Met-Info

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The Indian Institute of Metals
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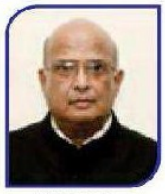

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Stainless Steels and CO_2

Like any other major industry, the stainless steels industry endeavours to reduce its operational CO_2 emissions on an ongoing basis.

In the stainless steels industry there are mainly two production systems, namely

1. The scrap-based production system in which the bulk of used raw materials are end-of-life stainless steels and/or similar alloy materials that are melted / recycled to produce new stainless steels. This production system is for such locations where the availability of end-of-life materials and scrap is high.
2. The Nickel Pig Iron (NPI) production system in which most of the Nickel required for stainless steel production is not derived from SS steel scrap, but from extracted Nickel ores which are converted into NPI. This system is suited to geographical locations where availability of stainless steel scrap is low.

Presently there is insufficient availability of end-of-life SS steel scrap in all regions of the world to permit only scrap-based production. Therefore, these production routes will co-exist for the foreseeable future.

Stainless steel is the term used for extremely versatile family of metals that contain a minimum of 10.5 % chromium. Chromium is essential to achieve the metal's "stainless" properties. Other alloying elements (such as nickel, molybdenum and copper) provide a wide range of mechanical and physical properties.

For the stainless steel industry, scrap has a high intrinsic value. The only limitation is the availability of scrap, especially in emerging countries. The durability of stainless steel restricts the availability of scrap. For example, when stainless steel is used in buildings, it remains there for many years and cannot be reused before the building is dismantled. Stainless steel is 100 % recyclable and has one of the highest recycling rates of any material. It is estimated that about 95 % of stainless steels are recycled at the end of their life.

Over the past 20 years, the world has produced approximately 800 million metric tons of stainless steel (world stainless, 2024). World annual production increased from 25 million tonnes to over 58 million tonnes over this period. Growth in the use of stainless steel has been the highest of any bulk formable material in the world (worldstainless, 2023). Stainless steel's properties, such as its 100 % recyclability, reusability, durability, corrosion resistance, extremely low maintenance needs and product safety partly explain this amazing consumption growth.

CO_2 Emissions

Scrap mix	CO_2 emissions per ton of stainless steel
85% scrap	1.95
75% scrap	2.45
50% scrap	3.70
30% scrap	6.80

CO_2 emissions are quantified from the following three sources.

- **Scope 1 Emissions** which covers direct emissions from business-owned or business-controlled emission sources.
- **Scope 2 Emissions** which covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company.
- **Scope 3 Emissions** which are associated with the extraction, preparation and transport of ores and the subsequent production and transport of ferro-alloys including the electricity needed for these processes.

These 3 sources provide us a view of the stainless steel industry's CO_2 emissions.

Scope 1 Emissions

The current scrap-based producer average is 0.41 tonnes of CO_2 per tonne of stainless steel produced. 85 % of the producer results sit (normally distributed) in the range 0.20 to 0.50 tonnes of CO_2 per tonne of stainless steel produced. In

2012 the average figure was 0.43 tonnes of CO_2 per tonne of stainless steel produced.

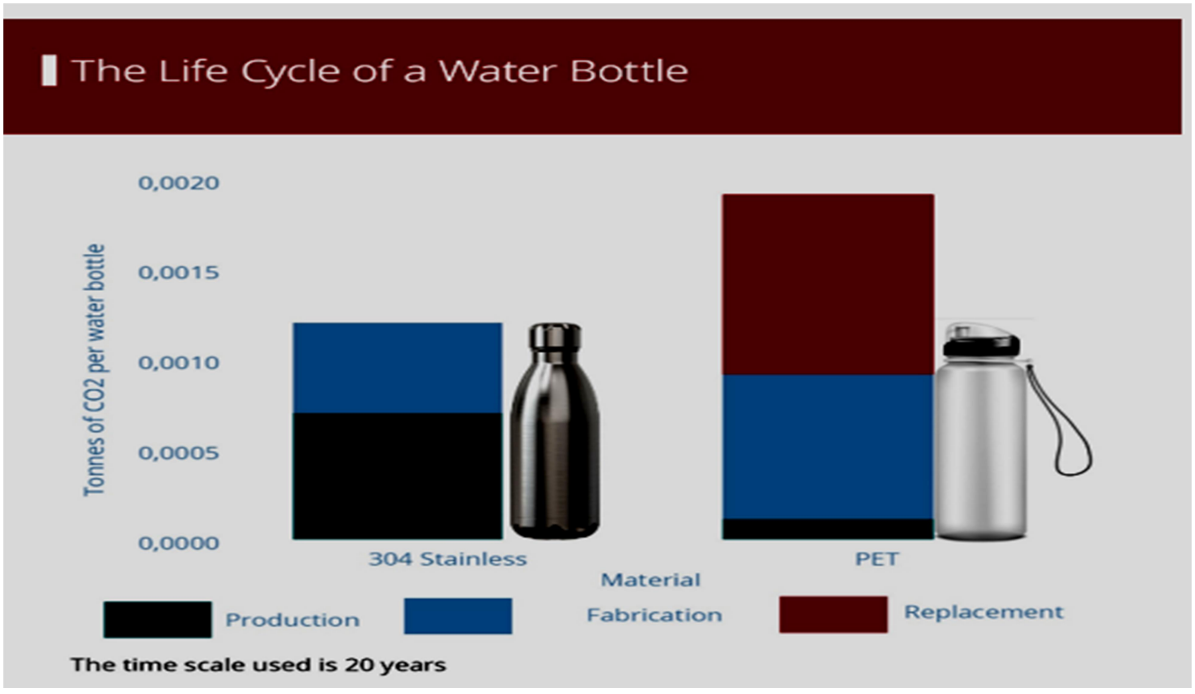
Scope 2 Emissions

The current scrap-based producer average is 0.39 tonnes of CO_2 per tonne of stainless steel produced. The figure has dropped from the average figure reported in 2023 which was 0.45. Changes in the regional energy grid mixes have positively impacted on Scope 2 emissions and thereby the figure has started to become lower than it historically was.

Scope 3 Emissions

Scope 3 emissions cannot be defined in the same manner. We know that there is a linear relationship between the amount of recycled content (scrap stainless steel and scrap low alloy steels) charged and the magnitude of Scope 3 emissions. The higher the recycled content the lower the Scope 3 emissions.

Life Cycle Emissions



To illustrate how stainless steels can in the long run be the material with the lowest CO_2 emissions, the life cycle of two reusable water bottles is shown. At first sight, the stainless steel water bottle has higher CO_2 production emissions, but

because this bottle will last 20 years or more and a PET bottle will need to be replaced at least 10 times in these 20 years, the stainless steel water bottle will be the lowest emitter of CO_2.

Source: worldstainless, Published 24 September 2024

Hindustan Zinc to Double Metal Output

Hindustan Zinc has initiated a $2-2.5 billion (₹30,000 crore) capex plan to double its metal production to over 2 million tonnes. The company will be engaging global contractors who would look at mine expansion and development.

While the zinc capacity will be doubled to 2 mt, lead and silver capacity will be enhanced from 800 tonnes to 2000 tonnes. The company recently roped in a couple of international consultants - two Australian mine-planning and mine-contracting entities. It has also engaged a consultant to work on expanding zinc smelting capacity, a mix of greenfield and brownfield diversification.

It is envisaged to develop mines in a particular manner to make adequate ore for 2 million tonnes. The mines have to be expanded. Investments will be a through a mix of internal accruals and debt. These investments will be spread over a few years.

For FY25, the company has guided for a mined metal production of 1.2 mt and in H1, its production was around 0.52 mt.

Sequentially mined metal capacities will be upped, say from 1.2 mt to 1.3 mt in the following year and so on.

The FY25 guidance also include 1.075 - 1.1 mt refined metal, and 750-775 tonnes saleable silver, with mined metal target of 1.2 mt to be achieved in FY26.

Expansion of capacity (mined metal) includes working out on the logistics of how to transport the material out of the mine and then the concentrator expansion.

The company operates six mines, all of which are located in Rajasthan. It has three smelters. Zinc smelting alone accounts for over 913,000 tonnes per annum.

Source: The Hindu Businessline, 23rd October 2024

Kutch Copper and BHP in Talks to Ink Copper Sourcing Deal

Kutch Copper is in discussions with Australia - headquartered mining conglomerate BHP to source up to 1.6 million tonnes per annum (mtpa) of copper concentrate.

The company plans to set up a copper smelter with 0.5 mtpa capacity in the first phase. A similar capacity will be added upon completion of the second phase. At 1 mtpa, Kutch Copper will be the world's largest single-location custom smelter.

BHP gets copper from Chile, Australia, Argentina and Arizona and is the largest supplier of copper concentrates to India. Indian companies generally import copper concentrate with 25% copper content.

In India, the public sector undertaking Hindustan Copper Limited is the only producer of copper ore. Total copper concentrate production in the country is about 4.0 mtpa which meets roughly 4.5% of its requirement.

India's per capita copper consumption is expected to increase to 1 kg from 0.6 kg, according to an estimate by the Union mines ministry. Global per capita copper consumption stands at 3.2 kg.

Source: Business Standard, 24th October 2024

Iron Ore Production in H1(24-25) India

Tata Steel has emerged as the largest producer of iron ore in India during the first half of the fiscal, toppling state-run miner NMDC.

Tata Steel, which has six operating mines in the eastern states of Odisha and Jharkhand, produced 19.6 million tonne (mt) in April-September, ahead of 17.5 mt mined by NMDC.

Tata Steel is a captive miner that feeds its own steelmaking operations compared with NMDC, which having mines in Chhattisgarh and Karnataka, is a merchant miner selling iron ore to end users. Production of Tata Steel reflected a growth of 11 per cent over the same period of the last fiscal compared with an 11 per cent drop by NMDC.

In the fiscal year ended March 31, 2024, NMDC had produced 45.1 mt iron ore compared with 35.32 mt produced by Tata Steel, which has aspirations to take iron ore production to 60-65 mt by end of this decade to meet a burgeoning steel production of 40 mt. The Tatas have acquired two new leases of mines — Gandhalpada and Kalamang — where mining operations will commence in the coming years.

Odisha Mining Corporation (OMC), a PSU of Odisha, came after Tata and NMDC as the third largest producer in H1, during which India as a country mined 139 mt iron ore, up 10 per cent over the same period of FY24. India's iron ore production stood at 279 mt in FY24 compared with 256 mt in 2023.

JSW Steel, a late entrant into iron ore mining, recorded a 17 per cent growth in H1FY25 with production of 13 mt, one rank behind SAIL which produced 15.9 mt. The top 10 producers include a balanced mix of captive and merchant miners. While production showed positive bias, export of iron ore showed a 12.5 per cent decline year-on-year to 16.35 mt compared with 18.69 mt in H1FY24.

In FY24, iron ore and pellet exports stood at 47.83 mt. China showed a 25.6 per cent decline in the first half, recording shipment of 13.29 mt compared with 17.87 mt in H1FY25. The lower export reflected on Indian ports, especially Goa's Mormugao, where cargo handled reflected a drop.

While Tata Steel came surprisingly at the top as an enterprise, Odisha came first among states in iron ore production, producing 81 mt ore, which accounted for 58 per cent of India's production. Karnataka came a distant second with 20 mt, ahead of Chhattisgarh with 18 mt.

Source: The Telegraph India, 22nd October 2024

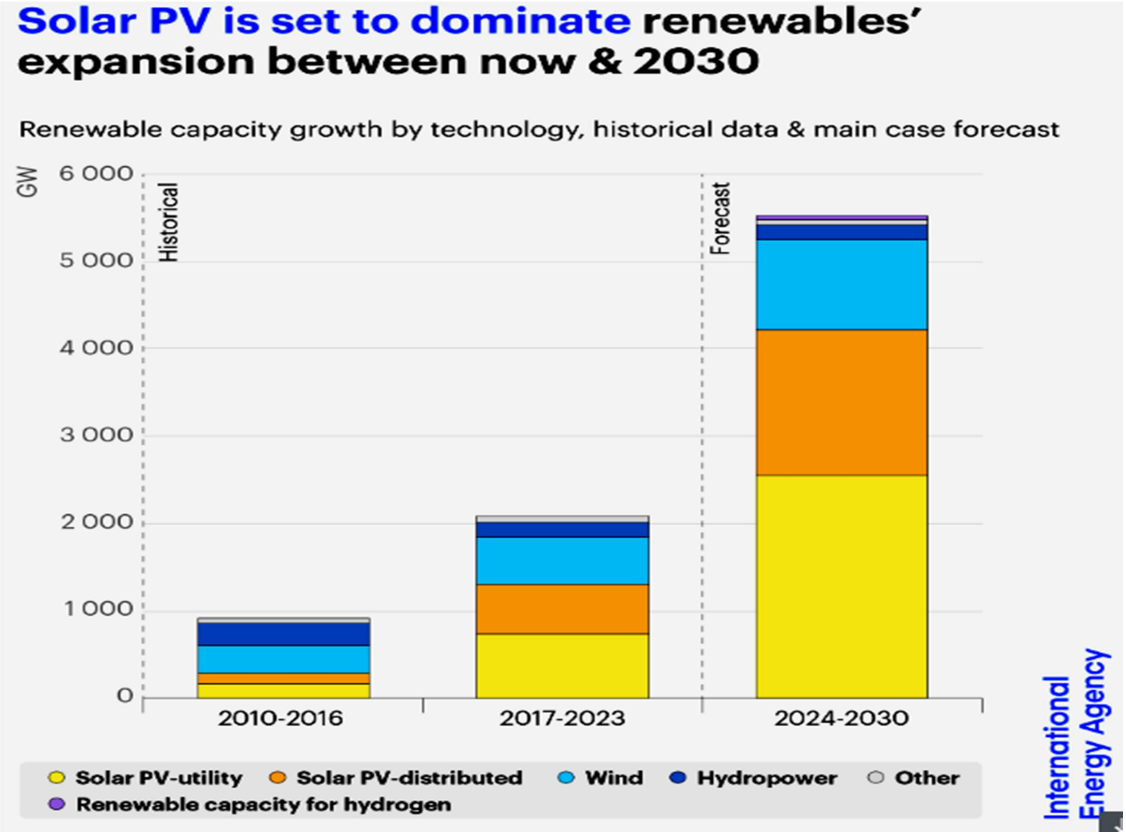
Massive Growth in Renewables to 2030 is set to Transform the Electricity Sector

World's renewable power capacity is expected to surge over the rest of this decade – with global additions on course to roughly equal the current total power capacity of China, the European Union, India and the United States combined.

Globally it is expected that more than 5500 gigawatts of new renewable energy capacity shall be added between 2024 and 2030 – almost three times the increase seen between 2017 and 2023.

Solar PV and wind are already the cheapest options to add new electricity generation in almost every country, and solar is expected to account for around 80% of the renewable capacity added between now and 2030. Renewables' huge growth in capacity worldwide, of which China is set to account for 60%, means they are on course to generate almost half of global electricity by 2030, with the share of wind and solar PV doubling to 30%.

Solar PV alone is forecast to account for a massive 80% of the growth in global renewable capacity between now and 2030 – in the form of new large solar power plants as well as rooftop solar installations by companies and households. And despite ongoing challenges, the wind sector is also poised for a recovery, with the rate of expansion doubling between 2024 and 2030, compared with the period



between 2017 and 2023.

However, there is need to ramp up efforts to securely integrate variable renewable sources like solar and wind into power systems. Making a concerted push to address policy uncertainties and streamline permitting processes – and to

build and modernise electricity grids and massively increase energy storage capacity – would enable even larger shares of generation from renewables.

IEA Energy Mix Newsletter, 14 Oct. 2024

Global Emissions Set to Peak in 2024

It is predicted that global CO_2 emissions will begin to decline this year and halve by 2050. But that's not fast enough to meet climate goals.

According to an independent research firm - DNV, in 2024, global carbon emissions will peak — reaching their highest levels ever — then, they'll begin to decline. Rapid rise of renewables and electrification has put the world on track to cut greenhouse gas emissions in half by 2050.

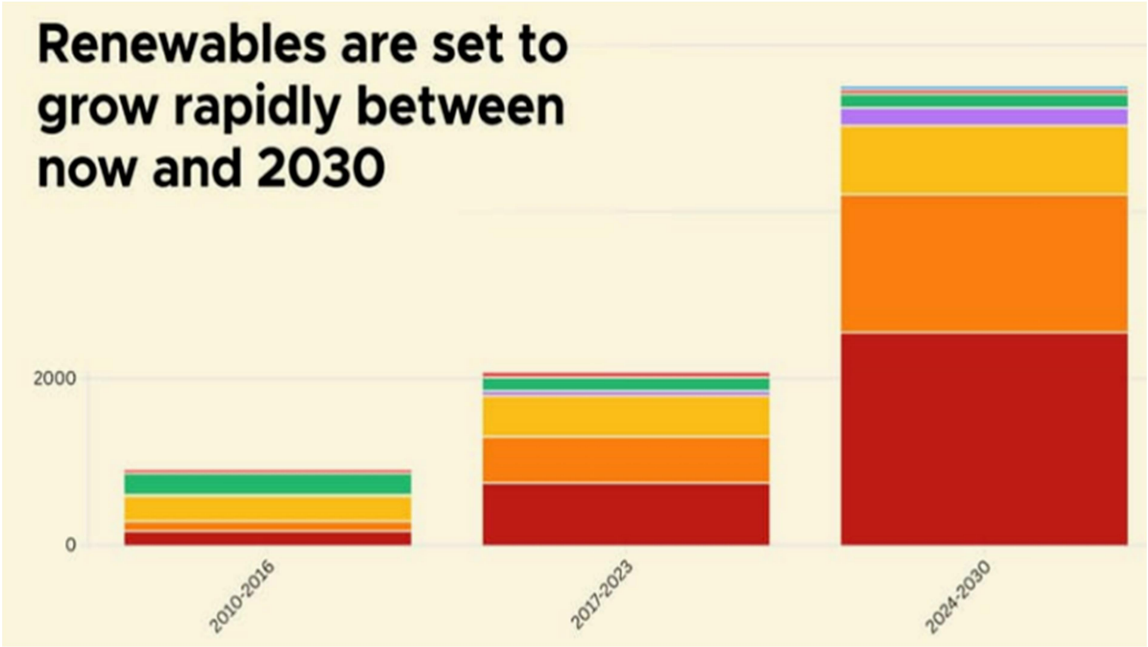
But that's far out of step with global climate goals. To avoid warming the planet by more than 1.5 degrees Celsius — the limit determined in the Paris Agreement to avoid the worst impacts of climate change — emissions would need to halve far sooner than that, by 2030. Along the current trajectory, DNV predicts the atmosphere will warm 2.2 degrees Celsius by 2100.

Still, "It's really a milestone." Instead of saying that we're on the wrong track, we can say that we're on the right track, although we're still at the wrong pace."

The world is managing to bend the curve on emissions due to the mass adoption of solar, batteries, and electric vehicles. These emissions-free technologies are helping to displace fossil fuels; next year, renewables could surpass coal, as per an International Energy Agency forecast released last week.

Annual solar installations increased 80 percent last year, a major factor putting the global power sector on track to reduce its consumption of coal, the dirtiest source of electricity. Meanwhile, battery prices dropped 14 percent last year, a development that makes solar even more appealing: Cheaper batteries mean it is more cost-effective to store and tap into surplus solar power produced during the day.

Solar installations are expected to shatter records again this year — and it's worth noting that solar has consistently outperformed forecasts, rising faster than predicted. It is possible that we could see an even steeper growth than what we have.



World could triple renewable energy by decade's end

The falling cost of batteries also has implications for electric vehicle sales, which are increasing. Battery prices, along with electric vehicle costs, should continue to fall in the years to come. Last year, EVs accounted for 13 percent of all new vehicle sales globally; by 2031, itis estimated that EVs will make up half of global auto sales.

No country is installing more renewables or adopting more EVs than China, and its massive markets and manufacturing power have helped drive down the cost of clean energy technologies worldwide. As just one example, China produced nearly 90 percent of the world's solar panels in 2023 — and more than half were used at solar installations in the country itself.

China is still the world's largest consumer of coal and emitter of CO_2, but its rapid uptake of solar and wind mean its dependence on fossil fuels will fall rapidly in the coming years. Gasoline use in China is also declining from its 2023 peak thanks to the country's embrace of EVs, which made up a third of new car registrations last year.

The country's clean energy progress led to a spate of recent projections that China's carbon emissions have already peaked, years before its pledge to begin reducing emissions by 2030.

Emissions have been tapering off for several years in a number of high-income countries, including the United States, Europe, Australia, and Japan. In lower income countries, emissions are still increasing, and that will continue for a while. But that won't be enough to change the overall direction of emissions. The sum of countries, whose emissions are, on their way down is now, for the first time, passing the sum of the countries who are on their way up.

The report was careful not to assume that every region will reach its stated goals. Europe, for example, aims to reach zero emission by 2050. It is assumed that Europe will reduce emissions 85 percent by 2050, not 100 percent.

Policy changes, like emission reduction mandates, government incentives, and carbon pricing, could help reduce emissions even faster, possibly limiting warming to less than 2.2 degrees. Policy is the lever where there is the most potential.

Source: Canary Media, Daily Newsletter, 14 October 2024

Research Must be Correct and Reproducible

Science is cool and needs more attention. But "doing science" does NOT always mean "doing genuine research".

- If you do research and don't publish, it's not Science.
- Research must be correct and reproducible.
- Research requires maximally rigorous pursuit of the truth, without regard to popularity or political correctness.
- Reproducibility crisis … A lot of work is just not reproducible.
- A lot of research has awful statistics. Let's measure 5 samples, cherry-pick 2 datasets and draw a big-picture conclusion!
- Some researchers use methods without any expertise in them. Mistakes and misinterpretations are hidden in many publications.
- Few researchers go deep. Most scientists just want to do "easy" research. Risky research is associated with risky career.
- What is needed from researchers today:
  - Be brave and look for the unexplored.

- Be brave and publish ONLY when the study is rigorous and strong.

- Normally, science is (at least) about:
  Knowledge about the physical world + Reproducible data + Published / disseminated results + Feedback from others
- Today, scientists need to have an affiliation/lab/etc. to do rigorous research
- In India we'll never break free of our current problems in science without completely overhauling the funding system. Funding indeed is the key to how science works today. But it should not be a part of the definition of what science is. Often mostly funding is asked for risk-averse proposals which are geared towards maximising journal impact.
- The funding agencies are the true enablers of making science impactful to society. But these agencies are also under pressure to distribute taxpayer money to technically strong proposals. "Non mainstream" ideas are less likely "technical strong", and have greater scrutiny. These ideas less likely to receive good reviewer comments, and hence likely won't get funded.
- VC-backed companies have high chance of doing non-mainstream based applied R&D. They very well decide not to publish anything to maintain their lead.
- Technical literature is full of meaningless reviews and articles, most of them unreproducible.
- Considering that novel and risky research will imply multidisciplinary expertise and methods, how many of these skills can we acquire enough to an expert level to be able to do such research and in what time can we expect to achieve this?
- "Real science can stand the test of time" - only if its reproducible.
- One can come up with many philosophical questions. But the practical ones all condense to several points related to trustworthy, novelty, robustness and dissemination.

Congratulations

Shri S S Mohanty

CEO & MD, Essar Minmet Ltd.

Former President, IIM

Ex Director (Technical), SAIL

Ex VC & MD, NINL

Ministry of Steel, Govt. of India, organises National Metallurgy Awards (NMA) function every year to motivate the professionals in the metallurgical field. One of these awards is Life Time Achievement Award.

Shri S S Mohanty, CEO & MD, Essar Minmet Ltd., and former Director (Technical), SAIL and also former President IIM was conferred Life Time Achievement Award by Hon'ble Minister of Heavy Industries & Steel at Bengaluru on 21st November 2024.

Shri S S Mohanty is closely associated with the promotion of metallurgical activities in IIM.

Delhi Chapter of the IIM extends its congratulations to Shri Mohanty on the conferment of this prestigious Award.

Know Your Members

K K Mehrotra

Academics

B. Tech and M. Tech in Metallurgical Engineering from INSTITUTE OF TECHNOLOGY, Banaras Hindu University. Post Graduate Diploma in Industrial Engineering from NITIE

Experience and Expertise

Shri K. K. Mehrotra superannuated as Chairman-cum-Managing Director of MECON LIMITED, a premier Consultancy, Design & Engineering organization under Ministry of Steel, Government of India, and Former Managing Director of Metallurgical & Engineering Consultants (Nigeria) Ltd., a joint venture company formed by MECON Limited with Delta Steel Plant, Ajaokuta Steel Plant and Nigerian Partners. He had steered MECON Limited for Rs 75,000 Crores modernization and expansion of 5 integrated steel plants of Steel Authority of India Limited (SAIL) and 3.0 Mt/yr green field plant of M/s NMDC Limited at Nagarnar, Chattisgarh. He has 47 years of experience in Consultancy, Design, Engineering & Project Management in the field of Steel, Power and Oil and Gas sectors. After superannuation Shri Mehrotra was independent director of Steel companies, Consultant to State Bank of India for steel /power projects, Independent External Monitor of Security, Printing & Minting Corporation of India under Ministry of Finance, Member of Panel of Judges for Prime Minister Trophy for best Integrated Steel Plant, Ministry of Steel and Task Force Member of MOU for Public Sector Undertaking, Department of Public Enterprises, Government of India. He was chairman, Enquiry Committee constituted by Ministry of Steel and Adviser to some companies including Andhra Pradesh Government for their proposed Steel Project. Shri Mehrotra was Chairman of The Indian Institute of Metals, Delhi Chapter and presently is Council Member and Chairman of Metallurgical & Materials Engineering Division of The Institution of Engineers (India). He is presently board member of reputed Indian company & providing consultancy and advisory services to steel industries. He has over 40 technical papers to his credit in national and International journals.

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