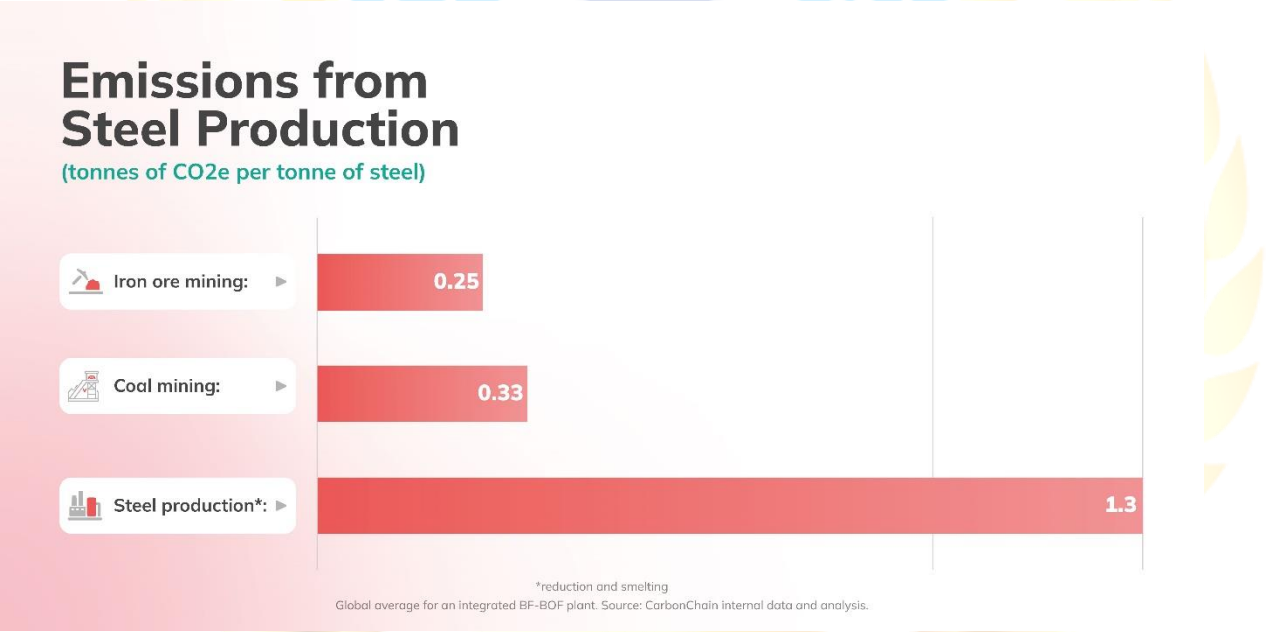
STEEL SECTOR DECARBONIZATION - ECONOMY

In response to escalating environmental concerns and the global movement towards sustainable industrial practices, the Ministry of Steel is formulating financial strategies to endorse decarbonization initiatives within the steel sector. This proactive stance aims to mitigate the environmental impact of steel production and align with international sustainability goals.

Steel Sector Decarbonization Options

Strategic Initiatives

- **Performance-Linked Incentives (PLI):** The Steel Ministry is evaluating the use of PLI schemes for funding decarbonization initiatives. These are still under discussion and require finalization.
- **Financial Projections:** A comprehensive decarbonization strategy will necessitate an estimated USD 300 billion, covering USD 13 billion for small steel mills upgrades and USD 150 billion for cutting-edge technologies like iron direct reduction and carbon capture.



Technological Innovations

- **Direct Iron Reduction:** This process eliminates oxygen from iron ore without melting, contrasting traditional blast furnace operations.
- **Policy Development:** The formulation of India's Green Steel Policy, incorporating multiple PLI schemes, is currently underway but remains in preliminary phases.
- **Alternative Energy Sources:** Considering natural gas as a substitute for coal or coke in blast furnaces to decrease emissions.

Efficiency and Emission Control

- **Energy Usage:** Energy consumption in Indian steel plants averages 6-6.5 Gigacalorie (Gcal)/tonne, surpassing the 4.5-5 Gcal/tonne used in foreign facilities, mainly due to the prevalent use of coal and outdated technology.
- **CO2 Intensity Reduction:** Aiming to lower CO2 emissions from 3.1 T/tcs in 2005 to 2.64 T/tcs by 2020, with a target reduction to 2.4 T/tcs by 2030, equating to a 1% annual decrease.

Regulatory and Trade Considerations

- **Import Regulation:** Strategies are being developed to shield the domestic industry from competitive foreign markets through pricing strategies, elevated import duties, and safeguard measures.
- **Trade Balance:** Efforts to mitigate the transition from a net steel exporter to a net importer with a 1.1 million tonne deficit in 2024 are integral.

Understanding Decarbonization in the Steel Sector

Definition and Importance

- **Decarbonization Explained:** It involves reducing CO2 emissions and the carbon footprint associated with steel production, leading towards the creation of Green Steel.
- **Crucial for Sustainability:** Vital for addressing climate change and enhancing sustainability within the sector.

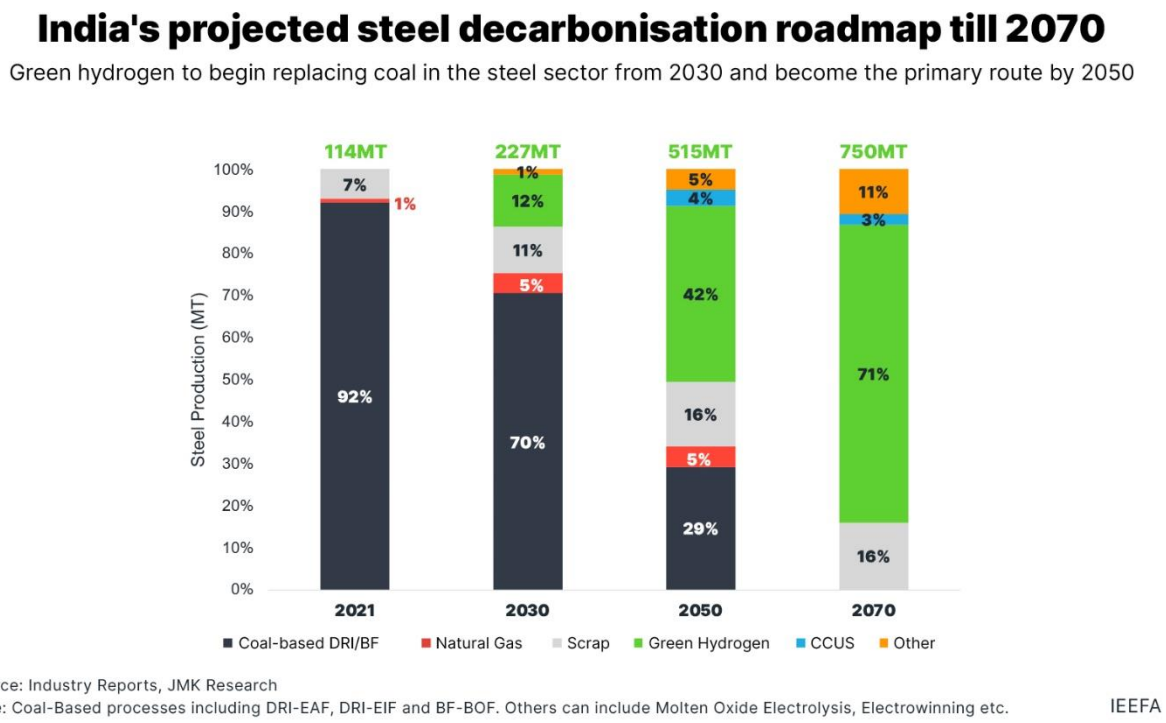
Industry Dynamics

- **Production Capacity:** India ranks as the second-largest crude steel producer globally, with significant production capacities.
- **Consumption Patterns:** Current per capita steel consumption in India stands at 97.7 kg, significantly below the global average but set to increase per national policy goals.

National and Global Commitments

- **Greenhouse Gas Management:** India, which houses 17% of the global population, contributes to only 4% of global greenhouse gas emissions but is committed to substantial green initiatives.

- **Future Goals:** Aligning with the 2070 net-zero targets, the steel industry's decarbonization is essential for meeting both national and international climate objectives.



Green Steel Production

- **Innovative Practices:** Focus on manufacturing steel through sustainable means such as green and blue hydrogen—produced from renewable electricity and fossil fuels with carbon capture, respectively.
- **Strategic Importance:** Enhancing the development of green steel is crucial for significantly reducing the industry's carbon footprint and supporting global sustainability efforts.

Unique Challenges to Decarbonizing India's Steel Sector

- **Material and Resource Constraints**: Unlike developed countries that rely more on scrap and have access to low-carbon fuels, India faces a shortage of sufficient scrap and contends with expensive natural gas.
- **Energy Source Limitations**: Predominantly using low-grade coal and iron ore, India experiences elevated emissions and energy consumption.
- **Emission Intensity**: The emission intensity for Indian steel stands at 2.54 tonnes of CO_2 per tonne of crude steel, surpassing the global average of 1.91.
- **Energy Production Methods**: Integrated steel plants in India predominantly use coal-based captive power plants, resulting in higher emissions compared to those utilizing cleaner energy sources internationally.

- **Research and Development**: R&D in India is crucial yet underfunded, with only 0.64% of GDP invested, and a limited private sector contribution, hindering the advancement of critical technologies like hydrogen-based direct reduced iron (DRI).
- **Financial Hurdles**: The transition to greener technologies in the steel sector is financially daunting, estimated to require between USD 5.2 to 6.1 trillion globally, with Indian steel plants alone needing approximately USD 283 billion.
- **CO2 Monitoring Challenges**: Effective CO2 emissions monitoring is hampered by complex supply chains, fragmented data, and a lack of skilled carbon management professionals.

Government Initiatives Promoting Steel Industry Decarbonization

- **Strategic Task Forces**: Under the Ministry of Steel, 14 task forces aim to develop and recommend decarbonization strategies.
- **Steel Scrap Recycling Policy**: Enacted in 2019 to enhance the circular economy through increased scrap availability and metal scrapping centers.
- **National Green Hydrogen Mission**: Focused on boosting green hydrogen production, crucial for the steel industry's transition to lower emissions.
- **Vehicle Scrapping Rules**: Introduced to augment scrap material availability for steel production.
- **National Solar Mission**: Promotes solar energy utilization to reduce emissions within the steel sector.
- **PAT Scheme**: A part of the National Mission for Enhanced Energy Efficiency aimed at incentivizing significant energy savings.
- **Carbon Credit Trading**: Launched in 2023 to facilitate carbon credit exchanges, aiding emission reduction at reduced costs.

Strategies for Steel Sector Decarbonization

- **Energy Efficiency**: Leveraging the PAT scheme has already yielded significant energy savings, exceeding initial targets.
- **Technological Upgrades**: Adopting Best Available Technologies (BATs) can further reduce energy intensity, though challenges like retrofitting and high costs remain.
- **Process Enhancements**: Improving ore beneficiation and pelletization could decrease reliance on coke, enhancing productivity.
- **Hydrogen Utilization**: Exploring 100% hydrogen-based DRI and hydrogen injection methods to cut down on coke usage and reduce emissions.
- **Carbon Capture Utilization and Storage (CCUS)**: Seen as essential for deep decarbonization, aiming to mitigate up to 56% of existing emissions.
- **Biochar Integration**: Utilizing biomass-derived biochar offers a promising route to replace or reduce fossil fuel usage in steel production, with potential significant emission reductions.

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