easily spin-coat thin films that are extraordinarily strong.” Because the material self-assembles in solution, it can be made in large quantities by simply increasing the quantity of the starting materials. The researchers showed that they could coat surfaces with films of the material, which they call 2DPA-1. “With this advance, we have planar molecules that are going to be much easier to fashion into a very strong, but extremely thin material,” Strano says.

Light but strong

The researchers found that the new material’s elastic modulus — a measure of how much force it takes to deform a material — is between four and six times greater than that of bulletproof glass. They also found that its yield strength, or how much force it takes to break the material, is twice that of steel, even though the material has only about one-sixth the density of steel. Matthew Tirrell, dean of the Pritzker School of Molecular Engineering at the University of Chicago, says that the new technique “embodies some very creative chemistry to make these bonded 2D polymers.” “An important aspect of these new polymers is that they are readily processable in solution, which will facilitate numerous new applications where high strength to weight ratio is important, such as new composite or diffusion barrier materials,” says Tirrell, who was not involved in the study.

Another key feature of 2DPA-1 is that it is impermeable to gases. While other polymers are made from coiled chains with gaps that allow gases to seep through, the new material is made from monomers that lock together like LEGOs, and molecules cannot get between them. “This could allow us to create ultrathin coatings that can completely prevent water or gases from getting through,” Strano says. “This kind of barrier coating could be used to protect metal in cars and other vehicles, or steel structures.” Strano and his students are now studying in more detail how this particular polymer is able to form 2D sheets, and they are experimenting with changing its molecular makeup to create other types of novel materials. The research was funded by the Center for Enhanced Nanofluidic Transport (CENT) an Energy Frontier Research Center sponsored by the U.S. Department of Energy Office of Science, and the Army Research Laboratory.

Source: www. news.mit.edu

STEEL INDUSTRY'S JOURNEY THROUGH THE PANDEMIC

Introduction

Coronavirus pandemic or Covid-19 first appeared in India towards the end of January 2020 and gradually spread throughout the country. To control its growth and to keep the fatalities to the minimum, government of India imposed strict national lockdown on 25-03-2020. This brought the economy to a virtual standstill and steel consumption in the country fell to a record low of 1 million tonnes in April 2020. The lockdown restrictions were gradually lifted and by October/November 2020, restrictions concerning mining, industrial activity and logistics were mostly lifted. This helped the economy to recover and by end of Q3 FY21, many sectors have either reached or surpassed pre-pandemic levels of performance. This paper analyses the journey of Indian Steel Industry through this difficult period.

The Crash and the Recovery

Due to the strict lock down, demand for steel products virtually vanished and the finished steel consumption hit a rock bottom 0.977 MT in April 2020. Blast furnace based producers had to bank the furnaces, while electric furnace based producers suspended their operations, particularly in April and May 2020. With the gradual lifting of restrictions, the economy started recovering and with that the steel consumption, which reached 8 MT in September and crossed 9.5 MT in December. Crude steel production improved from 3.1 MT in April 2020 to 9.8 MT in December 2020. Chart1 below shows crude steel production and finished steel consumption in the year 2020, month wise (Source: JPC). It can be seen from the chart that production and consumption declined in March 2020 also since last week of the month was washed out.

Chart-1

Quarter Wise Progress

With the domestic demand having virtually disappeared, steel producers kept the operations going by resorting to exports in first quarter. This continued in the second quarter at a reduced rate and reversed in the third quarter. As the pandemic spread across the globe, imports came down drastically in first two quarters. Luckily, China started recovering from April and this helped for the export push. Alloy and stainless steel sector suffered more in the first two quarters due to drastic fall in production of automobiles and decline in other sectors but made a remarkable recovery in the third quarter. There was a depletion of finished steel stocks by 3.158 MT during the nine month period. Table1 gives the quarter wise details (% growth compared to the same quarter/period in the previous year). Both production and consumption exceeded last year performance in third quarter. If the trend of Q3 continues in Q4, contraction in steel consumption in the full year 2020-21, is unlikely to exceed 10 per cent.

Table-1

Particulars	Quarter 1	Quarter 2	Quarter 3	9 months
Crude Steel Production	-43.2	-7.5	7.6	-11.6
Finished Steel Production	-54.3	-5.9	7.1	-14.4
Finished Steel Exports	145.0	25.9	-31.5	27.5
Export of semi-finished products	360.0	260.5	-3.6	150.0
Finished Steel Imports	-32.7	-65.2	-18.2	-41.8
Finished steel consumption	-58.5	-13.5	13.8	-15.3
Alloy + Stainless Steel Consumption	-62.2	-34.1	23.6	-23.4

Main finished product exported was HR Coil (73.8% of total exports in Q1 and 63.4% in Q2). China was the main importer from India and during the nine months period accounted for 54.4 per cent of semis, 35.8 per cent of HR Coils and 69.7 per cent of pig iron exported. Ironically, China accounted for 40.3 per cent of alloy and stainless steel imported into the country and this product accounted for 63.8 per cent of total finished steel imports from China during the nine month period. So far as production is concerned, JSPL achieved growth right from April 2020.

The growth in crude steel production was 9.2 per cent in Q1. The company started exporting semis right away. Finished steel production, however, contracted by 43.9 per cent. Other major producers reached pre-pandemic levels of production level by August/September in respect of both crude steel and finished steel, after a contraction of 46.1 per cent in case of crude steel (55.2% in case of RINL) and 54.3 per cent in case of finished steel (80% in case of RINL) in Q1. 'Other Producers' faced a contraction of 62.4 per cent in case of crudes steel and 136.2 per cent in case of finished steel in Q1 due to logistical issues, non-availability of raw materials and extremely low domestic demand. The contraction reduced to18 per cent and 13 per cent respectively in Q2. They crossed last year's production in Q3 (8.4% growth in case of crude steel and 12.9 per cent growth in case of finished steel). However, due to iron ore shortage, pig iron producers, sponge iron producers and pellet producers have not reached pre-pandemic levels of production even in Q3.

Category Wise Consumption

Percentage growth in category wise consumption in the three quarters, as compared to the corresponding quarter in the previous year, is shown in table 2.

Table-2

Product Category	Q1	Q2	Q3	Nine Months
Bars and Rods	-51.75	-8.31	15.93	-13.72
Structural	-54.78	10.65	1.56	-13.33
Railway Materials	0.00	-12.19	-24.85	-13.90
PM Plates	-59.26	12.78	-1.15	-17.90
HR Coil and Strip	-57.73	-3.51	16.52	-15.45
HSM Plates	-57.14	-15.67	20.20	-24.18
HR Sheets	-57.50	-2.85	46.48	-12.63
CR Coil and Sheets	-54.46	-5.14	20.21	-10.51
GP/GC Sheets	-56.05	0.48	0.37	-21.82
Colour coated sheets	-49.58	14.34	6.36	-10.40
Electrical Sheets	-68.29	-11.34	14.50	-25.97
Tin Plates	-70.97	16.11	20.14	-15.06
Pipes (large diameter)	-48.01	1.05	-21.11	-20.48
Total Non-alloy Steel	-54.27	-4.16	13.13	-14.64
Alloy Steel	-64.88	-18.48	28.33	-21.27
Stainless Steel	-63.78	-35.42	17.35	-26.47
Total Finished Steel	-55.02	-5.70	13.83	-15.26

In the first quarter FY21, consumption of all product categories contracted by 50% or more (except railway products) compared to first quarter FY20 due to disruption in all economic activities caused by coronavirus induced lockdown. With gradual relaxation in restrictions, activities started picking up and with that the steel consumption. This helped in reducing the contraction in consumption in the second quarter to 15 per cent or low in non-alloy steel categories. In alloy and stainless steel, it was 20-35 per cent as compared to more than 60 per cent in 1st quarter. There was more opening up in third quarter and automobile & engineering industry also started picking up. All product categories, except railway materials and pipes, recorded good growth rates in the quarter. This helped in reducing the contraction in consumption in the 9 months period (April-December). Electrical steel and stainless steel had the maximum contraction of 25 per cent or above.

Chart-2

Steel Prices

Steel prices hit the bottom in March-April 2020, when the lockdown was very strict and consumption fell to very low levels. Prices started improving from June/July and reached pre-pandemic levels by August. They continued their upward march in subsequent months and increase in price in December 2020 compared to August 2020 was 9.3 per cent in case of billets, 17.2 per cent in case of rebar and 31.1 per cent in case of HR Coil. All sections of steel consumers complained to the government about high steel prices. Steel industry justified the increase citing high iron ore prices (92.4% increase since April and 72.9% increase since August 2020 by December) and maintained that domestic prices are still lower than international prices. Due to recovery of steel demand across the globe by September/October, international prices started increasing. Chart2 shows the month wise change in retail prices of billets 100 mm, rebar 12 mm and HRC 2 mm at Mumbai during January 2020-January 2021 (Prices in April and May 2020 could not be collected due to the pandemic related restrictions).

Performance of Steel Companies

Financial performance of four major steel companies-SAIL, Tata Steel, JSW Steel and JSPL (the combined share of these four companies was over 50% in crude steel production and slightly under 50 per cent in finished steel production during April-December 2020) for the first three quarters of FY21 is shown in Table 3. Q4 FY20 performance is also included in the table since lockdown started on 25th March and performance was adversely affected in March 2020. The figures in the table are percentage change compared to the same quarter in the previous year.

Following can be summarized from the table.

In Q4 FY20 and Q1 FY21, contraction in revenue from operations is more than the contraction in saleable steel sales (in case of JSPL, sales grew in Q1 FY21). This is because of low steel prices in the two quarters.

In Q2 FY21, growth in saleable steel sales was more than growth in revenue from operations. This is because, while demand for steel started recovering, steel prices were still lower than in Q2 FY20.

Table-3

Particulars/Company	Q4 FY20	Q1 FY21	Q2 FY21	Q3 FY21
Saleable Steel Sales: Tata Steel	-14.62	-26.01	22.27	-4.12
JSW Steel	-13.75	-25.33	14.44	-3.23
JSPL	-3.45	3.31	29.53	11.98
SAIL	-8.78	-30.30	35.48	5.62
Revenue from Operations: Tata Steel	-25.71	-41.96	10.03	17.71
JSW Steel	-23.08	-41.84	8.23	22.02
JSPL	-19.89	-11.35	19.56	31.60
SAIL	-12.55	-38.82	19.80	19.90
EBITDA: Tata Steel	-24.90	-69.81	33.05	77.71
JSW Steel	-26.68	-62.71	49.36	111.21
JSPL	8.47	13.68	94.00	189.05
SAIL	181.06	Rs 125 Cr loss (!)	59.18	346.37
Profit after tax: Tata Steel	Rs 437 Cr loss (@)	-22.48	-42.55	100.40
JSW Steel	-85.99	Rs 146 Cr loss (#)	-42.00	309.41
JSPL	Rs 282 Cr profit ($)	125.47	6486.67	2194.84
SAIL	482.26	Rs 1,270 Cr loss (%)	Rs 393 Cr profit (&)	Rs 1,283 Cr profit (*)
Total Finished Steel	-55.02	-5.70	13.83	-15.26

! Profit Rs 1,765 Cr in Q1 FY20, @ Rs 2,491 Cr in Q4 FY19, # Rs 1,439 crore profit in Q1 FY20, $ Rs 1,154 Cr loss in Q4 FY19, % Rs 69 Cr profit in Q1 FY20, & Rs 343 Cr loss in Q2 FY20 and * Rs 430 Cr loss in Q3 FY20. (Source: respective web sites).

In Q3 FY 21, the situation got reversed. Growth in revenue from operations was higher than the growth in saleable steel sales. Steel prices increased considerably during this quarter. As a matter of fact, steel sales contracted in case of Tata steel and JSW steel. Only SAIL made loss at EBITDA stage in Q1 FY21. SAIL and JSW steel incurred net loss in Q1 FY21.

Tata steel incurred net loss in Q4 FY20. Tata steel's net profit in Q1 and Q2 FY21 and JSW steel's net profit in Q2 FY21 contracted.

All companies returned to handsome profit in Q3 FY21 due to good recovery in steel demand and higher sales realization.

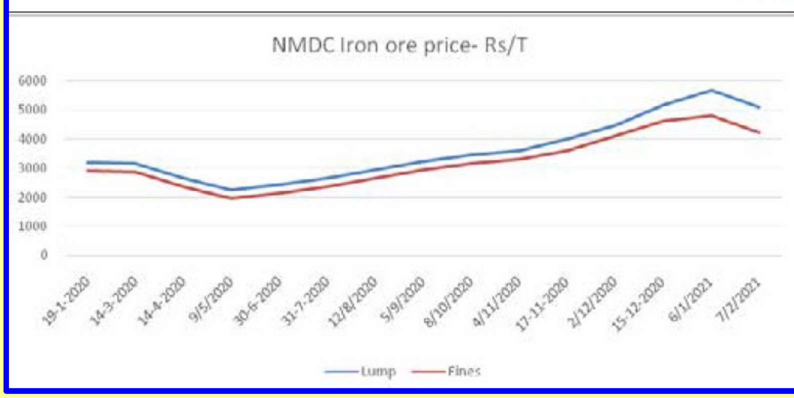
JSPL was the best performing company in the pandemic period as it straight away went for exports and was also helped by the iron ore inventory at Sarda mines.

Raw Materials

Apart from disruption caused by covid-19 pandemic, steel industry faced iron ore shortage and high prices. Shortage was because of the following.

Mining sector has not fully recovered from covid-19 impact. As per IIP growth figures for December 2020, mining sector contracted 11.3 per cent in April-December 2020 (www.mospi.gov.in- 12/01/2021). In HI FY20, iron ore production contracted by around 50 per cent to 47 MT. During April-October 2020, iron ore production in Odisha contracted by 39.13 per cent to 46.2 MT from 75.9 MT in the year ago period, due to low production (6.5 MT) from auctioned mines (down 84.63%)

Chart-3



Auctioning of mines, whose leases were to expire by 31-03-2020 took place in Q4 FY20. Some of these mines were won by JSW steel, AMNSIL and JSPL. Of the 24 mines auctioned in Odisha, only 5 are in operation. In Jharkhand all 11 mines are closed. Required formalities after ownership change have not been fully completed. In FY20, these auctioned mines produced 71 MT, while the production was only 4.06 MT in H1 FY21 against the target of 24.5 MT.

NMDC's production contracted by 8.87 per cent and sales by 11.1 per cent in HI FY21. Realisation from iron ore declined by 14.46 per cent and net profit by 30.59 per cent during this period y-o-y. 88 iron mines in Goa remain closed since February 2018 as per Supreme

Court orders. There is no production from the state since then. It used to produce up to 40 MTPA.

In Karnataka, there is cap on quantity to be mined in a year. The miners in the state can neither export nor sell outside the state. Inside the state, sales must be only through e-auction. The production is down to 30 million tonnes per annum, from 45-50 million tonnes per annum earlier.

Donimalai mine of NMDC in Karnataka is closed since November 2018 as the state government demanded payment of 80 per cent premium for extending mining lease. Agreement has now been reached for 22.5 per cent premium.

MMDR Act has been amended by Central government to make it mandatory for state governments to renew lease for PSUs by 20 years. The mine started in December but closed after ten days as state government extended lease for only four years from 2018 i.e., up to 2022.

There has been a quantum jump in export of iron ore. Exports increased by 270 per cent in FY20 (from 6.79 MT to 25.14 MT: www.ibm.gov.in). and by a further 34.4 per cent in April-December 2020 (from 29.45 MT to 39.58 MT). It has been reported that in Karnataka, there has been some illegal export of iron ore as pellet. Iron ore attracts 30 per cent export duty while there is no export duty on pellets and the state cannot export iron ore. Pellet export increased by 34.8 per cent in FY20 (from 9.36 MT to 12.62 MT) and a by a further 11.6 per cent in April-December 2020 (from 9.93 MT to 11.08 MT) (JPC). Huge increase in export was due to high demand in China, where steel industry is doing extremely well. In CY2020, crude steel production in China increased by 5.2 per cent to 1,053 MT as against 1,001 MT in 2019. Also, there have been covid-19 related disruptions in supply from Brazil. China imported a record 1.17 billion tonnes of iron ore in CY 2020, up 9.5% y-o-y. India exported 44.8 MT to China in CY 2020, up 88% from 23.8 MT in 2019. This constitutes around 85% of total. Pellet exports to China in CY 2020 were 11.08 MT or 83% of the total. It was 10 MT in 2019 (77% of total).

Material	Auction date	Daitari	Gandhamardan		Koira	TiningPahar (Barbil)
			Block- A	Block- B		
Lump-62% Fe (10-40 mmm)	01-10-2020	4,207	4,167	4,021*	4,914	
	02-12-2020	7,044	6,770	6,533	7,345	8,300
	01-02-2021	6,013	5,730	5,720#	6,684	6,136
Fines- 62% Fe						
60% Fe	03-11-2020	4,006	2,943	2,927	3,611	
	03-11-2020	3,878				
Fines- 62% Fe	07-01-2021	5,104		4,200	4,785	4,550
60% Fe	07-01-2021	5,014	3,771	3,929		

*65% Fe, 10 to 180 mm- 4,436, #5,300 (Source: www.omcltd.in).

Iron ore prices of NMDC during January 2020 to February 2021 are depicted in chart 3. Domestic iron ore prices declined between January and May 2020 due to low demand from steel industry because of pandemic related disruptions in steel production (29.7% decline in case of NMDC). Prices started increasing from July, as steel production went up and demand for iron ore increased. Production did not match the demand for the ore and exports were also on the rise. This resulted in continuous increase in ore prices.

High premium agreed by parties (100% or more) in bids for mines is also a reason for higher prices. NMDC lump ore prices increased by 153.3 per cent between 9th May 2020 and 6th January 2021 and by 75.4 per cent between 05-09-2020 and 06-01-2021. Increase in average domestic price was 35.3 per cent in Q3 FY21 compared to Q3 FY20, while production increased by 11.86 per cent. NMDC reduced the prices by 10.5 per cent in case of lump ore and 12.5 per cent in case of ore fines, on 7th February 2021. NMDC specifications are: Lump- 65.5 per cent Fe and 6-40mm and Fines- 64 per cent Fe and -10mm. Iron ore prices in Odisha are even higher (in spite of lower Fe) as can be seen from the table-3, which gives prices obtained by Odisha Mining Corporation through auctions, in Rs/T. Size of fines is -10 mm. Increase in prices from auction in October/November to auction in December/January is over 60 per cent in case of lump ore and over 30 per cent in case of ore fines. In the auction held for lump ore on February 1, prices came down by 10 to 15 per cent in case of Daitari, Gandhamardan & Koira and 26 per cent in case of Tining Pahar.

Chart-4

Movement of international prices of iron ore fines (62% Fe CFR China) and prime hard coking coal(FOB Australia) is shown in chart 4 (in $/T). It can be seen that international prices of iron ore have been continuously going up since April 2020. Though India's imports were negligible, steel companies faced the heat as domestic iron ore prices increased in tandem. However, steelmakers were benefitted by fall in coking coal prices. In the calendar year 2020, prices of coking coal fell by over 30 per cent. This was mainly due to low demand from China because of the restrictions put on Australian imports, particularly from October 2020 and using more Mongolian coal and domestic coal. In CY 2020, China imported 72.57 MT of coking coal, down 2.8 per cent over 2019. Demand was low from India and Japan also due to lower steel production caused by coronavirus disruptions. India imported 37 MT of coking coal in April-December 2020 against 42 MT in April-December 2019, down 11.9%. After many years, coking coal prices fell below that of iron ore. Steel scrap is an important raw material for EAF and IF route of steelmaking. Due to insufficient domestic availability, India imports around 6 MTPA of steel scrap. Imports have come down this year (from 5.085 MT in April-December FY20 to 4.167 MT in April-December FY21) as the secondary sector was adversely impacted due to disruptions caused by the pandemic (Source: JPC). Turkey, Iran, Vietnam are some countries who make most of the steel through electric process (In US, the share is over 60%). Scrap prices dropped during March-July due to low demand from these countries but surged later as there was recovery across the globe. International scrap prices during the period February 2020 to January 2021 are shown in chart 5. Between August 2020 and January 2021, prices increased by over 60%. Critical inputs for stainless steel making like Nickel and Molybdenum increased by 40 per cent and 27 per cent respectively between July and December 2020. Imports were more in case of stainless steel and constituted 27 per cent of domestic consumption.

The Way Forward

Even though there has been good recovery in third quarter, things are not yet fully normal. As per National Statistical Office, in FY21, construction sector is expected to shrink by 12.6 per cent (actual 29.4% in H1) manufacturing sector by 9.4 per cent (actual 15.1% in April-December 2020) and mining sector by 12.4 per cent (actual 11.3% in April-December 2020). As per IIP numbers for April-December 2020, capital goods declined by 27.5 per cent and consumer durables by 24.7 per cent (The Times of India- 06/01/2021, www.mospi.gov.in-12/02/2021). In FY20, Construction sector grew by only 2.2 per cent and capital goods contracted by 13.7 per cent, due to economic slowdown. Housing sector performance is also not satisfactory. Sales in CY 2020 were down 47 per cent to 1.38 lakh units from 2.61 lakh units in 2019. Unsold inventory was 7,18,483 units as on 31-12-2020, inventory overhang was 47 weeks.

Chart-5

During April-December 2020, passenger vehicle sales declined by 16.1 per cent, two wheeler sales by 22.6 per cent, commercial vehicle sales by 37.2 per cent and three wheeler sales by 74.2 per cent. Overall decline of the sector in FY20 was 14.7 per cent. Based on the recovery shown by Indian economy in quarter 3 and if the same trend continues in quarter 4, finished steel consumption could reach 91.5 MT in FY21, showing a contraction of 8.5 per cent over FY20. To reach 100 MT consumption in FY22, growth rate required over FY21 is 9.3 per cent.

Construction sector, which consumes over 60% of total steel, has to come back to the growth rate of around 7 per cent, which was the average growth rate achieved between FY17 and FY19. The main hope in this is the National Infrastructure Pipeline with a planned investment of Rs 111 crores. The steel sector has to closely work with various government departments regarding supplies and prices. There are lot of noises regarding high prices and threat to allow use of ‘Synthetic fibre’ and ‘Composite fibre’ bars and also allow induction furnace based units to participate in tenders for rebars.

The import duty on steel products has been uniformly reduced to 7.5 per cent in the budget 2021.Tax holiday for affordable housing projects has been extended by one more year. Announcement of vehicle scrappage policy in the budget is a big boost for the automobile industry and the demand for vehicles is expected to go up in the medium and long term. Even though details of the policy are awaited, life for personal and commercial vehicles has been announced (20 years and 15 years respectively). However, continuous increase in prices of petrol and diesel is a dampener for vehicle buyers. Electrical vehicles (EVs) seem to be the answer. For EVs, facilities are required for both manufacturing of vehicles and for charging infrastructure. As the economy improves further and disposable incomes increase, demand for consumer durables, personal vehicles and houses should improve. Banks have reduced the lending rates and simplified the procedures. Demand for capital goods will improve only when there is fresh investment. Even though government has reduced corporate tax rates about a year back, it will take some more time for investments to be taken up in a big way, because companies will wait for the demand to pick up after two disappointing years. Besides, companies could not generate adequate internal resources during these two difficult years (FY20 and FY21).

In order to increase iron ore production, Mines Ministry has proposed that the mining lessee will have to pay statutory dues equal to the minimum dispatch stipulated in a quarter, even if dispatch falls short. If the lessee fails to maintain the minimum dispatch criteria for three consecutive quarters, state government may terminate such lease. The ministry has also proposed that for fully explored blocks, 50% rebate will be allowed in the quoted revenue share for the quantity of mineral produced and dispatched earlier than the scheduled date as provided in the tender document (Source: The Financial Express- 26/01/2021). In the new Iron Ore Policy 2021, which has come into effect on 10-02-2021, Railways will give higher priority to the movement of iron ore traffic for domestic manufacturing activity (www.steelguru. com- 17/01/2021). While these steps are welcome, government should take necessary measures to operationalize Donimalai mine of NMDC in Karnataka and the 88 mines in the state of Goa.

As per the 'Steel scrap recycling Policy' announced by the Ministry of steel on 7th November 2019, current supply of scrap from unorganized industry is about 25 MTPA (www.steel.gov.in). Assuming that crude steel production will be 110 MT in FY 22, scrap requirement will be 32 MT at 25 per cent scrap usage and 38 MT at 30 per cent scrap usage. Increasing scrap usage will reduce greenhouse gas emissions and help conserve natural resources. Mahindra MSTC Recycling Pvt Limited (JV between Mahindra Accelo and MSTC) and Tata Steel Limited have set up scrap processing plants at greater NOIDA and Rohtak in Haryana respectively, even before the vehicle scrappage policy was announced. More such plants will be required to bridge the gap between demand and supply. A policy for scrappage of domestic appliances is also necessary. Domestic supply has to be increased as international scrap market is likely to remain tight in view of China's decision to increase scrap usage. Scrap usage in BOFs is planned to be increased to 20-30 per cent and EAFs, which will mainly use scrap, will have a capacity of 196 MT by end 2021 (www.spglobal.com-13/01/2021). Announcement in the budget that import duty on scrap (including stainless steel scrap) will be zero in the year 2021-22, will help the stainless steel sector and EAFs and IFs. For other critical inputs like Nickel, Molybdenum, high grade limestone & Graphite electrodes, government may consider reducing the import duties.

Government has announced that coal gasification and use of coal bed methane will be encouraged. Government has also announced a new tariff policy for electricity, and this is expected to bring down the power tariff for industrial sector. These measures will make EAF operations competitive. Use of hot metal in EAF should be gradually discontinued. Indian steel industry should invest up to at least 1 per cent of the turnover on Research and Development. This should be directed at improving raw material quality, improving equipment productivity, improving operational performance (SAIL and RINL have to increase PCI usage to at least 150 Kg/THM), reducing consumption of heat, power, water, and other utilities, reducing greenhouse gas emissions (presently considerably higher than global average) and developing new grades for various applications, as per the evolving scenario.

The year 2021-22 will see commissioning of the expansion units of JSW Steel's Dolvi plant (from 5 MTPA to 10 MTPA) and NMDC's 3 MTPA Nagarnar steel plant (this plant is likely to be privatized in 2021-22) and takeover of BPSL's Odisha plant by JSW Steel. Tata Steel's Kalinganagar steel plant expansion is also expected to make good progress. Overall, availability of steel is expected to go up. Therefore, cost reduction and improvement of quality are important, particularly in reduction of import duty to 7.5%. Product prices can be increased only up to a certain extent.

Source: JPC Bulletin

GOVERNMENT REVOKES ANTI-DUMPING DUTIES ON CERTAIN STEEL PRODUCTS

The government announced revoking of anti-dumping duties on certain steel products imported from countries including China, a move aimed at containing high prices of metals and promoting domestic manufacturing. Countervailing duty (CVD) is also being permanently removed on imports of certain hot-rolled and cold-rolled stainless steel flat products from China.

"Certain anti-dumping and CVD on stainless steel and coated steel flat products, bars of alloy steel and high-speed steel are being revoked in larger public interest considering prevailing high prices of metals," Finance Minister Nirmala Sitharaman said in her Budget Speech. Engineering exporters have demanded from the government to take steps to control high steel prices. The anti-dumping duty was removed on straight length bars and rods of alloy steel, imported from China. It was imposed on October 18, 2018. A similar move was done for flat-rolled products of steel, plated or coated with an alloy of aluminium or zinc imported from China, Vietnam and Korea.

It was also revoked on high-speed steel of non-cobalt grade, imported from Brazil, China and Germany. It was slapped on September 25, 2019. Countries initiate anti-dumping probes to determine if the domestic industry has been hurt by a surge in below-cost imports. As a counter-measure, they impose duties under the multilateral WTO regime. Anti-dumping measures are taken to ensure fair trade and provide a level-playing field to the domestic industry. They are not a measure to restrict imports or cause an unjustified increase in the cost of products. India has initiated maximum anti-dumping cases against dumped imports from China.

Source: The Economics Times

ALUMINIUM VS STEEL: THINKING LONG-TERM – ALUMINIUM AS THE SMARTER CHOICE

As the construction industry takes a more long-term view – looking to build for 25 or 50 years out and considering the total cost of a project, both financially and environmentally – it's encouraging to see sustainability becoming more of a focus. It's about efficiency not only in design, but also in choosing locations, in construction itself, in maintenance and renovation, and even in demolition.

In this way, construction is becoming more about development that meets the needs of the present without compromising the ability of future generations to meet their own needs too. Building practices are beginning to work towards the smallest possible environmental footprint as they look to minimise waste, conserve energy, and often, as another positive by-product, save money.

So what does this have to do with aluminium? And how does it stack up against steel when it comes to its use in structural elements?

A smarter choice

For starters, aluminium is non-corrosive and resistant to the elements. The average rate of penetration for corrosion of aluminium is as low as 0.00051MM/year compared to steel which can be as high as 0.0445mm/year. These numbers may seem miniscule, but the impact is significant. Evidence from the shipbuilding industry shows that the aluminium alloys used to construct ocean-going vessels corrode roughly 100 times more slowly than their steel counterparts. We don't need to tell you what this longevity means for production requirements and overall environmental footprint.

However, there are other benefits too. Aluminium is lighter in weight by almost a third as compared to its steel counterpart. It also has a high strength-to-weight ratio, allowing the opportunity to minimise the dead load on supporting structures without compromising the strength of a building as a whole.

And lastly, it has a greater capacity to absorb crash energy than steel – helping aluminium to become the material of choice for structures designed to resist fire or explosive blasts. When exposed to heat, aluminium is highly reflective and absorbs less radiant energy – meaning it takes longer to heat up. This speaks to its choice as a roofing material in energy efficient homes, as it moderates the internal temperature increases that occur on hot, sunny days.

Specific sustainability factors

While its physical properties are impressive on its own, aluminium has one of the most sustainable production lifecycles of any metal, even before it becomes part of a building. There are several other factors, however, that earn aluminium further ticks in the sustainability boxes.

Recycling

Aluminium is remarkable in the extent to which it can be recycled. In the European Union, more than half of the current aluminium production uses recycled raw materials and this proportion continues to rise. At present, it is estimated that roughly 75% of all the aluminium ever produced is still in circulation owing to both its long lifespan and strong economic incentives to reuse deconstructed aluminium components.

A big factor driving these high rates of aluminium recycling is the retention of its original properties at the end of the recycling process; it can be reused as pure aluminium or alloyed with a variety of other metals in much the same way as newly extracted aluminium. In

Europe, over 70% of used aluminium cans are recycled in a process that sees that same metal used to make new cans in less than 60 days. So, not only does aluminium have a long lifespan, it can be reincarnated ad infinitum.

Another key factor is cost

One of the biggest costs in the primary production of aluminium is the energy required to extract it from ore; smelters require large amounts of electricity to drive the extraction process. By comparison, the recycling of aluminium uses approximately 5% of the energy expended in the extraction stage. This provides an enormous economic incentive to reuse aluminium instead of expanding mining operations.

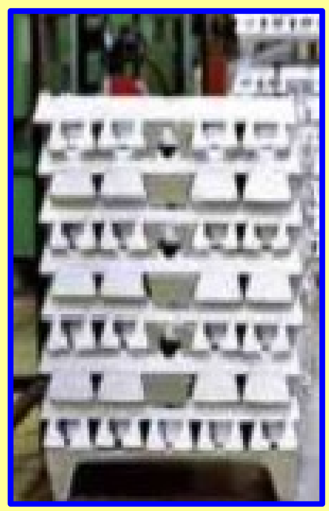
Neutrality

Aluminium alloys have been shown to be completely neutral in their effect on air, soil, and water quality. They also don't easily react with most substances, so present no significant chemical hazard to building occupants. In a similar way, aluminium provides an effective barrier against airflow, light, and microorganisms and can be used strategically in structures that have need for these qualities.

Source: www.monkeytoe.com.au

HOW METALS CAN GALVANISE INDIA'S ECONOMIC REVIVAL

Zinc and aluminium will play a key role in the infrastructure and sustainability drive



India pioneered in producing and making use of various metals like iron, steel, and zinc as early as 3rd-4th Century BC. Even today around the small mining town of Zawar in Rajasthan, one can locate sites where the extraction of zinc was perfected in ancient times in a crude yet effective way.

With huge deposits of iron, coal, dolomite, lead, zinc, silver, gold, etc. India is a natural destination for the mining and metal industry. In the last few decades, economic liberalization, supply of technical manpower and the IT revolution have powered threefold growth in steel making. This was closely followed by growth in zinc mining and smelting, establishing the nation on the global metal map.

The various flagship infrastructure projects announced by the government will result in a big boost to the steel industry and its downstream metal sector.

The demand for zinc is also tied to the demand for galvanised steel that ensures infrastructure has a longer life and is corrosion free. Although 60 per cent of the zinc produced is primarily consumed in galvanisation, the segment is still under-utilised and with growing demand for safer and sustainable solutions, the potential for galvanised products is huge. Other metals like aluminium in windows and doors, copper in pipes, and alloys like zinc die casting in faucet handles are also crucial to the infrastructure story.

Furthermore, the Railways is also geared up for a series of upcoming projects such as 100 per cent track electrification, dedicated freight corridors and high-speed rail corridors that will see a rise in the demand for zinc and copper. While the galvanisation with zinc contributes towards building safer and stronger tracks, copper will be needed to make the overhead wires.

With an ambitious target of 450 GigaWatts of renewable energy capacity by 2030, the government plans to meet half of the country's power demand with clean energy resources. Silver is a critical component in the manufacture of solar panels and the metal and its growing downstream industries will play a significant role. Simultaneously, storing this clean energy will be equally important, which will see a huge scope for recyclable lead-acid batteries.

Electric vehicles' drive

Add to this the rising demand for Electric Vehicles (EVs) where green base metals that ensure high strength at low weight will drive the transformation. EVs will open newer applications of such metals where we will see zinc-based storage batteries, aluminium supported chassis, copper wired harnesses and the use of rare-earth metals to manufacture the magnets for the motors.

The government's boost to green energy and infrastructure is expected to drive consumption and power the demand for automobiles further giving a push to metals. The challenge of the automotive industry to balance power performance at one end and reduced emissions at the other has made the sector explore metals like aluminium to reduce weight.

For India the need of the hour for enhanced agricultural crop production is mechanisation and adoption of cutting-edge technologies, which will also give a huge boost to rural consumption of metals. Additionally, the other big focus remains high yielding crops that are rich in micro-nutrients ensuring food security for the country. This will need better soil management and essential growth nutrients for crops thus opening the market for fertilisers that offer the right doses of micronutrients such as copper, iron, manganese, nitrogen, phosphorous, potassium and zinc.

The Metal and Mining industry continues to be at the forefront of India's economic development. As a direct contributor to over 2 per cent of India's GDP, the sector also gives direct and indirect employment to millions of people. The industry can be the much needed booster dose for the nation's growth trajectory.

Currently, the exploration and mining policies are centred around the mining of surficial minerals like bauxite, iron ore, limestone, and coal, whereas India continues to import over $100-billion worth minerals of which more than 75 per cent are deep-seated, strategic and precious mineral/metals like gold, copper, zinc, and nickel.

More favourable policies that support the opening of exploration and mining of such minerals through global e-auction and allowing private players an opportunity to pick areas of interest, define the block, explore and mine to keep pace with the growing demand can be the real game changer for India's dream of a $5trillion economy.

Source: The Hindu Business Line

TIME TO LOOK AT WASTE AS A RESOURCE

Of late, waste has moved to the centre of the discourse on protecting the environment locally, and dealing with the hazards of climate change globally. Prime Minister Narendra Modi recently raised the issue at the World Sustainable Development Summit (WSDS) while appealing to world leaders to make LIFE (Lifestyle for Environment) a global movement through a 3P's – ProPlant People – approach for sustainable development.

He said "reduce, reuse, recycle, recover, re-design and re-manufacture" have been parts of India's cultural ethos. The country has indeed followed this approach from time immemorial, and the 'waste to wealth' route has even got policy support. In fact, India has traditionally regarded 'waste' as 'displaced resources'. This is where the concept of circularity comes in. It looks beyond the end of a product's lifecycle through continuous processing and reusing of the waste generated at different stages – be it from the use of plastic materials, electronic items, water, agriculture, lithium ion batteries, vehicles, or solar photovoltaic cells/panels and related structures during energy transition.

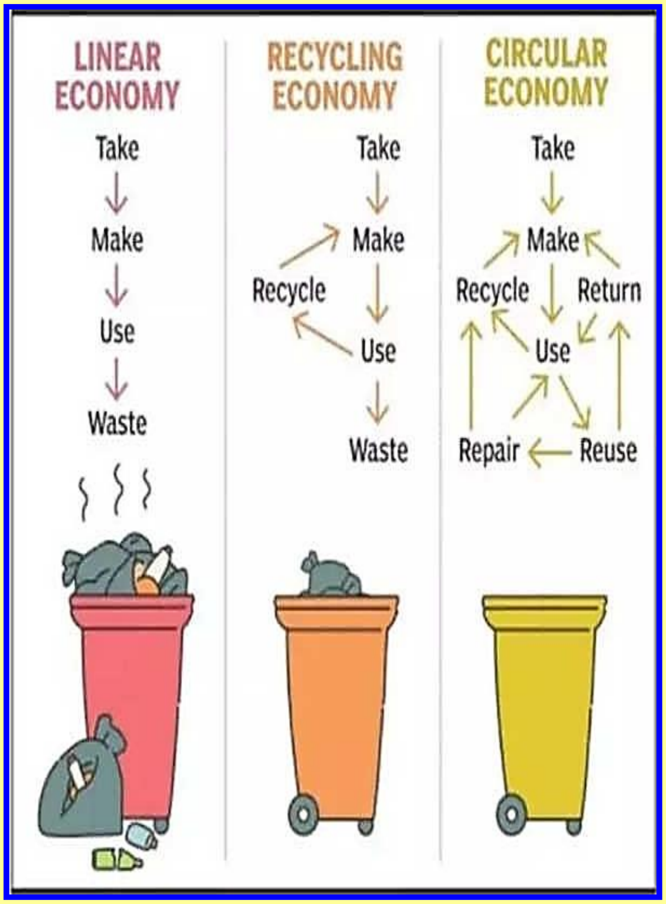
Roadmap for Circularity

Against this backdrop, RePlanet, a joint initiative between Coca-Cola and The Times of India with Climate Trends as the knowledge partner, will delve into different aspects of circularity across several economic sectors over the course of months, bringing into focus how India has been dealing with its waste at different stages and the kind of policy it might need to fill the gaps towards its 'waste to wealth' goal while moving from a linear to a circular economy (CE). The Centre has, meanwhile, initiated a process to make an action plan for a circular economy, and to have an overarching national policy for mainstreaming resource efficiency across all sectors. "Circular Economy Action Plans are being developed for 11 categories of waste by committees constituted by the Niti Aayog," Union environment minister Bhupender Yadav told TOI.

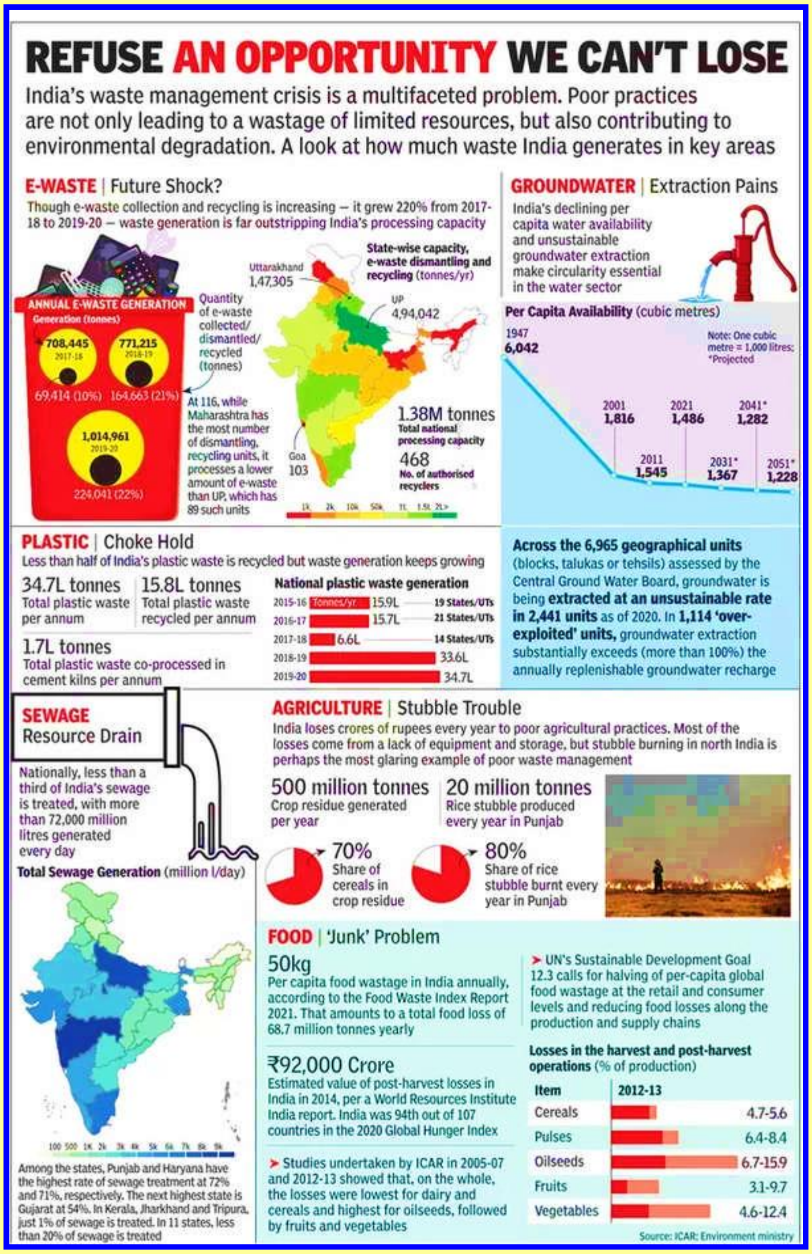
He said even the 2022-23 Budget is a reflection of the country's commitments as it announced support for implementation of action plans in important sectors, including electronic waste, end-of-life vehicles, used-oil waste, and toxic and hazardous industrial waste. The Niti Aayog has already constituted 11 committees led by the ministries concerned and comprising domain experts, academics and industry representatives to prepare comprehensive action plans for 11 focus areas, including end-of-life products, recyclable materials and waste that either continue to pose considerable challenges or are emerging as new challenge areas that must be addressed in a holistic manner.

Necessary for Growth

"With only 2% of the world's landmass and 4% of freshwater resources, a linear economy model of 'take make-dispose' would constrain India's manufacturing sector and, consequently, the overall economy," said the Niti Aayog in its note on how the government is driving the transition from a linear to a circular economy. It is, of course, not easy, given the volume of waste generated in India. The gaps between waste generation and processing, and the lack of adequate infrastructure for efficient use of resources make the road to circularity quite rough. "In India, considering materials as isolated from livelihoods is unrealistic, as a large informal sector is integral to waste flows. Despite recent regulations which require waste to be channelled to the formal sector through licensed operations, this has not happened. In fact, waste processing is often illegally subcontracted to the lower cost informal sector," said Ravi Agarwal, director, Toxics Link, one of the oldest Delhi-based organisations working in this area. Agarwal noted that over 95% of electronic and plastic waste is still dealt with by the informal sector of waste-pickers, 'kabadiwalas' and small recyclers. "Here resource recovery efficiencies compared to formal operations are low (65% vs 95%) and toxic exposures to workers high. Also, recycled products can contain residual toxics," he said.



Experts say the objective of circularity can only be achieved by making waste collection and recycling lucrative. “One of the key challenges towards achieving environmental sustainability through the circular economy is to keep plastic waste collection and recycling lucrative. India generates enough waste to meet the demands of local industries which use recycled plastic waste as raw material for their products. Through a network of waste pickers, ‘kabadiwalas’, recyclers, our country is the leader in the collection and recycling of many plastic resins,” said Vinod Shukla, president, Pandit Deendayal Upadhyay Smriti Manch. The organisation has been working on research and advocacy in the plastic waste domain. He said the new extended producer responsibility (EPR) guidelines on plastic packaging will help in strengthening the collection and recycling ecosystem. The environment ministry has recently set up a ‘market mechanism’ for plastic waste management where an efficient approach can get waste generators credits that can be sold and purchased.



“The circular economy functions on the same principle as the cycle of life – creation, sustenance and destruction. The materials created by humans, such as plastics, do not follow this cycle in their present form. Without the plan for destruction, most of the discarded plastic items are bound to pollute for many centuries,” said Shukla while pitching for a robust policy. He cited packaging waste as an example. “The circularity of packaging can be achieved by making amendments to the material/design of the packaging at the production stage or by introducing processes/catalysts which ensure the end-of-life treatment of post-consumer waste. The problem of single-use packaging pollution grew because a lot of it is not designed to enable the end-of-life destruction or material recovery. "

As the government is working on an overarching policy to deal with the issue, Agarwal suggested the circular economy needs to be "rethought as an integrated issue of livelihood and materials", and an opportunity to create inclusive, safe and dignified green jobs. He said, "For just transitions, investments in upskilling, recycling facilities, collection mechanisms based on extended producer responsibility, cleaner materials, etc., are needed. Despite three decades of lip service, we still do not have an implementable plan or mechanism to enable this shift. Instead, courts and regulators periodically attempt to shut them down."

Source: Times of India