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Roadmap for decarbonisation of Indian Steel sector-

Presentation Workshop Organised by World Steel for National and Regional Associations

December 1st, 2025

Global Scenario

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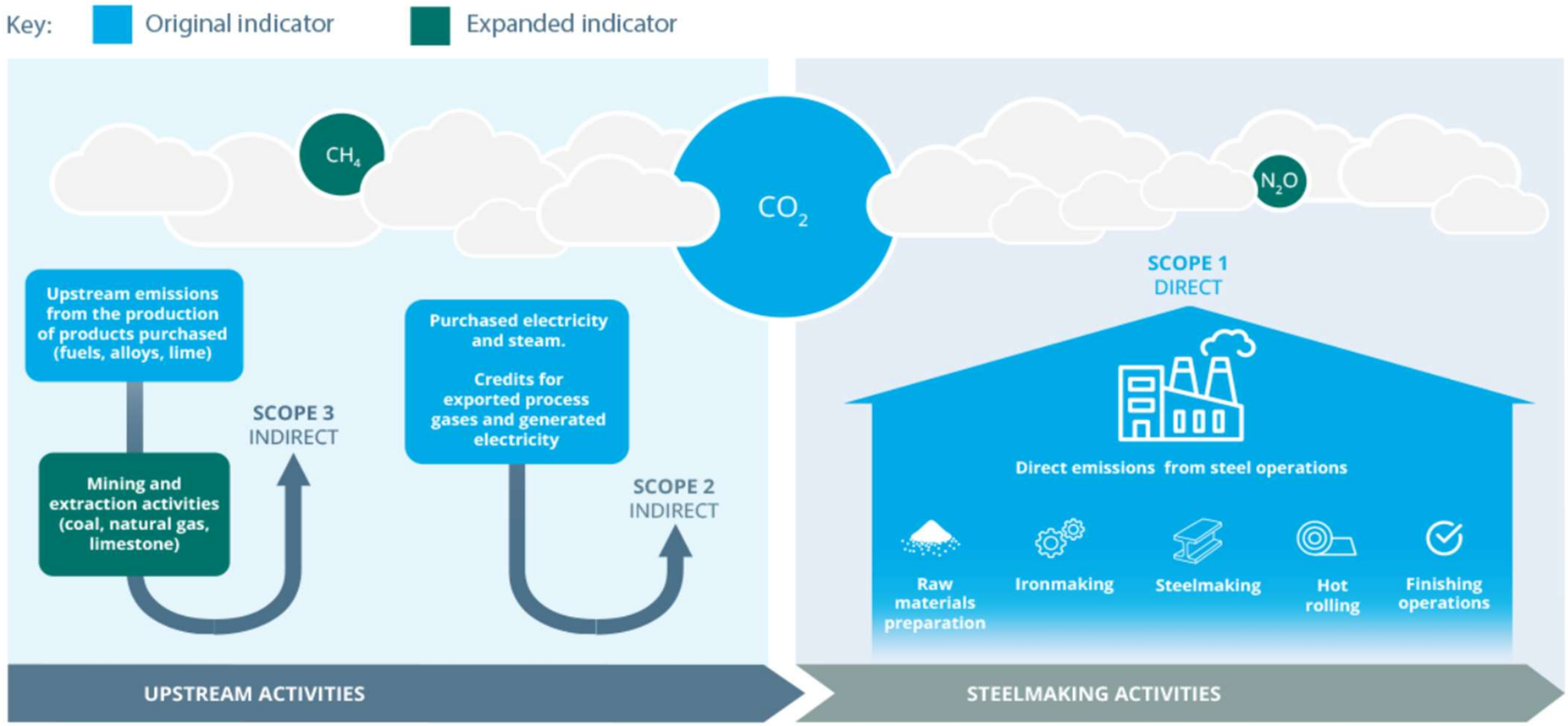
New Global GHG Emission Intensity- 2024

	BF-BOF (Scrap use - 10%)	Scrap-EAF (Scrap use >70%)	DRI-EAF (Scrap use <30%)	Global
Original Indicator	**2.34**	**0.69**	**1.47**	**1.92**
Direct CH_4 and N_20 (GWP 100)	0.09	<0.01	<0.01	-
Upstream mining $C0_2$ only	<0.01	<0.01	0.01	-
Upstream mining CH4 and N20 (GWP 100)	0.23	0.03	0.18	-
Expanded indicator	2.66	0.71	1.66	2.18

Source –WorldSteel

New Global GHG Emission Intensity- 2024 Contd

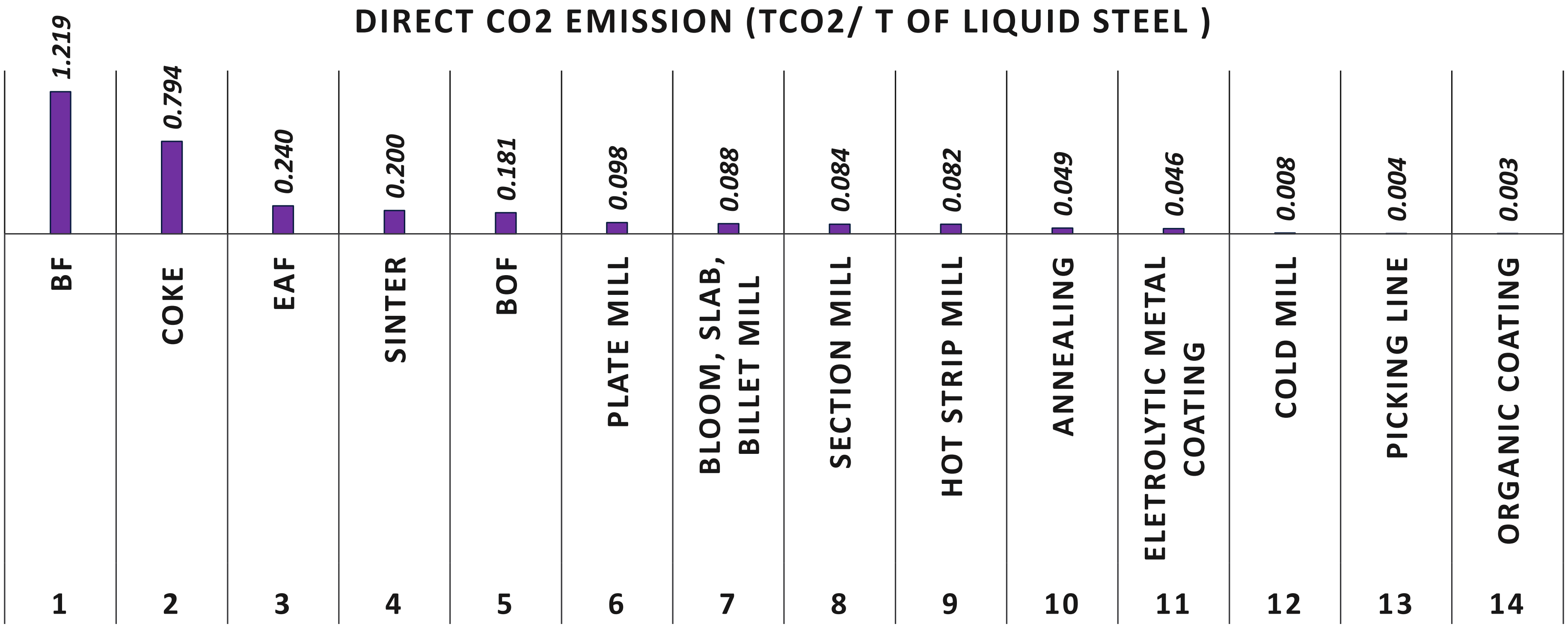
Expanded indicator vs original indicator



Transportation and downstream activities are not included in our scope 3 calculation.

Source –WorldSteel

Unit and Process Wise Steel Plant- Direct CO2 Emission



Rank Wise Emission- Unit of Plant

Source - JRC Scientific & Policy Reports, From the EU Commission

Indian Steel Industry

Growth Trajectory

The Steel Industry remains a cornerstone in driving India's economic trajectory and future growth ambitions

Steel is a crucial part of the Indian economy…

~18%	*Contribution of steel to India's manufacturing GDP*
2.6Mn	*People employed in the Steel and allied industries*
~35%	*Contribution of MSMEs to India's steel capacity*
2nd	*Largest Steel consumer in the world at ~100kg per capita consumption*

… and will continue to play a pivotal role in India's security and future growth

Pillar for national priorities: Steel is the core driver of India's infrastructure and national ambitions such as **Clean Mobility, Smart Cities, Affordable Housing, Make in India**—which will be essential to achieving the **$5 trillion economy target**

Pre-requisite for GDP growth: Sufficient steel capacity is vital for sustaining India's GDP growth trajectory (7-8%), given steel's **1.4X output multiplier** and **6.8X employment multiplier**, translating into sustained economic activity and long-term value creation

Ensuring self-reliance: India must rapidly expand **steel production capacity** to address **critical defense and infrastructure demands**, reinforcing **domestic supply chain resilience** and the goal of **Atmanirbhar Bharat**

Crucial for Indian Defense: Approximately **15-20% of India's steel output** supports the top 5 defense arenas, underscoring its pivotal role in producing **tanks, warships, aircraft, missiles**, and other defense infrastructure

Source: IBEF and PIB industry reports, Ministry of Steel reports

US$5T GDP Vision | *Key Government Initiatives expected to drive Steel Growth*

Atmanirbhar Bharat

- Steel is strategically a principal industry for economic development – recognized as Champion sector
- Steel contributes 2.3% of GDP & has output multiplier of 1.4x, employment multiplier of 6.8x

Production-linked incentive

- The Union Cabinet has approved PLI scheme of Rs 1.46 lakh crore for 10 key sectors to boost India's manufacturing capabilities and enhancing exports (auto & components; White goods; renewables; manufacturing – electronics)
- Rs 6,322 crore has been allocated to Specialty steel by the Finance Minister

Steel scrap policy

- To ensure adequate availability of scrap for steel manufacturers which will reduce imports and improve competitiveness of Indian steel sector

Cluster Policy for Steel Hubs

- The Ministry of Steel has proposed setting up integrated steel hubs similar to the ones in Korea, China and Germany.
- The hubs would support the growth of the steel sector.

Investment in Steel Intensive Sectors

- India plans to increase refining capacity to 400 MMTPA by 2024.
- $58 bn will be invested in E&P by 2023
- $60 bn will be invested in natural gas infrastructure by 2024
- Rs 3.5 lakh crore allocated to be spent in 2019-24 to provide safe drinking water to every rural household by 2024.

Railway & Industrial Corridor

- Pan India Road & Freight Corridors under Construction using Steel as a major raw material

High Speed Rail & Metros

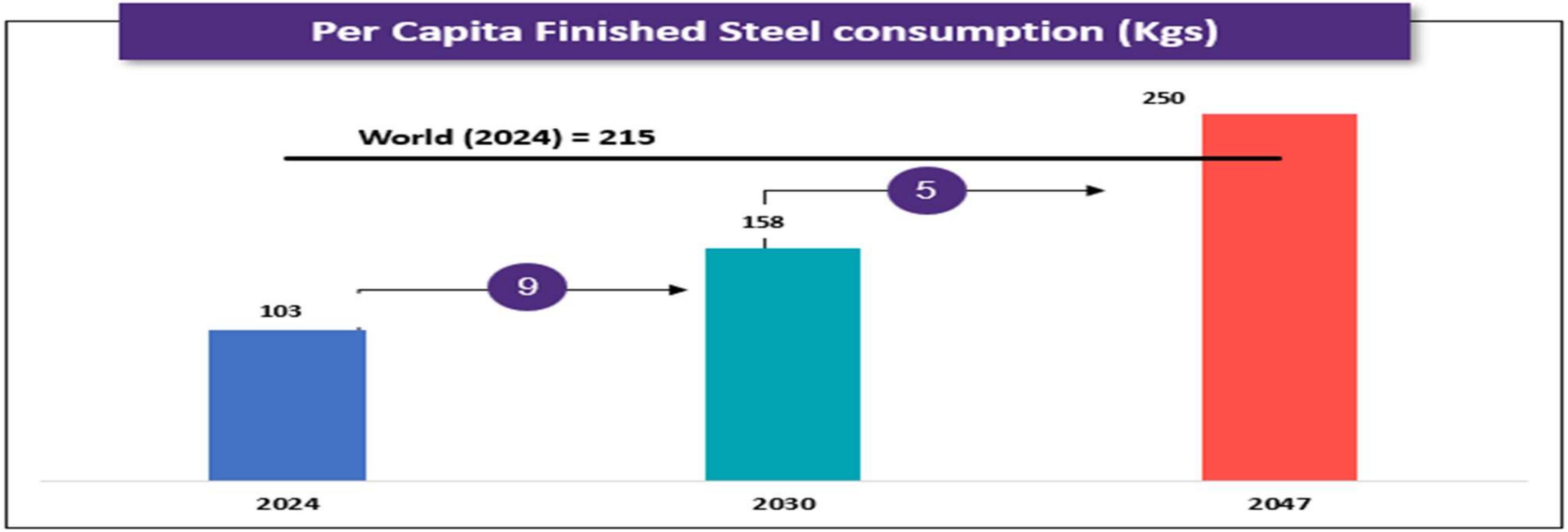
- The government is planning to invest Rs 10 trillion into seven new bullet train projects across the country
- First HSR project underway between Mumbai-A'bad with a cost of Rs 1.1 trillion

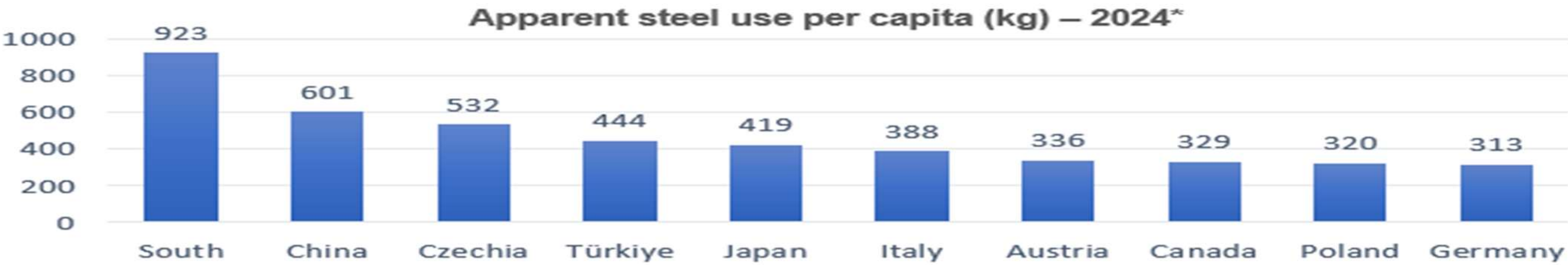
Real Estate - Investment

- Approval of INR 25,000 Crore ($ 4Bn) investment to enable completion of stalled housing projects,
- Interest subsidies for 1st time home buyers of upto 4%

Improving competitiveness for Indian Investments and FDIs, govt. focus on development of steel-consuming sectors

India's has to grow- Per Capita Steel Consumption vis-à-vis Other Countries





- **India has to grow to 300 Mnt Steel Capacity by 2030-31 with Per Capita Consumption of 158 Kg**
- **The Steel Capacity has to go to 500 Mnt by 2047 with appx. Per Capita consumption to 250 Kg**

*Source: * World Steel Association,*

Declared Nationally Determined Contributions (NDC) and Targets Set 2005

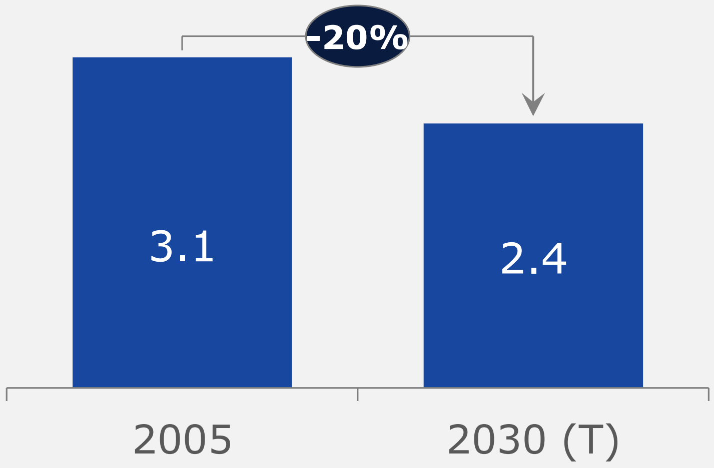
And Industry Composition

India as a country Journey based on Declared NDC since 2005

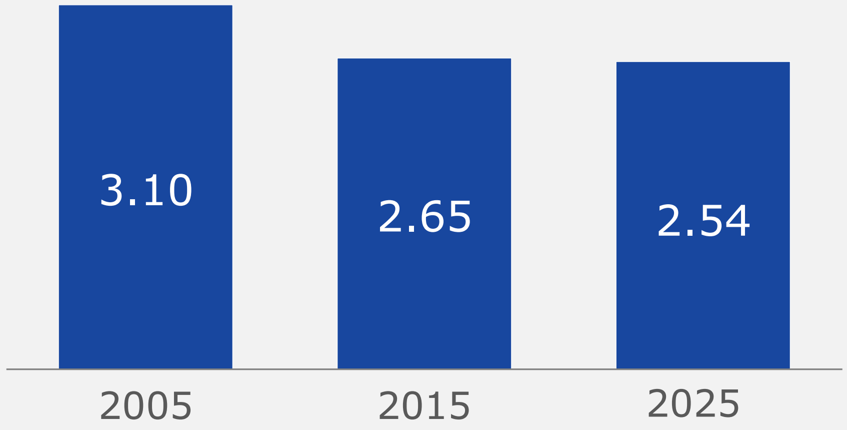
The Ministry of Steel, GOI has committed a reduction of carbon dioxide to ~2.4 tCO_2/tcs by 2030 from 3.1tCO_2/tcs in 2005 and transition towards a path of 'Zero Carbon Steel'

India has seen a plateaued change towards carbon emission in last 5 years v/s earlier in 2005-2015; while change is happening, it is at lower pace

Target CO_2/tcs emissions for India



Historic CO_2/tcs emission in India



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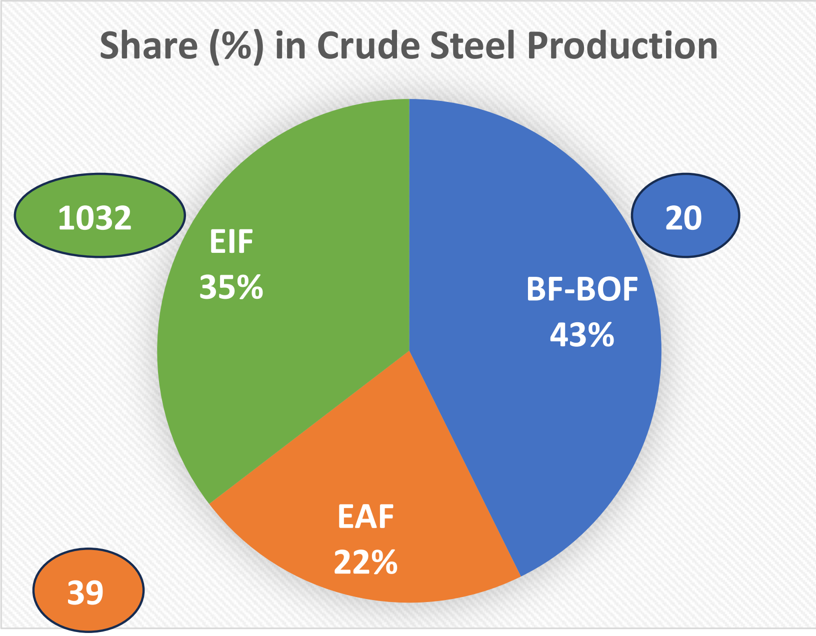
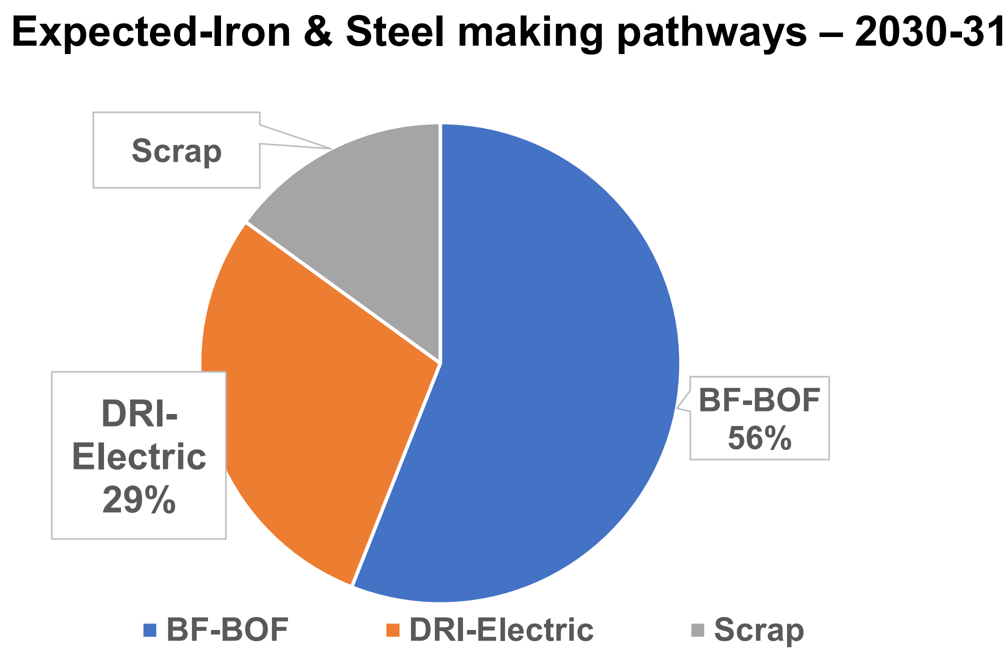
Current and Expected Future Structure of the Steel Industry in India





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Source: Joint Plant Committee;

No. of units in each route given in the oval boxes

Beyond the 1,091 crude steel producing units, there are more than 1,200 re-rollers spread all across the country.

- India is the 2nd largest steel producer. It produced 152 million tons of crude steel in 2024-25.
- India is the 2nd largest steel consumer & consumed 150 million tons of finished steel in 2024-45.
- Installed crude steel capacity is ~ 200 million tons.

Indian Steel Industry- Heterogeneous in nature

- ✓ **The steel industry in India is relatively heterogeneous compared to other countries**, with a wide range of different sized facilities in the primary & secondary steelmaking as different technologies currently in use, includes BF-BOF, coal-DRI, gas DRI, Electric Induction Furnace (EIF) and Electric Arc Furnace (EAF).

- ✓ India needs to put in policies that will enable ore-based steel making for the coming years and decades, due to absence of sufficient scrap in India.

- ✓ Indian steel industry would also need to add capacity till 2035 using traditional blast furnace routes. A significant part of scrap available in India is being consumed in EAF routes steel making, apart from EIF which uses steel scrap in in small proportion but is largely thermal Coal Based DRI.

- ✓ Use of Green DRI needs iron ore with high Fe content (65% above), hydrogen and vertical shaft Kilns. However, India has majorly horizontal shaft kilns and so, high investment is needed for vertical shaft kilns, unless pilot studies show that Horizontal Kilns can be retrofitted to use hydrogen.

- ✓ The earliest India could look at deep decarbonization of its steel production is in the period beyond 2035, when such options become commercially competitive compared to the traditional ways of steel making. Also important is that the policy landscape later on encourages adoption of deep decarbonization technologies for the period beyond 2035.

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Initiatives by The Government of India

To reach Net Zero by 2070

Landscape Review- Steel Industry

Indian steel sector

1st

Largest producer of sponge Iron or DRI in the world (51.6 MT)

2nd

Largest steel producer of crude steel (149.4 MnT) and consumer of finished steel (147.9 MT) as on CY 2024

5th

Highest iron ore reserves in the world

7%

CAGR (since 2004)

7.4%

India's share in global steel production

	World	India
CO2 Emission Contribution	8%	10-12%
Average Emission Intensity	1.91 T/TCS	2.54 T/TCS
Use of scrap	31%	21%
Natural gas availability	High	Low
Quality of Ore	High	Low
Emission intensity of grid	Low	High

Source- Ministry of Steel, Government of India

The Ministry of Steel, Government of India - journey Earmarked for Steel decarbonisation

2030 Glasgow Commitments

- Enhance non-fossil energy capacity to 500 GW
- Reduce economy's carbon intensity down by 45%
- 50% of energy requirement through renewable energy
- Reduce 1 billion tonnes of carbon emissions

2070 Achieve Net Zero Emissions

Ambitious Growth Targets

VISION 2047
500MT

National Steel Policy 2017
VISION 2030
300MT

Constraints

Legacy Capacity upto 2040

- Steel plants Long-lived
- Capital intensive
- Long term Technology Lock-in
- Hence, Emission Inertia lock-in

Source- Ministry of Steel, Government of India

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Growth in Non-Fossil Fuel Electricity Generation

➢ Installed Generation Capacity (Fuelwise) as on 30.09.2025 :

	Category		Installed Generation Capacity (MW)	% Share in Total
Fossil Fuel	Coal		2,17,458	43.4%
Fossil Fuel	Lignite		6,620	1.3%
Fossil Fuel	Gas		20,132	4.0%
Fossil Fuel	Diesel		589	0.1%
Fossil Fuel	**Total Fossil Fuel :**		**2,44,800**	**48.9%**
Non-Fossil Fuel	RES (Incl. Hydro)		2,47,310	49.4%
Non-Fossil Fuel	Hydro	50,108		10.0%
Non-Fossil Fuel	Wind, Solar & Other RE	1,97,201		39.4%
Non-Fossil Fuel	*Wind*	*53,124*		*10.6%*
Non-Fossil Fuel	*Solar*	*1,27,332*		*25.4%*
Non-Fossil Fuel	*BM Power/Cogen.*	*10,757*		*2.1%*
Non-Fossil Fuel	*Waste to Energy*	*854*		*0.2%*
Non-Fossil Fuel	*Small Hydro Power*	*5,134*		*1.0%*
Non-Fossil Fuel	Nuclear		8,780	1.8%
Non-Fossil Fuel	**Total Non-Fossil Fuel :**		**2,56,090**	**51.1%**
	Total Installed Capacity (Fossil Fuel & Non-Fossil Fuel)		**5,00,889**	**100%**

Government of India’s (GoI) Policies for decarbonisation of the Indian Steel sector

Multiple isolated initiatives have been taken which promote steel industry decarbonization; However, there is a need for a comprehensive roadmap

National Solar Mission	Perform Achieve Trade Scheme	Steel Scrap Recycling Policy	National Green H_2 Mission	14 Taskforces by MoS	Carbon credit trading scheme
2010	2012	2019	2023	2023	2024
Promotes use of solar **to replace fossil-based power usage** across sectors	**Incentivize and track energy efficiency** efforts for various industries *(Reducing emissions in steel sector from ~3.1 tCO2/tcs to ~2.5 tCO2/tcs)*	Promote decarbonization of transport sector and enhance **domestically generated scrap** through vehicle scrappage	Incentivizes **substitution of fossil fuels with Green Hydrogen** with dedicated investment for steel sector	Engagement of diverse stakeholders to **discuss, deliberate and recommend upon decarbonization** of sector	Evolution of PAT scheme to incentivize decarbonization manufacturers through **development of an Indian Carbon Market**

Areas deliberated by 14 Task Forces Constituted by the Ministry of Steel- GoI

Decarbonisation pillar

- Energy Efficiency
- Renewable Energy
- Material Efficiency
- Green Hydrogen
- CCUS
- Process Transition
- Biochar

Broad Transition pillar

- RD&D
- Finance
- International Focus
- Skill Development

Incentivisation and ecosystem development pillar

- Taxonomy
- Monitoring CO2 emissions
- Demand Generation

Decarbonisation Levers

Demand Side Drivers

POLICY ACCELERATORS

- Developing taxonomy of green steel
- Monitoring CO2 emissions
- Demand generation

Supply Side Push

TARGET SPRINTS

- Energy Efficiency
- Renewable Energy

- Process Transition
- Material Efficiency

DEEP DECARBONISATION

- Green Hydrogen
- CCUS

- Biochar

Key Enablers

- R&D
- Finance
- International Focus
- Skill Development

Source- Ministry of Steel, Government of India

Strategies for transition in the steel sector

Low hanging fruits
- Energy efficiency
- Renewable energy

Transition to alternate fuels
- Natural gas - bridge fuel
- Green hydrogen
- CO2 recycling - CCU
- Biochar

Cluster based approach
- Hydrogen
- Biochar
- CCS
- Syn gas

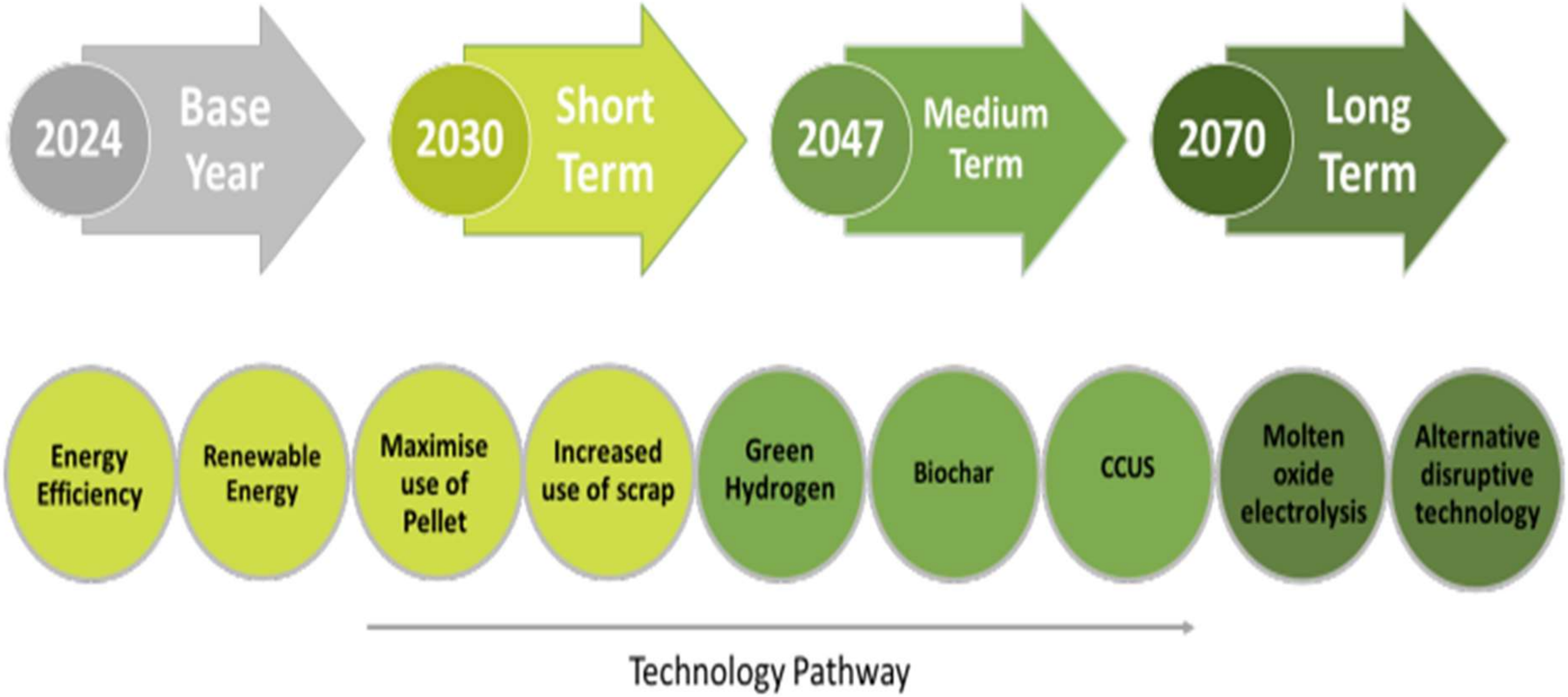
Aggregator model
- Aggregating green steel demand
- Renewable energy
- Natural gas
- Aggregated finance for SSI

Sectoral approach
- Supporting decarbonisation of SSIs
- Supporting decarbonisation of ISPs

RD&D
- Electrolytic production of iron
- Piloting over-the-horizon technologies

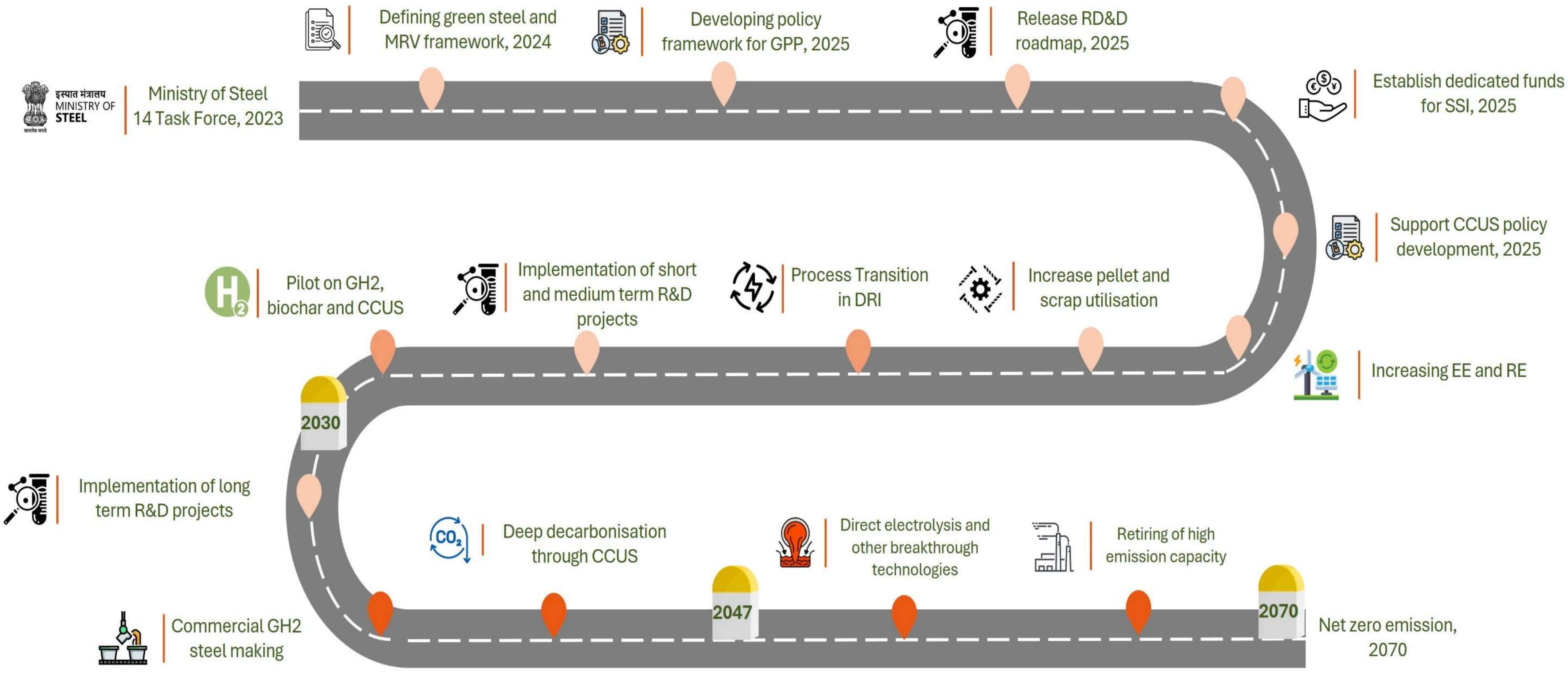
Source- Ministry of Steel, Government of India

Ministry of Steel – GoI- Decarboniation Road Map



Source- Ministry of Steel,
Government of India

Ministry of Steel – GoI- Decarboniation Road Map Contd



Source- Ministry of Steel, Government of India

Constraints for Green Transition

Resources

- Low grade coal and **iron ore**
- Low availability of **natural gas**
- Low availability of **scrap**
- Low **grid** intensity
- Low **land** availability for RE plants

Source- Ministry of Steel, Government of India

Policy

- Green steel not still suitably **defined** for different routes.
- Emission **baseline** for the whole steel industry not established yet
- No **incentive** for the steel producers to produce low-carbon emission steel
- **Variable policies**/charges across different states for RE

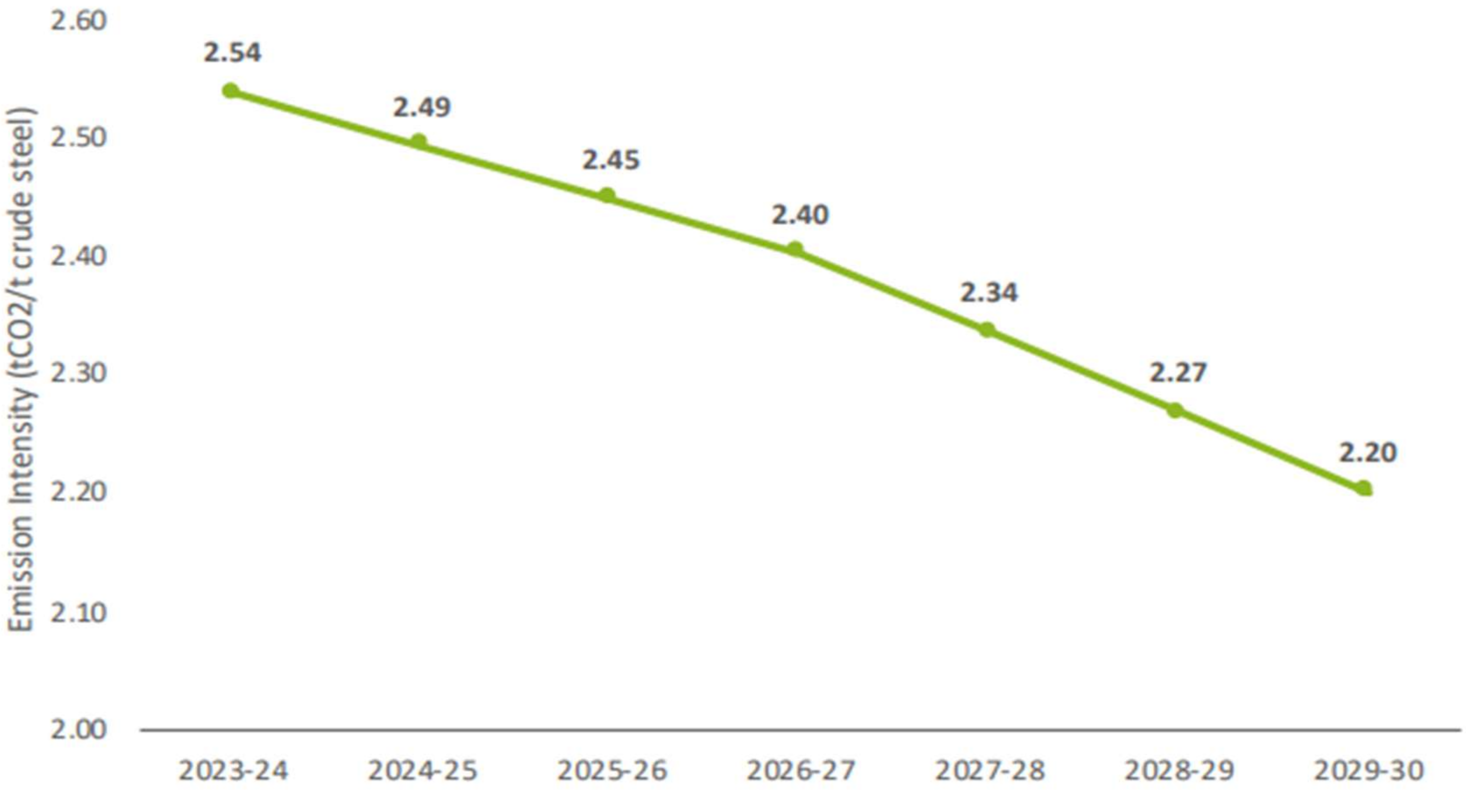
Technology

- Long-term technology lock-in
- Use of 100% **GH2** not established commercially
- **CCUS** technology not fully matured
- **CCS** potential not established yet
- Lack of adequate investment in **RD&D**
- Lack of access to **RTC RE**
- **Alternative routes** of low emission steel-making still at low TRL

Finance

- Highly **capital-intensive** steel industry
- Prohibitive cost of **GH2**
- Prohibitive cost of **CCUS**
- High cost of **Energy Efficiency** measures
- High capital investment for captive **RE** plants
- High cost of **beneficiation**
- **Limited availability** of green finance

Ministry of Steel – GoI- Proposed Carbon Emission Intensity Targets for Steel Sector



Source- Ministry of Steel, Government of India

Ministry of Steel – GoI- Green Steel Taxonomy

1. **"Green Steel"** shall be defined in terms of percentage greenness of the steel, which is produced from the steel plant with CO_2 equivalent emission intensity less than 2.2 tonnes of CO_2e per tonne of finished steel (tfs). **The greenness of the steel shall be expressed as a percentage, based on how much the steel plant's emission intensity is lower compared to the 2.2 t-CO_2e/tfs threshold.**
2. Based on the greenness, the Green steel shall be rated as follows:

   Five-star green-rated steel: Steel with emission intensity lower than **1.6 t-CO_2e/tfs.**

   Four-star green-rated steel: Steel with emission intensity between **1.6 and 2.0 t-CO_2e/tfs.**

   Three-star green-rated steel: Steel with emission intensity between **2.0 and 2.2 t-CO_2e/tfs.**

   Steel with emission intensity higher than 2.2 t-CO_2e/tfs shall not be eligible for green rating.
3. The threshold limit for defining star rating of Green Steel shall be reviewed every three years.

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Key Highlights of A.T. KEARNEY REPORT

Study Commissioned by ISA

Highlights of A T Kearney Study

- India's commitment to UNFCCC[1] is 200-250 Giga tons CO_2 as it's **fair carbon budget** till 2070, with steel sector accounting for 24-30 Giga tons CO_2 till it achieves Net Zero[2]
- Industry currently contributes 350-370 Mn tCO_2 per year, expected to grow to 1,500-1,600 Mn tCO_2 per year in 2070 (cumulative 50-51 Giga tCO_2) if left unaddressed, calling for a clear roadmap
- Multiple decarbonization pathways have been evaluated. The selection of optimal pathway for India is based on technically feasibility[1], lifetime carbon emissions, and investment levels.
  - It is a **pragmatic pathway** for Indian steel sector with 10-15% reduction by 2030, 75-85% by 2050, reaching net zero by 2070
  - **USD 1,200-1,300 Bn investment** (USD 420-470 Bn Capex and USD 17-19 Bn/ yr. Opex) required for decarbonization
  - Production **technology mix will have to shift** towards low-emission DRI-EAF (NG) from current 7-9% to 18-20% and scrap-based technologies from current 10-12% to 25-27%
  - Adoption of pathway to lead to increase in **steel's levelized cost of production** by 52-57% by 2070 with lifetime carbon emissions of 6 – 8 Giga tons CO_2 (25-30%) below 2°C scenario

Source : A.T.Kearney Study for ISA

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Phased manner intervention with Estimated outlay- A.T. Kearney Study

Direct outlay | Facilitation

		Phase 1: Up to 2030	Phase 2: 2030 – 2040	Phase 3: 2040 – 2050
1	**Energy efficiency**	Loans at subsidized interest rates		
2	**Renewable energy**	Waiver of ISTS charges		
3	**Natural gas ecosystem**	Pipeline infrastructure setup to increase accessibility of Natural Gas		
4	**Technology indigenization**	R&D for indigenization of NG-DRI tech.		
5	**Biochar ecosystem**	Biomass collection and processing ecosystem		
6	**Green Hydrogen**	R&D for commercial-scale use		
		Production-linked incentives for GH2 manufacturing		
7	**CCU and CCS**	Fund for exploration and commercial pilots	Viability-gap funding / incentives for carbon capture, utilization, storage	
8	**Scrap ecosystem**	Scrap shredders, collection centers, and processing facilities setup		
9	**Carbon market**	Institutionalize CCTS		
10	**Enablers for smaller players**	Energy transition funds for adoption of decarbonization technologies by smaller, high-emitting players		
11	**Demand generation**	Incentives for low-emission steel		
	Total outlay *(excl. facilitation)*	**USD 3 – 7 Bn**	**USD 20 – 30 Bn**	**USD 55 – 65 Bn**

India Carbon Market

Carbon Credit Trading Scheme-Approach

Indian Carbon Market Carbon

Carbon Credit Trading Scheme (CCTS) –

- A draft notification Greenhouse Gas Emission Intensity Target rules 2025 apart from various sectors and Iron and Steel for 253 Obligated entities has been issued on June 23, 2025 for comments by the Astakine Ministry of Environment Forest, Climate Changer MoEFCC – Government of India .

1) Baseline equivalent at Major Product Output 2023-24 in tons,

2) Baseline Emission Intensity 2023-24 (as tCo2/ tons of equivalent product),

3) GHG Emission Intensity Target – Compliance year 2025-26 and Compliance year 2026-27 (as tCo2 equivalent / tons of equivalent product). While these initiatives have helped kickstart the journey, there is a need for dedicated efforts for decarbonization of the steel sector. Therefore, a well—defined roadmap with a clear emission reduction pathway and focused interventions will help in channelizing the effort of all stakeholders towards a common goal.

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Gross Energy Intensity (GEI) Variance analysis: Self Declared Vs Audited data

Description	Unit	Audited	Self attested	Percentage Difference
Number of Entities	number	251	233	-
Major Eq. product	Mn Ton	120	120	0%
GEI (overall)	tCO2 (e)/ton of eq. crude steel	**2.5490**	**2.5370**	**0.5%**

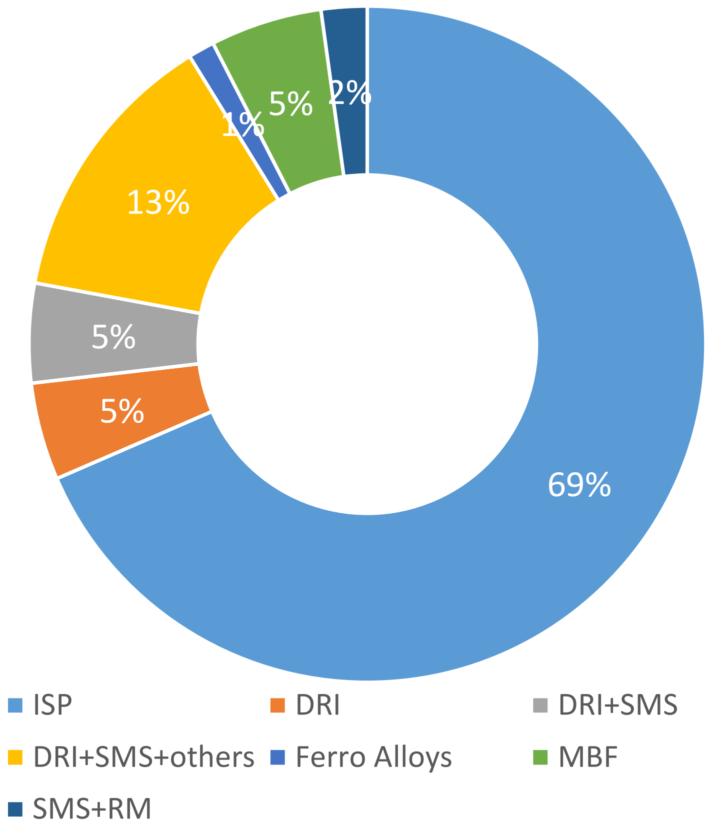
Note -Supplementary Audits have also be sought in some cases where abnormal variations have been observed

Variance Reason

- Adjustment in overall GEI due to addition of Import and Export of Intermediary product
- Addition of Process emission in the proforma
- Changes in Net Calorific Value(kcal/kg) of Solid fuel consumption
- Up-dation of latest Grid emission factor (0.727 tCo2/mWh)

Source – Bureau of Energy Efficiency (BEE)-India

Sub-Sector Emission Bifurcation



Broad Approach Followed in CCTS

- Development of emission trajectory with respect to audited data.
- Considered – 2.2 tCO_2/ton of crude steel as target for FY 2030.
- Emission reduction – 13.69% up to 2030 from Baseline 2023-24.
- Notification of target – GEI (Energy and Process)

Source – Bureau of Energy Efficiency (BEE)-India

Proposed Pilot Studies/ R&D Work

for the benefit of the Indian Steel Industry

Proposed Pilots Studies for alternative fuels uptake in rotary kilns (For Sponge Iron/DRI)

This study will evaluate the role of alternative fuels in mitigating emissions from rotary kilns:

- Solid fuels: Biomass, plastics, municipal solid waste
- Liquid fuels: Ammonia and Methanol
- Gaseous fuels: Green hydrogen, Natural gas, Syngas

Phase I: Research and modelling

- Develop a model for alternate fuels injection in rotary kilns
- Validate and optimise the model
- Evaluate retrofit options

↓

Phase II: Piloting

- Conduct pilots and trials for various scenarios
- Manage supply chain and fuel availability
- Optimise process and support retrofitting

↓

Phase III: Assessment

- Technical evaluation of the project
- Economic feasibility of the project
- Assess the emission mitigation potential of the transition

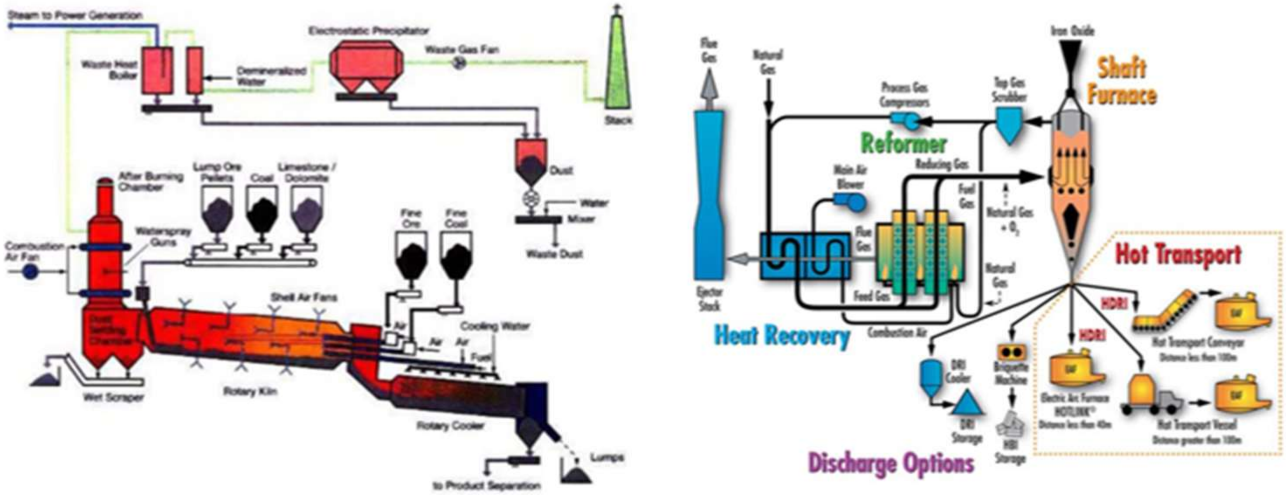
Source- Ministry of Steel- Government of India

Proposed Pilot Study/ R&D work -Use of Green Hydrogen in DRI (Sponge Iron)

Shift toward Gas based Technologies:-

- Vertical Shaft
- Fluidized Bed Reduction
- Hydrogen generation from coal gasification

23% Share	7% Share
COAL BASED SPONGE IRON	GAS BASED SPONGE IRON

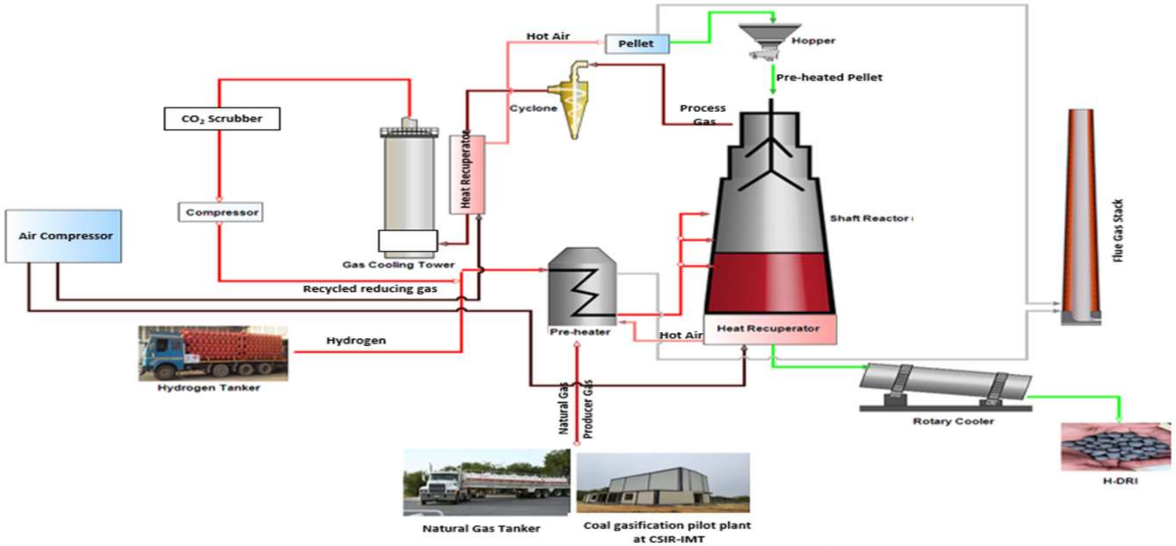


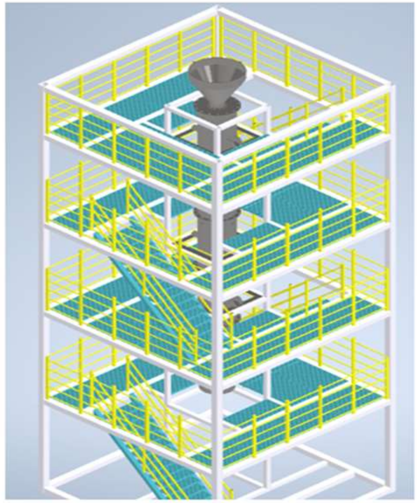
Coal based	Gas based
Temperature:1050 °C	Temperature:950 °C
Carbon in DRI: Max. 0.2 .%	Carbon in DRI: Min.1%
Metallization: Low	Metallization: High
CO_2 emission: 2.5ton/tonne of DRI	CO_2 emission: 1 ton/tonne of DRI

Source: Council of Scientific & Industrial Research-India ·

Proposed Pilot Study/ R&D work -Use of Green Hydrogen in DRI (Sponge Iron)-Contd

Use of Hydrogen in Vertical Shaft Furnace: Upgradation of Low-grade Resources and production of DRI





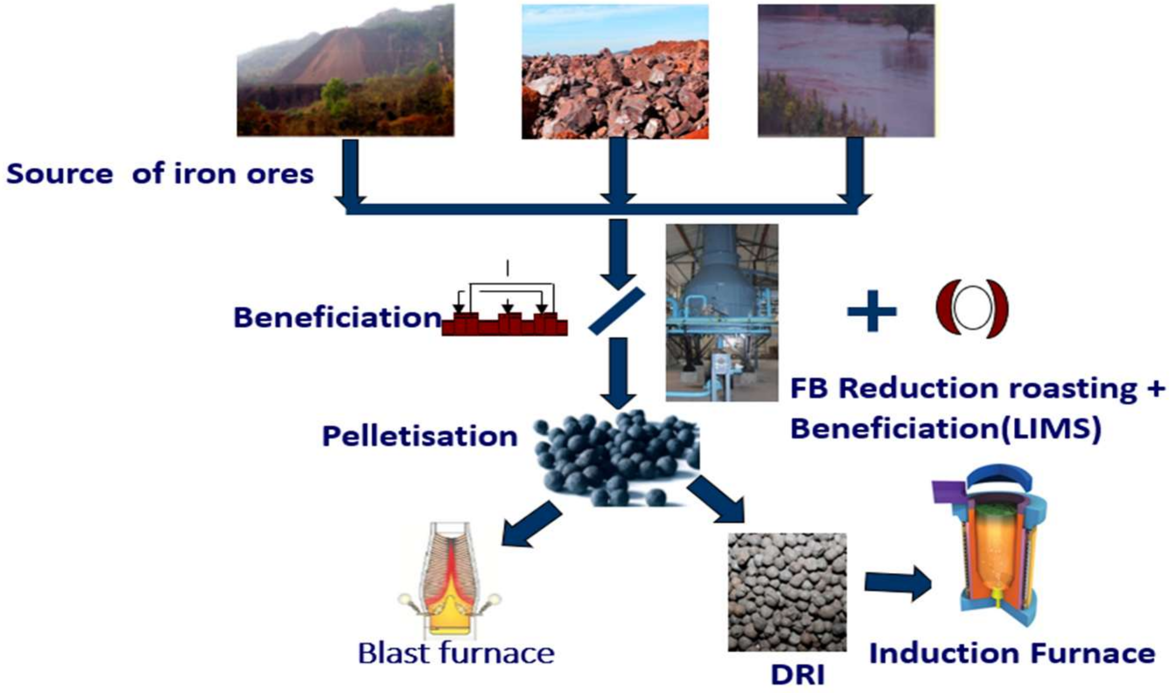
Shaft Furnace Layout

- CSIR-IMMT will set up a vertical shaft furnace for DRI production using syngas or hydrogen.
- Hydrogen-based DRI needs high-grade iron ore (Fe% > 65), which India lacks.
- The vertical shaft furnace can upgrade low-grade Indian iron ore via reduction roasting.

Source: Council of Scientific & Industrial Research-India ·

Proposed Pilot Study/ R&D work -Use of Green Hydrogen in DRI (Sponge Iron)-Contd

Use of Hydrogen in Fluidized Bed Reduction Roasting: Upgradation of Low-grade Resources and Production of DRI fines



Fluidized bed Roaster(Capacity:1 TPH)

Source: Council of Scientific & Industrial Research-India

Companies are deeply committed to Net Zero

Broad Pathway Initiative by Some ISA Member Companies

Targeting Net Neutral in Carbon Emissions by 2050

Short-Term

- Ensuring Energy Efficiency
- Renewable Power (Energy Transition)
- Actively Improving Material Quality
- Enhancing Process Efficiency
- Utilizing Alternative Fuel Sources
- Increase in Scrap (Material Circularity)

Medium and Long-Term

- Commercial Deployment of Green Hydrogen for Steelmaking
- Nature Based Solutions
- Use of Syngas & **TGR**[1] in BF (Carbon Circularity)
- Scrap-based EAF
- Increasing Demand-side Material Efficiency
- Carbon Offsetting
- Large Scale Implementation of **CCUS**[2]
- Alternate Steel-making Technologies, e.g. Electrolysis

1-Top Gas Recovery, 2- CCUS: Carbon Capture, Usage and Storage

IndianSteel Association

Leveraging alternate fuels towards achieving Carbon Neutrality target

Use of Natural Gas

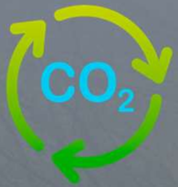
JSW Steel plans to utilise the injection of natural gas as a partial replacement for coal. However the cost and availability at locations remains a major barrier.

Use of Green Hydrogen

JSW Steel has initiated a pilot project to construct green hydrogen facility of 25MW at our Vijayanagar plant.

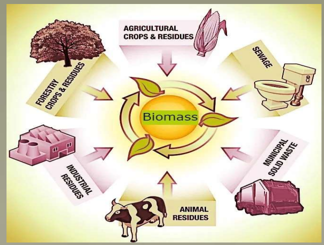
Use of Waste Plastics

JSW Steel has successfully conducted these trials of adding waste plastic in Blast Furnace and EAF



Use of Top Gas Recycling (TGR) in Blast Furnace

TGR is a process where the top gas from the blast furnace is recycled and used as a reducing agent. JSW Steel is planning to implement this and is in discussion with the OEMs.



Use of Biomass

JSW is exploring the usage of biomass and biochar addition to replace coke, however the constraint remains with the availability of biomass and its prices.

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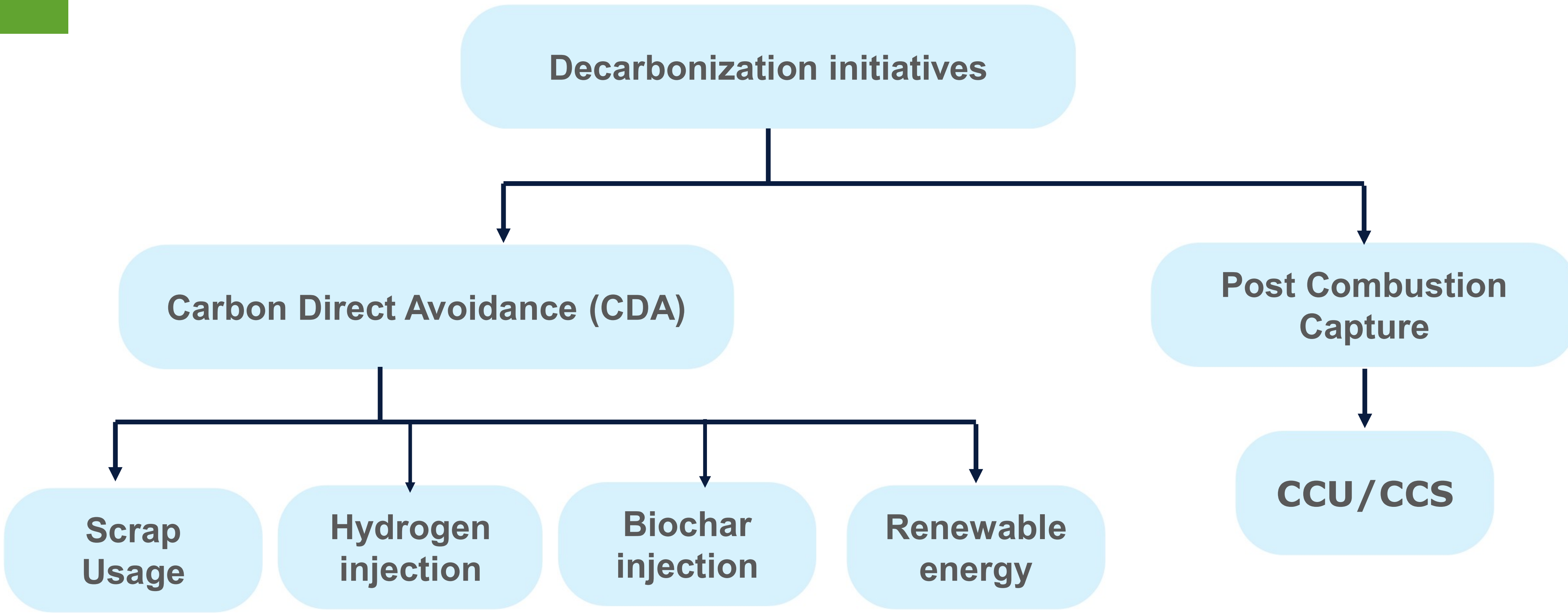
Tata Steel's initiatives for decarbonization



…….Along with this, operation efficiency improvement is an ongoing activity.

CCU: Carbon capture and utilisation; CCS : carbon capture and storage

Initiatives by Jindal Steel Limited

Decarbonisation Pillars for Steel Business

CO_2 Minimization

- Syngas based production
- Resource optimisation
- Pellet feed in blast furnaces
- Zero waste approach

CO_2 Avoidance

- Zero power furnace
- Heat recovery from off gases
- Heat recovery from slags
- Use of renewable power
- Maximizing hydrogen usage from existing 55-60%

Carbon Circularity

- CO_2 to CO
- CO_2 to syngas
- Dry reforming of CO_2

Carbon Capture & Utilization

- Fuels – bioethanol
- Chemicals – methanol
- Biological – crude algae oil (biodiesel/ SAF)

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Identified Levers for Decarbonisation at SAIL

Energy Efficiency	• Enhanced CDI rate • Reduction in Coke rate • Enhancing energy efficiency measures
Renewable Energy	• Installation of Renewable Energy facilities • Procurement of Green Power
Material Efficiency	• Enhanced use of Pellets in prepared burden • Improvement in quality of Iron Ore, latest beneficiation Technologies
Biomass in Steel Plant	• Use of biochar in Sinter making. • Injection of Bio-char with PCI
CCU/CCUS	• Production of value-added products from captured CO_2 as well as storage.
Alternate fuels	Use of Hydrogen/ CO_2 gas in Iron making

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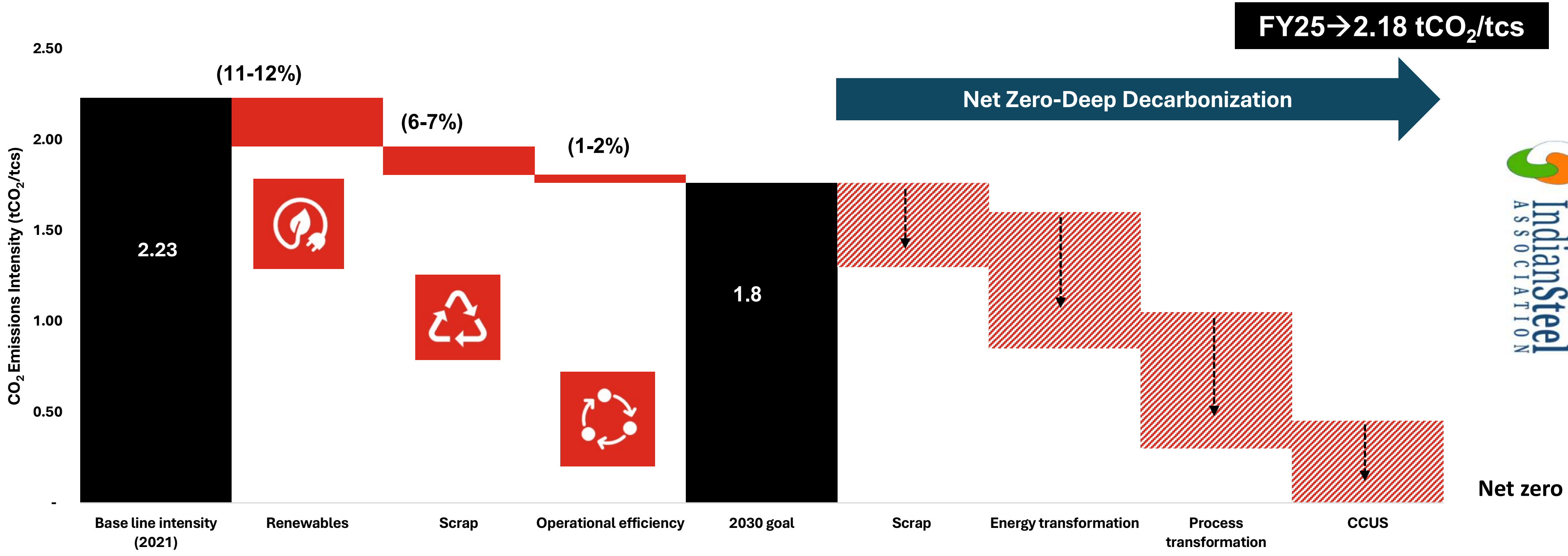
AMNS India -Climate Change

Aim to reduce 20% emission intensity by 2030. (1.8 tCO_2/tcs)



Broad Challenges

..but the Indian steel market faces some unique challenges

BF-BOF (~43%[1] of Crude Steel production) has witnessed limited technological investments; existing BF assets are nascent with average age of ~18 years and a long shelf life

Dearth in availability of good quality scrap for charging; likely scrap squeeze in future with predicted reduction in imports, coupled with increase in demand from ISPs. As regards EAF process, limited availability of graphite electrode is a constraint as China has a monopoly on this.

High costs of \$3-\$4 per kg, and low availability of Green Hydrogen prohibit transition to lower emitting routes (e.g., Green DRI-EAF) & cleaner fuel usage

Dearth in availability of good quality iron ore is prohibitive for transition to DRI-EAF route, and results in higher flux & slag rates in BF-BOF routes

Limited availability of low-cost natural gas, coupled with import duties (2.5%) prohibits transition to lower emitting routes (e.g., DRI-EAF)

Higher grid emission intensity compared to Western counterparts, owing to ~50% share of power generation from fossil fuels.

Source: JPC

IndianSteel
ASSOCIATION

Thank You

Contact Us

Address:
Upper Ground Floor-4
Kanchenjunga Building,
18 Barakhamba Road,
New Delhi-110 001

Tel: +011 4266 8811
Fax: +011 4266 8805
E-mail: a.kashyap@indsteel.org
Website: http://indsteel.org/