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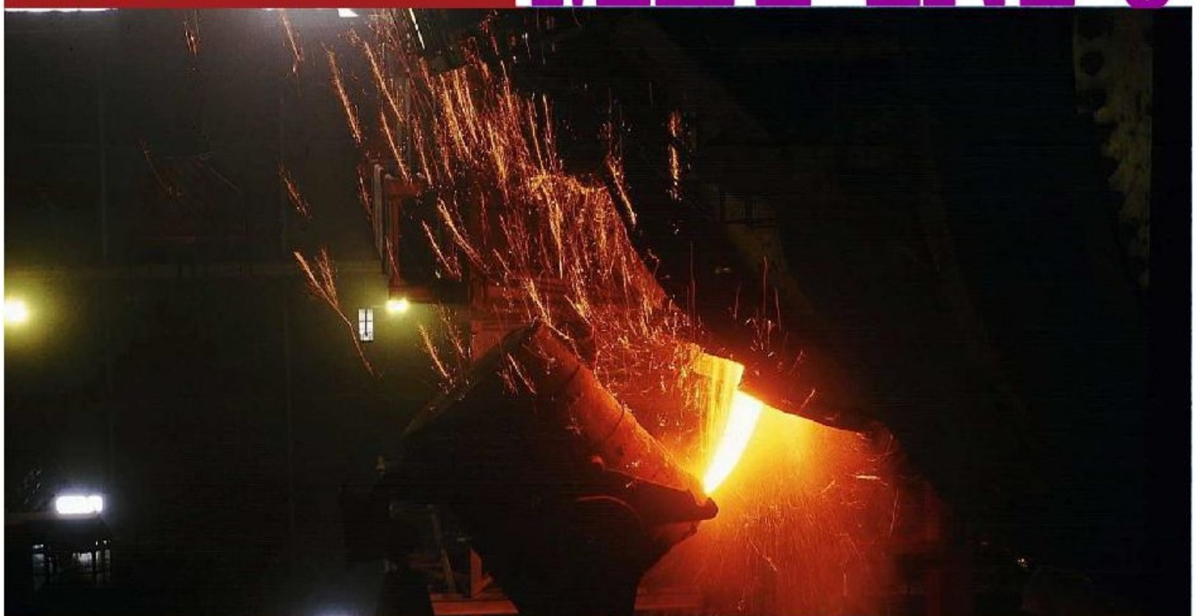

Published By

THE INDIAN INSTITUTE OF METALS
DELHI CHAPTER

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An Inhouse Publication

For Private Circulation Only

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Editor-in-Chief

S C SURI

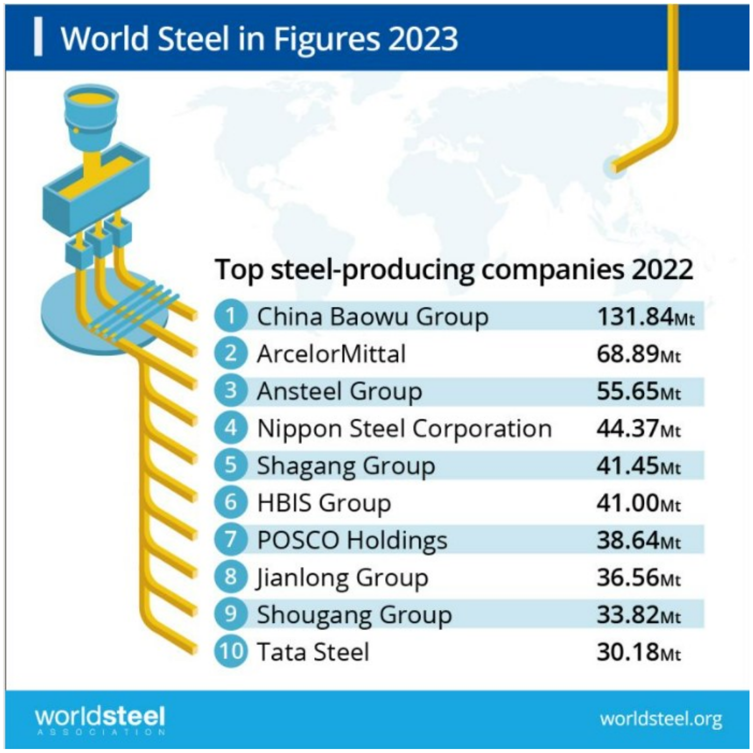
IIM Delhi Chapter Received Ispat Mitra Award from All India Induction Furnaces Association

Steelex 2023 event consisting of Conference and Exhibition was organised by All India Induction Furnaces Association (AIIFA) at Pragati Maidan, New Delhi on 28th and 29th July 2023. The Theme of the Conference was "Decarbonisation, Capacity

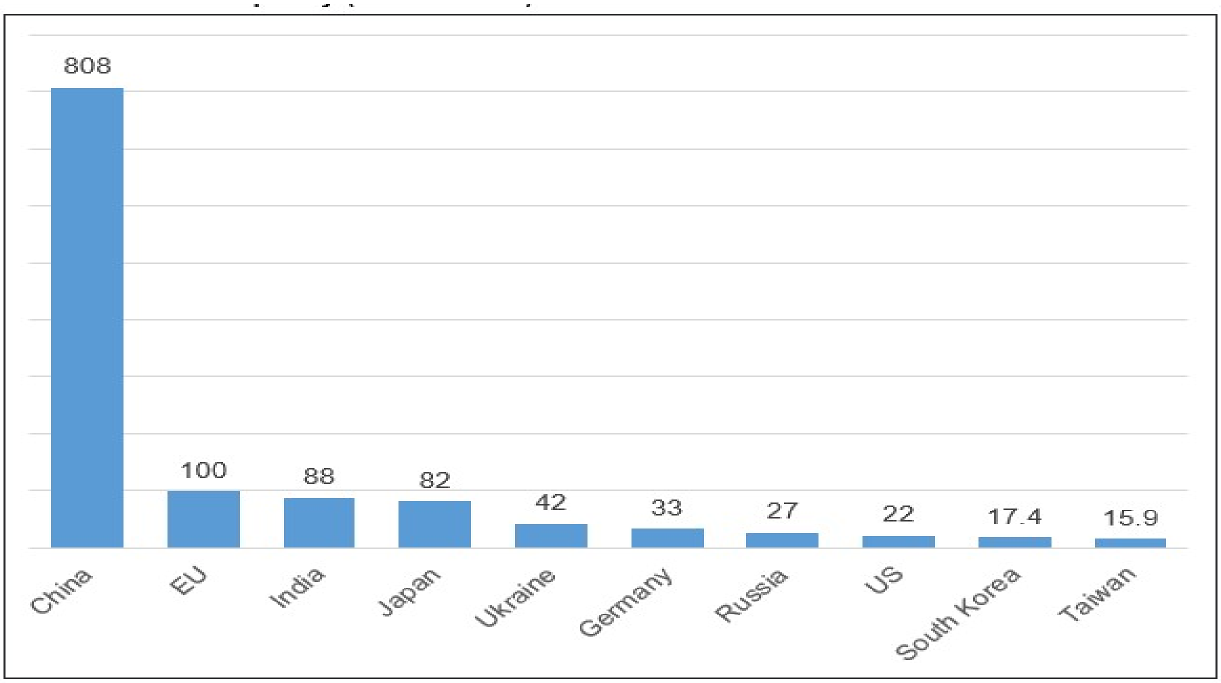
Building and New Entrepreneur Development in the steel sector of India". Some IIM Members affiliated to Delhi Chapter participated in the Conference.

The programme of the Conference, inter alia, consisted of conferment of AIIFA Awards 2023. The list of Awards included Ispat Mitra Award. In recognition of IIM Delhi Chapter's contribution and cooperation to AIIFA, the Association conferred Ispat Mitra Award to IIM Delhi Chapter.

On behalf of the Delhi Chapter the Award was received by Shri R K Vijayavergia, Chairman, Delhi Chapter.



Global Blast Furnace Capacity



(Unit Million Tonnes)

Global Blast Furnace Tracker

Non-government organization and clean energy reporter Global Energy Monitor has released a Global Blast Furnace Tracker (GBFT), which is the first free and publicly available dataset with global coverage of blast furnaces. The tracker aims to provide data on blast furnaces across the world, in all stages of construction and activity.

According to Global Energy Monitor, the tracker catalogues 1408 blast furnaces across 477 plants in 55 countries for a total of 2.0 billion tonnes of pig iron capacity (1.45 billion tonnes operating with an additional 0.28 billion tonnes in development and 0.23 billion tonnes idled/retired), which represents 91% of global pig iron capacity compared to global estimates of approximately 1.6 billion. The GBFT builds off of the organization's Global Steel Plant Tracker (GSPT), which provides ownership and location information on each of the plants included in the GBFT.

The tracker also includes furnaces that have been proposed or under construction since 2017 and retired or mothballed since 2020.

Hyundai Steel Launches Low-carbon Steel Brand

Hyundai Steel has launched its own low-carbon steel brand, HyECOsteel, furthering its commitment to achieve its goal of carbon neutrality.

The launch comes after the South Korean company unveiled in April its carbon neutrality road map to reduce carbon emissions by 12% by 2030, and achieve net zero by 2050.

Advanced countries around the world are focusing on securing an earlier edge in the climate sector and protecting their own industries. Carbon neutrality is not an option but a must. Hyundai Steel will pour resources into nurturing new growth drivers and taking another big leap as a sustainable, eco-friendly steel maker.

As part of its decarbonization efforts, the company also plans to construct new electric arc furnaces, which will be a part of a production system for low-carbon steel called Hy-Cube.

Hy-Cube minimizes carbon emissions, says Hyundai Steel, while producing high-quality steel sheets by combining scrap metal, molten iron from blast furnaces and hydrogen-based directly-reduced iron. The company expects this will help reduce its carbon emissions by approximately 40% by 2030.

The company aims to have an annual production capacity of 5 Mt of low-carbon steel products by 2030, while marketing the products under the new brand HyECOsteel.

Source: Steel Times International, Weekly News, 5th July, 2023

ArcelorMittal's XCarb™ Innovation Fund Programme

ArcelorMittal today announces that CHAR Technologies has been selected as the winner of its inaugural XCarb™ Accelerator Programme, securing a $5 million investment through ArcelorMittal's XCarb™ Innovation Fund.

ArcelorMittal launched the XCarb™ Accelerator Programme in mid-2022. The programme – a search for the best companies and brightest breakthrough technologies that hold the potential to accelerate the decarbonisation of the steel industry – received an overwhelmingly positive response, with over 90 start-ups from five different continents submitting applications across seven distinct technology domains.

The Accelerator Programme winner, Ontario, Canada based CHAR Technologies ('CHAR'), is developing a high temperature pyrolysis ('HTP') technology that transforms organic waste streams into one of two valuable energy outputs: a high-calorific value and hydrogen-rich syngas that can be used as a replacement for natural gas or to make green hydrogen; and biocarbon - made from the remaining solids after the HTP process - which can be used as a biochar fertiliser to improve soil health, a pollutant filter or as biocarbon to replace fossil coal in industrial processes.

ArcelorMittal's Canadian flat steel operation, ArcelorMittal Dofasco, has been collaborating with CHAR to test the use of its biocarbon as a partial replacement for fossil coal in its steelmaking processes, with encouraging results. CHAR's biocarbon enables an approximate 91 per cent reduction in greenhouse gas emissions compared to metallurgical coal and has been tested by ArcelorMittal Dofasco since 2021. ArcelorMittal Dofasco has therefore signed a memorandum of understanding with CHAR for the purchase of biocarbon from CHAR's Thorold, Ontario facility that will enable larger scale trials in the coming years. Carbon Upcycling and D-CRBN were joint runners-up in the Programme. ArcelorMittal has established strategic partnerships with both companies, with its global research and development teams supporting the development of their technologies, and ArcelorMittal holding the option to invest in the future.

Carbon Upcycling focuses on circularity and carbon reduction in hard-to-abate sectors. Its practical carbon-tech integrates directly into industrial facilities, like steel and cement, to upcycle by-products and mineralize carbon - resulting in zero-carbon cement replacements. D-CRBN has developed a proprietary plasma-based carbon capture and utilisation (CCU) technology which recycles captured CO_2 into value added products such as e-fuels, polymers and chemicals.

ArcelorMittal's XCarb™ Innovation Fund launched in March 2021. Since launch it has invested over $160 million in seven companies that are developing technologies ranging from long-term battery storage to green hydrogen production to CCU, and more. Via the fund, ArcelorMittal is also an anchor partner in the Bill Gates founded Breakthrough Energy's Catalyst programme, committing $100 million over five years.

The seven technology domains are: disruption in steelmaking (processes and technologies); waste to gas or biocarbon; gases reforming / gases transformation technologies; disruptive hydrogen technologies; carbon capture, utilisation and storage; long-term, large-scale energy storage technologies; clean energy technologies.

Source : ArcelorMittal Press Release 5th July 2023

Robotics in Safety Management

Stainless steel producer Outokumpu claims to have become the first in the steel industry to use robotics in safety management, with an aim to achieve the lowest accident frequency rate in the industry by 2025.

Outokumpu will start to utilize artificial intelligence (AI) and safety inspection robots to improve and digitize the company's facilities' health and safety monitoring. The company signed a deal with a Swiss robotics company

ANYbotics on autonomous robotics solutions and, in June 2023, the first ANYmal robot arrived to Outokumpu's site in Krefeld, Germany.

The use of AI and robotics for safety management is one of the cornerstones of Outokumpu's safety strategy. ANYbotics' robotics technology will help them to increase safety by reducing employee exposure to hazardous substances and environments, optimize production through preventive maintenance, and decrease environmental impacts. In 2022, the possibilities to utilize AI in safety management started. Safety robotics emerged as the best alternative and ANYbotics as the best supplier for the robotics.

Outokumpu's site in Krefeld poses particular challenges in dealing with its tough environmental conditions and hazardous substances where the robot can prove its industrial ruggedness, autonomy, and end-to-end integration.

According to Outokumpu, the use of robotics could reduce human exposure to hazardous substances by 80%, with the company having already deployed one robot at its site in Krefeld, Germany.

Source: Steel Times International Weekly News July 19,2023

Swedish Steelmaker SSAB and KIRCHHOFF Automotive Collaborates on Fossil-free Steel

Through the collaboration, KIRCHHOFF Automotive, manufacturer of structural components for the international automotive industry, hopes to reduce its CO_2 footprint by 40%. The company will purchase SSAB'S Fossil-free Steel™, a steel recently developed by SSAB to supply the market need for sustainable steel.

KIRCHHOFF Automotive is taking the reduction of carbon emissions seriously and the partnership with SSAB allows them to further accelerate their efforts in bringing CO_2-reduced solutions to their customers and on the road. In addition, it will contribute to the achievement of KIRCHHOFF Automotive's sustainability targets.

KIRCHOFF Automotive's crash boxes, lower beams and closure plates are manufactured using the cold forming process, and the individual parts weigh between 300 grams and 1.3 kg. By using the SSAB Fossil-free Steel™, KIRCHHOFF Automotive says it will save almost 40% in emissions in the production of a front bumper.

SSAB's Fossil-free Steel™ uses DRI and is produced with biogas and fossil-free electricity, as opposed to fossil fuels.

Source: Steel Times International Weekly News July 19, 2023

New Material to Enhance the Rate of Green Hydrogen Production from Alkaline Electrolysers

A new metallic-alloy coating that researchers claim can almost double the rate of green hydrogen production from an alkaline electrolyser — and potentially halve stack capex cost - could be used in commercially-available systems within two years.

The "nanoFlux" coating, developed by UK-based Oxford NanoSystems (ONS), is made from a metallic alloy that is applied to the electrodes in place of the nickel-based coatings typically used in alkaline electrolysers.

The coating encourages the formation of smaller bubbles that move away from the electrodes, instead of fewer, larger bubbles that stick and obstruct the movement of electrons in the system.

This also means that producers can feed higher levels of electrical current through the electrolyser without it overheating. As a result, the rate of production is greatly improved — meaning that the electrolyser produces more hydrogen over a given period of time compared to a similarly rated equivalent using a nickel-based coating.

Compared to typical nickel-type electrode coatings, the ONS coating can almost double the production capacity, i.e., the rate of hydrogen production, of an alkaline electrolyser stack without any other changes —all other parts of the stack remain the same.

Because the coating also costs less than the nickel-type coatings, this means that the capex cost of the stack is reduced by approaching 50% when measured on a $/kW basis. But it does not affect round-trip efficiency, measured in terms of energy losses per kWh of electricity delivered to the system. For alkaline electrolysers, this is typically around 80%, meaning that for every 1MWh of electrical input, the equivalent of around 800kWh of hydrogen will be produced.

ONS also found that its metallic-alloy coating costs around 60% less to install than nickel-based equivalents, but pointed out that the coating accounts for just a "few percent" of overall stack costs.

There is currently a global shortage of nickel, a metal used extensively in battery production for electric vehicles, which could lead to a future components crunch as electric vehicle and electrolyser manufacturing ramps up.

Make-up of nanoFlux is not disclosed, but it is emphasised that no rare platinum group metals (PGMs) - also in short supply - are used.

But one must caution against over-emphasising the impact of rate of production on overall electrolyser cost, as the balance of plant, the parts of the electrolyser system outside of the stack itself, account for 50-55% of costs for a 1MW unit.

The range of costs for alkaline is pretty large, so one has to agree on what the reference point is and apply the cost reduction to that one. The real yardstick of success would be the LCOH. The coating may add knock-on costs to hydrogen production compared to nickel-based coatings, for example if it did not last as long and curtailed the lifetime of the stack.

ONS had carried out durability tests on nanoFlux as part of its testing regime and had found them favourable, but that electrolyser manufacturers are now carrying out their own tests for this purpose.

Source: Accelerate Hydrogen newsletter, July 20,2023

Circular Economy for Rare-earth Elements

Rare-earth elements (REEs) are found in smartphones, plasma screens and even artificial joints. As components of wind turbines or electric motors, they play an important role in the production of clean energy. The battle for these valuable resources is already in full swing.

There are new ways to get a circular economy for REEs off the ground. In order to meet the increasing demand without harming the environment, the entire REE industry needs to be rethought.

The demand for REEs has been rising for years. According to forecasts, global use of these elements will probably increase fivefold—from about 60,000 tons in 2005 to 315,000 tons in 2030. If the energy transition is to succeed, REEs are needed—for example, about 170 kilograms of the REEs are required to generate one megawatt of wind-powered energy.

At the same time, REEs are not abundantly available. More than half (56%) of the world's reserves and over three quarters (76%) of production are controlled by the three major powers: China, the U.S. and Russia.

Green industries in the United States and Europe are facing shortages of these important materials as they forgo Chinese and Russian exports. The U.S. and EU have classified REEs as critical raw materials.

In the competition for these resources, even the ocean floor is now coming into focus, as seen in the current negotiations on deep-sea mining.

There is a geopolitical race for control of REEs. Countries are trying to squeeze each other out. The REE market is currently a zero-sum game, where gains for one nation mean losses for another, with no benefit for the general public. Many countries promote the search for rare earths and mining in their own countries while at the same time restricting export opportunities. Moreover, the processing of REEs is increasingly damaging to the environment as the value chain consumes large amounts of energy and water and releases pollutants and carbon emissions. According to a U.S. study, refining one ton of REE oxide can produce not only 1.4 tons of radioactive waste, but also 2,000 tons of waste material and 1,000 tons of wastewater containing heavy metals.

Only about 1% of REEs are recycled

Meanwhile, only about 1% of REEs are currently recycled, as there are no policies or programs anywhere in the world for recycling REEs from products. Many devices that contain REEs in relatively high concentrations, such as batteries in electric cars and magnets in wind turbines, are still in use and years away from being retired.

Experts in circular economy has now come up with ideas how to fuel the global REE recycling thus possibly taking the heat out of the geopolitical race and conserving resources. In their article in *Nature*, the scientists show concrete examples of implementation, weigh the pros and cons and make a case for investment in research and innovative recycling technologies.

Low- and middle-income countries could also gain access to REEs in this way to accelerate their energy transition.

Source: Circular Bulletin, Edition 51, International Council for Circular Economy, July 2023

Circular Battery Economy: Policies and Processes to Accelerate Recycling and Reuse

As battery production scales up, so do the risks of the long global supply chain failing, or causing more emissions and damaging the environment. A circular battery economy should greatly reduce those risks. Yet the countries either have no recycling policies or requirements for lithium-ion batteries, or policies are inconsistent.

Before recycling and reuse becomes efficient and commercial, many things must be in place. Manufacturers must design their batteries with easy recyclability and end-use in mind. Today, all used batteries are treated as hazardous waste, significantly raising the cost of all storage and transport; accurate data that identifies what's not hazardous can cut recycling costs in half. Supply chain traceability across nations – for environmental concerns – will require data collection, transparency and monitoring, and the essential global harmonisation of the rules to make it work.

A circular battery economy, one in which used batteries are repurposed or recycled, can help mitigate the risks associated with battery production while at the same time strengthening the EV battery supply chain. By repurposing and recycling EV batteries, we can decrease our reliance on virgin materials and negative community impacts associated with their extraction. We will also reduce the risk of supply chain interruptions due to changing trade alliances, geopolitics, and extreme weather.

Robust policies

To make a circular battery economy a reality, a robust policy is needed that:

- Provides a standard compliance approach and works to harmonise global battery supply chain rules and regulations;
- Clearly describes how businesses can increase supply chain traceability, material transport and storage, manufacturing and production, recycling, and repurposing; and
- Details how businesses can track compliance.

Economic viability

The economic viability of battery reuse and recycling is currently challenging, given economic uncertainties. Today, it's often cheaper to mine for minerals or produce new batteries using the status quo for linear processes.

The economics of recycling vary greatly based on the material composition of the battery and the related market value of constituent minerals. If it takes place at all, most recycling seeks to recover higher value nickel, cobalt, and lithium.

Plastic recycling: an example

Recycling and repurposing used EV batteries can become self-sustaining or even profitable with effective battery circularity polices. Low rate of plastic recycling is mostly due to the fact that it's cheaper to create new plastics than to recycle used plastics. Policies discouraging single-use plastic and extending producer responsibility would help in achieving higher recycling rates.

Given the urgency of the climate crisis, and the significant investment required to create a circular battery economy, policies can serve as a powerful market signal to demonstrate government priorities and help catalyse much needed investment.

Today, countries have no recycling policies or requirements for lithium-ion batteries: the lack of uniform standards translates to a piecemeal, insufficient approach to battery circularity. Clear guidelines would greatly expedite the creation of a robust and circular battery economy.

It's also important to note that no policy can be perfect: every approach has its benefits and challenges. The private and public sectors must collaborate intensely so that policies meaningfully advance a circular battery economy.

Below five policy features are described that can be applied globally to ensure effective policy implementation, including current legislative and voluntary examples as well as key considerations.

1. Supply chain traceability

Today's EV battery supply chain is opaque, making it difficult for midstream and downstream actors to determine where their raw materials come from. This opacity means it's hard or even impossible to know if the materials were extracted using child or forced labour and how mining affects local environments. By making the supply chain more transparent and/or traceable, industry actors and policymakers can better address the abuses associated with mining. Transparency can also help the public and private sectors know where batteries are and the quantity of materials available that could be recycled or repurposed.

...The EU's new battery regulation

The European Union has taken a significant step to improve supply chain traceability by adopting a battery regulation that requires recycling an increasing percentage of a battery's weight. Manufacturers now have to disclose a battery's carbon footprint and recycled content, and whether its materials come from mines that engage in human rights abuses. Upstream actors are required to undergo third-party audits of their mines to ensure that materials are being ethically extracted. The EU Parliament recently approved a directive that requires that companies based in the EU identify, prevent, end, and/or mitigate the negative impact of their activities on human rights and the environment.

...Battery passports

Battery passports, which digitally track a battery's production and use throughout its life cycle, are also a powerful tool that improves transparency. The Global Battery Alliance, a public-private consortium that includes original equipment and battery manufacturers, created the battery passport framework, which the private sector is beginning to adopt.

Improving traceability is no small feat; it will require private and public stakeholders to gather, store, and organise large amounts of data. Further complicating matters is the fact that there is no agreed-upon standard practice. However, traceability is essential and represents a cross-cutting policy feature. Without a framework to measure and manage the supply chain flow of these materials, all those involved in the EV battery supply chain cannot effectively reuse or recycle batteries.

2. Material transport and storage

Today, regulators treat used batteries as hazardous materials and hazardous waste regardless of a battery's state of health (SOH), which measures how a used battery compares to a new one and is not easy to determine. Batteries' classification as hazardous adds delays and costs to the battery reuse and recycling process. It also means that used batteries must be transported and stored in the same way as new batteries.

Currently, battery storage and transport account for 40–60 percent of battery recycling costs, which is why the private sector is hesitant to invest in recycling facilities and processes, as there can be little financial incentive to do so.

One way to incorporate more nuance into existing battery transport and storage practices is through transparent labelling of batteries. By revisiting these waste classifications and using battery diagnostics to provide clearer and more nuanced waste management distinctions, companies can transport and store batteries based on a battery's specific risk profile instead of using an expensive one-size-fits-all process.

Reducing the regulatory burden for batteries with remaining capacity will make it easier to seamlessly integrate battery reuse and recycling into the battery supply chain. Clearly listing SOH, remaining capacity, and chemistry on a battery can help regulators create more meticulous waste distinctions and remove the regulatory barriers for "healthier" batteries. Easy-to-access information on the battery's SOH can signify to market actors the level of degradation and remaining capacity, enabling stakeholders to identify the most viable secondary use.

3. Manufacturing and production

Currently, there is no requirement to design batteries with the primary intention of being easily recyclable, which means that every kind of battery must be disassembled in a specific way, making it difficult to scale battery recycling and repurposing**.** Also, the cost of extracting critical minerals from batteries after initial use is often higher than simply producing a new battery, discouraging recycling and reuse.

Effective policies will involve policymakers and businesses working together to determine how battery circularity can be profitable for any EV battery, regardless of vehicle assembly or battery chemistry. Standards requiring that batteries and EVs be manufactured in ways that make EV batteries easy to recycle and repurpose can encourage the implementation of these practices and ensure the costs of doing so are not passed on to consumers and insurers.

...home-grown batteries %

Although the Inflation Reduction Act, the US climate bill passed in 2022, does not include provisions that directly address battery circularity, it does require a specific percentage of battery materials to come from North America or countries with which the United States has a free-trade agreement (FTA). This stipulation has the potential to encourage more investment in recycling and repurposing facilities**.** Because it will likely take years to set up operational mines and processing facilities in North American and FTA countries, manufacturers are increasingly interested in exploring recycling and repurposing used batteries to help them meet the growing demand for EV batteries.

4. Recycling

Recycling - the extraction and reuse of battery materials in another product, including another battery - has the potential to reduce the demand for raw minerals by up to 64 percent by 2050. Recycled battery scrap - the residual materials discarded during battery production - alone can serve as critical input material, reducing the need for virgin critical minerals such as cobalt and nickel.

Policies that require manufacturers to meet recycling targets, like those enacted in South Korea, have the potential to meaningfully accelerate battery recycling. South Korea's legislation is also notable for providing dedicated funding to research and development to improve battery circularity.

The private sector is also exploring how to increase battery recycling in their business practices. For example, battery producers and original equipment manufacturers have formed joint ventures dedicating research and development funding toward battery recycling solutions: in 2021, Umicore and Volkswagen formed such a partnership, and in 2022, General Motors partnered with Lithion Recycling to develop a recycling strategy.

Simply put, effective policies should address recycled material content requirements, provide funding for research and development, and stipulate the recycling of manufacturing scrap. However, compliance with such policy frameworks will initially come with an upfront cost. Policymakers and industry leaders should work in tandem to align on what incentives are needed to help advance robust battery recycling.

5. Reusing

Battery reuse differs from recycling in that it involves upgrading a battery so it can be used again in an EV or other form of stationary energy storage. In different regions globally, it is found that policies that mandate extended producer responsibility (EPR) can help increase material repurposing and reuse by requiring that manufacturers assume responsibility for a product's end-of-life management once a consumer no longer uses it.

EPR policies shift financial and management responsibilities away from the public sector to manufacturers. Effective EPR policies also provide manufacturers with incentives to encourage them to incorporate environmental considerations into their products' design and packaging, making batteries that are easier to repurpose.

While policies that include EPR promise to increase battery repurposing, consumers risk footing the bill if manufacturers pass on the cost of complying with EPR to them. Another thing to consider when integrating EPR is its possible effects on existing vehicle scrappage and salvage companies: EPR policies can disrupt this market which is why hybrid approaches may be considered, allowing salvage companies to opt-in to EV end-of-life management.

In addition to integrating EPR, effective policies will include regulations that set reuse targets, define who is responsible for ensuring that EV batteries are repurposed and eventually recycled, and impose standards on the batteries' SOH**.**

We need a cohesive national policy

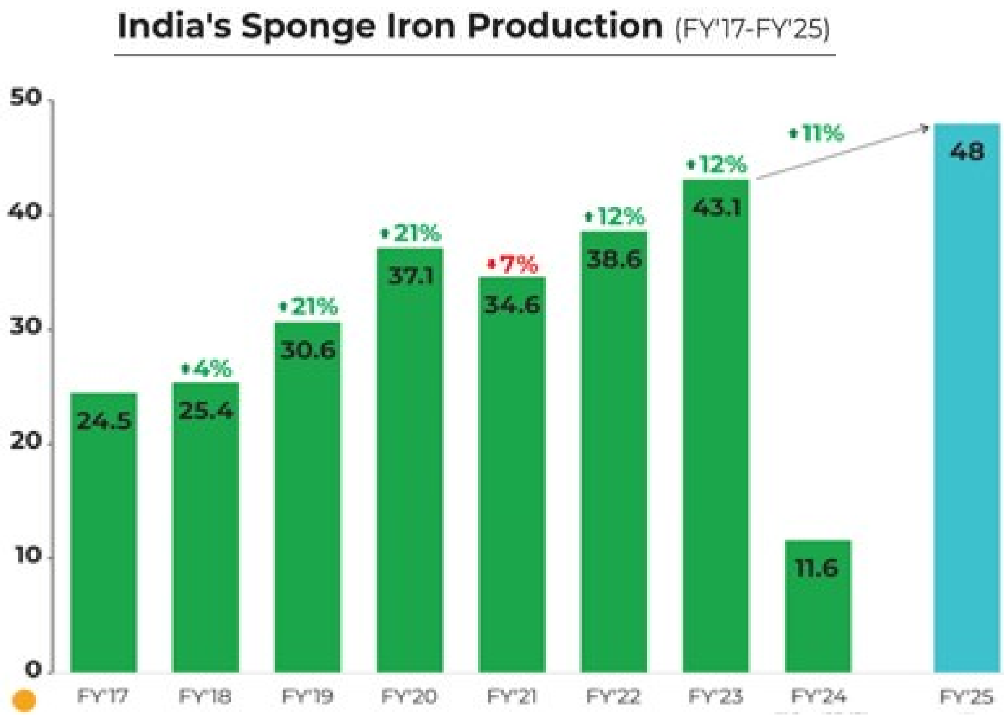
Well-thought-out policies are required to successfully create a circular battery economy. Without policy, industry stakeholders are not likely to prioritise or invest in recycling and repurposing efforts.

A cohesive national policy agenda on battery circularity will be the most effective strategy. A piecemeal approach with redundant and contradictory policies will not suffice, given the global scale of the battery supply chain.

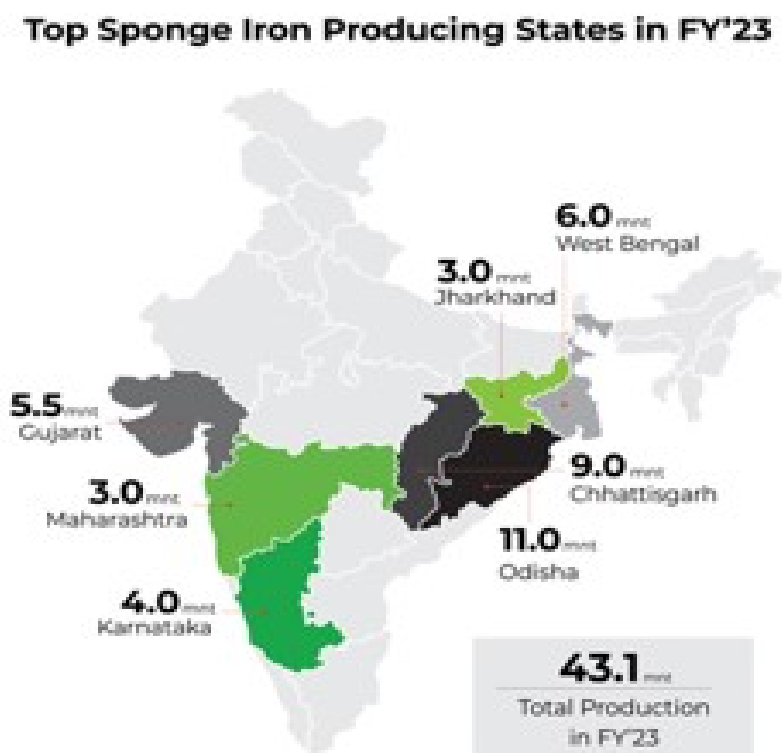
There is no one path to achieve a circular supply chain, but policy can and will be a driving impetus for its creation. Given the supply chain's complexity, and the many actors involved, each policy will necessarily include trade-offs; and businesses and policymakers will need to work together to improve traceability, reduce complexity, and provide incentives.

Source: Circular Bulletin, Edition 51, International Council for Circular Economy, July 2023

India's Sponge Iron Production



(Unit Million Tonnes)



India's sponge iron production is projected to increase by around 12% to 48 million tonnes (mnt) by financial year 2024-25 (FY25). Production has already witnessed a considerable growth of around 12% in FY23 to over 43 mnt from 38.60 mnt in FY22, with the country emerging as a key player in the global market.

State-wise production capacity

India's eastern region is the predominant player in DRI. The state of Odisha is India's largest DRI producer, with almost 15 mnt per annum (mntpa) to its credit which is 24% of the total production. This volume is expected to rise to around 16 mnt by 2025. Chhattisgarh, with 12.4 mnt (20%), stands as the second-highest producer and sees an increase to 13.6 mnt in two years' time.

West Bengal is third at 8 mnt, with an expected volume rise to 9.4 mnt in 2025 while Jharkhand anticipates an increase to 5.4 mnt from the present 4.9 mnt.

- Odisha seen retaining largest-producer tag by FY25
- Higher crude steel, pellet production to boost sponge output
- Larger role in billet production expected

India's top DRI producers

AM/NS India is the top DRI producer in India with a capacity of 7.83 mtpa, followed by the JSW Group with 6.71 mtpa. Tata Steel (3.17 mtpa), Jindal Steel & Power (3.12 mtpa), Shyam Metalics & Energy (2.71 mtpa) and Rashmi Group (2.18 mtpa) are in fifth and sixth positions respectively. Rungta Group is at seventh with 1.55 mtpa. While AM/NS India, JSW Group, Tata Steel and JSPL are seen having flat growth in production by FY25, others will expand capacity. Shyam Metalics contribution will possibly rise to 4.08 mtpa, and Rungta's to 2.32 mtpa.

Other producers include Prakash Industries (1.20 mpta), Shyam Industries (0.39 mtpa) and Real Ispat, whose output plans include an increase from the current 0.36 mtpa to 0.76 mtpa by FY25.

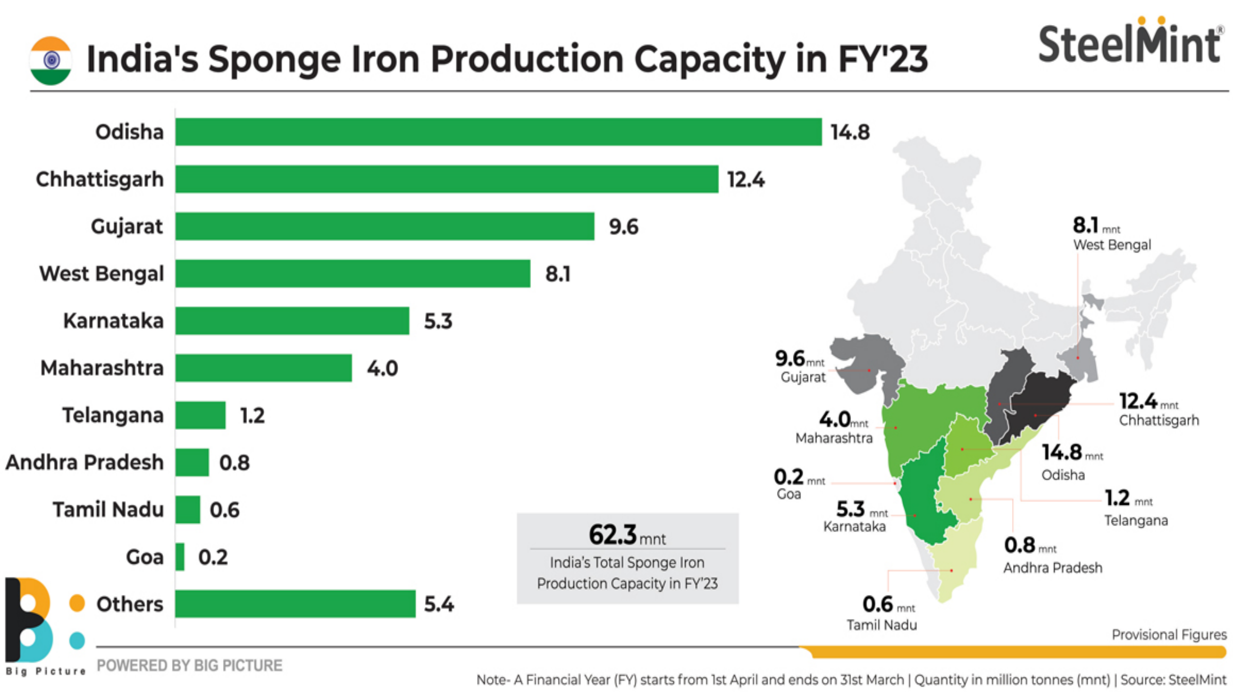
What factors will drive higher sponge iron production?

Rise in crude steel production

India's crude steel production has experienced significant growth, currently standing at approximately 126 mt. Around 45% of this is produced by the blast furnace-basic oxygen furnace (BF-BOF) route, with the rest being produced via the electric arc furnace-induction furnace (EAF-IF) method. It is estimated that crude steel production could touch around 145 mt by FY25, representing an overall growth of around 15%. This growth will directly impact upward the demand for sponge iron as a raw material, especially since the EAF-IF segment, whose key raw material is sponge iron (along with scrap), will still hold sway by FY25.

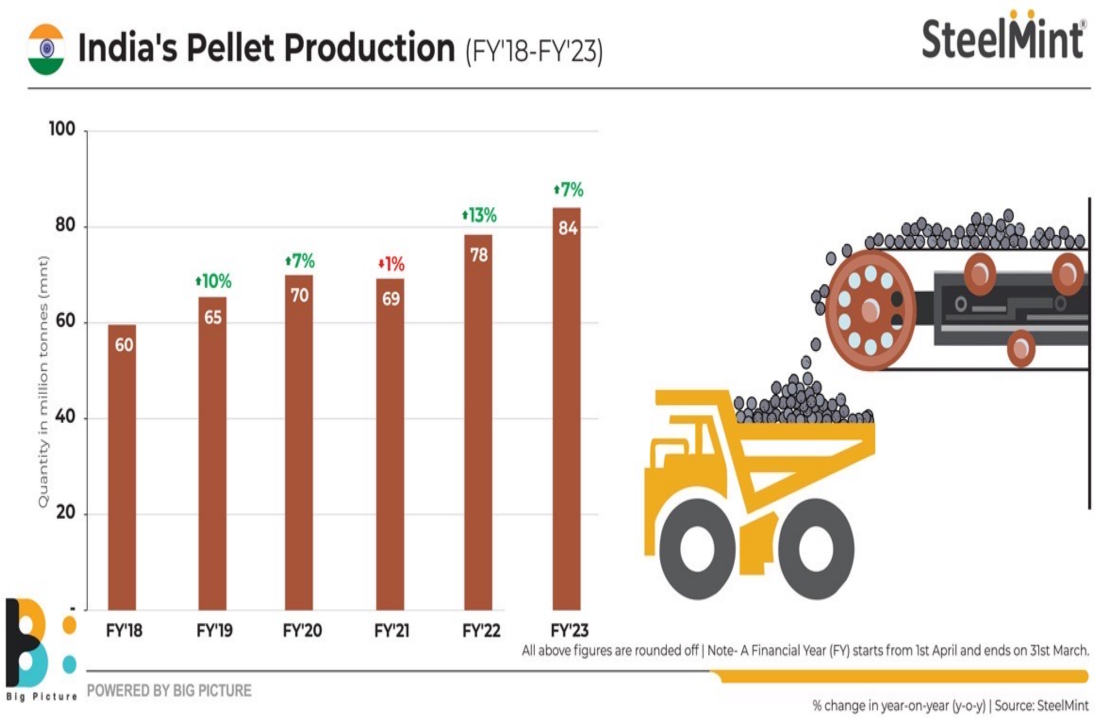
Expected increase in DRI capacity

DRI has gained prominence as an alternative to melting scrap in India's induction and electric arc furnaces. Currently, DRI has about 30% share in India's total crude steel-making. With an annual installed capacity of approximately 63 mt in FY23, India stands as the world's largest DRI producer. India's DRI capacity is set to reach 68 mt by FY25, representing an 8% growth compared to FY23.



Increasing pellet production

Pellet is a key raw material for manufacturing sponge iron. In FY23, India's pellet production rose an estimated 7% to 84 mt, from 78.40 mt in FY22. Production increased on the back of capacity increase of 18% to 133.3 mt in FY23 from 112.5 mt in FY22. Higher pellet output is also seen driving up sponge production over the next couple of years.

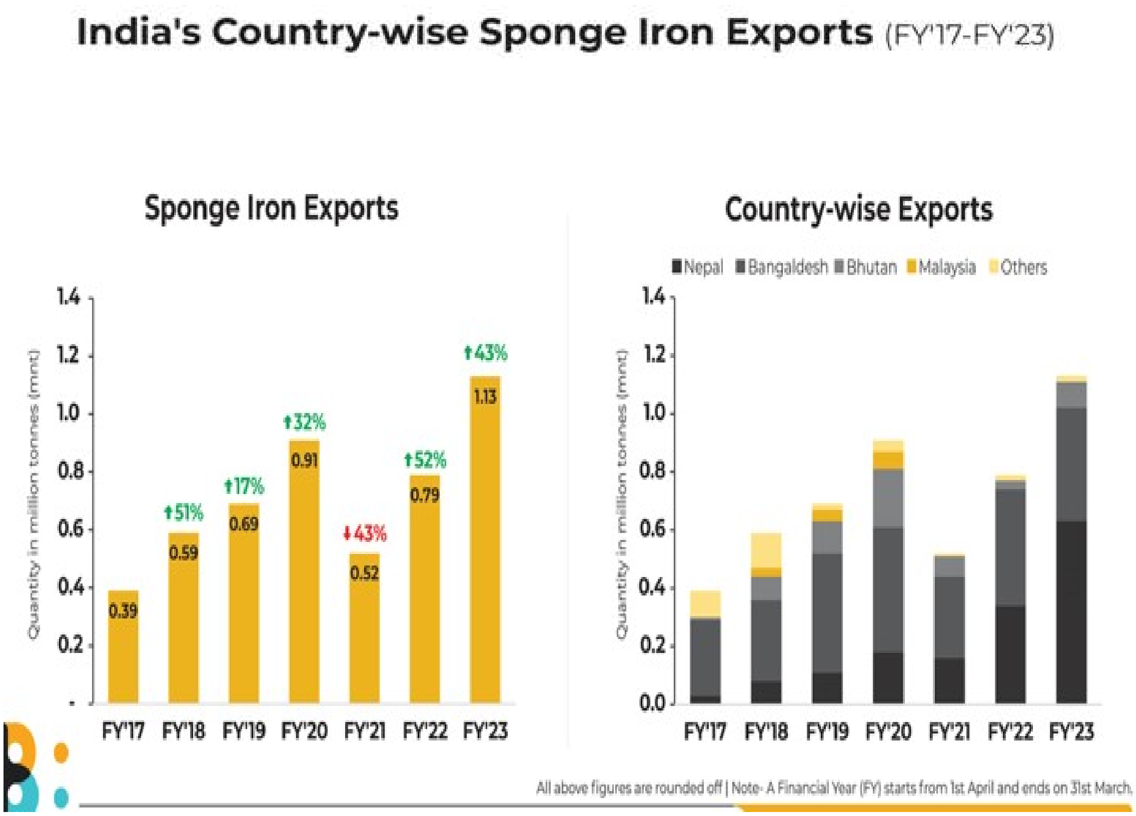


Greater role in billet manufacturing

Scrap imports have decreased but domestic sponge iron output has increased. Hence, furnace owners have modified their procedures to rely increasingly on sponge iron as a scrap substitute in billet manufacturing. For instance, the eastern market usually makes 85% usage of sponge iron in billet-making, the balance 15% being scrap and pig iron. However, Maharashtra and the adjacent belts, which habitually used 75% scrap and 25% sponge, are switching to a scrap:sponge ratio of 65:35 amid lesser scrap availability. The rising use of sponge iron in billet manufacturing demonstrates the industry's flexibility and adaptability in responding to shifting market conditions. This trend is likely to continue since scrap will increasingly become a scarce commodity as countries adopt green steel-making measures.

Sponge iron exports increase

India is also a significant exporter of sponge iron, primarily to Nepal, Bangladesh, and Bhutan. India's sponge iron exports hit a record high of 1.16 mt in FY23, up 49% from 0.78 mt in the preceding fiscal. The increase in melting capacity in Nepal was primarily responsible for the trend. Nepal is increasing its DRI usage while lowering billet imports. The country's mills have increased melting capacities, and it appears that they prefer to manufacture billets from sponge iron rather than import semi-finished steel. Nepal's increasing dependency on India's sponge iron is likely to continue into the long term.



Looking ahead

It is worth mentioning that as India's infrastructure and construction continue to gain momentum, demand for steel and its raw materials is expected to stay strong. This spells good news for sponge manufacturers.

Summary

India's DRI production is projected to increase by around 12% to 48 million tonnes (mt) by financial year 2024-25 (FY25). Production has increased by around 12% in FY23 to over 43 mt from 38.60 mt in FY22, with the country emerging as a key player in the global market.

DRI has about 30% share in India's total crude steelmaking.

India's Top DRI Producers

- AM/NS Ltd.: 7.83 mtpa
- JSW Group: 6.71 mtpa
- Tata Steel: 3.17 mtpa
- Jindal Steel & Power: 3.12 mtpa
- Shyam Metalics & Energy: 2.71 mtpa
- Rashmi Group: 2.18 mtpa
- Rungta Group: 1.55 mtpa.

Source : Steelmint Bureau

Blue Blast Furnace

Even before steelmaking customers opt for a complete changeover in technology, gradual and staged – though nevertheless substantial – reductions in the CO_2 footprint can be reached in the short and medium term by retrofitting innovative, resource-saving solutions onto the existing installed equipment.

Currently, Paul Wurth is extending its offering of technologies designed to gradually reduce CO_2 emissions in the classic blast furnace process, thereby creating a sensible balance between ambitious environmental targets and economic constraints. This 'blue' blast furnace is capable of substantially reducing the carbon footprint of this established and proven technology.

Reality Check: Natural Gas's True Climate Risk

Methane leakage as low as 0.2 percent puts gas's climate impact on par with coal.

For decades, natural gas has been touted as a safer climate alternative to fossil fuels such as coal. Even the word "natural" suggests its alignment with sustainability goals - a misnomer that has, until recently, largely flown under the radar of public scrutiny. But factoring in methane releases from unintentional leaks and intentional venting throughout the natural gas supply chain quickly calls those climate-safe credentials into question.

Proponents of natural gas often cite that it emits 50 percent less of the climate pollutant carbon dioxide (CO_2) than coal, based on its end-use combustion alone. That CO_2 calculation gives rise to the Environmental Protection Agency's (EPA) 2021 report that US greenhouse gas (GHG) emissions "continued downward largely due to the growing use of natural gas and renewables to generate electricity in place of more carbon-intensive fuels."

The reality

Natural gas and coal have significant life-cycle emissions of CO_2 and other climate pollutants like methane throughout their supply chains from extraction to end use. Many coal-to-natural gas comparisons consider only end-use combustion, factoring in emissions from a power plant or home furnace. This leaves out total GHG life-cycle emissions created by extracting, shipping, and processing natural gas and coal. In reality, methane leakages drive emissions parity between gas and coal, especially through the gas supply chain.

Why methane is low-hanging fruit

Methane comprises roughly 70 to 90 percent of gas. So, when natural gas leaks, mostly methane is released. As a climate pollutant, methane is over 80 times more potent than CO_2 across a 20-year period.

While CO_2 has dominated mainstream conversations about climate change and emissions reduction strategies, tackling methane can deliver bigger reductions, at lower costs, sooner. Compared to the more complex global strategies to slash CO_2 emissions for a safer climate future, cutting methane is low-hanging fruit.

It is concluded that leaky gas is as damaging to the climate as coal. Two percent methane release puts gas's climate risk on par with coal. However, when considering the net emissions from all natural gas and coal greenhouse gases (including CO_2, methane, and sulfur dioxide), the climate risk for natural gas and coal is on par at just 0.2 percent methane leakage. Ongoing aerial surveys and a growing constellation of satellites are finding that methane leaks are far more frequent and intense than previously assumed. Massive methane plumes make it clear that production equipment alone can persistently leak beyond that 0.2 percent threshold. Tighter methane detection and reporting will be imperative to protect the climate.

Where methane shows up in the gas supply chain

Emissions of methane from the gas supply chain fall into two main categories: unintentional and intentional releases.

Unintentional releases of methane into the atmosphere come from the malfunctioning of gas field equipment like well pads, valves, and compressor stations. Catastrophic failures, like well blowouts can pump hundreds of tons of methane into the atmosphere for weeks or months. The same goes for gas pipelines. The September 2022 Nord Stream pipeline explosion released over a half million tons of the climate pollutant over the course of a week. But many methane releases go unnoticed unless a methane-detecting satellite or sensor happens to make them visible.

Intentional releases are predominantly linked to venting and flaring. Flaring is the term used for burning off unwanted gas in the oil and gas system. Incomplete combustion of that gas leads to its release into the atmosphere as methane. Recent studies have shown that unlit or inefficient flares are releasing five times more methane than previously thought.

Stopping methane at the source: it's cheap and easy

A majority of global gas and oil assets from 2015 to 2022 reveals that methane drives one-half of oil and gas industry GHG emissions. Fortunately, strategic interventions to cut methane emissions in the natural gas supply chain are relatively simple and cost-effective compared to the complexity and expense of decarbonizing the global economy. Prohibiting venting and routine flaring and incorporating routine equipment fixes and upgrades into maintenance plans can significantly cut methane emissions from production sites.

Emissions transparency throughout oil and natural gas supply chains can help policymakers and industry leaders act on specific interventions and emissions reduction solutions to stop methane leakage and wasted gas. Industry action could also boost profits by earning premium pricing for low-emissions natural gas and avoiding regulatory fines like the Inflation Reduction Act's Methane Fee.

Natural gas produced and delivered for consumer end use with zero leakage has 30 percent fewer greenhouse gas emissions than coal. As long as this fossil fuel remains in the global energy mix, it is essential that industry leadership combined with strong policy, financial incentives, and technology innovation are urgently applied to cut methane across the natural gas supply chain. In this decisive decade, where a 50 percent cut in greenhouse gas emissions is needed across the global economy to remain on track for a safer climate future, methane cuts are an immediately actionable step to prevent waste and avoid catastrophe.

Source : RMI Spark Newsletter | July 20, 2023

Hyundai Steel to Open Carbon-neutral Steel Lab by 2023

Hyundai Steel Co., a unit under South Korean auto giant Hyundai Motor Group, is set to kick off research on hydrogen-based steelmaking as its new lab will open by the end of this year in Dangjin Integrated Steelworks, South Chungcheong Province, about 90 kilometers southwest of Seoul. The company broke ground on the lab with 680 square meters of flooring area late last year. At the new building, it will develop technologies on hydrogen-fueled steelmaking and study some types of hydrogen that are generated by natural gas reforming and electrochemical processes.

Hyundai Steel will start empirical research on hydrogen-based steel by the end of this year, with an aim to achieve carbon neutrality by 2050. The company is developing technologies related to fluidized bed reduction reactors, which Korean steel giant POSCO Group is planning to use at its Pohang steel complex pilot facility from 2026.

The Ministry of Trade, Industry and Energy said in February of this year that it aims to complete the development of basic technologies for the reactors by 2025 with a 27 billion won ($20.7 million) investment and execute empirical studies on the production of 1 million tons of steel by 2030. The government also plans to alternate shaft furnaces across the country with 14 fluidized bed reduction reactors by 2050.

In addition to the reactor study, Hyundai Steel is developing an electric arc furnace that can melt raw materials and remove impurities. The company plans to connect the new furnace with hydrogen-fueled steelmaking facilities to achieve its net zero goal. Hyundai Steel will operate the new facilities with the hydrogen produced by the natural gas reforming and electrochemical processes first, the company said. Compared with green hydrogen, this type of hydrogen has lower purity and generates more carbon during the production process but is more price competitive.

Source : The Korean Economic Daily, July 10, 2023

ArcelorMittal and IIT Madras to Mentor Start-ups Focused on Industrial Decarbonisation Technologies

ArcelorMittal today announced that its XCarb™ Innovation Fund is launching an accelerator programme to fund and support the next wave of breakthrough ideas on decarbonisation emerging from India.

Launched in 2021, the XCarb™ Innovation Fund invests in companies developing technologies that hold the potential to accelerate the steel industry's transition to carbon neutral steelmaking. Its inaugural accelerator programme, launched globally in 2022, received an overwhelmingly positive response. Over 90 start-ups from five different continents submitted applications, with CHAR Technologies, which is developing a high temperature pyrolysis technology that transforms organic waste streams into valuable energy outputs, selected as the winner, securing a $5 million investment in the process.

In recognition of India's ambition, capabilities and unique challenges in supporting the global energy transition, ArcelorMittal is now launching a dedicated XCarb™ Accelerator Programme targeted at the country's deep ecosystem of technology start-ups, now recognised as the third largest after the US and China.

For the XCarb™ India Accelerator Programme, ArcelorMittal is collaborating with the Indian Institute of Technology Madras ('IIT Madras'), whose pedigree in nurturing ideas and mentoring will be applied to support start-ups or early-stage companies selected, enabling them to scale their technologies and business models from lab to the market.

The programme will also be supported by ArcelorMittal's joint venture, AM/NS India, which is actively developing its own decarbonisation strategy and initiatives for lower emissions domestic steel manufacturing. Successful participants will have access to expertise, resources and advice from ArcelorMittal and AM/NS India.

Applicants to the Accelerator Programme will need to be start-ups or early-stage companies with concepts for commercially scalable technologies that hold strong potential to decarbonise steelmaking. Submissions are invited across four distinct technology domains:

1. Raw materials and circularity
    a. Iron ores and scrap quality improvement
    b. Steelmaking by-products valorisation (i.e steel slags)
    c. Biomass valorisation, waste to gas or biocarbon

2. Disruptive steelmaking for process decarbonation
    a. Reduce fossil fuel usage
    b. Gas heating technologies

3. Clean energy technologies
    a. Renewable energy sources
    b. Hydrogen technologies
    c. Energy storage technologies

4. Gas reforming and gas transformation technologies
    a. Capture and separation of CO_2
    b. Conversion of CO_2 to C or CO
    c. Carbon capture and storage or utilisation
    d. CO_2 transformation or valorisation to chemicals

The India Accelerator Programme will commence with a three-day workshop at IIT Madras to introduce start-ups to the faculty, followed by a comprehensive 8–10-week mentorship program to prepare finalists for their pitch to the

XCarb™ Innovation Fund Investment Committee, chaired by Aditya Mittal, CEO of ArcelorMittal. Finalists can seek an equity investment or a potential research collaboration.

Prioritising the reduction of carbon intensity in steel production remains at the core of long-term strategy of ArcelorMittal. Carb™ Innovation Fund exists to find the most exciting global ventures focused on steel decarbonisation and India's record as a technology leader, combined with its efforts to become a climate leader, makes it a natural destination for the fund's second Accelerator Programme.

ArcelorMittal is already making important strides in developing an industry-leading portfolio of decarbonisation technologies but is continuously seeking additional opportunities to expedite the progress. The participants can leverage dual benefits from this platform; ArcelorMittal's advice and expertise in research and development and IIT Madras' technical know-how through a commercialisation and business mentorship programme to harness the potential of decarbonisation technologies for the steel industry and the planet on the whole.

This partnership allows IIT Madras to combine their technical expertise, and long track record of supporting the Lab-to-Market journey of disruptive deep-technologies along with ArcelorMittal's industry excellence, creating a powerful ecosystem to support the growth of the innovative Indian start-ups."

Source: ArcelorMittal website,11 July 2023

Carbon-Negative Bioenergy: A Key Player in the Circular Economy

The advent of carbon-negative bioenergy has emerged as a revolutionary player in the advancement of the circular economy, promising to not only provide sustainable energy but also to actively combat climate change by reducing atmospheric carbon dioxide levels. This innovative technology, which effectively reverses the carbon emission process, could be the key to a sustainable future.

Carbon-negative bioenergy, also known as Bioenergy with Carbon Capture and Storage (BECCS), involves the burning of biomass to generate energy, while simultaneously capturing and storing the resulting carbon emissions. This process essentially creates a carbon sink, where more carbon is absorbed and stored than is released into the atmosphere. As a result, BECCS has the potential to be not just carbon-neutral, but carbon-negative, making it a powerful tool in the fight against climate change.

The role of carbon-negative bioenergy in the circular economy cannot be overstated. The circular economy is a sustainable economic model that aims to eliminate waste and the continual use of resources. It employs recycling, reusing, and remanufacturing to create a closed-loop system, minimizing the use of resource inputs and the creation of waste, pollution, and carbon emissions. The integration of BECCS into this model could significantly enhance its effectiveness.

The use of biomass in BECCS provides a perfect example of the circular economy in action. Biomass, such as agricultural waste or specially grown energy crops, absorbs carbon dioxide from the atmosphere as it grows. When this biomass is burned for energy, the carbon it absorbed is released. However, with BECCS, this carbon is captured and stored, preventing it from re-entering the atmosphere. The biomass can then be regrown, absorbing more carbon and continuing the cycle.

Moreover, the captured carbon has potential uses that further contribute to the circular economy. It can be used in a variety of industrial processes, including the production of biofuels and plastics, further reducing the need for fossil fuels. In addition, it can be used in enhanced oil recovery, where it is injected into depleted oil fields to increase their productivity, or even stored underground for long-term sequestration.

However, the implementation of carbon-negative bioenergy is not without its challenges. It requires significant investment in infrastructure and technology, as well as careful regulation to ensure the sustainable sourcing of biomass and the safe storage of captured carbon. Despite these challenges, the potential benefits of BECCS make it a compelling solution for a sustainable future.

In conclusion, carbon-negative bioenergy represents a promising avenue in the pursuit of a circular economy. Its ability to not only generate sustainable energy but also actively reduce atmospheric carbon levels positions it as a key player in the fight against climate change. While challenges remain in its implementation, the potential benefits of this innovative technology make it an exciting area of research and development. As we strive towards a sustainable future, carbon-negative bioenergy could play a pivotal role in shaping our energy landscape and advancing the circular economy.

Source: EnergyPortal.eu, 22.723, International Council of Circular Economy, Newsletter, 25.7.23