Net Zero pathways- Global insights from emerging scenarios and sector strategies

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Setting the Context ...

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Why Net Zero Matters — The Industrial Imperative

Over **90% of global GDP** is now covered under **net zero commitments**

Industry accounts for ~25% of global GHGs, rising to 35–40% including electricity use

Net zero is becoming a **requirement to do business globally** – not just CSR

Global Scenario Models – Summary?

Industrial CO_2 must drop from 9.4 Gt (2022) → 1.7 Gt by 2050 (IEA)

Industry must cut emissions **by 70–90% by 2050** to stay under 1.5°C (IPCC)

$6T/year investment needed till 2050, 40% of which is in energy & industry (McKinsey)

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India's Climate and Energy Snapshot

Indicator	2024/2025 Value	Trend/Note
CO_2 emissions (2024)	**2.9 $GtCO_2$** (5.3% YoY increase)	Driven by coal and power demand
Electricity demand (2024)	**+4.3%** YoY growth	Driven by cooling, digital, industrial loads
Per capita emissions	**~2.1 tCO_2/person**	Global avg ~4.7 tCO_2
Renewables installed (2024)	**~220 GW**	Target: 500 GW non-fossil by 2030
EV sales penetration (2025)	**~7.4% of new vehicles**	Doubling every ~2 years
Green hydrogen policy	**₹8,000 Cr**+ investment pipeline	

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India’s Climate and Energy Snapshot

Metric	Value (2024/2025)	Target
Solar additions (2024)	~24.5 GW	Needs to triple pace
Share of coal in power mix	~47%	Still dominant
T&D losses	~17%	Very high vs. global avg (~8%)
Battery storage tenders	9+ GWh awarded (2024)	Backed by SECI and NTPC

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Sectoral Transition - Global

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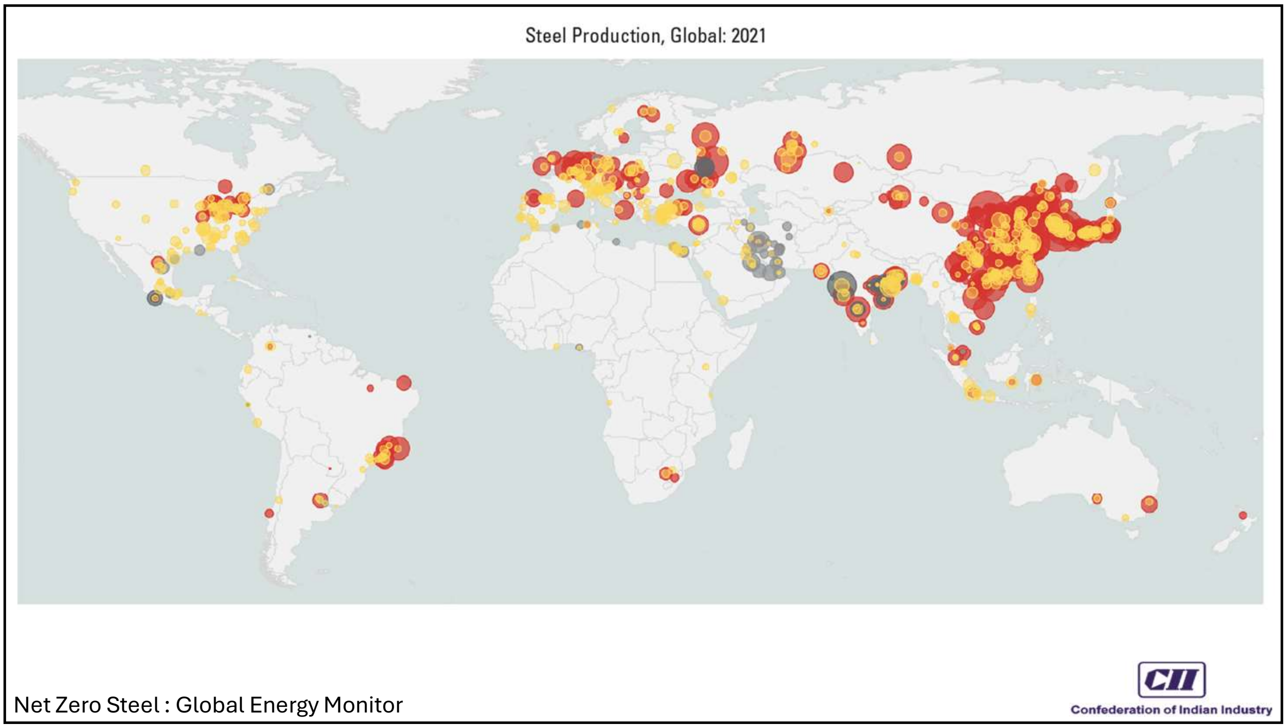
Steel Production, Global: 2021
Net Zero Steel : Global Energy Monitor
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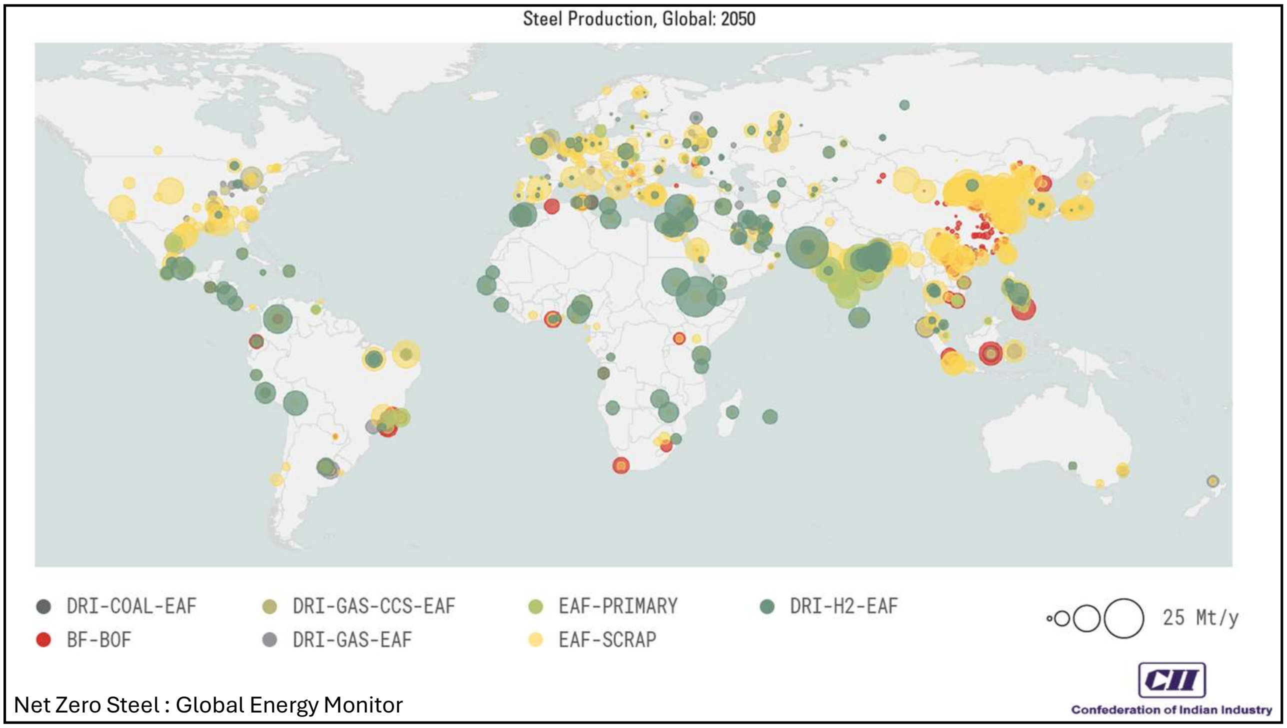
Steel Production, Global: 2050
DRI-COAL-EAF
BF-BOF
DRI-GAS-CCS-EAF
DRI-GAS-EAF
EAF-PRIMARY
EAF-SCRAP
DRI-H2-EAF
25 Mt/y
Net Zero Steel : Global Energy Monitor
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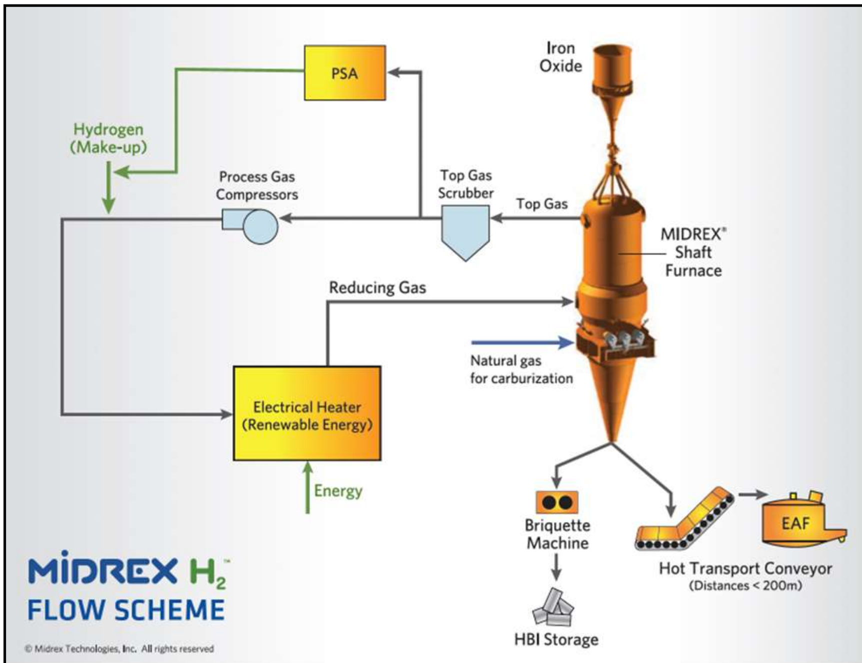

STEGRA : Plant Features

Capacity: 2.1 million t/y

HDRI Feeding: Continuously charged to EAF via a hot transport conveyor

CO2 Emissions: 50 Kg/t DRI (carburized DRI case), 90% or
greater emissions reduction

5 years – Forward Contracts
30% Premium for Green Steel

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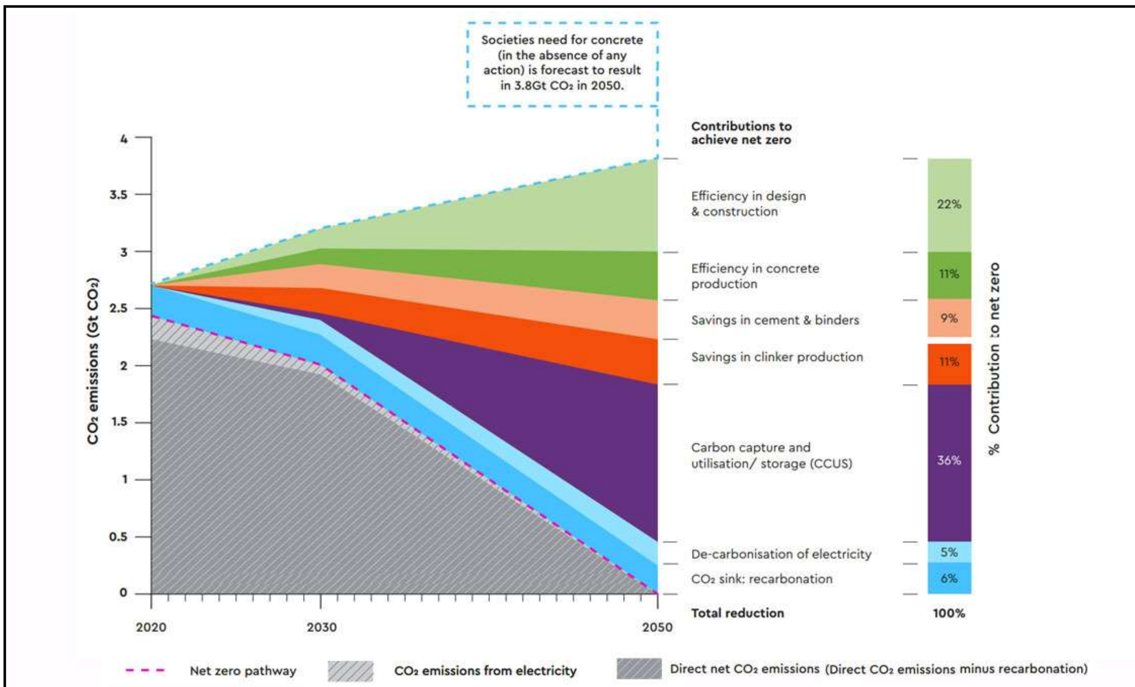

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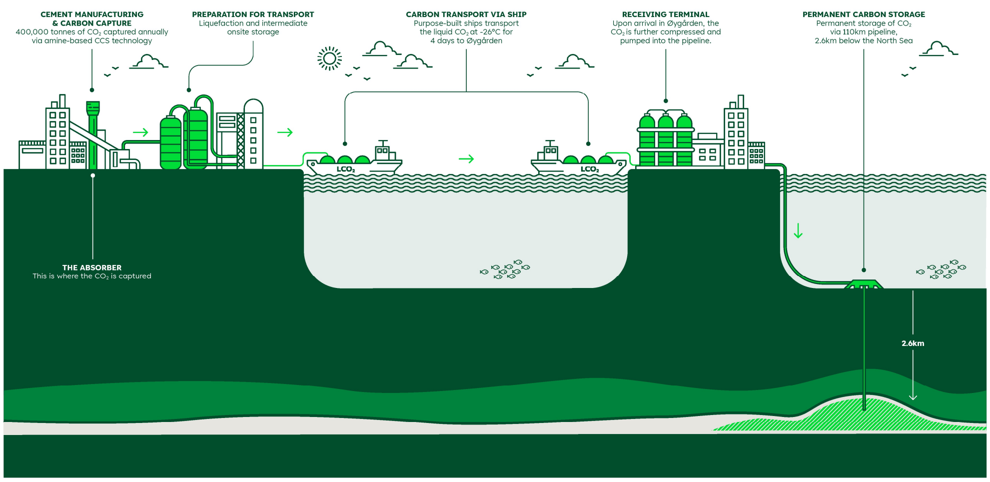
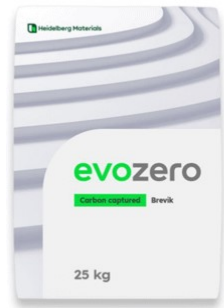
CCS Project - Heidelberg

Heidelberg Materials’ Brevik CCS project





Premium over conventional cement

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Growing List of Big EV adopters

Country	EV sales in Q4 2023	Latest EV market share
Norway	25,028	79.6%
Iceland	3,507	58.4
Denmark	21,890	44.9
Sweden	31,780	39.8
Finland	6,686	35.3
Netherlands	29,199	35.1
Ireland	1,164	33.9
Belgium	25,752	25.3
Portugal	11,265	24.3
Switzerland	16,581	23.9
China	**1,879,600**	**23.8**
Austria	13,083	23.3
Israel	6,772	22.9
France	98,755	20.3
New Zealand	7,435	20.0

Country	EV sales in Q4 2023	Latest EV market share
Germany	**138,390**	**19.6**
UK	79,602	17.6
Thailand	23,864	12.6
Turkey	36,026	12.0
Romania	3,655	10.8
Slovenia	1,126	10.7
Australia	21,571	9.5
Canada	38,160	9.4
Spain	20,666	8.7
US	**313,822**	**8.1**
Estonia	400	7.5
South Korea	36,009	6.9
Hungary	1,614	6.5
Bulgaria	551	5.8
Italy	21,033	5.4
Greece	1,579	5.3
Global total	**3,008,662**	**14.5**

> “Not a single country thus far has taken more than three years to go from 5% to 15% Evs”
>
> *– Bloomberg Green Analysis*

Source : https://www.bloomberg.com/news/articles/2024-03-28/electric-cars-pass-adoption-tipping-point-in-31-countries

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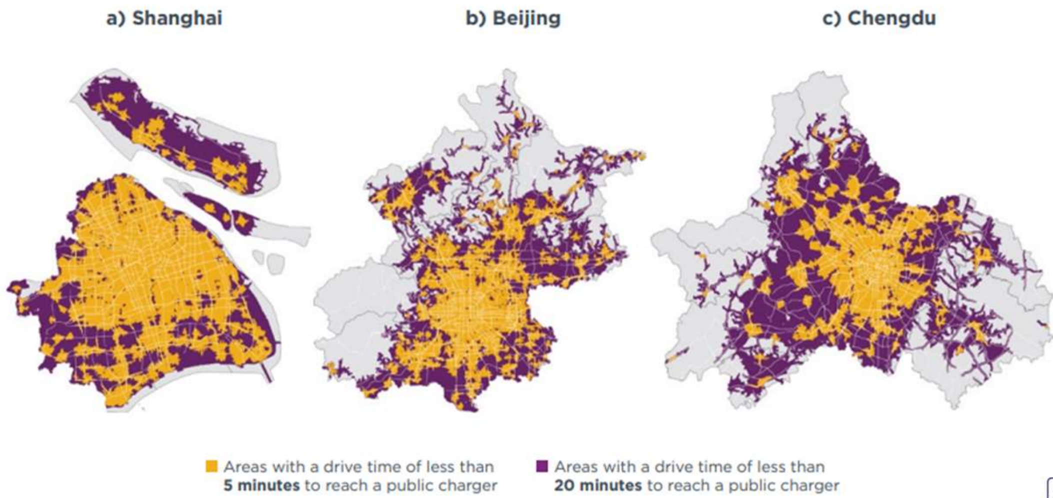
Charger Density in Top 3 Cities in China



Source: https://theicct.org/wp-content/uploads/2024/01/ID-93-%E2%80%93-China-charging-Report-A4-70131-v6.pdf

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Corporate & Market Signals …

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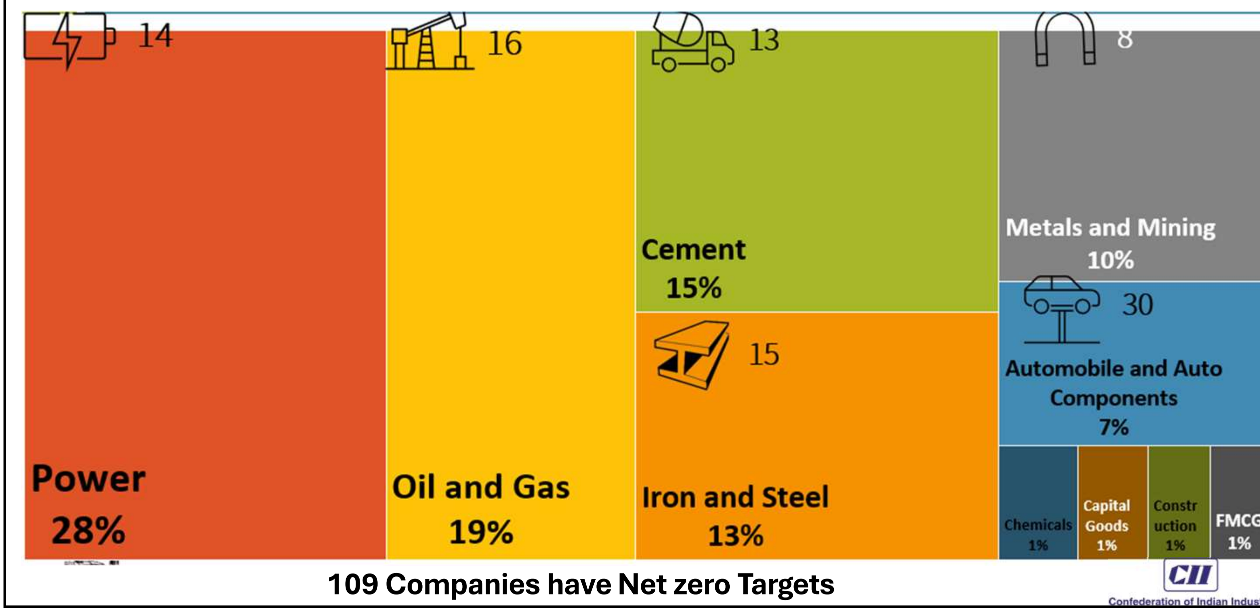
NSE – 500 companies Net Zero Journey

AGGREGATE GHG EMISSIONS OF NSE 500 : 1.78 Billion Tonnes (FY 2023)



109 Companies have Net zero Targets

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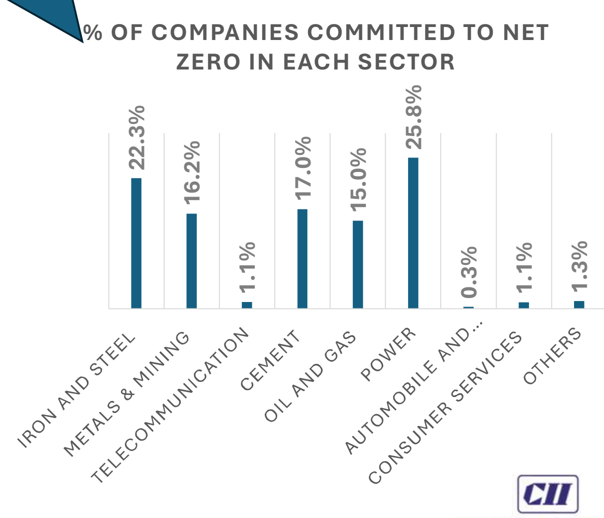
NSE – 500 companies Net Zero Journey

~21% of India's GHG emissions are covered under Net zero based on NSE 500 Companies Analysis 2023-24



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Sectoral Transition - India

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Net Zero Financing in India

Indicator	Value/Update
Estimated need (2023–30)	~$1.2 trillion
Domestic green finance flows (2024)	~$40–45 billion
% of requirement currently met	~30–35%
Sovereign green bonds raised (FY24-25)	₹16,000 Cr
Carbon market launch	in 2025

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Transport Transition

Metric	2024/25 Status
EV 2-wheeler share	~5.8% of new sales
EV 4-wheeler share	~2.3% of new sales
FAME II disbursed	₹5,000+ Cr (as of 2025)
Charging points	~12,000 (public + semi-public)
Railways (electrified)	85% of routes electrified
Urban metros operational	20+ cities with mass transit

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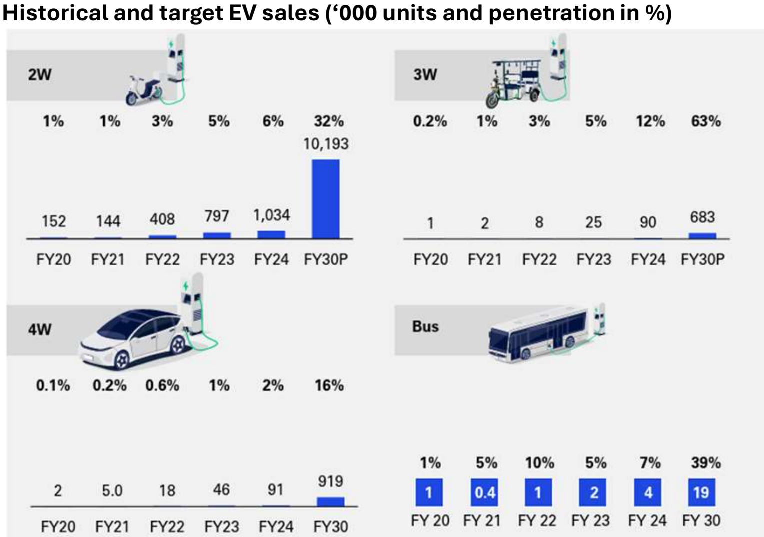
EV Sales/Penetration Trend – Indian markets

Historical and target EV sales ('000 units and penetration in %)



Source : KPMG Report (https://kpmg.com/in/en/insights/2024/12/enabling-infrastructure-changes-through-policies-for-growth-of-evs.html)

•**Total EV Sales (FY24)**: 1.2 million EVs, 5% penetration.
•**Penetration Growth**: High single-digit penetration in multiple vehicle categories.
•**Growth Drivers**: Policy support, cost parity, start-up ecosystem, tech access.
•**Target**: 30% EV penetration by 2030 (EV30@30 campaign).

Segment-Wise Sales:
•**Two-Wheelers**: Dominant, affordable, and widely available.
•**Three-Wheelers**: Growing in commercial last-mile connectivity.
•**Four-Wheelers**: Smaller share, high costs, limited charging.
Hybrid vs. EV Sales: 12,81,208 hybrids sold, transition to full EVs.
Regional Trends: Delhi and Maharashtra lead in adoption.

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CBAM – Steel sector

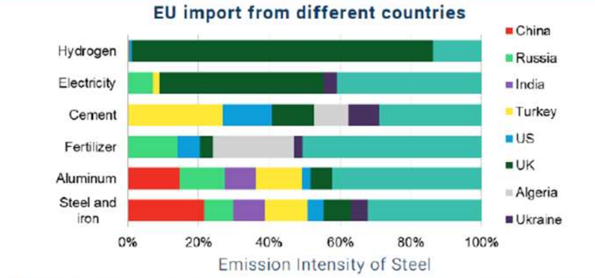
EU introduced the Carbon Border Adjustment mechanism (CBAM) in 2022, **implementation starts in 2026**

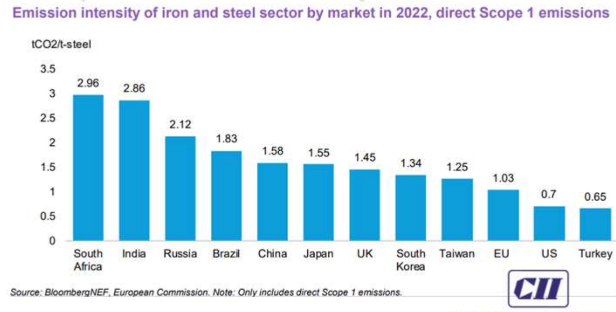
•Applies to six sectors -Iron & steel**,** fertilizers, electricity, aluminum, cement, and hydrogen

•Tariffs phased in from 2026 and increase till 2034

•For non-compliance, incorrect or incomplete filing of a CBAM report, **penalties up to EUR 50 per tonne** of unreported embedded emissions are expected

UK CBAM to start in 2027, like EU CBAM





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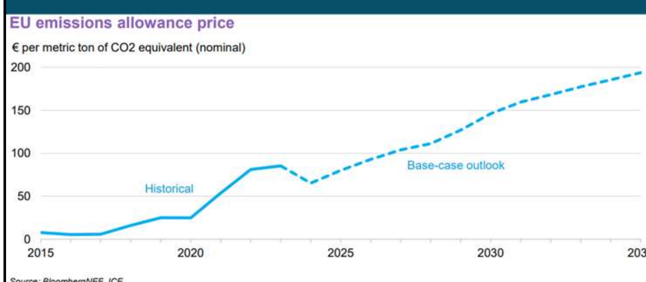
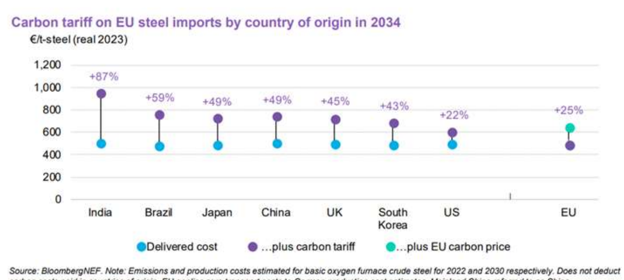
CBAM- Steel sector



Carbon prices in the bloc could rise to almost €200 per ton by 2035

CBAM Tax will make New BF-BOF Indian steel far more expensive than European steel



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CCTS (Carbon Credit Trading Scheme)

Readiness & Timeline

•**Compliance Market** to begin in **Financial Year 2025–26**, with credit issuance and trading starting **by October 2026**

•**Offset Market** (voluntary) already allows project registration (e.g., agroforestry, biochar, landfill gas), with methodologies

Coverage

•**Nine sectors** mandated under compliance: Iron & Steel, Aluminium, Cement, Fertilizers, Petrochemicals, Petroleum Refineries, Pulp & Paper, Chlor-Alkali, Textiles

•Scope includes **Scope 1** (fuel/process) + **Scope 2** (electricity/heat)

Instrument Design

•Intensity-based baseline-and-credit system: each facility gets emissions intensity targets (tCO_2e per unit of output)

•Carbon Credit Certificates (CCCs) issued for outperforming the target

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BEE – CCTS

Trajectory & Targets

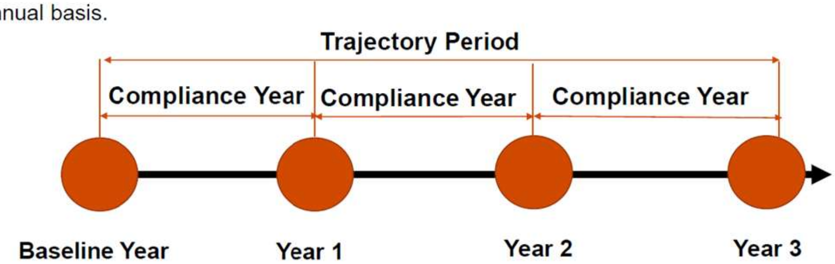
- **GHG Emission intensity Targets**

In terms t CO_2/t of equivalent product

Notified by the MoEFCC under the Environment Protection Act, 1986

Notified for three years, however compliance will be on annual basis.

- **Type of Targets:** GHG Emission Intensity (t CO_2/t)
- **Notification of Targets** – For trajectory period and annual targets
- **Compliance**: Annually



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Green Steel Taxonomy

- 5 Star
  - Emission intensity less than 1.6 tCO_{2e}/tcs
- 4 Star
  - Emission intensity between 1.6 and 2.0 tCO_{2e}/tcs
- 3 Star
  - Emission intensity between
  - 2.0 and 2.2 $tCO_{2e/}$tcs

4 THE GAZETTE OF INDIA : EXTRAORDINARY [PART II—SEC. 3(i)]

2. Based on the greenness, the steel shall be rated as follows:

Five-star green-rated steel: Steel with emission intensity lower than 1.6 t-CO2e/tfs shall be defined as five-star green-rated steel.

Four-star green-rated steel: Steel with emission intensity between 1.6 and 2.0 t-CO2e/tfs shall be defined as four-star green-rated steel.

Three-star green-rated steel: Steel with emission intensity between 2.0 and 2.2 t-CO2e/tfs shall be defined as three-star green-rated steel.

Steel with emission intensity higher than 2.2 t-CO2e/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.

4. The scope of emissions shall include Scope 1, Scope 2, and limited Scope 3, up to finished steel production. Scope 3 emissions shall include agglomeration (including sintering, pellet making, coke making), beneficiation, and embodied emissions in purchased raw materials and intermediary products, but shall not include upstream mining, downstream emissions and transportation emissions, both within and outside the gates of a steel plant.

Source: PIB, GoI

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Supply Chain Emissions - Insight

Metric	Insight
Total emissions from supply chain (Scope 3)	**65–95%** in industrial sectors like auto, electronics, FMCG
Suppliers globally able to measure GHGs	**Only 27% of suppliers** have partial carbon data reporting ability
Suppliers in India reporting emissions	**Less than 8%** of Indian SMEs provide GHG data to buyers
Companies planning to decarbonize Scope 3	73% of global firms have Scope 3 targets, but **<25%** have execution mechanisms
India's CBAM-exposed exports (steel, aluminium, etc.)	**> $8.2 billion/year trade** at direct risk due to embedded carbon

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CCUS Mission - India

CCUS Mission was approved by the Indian Govt in 2024

India targets 750 Mt CO_2 storage by 2050, led by MoPNG; pilots underway in cement and energy sectors.

INR 1000 Cr has been allocated for the mission's first phase

The mission targets to develop and scale up CCUS technologies, demonstrate success at Industrial hubs and attract investment

This mission will be important to achieving India's Net zero target by 2070

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CCUS - Testbeds

Academia – Industry Collaboration: Initiative of Department of Science & Technology

विज्ञान एवं प्रौद्योगिकी विभाग
DEPARTMENT OF SCIENCE & TECHNOLOGY

2 TPD CCUS- Oxygen based Calciner

Carbon-negative Integrated Carbon Capture Mineralization Technology [ICCM]

CO_2 Capture- Indigenously designed catalytic process

CO_2 Capture- Vacuum Swing Adsorption Process

Focused on innovative carbon-lowering interventions

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Green Hydrogen

National Hydrogen Mission
₹19,744 cr (~$2.3B) budget

- ✓ includes ₹1,750 cr for manufacturing.
- ✓ Odisha emerging as H_2 hub with ₹11,200 cr in projects.

USD 4 bn (2030) → USD 78 bn (2050)

Green electrolyser opportunity in India Forecast ~ 39% CAGR

USD 4.67 /kg

India's IOCL tender (June 2025): ₹397/kg (USD 4.67/kg) is the first benchmark price for green H_2

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BESS (Battery Energy Storage System)

Record-Low Auction Prices	Dramatic Cost Declines	Strategic Implications
• Standalone BESS cleared at ₹2.8–2.85 lakh/MW-month (2 h, no VGF) • Co-located solar + storage at ₹3.1–3.5 INR/kWh	• Solar CAPEX: ~$350/kW (₹2.9 Cr/MW) → LCOE ₹2.5/kWh • Battery pack: ₹13,860 → ₹8,388/kWh (2020→2025)	• Undercuts new coal and captive power economics • Enables scalable, low-risk transition to 24×7 clean power

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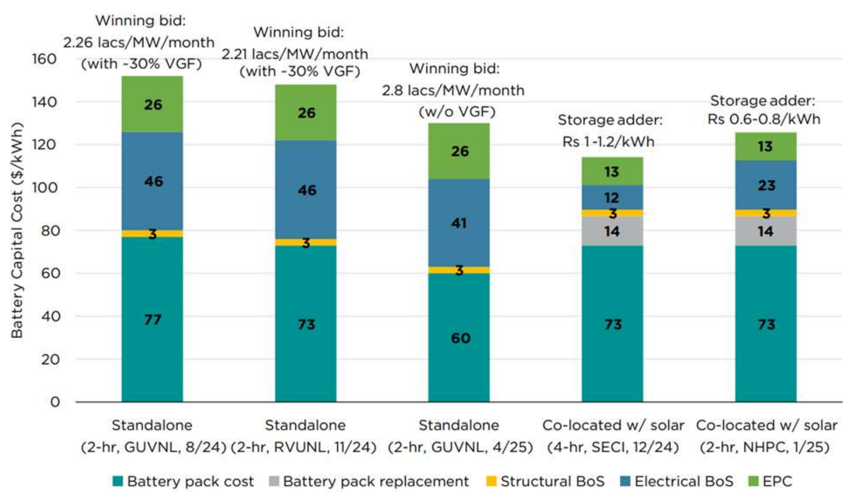
BESS (Battery Energy Storage System)



Availability & Backup	Levelized Cost (INR/kWh)
95 % (no backup)	4.5
100 % w/ grid backup	4.7

BESS cost now competitive or even lower than convention Grid power cost

Source: India Energy & Climate Center, Goldman School of Public Policy, University of California, Berkeley

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Net Zero Pathways – Key Takeaways

- Net zero - a global necessity and national opportunity
- Sectoral readiness varies
- Emerging technologies like green hydrogen, BESS, and CCUS will be pivotal
- New policy instruments — CCTS, CBAM — are reshaping market and carbon competitivenness.
- Corporate momentum is building — but requires a shift from compliance to innovation
- Green premium markets are real and growing
- Transition to net zero is certainly underway at a rapid pace

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Thank You

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